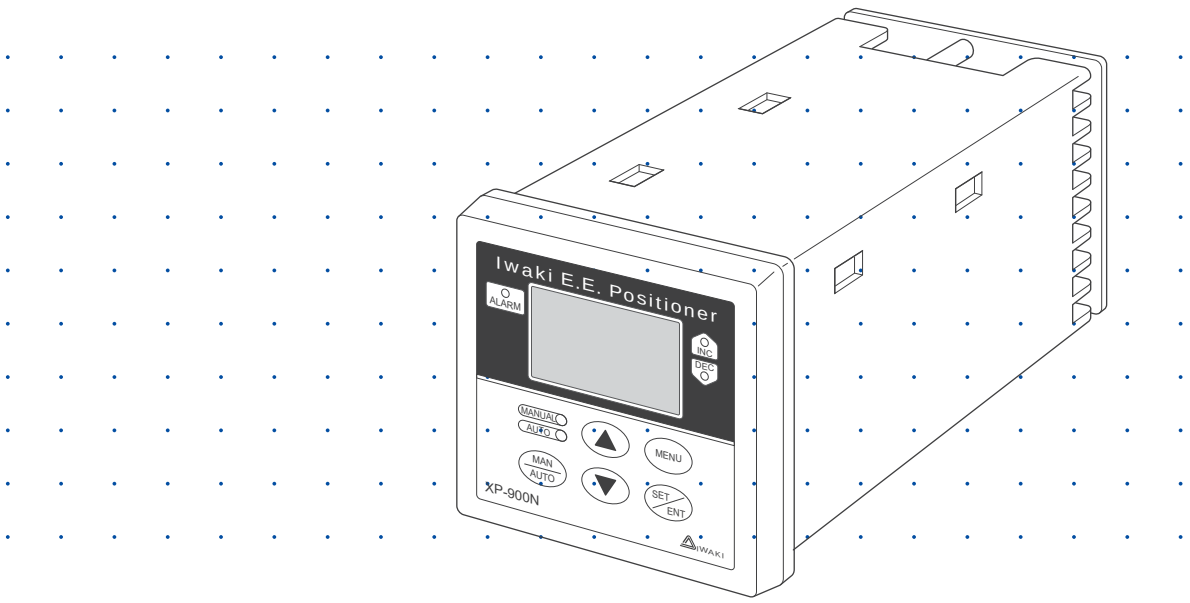
IWAKI PUMPS

Iwaki E.E. positioner

XP-900N



Instruction manual

Thank you for choosing our product.

⚠ Please read through this instruction manual before use.

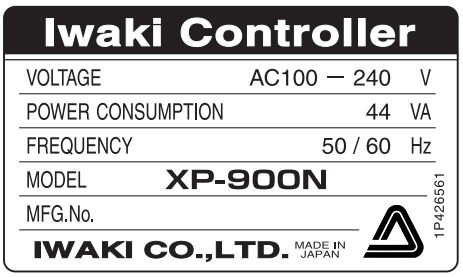
This instruction manual describes important precautions and instructions for the product. Always keep it on hand for quick reference.

Order confirmation

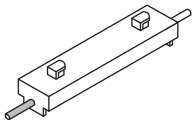
Open the package and check that the product conforms to your order. If any problem or inconsistency is found, immediately contact your distributor.

a. Check if the delivery is correct.

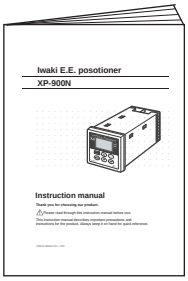
Check the nameplate to see if the information such as model codes is as ordered.



b. Check accessories are complete.



Mounting hardware ×2



Instruction manual

c. Check if the delivery is damaged or deformed.

Check for transit damage and loose bolts.

Contents

Safety instructions

Read through this section before use. This section describes important information for you to prevent personal injury or property damage.

■ Symbols

In this instruction manual, the degree of risk caused by incorrect use is noted with the following symbols. Please pay attention to the information associated with the symbols.

⚠ WARNING	**Indicates mishandling could lead to a fatal or serious accident.**
⚠ CAUTION	**Indicates mishandling could lead to personal injury or property damage.**

A symbol accompanies each precaution, suggesting the use of "Caution", "Prohibited actions" or specific "Requirement".

Caution marks


Caution


Electrical shock

Prohibition mark


Prohibited


Do not rework or alter

Requirement mark


Requirement


Wear protection


Grounding

⚠ Export Restrictions

Technical information contained in this instruction manual might be treated as controlled technology in your countries, due to agreements in international regime for export control.
Please be reminded that export license/permission could be required when this manual is provided, due to export control regulations of your country.

⚠WARNINGS


Turning off power

Turn off power before service

Risk of electrical shock. Be sure to turn off power to stop this product and related devices before service is performed.


Requirement

Stop operation

If you notice any abnormal or dangerous conditions, suspend operation immediately and inspect/solve problems.


Caution

Qualified personnel only

The product should be handled or operated by qualified personnel with a full understanding of this product. Any person not familiar with the product should not take part in the operation or management.


Do not remodel

Do not modify this product

Alterations to this product carries a high degree of risk. It is not the manufacturer's responsibility for any failure or injury resulting from alterations to this product.


Prohibited

Do not use this product in any condition other than its intended purpose

The use of this product in any conditions other than those clearly specified may result in failure or injury. Use this product in specified conditions only.


Prohibited

Do not use a damaged positioner

Using a damaged positioner could lead to an electric leak or shock.


Grounding

Grounding

Risk of electrical shock! Always properly ground this product. Conform to local electric codes.


Prohibited

Do not use this product in a wet location

This product is not waterproof. Use of the product in wet or extremely humid locations could lead to electric shock or short circuit.


Prohibited

Keep electric parts and wiring dry

Risk of fire or electric shock. Install this product where it can be kept dry.


Prohibited

Do not damage the power cable

Do not pull, knot or crush the power cable. Damage to the power cable could lead to a fire or electrical shock if cut or broken.


Prohibited

Use specified power only

Do not apply power other than that specified on the nameplate. Otherwise, failure or fire may result. Ensure this product is properly grounded.

⚠CAUTIONS


Electrical shock

Install a GFCI (earth leakage breaker)

An electrical failure of this product may adversely affect other devices on the same line. Purchase and install a GFCI (earth leakage breaker) separately.


Prohibited

Do not install/store this product:

- In a flammable atmosphere.
- In a dusty/humid place.
- In direct sunlight or wind & rain.
- Where ambient temperature can exceed 0-50ºC.
- Under mechanical vibrations.


Requirement

Disposal of a used positioner

Dispose of any used or damaged product in accordance with local rules and regulations. If necessary, consult a licensed industrial waste disposal company.


Caution

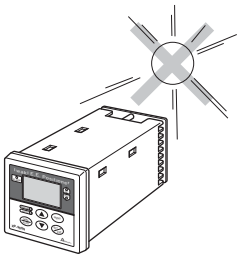
Keep the spec label and nameplate clean

If labels and a nameplate come unglued or illegible, contact us to replace them with new ones.

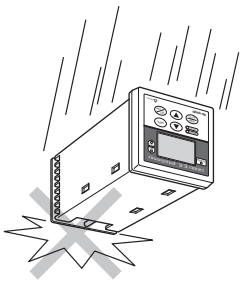
Precautions for use

• Electrical work should be performed by a qualified electrician. Otherwise, personal injury or property damage may result.

• Do not install this product:
  –In a flammable atmosphere.
  –In a dusty/humid place.
  –In direct sunlight or wind & rain.
  –Where ambient temperature can exceed 50ºC or falls below 0ºC.
  –Under mechanical vibrations
  Protect this product with a cover when installing it out of doors.



• Use care handling this product. Do not drop. An impact may affect positioner performance. Do not use a positioner that has been damaged to avoid the risk of electrical damage or shock.



• Do not clean this product or nameplate with a solvent such as benzine or thinner. This may discolour the positioner or erase printing. Use a dry or a damp cloth or a neutral detergent.

Positioner characteristics, features and part names are described in this section.

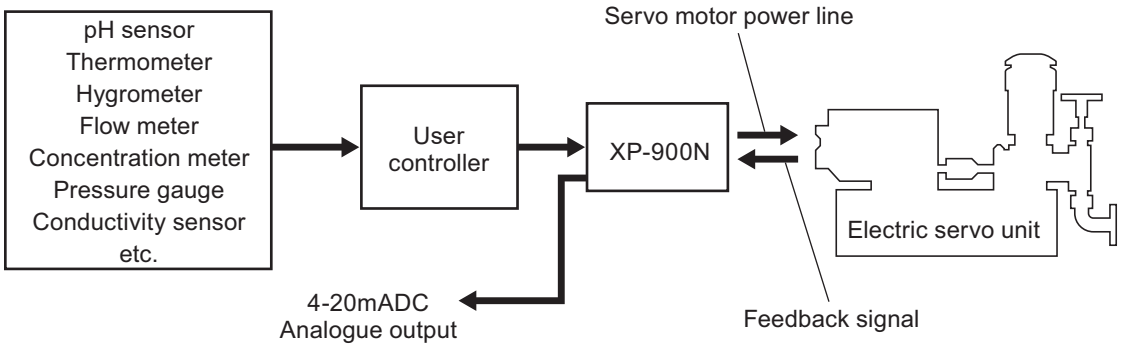
Introduction

Operating principle

An Iwaki XP-900N E.E. positioner is designed for use with the Iwaki LK metering pumps with a servo unit. The positioner controls the stroke length of the LK pumps in proportion to 4-20mADC or 1-5VDC signal from user's controller (proportional control).

Principle of operation

The XP positioner monitors pump stroke length via the feedback signal (signal voltage from the potentiometer) and adjusts to a target length by controlling the servo motor (feedback control).



Features

- **Manual control (stroke length)**

  Keypad operation changes the stroke length of the pump in between 0 and 100%.

- **Auto control (stroke length)**

  The XP positioner controls a stroke length in proportion to 4-20mA(/1-5VDC) signal from user's controller and the operation programming.

- **Remote control**

  "Local control (default)" is changed to "Remote control (AUTO mode with keypad locked)" while a no-voltage contact signal or open collector signal is inputted to the terminal pin 8(plus) & 9(minus).

- **Multivoltage operation**

  The XP positioner is a multivoltage type (100-240VAC) and can be selected without concern for local power voltage.

NOTE

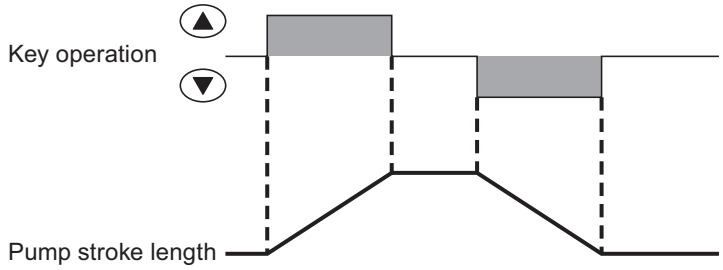
The power voltage to the servo motor is provided through the XP positioner. Always keep the power voltage to the XP positioner to the same level as the servo motor rating.

Operational functions

Manual mode

■ Real-time SL adjustment

Use the UP and DOWN keys to change a stroke length in operation (MAN mode). Stroke length changes only while either key is pressed. The "INC" LED lights when the stroke length extends, and the "DEC" LED lights when the stroke length retracts. This adjustment is selected as factory default settings.

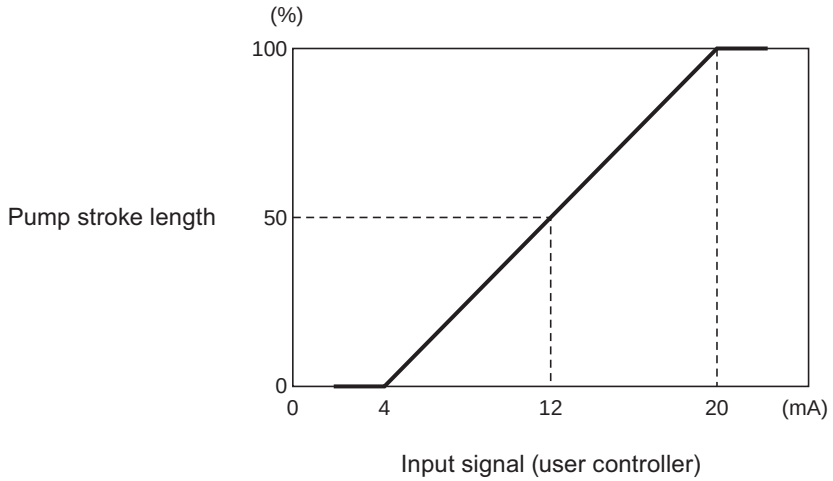


■ Target SL setting

Use the UP and DOWN keys to set and the SET/ENT key to enter a target stroke length in operation (MAN mode). The XP positioner starts to control the servo motor to meet the target length. See page 34 for selecting this method.

Auto mode

The pump extends/shortens the stroke length in the range of 0-100% in proportion to 4-20mA or 1-5VDC from user controller. See page 38 for detail. A proportional line can be programmed by proportional band setting, Current-Stroke setting or upper/lower limit setting as necessary.



Adjustment/Correction functions

■ Stroke length cognition

Give the XP positioner the 0% and 100% stroke length positions through keypad operation. See page 25 for detail. The positioner automatically behaves to store the positions. Perform stroke length cognition every time the XP positioner is used with a unrecognized LK pump, the electric servo unit is repaired, or a displayed stroke length differs from the actual length.

