1/32 DIN Digital Panel Meter
K3GN

Compact and Intelligent Digital Panel Meter

- A single Panel Meter covering a wide range of applications.
  3 main applicable functions:
  - Process meter (DC voltage/current input).
  - RPM processor/tachometer (frequency input).
  - Digital data display for PC/PLC (RS-485 communications).
- Easy configuration
  - Multi-range analog input: applicable for all standard analog signals.
    6 input ranges available: 4 to 20 mA/0 to 20 mA, 1 to 5 VDC/ 0 to 5 VDC, ±5 VDC, ±10 VDC.
  - 5 KHz max. input-pulse frequency range.
  - Scaling in a wide range of engineering units.
  - Programmable output operation action, decimal point position setting, teaching function for input range, leading zero suppression, average processing.
- Advanced and compact design
  - Very compact 1/32 DIN housing: 48 (W) x 24 (H) x 83 (D).
  - 5-digit display with programmable display color in red or green.
  - Good visibility: High contrast backlit LCD display.
  - High protection against water and dust: NEMA4X/IP66 front panel.
- Selectable outputs: 2 relay outputs, 3 transistor outputs, RS-485, and combinations of these.
- High accuracy: ±0.1% full scale.
- Easy to configure through the front panel or via RS-485.
- EN/IEC conformity with CE marking and UL/CSA approval.

Model Number Structure

■ Model Number Legend

K3GN - □ □ - □ 24 VDC
1 2 3

1. Input Type
ND: DC voltage/current, NPN
PD: DC voltage/current, PNP
2. Output Type
C: 2 relay contact outputs (SPST-NO)
T1: 3 transistor outputs (NPN open collector)
T2: 3 transistor outputs (PNP open collector)
3. Communications Output Type
None: Communications not supported
FLK: RS-485

Ordering Information

■ List of Models

Input type	Supply voltage	Output	Communications	
			No communications	RS-485
DC voltage/current, NPN	24 VDC	Dual relays (SPST-NO)	K3GN-NDC 24 VDC	K3GN-NDC-FLK 24 VDC
		Three NPN open collector	K3GN-NDT1 24 VDC	K3GN-NDT1-FLK 24 VDC
DC voltage/current, PNP		Dual relays (SPST-NO)	K3GN-PDC 24 VDC	K3GN-PDC-FLK 24 VDC
		Three PNP open collector	K3GN-PDT2 24 VDC	K3GN-PDT2-FLK 24 VDC

Specifications

■ Ratings

Supply voltage	24 VDC
Operating voltage range	85% to 110% of the rated supply voltage
Power consumption (see note)	2.5 W max. (at max. DC load with all indicators lit)
Insulation resistance	20 MΩ min. (at 500 VDC) between external terminal and case. Insulation provided between inputs, outputs, and power supply.
Dielectric strength	1,000 VAC for 1 min between external terminal and case. Insulation provided between inputs, outputs, and power supply.
Noise immunity	±480 V on power supply terminals in normal mode, ±1,500 V in common mode, ±1 μs, or 100 ns for square-wave noise with 1 ns
Vibration resistance	Malfunction: 10 to 55 Hz, 10 min each in X, Y, and Z directions; acceleration: 9.8 m/s^2 Destruction: 10 to 55 Hz, 30 min each in X, Y, and Z directions; acceleration: 19.6 m/s^2
Shock resistance	Malfunction: Models with transistor outputs: 196 m/s^2 for 3 times each in X, Y, and Z directions Models with relay contact outputs: 98 m/s^2 for 3 times each in X, Y, and Z directions Destruction: 294 m/s^2 for 3 times each in X, Y, and Z directions
Ambient temperature	Operating: −10°C to 55°C (with no condensation or icing) Storage: −25°C to 65°C (with no condensation or icing)
Ambient humidity	Operating: 25% to 85% (with no condensation)
EMC	(EMI) EN61326+A1 Industry Emission Enclosure: CISPR 11 Group 1 class A: CISRP16-1/-2 Emission AC Mains: CISPR 11 Group 1 class A: CISRP16-1/-2 (EMS) EN61326+A1 Industry Immunity ESD: EN61000-4-2: 4 kV contact discharge (level 2), 8 kV air discharge (level 3) Immunity RF-interference: EN61000-4-3: 10 V/m (amplitude-modulated, 80 MHz to 1 GHz) (level 3) Immunity Fast Transient Noise: EN61000-4-4: 2 kV (power line) (level 3) Immunity Burst Noise: 1 kV line to line (I/O signal line) Immunity Surge: EN61000-4-5: 1 kV line to line, 2 kV line to ground (power line) Immunity Conducted Disturbance EN61000-4-6: 3 V (0.15 to 80 MHz) (level 2) Immunity Voltage Dip/Interrupting EN61000-4-11: 0.5 cycles, 0, 180°, 100% (rated voltage)
Approved standards	UL508, CSA22.2; Conforms to EN61326+A1, EN61010-1 (IEC61010-1) Conforms to VDE0106/P100 (finger protection) when the terminal cover is mounted.
Weight	Approx. 100 g

Note: A control power supply capacity greater than the rated capacity is required when the Digital Panel Meter is turned ON. Do not forget to take this into consideration when using several Digital Panel Meters. When power is supplied, all indicators will light and outputs will be OFF. When using startup compensation time operation, the display will read "□□□□□" and all outputs will be OFF.

■ Characteristics

Input signal	Process voltage (1 to 5 V, 0 to 5 V, ±5V, ±10 V) Process current (4 to 20 mA, 0 to 20 mA)	No-voltage contact (30 Hz max. with ON/OFF pulse width of 16 ms min.) Open collector (5 kHz max. with ON/OFF pulse width of 90 μs min.)	Digital data display (by RS-485 communication)
A/D conversion	Double integral method 14 bit resolution	---	
Sampling period	250 ms	---	
Display refresh period	Sampling period (sampling times multiplied by number of averaging times if average processing is selected.)		
Pulse measurement method	---	Periodic measurement	---
Connectable Sensors	---	ON residual voltage: 2.5 V max. OFF leakage current: 0.1 mA max. Load current: Must have a switching capacity of 15 mA min. Must be able to reliably switch load currents of 5 mA max.	
Max. displayed digits	5 digits (–19999 to 99999)		
Display	7-segment digital display, character height: 7.0 mm		
Polarity display	"–" is displayed automatically with a negative input signal.		
Zero display	Leading zeros are not displayed.		
Scaling function	Programmable with front-panel key inputs (range of display: –19999 to 99999). The decimal point position can be set as desired.		
External controls (see note 1)	HOLD: (Measurement value held) ZERO: (Forced-zero)	---	
Hysteresis setting	Programmable with front-panel key inputs (0001 to 9999).		
Other functions	Programmable Color Display Selectable output operating action Teaching set values Average processing (simple average) Lockout configuration Communications writing control (communications output models only)		
	Forced-zero set with front panel keys Control inputs (HOLD/ZERO) selection via front panel keys Field calibration	Startup compensation time (0.00 to 99.9 s) Auto-zero time (0.0 to 19.9 s)	
Output	Relays: 2 SPST-NO Transistors: 3 NPN open collector 3 PNP open collector		
	Combinations: Communications output (RS-485) + relay outputs (2 SPST-NO); Communications output (RS-485) + transistor outputs (3 NPN open collector); Communications output (RS-485) + transistor outputs (3 PNP open collector)		
Communications	Communications function: RS-485		
Delay in comparative outputs (transistor outputs)	750 ms max.		
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66) Rear case: IEC standard IP20 Terminals: IEC standard IP20		
Memory protection	Non-volatile memory (EEPROM) (possible to rewrite 100,000 times)		

Note 1. The minimum input time for control signals is 80 ms.

2. Refer to *N102 Operation Manual* for more details.

■ Measuring Ranges

Process Voltage/Current Inputs

Input	Measuring range	Measuring accuracy	Input impedance	Displayable range
DC voltage	1.000 to 5.000 V/ 0.000 to 5.000 V	±0.1% FS ±1 digit max. (at 23±3°C)	1 MΩ min.	–19999 to 99999 (with scaling function)
	–5.000 to 5.000 V	±0.1% FS ±1 digit max. (at 23±5°C)		
	–10.00 to 10.00 V			
DC current	4.00 to 20.00 mA/ 0.00 to 20.00 mA	±0.1% FS ±1 digit max. (at 23±3°C)	60 Ω	

No-voltage Contact/Open Collector Inputs

Input	Measuring range	Measuring accuracy (at 23±5°C)	Displayable range
No-voltage contact (30 Hz max.) with ON/OFF pulse width of 16 ms min.	0.05 to 30.00 HZ	±0.1% FS ±1 digit max.	–19999 to 99999 (with scaling function)
Open collector (5 kHz max.) with ON/OFF pulse width of 90μs min.	0 to 5000 HZ		

Digital Data Display (By RS-485 Communications)

Displayable range	–19999 to 99999

■ Input/Output Ratings

Relay Contact Output

(Incorporating G6K Relays)

Item	Resistive load (cosϕ = 1)
Rated load	1 A at 30 VDC
Rated carry current	1 A max. (at COM terminal)
Max. contact voltage	60 VDC
Max. contact current	1 A (at COM terminal)
Max. switching capacity	30 VA
Min. permissible load (P level, reference value)	10 mV, 10 μA
Mechanical life	50,000,000 times min. (at a switching frequency of 36,000 times/hr)
Electrical life (at an ambient temperature of 23°C)	100,000 times min. (at the rated load with a switching frequency of 1,800 times/hr)

Transistor Output

Rated load voltage	24 VDC
Max. load current	50 mA
Leakage current	100 μA max.

