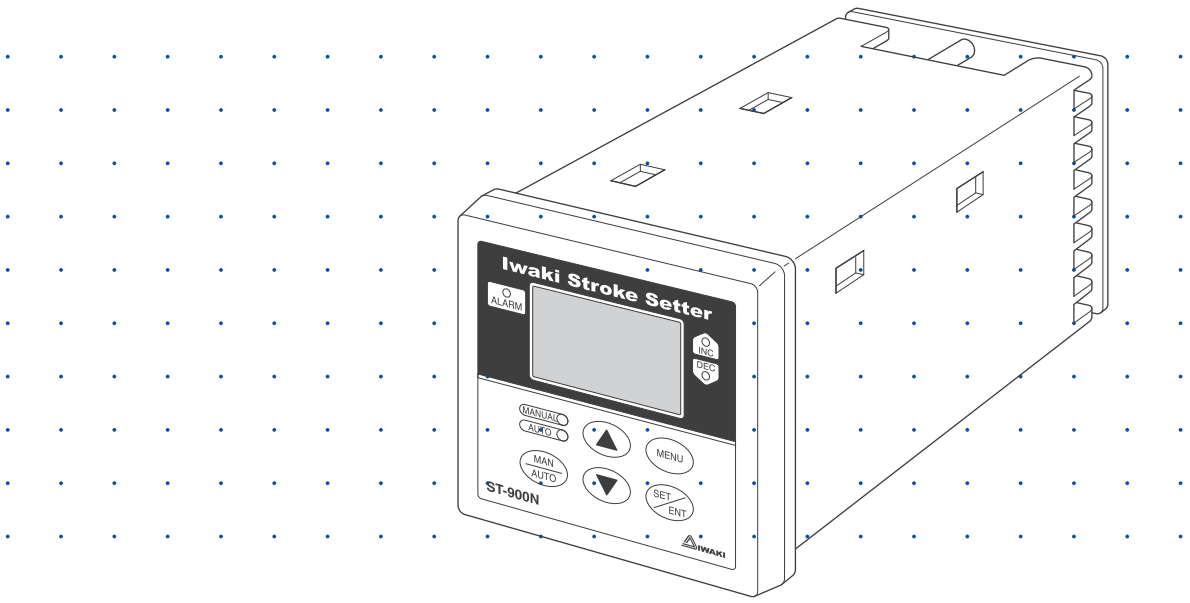
IWAKI PUMPS

Iwaki Stroke setter

ST-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.

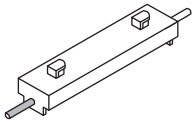
Order confirmation

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

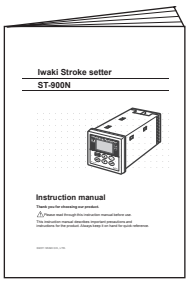
a. Check if the delivery is correct.

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.

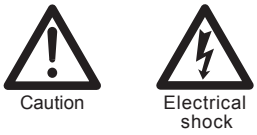
■ Symbols

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



Prohibition mark

Requirement mark

⚠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 setter

Using a damaged setter 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 setter

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


Caution

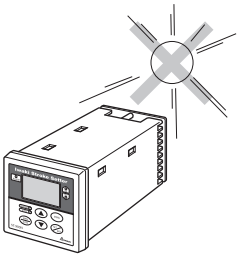
Keep the spec label and nameplate clean

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

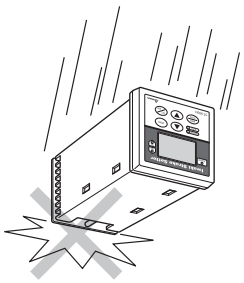
Precautions for use

• 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 setter performance. Do not use a setter 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 setter or erase printing. Use a dry or a damp cloth or a neutral detergent.

Overview

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

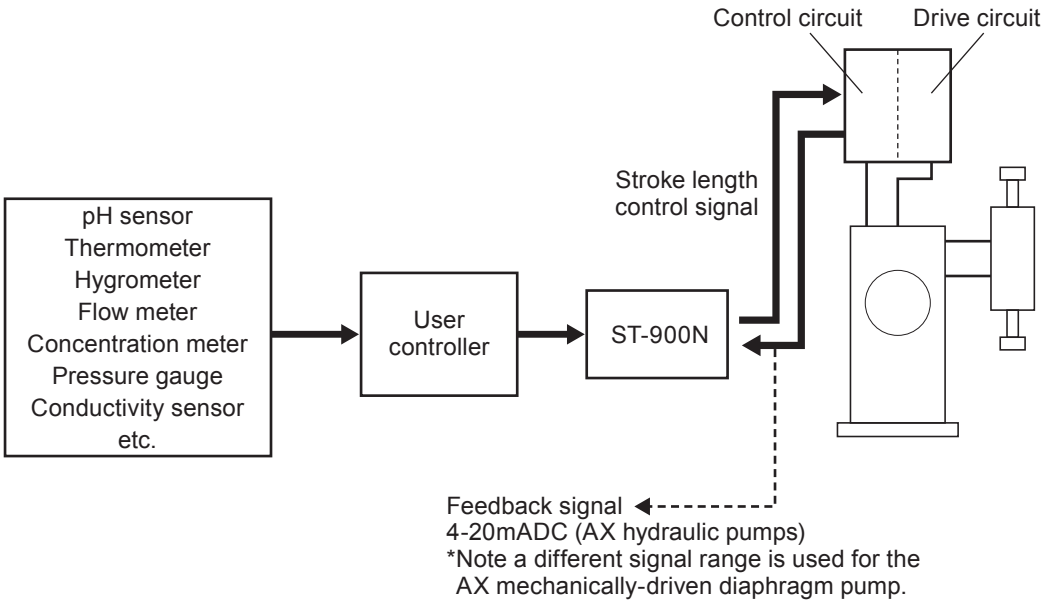
Introduction

Operating principle

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

Principle of operation

The ST setter 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 ST setter 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**

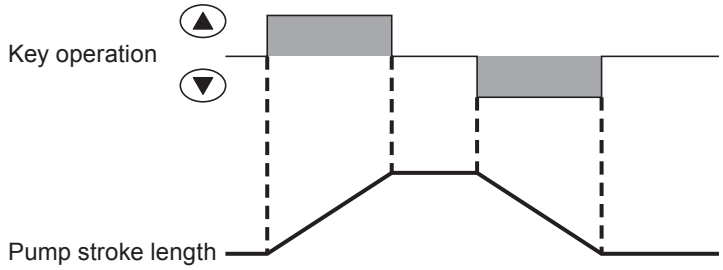
  The ST setter is a multivoltage type (100-240VAC) and can be selected without concern for local power voltage.

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 the factory default setting.

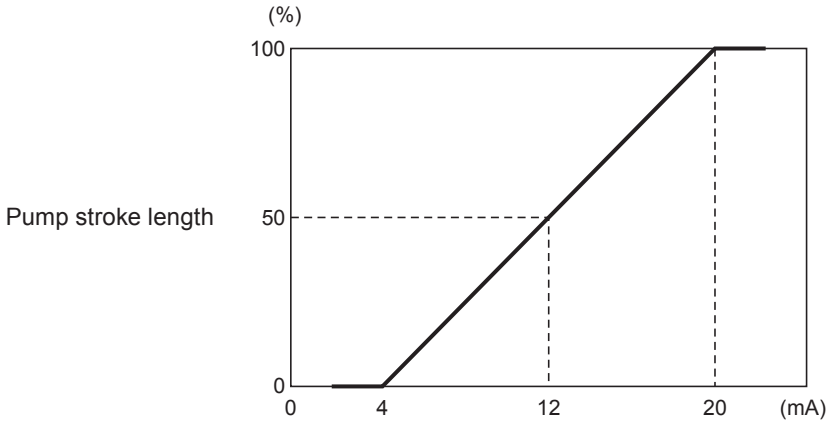


■ Target SL setting

Use the UP and DOWN keys to set and the SET/ENT key to enter a target stroke length in operation (MAN mode). The ST setter starts to control the servo motor to meet the target length. See page 33 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 37 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 ST setter the 0% and 100% stroke length positions through keypad operation. See page 25 for detail. The setter automatically behaves to store the positions. Perform stroke length cognition every time the setter is used with a unrecognized AX 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 ST setter. The setter 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).

■ Servo unit control signal (AX mechanically-driven diaphragm pump)

The stroke length of the AX hydraulic pumps are controlled by the 4-20mA control signal from the ST setter, however, different signal ranges as below need be set at each model for the AX mechanically-driven diaphragm pumps. See page 36 for programming procedure.

Model codes	OUT.H	OUT.L
AXA-K (KE) 90	8.0mA	4.0mA
AXA-K (KE) 120	9.3mA	
AXB-K (KE) 150		
AXB-K (KE) 180	10.4mA	

■ Inversely proportional line

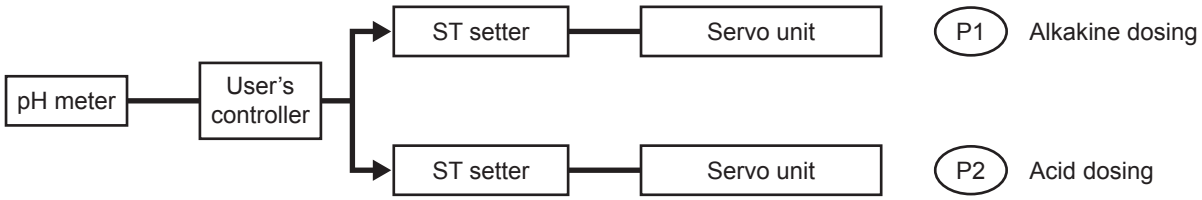
With this setting "ON", the ST setter controls the stroke length inversely proportional to the 4-20mA(/1-5V) signal from a user controller. See page 27 for detailed procedure. Use this function along with the proportional line programming below as necessary (e.g. for pH control).

