

## CVS 2400 SERIES SMART POSITIONER

### PRODUCT DESCRIPTION

YT-2400 Smart Valve Positioner accurately controls valve stroke according to input signal of 4~20mA input from a controller. In addition, a highly efficient micro-processor performs various, powerful functions like Auto-calibration, PID control, alarm, and HART protocol.

### MANUAL DESCRIPTION

Our products are produced and inspected under strict standards. In order to use our products appropriately and efficiently, we recommend that users read this manual carefully.

- This manual could change without prior notice.
- This manual, in whole, or part, should not be transcribed or copied without approval by CVS Controls Ltd.

### SAFETY & WARRANTY

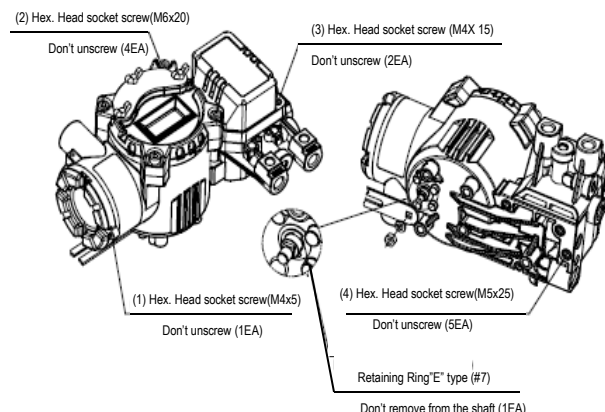
**\*Before handling the YT-2400, it is absolutely imperative that users read and observe the safety instructions in this manual to ensure the protection and safety of its operators.**

**\* CVS Controls Ltd. is not responsible for the damage caused by users' repair or conversions of the item. If the repair or conversion is necessary please contact CVS Controls Ltd.**



**WARNING:** The following information is related to the explosion proof rating, so please note that operations/distribution should be handled with great care.

1. Open cover once power is off. After operation, close the cover, screwing it back on. Be careful not to damage the threads or screws.
2. Be careful not to lose the “E-Stopping Ring”.



## Notes on Maintenance of Explosion Proof Structure in Hazardous Area



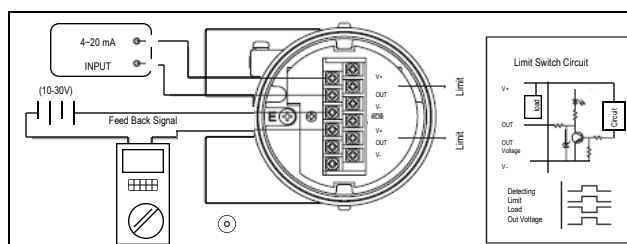
- Confirm the operating conditions so that the explosion proof rating is available and ensure not to use beyond that rating.
- The explosion proof of the YT-2400 is flame-proof, which is marked **ExdIIBT6**. and can be used in Zone 1 & 2.
- In hazardous areas with explosive gas, ensure connecting explosion proof conduit or pressure-proof packing cable must be sealed using a gasket.
- Confirm that the power is shut off before opening the cover.
- When opening the PCB Terminal or cover, of the terminal or PCB, the current or voltage must not remain in the wires or electronic parts after the power is shut down.
- YT-2400 has two conduit entries. When one explosion proof conduit or pressure-proof packing cable is used, the other port must be blocked to ensure explosion proof rating.

Model	YT-2400L		YT-2400R	
Acting Type	Single	Double	Single	Double
Input Signal	4~20 mA DC			
Minimum Current Signal	3.2mA(Standard), 3.8mA(Hart Included)			
Supply Pressure	1.4~7kgf/cm <sup>2</sup> ( 0.14~0.7 MPa )			
Stroke	10 - 150 mm		0°- 90°	
Impedance	Max.500 Ohm/20mA DC			
Air Connection	PT 1/4, NPT 1/4			
Gauge Connection	PT 1/8, NPT 1/8			
Conduit Entry	PF 1/2(Standard), NPT1/2(Option)			
Protection	IP66			
Explosion Proof	Ex d IIB T6 + H <sub>2</sub>			
Ambient Temperature	Explosion Temp : -20~60℃, Operating Temp : -30~85℃			
Linearity	± 0.5% F.S.			
Hysteresis	0.5% F.S.			
Sensitivity	± 0.2% F.S.			
Repeatability	0.3% F.S.			
Flow Capacity	70 LPM			
Air Consumption	Below 2 LPM (sup=1.4K)			
LCD Temp. Condition	Storage Temp:-30~85℃, Operating Temp:-10~70℃			
Output Characteristic	Linear, Quick Open, EQ%, User Set (16 Point)			
Humidity	5-95% RH at 40℃			
Communication (Option)	HART Communication			
Feedback Signal (Option)	4-20mA ( DC 10 - 30V )			
Material	Aluminum Diecasting			
Weight	3.35 kg (7.37 lb)			
Painting	Epoxy Polyester Powder Coating			
Color	Blue or Black			

Based on temperature 20°C , absolute pressure 760mmHg and relative humidity 65%

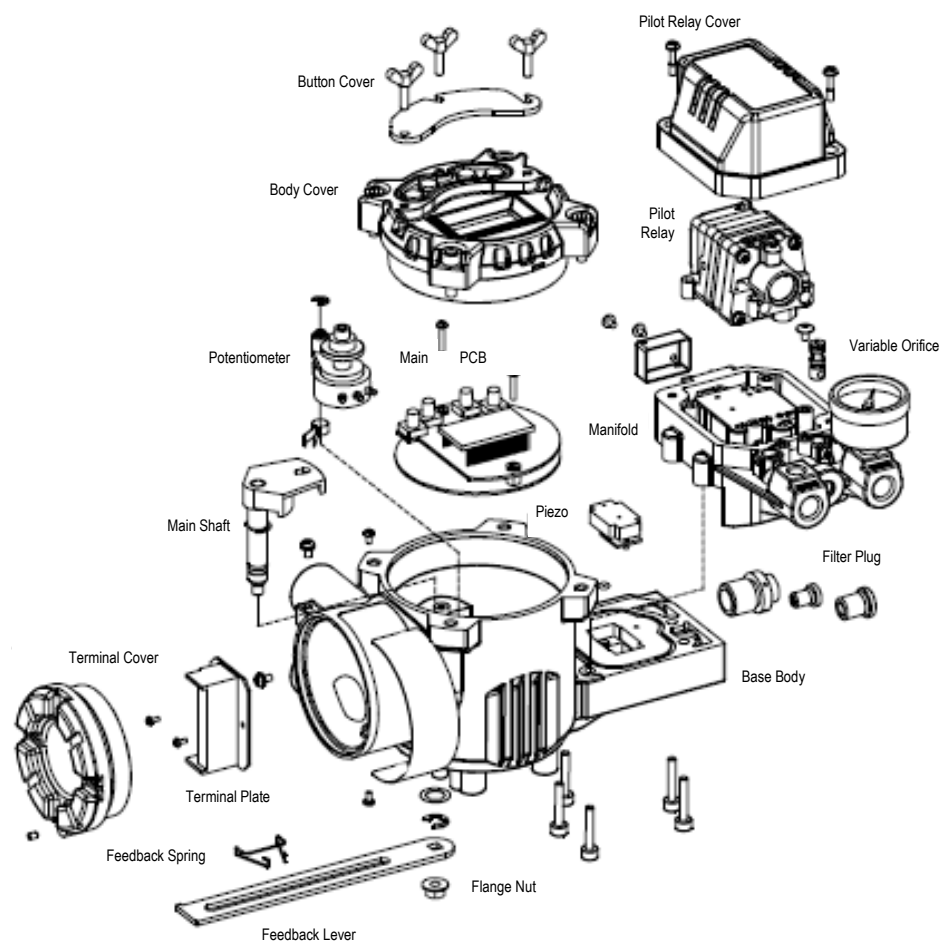
## FEATURES and FUNCTIONS

1. There are four buttons on the outside of the positioner which allows for adjustment of parameters and menus without opening the cover in explosive gas areas.
2. The smart positioner is ExdIIBT6 explosion proof rated.
3. Endures severe vibration.
4. The pilot relay valve is installed on the outside of the positioner body, which allows for easy serviceability.
5. It operates normally regardless of the change in supply pressure during operation.
6. This positioner is easy to auto-calibrate.
7. Its compact size allows for easy installation on small actuators.
8. Plant operating costs may be reduced due to its low air consumption.
9. Due to the low voltage (8.5V) usage, there is no limitations with the controller.
10. An adjustable orifice is used to accommodate small actuators so control is optimized during operation.
11. The valve positioner has HART communication capability.
12. The positioner output uses an analog feedback system.
13. An alarm function is available when using a limit switch.
14. Available valve flow characteristics are linear, quick opening, and equal percent.
15. Specific flow control is available with 16 specified user points.
16. Tight shut-off and open can be set by the user.
17. Regulated filtered air flows to the actuator by using the A/M switch.
18. Split range input is 4-20mA, 12-20mA.
19. The Hand Calibration function can be used to set zero and span.
20. The positioner has a self diagnose function for greater reliability.
21. It is equipped with a manual override.
22. The protection class is IP 66.
23. The epoxy powder coating allows for long periods of exposure to a corrosive environment.
24. Very easy to maintain with its modular design.



## STRUCTURE

The structure of the YT-2400L is as follows. The YT-2400R is the same as the linear type except for the feedback lever.