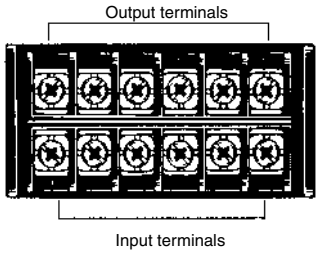
■ Communications Specifications

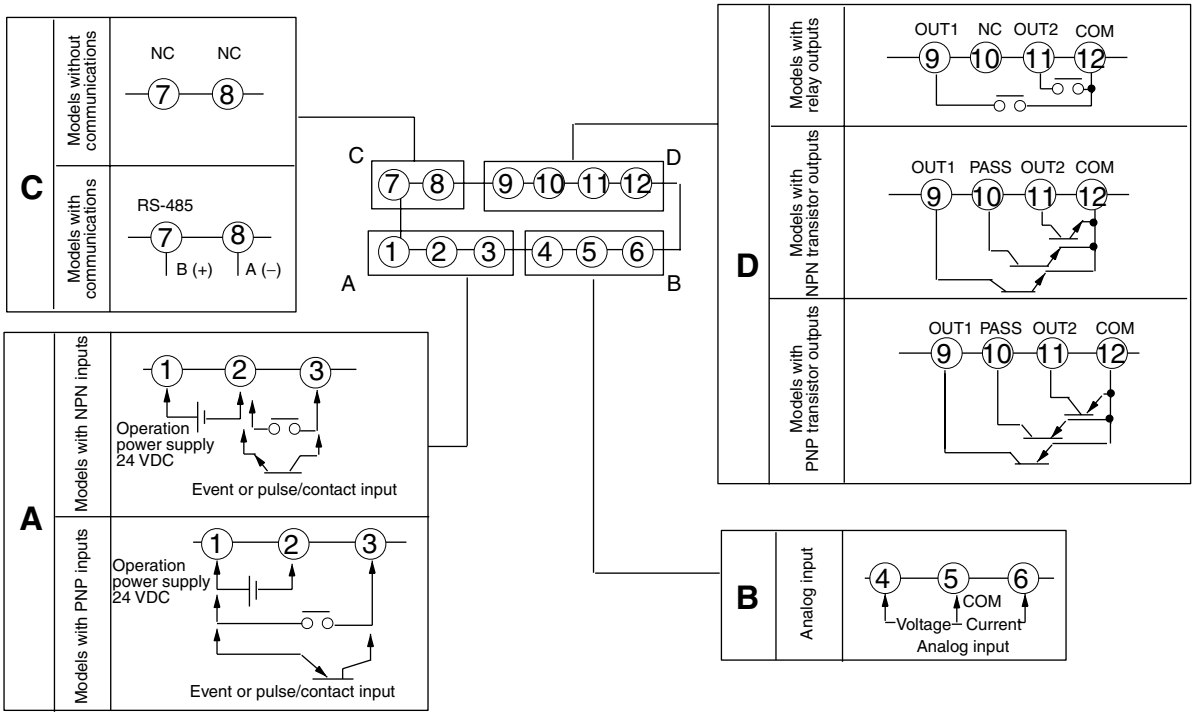
Item		RS-485
Transmission method		2-wire, half-duplex
Synchronization method		Start-stop synchronization
Baud rate		1,200/2,400/4,800/9,600/19,200 bps
Transmission code		ASCII
Communications	**Reading/Writing to the K3GN**	Read/write set values, read/write scaling values, enable/disable the writing of data through communications, forced-zero control, and other data.

Refer to *N102 Operation Manual* for more details.

Connections

■ Terminal Arrangement

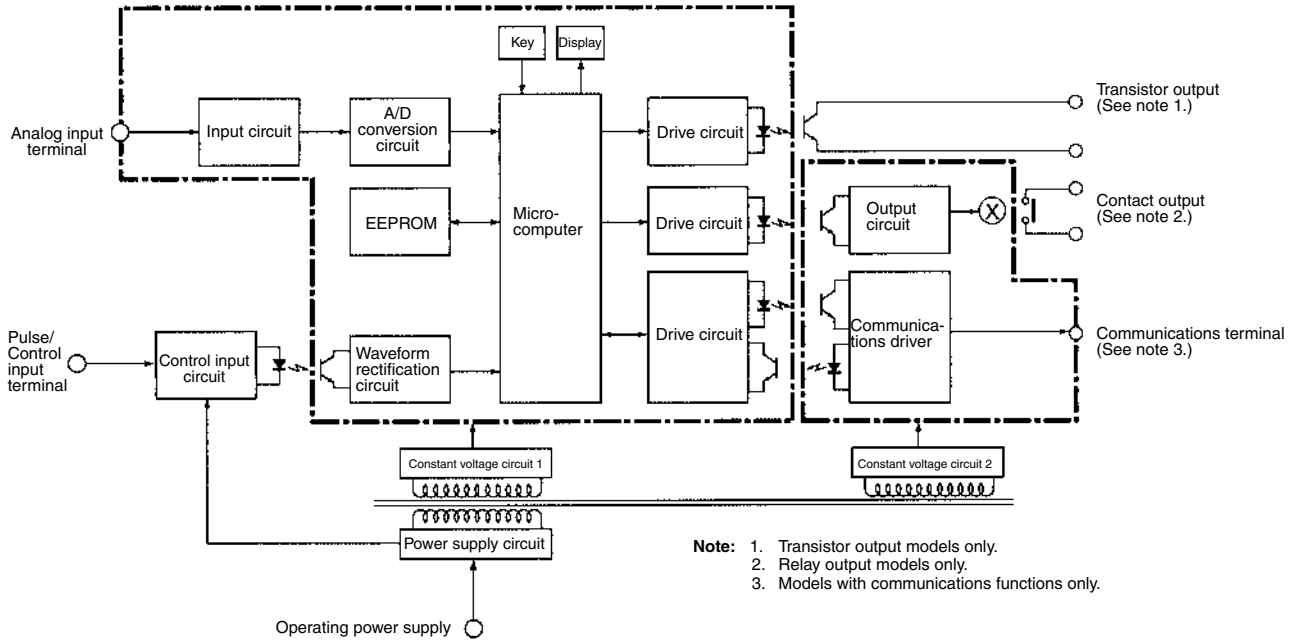




Terminal No.	Name	Description
①-②	Operation power	Connect the operation power supply.
③-②	Event input or pulse/contact input	Operates as follows depending on parameter setting: • Holds process value. • Calibrate the process value to zero and clear the forced-zero function. • Pulse or contact input.
③-①		
④,⑥-⑤	Analog input	Connect the voltage or current analog input.
⑦-⑧	Communications	RS-485 communications terminals.
⑨,⑪-⑫	Outputs	Outputs relay or transistor outputs. There is also a PASS output for models with transistor outputs.
⑨,⑩,⑪-⑫		

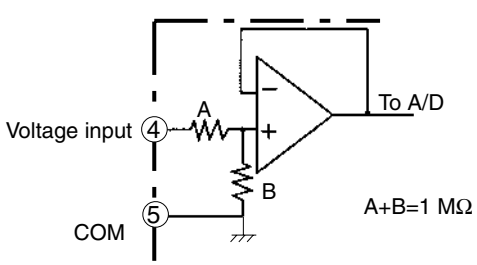
■ Wiring

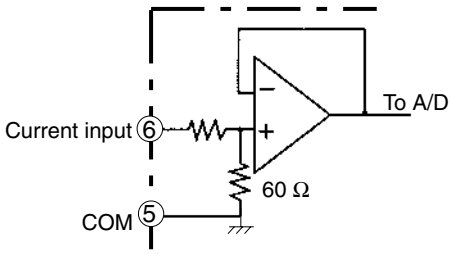
Block Diagram



Input Circuits

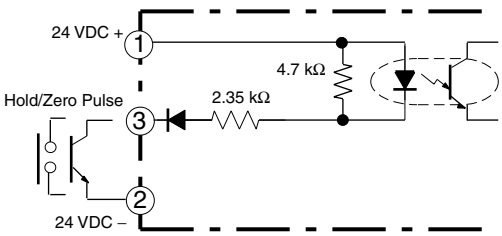
Analog Input (DC Voltage/Current)



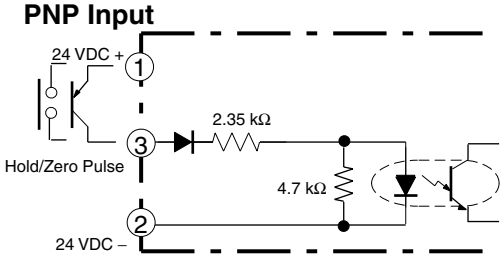


Pulse Input/Control Event Input (HOLD/ZERO)

NPN Input

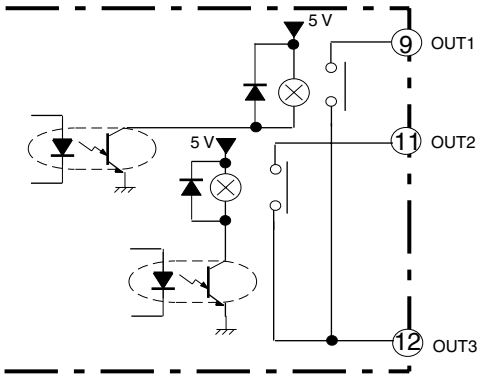


PNP Input



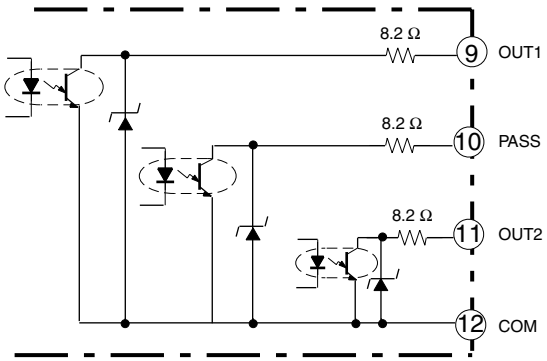
Output Circuits

Contact Output

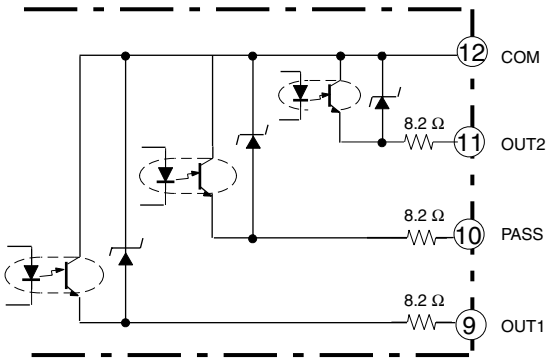


Transistor Output

NPN Output



PNP Output



Operation

■ Main Functions

Input Types and Ranges

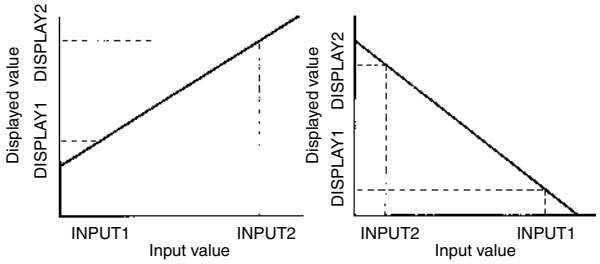
Input type (setting parameter)	Function	Input range (setting parameters)	Setting range
Analog input (*AnALG*)	Selects DC voltage/current signal input.	4 to 20 mA/0 to 20 mA (*4-20*)	Displayable from –19999 to 99999 with scaling function. The position of the decimal point can be set as desired.
		1 to 5 V/0 to 5 V (*1-5*)	
		±5 V (*5*)	
		±10 V (*10*)	
Pulse input (*PULSE*)	Selects pulse input signal.	0.05 to 30 Hz (*30*)	
		0 to 5 kHz (*5K*)	
Remote (*rmt*)	Displays digital data from PLC or PC.	---	

Scaling

Analog (Process) Inputs

The K3GN converts input signals into desired physical values.