■ Input current/voltage correction

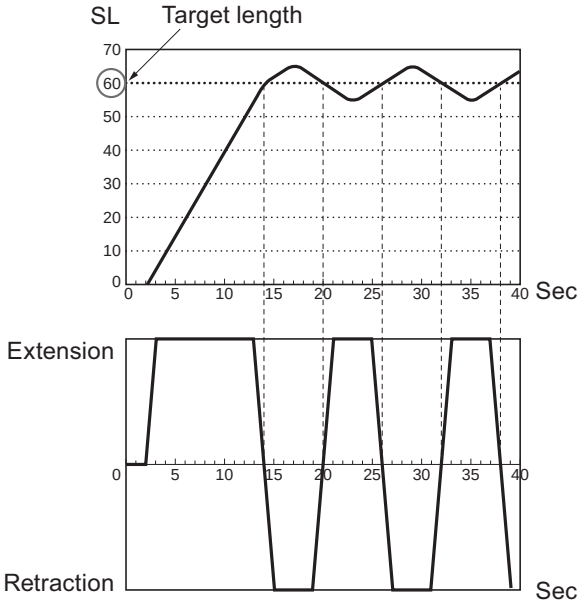
Measure a 4mA(/1V) and a 20mA(/5V) signal from a user controller with the XP positioner. The positioner corrects its reading accordingly. Otherwise, a target stroke length may not be met in proportional control. See page 26 for detailed procedure.

*The correction may fail if the signals from a user controller is far different from 4mA(/1V) or 20mA(/5V).

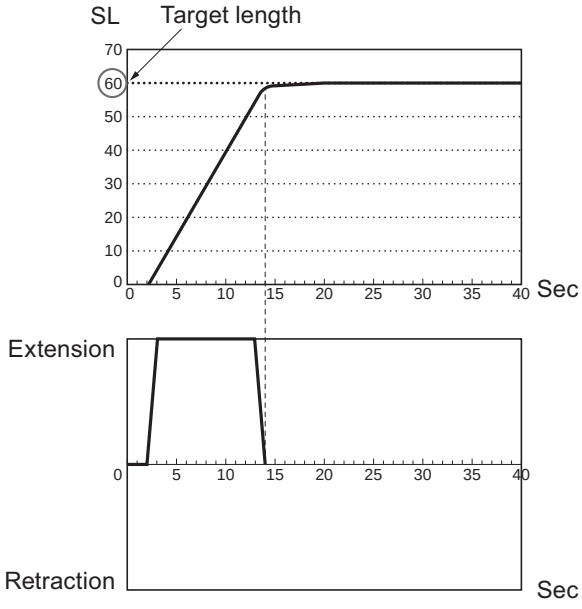
■ Dead band setting (Stroke length)

Stroke length may not stay exactly at a target length, moving around it (hunting). Widen the dead band of detection to stop hunting. The optimal width changes with pump models and operating conditions. Do not change it unless hunting does happen. See page 36 for detailed procedure.

Stroke length behaviour with unsuitable dead band



Stroke length behaviour with optimal dead band



■ Inversely proportional line

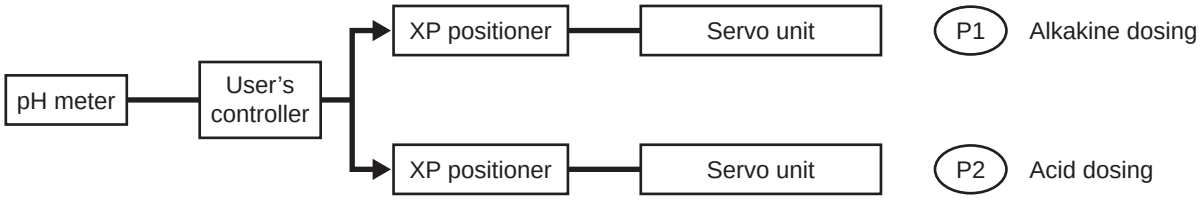
With this setting "ON", the XP positioner controls the stroke length inversely proportional to the 4-20mA(/1-5V) signal from a user controller. See page 27 for detailed procedure. Use this function along with the proportional line programming below as necessary (e.g. for pH control).

■ Proportional band/Current-Stroke setting (Proportional line programming)

The default setting proportional line (4-20mA to 0-100%) can be changed by means of proportional band setting ("P.B."), Current-Stroke setting ("2P" and "I.IN"). See page 28 for detail.

pH control

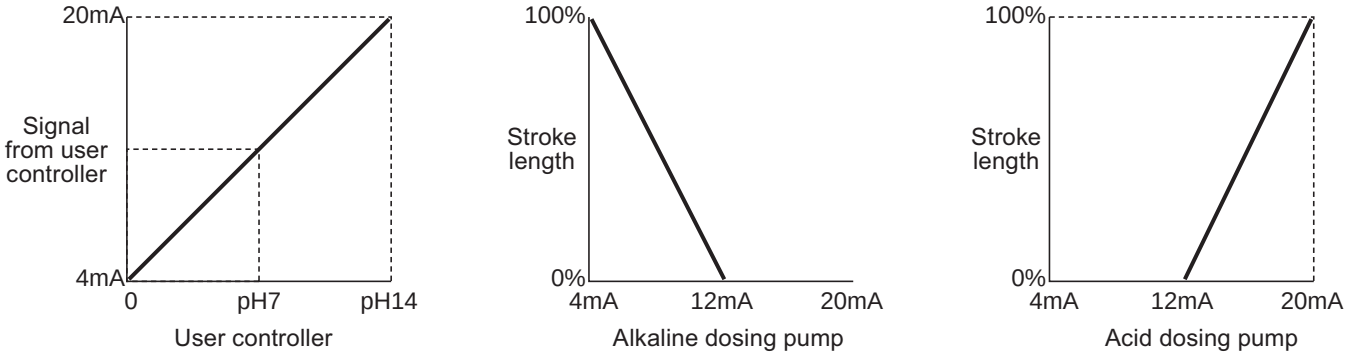
Two pumps may be needed to control pH in a sample. One is for acid, and the other is for alkaline dosing. In this case, provide the XP positioner at each servo unit to control the pump with 4mA(/1VDC)-20mA(/5VDC) signal from a user controller.



Current-Stroke setting ("2P")

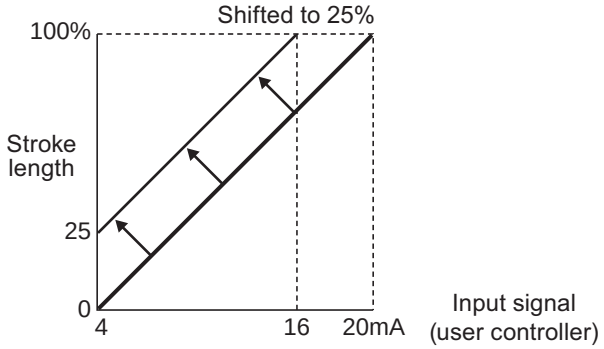
When a target is pH7, proportional line programming would be as follows.

	Parameter	
	Inversely proportional line	Proportional line programming
XP1	ON	Current-Stroke setting ("2P") Hi-SL : 100, Hi-I : 12 Lo-SL : 0, Lo-I : 4
XP2	OFF	Current-Stroke setting ("2P") Hi-SL : 100, Hi-I : 20 Lo-SL : 0, Lo-I : 12



Proportional band setting ("P.B.")

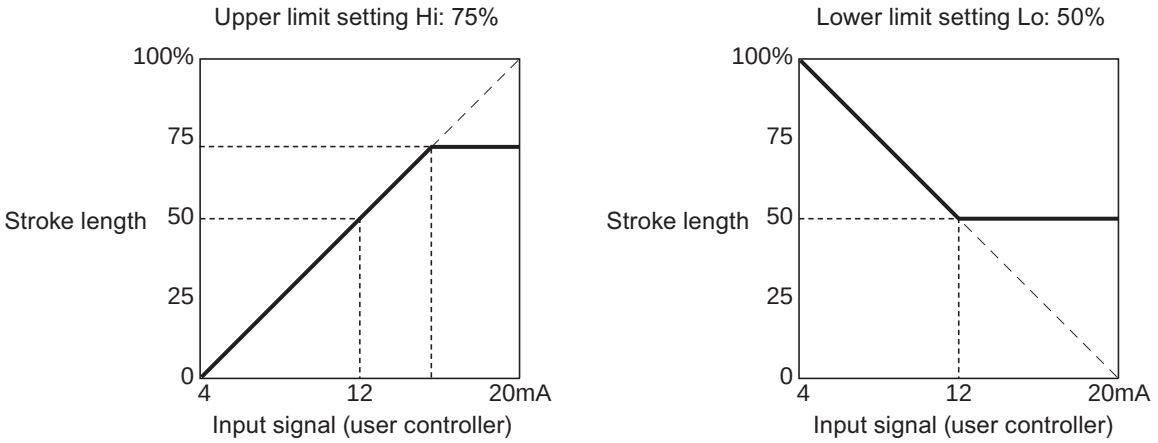
Sift the proportional line as necessary. 25% stroke length is obtained at 4mA in the following graph.



The left graph is in the following setting.
Hi-SL: 100 Hi-I: 16
Lo-SL: 25 Lo-I: 4

■ Upper/Lower limit setting

Set the upper or lower limit of the proportional line in between 0 and 100%. See page 32 for detail. The upper limit is provided to control the discharge pressure not to exceed the piping limit pressure. The lower limit is provided to keep the minimum flow rate at any signal current/voltage (user controller).



■ Analogue output setting

In factory default settings, the XP positioner sends out 4-20mA analogue signal via the terminal pin 15 and 16 in proportion to the stroke length range (0-100%). The minimum and maximum signal levels can be changed as necessary. See page 33 for detail.

*The XP positioner transmits the signal in both Man and Auto modes.

Monitoring functions

■ Operating conditions

In AUTO mode, the XP positioner monitors operating conditions of 4-20mA(1-5V) input via the terminal pin 17(plus) and 18(minus), the analogue output via the terminal pin 15 (plus) and 16 (minus), and the target stroke length. The input and output signals are converted into stroke length and shown up on the screen in % as well as the target stroke length. See page 40 for detail. The parameter setting for AUTO mode such as inversely proportional line selection, a proportional band ("P.B."), Current-Stroke ("2P" and "I.IN"), and upper/lower limits are checked during operation.

■ Operation history

In the menu mode, the XP positioner shows total power connection days (from being shipped or formatted) and recalls the previous parameter setting of an inversely proportional line, a proportional band ("P.B."), Current-Stroke ("2P" and "I.IN"), upper/lower limits and an analogue output. See page 35 for detail.

Other functions

■ Keypad lock

Activates/deactivates keypad lock for the prevention of erroneous key operation. Press and hold the MAN/AUTO key. See page 37 for detail.

*Keypads can be locked/unlocked in MAN or AUTO mode. The "LOCK" indication appears while keypads are locked.

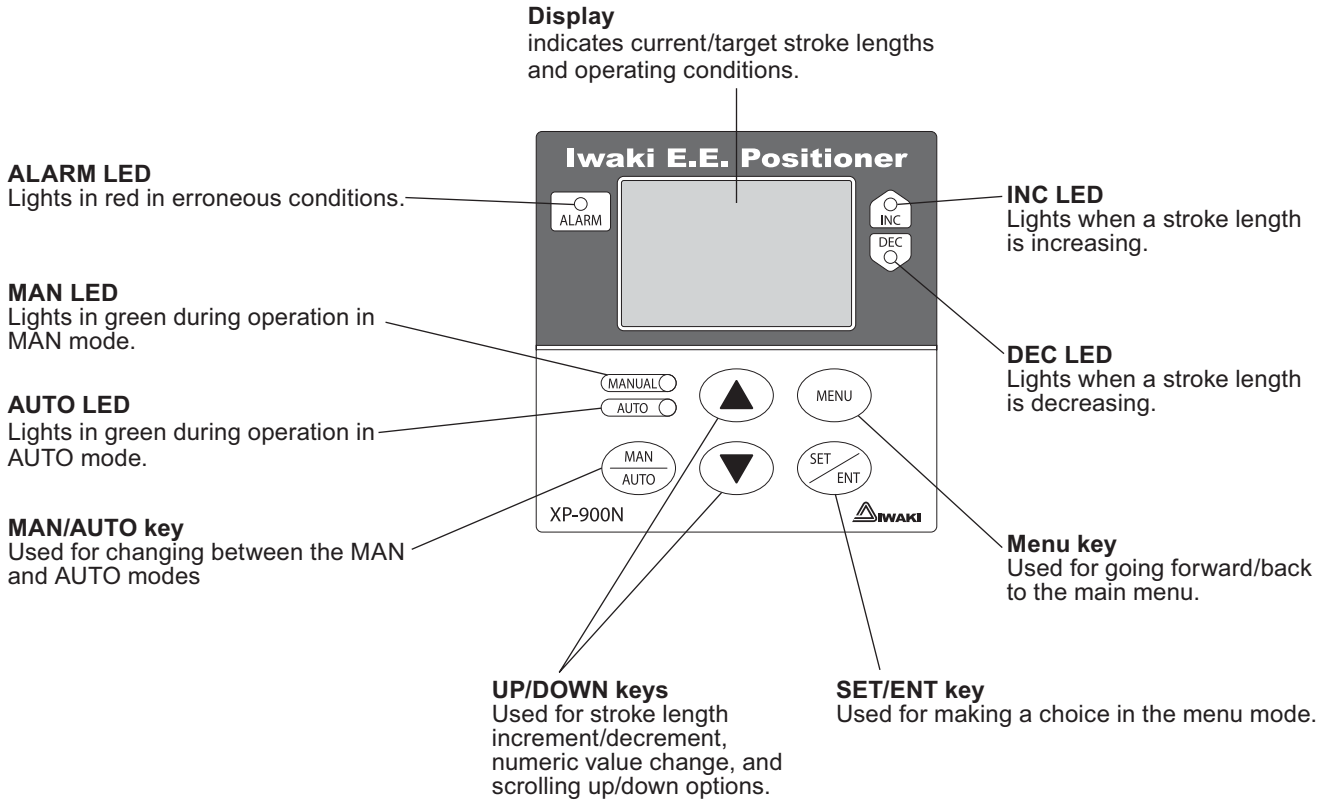
■ Remote control

"Local control (default)" is changed to "Remote control (AUTO mode with keypad locked)" while a no-voltage contact signal or open collector signal is inputted to the terminal pin 8(plus) & 9(minus).