YT-2400L (Linear Type)

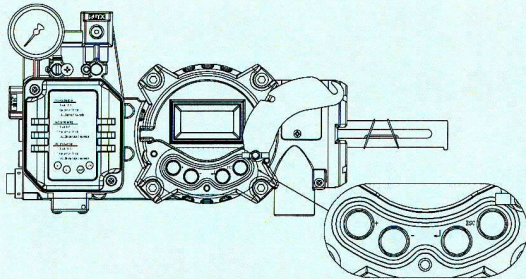


YT-2400R (Rotary Type)



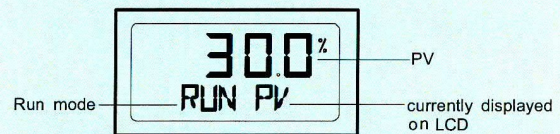
## FEATURES & FUNCTIONS

### Button

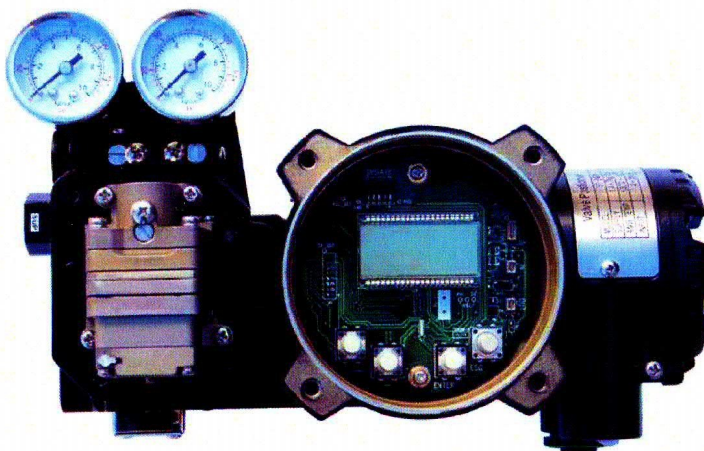


YT-2400 Series perform various functions with using four buttons.

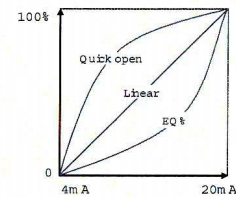
### LCD



LCD equipped outside of product makes to check the positioner condition in the field directly.

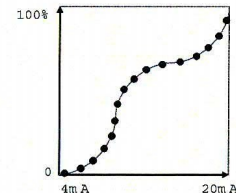


### Linear, Quick open, EQ%



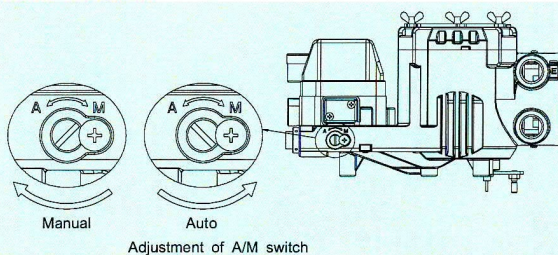
The adjustment of Valve characteristics is available.

### User defined



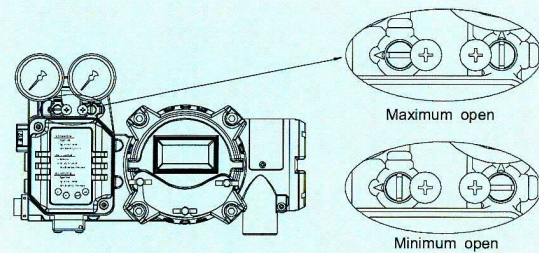
Specific flow control is available with setting 16 point at users' command.

### A/M Switch



If this switch is set as auto, supply pressure is transmitted to actuator by the operation of YT-2400 and if it is set as manual, supply pressure of air filter regulator is transmitted to actuator regardless of YT-2400.

### Variable orifice

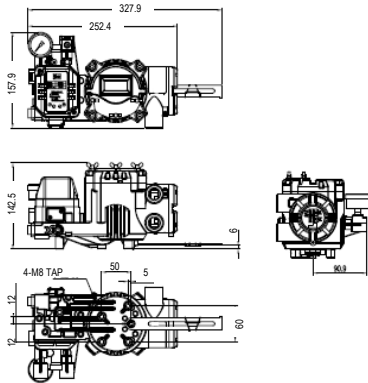


Adjustment of variable orifice  
The actuator volume is too small, hunting can be occurred. In this case, adjust variable orifice with using (-) driver, then hunting is prevented by reducing flow rate of supply pressure transmitting to actuator.

## INSTALLATION

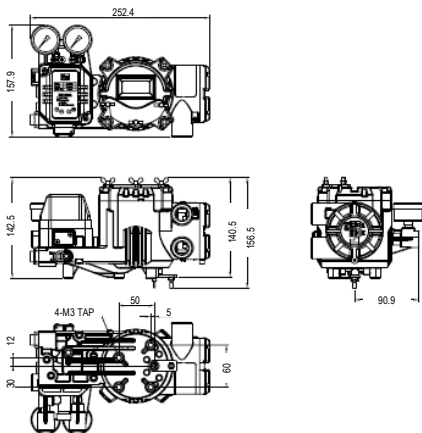
**NOTE:** When the positioner is installed or replaced with the actuator, ensure the following:

**WARNING:** To avoid damage to the process system or personal injury, isolate the valve from the system and relieve any pressure contained within prior to disassembly. Disconnect any operating lines providing air pressure, control signals, or electrical power to the actuator.



YT-2400L Drawing

YT-2400R Drawing



## TOOLS FOR INSTALLATION

Tools and bolts used for assembly are:

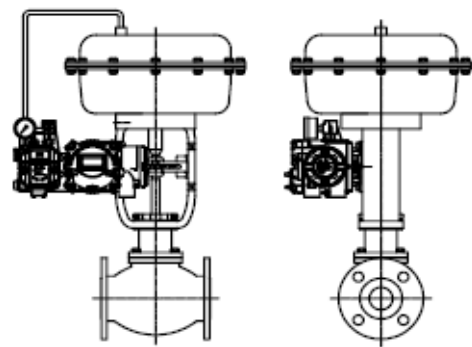
1. Hexagonal wrenches
2. (+) screw driver
3. (-) screw driver
4. Spanners for hexagon head bolts

### YT-2400L Installation

YT-2400L is used for linear motion valves such as globe valves or gate valves using spring return type diaphragm actuators or piston actuators. YT-2400L consists of the following components. Be sure that all the components are prepared.

1. YT-2400 body
2. Feedback lever and spring lever
3. Flange nut (attached on the body of the main shaft of the YT-2400L body)
4. 4 pcs of hexagon head bolt M8x1.25P
5. 4 pcs of M8 plate washer

YT-2400 Installation Example



### **Installing YT-2400L with Bracket**

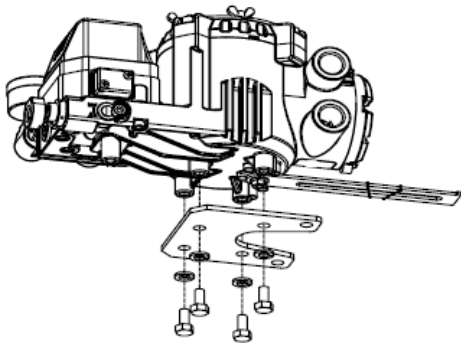
1. It is necessary to make a proper bracket to attach onto the actuator yoke.  
The most important notes in making the bracket are as follows:

A) YT-2400L feedback lever should be level at 50% of the valve stroke (Refer to point #7)

B) Feedback lever connection bar of the actuator clamp should be connected at the position that the valve and stroke numbers engraved on the feedback lever match. (Refer to point #8)

If the bracket meets the above conditions, installation of the YT-2400L is simple.

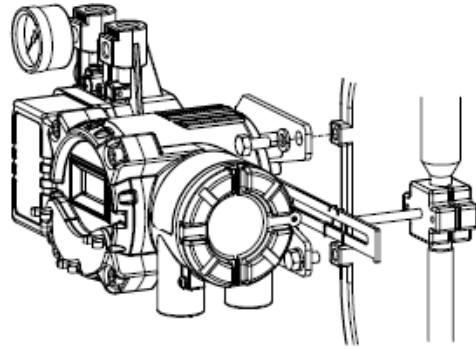
2. Assemble the YT-2400L and bracket with supplied bolts.



Installing YT-2400L with Bracket

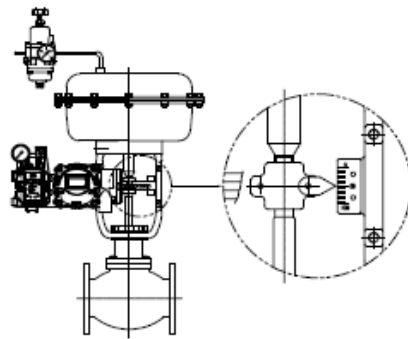
3. After assembling the YT-2400L attach it using the bolt holes of the actuator yoke. Do not tighten bolts completely - there must be some space remaining.

4. Install the bar connected to the YT-2400 feedback lever on the actuator clamp. The slot length between the YT-2400L feedback lever is 6.5mm, so the diameter of the connection bar should be less than 6.3mm.



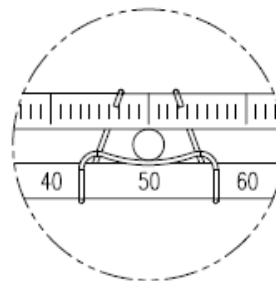
Installation of the actuator clamp and connection bar

5. Temporarily connect the air filter regulator to the actuator temporarily. Set the supply pressure of the air filter regulator to ensure that the actuator clamp is positioned at 50% of the valve stroke.



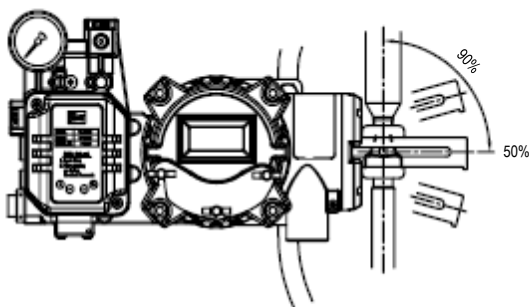
Connection of supply pressure pipe between the actuator and air filter regulator

6. Insert connection bar attached on the actuator clamp into the slot of the YT-2400 feedback lever. Ensure the connection bar looks like the diagram below in order to reduce hysteresis.