INPUT2: Any input value
DISPLAY2: Displayed value corresponding to INPUT2
INPUT1: Any input value
DISPLAY1: Displayed value corresponding to INPUT1



Pulse Frequency

The K3GN converts pulse signal inputs into desired units such as revolutions or rotational speeds.

The slope of the linear relationship between the input value and display value is calculated automatically when an input value and its corresponding display value are entered.

Input value: Any arbitrary input value
Display value: Desired display value corresponding to input value

If scaling for pulse signals is not performed, the input frequency will be displayed.

The relationship between input, f, and display, D, is expressed in the form D = f × *a* (multiplication factor). The value of *a* will vary according to the display unit. For example, if the display unit is rpm, Y is given by the following:

D = f × 1/N × 60 (i.e., *a* = 1/N × 60)

where N is the number of pulses per revolution and f is the input pulse frequency (Hz).
If the display unit is m/min, Y is given by the following:

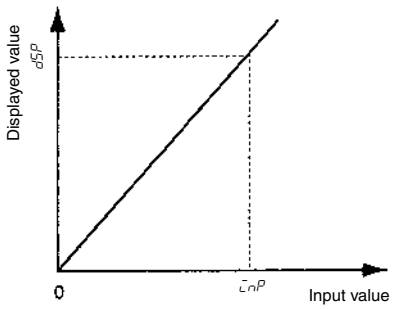
D = f × πd × 1/N × 60 (i.e., *a* = πd × 1/N × 60)

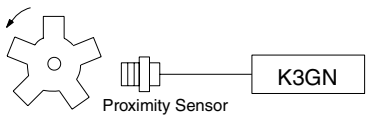
where πd = the wavelength (m) per revolution.

Example: When displaying the rotational speed (rpm) for a machine that generates 5 pulse signals per revolution, D is given by the following:

D = f × 1/5 × 60,

so if f = 1, then D = 12. Therefore, input 1 for *InP* and 12 for *dSP*.





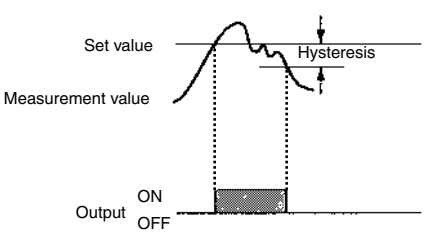
Average Processing

The average processing function stabilizes displayed values by averaging the corresponding input signals that fluctuate dynamically.

Hysteresis

The hysteresis of comparative outputs can be set to prevent the chattering of relay or transistor outputs.

Upper limit (high acting)



Startup Compensation Time (Pulse Input Only)

The startup compensation time parameter keeps the measurement operation from sending an unnecessary output corresponding to instantaneous, fluctuating input from the moment the K3GN is turned ON until the end of the preset period.

The compensation time can be set in a range from 0.0 to 99.9 seconds as the waiting time until the devices subject to measurement become stable after the startup of the power supply.

Changing the Display Color

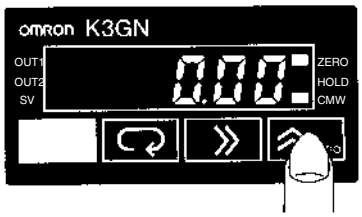
The display can be programmed to change color when an output turns ON. In an example, the K3GN can be programmed to display Green for normal, and Red for errors. The color can be set to change from either green to red or red to green when output turns ON.
K3GN can also be programmed to display only one unchanging color: Red or Green.

Teaching

An actual measured value as a set value without any front panel key input can be set with the teaching function. Teaching is useful for making settings while checking the operation status of K3GN.

Forced-zero Function

It is possible to shift the zero point to a desired value (such as might be required when adjusting reference values) with one touch of the Up/Zero Key on the front panel.



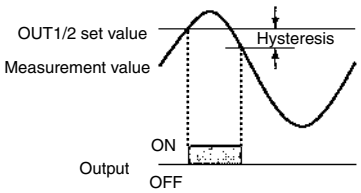
Configurable Output Operating Action

Output 1 and output 2 can be set to operate in one of the 3 following modes:

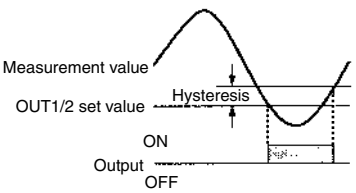
- Upper limit (High Acting):
  The output is turned ON when the measured value is greater than its set value.
- Lower limit (Low Acting):
  The output is turned ON when the measured value is less than its set value.
- Upper and lower limits (Outside band Acting):
  An upper limit (H set value) and lower limit (L set value) can be set independently.
  The output is turned ON when the measured value is greater than upper-limit set value or less than the lower-limit set value.

Only transistor outputs have a PASS output which is output when both OUT1 and OUT2 are OFF.

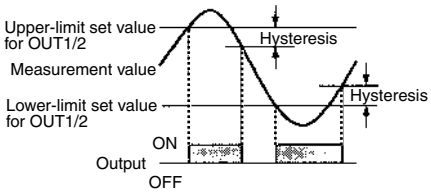
Upper Limit (High Acting)



Lower Limit (Low Acting)

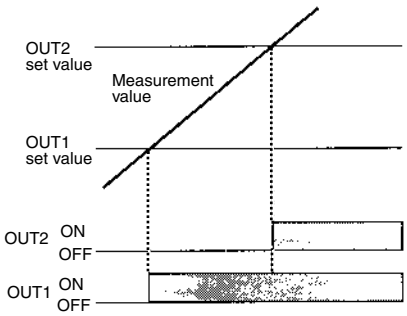


Upper and Lower Limits (Outside Band Acting)

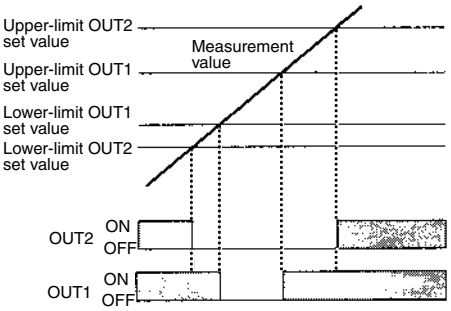


The three types of output operations shown above can be combined as desired. The following are examples of possible combinations.

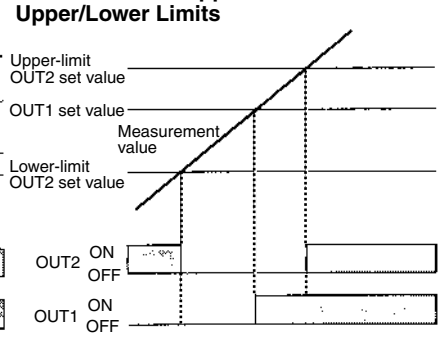
Upper Limit 2-stage Output



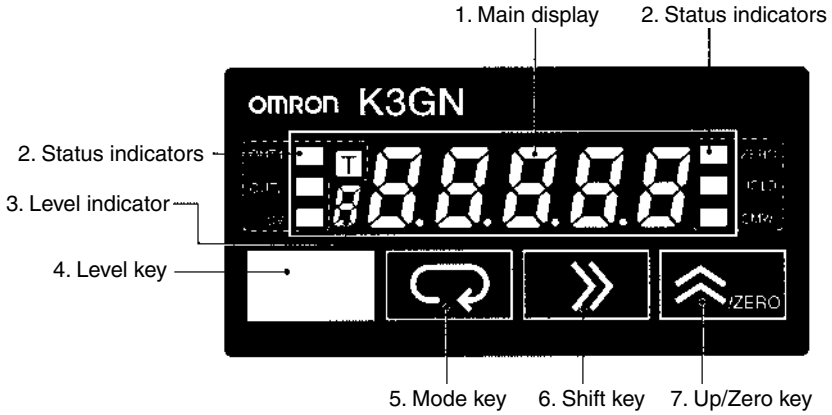
Threshold Output



Combination of Upper Limit and Upper/Lower Limits



Nomenclature

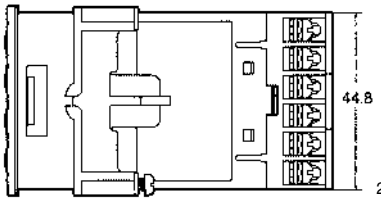


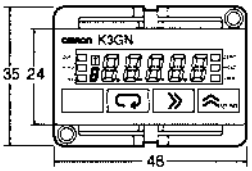
Name		Functions
1. Main display		Displays process values, parameters, and set values.
2. Status indicators	**OUT1**	Lit when output 1 is ON.
	OUT2	Lit when output 2 is ON.
	SV	Lit when a set value is being displayed or changed.
	T	Lit when the teaching function is enabled. Flashes when the K3GN is in teaching operation. Lit when a calibration value is being displayed during user calibration. Flashes while reading a calibration value.
	ZERO	Lit while the forced-zero function is activated.
	HOLD	Lit when HOLD input is ON.
	CMW	Lit when communications writing is “enabled” and is out when it is “disabled.”
3. Level indicator		Displays the current level that the K3GN is in. (See below for details.)
4. Level Key		Used to change the level.
5. Mode Key		Used to allow the Main display to indicate parameters sequentially.
6. Shift Key		Used to enable that set value to be changed. When changing a set value, this key is used to move along the digits.
7. Up/Zero Key		Used to change a set value. Used to set or clear a forced-zero function when a measurement value is being displayed.

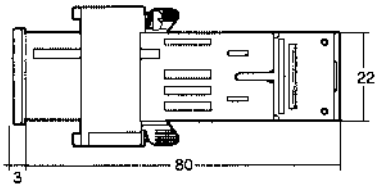
Level indicator	Level
P	Protect
Not lit	Operation
A	Adjustment
S	Initial setting
C	Communications setting
F	Advanced function setting
U	User calibration

Dimensions

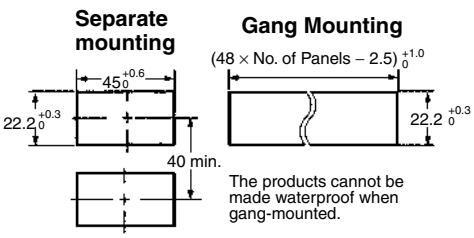
Note: All units are in millimeters unless otherwise indicated.