■ 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

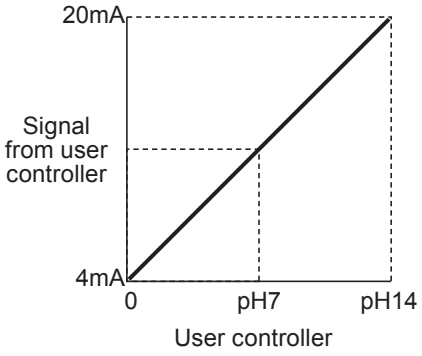
Two pumps may be needed to control pH in a sample. One is for acid, and the other is for alkaline dosing. In this case, provide the ST setter at each servo unit to control the pump with 4mA(/1VDC)-20mA(/5VDC) signal from a user controller.

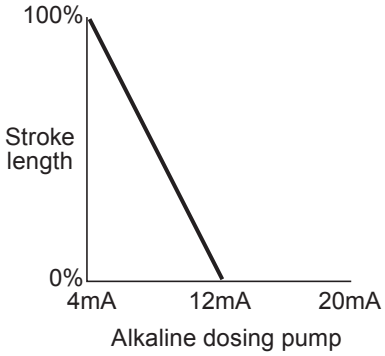


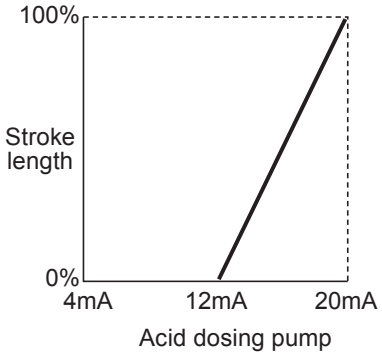
Current-Stroke setting ("2P")

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

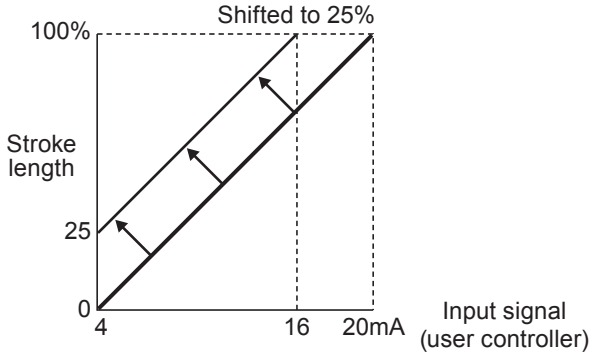






Proportional band setting ("P.B.")

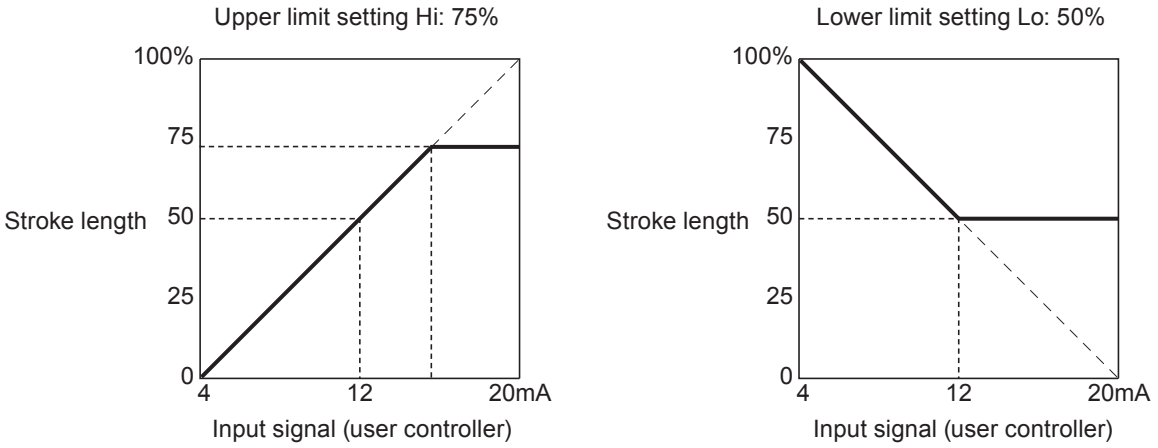
Sift the proportional line as necessary. 25% stroke length is obtained at 4mA in the following graph.



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).



Monitoring functions

■ Operating conditions

In AUTO mode, the ST setter monitors operating conditions of 4-20mA(1-5V) input via the terminal pin 17(plus) and 18(minus), the control signal output via the terminal pin 15(plus) and 16(minus), and the target stroke length. Both the signals are converted into stroke length and shown up on the screen in % as well as the target stroke length. See page 39 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 ST setter shows total power connection days (from being shipped or defaulted) 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 a control signal. See page 34 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 35 for detail.

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

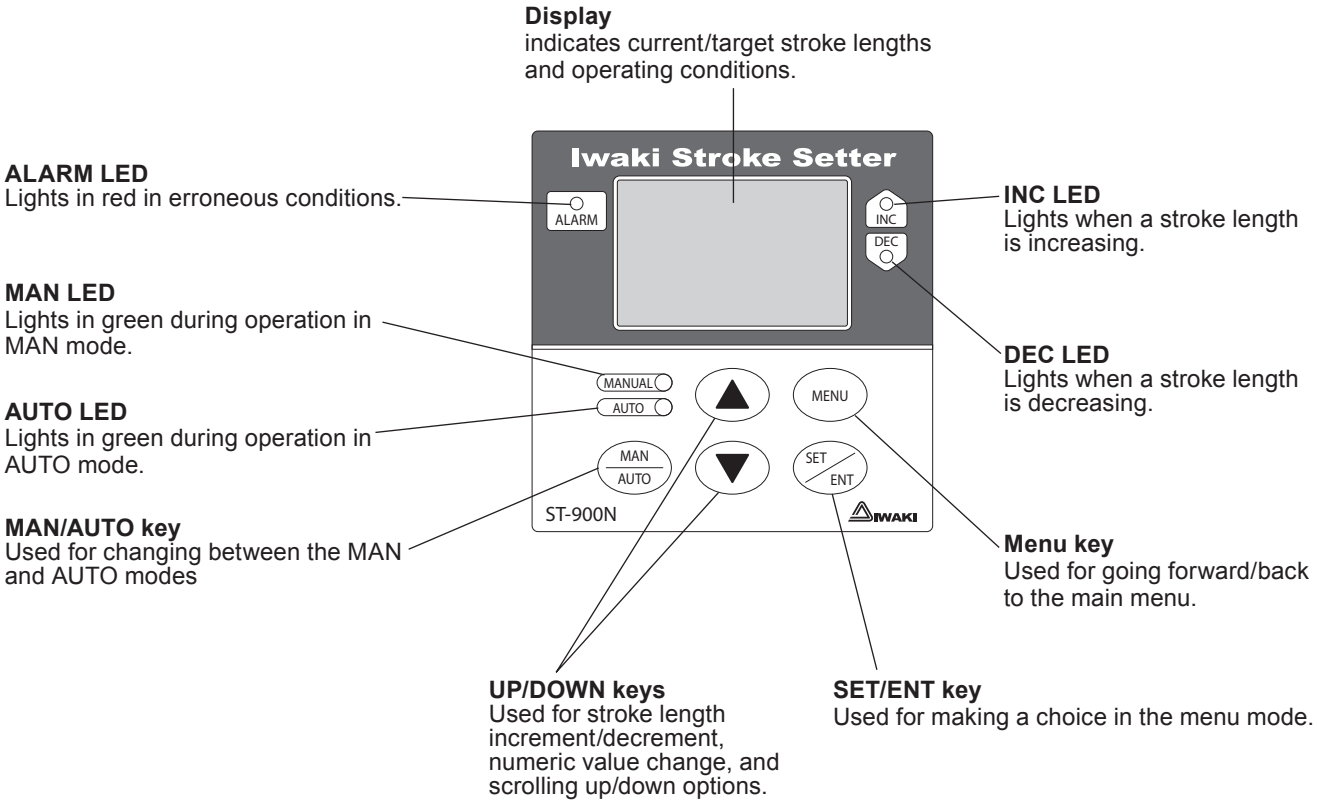
■ Remote control

"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.

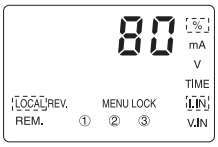
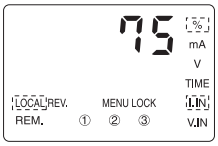
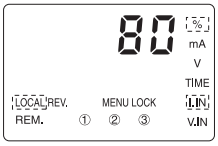
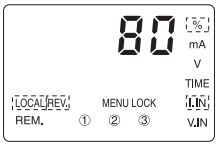
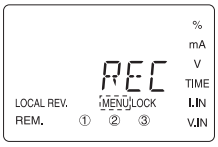
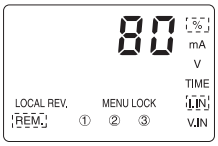
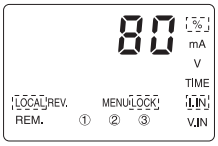
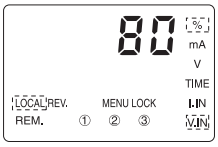
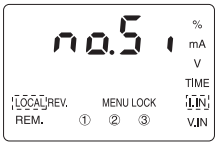
Part names

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 ST setter is set for receiving the signal current from user controller.
V.IN	: Appears when the ST setter 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 ST setter 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 ST 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 ST increases/ decreases the pump stroke length.
	AUTO LED lights green.	-	-	The ST is in Auto mode.
	AUTO LED lights green.	-	-	The ST in Auto mode with an inversely proportional line.
	-	INC or DEC LED lights during in SL cognition behaviour.	-	The ST 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 ST is set for receiving signal voltage from user controller.
	MAN or AUTO LED lights depending on operating mode.	-	ALARM LED lights red.	The ST is in erroneous conditions.

Identification codes

Each code represents the following information.

Setter

ST - 900N __
a b c

a. Series name
ST

b. Series code
900N

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

Installation

This section describes the installation and wiring of the ST setter. Read through this section before work.