*Remote/Local control switching is accessible at any time during MAN or AUTO mode. Keypads are locked when "Remote" is selected.

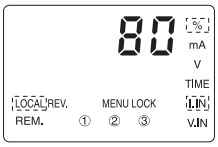
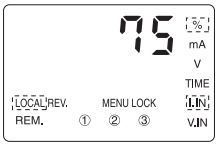
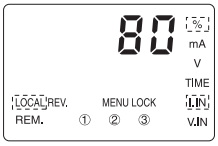
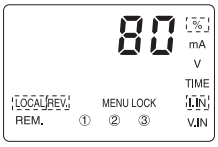
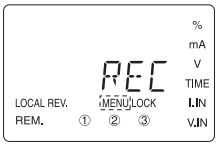
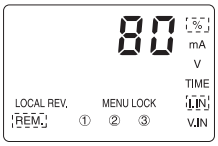
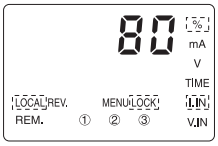
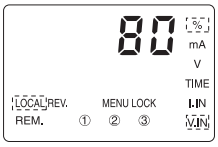
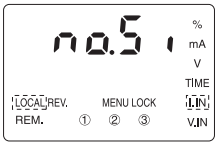
Part names

Operation panel



%	: Appears with a stroke length indication.
mA	: Appears with signal current indication.
V	: Appears with signal voltage indication.
TIME	: Appears with a total power connection day
I.IN	: Appears when the XP positioner is set for receiving the signal current from user controller.
V.IN	: Appears when the XP positioner is set for receiving the signal voltage from user controller.
LOCAL	: Appears when the Local control is selected.
REM.	: Appears when the Remote control is selected.
REV.	: Appears when a proportional line is inverted.
MENU	: Appears when the XP positioner is in the menu mode.
LOCK	: Appears with keypads locked.

■ Basic displays

Display	MAN/AUTO LED	INC/DEC LED	ALARM LED	Conditions
	MAN LED lights green.	-	-	The XP is in Manual mode.
	MAN or AUTO LED lights depending on operating mode.	INC or DEC LED lights during increment/decrement of stroke length.	-	The XP increases/ decreases the pump stroke length.
	AUTO LED lights green.	-	-	The XP is in Auto mode.
	AUTO LED lights green.	-	-	The XP in Auto mode with an inversely proportional line.
	-	INC or DEC LED lights during in SL cognition behaviour.	-	The XP is in the menu mode.
	AUTO LED lights green.	-	-	When the Remote control is selected.
	MAN or AUTO LED lights depending on operating mode.	-	-	Keypad operation is disabled.
	MAN or AUTO LED lights depending on operating mode.	-	-	The XP is set for receiving signal voltage from user controller.
	MAN or AUTO LED lights depending on operating mode.	-	ALARM LED lights red.	The XP is in erroneous conditions.

Identification codes

Each code represents the following information.

Positioner

XP - 900N __
a b c

a. Series name
XP

b. Series code
900N

c. Special version
No code : Standard models
S : Customized models

Installation

This section describes the installation and wiring of the XP positioner. Read through this section before work.

Points to be observed

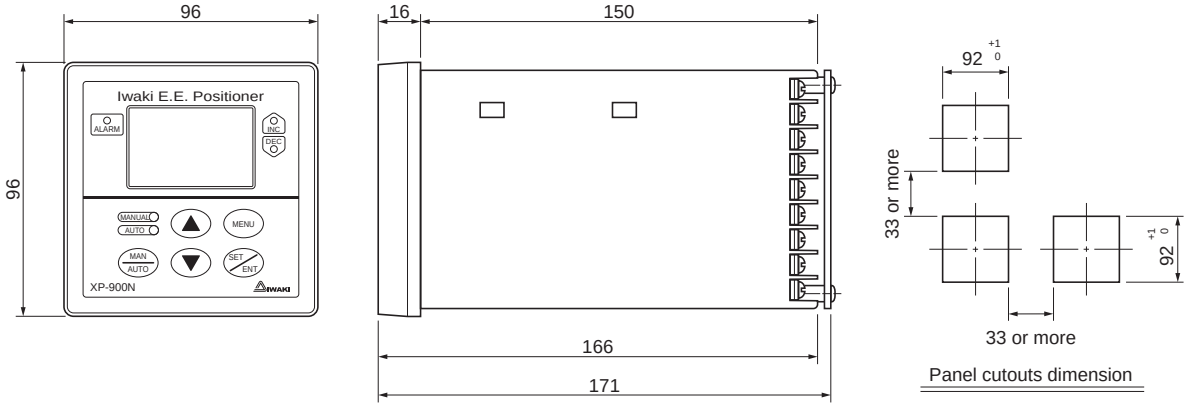
Do not install this product:
–In a flammable atmosphere.
–Where ambient temperature can exceed 50ºC or falls below 0ºC.
–Where humidity can exceed 85%RH or falls below 30%RH.
–In direct sunlight or wind & rain.
–In a dusty or a corrosive environment.
–Under mechanical vibration or electromagnetic field.
–With exposed electrical terminals.

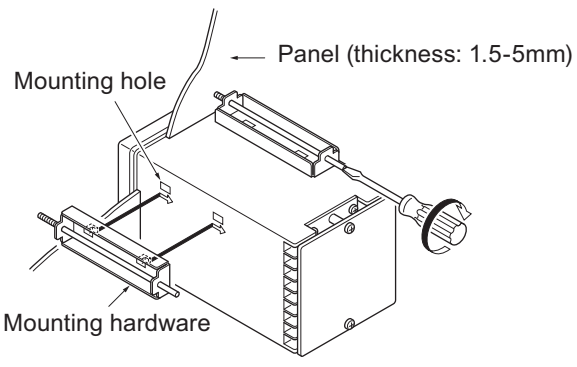
*Mounting panel should tolerate the weight of the positioner.

Positioner mounting

See the following instructions for installation. Use the attached mounting hardware.

a. Open a panel cutout, seeing the dimension below.
b. When two or more XP positioners are installed in a control panel, keep the distance between each positioner 33mm or more in both vertical and horizontal directions.
c. Allowable thickness of the control panel is 1.5-5mm.
d. First insert the positioner into the cutout.
e. Attach the mounting hardware to the XP positioner and fix to the panel.





Wiring

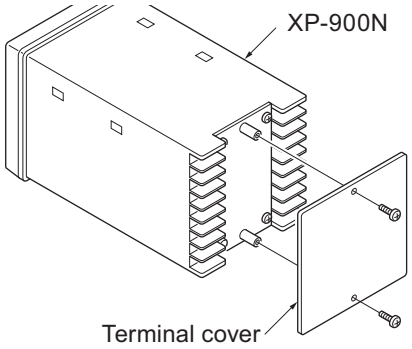
Wiring for power voltage, earthing and external signals.

! Points to be observed

Observe the following points during wiring work.

- Risk of electrical shock. Be sure to turn off power to stop this product and related devices before service is performed.
- Check that power voltage is turned off. The XP positioner is still charged right after turning off power. Wait for one minute before wiring.

1 Remove the terminal cover.



2 Connect the power, earth and signal wires to the XP positioner.

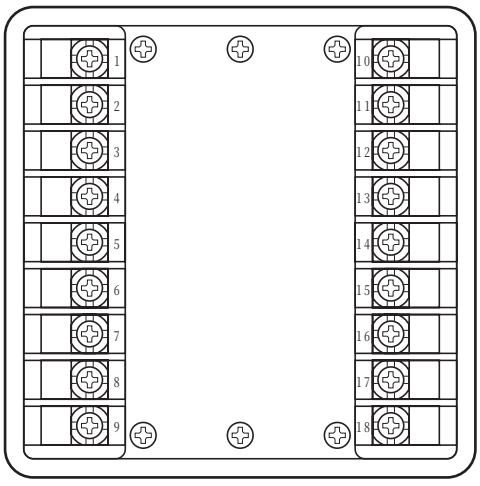
Use the spade terminal for the wire connections. Fasten them to 0.6N•m.

NOTE

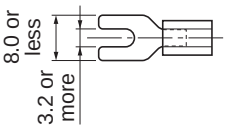
Always check that the wire connections are properly fixed. Disconnection can cause malfunction.

3 Remount the terminal cover.

Wire terminals



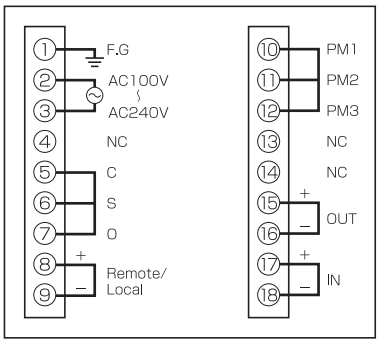
Use the spade terminal in the following size.

Terminal #	1 - 18
Terminal size	

1	F.G		10	Potentiometer power voltage	PM1
2	L 100-240VAC		11		PM2
3	N 100-240VAC		12		PM3
4	NC		13	NC	
5	Servo motor power voltage	C	14	NC	
6		S	15	Analogue OUT	⊕
7		O	16	Analogue OUT	⊖
8	Remote/Local IN	⊕	17	Input signal	⊕
9	Remote/Local IN	⊖	18	Input signal	⊖

End terminals

Observe the electric diagram shown on the terminal cover at the back of the XP-900N enclosure. Use M3 screws to fix each wire connection.



■ Input signal (4-20mA/1-5V)

Connect the lead wires from user's controller to the terminal pin 17(+) and 18(-). Input resistance is 75Ω (4-20mA signal current) or 218kΩ (1-5V signal voltage). Observe polarity.

■ Power voltage

Connect the AC power voltage line (50/60Hz) to the terminal pin 2 and 3. The XP positioner is a multivoltage type (100-240VAC), however, the rated power voltage of the servo motor must be observed (the XP positioner and the servo motor share the same power source.). Otherwise, failure may result.

■ Frame ground

Connect an earth wire to the terminal pin 1.

■ Electric servo unit

Electrically connect the XP positioner and the servo motor through the corresponding terminals of "C", "S", "O", "PM1", "PM2" and "PM3".

■ Analogue output

Electrically connect the XP positioner (terminal pin 15 and 16, observe polarity) and an external device that can receive 4-20mA signal in proportion to 0-100% stroke length as necessary. The allowable load resistance is 600Ω.

■ Remote/Local control

"Local control" is changed to "Remote control (AUTO mode with keypad locked)" while a no-voltage contact signal or open collector signal is inputted. Electrically connect the XP positioner (terminal pin 8 and 9, observe polarity) and an external device that can give the Remote/Local control signal as necessary.

NOTE

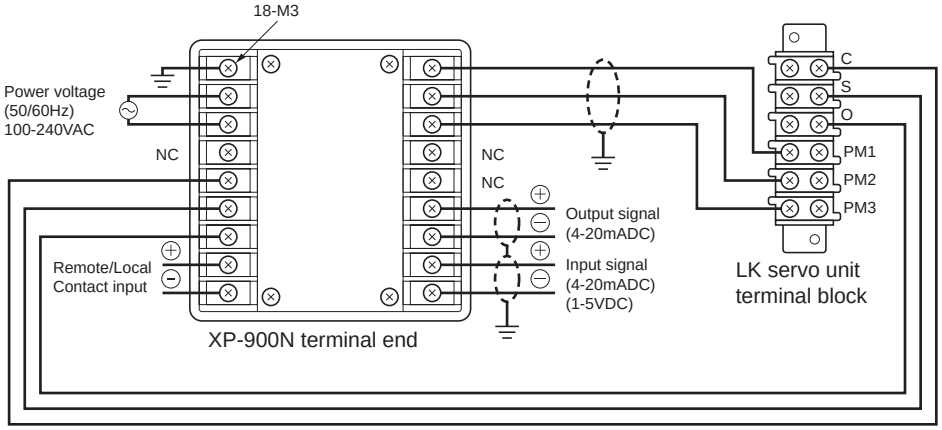
- When using a mechanical relay, its minimum application load should be 5mA or less.
- Any open collector output has polarity, and it must be observed. Otherwise, the XP positioner may fail. (Maximum applied voltage is 12VDC at 5mA.).

■ Terminal assignment for the servo unit

*****Do not confuse the terminal pin # with terminal code for the servo unit.

C, S and O : Power voltage to the servo motor (through the XP positioner)

PM1, PM2, and PM3 : 1-5VDC feedback signal from the servo unit (potentiometer)



Power voltage/Earthing

Points to be checked

- Check that power voltage is turned off.