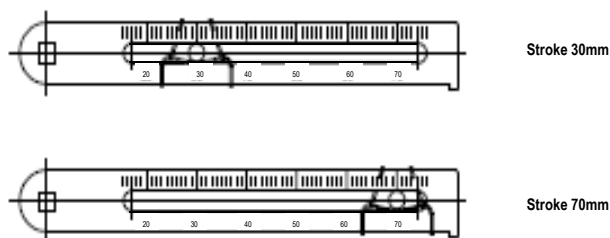
The connection bar inserted correctly between the feedback lever and lever spring

7. Ensure the YT-2400L feedback lever is level at 50% of the valve stroke. If not, make it level by moving the bracket of feedback link bar. If the YT-2400 is installed and not level at 50% of the valve stroke, product linearity becomes worse.



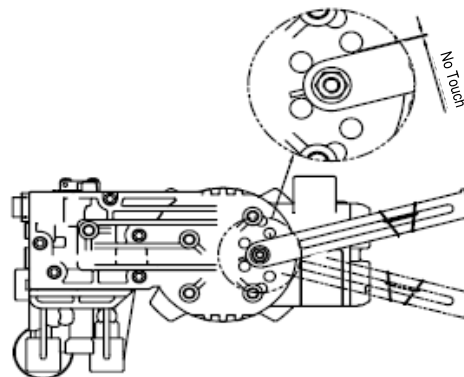
Feedback lever being leveled correctly

8. Check the valve stroke. The numbers indicating stroke are engraved on the YT-2400L feedback lever. Set the connection bar attached on the actuator clamp on the number so the feedback lever is applicable to the valve stroke as shown in the following picture.



Installation position of the connection bar for the valve stroke

**NOTE:** After installation, operate the valve from 0% stroke to 100% when using the air filter regulator on the actuator. When the stroke is both at 0% and 100%, the feedback lever should not reach the lever stoppers on the backside of the YT-2400. If the feedback lever reaches the lever stopper, move the attachment position of the YT-2400L to the direction becoming more distant from the yoke center.



Check whether or not the lever stopper and feedback lever is contacted

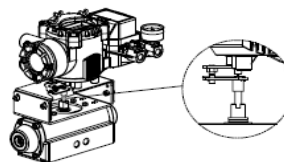
9. If the YT-2400L is installed correctly as shown in the above procedures, tighten the nuts and bolts on the bracket and feedback lever connection bar.

### YT-2400R Installation

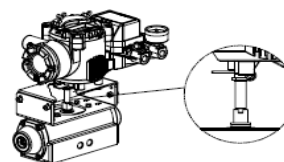
YT-2400R is used for a rotary motion valve such as a ball or butterfly valve using rack and pinion, scotch yoke or complex type actuators whose stem is rotated 90 degrees. YT-2400R consists of the following components:

1. YT-2400R main body
2. Fork spring & lever attach onto the actuator
3. 1 set of brackets
4. 4pcs of Hexagon head bolt M8x1.25P
5. 4pcs of M8 plate washer

YT-2400R Installation Example



YT-2400R Installation example of fork lever

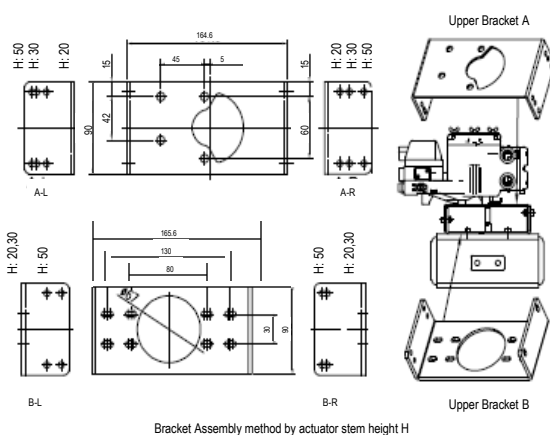


YT-2400R Installation example of NAMUR shaft



## Installing YT-2400R with Bracket

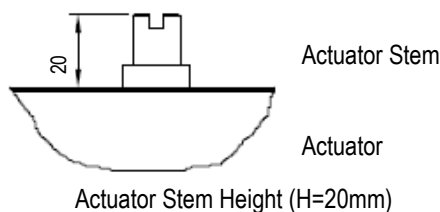
The YT-2400R is supplied with a standard bracket. The bracket consists of 2 parts and can be used with a fork lever and NAMUR shaft. The bracket is assembled in the factory based on 20mm of actuator stem height. If the actuator stem height exceeds 20mm, such as 30mm, or 50mm, reassemble the bracket adjusting to the height. Referring to the following table, check the hole positions.



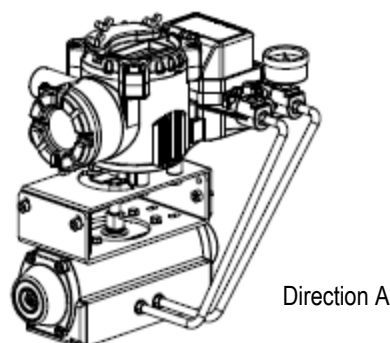
	Markings of Bolt Holes			
Actuator Stem Height (H)	A-L	B-L	A-R	B-R
20mm	H: 20	H: 20, 30	H: 20	H: 20, 30
30 mm	H: 30	H: 20, 30	H: 30	H: 20, 30
50 mm	H: 50	H: 50	H: 50	H: 50

Ex: In case that H is 30mm, A-L should be locked in H:30 hole B-L in H: 20,30; A-R in H:30, B-R in H:20, 30 with bolts.

1. In general, the height of an actuator (H) is 20, 30, or 50mm. After checking (H), assemble brackets as explained in the previous paragraph. The bracket is set as 20mm type in the factory.



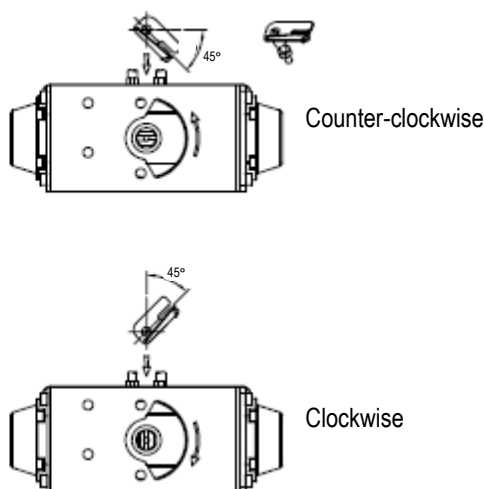
2. Attach the bracketed YT-2400R to the actuator by using the supplied bolts. The size of the bracket hole is 6mm. When tightening the bolts, use the spring washer or similar washer for firm attachment to the actuator. The direction of the bracket is different from the operating condition, but normal direction is shown in the following picture. So that, when the piping of the actuator and YT-2400R is in direction A, the bracket hole and indicator attached on the bottom of the YT-2400R main shaft should be the same direction as the half circle.



Attachment Direction of bracket and Actuator

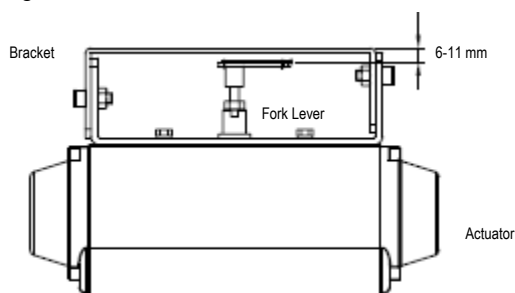
3. Set the rotation position of the actuator stem at the initial zero point which is stroke 0%. In the case of the spring return type actuator, the actuator stem is always rotated at zero point without supply pressure, it is easy to check zero point. If the actuator is double acting, check whether it is clockwise or counter-clockwise or the rotation direction of the actuator stem with using supply pressure.

4. Set the actuator stem at the initial zero point and install the fork lever as in the following picture. Ensure the position of the initial zero point when the actuator stem is clockwise or counter-clockwise. Installation angle of the fork lever should be 45 degrees based on the linear shaft, but the angle is not related to the NAMUR shaft.



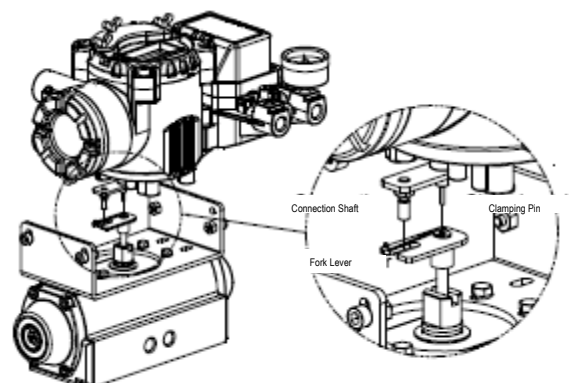
Installation position of the fork lever

5. If the fork lever position is set, check lock nuts assembled on the bottom of the fork lever when turning clockwise. Set the upper height of the fork lever as 6-11mm lower than the bracket's upper height.



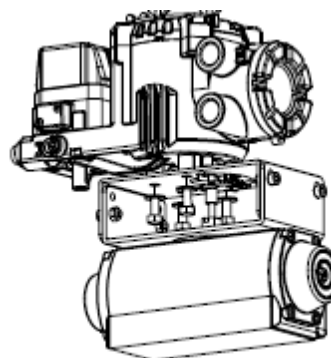
Height of bracket, fork and fork lever

6. Attach the YT-2400R to the bracket. Fix the clamping pin on the main shaft center of the YT-2400R into the hole of the fork lever and insert the connection bar attached on the main shaft lever into the fork lever slot to be locked. This is to fit the main shaft of the YT-2400R and the center of the actuator stem. If they are not fitted correctly, the product durability is reduced due to excess force on the main shaft of the YT-2400R.



Fitting the pin on the YT-2400R main shaft into the fork lever hole.

7. Fix the YT-2400R base and the bracket with the hexagon head bolts and plate washer. It is better to lock the bracket and YT-2400R after checking the position of the YT-2400R by inserting four bolts.



Assembly status of the YT-2400R.

## PIPING CONNECTION

### NOTE:

- To prevent moisture, oil and dust from getting inside the product, give careful consideration to the choice of supply pressure compressor and its system.
- We recommend to attach filter or air filter regulator in front of the supply port of the YT-2400R.