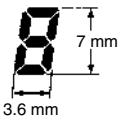
Panel Cutouts



The products cannot be made waterproof when gang-mounted.

The K3GN uses M3 terminals. A terminal cover is provided.

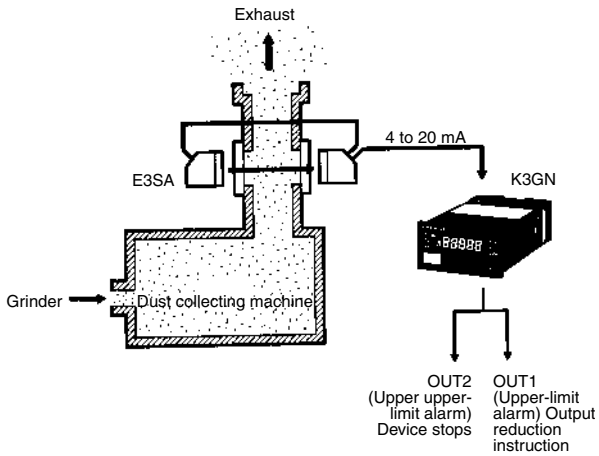
Main Display Character Size



Application Examples

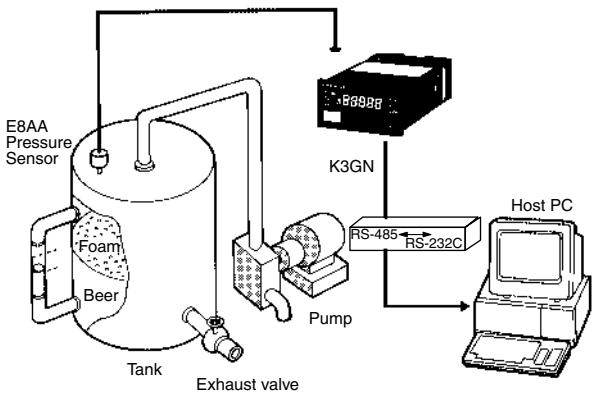
Detection of Dust Exhaust

The change in the density of the dust is detected via the E3SA and discriminated by the K3GN.



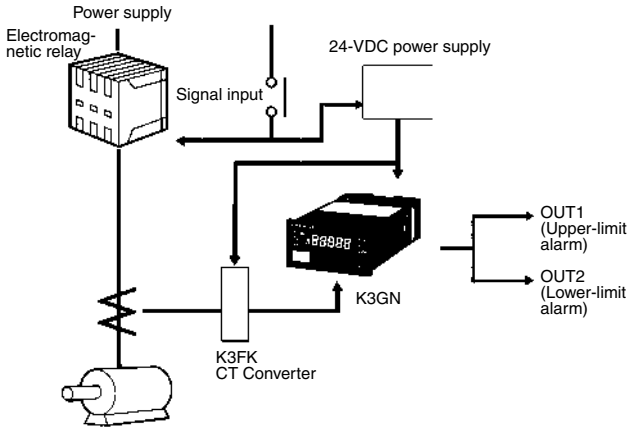
Monitoring of Tank Pressure

The output of the pressure sensor is processed and the pressure is displayed. Remote monitoring of the operation is possible with the communications function.



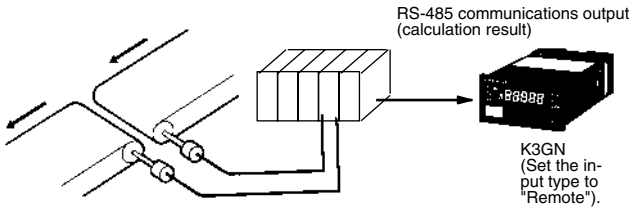
Monitoring of Motor Load Current

If the startup time compensation of the K3GN is enabled, the K3GN will not be influenced by the inrush current from starting the motor, and no signal will be output from the K3GN.



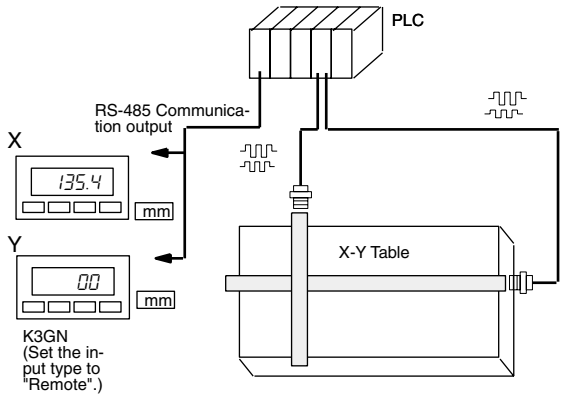
Monitoring Difference between Two Line Speeds

The difference between the two line speeds is calculated by the PLC and the result is written via RS-485 to the K3GN where it is displayed.



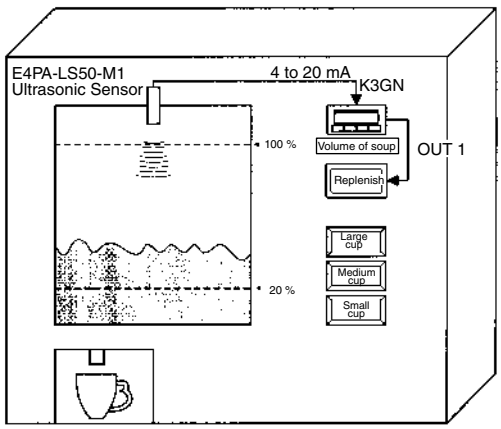
Position Indication on X-Y Table

The position on the X-Y table is calculated by the PLC and the result is written via RS-485 to the K3GN where it is displayed. The scaling function can be used to display the result in millimeter units.

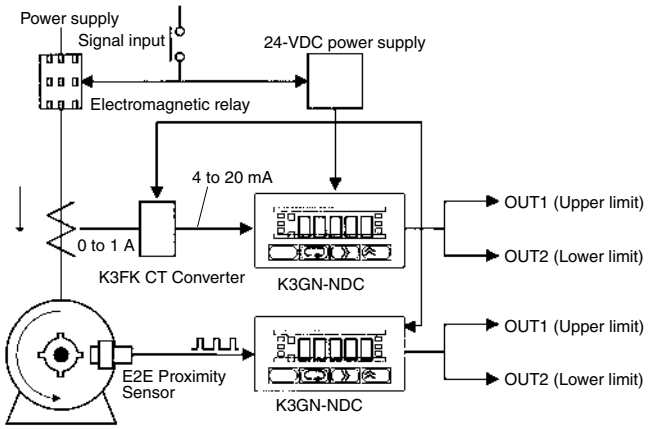


Monitoring the Remaining Quantity of Soup

The distance to the surface of the soup is detected with an ultrasonic sensor and, based on this distance, the K3GN displays the remaining quantity. When the remaining quantity of soup decreases to less than 20%, the K3GN lights the “Replenish” indicator.



Monitoring Number of Motor Revolutions



Precautions

⚠ WARNING

Do not touch any of the terminals while power is being supplied. Doing so may result in electric shock. Also, do not touch the terminals with a screwdriver while power is being supplied. Electrical shock may result via the screwdriver.

⚠ Caution

Do not allow metal objects or conductive wire cuttings to enter the product. Doing so may result in electric shock, fire, or malfunction.

⚠ Caution

Do not attempt to disassemble, repair, or alter the product. Doing so may result in electric shock, fire, or malfunction.

⚠ Caution

Do not use the product where flammable or combustion gasses are present.

⚠ Caution

The lifetime of output relays varies greatly with the switching capacity and conditions. Consider the actual operating conditions, and use the product within the rated load and electrical service life.

⚠ Caution

Do not use loads exceeding the rated value. Doing so may result in damage or burning.

⚠ Caution

Use a power supply voltage within the specified ratings. Not doing so may result in damage or burning.

⚠ Caution

Be sure to tighten the terminal screws securely. The recommended tightening torque is 0.5 N·m. Loose screws may result in product failure or malfunction.

⚠ Caution

Perform correct setting of the product according to the application. Failure to do so may cause unexpected operation, resulting in damage to the unit or injury.

⚠ Caution

This product is not a safety device. Product failure may prevent operation of comparative outputs. Take safety measures, such as installing a separate monitoring system, to ensure safety and to prevent serious accidents caused by such failure, thus ensuring safety.

Observe the following precautions to ensure safety:

1. Do not connect anything to unused terminals.
2. Be sure to check each terminal for correct number and polarity before connection. Incorrect or reverse connection may damage or burn out internal components of the K3GN.
3. Do not use the product in locations subject to the following:
   - Dust or explosive gasses (e.g., sulfide gas or ammonia gas).
   - Condensation or icing as a result of high humidity.
   - Outdoors or in direct sunlight.
   - Splashing liquid or oil atmosphere.
   - Direct radiant heat from heating equipment.
   - Extreme changes in temperature.
4. Do not block heat dissipation around the product, i.e., provide sufficient space for heat dissipation. Do not block the ventilation holes on the back of the product.
5. Do not use paint thinner for cleaning. Use commercially available alcohol.
6. Use a power supply meeting the power supply specifications of the K3GN. Be sure that the rated voltage is achieved within 2 s after turning ON the power.
7. Use the K3GN within the specified temperature and humidity ranges. When installing the K3GN in a panel, be sure that the temperature around the K3GN (not the temperature around the panel) does not exceed 55°C. If the K3GN is subject to radiant heat, be sure that the temperature of the surface of the K3GN exposed to the radiant heat does not exceed 55°C by providing a fan or other heat removal method.
8. Store the K3GN within the specified temperature and humidity ranges.
9. Do not lay heavy objects on the product during use or storage. Doing so may deform or deteriorate the K3GN.
10. Conduct aging for 15 minutes min. after power is ON for correct measurement.

Mounting

Recommended panel thickness is 1 to 5 mm.

Insert the K3GN in the square cutout, insert the adapter from the back, and push the K3GN into the cutout as far as possible. Use screws to secure the K3GN. To make the K3GN waterproof, insert watertight packing in the K3GN.

Install the watertight packing in the proper direction. Note that the packing is direction-sensitive.

When gang-mounting two or more products in a cutout, be sure that the ambient temperature does not exceed the specifications.

Mount the K3GN as horizontally as possible.

Separate the K3GN from machines generating high-frequency noise, such as high-frequency welding machines and high-frequency sewing machines.

Operation

A K3GN model with a relay contact or transistor output may not output any alarm signal normally if the model has an error. It is recommended that an independent alarm device be connected to the model.

The parameters are factory-set so that the K3GN will operate normally. The settings of the parameters may be changed according to the application.