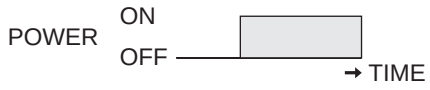
1 Connect power cable via crimp contacts.

2 Earth the pumps.

NOTE

- Do not share a power source with a high power device which may generate surge voltage. Otherwise an electronic circuit may fail. The noise caused by an inverter also affects the circuit.
- Energize the pump with a power voltage via a mechanical relay or switch. Do not fluctuate the voltage, or CPU may malfunction.

When power voltage is applied at a sitting

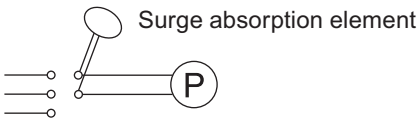


When power voltage is applied gradually

Surge voltage

The electronic circuit in the control unit may fail due to surge voltage. Do not place the pump close to a high power device of 200V or more which may generate large surge voltage. Otherwise, take any of the following measures.

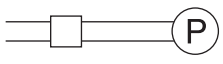
- Install a surge absorption element (such as a varistor with capacity of 2000A or more) via power cable or,



Recommended varisters. See manufacturer's catalogues for detail.

Panasonic	ERZV14D431
KOA	NVD14UCD430

- A noise cut transformer via the power cable.



Noise cut transformer

Electric servo unit

Connect wires via bell mouths to respective terminals according to terminal codes. Do not tense wires by external force. Always use suitable wring tools for wiring. Observe local electric codes.

Points to be observed

- A small amount of liquid may be discharged with 0% stroke length. To stop liquid completely, use a PLC or sequencer to stop the pump as a stroke length comes to 0%. Contact us for detail.
- The feedback signal line (PM1, 2 and 3) and the servo motor power line (C, S and O) must not share the same bell mouth. Otherwise, line induction happens every time the servo motor operates, resulting in malfunction. Always use different bell mouths.
- Always use shielded cables for the feedback (PM1, 2 and 3), input (terminal pin 17 and 18), and output (terminal pin 15 and 16) signal lines with a shield wire connected to the F.G. terminal. Or use IV signal wires (ø1.6mm or less) in a conduit pipe.
  Use ø9 mm CT or CV cables (0.75 - 1.25mm2) for the remote/local control signal and the power lines (terminal pin 2 & 3 and C, S, and O).
- Do not stress the bell mouths of the electrical servo unit when connecting a conduit pipe. Optimise the wiring route so that rain water can not get into the servo unit through the bell mouths.
- Do not operate the servo motor while the pump motor is stopped. Use a PLC or sequencer to turn off the XP positioner as the pump motor stops. Use the relay of 3A 220VAC. (or open only the C, S and O circuit to keep the XP positioner showing a SL indication or signal output.). Otherwise the servo motor may be overloaded.

Measures against noise

Observe the following points when laying the power and signal lines and reduce the possibility of noise generation which always tends to occur when using inverters. Contact us when an electric noise can not be removed.

Points to be observed

- Do not share a power source with another device.
- Use a shielded cable for 4-20mA(/1-5V) signal line from the user controller to the XP positioner. Install an isolator in the signal line as close to the XP positioner with the shortest signal line length. Do not lay on the line in parallel with a power cable.
- Position the XP positioner 1m away from an inverter and its power line that can generate noise.
- Do not connect the earth line to the F.G. terminal when noise is delivered through the line.
- See the inverter instruction manual to reduce noise.
- Transceiving may be adversely affected near the XP positioner.

Operation

This section describes positioner operation and programming. Run the pump with the XP positioner after pipework and wiring are completed.

Before operation

First check piping and wiring are correct. And then make commissioning before starting operation.

Points to be checked

Before operation, check if:

- The rated voltage of a servo motor is observed.
- Electrical wiring is correct and is free from the risk of short circuit and electrical leakage.
- The pump is running.

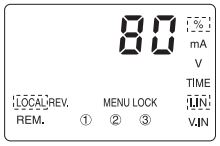
Calibration process

Follow the next steps before starting the XP positioner with unrecognized pumps.

1 Turn on the XP positioner.

2 Push the MAN/AUTO key to enter the MAN mode.

*The XP positioner enters the MAN mode and shows an actual stroke length when turning on power with factory default settings.



3 Push the MENU key to move to menu mode and then push the SET/ENT key.

The screen shows "REC" and then "FB".

4 Push the SET/ENT key once.

The XP positioner starts to store the 100% and 0% positions.

*Keypad operation is disabled during this behaviour.

NOTE

When purchasing the XP positioner and the pump together, Iwaki ships the combination after the above procedure is completed.

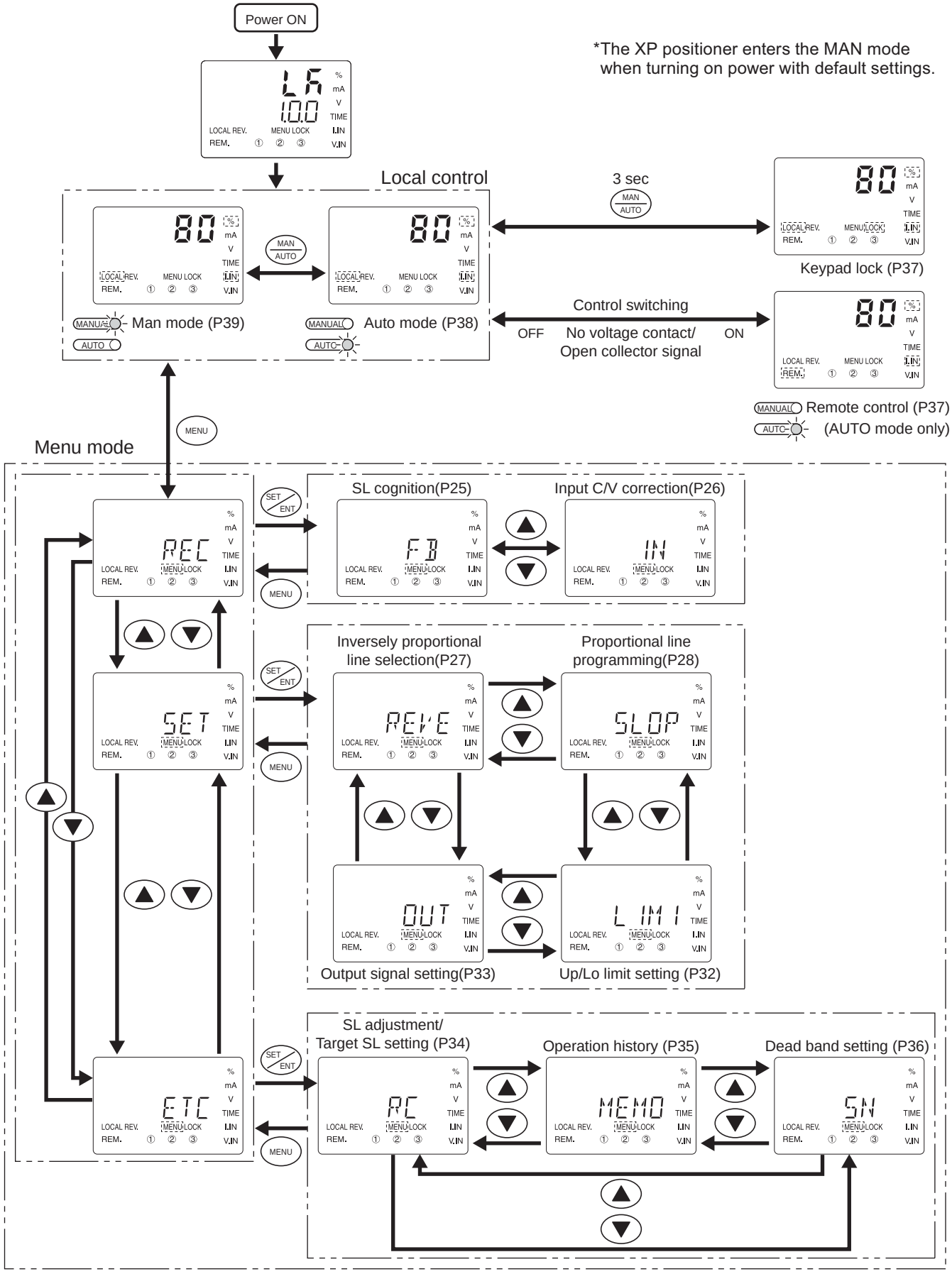
Operation programming

Operation at each mode is individually set and controlled by keypad operation. Select a proper mode to make optimal operation.

Mode	Parameters	Setting ranges	Factory default settings
Operation	-	MAN (SL adjustment/Target SL) /AUTO	MANUAL (SL adjustment)
Menu mode	Inversely proportional line	ON/OFF	OFF
	Proportional band change/Current-Stroke	4-20mA P.B. (15-670%) 2P (HI-SL: 15-100% @ Hi-I: 0-22mA) (Lo-SL: 0-85% @ Lo-I: 0-22mA) I.IN (HI-SL: 15-100% @ Hi-I: 0-22mA) (Lo-SL: 0-85% @ Lo-I: 0-22mA)	4-20mA
	Upper/Lower limit	Hi: 70-100% Lo: 0-50%	Hi: 100% Lo: 0%
	Analogue signal	Hi: 7-20mA Lo: 3-5mA	Hi: 20mA Lo: 4mA
	SL adjustment/Target SL selection	ON/OFF	OFF
	Dead band	0-10	0 (or 1)*
Others	External switching	Remote/Local control	Local control
	I-V input	Signal current/voltage	Signal current

*In our factory, the dead band of some positioners may has been shifted from "0" to "1" in order to reduce hunching of the servo motor. Once the positioner software is formatted (page 41), note the value returns to "0", and consequently hunching comes back to the servo motor. In such a case, reassign "1" (page 36).

Programming flow

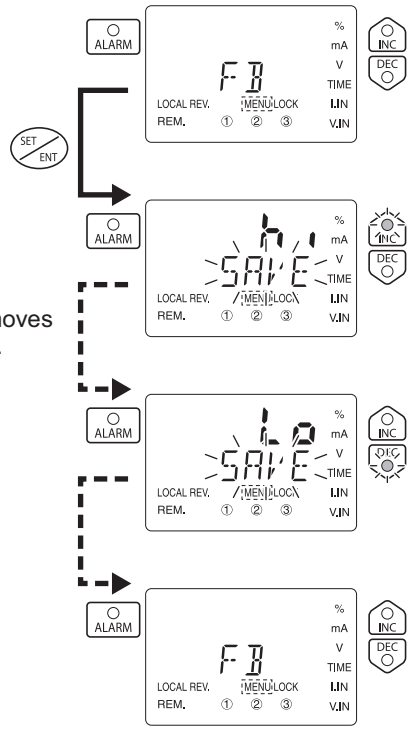


Menu mode

Change default settings as necessary. Always push the SET/ENT key to enter the new setting. Or push the MENU key to cancel.

■ Stroke length cognition

Give the XP positioner the 0% and 100% stroke length positions. Stroke length cognition is required every time the positioner is used with a unrecognized LK pump, the electric servo unit is repaired, or the displayed stroke length differs from the actual length.



Automatically moves to the next step.

Select "FB" and push the SET/ENT key".

The servo unit extends the stroke length to the full. "hi" appears and "SAVE" flashes.

The servo unit contracts the stroke length to the minimum. "Lo" appears and "SAVE" flashes.

Stroke length cognition has been completed.

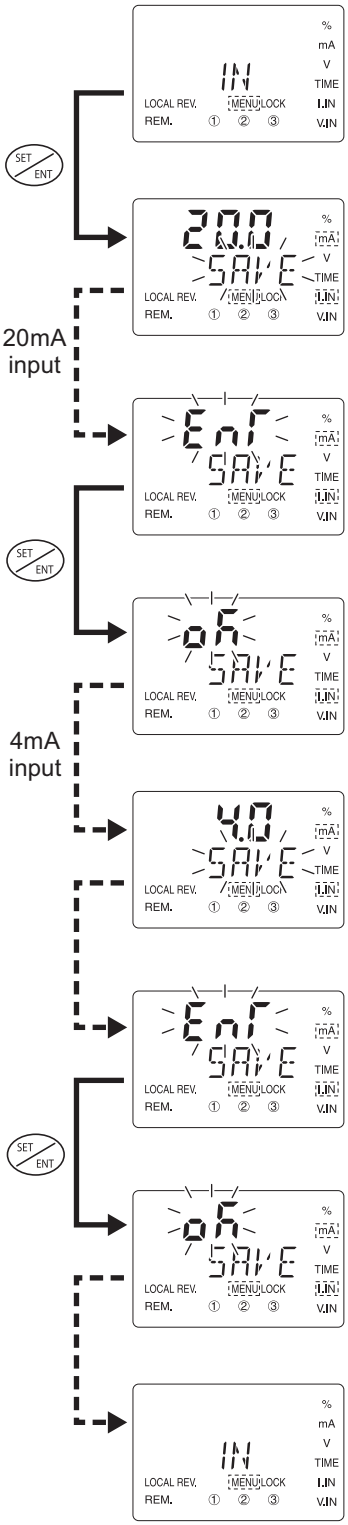
NOTE

Keep the pump running during this behaviour. Be sure to open the suction and discharge lines because the stroke length moves to the full extent. Any keypad operation is disabled during this behaviour.