### **Supply Pressure Condition**

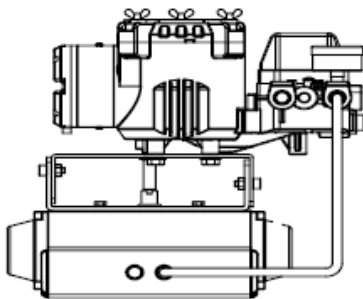
1. Dry air with at least 10°C lower than ambient temperature.
2. Keep away from dusty air. The filter is for 5 microns or larger.
3. Avoid oil.
4. Comply with ANSI/ISA-57.3 1975(R1981).
5. Not to be used beyond the range of 1.4-7 kgf/cm<sup>2</sup> (140 - 700 kPa).
6. Set air filter regulator's supplied pressure 10% higher than actuator's spring range pressure.

### **Pipe Condition**

1. Make sure inside of pipe is empty.
2. Do not use pipeline that is squeezed or has holes.
3. To maintain flow rate, use the pipeline that has more than 6mm inner diameter.
4. Do not use an extremely long pipeline system. It may affect flow rate due to the friction inside the pipeline.

### **Piping Connection with Actuator**

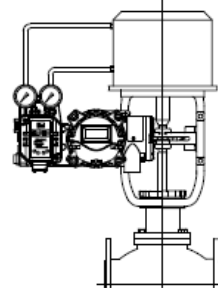
YT-2400 series single acting type is set out to use OUT1 port. OUT1 port should be connected with the supply pressure port from the actuator when using single acting type spring return actuator.



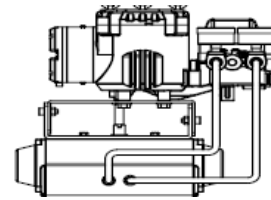
Piping connection example of YT-2400R with single acting actuator.

### **Double Acting Actuator**

In the case of the YT-2400 series, double acting type, when inserting current signal, supply pressure is from OUT1 port.



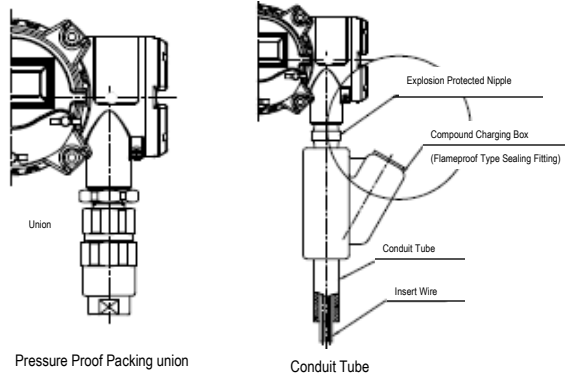
Piping connection example of the YT-2400L with double acting actuator.



Piping connection example of the YT-2400R with double acting actuator.

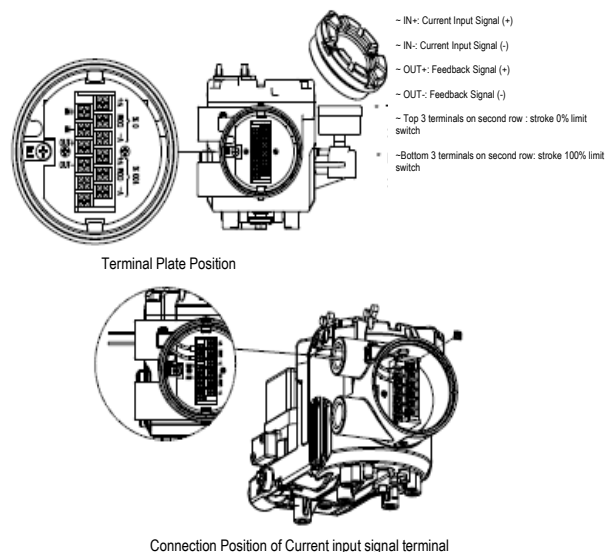
## **POWER CONNECTION**

1. In hazardous areas like explosive gas areas, conduit tube or pressure-proof packing union must be used. In case of pressure-proof packing union, use the cable that has appropriate outer diameter, considering inner rubber packing size. And in case of the conduit tube, ensure that it is fully sealed with using gaskets or sealing materials.



2. Conduit entry size is PF 1/2 or G 1/2.

3. When the power is connected, do not open the cover. Confirm that the power is shut down before opening the cover. Ensure that there is no remaining current voltage.
4. Use an approved flexible cable to protect against vibration, impact, and, tension.
5. If the position transmitter or limit switch is installed, 12-24VDC power should be additionally supplied to each switch. Ensure not to exceed the maximum 30VDC.
6. For product protection, ground with the ground terminal on terminal box or PCB plate.
7. Use a ring type wire terminal to prevent vibration or impact.
8. Do not install the cable near the equipment such as a high capacity transformer or motor generating noise.
9. Use shielded cable to protect against noise.



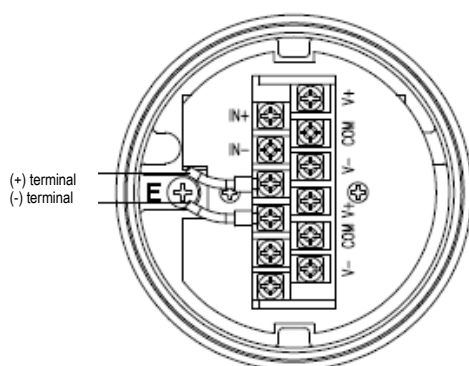
### **Terminal Connection of Current Input Signal**

1. Loosen bolts of terminal box cover with a 3mm wrench.
2. Open the cover by turning counter-clockwise by grabbing the terminal box cover or using a driver head.
3. There are two entries on the right bottom of the YT-2400. When connecting power, a pressure-proof packing union or conduit tube can be used. Choose an approved connection type considering explosion proof and installation conditions.
4. The terminal of the current input signal is on the bottom left of the terminal plate, as in the following picture. Insert terminal bolts in cable terminal holes and lock them with a (+) terminal and (-) terminal each on the terminal plate. Refer to the following diagram.
5. Ensure not to change the polarity of the terminal.
6. Set the terminal cover box with the terminal box and turn clockwise until the bolts are tightened.
7. Lock the locking bolts of the terminal box cover clockwise using a 3mm wrench.

### **Terminal Connection of the Feedback Signal**

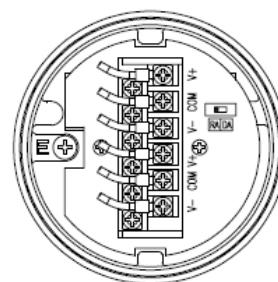
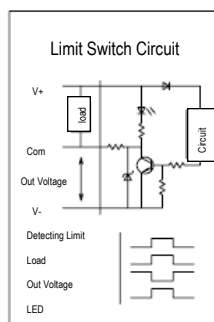
1. Loosen the bolts of the terminal box cover with a 3mm wrench.
2. Open the cover by turning counter-clockwise by grabbing the terminal box cover or using the driver head.
3. There are two entries on the right bottom of the YT-2400. When connecting power, a pressure-proof packing union or conduit tube can be used. Choose an approved connection type considering explosion proof and installation conditions.
4. The terminal of the current input signal is on the bottom left of the entire terminal plate, as in the following picture. Insert terminal bolts in cable terminal holes and lock them with a (+) terminal and (-) terminal each on the terminal plate. Refer to the following diagram.

5. Ensure not to change the polarity of the terminal.
6. Set the terminal cover box with the terminal box and tighten the bolts.
7. Lock the bolts of the terminal box cover clockwise while using a 3mm wrench.



Terminal Connection Transmitter

5. Ensure not to change the polarity of the terminal.
6. Install the terminal cover with the terminal box and tighten the bolts.
7. Tighten the bolts of the terminal cover with a 3mm wrench.
8. The adjustment of RA and DA is done by moving the dip switch on the right of the terminal plate.



Terminal Connection of Limit Switch

### **Terminal Connection of Limit Switch**

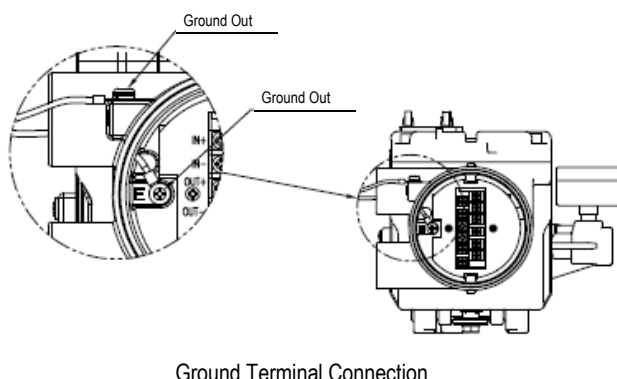
1. Loosen the bolts of the terminal box cover with a 3mm wrench.
2. Open the cover by turning counter-clockwise by grabbing the terminal box cover or using a driver head.
3. There are two entries on the right bottom of the YT-2400. When connecting power, a pressure-proof packing union or conduit tube can be used. Choose an approved connection type considering explosion proof and installation conditions.
4. Limit switch terminals are at the top of the terminal plate as shown in the following picture. The top three terminals on the right is the valves 0% position and the three terminal on the bottom is the valves 100% position. Insert the terminal bolts into the cable ring terminal holes and lock them with a (+) and (-) terminal on the terminal plate.

### **Terminal Connection for Ground**

1. The ground connection is necessary for the safety of the YT-2400 and its system.
2. The inside terminal is on the right bottom of the terminal plate and the outside terminal is beside the outer cable entry. Use any ground terminal when available and resistance must be less than 100 ohm.
3. When using an inside ground, loosen ground bolts. Insert outside ground bolts and spring washer into the ring type terminal of the cable ground and tighten them with bolts.
4. When using an outside ground, loosen the bolts of the terminal box cover with a 3mm wrench.
5. Open the cover by turning counter-clockwise by grabbing the terminal box cover or using a driver head.