Wiring

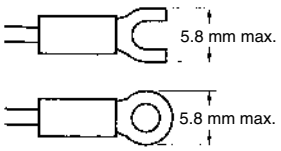
Wire the power supply with the correct polarity. Wiring with incorrect polarity may result in damage or burning.

Wire the terminals using crimp terminals.

Tighten terminal screws to a torque of approx. 0.5 N·m.

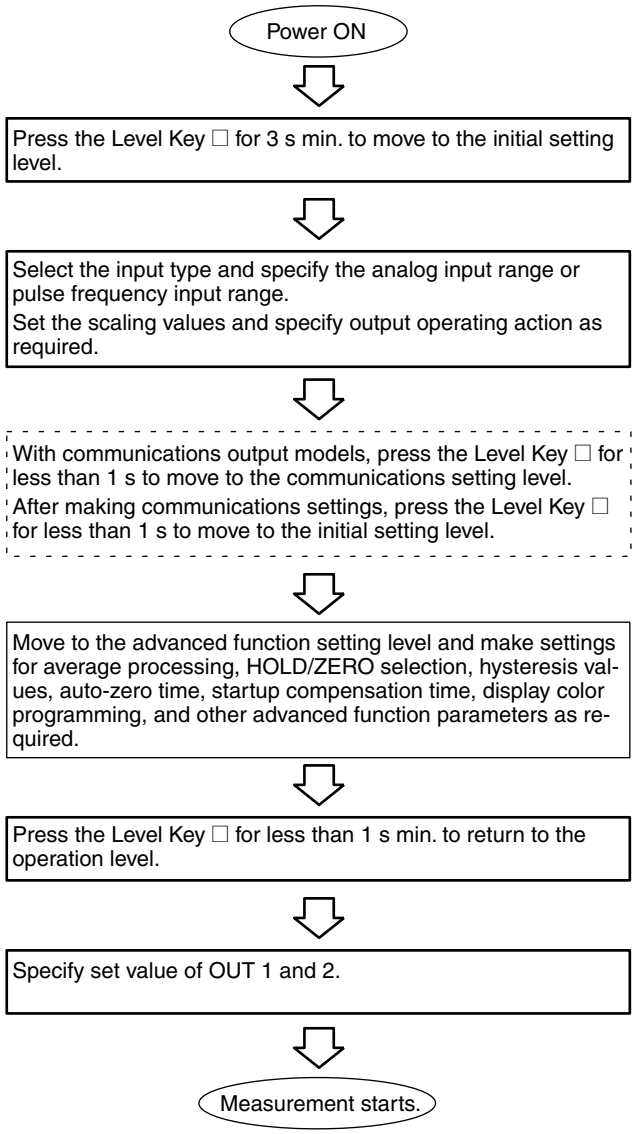
Wire signal lines and power lines separately to reduce the influence of noise.

Use M3 crimp terminals of the type shown below.



Operating Procedures

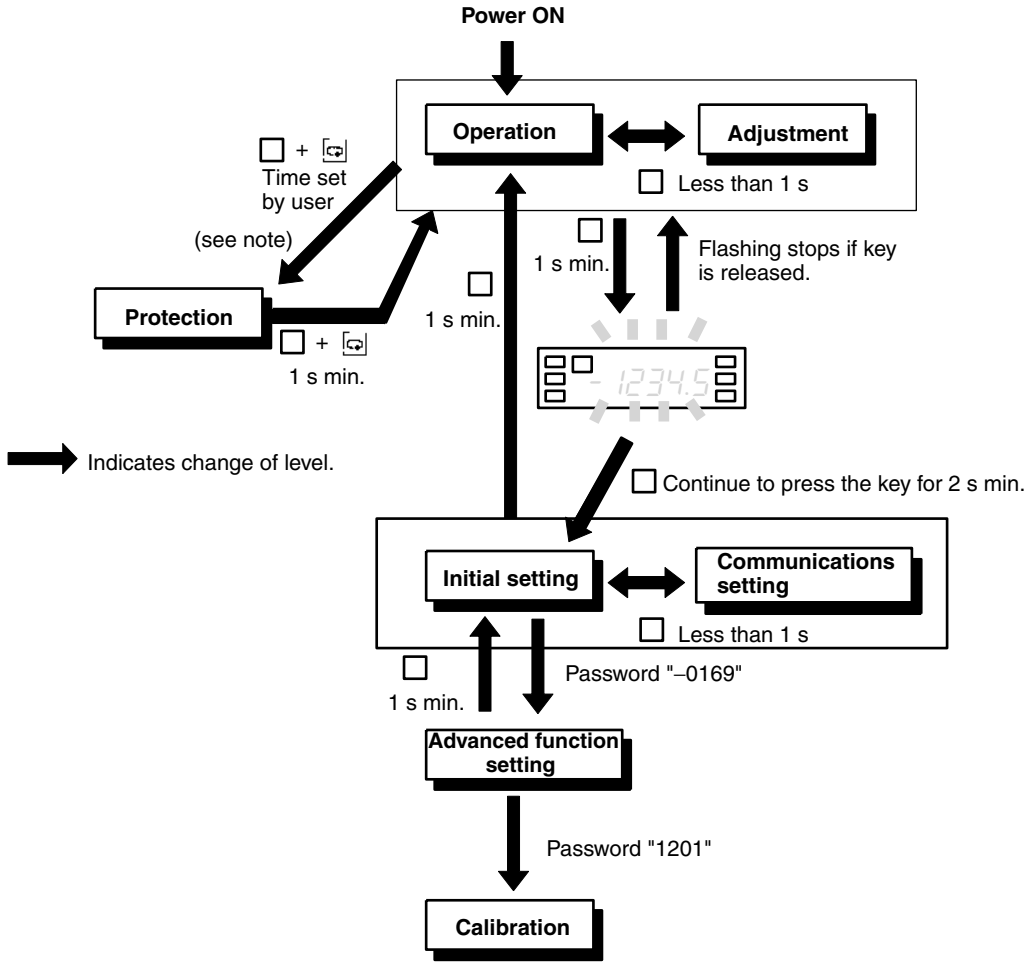
■ Initial Settings



■ Levels

"Level" refers to a grouping of parameters. The following table lists the operations that are possible in each of the levels, and how to move between levels. There are some parameters that are not displayed for certain models.

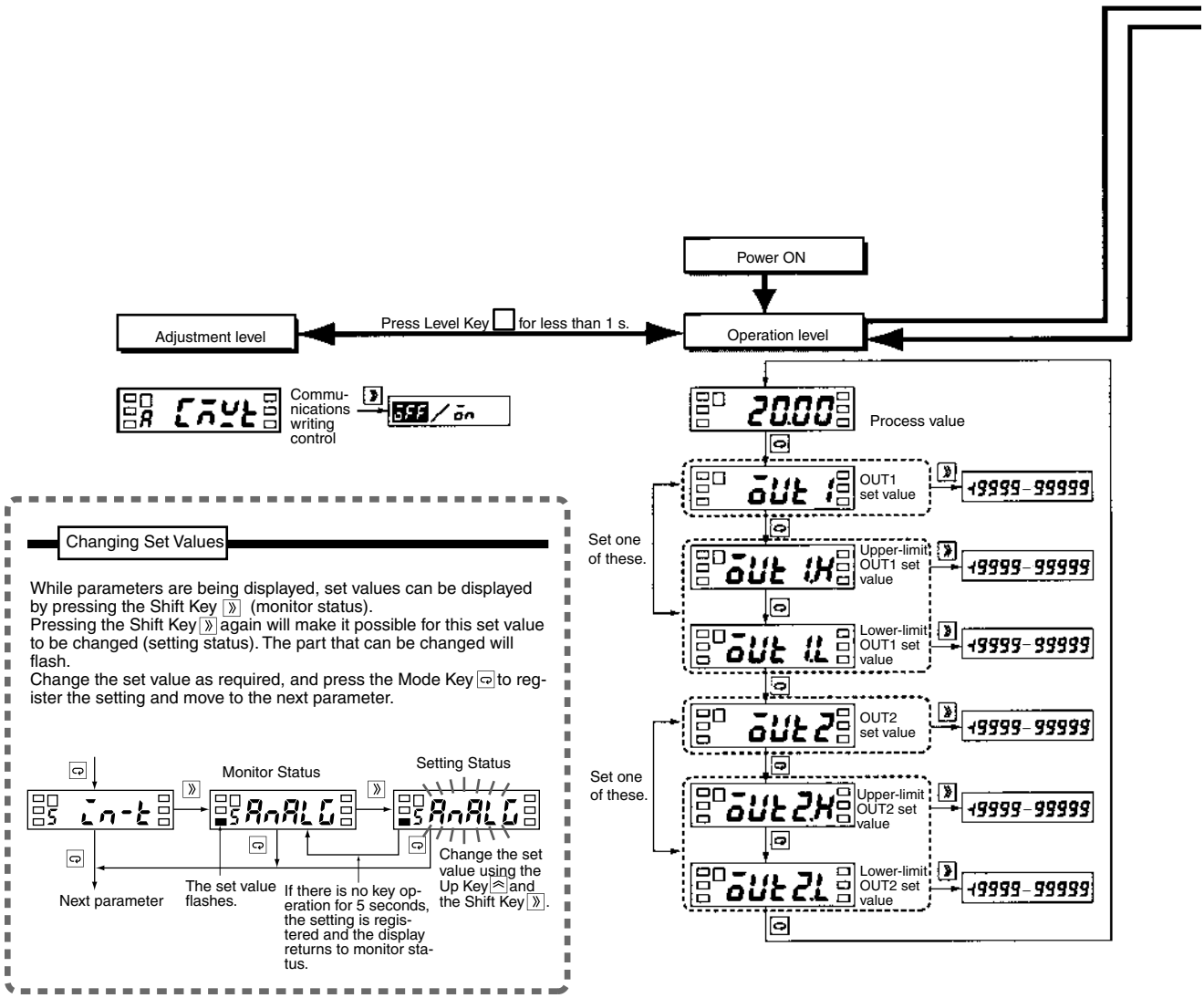
Level name	Function	Measurement
Protect	Setting lockouts.	Continue
Operation	Displaying process values, setting/clearing forced-zero function, and setting OUT 1/2 set values.	Continue
Adjustment	Setting communications writing control.	Continue
Initial setting	Making initial settings of input type, scaling, output operating action, and other parameters.	Stopped
Communications setting	Setting baud rate, word length, and other communications data.	Stopped
Advanced function setting	Setting average processing, display color settings, and other advanced function parameters.	Stopped
Calibration	Setting user calibration of the inputs.	Stopped