Points to be observed

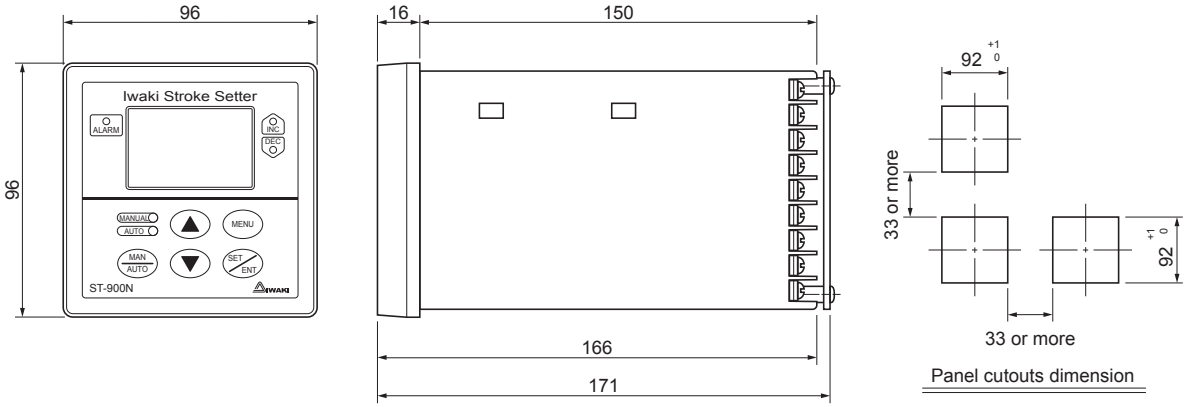
Do not install this product:
–In a flammable atmosphere.
–Where ambient temperature can exceed 50ºC or falls below 0ºC.
–Where humidity can exceed 85%RH or falls below 30%RH.
–In direct sunlight or wind & rain.
–In a dusty or a corrosive environment.
–Under mechanical vibration or electromagnetic field.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

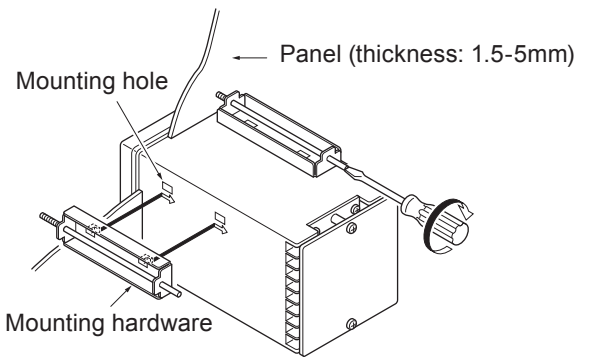
*Mounting panel should tolerate the weight of the setter.

Setter 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 ST setters are installed in a control panel, keep the distance between each setter 33mm or more in both vertical and horizontal directions.
c. Allowable thickness of the control panel is 1.5-5mm.
d. First insert the setter into the cutout.
e. Attach the mounting hardware to the ST setter and fix to the panel.





Wiring

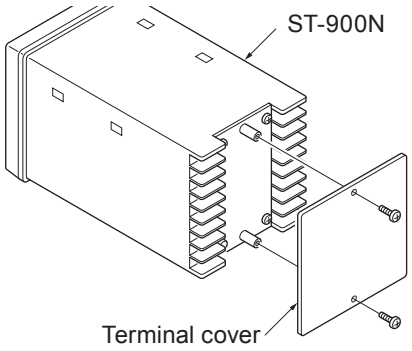
Wiring for power voltage, earthing and external signals.

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 ST setter 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 ST setter.

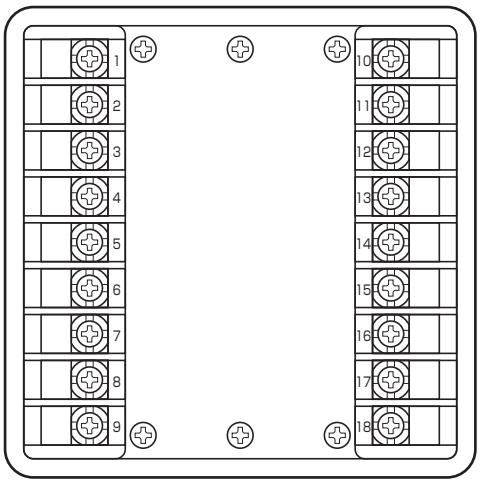
Use the spade terminal for the wire connections. Fasten them to 0.6N•m.

NOTE

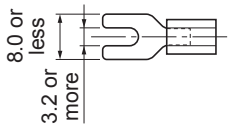
Always check that the wire connections are properly fixed. Disconnection can cause malfunction.

3 Remount the terminal cover.

Wire terminals



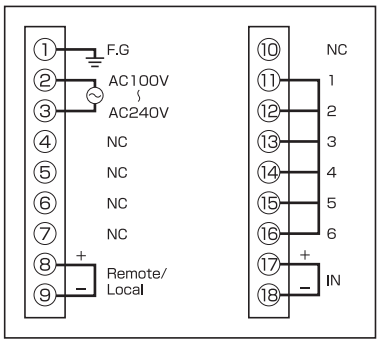
Use the spade terminal in the following size.

Terminal #	1 - 18
Terminal size	

1	F.G		10	NC	
2	L 100-240VAC		11	Feedback signal	1 ⊕
3	N 100-240VAC		12	Feedback signal	2 ⊖
4	NC		13	INC LED	3 ⊕
5	NC		14	DEC LED	4 ⊖
6	NC		15	Control signal	5 ⊕
7	NC		16	Control signal	6 ⊖
8	Remote/Local (IN)	⊕	17	Input signal (IN)	⊕
9	Remote/Local (IN)	⊖	18	Input signal (IN)	⊖

End terminals

Observe the electric diagram shown on the terminal cover at the back of the ST-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.

■ Frame ground

Connect an earth wire to the terminal pin 1.

■ Electric servo unit

Electrically connect the ST setter and the servo motor through the corresponding terminals of "1", "2", "3", "4", "5" and "6".

■ 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 ST setter (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 ST setter may fail. (Maximum applied voltage is 12VDC at 5mA.).

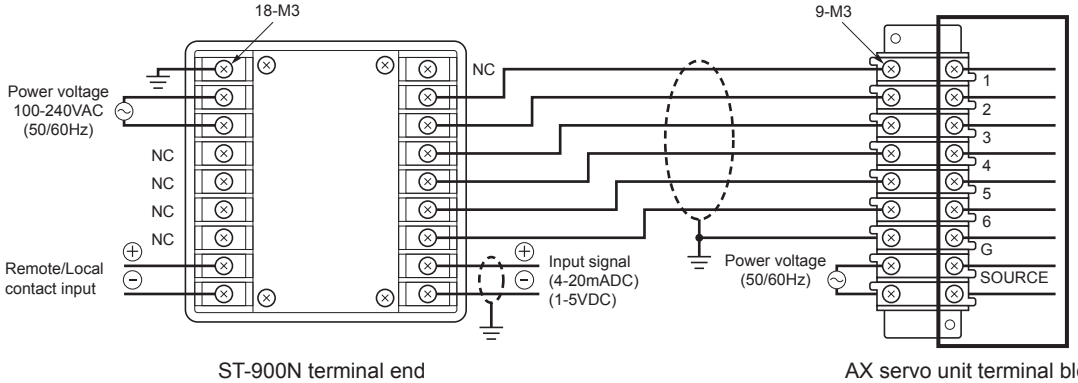
■ Terminal assignment for the servo unit

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

1-2 : 4-20mADC feedback signal from the servo unit to the ST setter

3-4 : +10mA/-10mA/0mA INC/DEC LED signal from the servo unit

5-6 : Servo unit control signal from the ST setter to the servo unit



ST-900N terminal end

AX servo unit terminal block

Power voltage/Earthing

Points to be checked

- Check that power voltage is turned off.

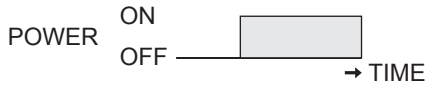
1 Connect power cable via crimp contacts.

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

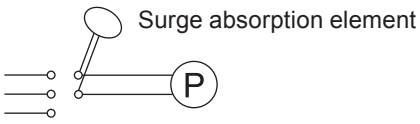


When power voltage is applied gradually

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.

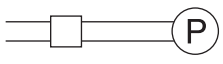
- Install a surge absorption element (such as a varistor with capacity of 2000A or more) via power cable or,



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

- The servo motor may suffer an overload if the pump motor is turned off first. To avoid overloading, use a PLC or sequencer to turn off either the ST setter or the servo unit, or just to stop the control signal (terminal pin 15 and 16) as turning off a pump motor. Contact us for detail.
  *If the servo unit is turned off, the ST setter shows an error display.
- 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 ST setter as the pump motor stops. Use the relay of 3A 220VAC. (or open only the C, S and O circuit to keep the ST setter 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 ST setter. Install an isolator in the signal line as close to the ST setter with the shortest signal line length. Do not lay on the line in parallel with a power cable.
- Position the ST setter 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 ST setter.

Operation

This section describes setter operation and programming. Run the pump with the ST setter 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 is observed.
- Electrical wiring is correct and is free from the risk of short circuit and electrical leakage.
- The pump is running.

Calibration

■ Input current/voltage correction

The ST setter is set to output the control signals of 4mA at the stroke length of 0% and 20mA at 100% with factory default setting. Perform input current/voltage correction as necessary. See page 26 for detail.

■ Stroke length cognition

This pre-shipment calibration is performed by Iwaki for the combination of a ST setter and an AX pump, however, further performance is needed every time the XP positioner is used with a unrecognized AX pump, the electric servo unit is repaired, or a displayed stroke length differs from the actual length.

*The control signal range of 4-20mA does not conform to the servo unit designed for mechanically-driven diaphragm pumps and differs with each models. See page 36 for detail.