6. There are two entries on the right bottom of the YT-2400. When connecting power a pressure-proof packing union or conduit tube can be used. Choose an approved connection type considering explosion proof and installation conditions.
7. Inside ground terminals are at the bottom of the terminal plate as shown in the following picture. There are two terminals on the right, both terminals can be used. Choose a suitable connection type considering explosion proof and installation conditions and insert cable ground into the terminal box.
8. Tighten the bolts of the terminal cover to with a 3mm wrench.



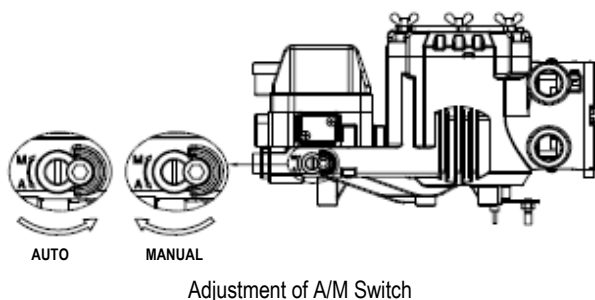
## A/M SWITCH - (AUTO/MANUAL SWITCH)

There is an A/M switch on the bottom of the YT-2400. If this switch is set as auto, supply pressure is transmitted to the actuator by the operation of the YT-2400. If it is set as manual, supply pressure of the air filter regulator is transmitted to the actuator regardless of the YT-2400.

\* When the A/M switch is set as manual, ensure that too much pressure is not transmitted to the actuator.

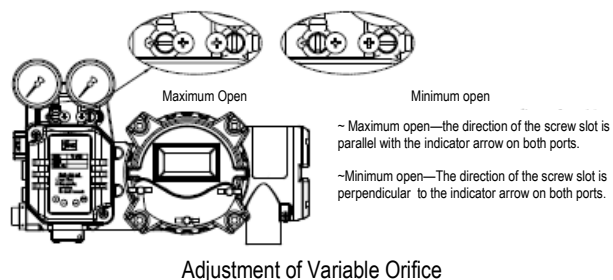
1. Ensure the supply pressure of the air filter regulator is correct.

2. Turn the switch clockwise and supply pressure of the air filter regulator is transmitted to the actuator.
3. If turning the switch counter-clockwise, the YT-2400 is operated normally.



## Variable Orifice

If the actuator volume is too small, hunting may occur. In this case, adjust the variable orifice using a slot screw driver, then hunting will be prevented by reducing the flow rate of supply pressure to the actuator.



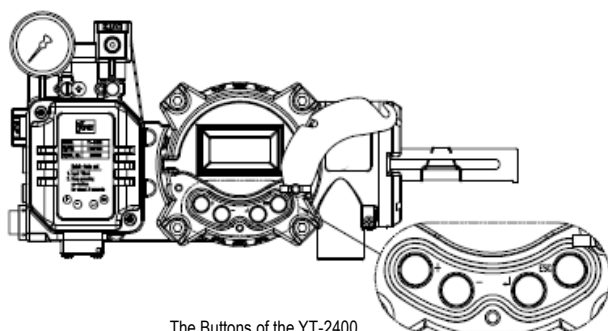
## AUTO CALIBRATION & BASIC OPERATIONS

**WARNING:** Since this makes the valve or actuator move, before auto calibration, the valve must be disconnected from the entire system.

### Button

The YT-2400 series performs various functions using four buttons.

The shape and position of buttons are as follows:



The Buttons of the YT-2400

**<ESC>**: To return to the previous menu

**<Enter>**: To go to the main menu, save adjusted parameter values or choose sub menus.

**<DOWN>**: To move to another menu or change parameter values.

**<UP>**: To move to another menu or change parameter values.

### Run Mode

After connecting power to the YT-2400, the following is displayed on LCD in 6 seconds.



Run on the bottom line means that the YT-2400 adjusts the valve stroke when receiving an outside signal (4-20mA) and PV means the number on the LCD. In RUN mode, the valve stroke is changed according to the input signal. There are six types displayed in RUN mode.

In order to change the display, push **<ESC>** and **<UP>** at the same time. Whenever pushing the buttons, the display is changed in that order. If pushing **<ESC>** and **<DOWN>** simultaneously, the order is opposite and if only pushing **<ESC>**, display is returned to RUN mode.

(1)	Run PV	Process Value	Valve Stroke (%)
(2)	Run SV%	Set Value	Input Signal (0-100%)
(3)	Run SV mA	Set Value	Input Signal (4-20mA)
(4)	Run MV	Manipulate Value	Motor Controlled Variable (Digit)
(5)	Run Vel	Velocity	Current Valve Speed (Digit)
(6)	Run Err	Error	Difference between SV and PV %

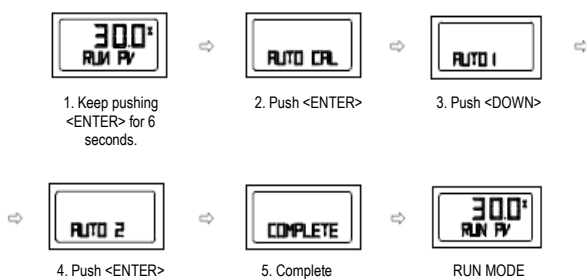
### First Auto Calibration

The first auto calibration is usually used when the YT-2400 has not been set, this occurs when the initial setting of the valve at the valve company or replacement with other products in the field. In this case, entire parameters are set by using AUTO2 calibration.

**WARNING:** When the YT-2400 is installed on the valve in the field, after setting, we recommend that you use "AUTO1 Calibration" rather than AUTO2. This allows optimum parameters set by the valve company and it is better if those parameters are not changed by AUTO1 calibration.

1. Connect power. Any values between 4-30mA (DC) can be used for power. After connecting power "READY 6, 5, 4, 3, 2, 1" message appears on the LCD, in order, that indicates the start time to operate the PCB unit and parts. The following message is displayed in 6 seconds. Push **<ENTER>** for 6 sec. at RUN mode and AUTO CAL message appears.

2. Push <ENTER> and AUTO1 mode is started.
3. Push <DOWN> and AUTO2 mode is displayed.
4. Push <ENTER> at AUTO2 mode. Auto 2 calibration is started and the next modes are displayed in order on the LCD. Normally it takes 3-5 minutes for auto calibration in AUTO2 mode, but it can differ depending on the actuator volume and other factors, such as conditions.
5. When auto calibration is done “**COMPLETE**” message appears on the LCD. After 4 seconds the procedure is returned to RUN mode and the valve stroke by current input signal is displayed as a percentage.
6. Zero, Span, PID parameters and RA/DA are automatically set when Auto 2 calibration is complete.



### Entire Modes and Functions

\*Auto calibration = (AUTO CAL)

The calibration of the YT-2400 is simply performed by auto calibration and there are 5 types of auto calibration as AUTO1, AUTO2, AUTO3, BIAS, V\_O.

**AUTO1 calibration is useful for users in the field and AUTO2 is for valve companies or setting the initial parameters of the YT-2400.**

AUTO1, AUTO2, AUTO3 calibration set RA/DA automatically.

	ZERO POINT	END POINT	KP / KI / KD	BIAS	V_O	RA / DA
AUTO 1	0	0	X	0	0	0
AUTO 2	0	0	0	0	0	0
AUTO 3	X	X	0	0	0	0
BIAS	X	X	X	0	X	X
V_O	X	X	X	X	0	X

Auto Calibration Types

### Auto 1 Calibration (AUTO1)

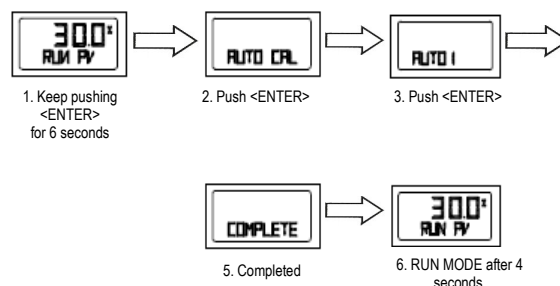
In this mode all parameters necessary for valve operation are set except KP, KI, and KD. It is used to re-execute calibration by users in the field after being supplied a YT-2400 whose parameters were set by a valve company.

1. Push <ENTER> for 6 seconds at RUN mode and an AUTO CAL message will appear.

2. Push <ENTER> and then AUTO1 mode is displayed.

3. Push <ENTER> again at AUTO1 mode and Auto1 calibration is started.

4. When Auto calibration is done, “COMPLETE” message will appear. After 4 seconds, the procedure is returned to RUN mode and the valve stroke by current input signal is displayed as a percentage.



### **Auto 2 Calibration (AUTO2)**

All parameters necessary to operate the valve are set. The calibration is used when the YT-2400 is first installed with the valve. Refer to the section on first auto calibration.

### **Auto 3 Calibration (AUTO3)**

All parameters necessary to operate the valve are set except zero and end point. This function is used to re-execute auto calibration without changing zero and the end point after manually adjusting them.

1. Push <DOWN> at AUTO2 and AUTO3 is displayed.
2. Push <ENTER> and AUTO3 calibration is started. The next procedure of this calibration is the same as the other calibrations.

### **BIAS Calibrations**

BIAS means standard value of motor control that is used in the positioner. It is affected by supply pressure, KP and other values, therefore it should be re-adjusted if supply pressure or KP is changed. Unless the value is correctly set, accuracy can be very low.

1. Push <DOWN> at AUTO3 mode and BIAS mode is displayed.
2. Push <ENTER> and BIAS calibration is started. The next procedure of this calibration is the same as the other calibrations.

### **Velocity Calibrations (V 0)**

This is the function to find the standard value to recognize accurate valve speed. Unless this value is correctly set, KI control can be slower or impossible. In order to check if this value is accurately set, push <ESC> at RUN mode and RUN Vel is displayed. At this time the number on the bottom line of the LCD indicated the value close to zero.

(After the valve is stopped) Usually the number is between -2 and 2. If the number is over 5, execute this function again and reset the V\_0 value.