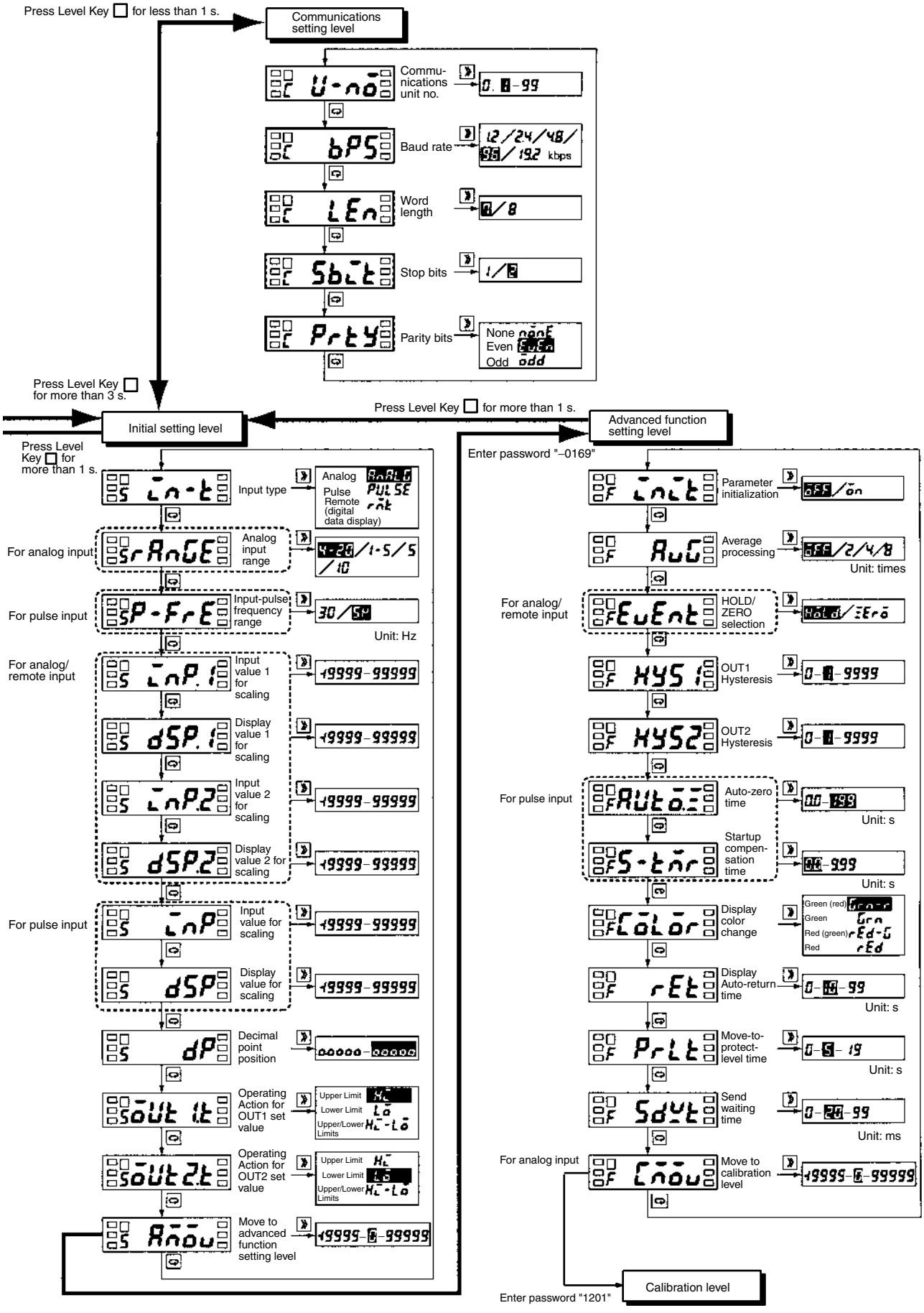


Note: The move to protection level time can be set in the advanced function setting level.

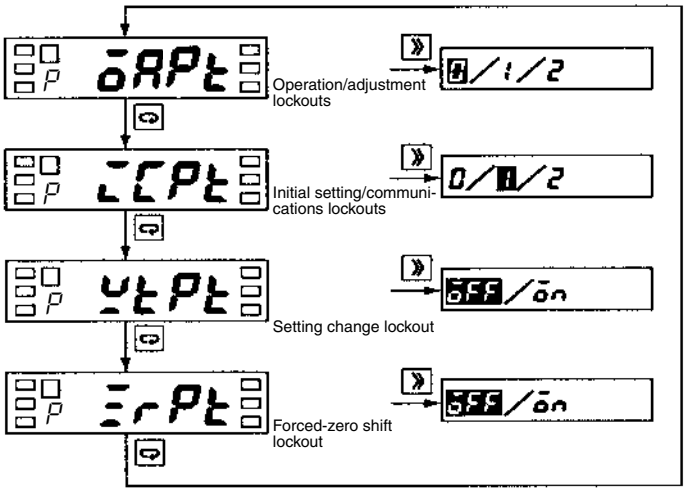
■ Parameters

Note: 1. Some parameters are not displayed for certain models.
2. The K3GN will stop measurement if the level is changed to the initial setting level, the advanced function setting level, the communications setting level, or the calibration level.
3. If the input range is changed, some parameters are set to default values. Therefore, set the input range first.
4. Settings displayed in reverse black/white are defaults.




Press Level Key for less than 1 s.
Communications setting level
Communications unit no.
0. 1-99
Baud rate
12/24/48/96/192 kbps
Word length
7/8
Stop bits
1/2
Parity bits
None
Even
Odd
Press Level Key for more than 3 s.
Press Level Key for more than 1 s.
Initial setting level
Advanced function setting level
Press Level Key for more than 1 s.
Enter password "–0169"
Input type
Analog
Pulse
Remote (digital data display)
For analog input
Analog input range
4-20/1-5/5/10
For pulse input
Input-pulse frequency range
30/5k
Unit: Hz
For analog/ remote input
Input value 1 for scaling
Display value 1 for scaling
Input value 2 for scaling
Display value 2 for scaling
For pulse input
Input value for scaling
Display value for scaling
Decimal point position
Operating Action for OUT1 set value
Operating Action for OUT2 set value
Upper Limit
Lower Limit
Upper/Lower Limits
Move to advanced function setting level
Parameter initialization
Average processing
Unit: times
For analog/ remote input
HOLD/ ZERO selection
OUT1 Hysteresis
OUT2 Hysteresis
For pulse input
Auto-zero time
Unit: s
Startup compensation time
Unit: s
Display color change
Green (red)
Green
Red (green)
Red
Display Auto-return time
Unit: s
Move-to-protect-level time
Unit: s
Send waiting time
Unit: ms
For analog input
Move to calibration level
Enter password "1201"
Calibration level

Protect level



- Prohibits menu display, writing, etc., for operation level and adjustment level.
- Prohibits access to menu display, initial setting level, communications setting level, and advanced function setting level.
- Prohibits setting changes using front panel keys.
- Prohibits use of the forced-zero function using front panel keys.

Operation/Adjustment Lockouts

Prohibits key operations for operation level and adjustment level.

Setting	Operation level		Moving to adjustment level
	Process value display	Set value display	
0	Allowed	Allowed	Allowed
1	Allowed	Allowed	Prohibited
2	Allowed	Prohibited	Prohibited

- Initial setting is 0.
- When the set value is 0 (the initial setting), protection is not set.

Setting Change Lockout

Prohibits setting changes.

Setting	Meaning
OFF	Setting changes using front panel keys allowed (i.e., it is possible to move to the state where changes to settings can be made).
ON	Setting changes using front panel keys prohibited (i.e., it is not possible to move to the state where changes to settings can be made).

- The initial setting is OFF.

Note: Changes to protection level parameters, moving to advanced function setting level, and moving to calibration level are all allowed.

Initial Setting/Communications Lockouts

Prohibits moving to the initial setting level, the communications setting level, and the advanced function setting level.

Setting	Moving to initial setting level	Moving to communications setting level
0	Allowed (message for moving to advanced function setting level displayed)	Allowed
1	Allowed (message for moving to advanced function setting level not displayed)	Allowed
2	Prohibited	Prohibited

- The initial setting is 1.

Forced-zero shift Lockout

Prohibits the setting or clearing of a forced-zero using the front panel key.

Setting	Meaning
OFF	Executing and clearing of forced-zero allowed.
ON	Executing and clearing of forced-zero prohibited.

- The initial setting is OFF.

■ Troubleshooting

When an error occurs, error details will be displayed on the main display. Confirm the error from the main display and take the appropriate countermeasures.

Main display	Level display	Error contents	Countermeasure
E111 (E111)	Not lit	RAM memory error	Turn the power supply OFF and ON again. If the same error is displayed even after the power is turned OFF and ON, it is necessary to replace the memory. If normal operation is restored by turning the power supply OFF and ON, it is possible that there is noise interference. Check that there is nothing in the vicinity that may be the source of noise.
E111 (E111)	5	EEPROM memory error	
S.Err (S.Err) (Flashes at 0.5-s intervals)	Not lit	Input error or input range exceeded	All outputs turn OFF. Check for incorrect input wiring, for disconnected power lines, for short-circuiting, and the input type. Bring the input value within range.
99999 (Flashes at 0.5-s intervals)	Not lit	Greater than displayable range	This is not an operational error. These messages are displayed when a value to be displayed lies outside the displayable range, even if the input value is within the input range and the range for which measurement is possible. Bring the input value and display value within range.
-19999 (Flashes at 0.5-s intervals)	Not lit	Less than displayable range	

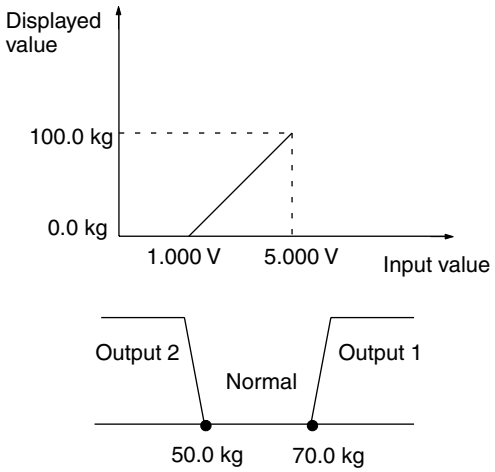
Additional Information

■ Application as a Process Meter

The initial settings required when using the K3GN a process meter are explained below using the following example.

Setting Example

Inputs in the range 1 to 5 V are scaled to the range 0 to 100.0 kg and displayed. If the measurement value goes over 70.0 kg, output 1 turns ON. If the measurement value goes below 50.0 kg, output 2 turns ON.