Operation

■ Input current/voltage correction

The XP positioner can correct its reading at 4mA(/1V) and 20mA(/5V) according to the signal current/voltage from a user controller to the terminal pin 17(+) and 18(-). Take the following steps every time a user controller is changed or the input is switched between signal current and signal voltage.



Select "IN" and push the SET/ENT key.

Apply the 20mA(/5V) from a user controller) to the terminal pin 17(+) and 18(-).

"ENT" flashes as long as it stays within 20±2mA(/5±0.5V).

Automatically moves to the next step.

Apply the 4mA(/1V) from a user controller to the terminal pin 17(+) and 18(-).

"ENT" flashes as long as it stays within 4±2mA(/1±0.5V).

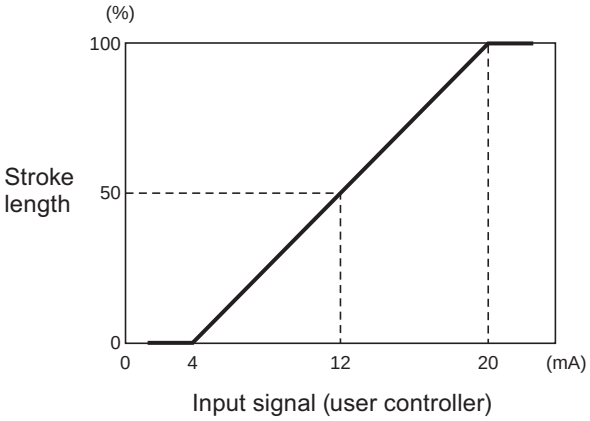
NOTE

The signal current is stored to the XP positioner as the SET/ENT key is pushed. Input voltage correction is possible after the XP positioner setting is switched to signal voltage.

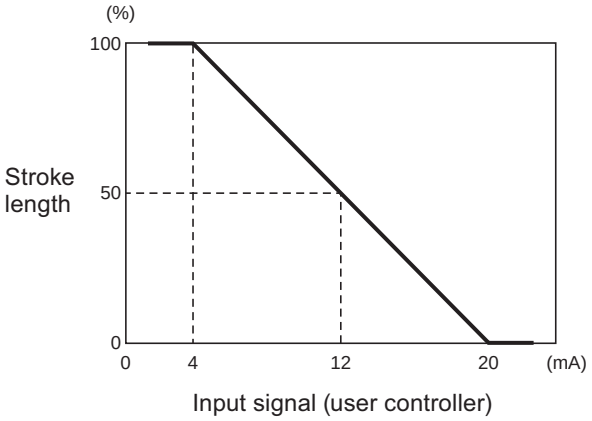
■ Inversely proportional line selection

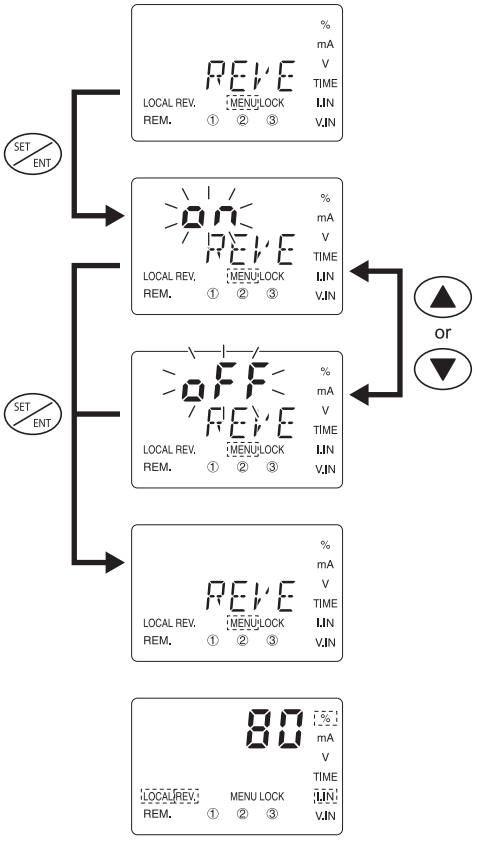
Follow the procedure below to control the stroke length inversely proportional to 4-20mA(/1-5V) input. This setting is available only in Auto mode.

Proportional line (with "off")



Inversely proportional line (with "on")





Select "REVE" and push the SET/ENT key.

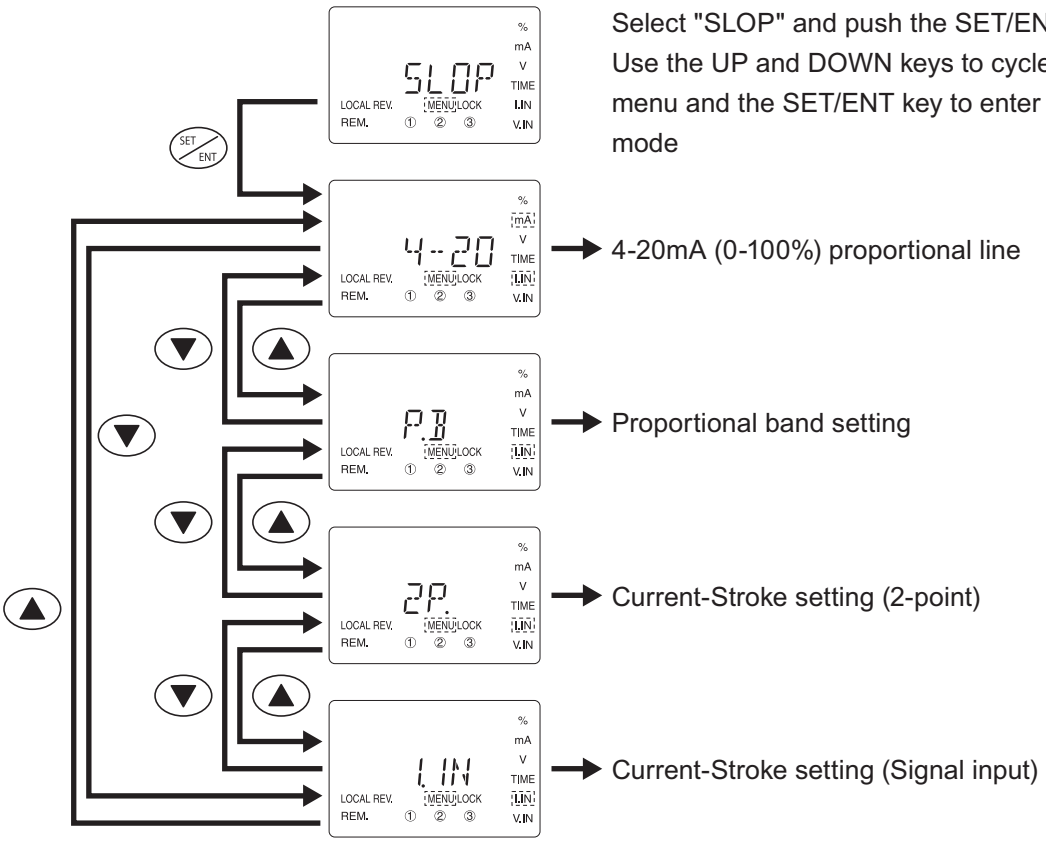
Select "on" and push the SET/ENT key.

An inversely proportional line becomes effective with "REVE" indication during AUTO mode.

Operation

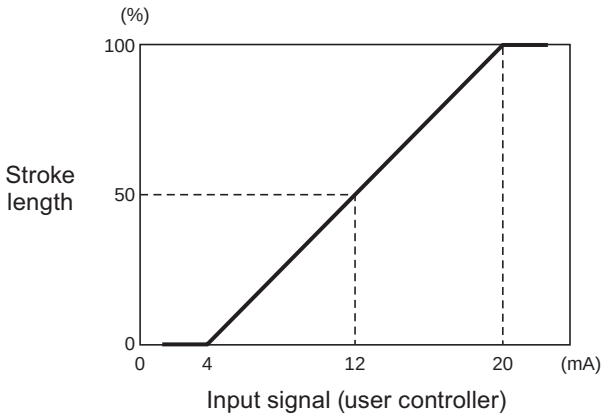
■ Proportional line programming

The default setting proportional line of 4-20mA(0-100%) can be changed by means of proportional band setting ("P.B."), Current-Stroke setting ("2P" and "I.IN"). These setting are effective in AUTO mode only.



4-20mA (0-100%) proportional line

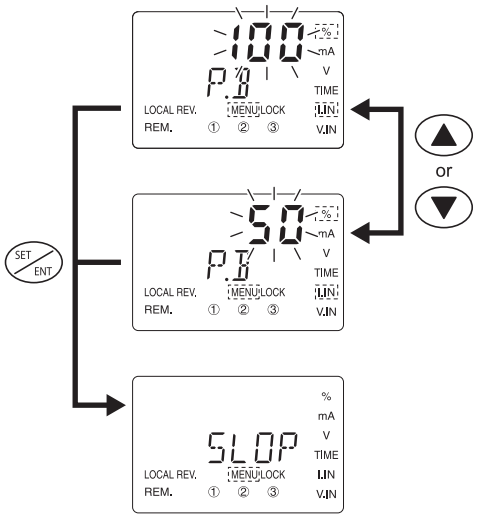
Factory default setting. Stroke length changes in between 0 and 100% in proportion to 4-20mA from a user controller



Proportional band setting

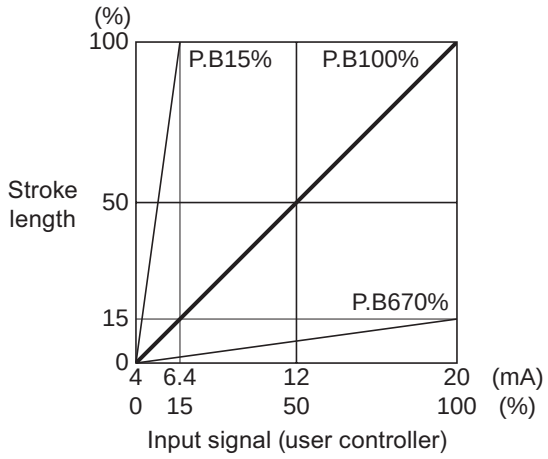
A proportional control band can be changed in between 15 and 670%. The factory default setting is 100%. Change the percentage as necessary (e.g. two-value separate control). A proportional band is calculated by the following formula (convert a signal current/voltage into %. e.g. 4mA = 0%, 20mA = 100%):

Proportional band = Signal current/voltage (%) ÷ Stroke length (%) × 100

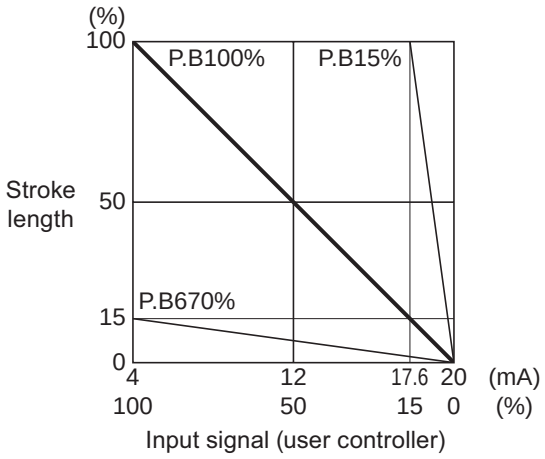


Use the UP and DOWN keys to determine a control band in between 15-670% and push the SET/ENT key.

Inversely proportional line: OFF



Inversely proportional line: ON



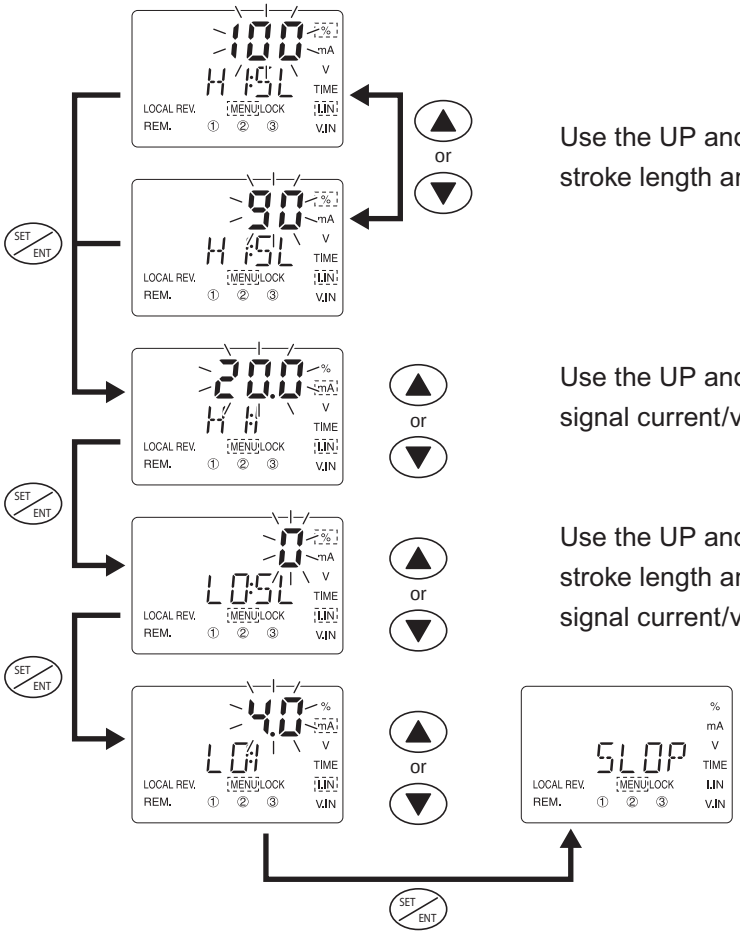
Setting for two-value separate control

The table below shows representative proportional bands (%) at 15spm. The bands change with pump models and motor output. Contact us for detail.