1. Push <DOWN> at BIAS mode and V\_0 mode is displayed.
2. Push <ENTER> and V\_0 calibration is started. The next procedure of this calibration is the same as the other calibrations.

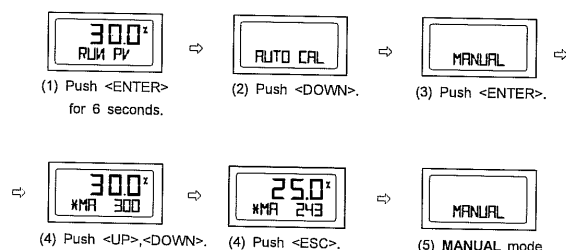
### **Manual Mode**

Manual mode is used to raise or lower the valve stem manually. In this mode valve stroke is adjusted only by operating buttons, not by the current input signal. This mode doesn't affect controlling data registered in the YT-2400 and only moves the valve stem up & down.

1. Keep pushing <ENTER> at RUN mode and the AUTO CAL message is displayed.
2. Push <DOWN> and MANUAL MODE is displayed.
3. Push <ENTER> again. Two lines on the LCD are displayed. The upper one indicates valve stroke by percentage and the lower one indicates the absolute value of inner resistance of the YT-2400. \*MA indicates manual mode is in operation.
4. Push <UP> or <DOWN> and the valve stem moves up or down. Regardless of RA or DA, if you push <UP>, the valve stem moves up (in case of linear valve) and if you push <DOWN> the valve stem moves down. In order to make the valve stem move faster, push <ENTER> with <UP> and <DOWN>.

Push <UP>	Valve stem moves up slowly
Push <UP> + <ENTER> at the same time	Valve stem moves up quickly
Push <DOWN>	Valve stem moves down slowly
Push <DOWN> + <ENTER> at the same time	Valve stem moves down quickly

5. Push <ESC> and MANUAL MODE is displayed.



### Parameter Mode (PARAM)

With auto calibration, optimum operation is available for most actuator control. But if the optimum operation is difficult because of hunting or oscillation, it can be solved by PID parameters and DeadZone.

### Parameter Types

There are four types of parameters: Dead Zone, KD, KP, & KI. These values are reflected as soon as they are changed, therefore the appropriate values are found when checking the valves motion in real time.

### Dead Zone (dEAdZONE)

This is the section of Error % that the control is not operated. If there is hunting or oscillation continuously due to the friction between stem and packing, they are prevented with this parameter.

### KP

This is the proportion constant value of correction that is correcting the Error %. If this value is too high, there can be hunting to find its position by input signal. If the value is too low, accuracy gets worse.

### KI

This is an integral constant value, adding or subtracting the correction that is correcting by Error % on the previous correction signal. If this value is too high, there can be oscillation. If it is too low, the time to find the exact position is longer.

### KD

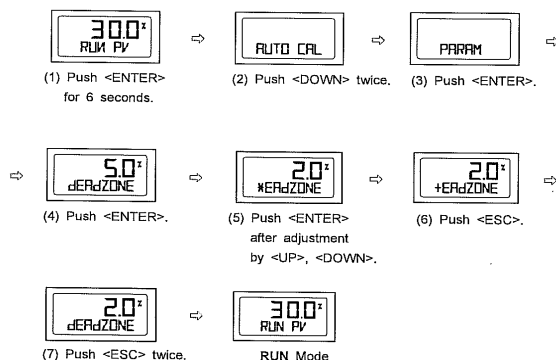
This is a differential constant value adding previous correction signal when changing correction signal by Error % change rate. If this value is too high, there can be hunting. If this value is too low, dynamic characteristics during the time to find the position get worse.

### Adjustment of Parameter

#### Dead Zone (dEAdZONE)

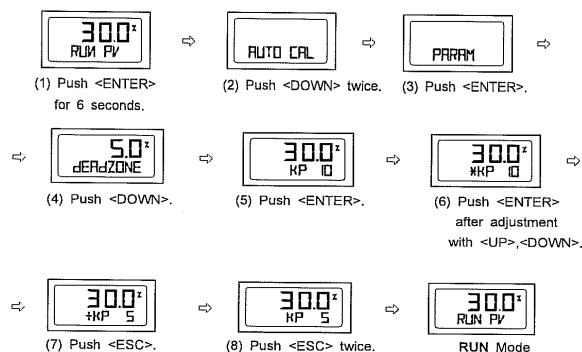
- (1) Push <ENTER> at RUN mode for 6 seconds and AUTO CAL message appears.
- (2) Push <DOWN> twice and PARAM mode is displayed.
- (3) Push <ENTER> and dEAdZONE mode is displayed.
- (4) Push <ENTER> again and \*EAdZONE message appears.
- (5) Adjust dEAdZONE value by <UP> or <DOWN>. Adjusted value is applied right away without additional operation, so users can easily check its adjustment by changing the current input signal to YT-2400. It means that optimum control value is found by adjusting values during valve operation.
- (6) Push <ENTER> to save the value. +EAdZONE message is on LCD.
- (7) Push <ESC> three times to return to RUN mode.





## KP

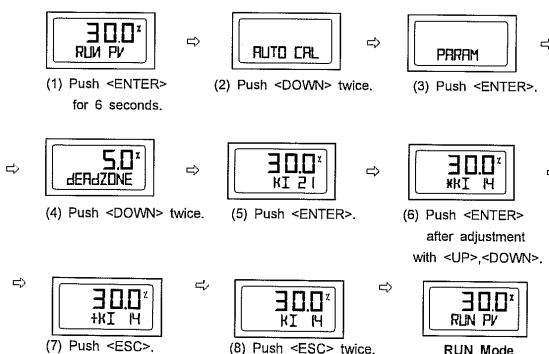
- (1) - (3) Adjustment method and procedure is the same as the dEAdZONE.
- (4) Push <DOWN> at dEAdZONE mode and KP mode is displayed.
- (5) Push <ENTER> and \*KP message is on LCD.
- (6) Adjust KP values with <UP> or <DOWN>. Adjusted value is applied right away without additional operation, so users can easily check its adjustment by changing the current input signal to YT-2400. It means that optimum control value is found by adjusting values during valve operation.
- (7) Push <ENTER> to save the value. +KP message is on the LCD.
- (8) Push <ESC>
- (9) Push <ESC> twice to return to RUN mode.



## KI

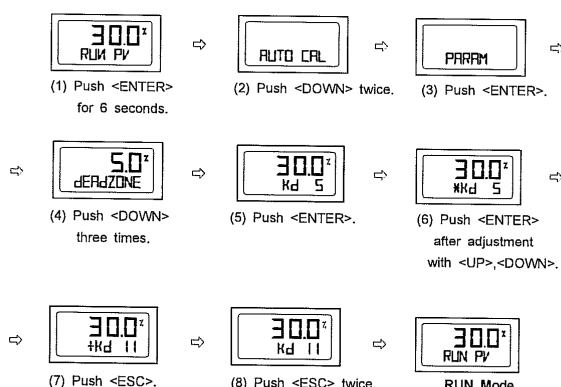
- (1) - (3) Adjustment method and procedure is the same as the dEAdZONE.
- (4) Push <DOWN> at dEAdZONE mode and KI mode is displayed.

- (4) Push <DOWN> at dEAdZONE mode and KI mode is displayed.
- (5) Push <ENTER> and \*KI message is on LCD.
- (6) Adjust KI values with <UP> or <DOWN>. Adjusted value is applied right away without additional operation, so users can easily check its adjustment by changing the current input signal to YT-2400. It means that optimum control value is found by adjusting values during valve operation.
- (7) Push <ENTER> to save the value. +KI message is on the LCD.
- (8) Push <ESC>
- (9) Push <ESC> twice to return to RUN mode.



## KD

- (1) - (3) Adjustment method and procedure is the same as the dEAdZONE.
- (4) Push <DOWN> at dEAdZONE mode and KD mode is displayed.
- (5) Push <ENTER> and \*KD message is on LCD.
- (6) Adjust KD values with <UP> or <DOWN>. Adjusted value is applied right away without additional operation, so users can easily check its adjustment by changing the current input signal to YT-2400. It means that optimum control value is found by adjusting values during valve operation.
- (7) Push <ENTER> to save the value. +KD message is on the LCD.
- (8) Push <ESC>
- (9) Push <ESC> twice to return to RUN mode.



## HAND CAL

When auto calibration is started YT-2400 sets zero point and end point based on a full stroke. But when there is a necessity of re-adjusting zero and end points to a specific section in an entire stroke. Hand calibration is used, and both the valve and transmitter can be re-adjusted.

### Hand Calibration Types:

**PV\_ZERO:** Edit mode to change the zero point of valve.

**PV\_END:** Edit mode to change the end point of valve.

**TR\_ZERO:** Edit mode to change the zero point of transmitter.

**TR\_END:** Edit mode to change the end point of transmitter.

Adjustment of valve zero point ((1)-(5)) and end point ((6)-(10))

1. Push <ENTER> at RUN mode for 6 seconds and then AUTO CAL mode is displayed. Push <DOWN> three times, then HAND CAL mode is displayed.
2. Push <ENTER> at HAND CAL mode and PV\_ZERO mode is started.
3. Push <ENTER> at PV\_ZERO mode and \*PZ mode is started. In this mode it is possible to change valve zero point and valve stem moves automatically to current zero point.

On the LCD valve stroke is displayed as 0%. \*PZ message indicating edit mode of zero point and inner value showing current zero point position are also displayed.

4. Adjust valve stem while pushing <UP>, <DOWN>. When valve stem is at the desirable zero point, save it with <ENTER>. +PZ message is appeared on LCD.