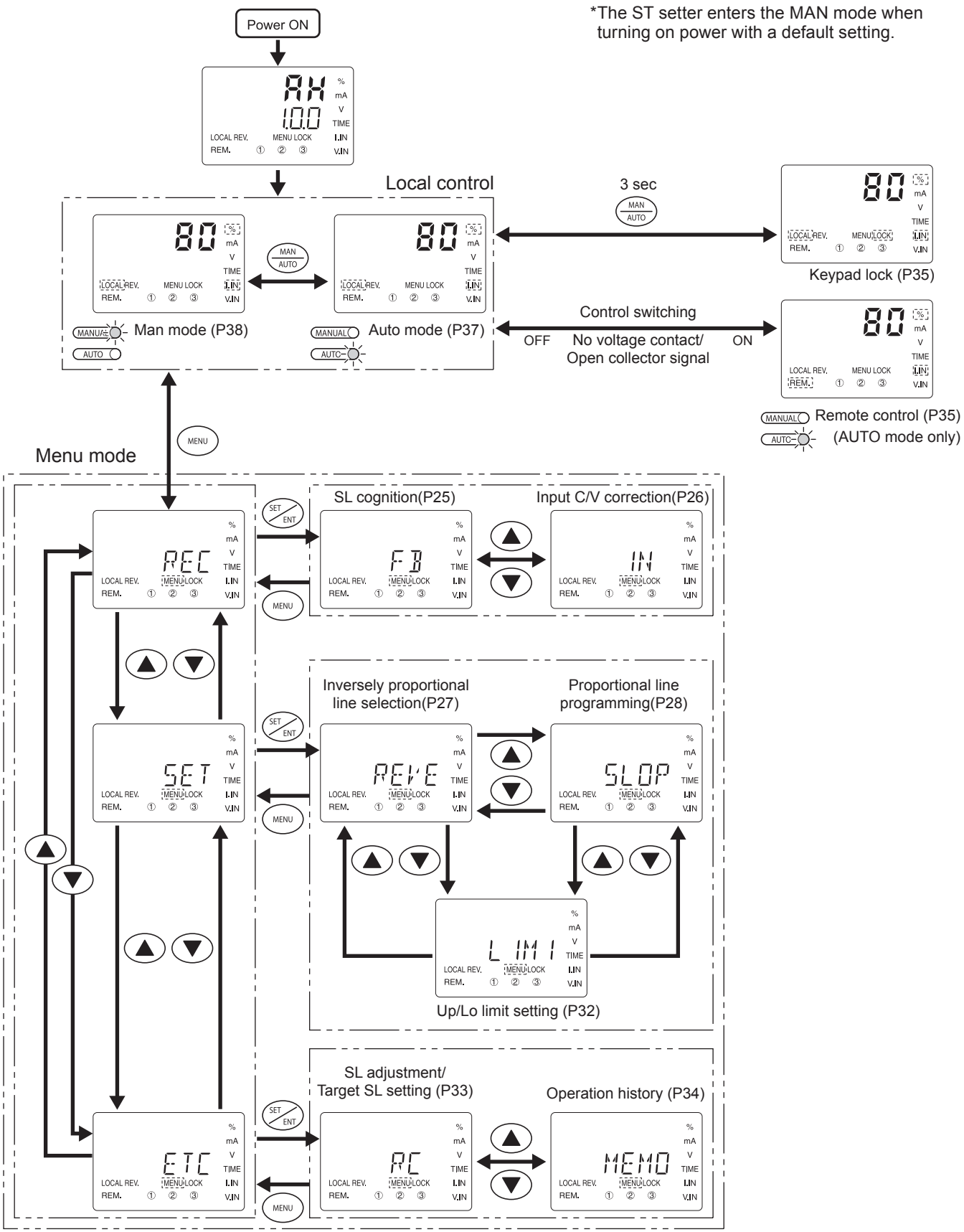
Model codes	OUT.H	OUT.L
AXA-K (KE) 90	8.0mA	4.0mA
AXA-K (KE) 120	9.3mA	
AXB-K (KE) 150		
AXB-K (KE) 180	10.4mA	

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
Operation	-	MAN (SL adjustment/Target SL) /AUTO	MANUAL (SL adjustment)
Menu mode	Inversely proportional line	ON/OFF	OFF
	Proportional band change/Current-Stroke setting	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%
	Control signal	Hi: 7-20mA Lo: 3-5mA	Hi: 20mA Lo: 4mA
	SL adjustment/ Target SL setting selection	ON/OFF	OFF
Others	External switching	Remote/Local control	Local control
	I-V input	Signal current/voltage	Signal current

Programming flow

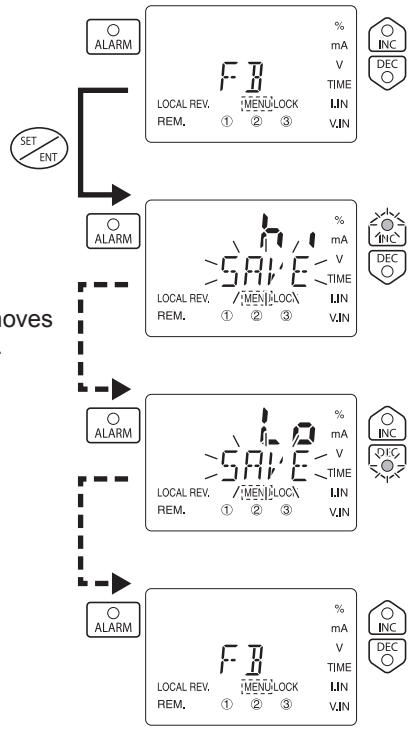


Menu mode

Change the default setting 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 ST setter the 0% and 100% stroke length positions. Stroke length cognition is required every time the ST setter is used with a unrecognized AX 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.

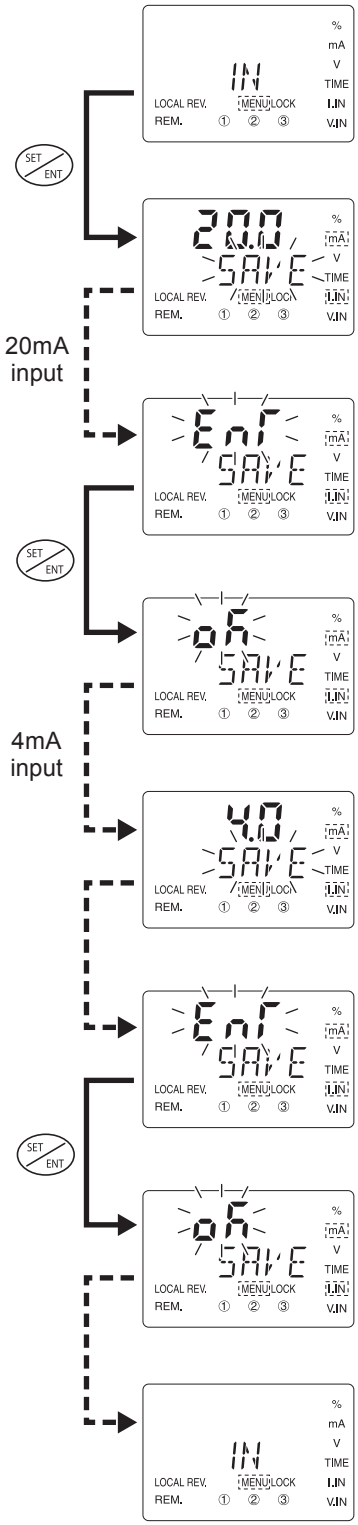
Stroke length cognition has been completed.

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.

■ Input current/voltage correction

The ST setter 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(-).

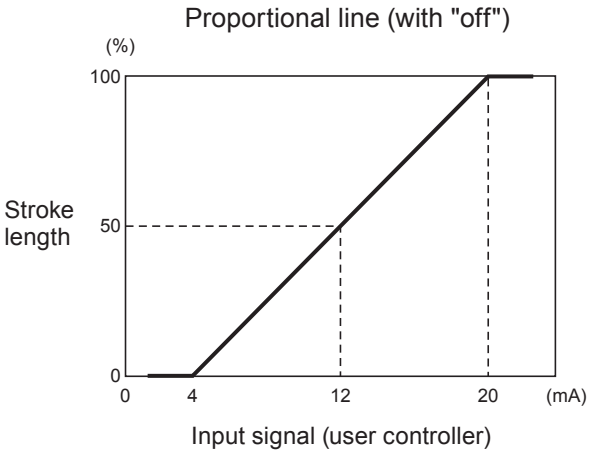
"ENT" flashes as long as it stays within 4±2mA(/1±0.5V).

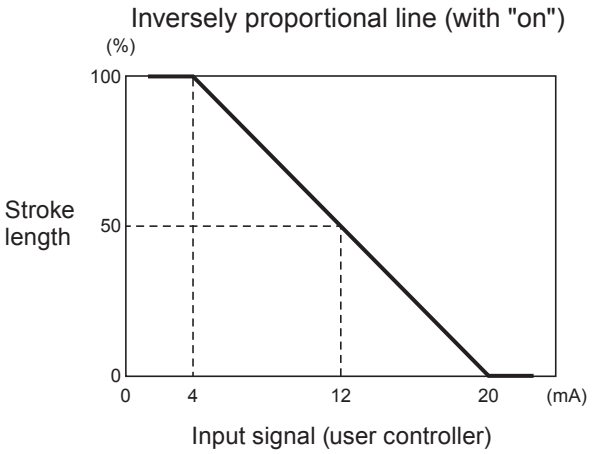
NOTE

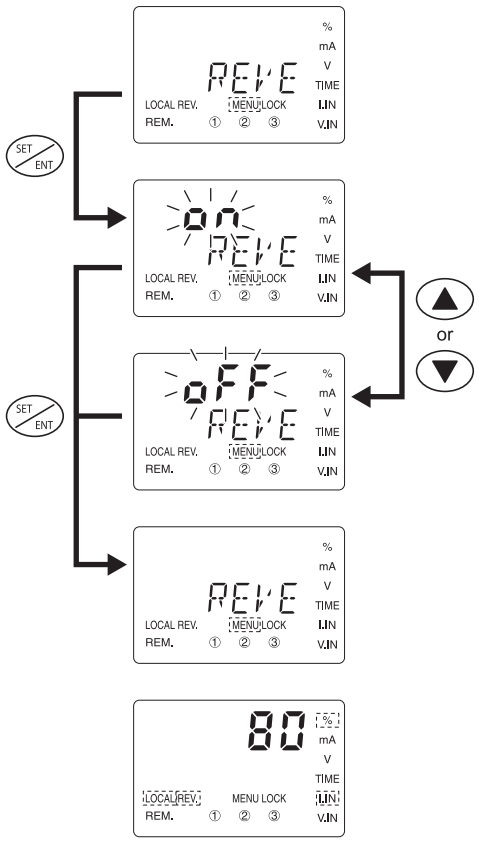
The signal current is stored to the ST setter as the SET/ENT key is pushed. Input voltage correction is possible after the ST setter setting is switched to signal voltage.