Initial Setting Procedure

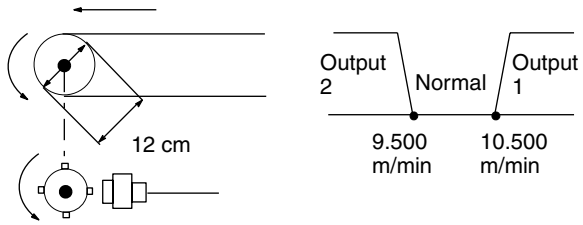
1. **Check the wiring and turn ON the power.**
2. **Set analog input as the input type.**
   If a measurement value is displayed (operation level), move to the initial setting level by holding down the Level Key for 3 s min.
   Set parameter *InPt* to *AnALG*.
3. **Set the analog range to 1 to 5 V.**
   Set parameter *rAnGE* to *1-5*.
4. **Set the scaling values.**
   Set parameter *InP.1* to *1.000*.
   Set parameter *dSP.1* to *0*.
   Set parameter *InP.2* to *5.000*.
   Set parameter *dSP.2* to *1000*.
5. **Set the position of the decimal point.**
   Set parameter *dP* to *oooo.o*.
6. **Operating action for OUT1 and OUT2 set values.**
   Set parameter *oUt1.t* to *HI*.
   Set parameter *oUt2.t* to *Lo*.
7. **Set OUT1 set value to 70.0 and OUT2 set value to 50.0.**
   If an initial setting level parameter is displayed, press the Level Key for 1 s min. to return to the operation level.
   Set parameter *oUt1* to *70.0*.
   Set parameter *oUt2* to *50.0*.
8. **Start actual operation.**

■ Application as a Tachometer

The initial settings required when using the K3GN as a tachometer are explained below using the following example.

Setting Example

The speed of a conveyor belt is displayed in m/min units. For every revolution of the shaft, 4 pulses are output. The diameter of the axis of rotation is 12 cm. If the Rotational speed goes over 10.500 m/min, output 1 turns ON. If the speed goes below 9.500 m/min, output 2 turns ON.



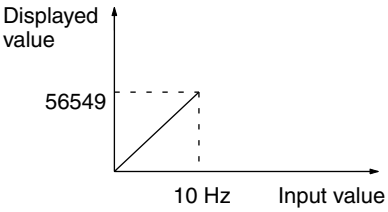
Deciding the Scaling Value

Rotational speed (m/min) = π × Diameter (m) × Revolutions per minute (rpm)
Revolutions per minute (rpm) = Input frequency (Hz) ÷ Number of pulses per revolution × 60

Applying the appropriate values to these 2 equations gives: Speed (m/min) = 5.654866... × Input frequency (Hz)

Multiply by 1,000 to display the first 3 digits to the right of the decimal point.

Speed (m/min) = 5654.866... × Input frequency (Hz)



To limit inaccuracies due to scaling, select a round number (e.g., 10) as the input value and select a display value of as many digits as possible. In this example, scaling is performed so that an input value of 10 gives a displayed value of 56549.

Initial Setting Procedure

1. **Check the wiring and turn ON the power.**
2. **Set pulse input as the input type.**
   If a measurement value is displayed (operation level), move to the initial setting level by holding down the Level Key for 3 s min.
   Set parameter *In-t* to *PULSE*.
3. **Set the pulse frequency to 30 Hz.**
   The input pulse frequency for the application is approximately 2 Hz and so can be assumed not to exceed 30 Hz. Set parameter *P-FrE* to *30*.
4. **Set the scaling values.**
   Set parameter *InP* to *10*.
   Set parameter *dSP* to *56549*.
5. **Set the decimal point.**
   Set parameter *dP* to *oo.ooo*.
6. **Operating action for OUT1 and OUT2 set values.**
   Set parameter *oUt1.t* to *Hi*.
   Set parameter *oUt2.t* to *Lo*.
7. **Set OUT1 set value to 10.500 and OUT2 set value to 9.500.**
   If an initial setting level parameter is displayed, press the Level Key for 1 s min. to return to the operation level.
   Set parameter *oUt1* to *10.500*.
   Set parameter *oUt2* to *9.500*.
8. **Start actual operation.**

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. N101-E1-03

Process Meter
K3MA-J

Highly Visible LCD Display with 2-color (Red and Green) LEDs

- Multi-range DC voltage/current input.
- Front-panel key operation for easy setting.
- Average processing function suppresses flicker.
- Scaling, front-panel forced-zero, zero-limit functions.
- Easy confirmation of max/min display.
- Short 80-mm depth (measured from edge of face plate).
- Finger protective cover (standard equipment) guards against electric shock.
- Water- and dust-proof NEMA4X (IP66 equivalent) front panel.
- Recognized to U.S. and Canadian requirements under the Component Recognition Program of UL.
- CE marking.

Model Number Structure

■ Model Number Legend

K3MA-J-□ □
1 2 3

1. Input Type
J: DC voltage/current

2. Output Type
None: No output
A2: 2 relay contact outputs (SPST-NO)

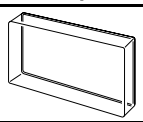
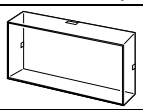
3. Supply Voltage
100-240VAC: 100 to 240 VAC
24VAC/VDC: 24 VAC/VDC

Ordering Information

■ List of Models

Input type	Supply voltage	Output	Model
DC voltage/current	100 to 240 VAC	None	K3MA-J 100-240VAC
		2 relay contact outputs (SPST-NO)	K3MA-J-A2 100-240VAC
	24 VAC/VDC	None	K3MA-J 24VAC/VDC
		2 relay contact outputs (SPST-NO)	K3MA-J-A2 24VAC/VDC

■ Accessories (Order Separately)

Name	Shape	Model
Splash-proof Soft Cover		K32-49SC
Hard Cover		K32-49HC

Specifications

■ Ratings

Model	K3MA-J 100-240VAC, K3MA-J-A2 100-240VAC	K3MA-J 24VAC/VDC, K3MA-J-A2 24VAC/VDC
Supply voltage	100 to 240 VAC	24 VAC/VDC
Operating voltage range	85% to 110% of the rated supply voltage	
Power consumption (under maximum load)	6 VA max.	4.5 VA max. (24 VAC) 4.5 W max. (24 VDC)
Insulation resistance	20 MΩ min. (at 500 VDC) between external terminal and case. Insulation provided between inputs, outputs, and power supply.	
Dielectric strength	2,000 VAC for 1 min between external terminal and case. Insulation provided between inputs, outputs, and power supply.	
Noise immunity	±1,500 V on power supply terminals in normal or common mode. ±1 μs, or 100 ns for square-wave noise with 1 ns.	±480 V on power supply terminals in normal mode. ±1,500 V in common mode. ±1 μs, or 100 ns for square-wave noise with 1 ns.
Vibration resistance	Vibration: 10 to 55 Hz, Acceleration: 50 m/s^2 5 min each in X, Y, and Z directions for 10 sweeps.	
Shock resistance	150 m/s^2 (100 m/s^2 for relay contact outputs) 3 times each on 3 axes, 6 directions.	
Ambient temperature	Operating: −10°C to 55°C (with no condensation or icing) Storage: −25°C to 65°C (with no condensation or icing)	
Ambient humidity	Operating: 25% to 85% (with no condensation)	
Approved safety standards	UL3121-1, conforms to EN61010-1 (Pollution degree 2/overvoltage category II) Conforms to VDE0106/P100 (finger protection)	
EMC	(EMI) EN61326+A1 Industry Emission Enclosure: CISPR 11 Group 1 class A: CISRP16-1/-2 Emission AC Mains: CISPR 11 Group 1 class A: CISRP16-1/-2 (EMS) EN61326+A1 Industry Immunity ESD: EN61000-4-2: 4 kV contact discharge, 8 kV air discharge Immunity RF-interference: EN61000-4-3: 10 V/m (amplitude-modulated, 80 MHz to 1 GHz) Electrical Fast Transient Noise: EN61000-4-4: 2 kV (power line) Immunity Burst Noise: 1 kV line to line (I/O signal line) Immunity Surge: EN61000-4-5: 1 kV (power line), 2 kV line to ground (power line) Immunity Conducted Disturbance: EN61000-4-6: 3 V (0.15 to 80 MHz) Immunity Voltage Dip/Interrupting: EN61000-4-11: 0.5 cycle, 0, 180°, 100% (rated voltage)	
Weight	Approx. 200 g	

■ Characteristics

Input signal	DC voltage/current (0 to 20 mA, 4 to 20 mA, 0 to 5 V, 1 to 5 V, ±5 V, ±10 V)
A/D conversion	Double integral method
Sampling period	250 ms
Display refresh period	Sampling period (sampling times multiplied by number of measurements for averaging if average processing is selected.)
Max. displayed digits	5 digits (–19999 to 99999)
Display	7-segment digital display, Character height: 14.2 mm
Polarity display	"–" is displayed automatically with a negative input signal.
Zero display	Leading zeros are not displayed.
Scaling function	Programmable with front-panel key inputs (range of display: –19999 to 99999). The decimal point position can be set as desired.
Hold function	Max. hold (maximum value), Min. hold (minimum value)
Hysteresis setting	Programmable with front-panel key inputs (0001 to 9999).
Other functions	Forced-zero (with front-panel key) Zero-limit Scaling teach function Display color change (green (red), green, red (green), red) OUT type change (upper limit, lower limit, upper/lower limit) Average processing (simple average)
Output	Relays: 2 SPST-NO
Delay in comparative outputs	750 ms max.
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66) Rear case: IEC standard IP20 Terminals: IEC standard IP00 + finger protection (VDE0106/100)
Memory protection	Non-volatile memory (EEPROM) (possible to rewrite 100,000 times)

■ Measuring Ranges

Process Voltage/Current Inputs

Input	Measuring range	Measuring accuracy	Input impedance	Displayable range
DC voltage	1.000 to 5.000 V	±0.1% FS ±1 digit max. (at 23±3°C)	1 MΩ min.	–19999 to 99999 (with scaling function)
	0.000 to 5.000 V			
	–5.000 to 5.000 V	±0.1% FS ±1 digit max. (at 23±5°C)		
	–10.00 to 10.00 V			
DC current	4.00 to 20.00 mA/ 0.00 to 20.00 mA	±0.1% FS ±1 digit max. (at 23±3°C)	45 Ω	