5. Push <ESC> at this mode to return PV\_ZERO mode. (Push <ESC> twice at this mode to return to RUN mode)

6. In order to change valve end point, push <DOWN> at PV\_ZERO mode and PV+\_END mode is started.

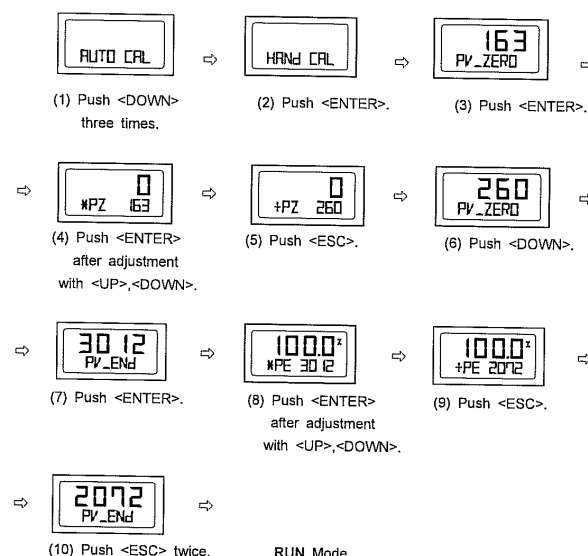
7. Push <ENTER> at PV+\_END mode and \*PE mode is displayed. In this mode it is possible to change the valve end point and the valve stem moves automatically to the current end point. On the LCD the valve stroke is displayed at 100%.

\*PE message indicating edit mode of end point and inner value of end point are also displayed.

8. Adjust valve stem with using <UP> or <DOWN>. When the valve stem arrives at a desirable end point, save it with <ENTER>. +PE message is appeared on the LCD.

9. Push <ESC> to return to PV+\_END mode.

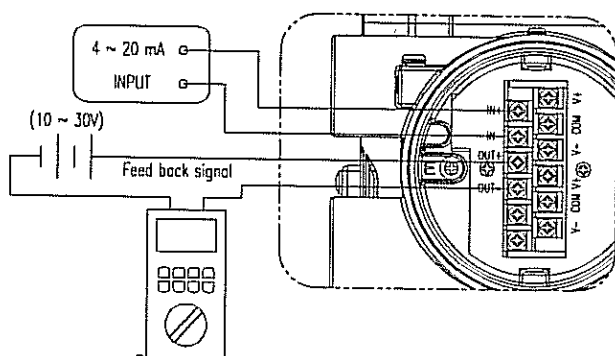
10. Push <ESC> twice and RUN mode is displayed. (Push <DOWN> at PV+\_END mode to go to TR\_ZERO mode)



Adjustment of zero point ((1)-(4)), end point ((5)-(9)) of transmitter.

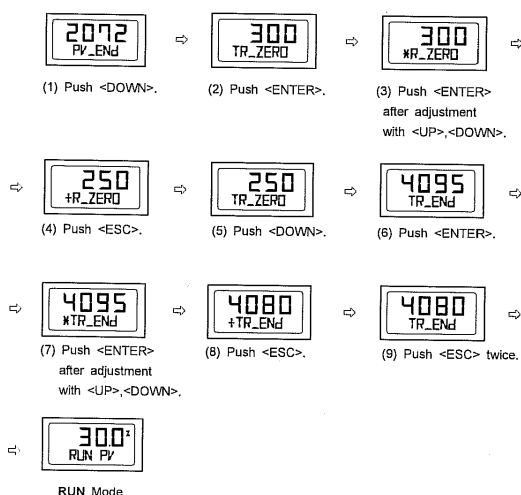
If valve zero point and end point are changed, the transmitter is also changed automatically. So usually there is no need for the transmitter zero point and end point to be adjusted by users, but if the transmitter output signal is unstable, transmitter zero point and end point should be adjusted.

The ammeter showing feedback signal is necessary and the connection should be done as in the following picture.



1. Push <DOWN> at PV\_END mode and then TR\_ZERO mode is displayed.
2. Push <ENTER>. \*R\_ZERO mode is started and in this mode users can adjust zero point of transmitter. Valve stem is moved to zero point automatically.
3. Push <UP> or <DOWN>. The number on the above on the LCD is changed and the measured current value is changed accordingly to the ammeter. Adjust it to be 4mA and push <ENTER> to save it. +R\_ZERO message appears.
4. Push <ESC>. TR\_ZERO mode is displayed.
5. Push <DOWN> at TR\_ZERO mode. Then TR\_END mode is displayed. (Push <ESC> twice to return to RUN mode)
6. Push <ENTER>. \*TR\_END mode is started and in this mode users can adjust the end point of the transmitter. The valve stem is moved to end point automatically.

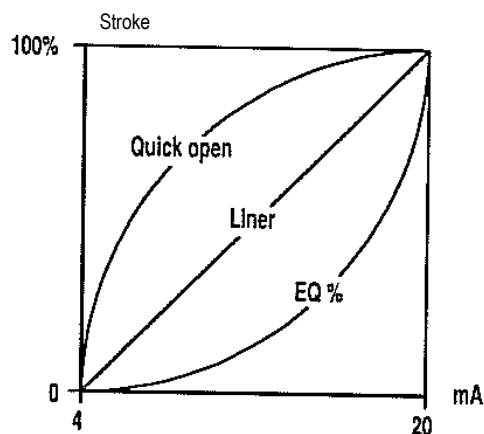
7. Adjust the measured current value to be 20mA on ammeter with <UP> or <DOWN>. Push <ENTER> to save it. +R\_END message appears.
8. Push <ESC>. TR\_END mode is displayed.
9. Push <ESC> twice at this mode to return to RUN mode.



**Valve Mode:** This mode is to adjust the various characteristics.

**Action Type (ACT):** It sets direct action (DA) and reverse action (RA).

**Characteristics (CHAR):** It sets characteristics. There are 3 types of valve characteristics, which are Linear (LIN), Equal percent (EQ), and Quick Open (QO). The following is an example of the 3 characteristic curves.



**User Characteristics (USER SET):** When a specific characteristic which is not included in the above characteristics is needed, it is possible to make a specific characteristic curve by choosing 16 points voluntarily according to field conditions and users' need.

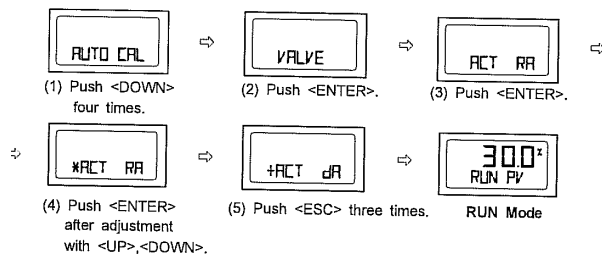
**Tight Shut Open (TSHUT OP):** This is to press down the valve fully at any valve around 20mA current input signal.

**Tight Shut Close (TSHUT CL):**  
This is to close valve completely at setting value around 4mA input signal from outside.

**Split Range Control (SPLIT):** This is to control the entire stroke by 3 input signals of 4-20mA, 4-12mA and 12-20mA.

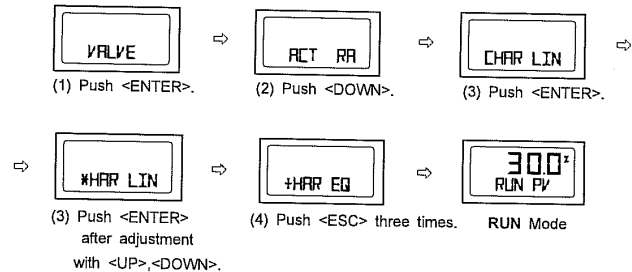
#### Adjustment of Acting Type (ACT):

1. Push <ENTER> at RUN mode for 6 seconds and then AUTO CAL mode is displayed. Push <DOWN> 4 times to go into VALVE mode.
2. Push <ENTER> and ACT RA (in case of RA) is displayed.
3. Push <ENTER> again, then \*ACT RA is displayed.
4. Adjust to \*ACT DA by pushing <UP> or <DOWN> and save it by pushing <ENTER>. +ACT DFA message is on.
5. Push <ESC> 3 times to return to RUN mode.



#### Adjustment of Characteristics (CHAR):

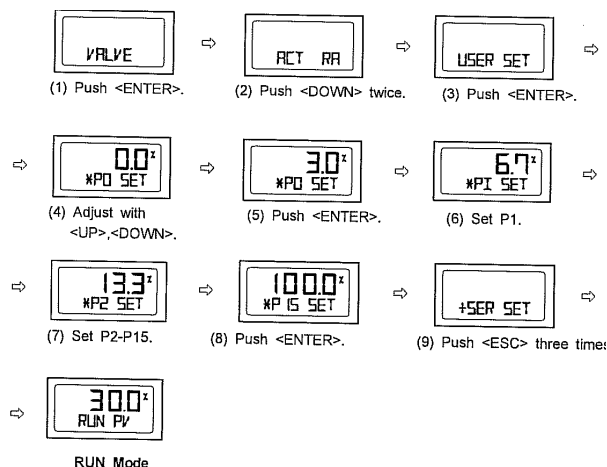
1. Push <ENTER> at VALVE mode and then push <DOWN>. CHAR LIN (in case of linear characteristic) mode is displayed.
2. Push <ENTER>. \*HAR LIN mode is displayed and characteristics can be adjusted at this mode.



3. Adjust characteristics (ex: EQ) by pushing <UP> or <DOWN> and save by pushing <ENTER>. +HAR EQ is displayed.
4. Push <ESC> 3 times to return to RUN mode.

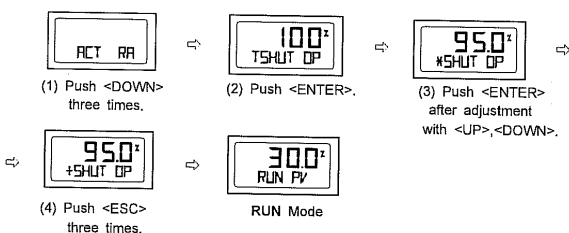
#### Adjustment of User Characteristics (USER SET):

1. Push <ENTER> at VALVE mode and ACT RA or ACT DA is displayed.
2. Push <DOWN> twice, then USER SET mode is started.
3. Push <ENTER>. \*P0 SET mode is displayed and at this mode users can adjust the first point of characteristic in 16 points. The number on the LCD is the valve stroke percentage set to P0.
4. Adjust valve stroke percentage by pushing <UP> or <DOWN>.
5. Save it by pushing <ENTER>. While P0 value is being saved, \*P1 SET mode is displayed.
6. \*P1 SET mode is to adjust the second point of characteristic in 16 points. Adjustment method is the same as \*P1 SET mode.
7. Save valve stroke percentage from P2 to P15 in the same way.
8. After adjustment of valve stroke percentage at \*P15 SET mode, save it with <ENTER>.
9. +SER SET is displayed. Total 16 points of valve stroke percentage are all set. Push <ESC> 3 times to return to RUN mode.