■ 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.







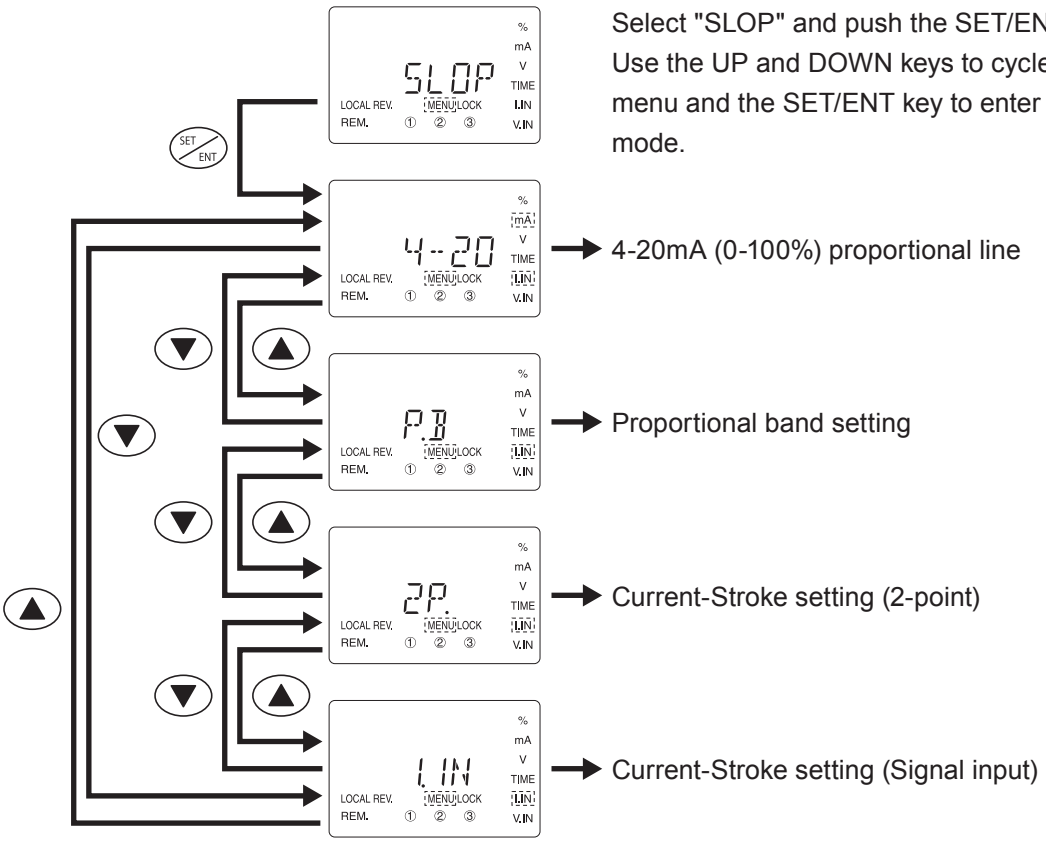
Select "REVE" and push the SET/ENT key.

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

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

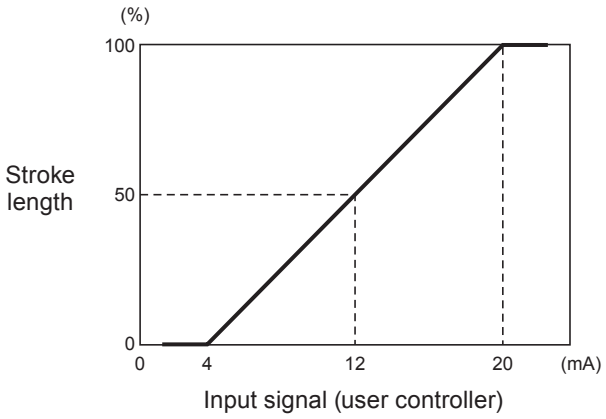
■ Proportional line programming

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

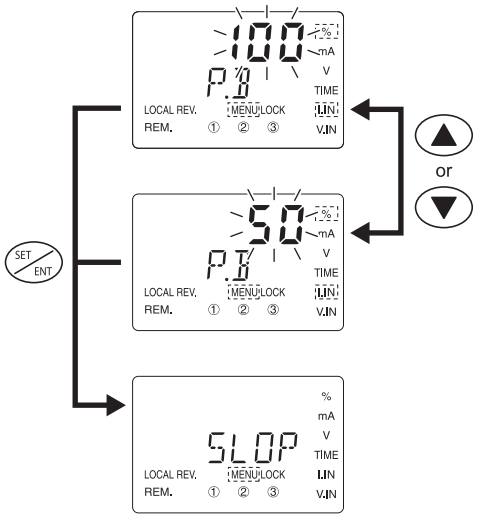
Factory default setting. Stroke length changes in between 0 and 100% in proportion to 4-20mA from a user controller.



Proportional band setting

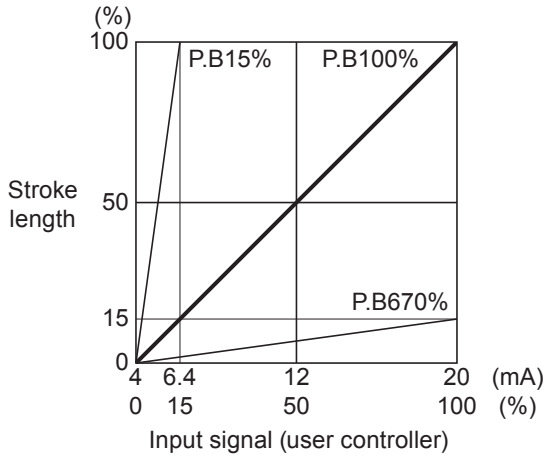
A proportional control band can be changed in between 15 and 670%. The factory default setting is 100%. Change the percentage as necessary (e.g. two-value separate control). A proportional band is calculated by the following formula (convert a signal current/voltage into %. e.g. 4mA = 0%, 20mA = 100%):

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

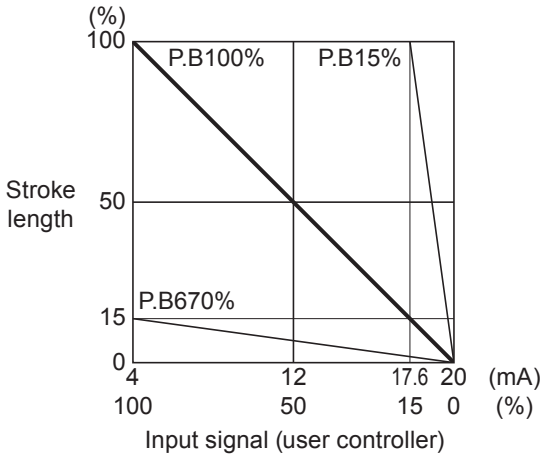


Use the UP and DOWN keys to determine a control band in between 15-670% and push the SET/ENT key.

Inversely proportional line: OFF



Inversely proportional line: ON



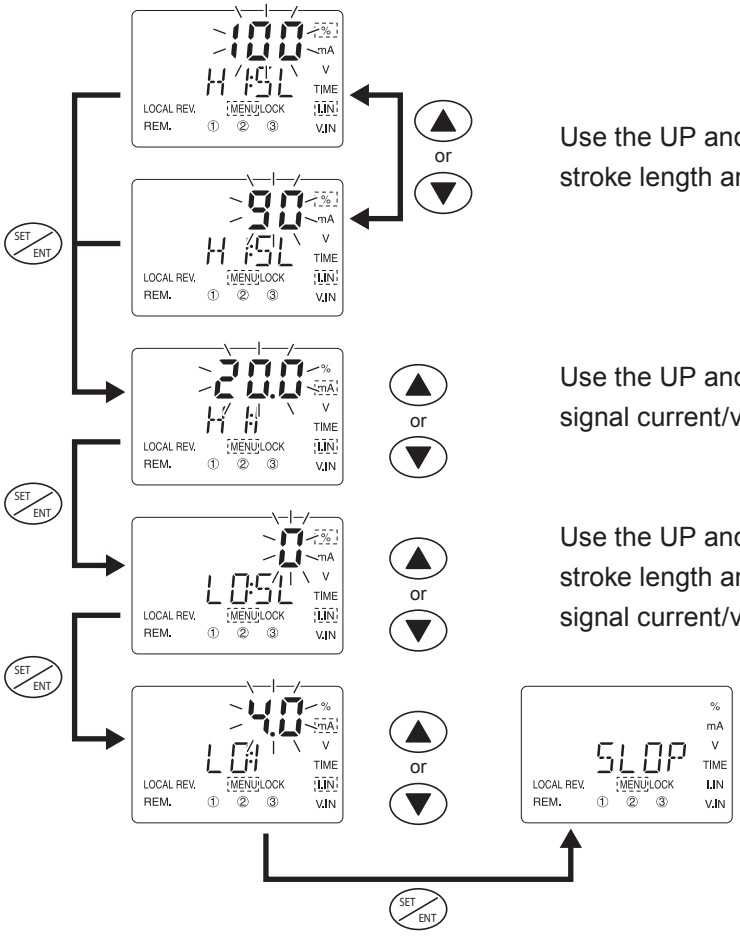
Setting for two-value separate control

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")

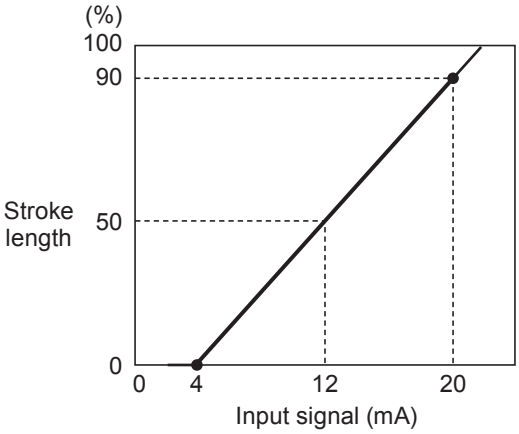
Set the maximum (or minimum) stroke length "HI:SL" (or "LO:SL") and the maximum (or minimum) signal current/voltage (user controller) to "HI:I" (or "LO:I") in order to determine the optimal proportional control line. Note the "HI:SL" and "HI:I" must be higher then "LO:SL" and "LO:I".