Motors / Speed ratio	VF motor 60Hz	VS motor	
		50Hz	60Hz
G (1/30)	25%	38%	30%
W (1/20)	20%	25%	20%
H (1/15)	15%	20%	15%
R (1/12)	-	15%	15%

Current-Stroke setting ("2P")

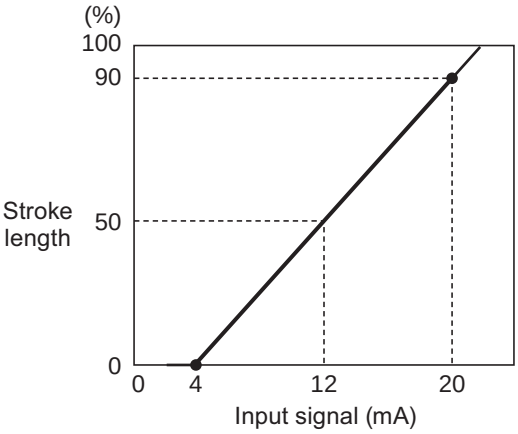
Set the maximum (or minimum) stroke length "HI:SL" (or "LO:SL") and the maximum (or minimum) signal current/voltage (user controller) to "HI:I" (or "LO:I") in order to determine the optimal proportional control line. Note the "HI:SL" and "HI:I" must be higher then "LO:SL" and "LO:I".



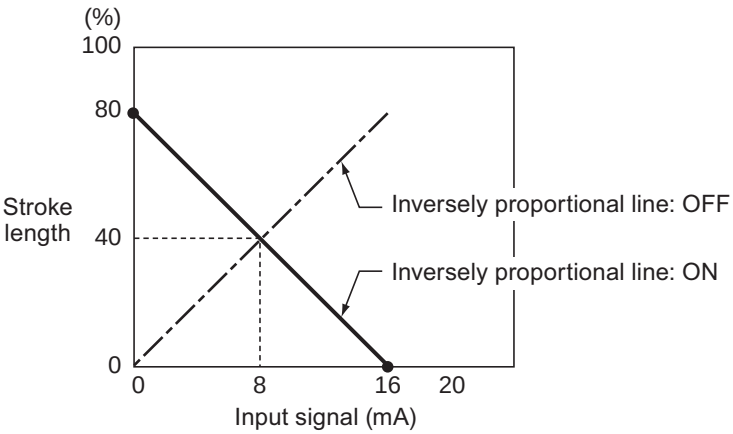
Use the UP and DOWN keys to determine the maximum stroke length and push the SET/ENT key,

Use the UP and DOWN keys to determine the maximum signal current/voltage and push the SET/ENT key.

Use the UP and DOWN keys to determine the minimum stroke length and push the SET/ENT key, Set the minimum signal current/voltage as well.



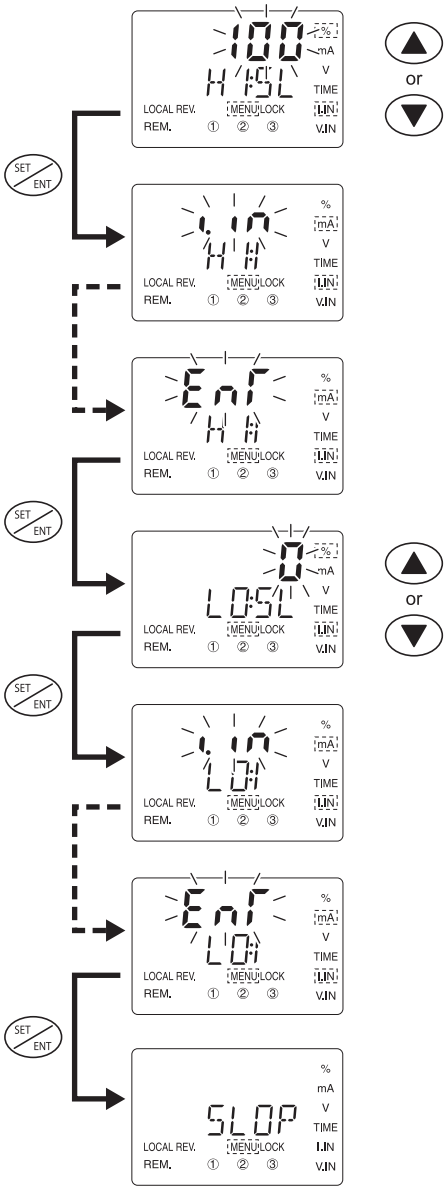
The left graph is in the following patterns.
HI-SL: 90
HI-I: 20
LO-SL: 0
LO-I: 4
Inversely proportional line: OFF



The left graph is in the following patterns.
HI-SL: 80
HI-I: 16
LO-SL: 0
LO-I: 0
Inversely proportional line: ON

Current-Stroke setting ("I.IN")

Choose the maximum (or minimum) stroke length "HI:SL" (or "LO:SL") and input the maximum (or minimum) signal current/voltage (user controller) to "HI:I" (or "LO:I") via the terminal pin 17 (plus) and 18 (minus). Note the "HI:SL" and "HI:I" must be higher then "LO:SL" and "LO:I".



Use the UP and DOWN keys to determine the maximum stroke length and push the SET/ENT key.

Send a signal current/voltage from user controller to "HI:I". The XP automatically stores the value.

Push the SET/ENT key.

Use the UP and DOWN keys to determine the minimum stroke length and push the SET/ENT key,

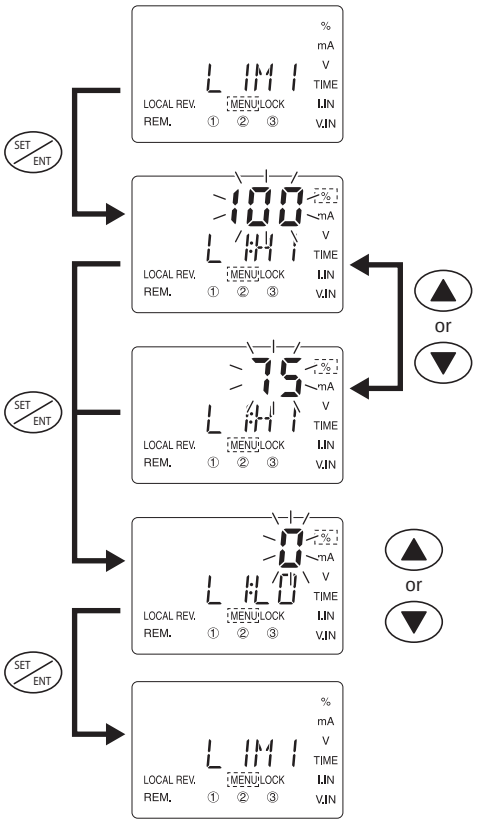
Send a signal current/voltage from user controller to "LO:I". The XP automatically stores value if it is 1mA or more. Otherwise, push the SET/ENT key.

NOTE

The allowable signal current range is 0-22mA, however, the "ENT" display will not appear to enter a signal current unless it is 1mA or more. When the signal current is less than 1mA, push the SET/ENT key to enter.

■ Upper/Lower limit setting

Set the allowable maximum and minimum stroke length for proportional control. The upper limit can be set in between 70 and 100% to control the discharge pressure not to exceed the piping limit pressure. The lower limit can be set in between 0-50% to keep the minimum flow rate at any signal current/voltage (user controller). This setting is effective in AUTO mode only.



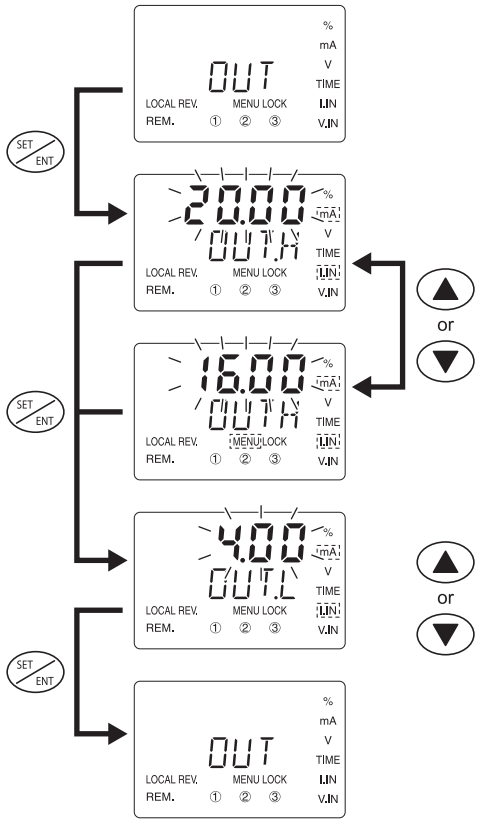
Select "LIMI" and push the SET/ENT key.

Use the UP and DOWN keys to determine the upper limit and push the SET/ENT key.

Use the UP and DOWN keys to determine the lower limit and push the SET/ENT key.

■ Analogue output setting

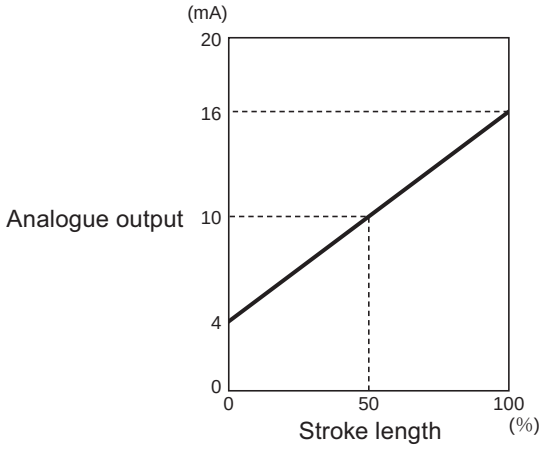
In factory default settings, the XP positioner is set to send 4-20mADC via terminal pin 15 (plus) and 16 (minus) in proportion to a stroke length (0-100%). The output range can be changed as necessary. Note a stroke length is always 0% at "OUT.L" and 100% at "OUT.H".



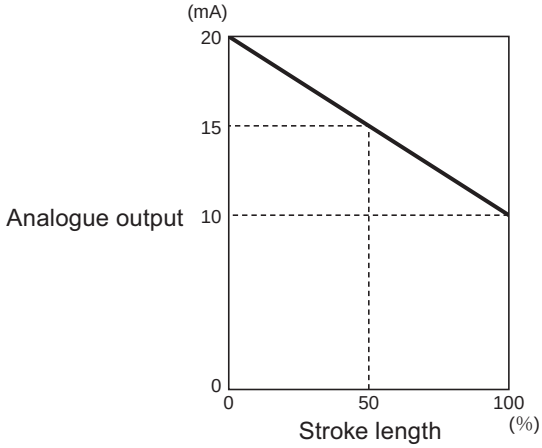
Select "OUT" and push the SET/ENT key.

Use the UP and DOWN keys to determine the maximum current and push the SET/ENT key.

Use the UP and DOWN keys to determine the minimum current and push the SET/ENT key.



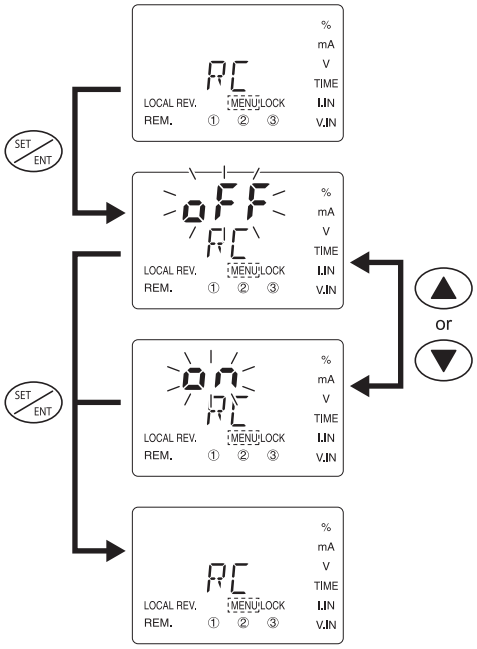
The left graph is in the following patterns.
Hi: 16mA
Lo: 4mA
Inversely proportional line: OFF



The left graph is in the following patterns.
Hi: 20mA
Lo: 10mA
Inversely proportional line: ON

■ Real-time SL adjustment/Target SL setting

A flow rate is manually set in two different ways, the real-time SL adjustment and the target SL setting. The former is the main way of flow rate adjustment and is the factory default setting. Take the following step to select the latter and see page 39 for setting procedure.