### Adjustment of Tight Shut Open (TSHUT OP):

1. Push <ENTER> at VALVE mode and ACT RA or ACT DA is displayed. Push <DOWN> 3 times at this mode, then TSHUT OP is displayed.
2. Push <ENTER> \*SHUT OP mode is displayed and in this mode users can set the stroke at the time of Tight Open. Initial setting is done at 100%, which means cancellation of this function. Adjust the value (ex: 95.0%) by pushing <UP> or <DOWN> and save it by pushing <ENTER>. +SHUT OP is displayed.
3. Push <ESC> 3 times to return to RUN mode.

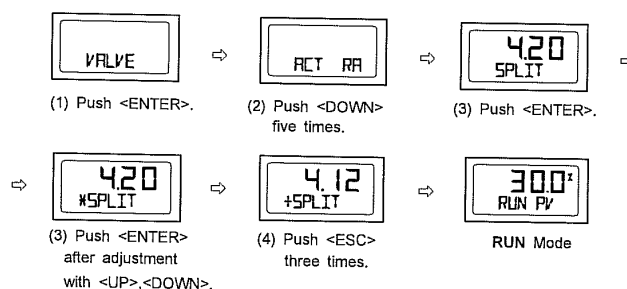


### Adjustment of Tight Shut Close (TSHUT CL):

1. Push <ENTER> at VALVE mode and ACT RA or ACT DA is displayed. Push <DOWN> 4 times at this mode, then TSHUT CL is displayed.
2. Push <ENTER> \*SHUT CL mode is displayed and in this mode users can set the stroke at the time of Tight Close. Initial setting is done at 0.3%. 0% which means cancellation of this function. Adjust the value (ex: 0.5%) by pushing <UP> or <DOWN> and save it by pushing <ENTER>. +SHUT CL is displayed.
3. Push <ESC> 3 times to return to RUN mode.

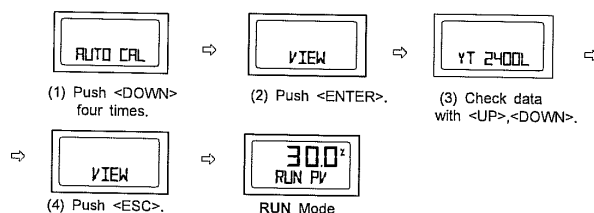
### Adjustment of Split Range (SPLIT):

1. Push <ENTER> at VALVE mode and ACT RA or ACT DA is displayed.
2. Push <DOWN> 5 times and SPLIT mode is displayed. The numbers on the LCD is the range of the current signal input to the YT-2400. 4-20mA current signal is set as the standard.
3. Push <ENTER> \*SPLIT mode is displayed and input signal range can be adjusted. Adjust signal range by pushing <UP> or <DOWN> and save it by pushing <ENTER>.
4. +SPLIT mode is displayed while saving the adjusted range. Push <ESC> 3 times to return to RUN mode.



**VIEW mode:** This mode provides users with various information about the YT-2400. And in this mode users can change the valve stroke types displayed on the LCD as % or numbers. Refer to the next table for information and description displayed on VIEW mode.

1. Push <DOWN> at AUTO CAL mode and VIEW mode is displayed.
2. Push <ENTER> at VIEW mode then the information mode is started.
3. Check information by pushing <UP> or <DOWN> and push <ESC>.
4. Push <ESC> again to return to RUN mode.





## Information Checked on View Mode

	DESCRIPTION
<b>YT-2400L</b>	Product Model
<b>Version</b>	Main Software Version
<b>HART V</b>	HART Protocol Version
<b>POL Addr</b>	Channel Address used in HART protocol
<b>BIAS V</b>	BIAS valve necessary to motor control (This variable is only used by the manufacturer.)
<b>0Y 0d</b>	Total using time But if the product is used less than one minute from power-on to power-off it is not added to total time.
<b>FULL_OP</b>	Full Open Time ( Sec.) of valve
<b>FULL_CL</b>	Full Close Time (Sec.) of valve
<b>VM NOR</b>	Display type of valve stroke on LCD
<b>Erro</b>	Error or warning code currently occurred Refer to the code table
<b>VALUE 1</b>	Currently controlled 1 value (This variable is only used by the manufacturer)

### Error and Warning Code:

If there are problems during YT-2400 operation you can check the error and warning code at VIEW mode as follows.

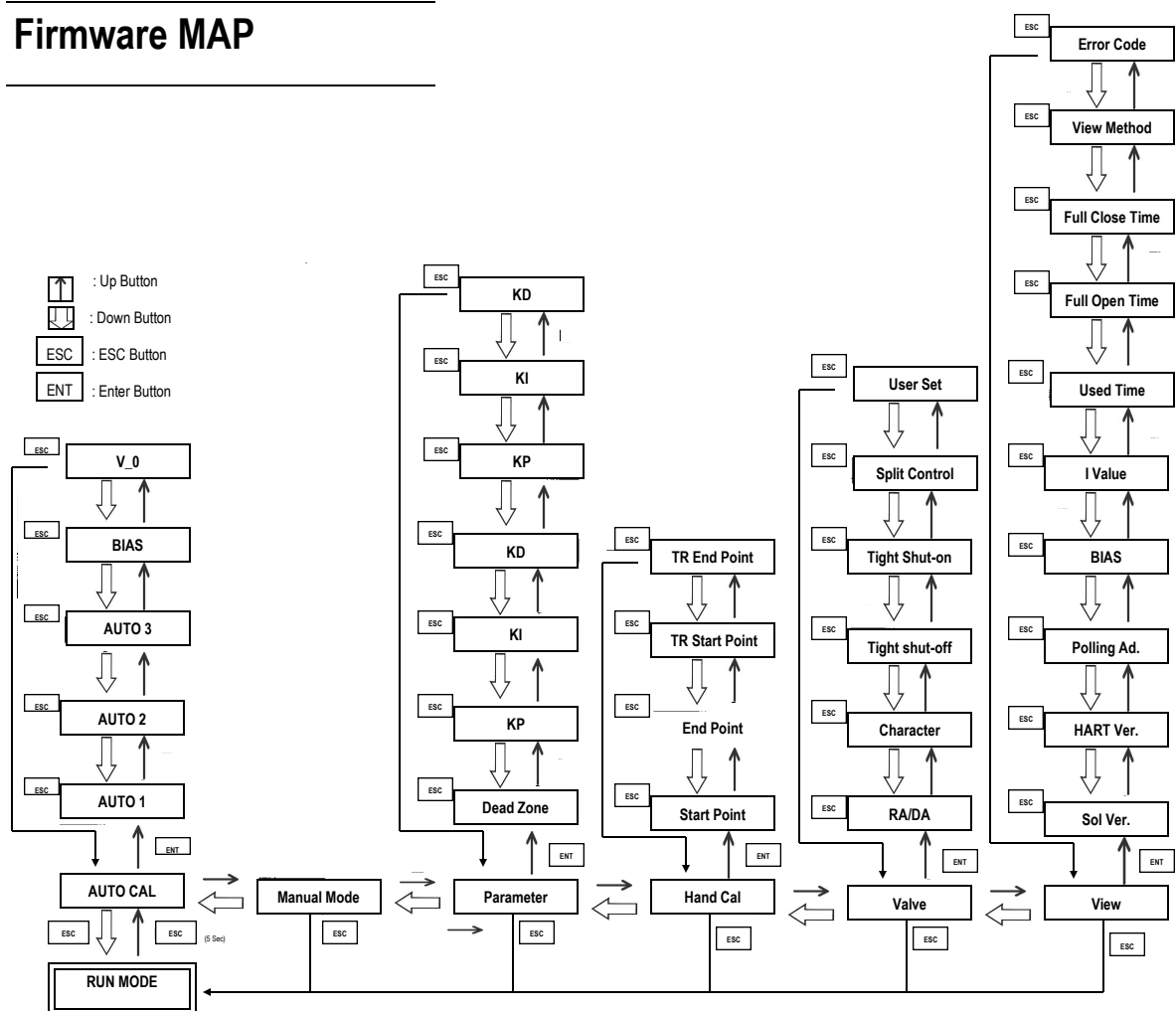
**Error code:** This code is displayed when YT-2400 control gets impossible and code C, D is applied.

**Warning Code:** This code is displayed when YT-2400 control is unavailable but there is possibility of a malfunction or low accuracy. Code B, F,G, H, is applied.

## Error / Warning Code

Code	Description and Cause	Measures
A	None	None
B	The range of Pv Span - Pv Zero is less than 500. > Operating angle of feedback is too small.	> Adjust operating angle of feedback lever to be bigger and execute AUTO 1 Calibration.
C	More than 10% error is continued over 1 minute. > There is no valve movement. > Valve friction is getting larger. > Regulator pressure setting has changed.	> Check the setting pressure of the air filter regulator. Adjust it to the recommended pressure, and execute BIAS calibration.
D	I value is at 1 max. or min. limit. > Valve friction has changed > Regulator pressure setting has changed.	> Check the setting pressure of the air filter regulator. Adjust it to the recommended pressure, and execute BIAS calibration.
E	None	None
F	Full open - close time is less than one second. > Actuator size is too small.	> Use variable orifice. > Replace actuator to larger one.
G	Pv is set below 100. > Operating angle of the feedback lever is too large.	> Adjust operating angle of feedback lever to be smaller, and execute AUTO 1 calibration.
H	Pv is over 4000. > Operating angle of the feedback lever is too large.	> Adjust operating angle of feedback lever to be smaller, and execute AUTO 1 calibration.

## Firmware MAP



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## NOTES

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