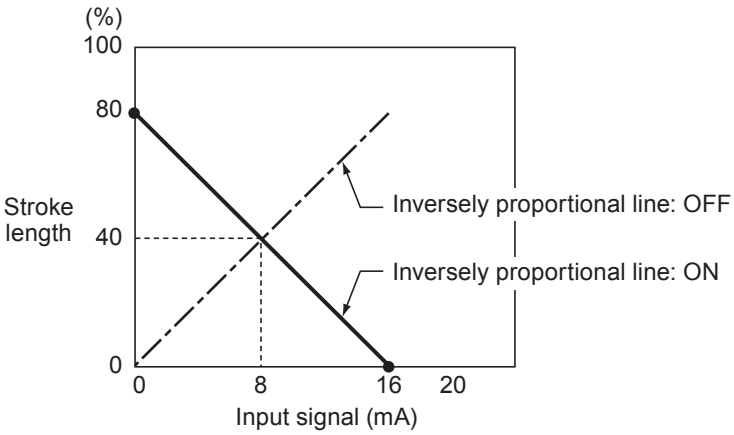
Use the UP and DOWN keys to determine the maximum stroke length and push the SET/ENT key,

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.



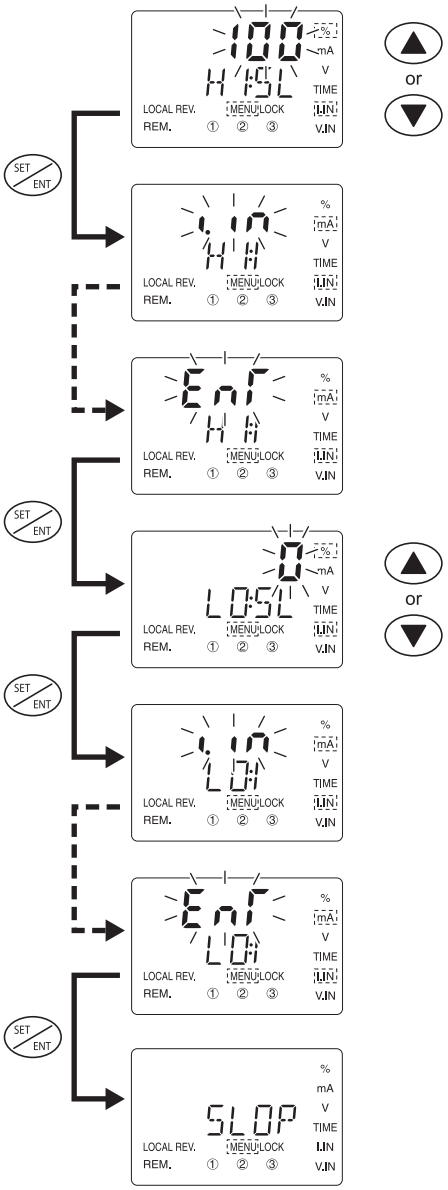
The left graph is in the following patterns.
HI-SL: 90
HI-I: 20
LO-SL: 0
LO-I: 4
Inversely proportional line: OFF



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 ST 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,

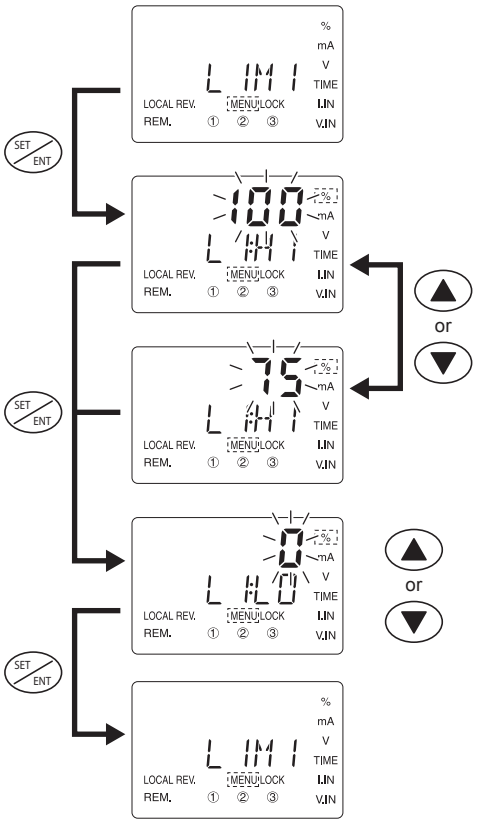
Send a signal current/voltage from user controller to "LO:I". The ST automatically stores value if it is 1mA or more. Otherwise, push the SET/ENT key.

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.



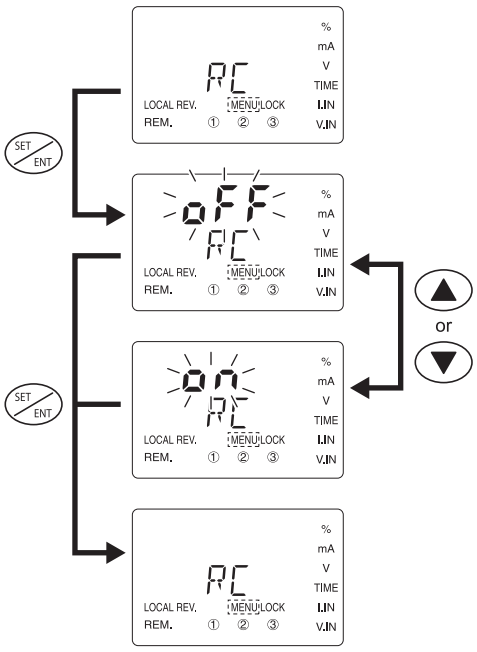
Select "LIMI" and push the SET/ENT key.

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.

■ 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 38 for setting procedure.

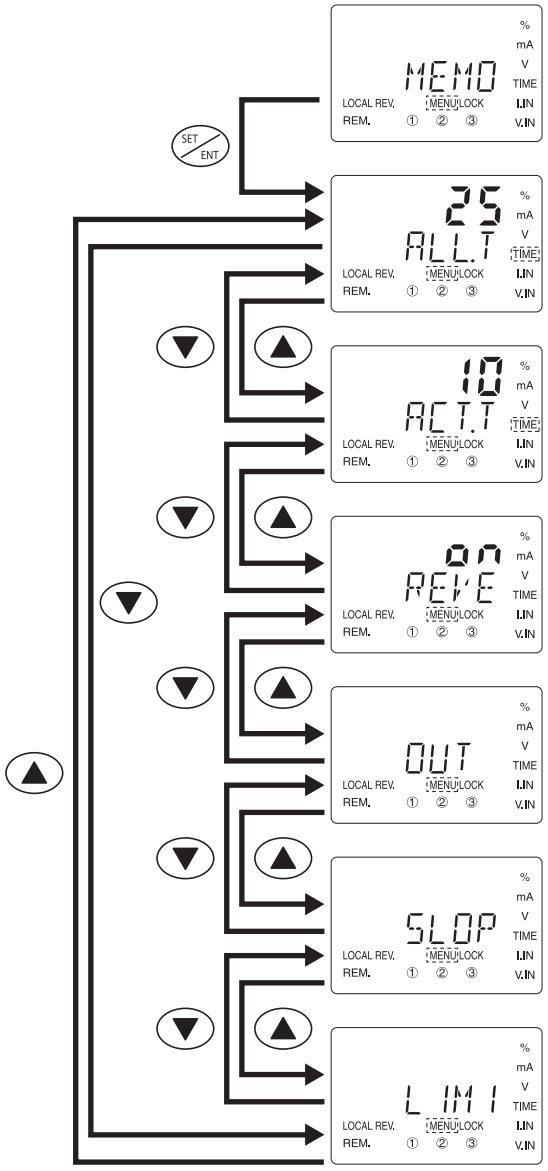


Select "RC" and push the SET/ENT key.

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 ST setter can shows operating history such as total power connection days from being shipped (ALL.T) or last defaulted (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 control signal.



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

Total power connection days (ALL.T)

Total power connection days (ACT.T)

Inversely proportional line selection

Control output (AX mechanically-driven diaphragm pumps)
Push the SET/ENT key and then the UP and DOWN keys to cycle through the previous settings. Push the MENU key to return.

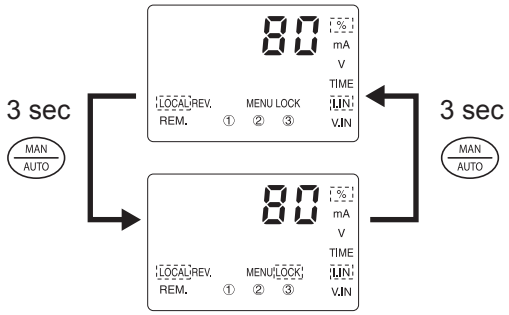
Proportional band/Current-Stroke
Push the SET/ENT key and then the UP and DOWN keys to cycle through the previous settings. Push the MENU key to return.

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.