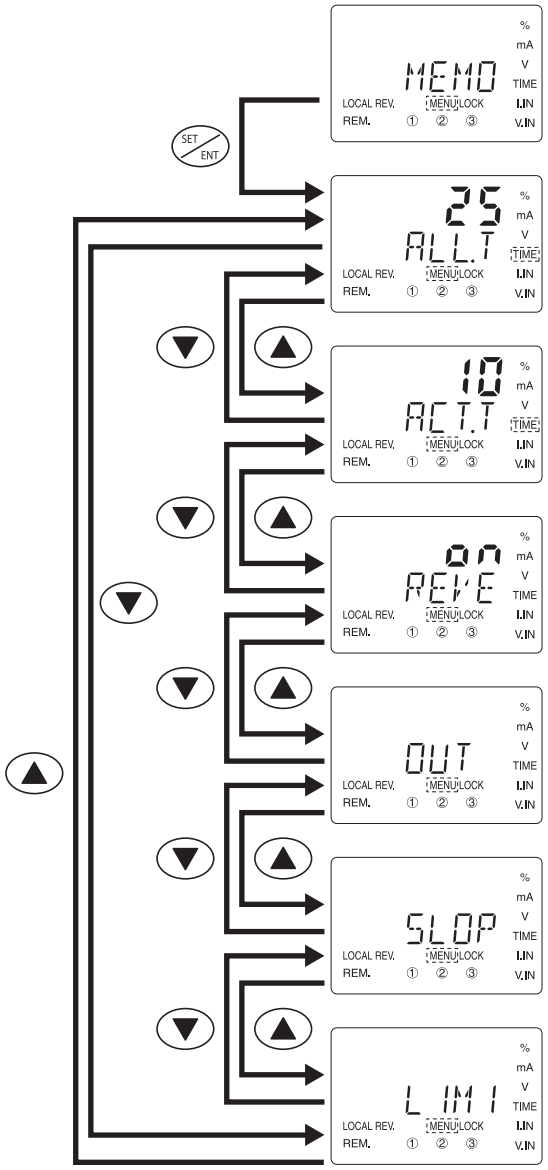


Select "RC" and push the SET/ENT key.

Use the UP and DOWN keys to select "ON" and then push the SET/ENT key. Target SL setting is now effective in manual mode.

■ Operating history (Setting confirmation)

The XP positioner can shows operating history such as total power connection days from being shipped (ALL.T) or last formatted (ACT.T) and recalls the previous setting of an inversely proportional line, a proportional band ("P.B."), Current-Stroke ("2P" and "I.IN"), upper/lower limit and analogue output.



Select "MEMO" and push the SET/ENT key.

Total power connection days (ALL.T)

Total power connection days (ACT.T)

Inversely proportional line selection

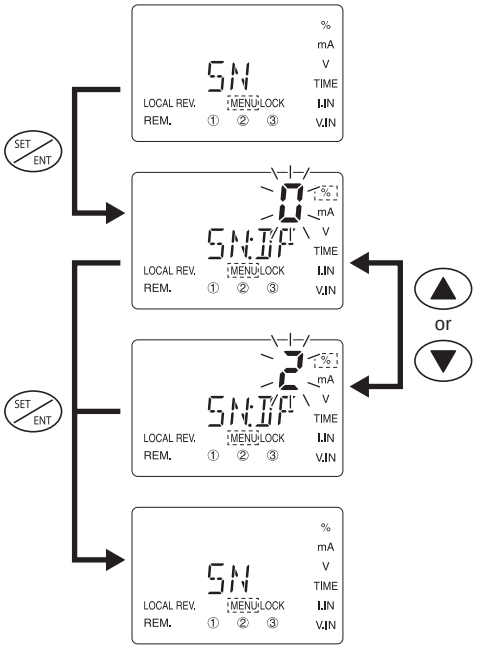
Analogue output
Push the SET/ENT key and then the UP and DOWN keys to cycle through the previous settings. Push the MENU key to return.

Proportional band/Current-Stroke
Push the SET/ENT key and then the UP and DOWN keys to cycle through the previous settings. Push the MENU key to return.

Upper/Lower limit
Push the SET/ENT key and then the UP and DOWN keys to cycle through the previous settings. Push the MENU key to return.

■ Dead band setting

A dead band (feedback signal from the potentiometer) is adjustable between 0 (narrowest) and 10 (widest). Find the best dead band as necessary (e.g. prevention of hunting).



Select "SN" and push the SET/ENT key.

Use the UP and DOWN keys to change numerical values and then push the SET/ENT key. The new setting is now effective in manual mode.

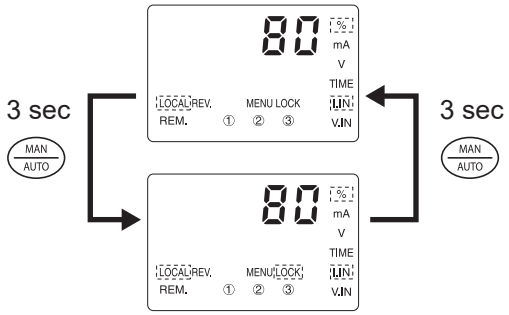
NOTE

The optimal dead band is programmed before the XP positioner is shipped depending on pump models or operating conditions. Do not change the optimal value if it is not needed.

Other settings

■ Keypad lock

Keypad can be active for the prevention of erroneous key operation.

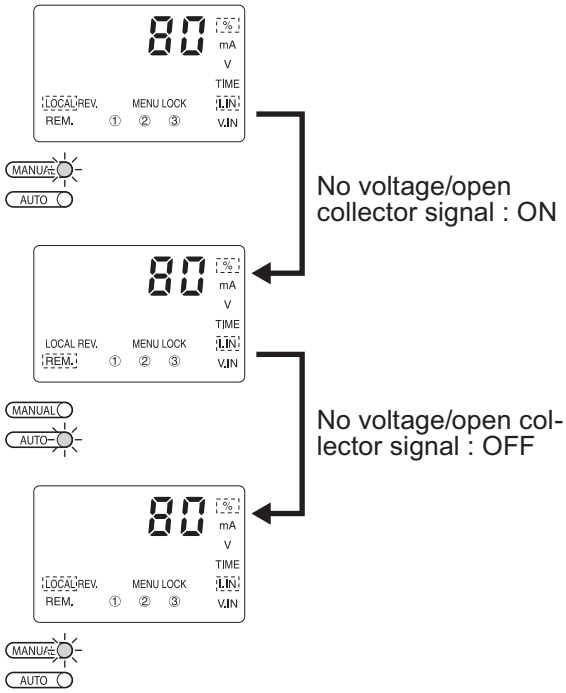


Push the MAN/AUTO key for 3 seconds.
Any keypad operation becomes ineffective as "LOCK" indication is highlighted. Push the MAN/AUTO key for 3 seconds to deactivate keypad lock.

■ Remote control

Input of a no-voltage contact signal or open collector signal via terminal pin 8(plus) and 9(minus) turns the XP positioner into the remote control (AUTO mode with keypads locked). The XP positioner returns to the local control as the signal input is stopped.

*Remote/Local control switching is accessible at any time during MAN or AUTO mode. Keypads are locked during the remote control.



Input a no-voltage contact signal or open collector signal via terminal pin 8(plus) and 9(minus).

The XP positioner enters AUTO mode and any keypad operation becomes ineffective as "REM" indication is highlighted.

Stop inputting the signal to return to the Local control. The XP positioner enters MAN mode.

NOTE

If the signal is inputted in a menu mode, the remote control will starts as the XP positioner entering MAN or AUTO mode. The maximum applied voltage to the Remote/Local contact is 12V at 5mA. When using a mechanical relay, the minimum application load should be 5mA or below.

Operation

The XP positioner and a servo unit are shipped in factory default settings as shown below. Start operation through the following steps.

	Factory default settings (P23)	Reference pages
Signal current/voltage	Signal current	P43
Input signal range	4-20mADC	P25-P37
Pump stroke length	0-100%	
Inversely proportional line	OFF	
Proportional line	4-20mA	
Upper/Lower limit	Hi: 100% Lo: 0%	
Analogue output	4-20mADC	
SL adjustment/Target SL selection	OFF	
Dead band	0 (or 1)	

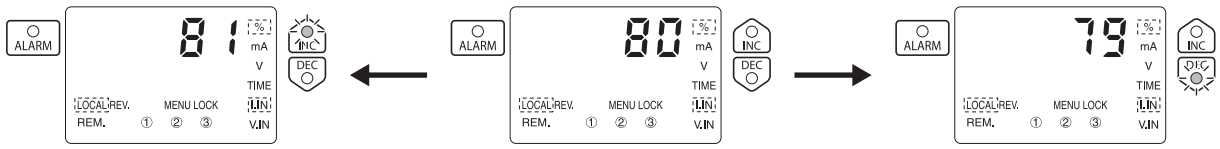
AUTO mode

1 Input 4-20mA(/1-5V) signal to the terminal pin 17 and 18 of the XP positioner.

2 Turn on the XP positioner.

3 Push the "MAN/AUTO" key to start AUTO mode (AUTO LED lights).

4 The XP positioner adjusts a stroke length in proportion to the 4-20mA(/1-5V) signal.



NOTE

The right error code appears with the ALARM LED ON when the signal current (/voltage) falls below 2mA(/0.5V).

Manual mode

■ Real-time SL adjustment

1 Turn on the XP positioner.

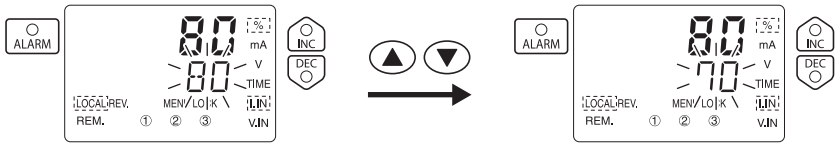
2 Push the "MAN/AUTO" key to start MAN mode (MAN LED lights).

3 Use the UP and DOWN keys to set a stroke length.
Press and hold either key for quick change.

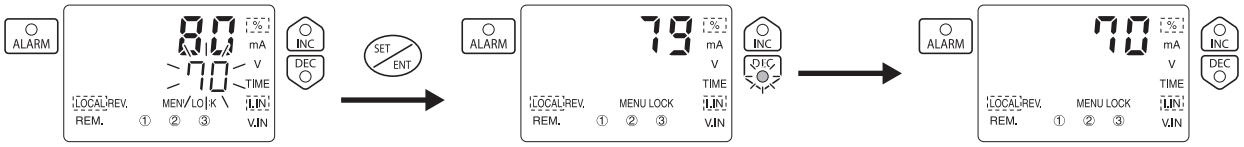
■ Target SL setting

1 Turn the target SL setting effective.
See page 34 for detail.

2 Use the UP and DOWN keys to set a target stroke length.



3 Push the SET/ENTER key to enter setting.
The XP positioner starts working to meet the target length. The target length disappears as the positioner starts adjustment. The adjustment stops as the target length is met.



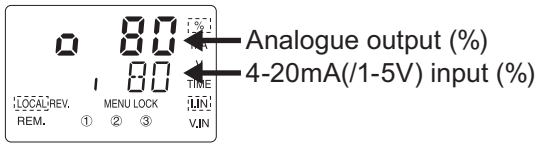
Operating conditions (Setting confirmation)

In AUTO mode, the XP positioner monitors the operating conditions of the 4-20mA(/1-5V) input via the terminal pin 17(plus) & 18(minus), the analogue output via the terminal pin 15 (plus) & 16 (minus), the target stroke length, and other settings.

■ 4-20mA(/1-5V) input/ Analogue output

1 Push the UP and SET/ENTER keys.

The XP positioner converts the 4-20mA(/1-5V) input via the terminal pin 17(plus) & 18(minus) and the analogue output via the terminal pin 15 (plus) & 16 (minus) into stroke length and shows on the screen in %. The information appears only while both the keys are pressed and held.

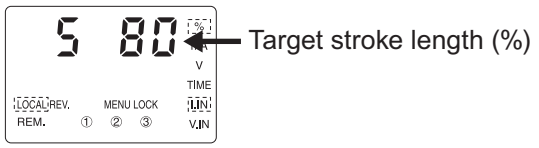


Analogue output (%)
4-20mA(/1-5V) input (%)

■ Target stroke length

1 Push the DOWN and SET/ENTER keys.

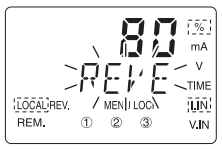
The screen shows the target stroke length. The information appears only while both the keys are pressed and held.



Target stroke length (%)

■ Parameter setting (AUTO mode)

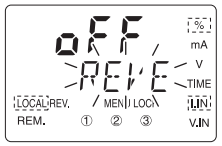
1 In AUTO mode, push the UP and DOWN keys



2 Select "REVE", "SLOP" or "LIMI" and push the SET/ENTER key.

3 Use the UP/DOWN and the SET/ENTER keys to check further options as necessary.

The information disappears as pushing the SET/ENTER key or 3 seconds after the last keypad operation.



Software formatting

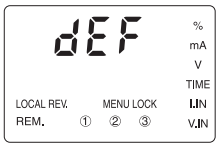
Format the XP positioner software as necessary through the following procedure below.

1 Turn off power.

2 Turn on power while pressing the MENU key.

Press and hold the key until the XP software is formatted with the display below.

*The XP positioner automatically returns to MAN mode after successfully formatted.



3 Set each parameters as necessary.

See page 25 for stroke length cognition.

NOTE

- Stroke length indication may be different between the XP display and the stroke length knob (pump). Always perform the stroke length cognition after the software is formatted.
- In our factory, the dead band of some positioners may has been shifted from "0" to "1" in order to reduce hunching of the servo motor. Once the positioner software is formatted, note the value returns to "0", and consequently hunching comes back to the servo motor. In such a case, reassign "1" (see page 36).

Software default

Parameters	Defaults
Stroke length cognition	0-100%
Input current/voltage correction	Hi: 20mA Lo: 4mA
Inversely proportional line	OFF
Proportional line	4-20mA
Upper/Lower limit	Hi: 100% Lo: 0%
Analogue signal	OUT.H: 20.00mA OUT.L: 4.00mA
SL adjustment/Target SL selection	OFF
Dead band	0

Troubleshooting

First check the following points. If the following measures do not help remove problems, contact your nearest distributor.