Other settings

■ Keypad lock

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

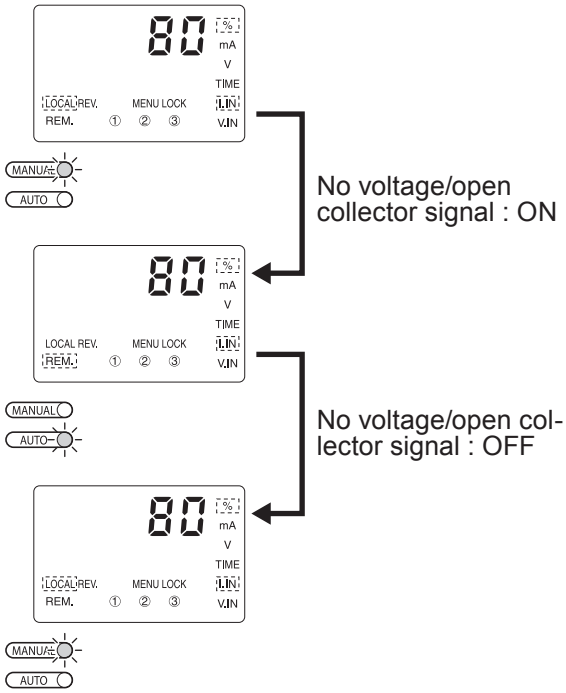


Push the MAN/AUTO key for 3 seconds.
Any keypad operation becomes ineffective as "LOCK" indication is highlighted. Push the MAN/AUTO key for 3 seconds to deactivate keypad lock.

■ Remote control

Input of a no-voltage contact signal or open collector signal via terminal pin 8(plus) and 9(minus) turns the ST setter into the remote control (AUTO mode with keypads locked). The ST setter 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 ST setter enters AUTO mode and any keypad operation becomes ineffective as "REM" indication is highlighted.

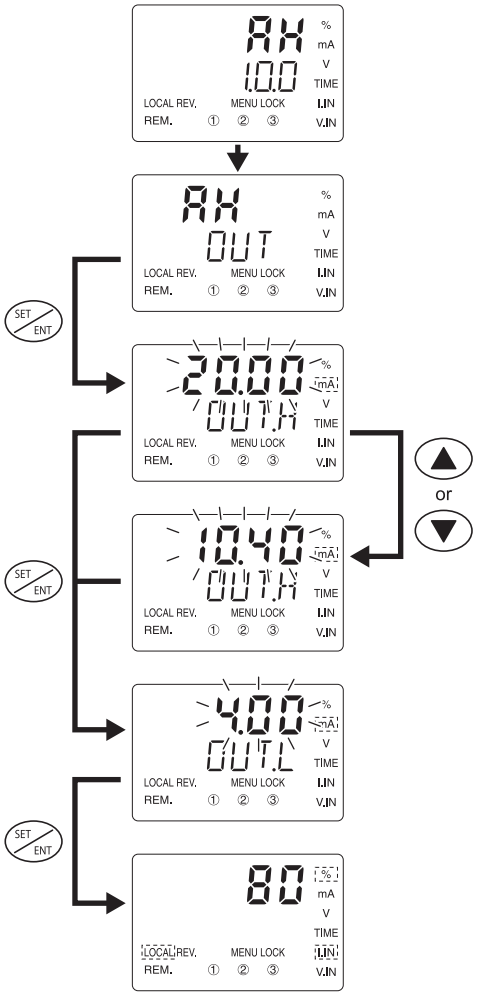
Stop inputting the signal to return to the Local control. The ST setter enters MAN mode.

NOTE

If the signal is inputted in a menu mode, the remote control will starts as the ST setter 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.

■ Servo unit control signal setting (AX mechanically-driven diaphragm pump)

The allowable maximum (20mA) and minimum (4mA) current of the control signal, outputted through the terminal pin 15 (plus) and 16 (minus), must be changed depending on AX mechanically-driven diaphragm pumps. See the table below.



Turn on power while pressing and holding both the UP and DOWN keys. Version information will appear. Push the SET/ENT key to move ahead.

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

*Do not change the lower limit of 4mA unnecessarily.

Upper limit at each model (AX mechanically-driven diaphragm pumps)

Model codes	OUT.H	OUT.L
AXA-K (KE) 90	8.0mA	4.0mA
AXA-K (KE) 120	9.3mA	
AXB-K (KE) 150		
AXB-K (KE) 180	10.4mA	

Operation

The ST setter and a servo unit are shipped in factory default setting as shown below. Start operation through the following steps.

	Factory default setting	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%	
SL adjustment/Target SL setting	OFF	
Control output	4-20mADC	P36

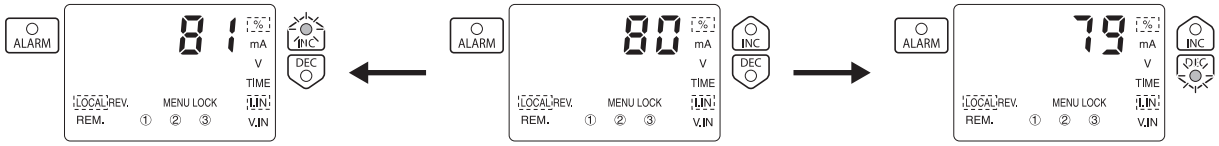
AUTO mode

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

2 Turn on the ST setter.

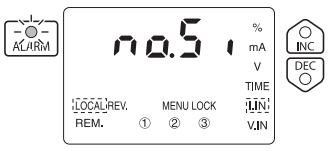
3 Push the "MAN/AUTO" key to start AUTO mode (AUTO LED lights).

4 The ST setter 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 ST setter.

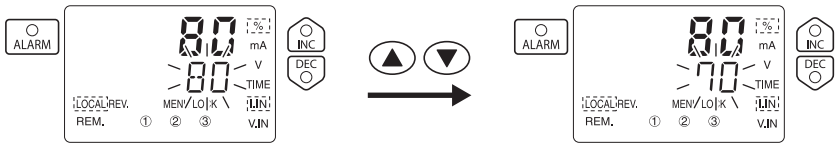
2 Push the "MAN/AUTO" key to start MAN mode (MAN LED lights).

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

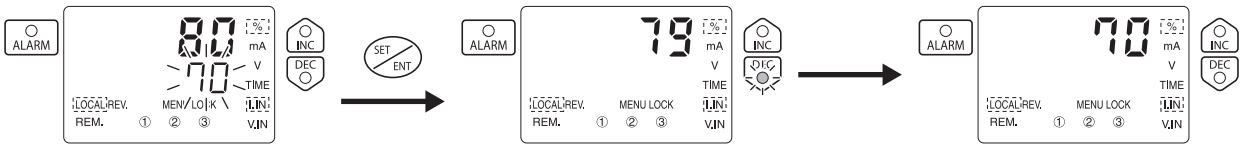
■ Target SL setting

1 Turn the target SL setting effective.
See page 33 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 ST setter starts working to meet the target length. The target length disappears as the setter starts adjustment. The adjustment stops as the target length is met.



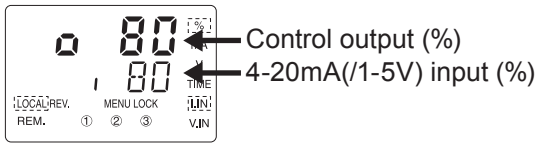
Operating conditions (Setting confirmation)

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

■ 4-20mA(/1-5V) input/ Control output

1 Push the UP and SET/ENTER keys.

The ST setter converts the 4-20mA(/1-5V) input via the terminal pin 17(plus) & 18(minus) and the control 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.

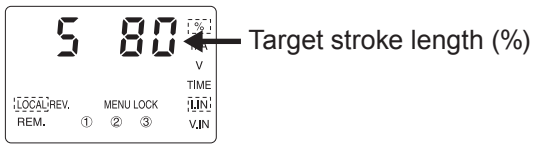


Control output (%)
4-20mA(/1-5V) input (%)

■ Target stroke length

1 Push the DOWN and SET/ENTER keys.

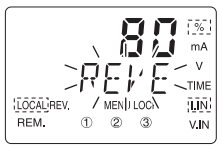
The screen shows the target stroke length. The information appears only while both the keys are pressed and held.



Target stroke length (%)

■ Parameter setting (AUTO mode)

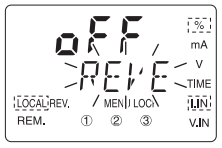
1 In AUTO mode, push the UP and DOWN keys



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.



Default setting

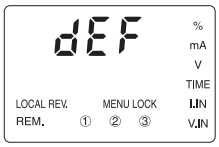
Default the ST setter as necessary through the following procedure below.

1 Turn off power.

2 Turn on power while pressing the MENU key.

Press and hold the key until the ST is defaulted with the display below.

*The ST setter automatically returns to MAN mode after defaulted.



3 Set each parameters as necessary.

NOTE

Program the proportional line before resuming two-value separate control (See page 28 for detail.), or perform the servo unit control signal setting before using the AX mechanically-driven diaphragm pumps (See page 36 for detail.).

Default setting

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%
Servo unit control signal (AX mechanically driven diaphragm pumps)	OUT.H: 20.00mA OUT.L: 4.00mA
SL adjustment/Target SL setting	OFF

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 18.
Stroke length indication on the ST does not change.	Electric servo unit is not powered.	• Supply the rated power voltage.
	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 18.
Stroke length control is upset.	The signal current (or voltage) from a user controller to the ST 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 ST is not set for receiving the signal current (or voltage).	• Select the signal current or signal voltage mode, whichever is proper. See next page.
Stroke length control occasionally becomes upset.	The ST is affected by noise through signal lines.	• Keep the ST away from the devices which may generate noise. • Use an earth wire, shield wire or isolator as necessary. See page 20.

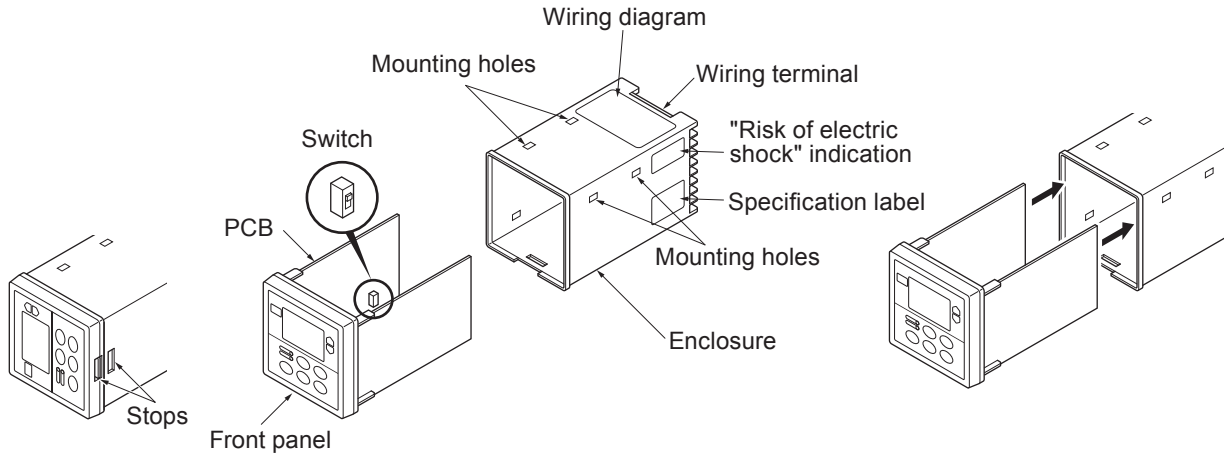
Error messages

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 ST 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.

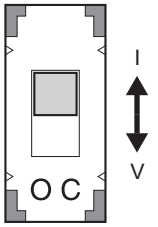


NOTE

Check that power voltage is turned off. The ST setter 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 setting.



NOTE

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

Specifications/Outer dimensions

Specifications

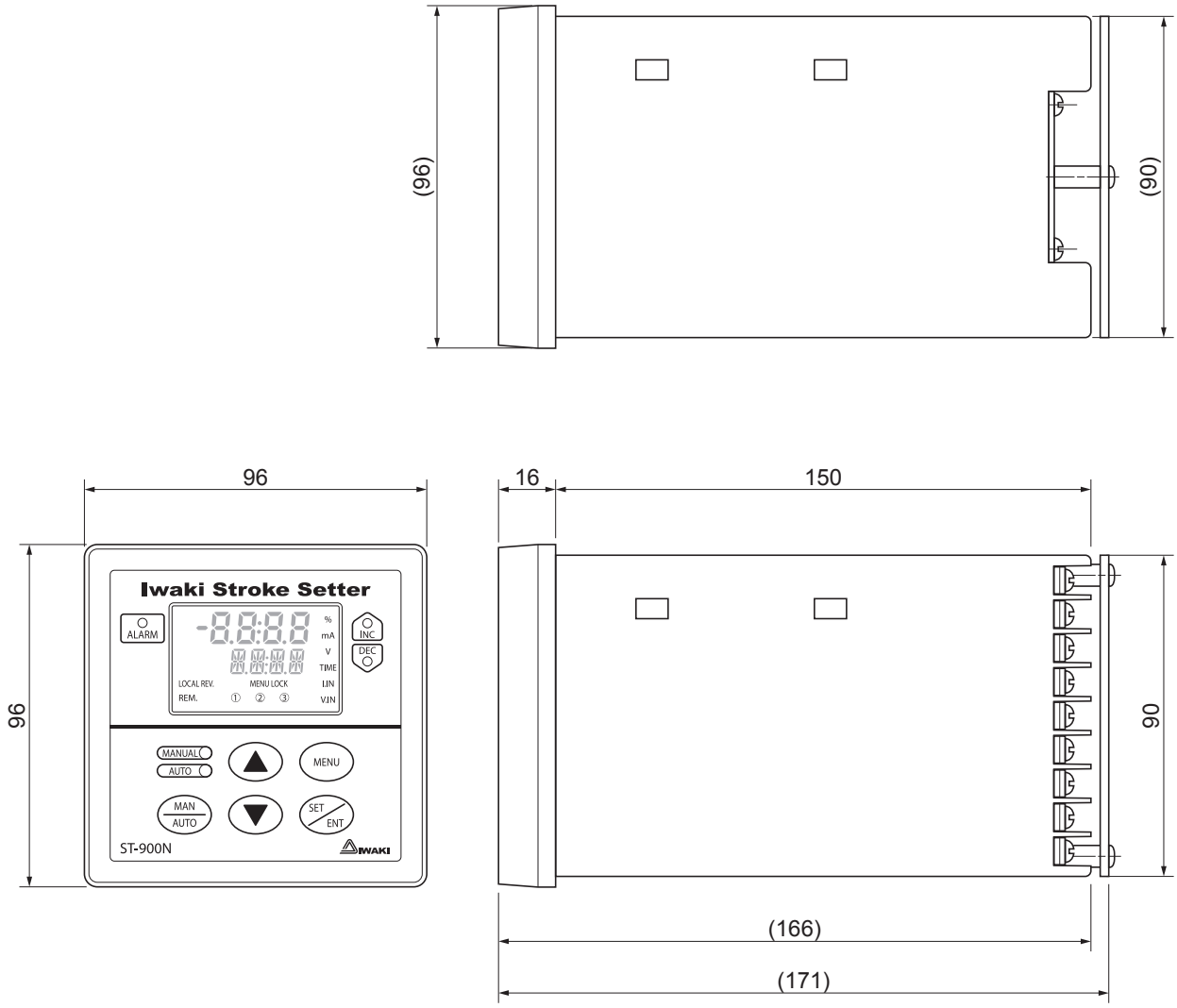
Information in this section is subject to change without notice.

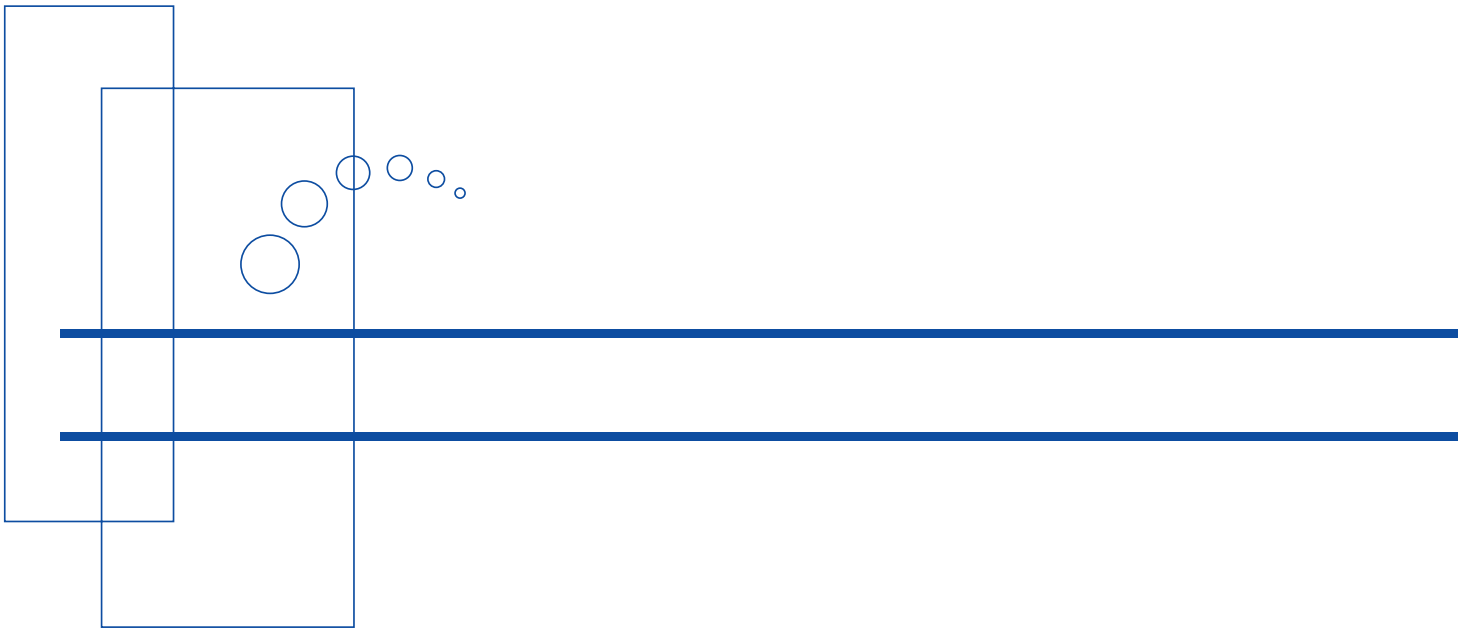
Operation modes	Manual	SL adjustment	Adjustment with the UP and DOWN keys
		Target SL setting	Setting with the UP/DOWN and SET/ENT keys
	AUTO	AUTO operation	Proportional control to 4-20mA or 1-5V from a user controller
Monitors	LCD	4×2 7/14seg backlit LCD	
		Operating conditions and units	
	LED	MANUAL	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
	AXOUT		Servo unit control signal setting (AX mechanically-driven diaphragm pump)
Control functions	REVE		Inversely proportional line selection
	SLOP		Proportional band change/Current-Stroke setting
	LIMI		Upper/Lower limit 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 defaulted (ACT.T), previous settings (an inversely proportional line, a proportional band, upper/lower limits and a control signal)
Input	User controller		4-20mA with 75Ω 1-5VDC with 218Ω
	Feedback signal		4-20mADC
	Remote control		No voltage contact or Open collector
Output	Servo motor control		4-20mADC NOTE: Allowable maximum load resistance is 600Ω.
Power consumption	23VA		
Power supply	100-240VAC 50/60Hz		
Accessories	Mounting hardware		

*The above data is based on the following conditions:

Power supply: 100-240VAC
Ambient temperature: 0-50°C
Ambient humidity: 30-85%RH (non freezing/condensing)
Allowable voltage fluctuation range: ±10% of the rated power supply
Storage temperature: -10 - 60°C
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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( )Country codes

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