States	Possible causes	Solutions
Blank LCD	Power line is not connected properly.	• Correct wiring. See page 19.
Stroke length indication on the XP does not change.	Electric servo unit is failed.	• Check control gears in the servo unit. See the manual of the servo unit.
	Signal lines are not connected properly to the servo unit.	• Correct wiring. See page 19.
Stroke length control is upset.	The signal current (or voltage) from a user controller to the XP is not correct.	• Perform input current/voltage correction. See page 26.
	0% and 100% stroke-length positions are not determined.	• Perform stroke length cognition. See page 25.
	A proportional line is not proper.	• Program an optimal proportional line for intended control. See page 28.
	The XP is not set for receiving the signal current (or voltage).	• Select the signal current or signal voltage mode, whichever is proper. See next page.
Servo motor does not rotate properly.	C, S, and O terminal wiring do not correspond between the servo unit and the XP.	• Correct wiring as necessary. See page 19.
	Supplied power voltage to the XP does not meet the rated voltage of a servo motor.	• Adjust the power voltage to meet the servo motor specification. See page 19 for detail.
Stroke length contracts (or extends) opposite to the servo motor rotation.	O and S (or PM1 and PM3) terminals are connected inversely between the servo unit and the XP.	• Correct wiring as necessary. See page 19.
Stroke length knob (pump) does not rotate along with servo motor.	Control gears in the servo unit are failed.	• Contact us.
Stroke length control occasionally becomes upset.	The XP is affected by noise through signal lines.	• Keep the XP away from the devices which may generate noise. • Use an earth wire, shield wire or isolator as necessary. See page 21.

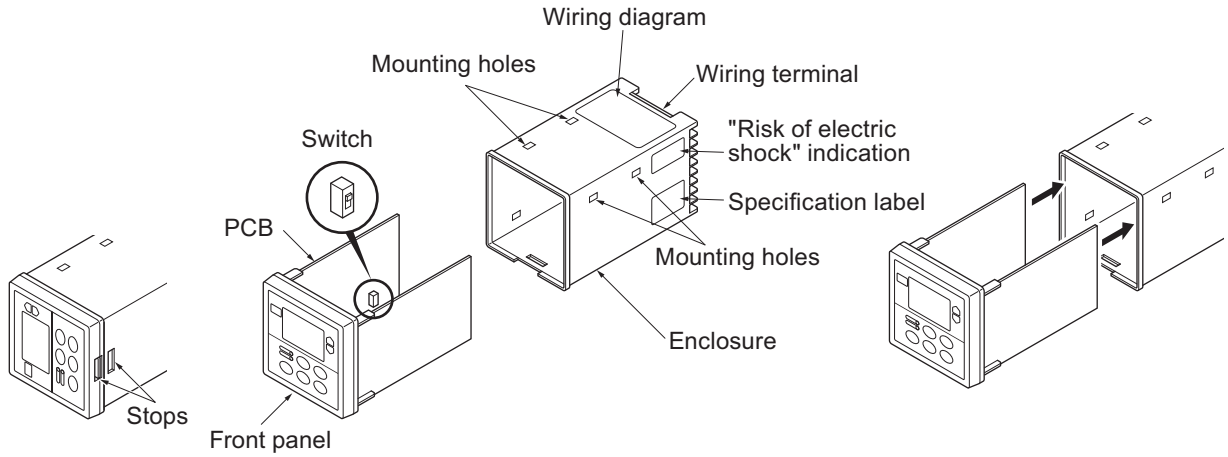
Error messages

Take measures below when error messages appear during operation. Contact us or your nearest distributor as necessary.

Error messages	Possible causes	Measures
ERR.1	Feedback signal from the potentiometer	• Check signal wire connections between the XP and servo unit.
ERR.2	Over-current/-voltage from user controller	• Observe the maximum signal current(/voltage) of 22mA(/5.5V)
ERR.3	Erroneous setting	• Make sure the signal current(/voltage) at the Lo position is higher than the Hi position in proportional line programming.
NO.SI	Low-current/-voltage from user controller	• Observe the minimum signal current(/voltage) of 2mA(/0.5V)

Input current/voltage switching

1 Pull the front panel together with PCBs out of the enclosure while releasing the stops.

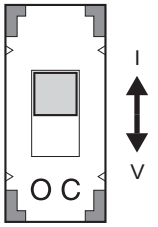


NOTE

Check that power voltage is turned off. The XP positioner is still charged right after turning off power. Wait for one minute before removal.

2 Switch up or down to change between signal current (I: 4-20mA) and signal voltage (V: 1-5VDC).

"I" (4-20mA) is selected with factory default settings.



NOTE

Always perform the Input current/voltage correction after switching. See page 26 for detail.

Specifications/Outer dimensions

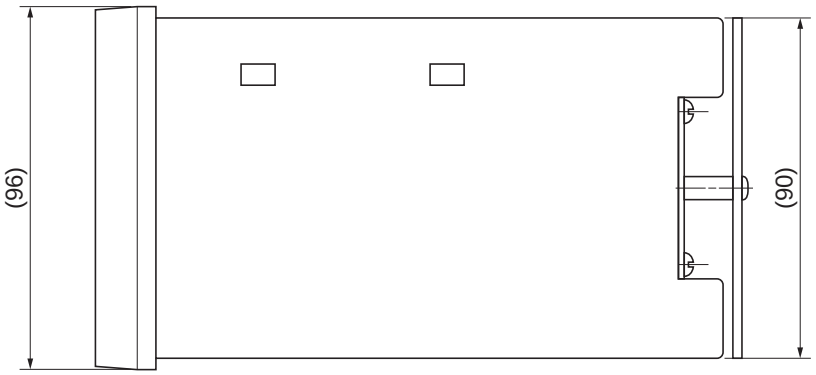
Specifications

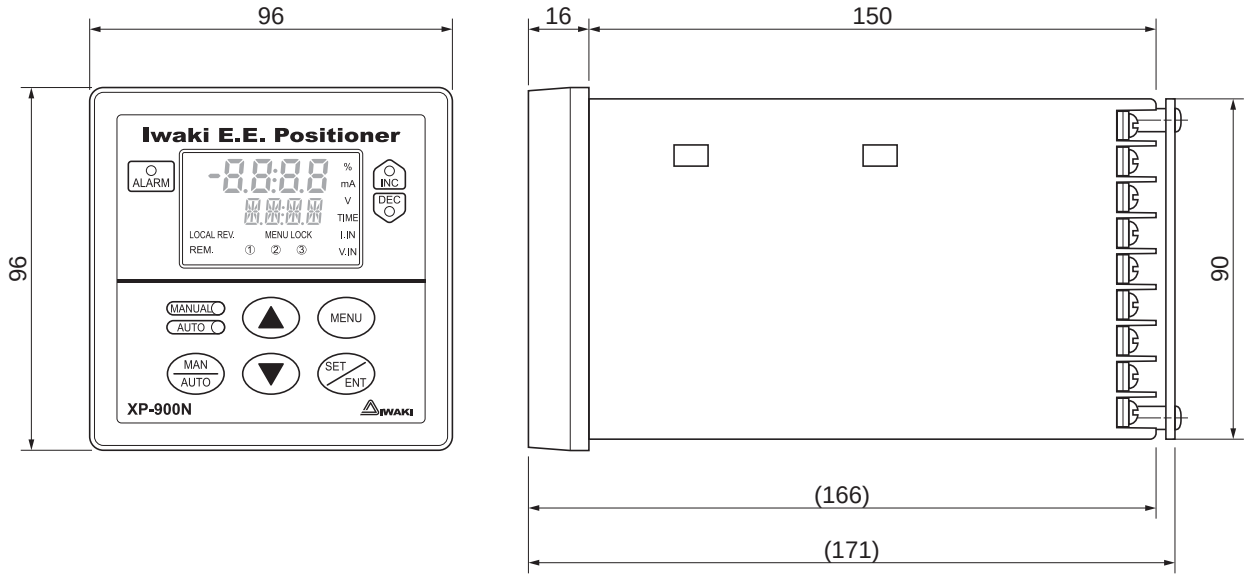
Information in this section is subject to change without notice.

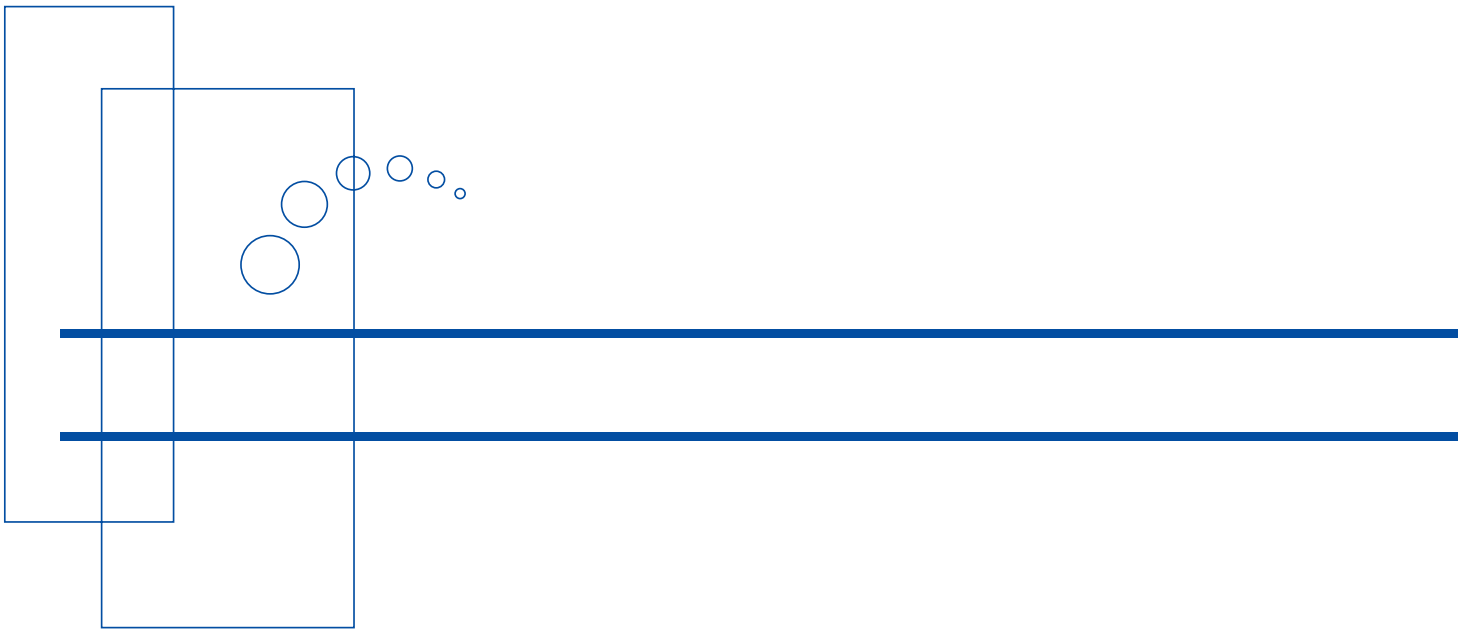
Operation modes	Manual	SL adjustment	Adjustment with the UP and DOWN keys
		Target SL setting	Setting with the UP/DOWN and SET/ENT keys
	AUTO	AUTO operation	Proportional control to 4-20mA or 1-5V from a user controller
Monitors	LCD	4×2 7/14seg backlit LCD	
		Operating conditions and units	
	LED	MANUAL	Lights in green colour during operation in MAN mode.
		AUTO	Lights in green colour during operation in AUTO mode.
		INC	Lights in yellow colour when a stroke length increases.
		DEC	Lights in yellow colour when a stroke length decreases.
		ALARM	Lights in red colour in erroneous conditions.
Operation	Keypads	MAN/AUTO, UP, DOWN, MENU, SET/ENT keys	
Calibration functions	FB		Stroke length cognition at 0 and 100% positions
	IN		Input current/voltage correction at 4 and 20mA
	SN		Dead band setting in between 0 and 10
Control functions	REVE		Inversely proportional line selection
	SLOP		Proportional band change/Current-Stroke setting
	LIMI		Upper/Lower limit setting
	OUT		Analogue output setting
	RC		Selection between Real-time SL adjustment and Target SL setting
Operation history	MEMO		Total power connection days from being shipped (ALL.T) or formatted (ACT.T), previous settings (an inversely proportional line, a proportional band, upper/lower limits and an analogue output)
Input	User controller		4-20mA with 75Ω 1-5VDC with 218Ω
	Feedback signal		Potentiometer (1kΩ)
	Remote control		No voltage contact or Open collector
Output	Servo motor power voltage		Voltage contact (TRIAC)
	External monitor		4-20mADC NOTE: Allowable maximum load resistance is 600Ω.
Power consumption	44VA		
Power supply	100-240VAC 50/60Hz NOTE: Observe the rated voltage of the servo motor.		
Accessories	Mounting hardware		

*The above data is based on the following conditions:
Power supply: 100-240VAC
Ambient temperature: 0-50ºC
Ambient humidity: 30-85%RH (non freezing/condensing)
Allowable voltage fluctuation range: ±10% of the rated power supply
Storage temperature: -10 - 60ºC
Withstand voltage: 1500VAC for 1 minute or 1800VAC for 1 second (between the earth terminal and power supply)
Insulation resistance: 500VDC 100MΩ or more

Outer dimensions







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