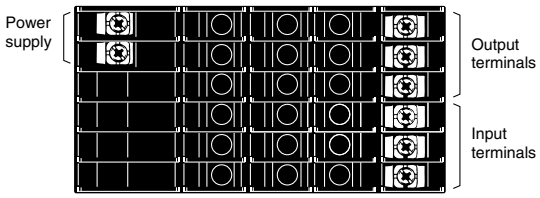
■ Input/Output Ratings

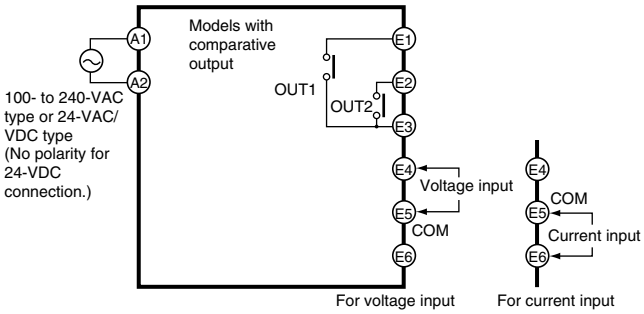
Relay Contact Output

Item	Resistive load (cosϕ = 1)	Inductive load (cosϕ = 0.4, L/R=7 ms)
Rated load (UL ratings)	5 A at 250 VAC, 5 A at 30 VDC	1.5 A at 250 VAC, 1.5 A at 30 VDC
Rated carry current	5 A max. (at COM terminal)	
Max. contact voltage	250 VAC, 150 VDC	
Max. contact current	5 A (at COM terminal)	
Max. switching capacity	1,250 VA, 150 W	250 VA, 30 W
Min. permissible load (P level, reference value)	10 mA at 5 VDC	
Mechanical life	5,000,000 times min. (at a switching frequency of 1,200 times/min)	
Electrical life (at an ambient temperature of 20°C)	100,000 times min. (at a rated load switching frequency of 10 times/min)	

Connections

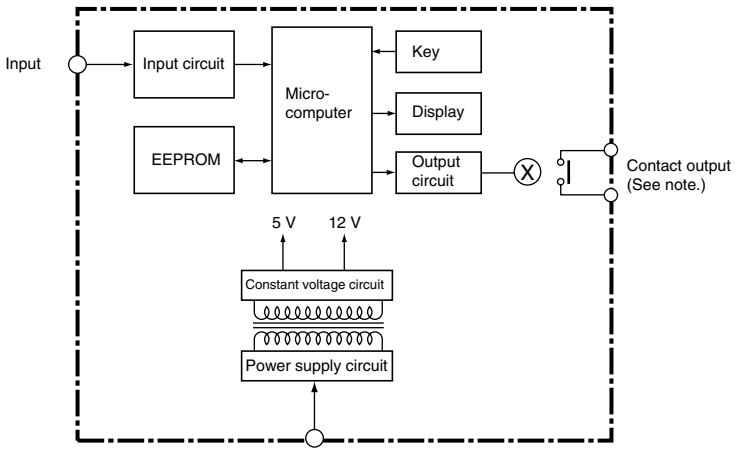
■ Terminal Arrangement





Terminal No.	Name	Description
(A1) - (A2)	Operation power	Connects the operation power supply.
(E4), (E6) - (E5)	Analog input	Connects the voltage or current analog input.
(E1), (E2) - (E3)	Outputs	Outputs the relay outputs.

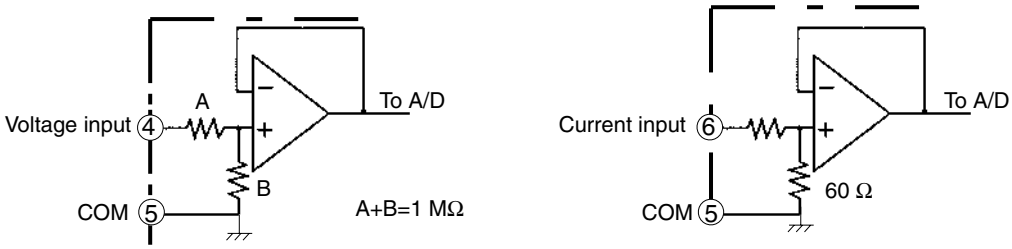
■ Block Diagram



Note: Relay output models only.

■ Input Circuits

Analog Input (DC Voltage/Current)



Operation

■ Main Functions

Input Types and Ranges

Input type (setting parameter)	Function	Input range (setting parameters)		Setting range
Input range (in-t)	Selects DC voltage/current signal input	0 to 20 mA	(0-20)	Displayable from –19999 to 99999 with scaling function. The position of the decimal point can be set as desired.
		4 to 20 mA	(4-20)	
		0 to 5 V	(0-5)	
		1 to 5 V	(1-5)	
		±5 V	(5)	
		±10 V	(10)	

Note: The initial value for the input range is "4 to 20 mA (4-20)."

Scaling

• Analog (Process) Inputs

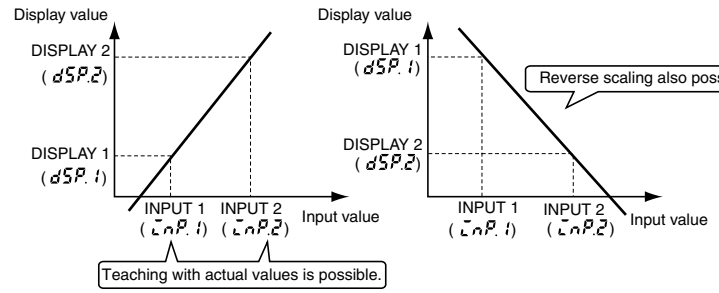
The K3MA-J converts input signals into desired physical values.

INPUT2: Any input value
DISPLAY2: Displayed value corresponding to INPUT2
INPUT1: Any input value
DISPLAY1: Displayed value corresponding to INPUT1

When DISPLAY1 is set for INPUT1, and DISPLAY2 is set for INPUT2, a line will be displayed joining the two points. (Raise shift, reverse scaling, plus/minus display, etc., can be adjusted as desired.)

Parameter	Setting value	Meaning
inP.1	-19999 to 99999	Input value for dSP.1
dSP.1	-19999 to 99999	Display value for inP.1
inP.2	-19999 to 99999	Input value for dSP.2
dSP.2	-19999 to 99999	Display value for inP.2

Parameter	Setting value	Meaning
dP	0.0000	Display four digits after decimal point
	00.000	Display three digits after decimal point
	000.00	Display two digits after decimal point
	0000.0	Display one digit after decimal point
	00000	No decimal point



The decimal point can be optionally displayed. When displaying the decimal point, consider the number of digits to follow the decimal point prior to setting the scaling display value.

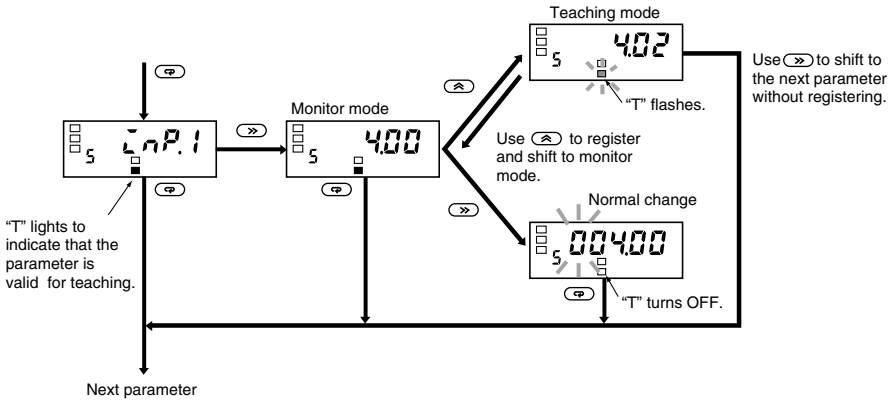
Reverse scaling, where the display value decreases as the input value increases, is also possible.

Instead of setting by inputting with the (≪) Up Key and (≫) Shift Key, current values can be input as scaling input values for teaching. This is useful for making settings while checking the operation status of the K3MA-J.

Convenient Functions

Scaling Teach

The parameters (InP.1, InP.2) for the K3MA-J's initial setting level can be set using actual input values with the teaching function. After displaying the parameters, the actual input settings can be made with the following operation.

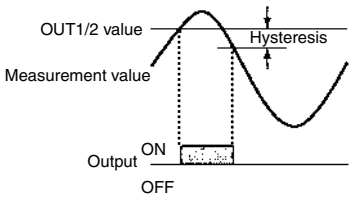


OUT Types (Comparative Output Models Only)

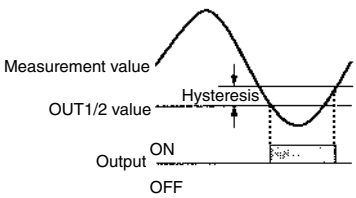
OUT 1 and OUT 2 can be set to operate in one of the three following modes in accordance with the compared values:

- Upper limit (High Acting):
  The output is turned ON when the measurement value is greater than its set value.
- Lower limit (Low Acting):
  The output is turned ON when the measurement value is less than its set value.
- Upper and lower limits (Outside Band Acting):
  An upper limit (H set value) and lower limit (L set value) can be set independently.
  The output is turned ON when the measurement value is greater than upper-limit set value or less than the lower-limit set value.

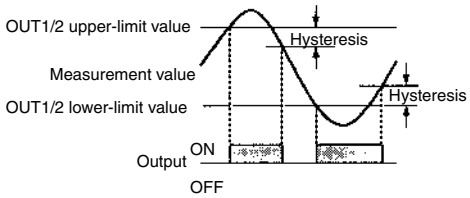
Upper Limit (High Acting)



Lower Limit (Low Acting)

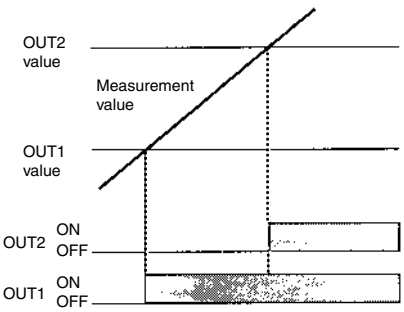


Upper and Lower Limits (Outside Band Acting)

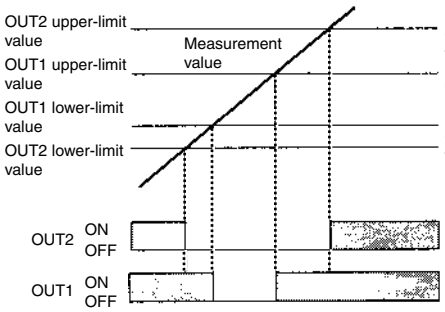


The three types of output operations shown above can be combined as desired. The following are examples of possible combinations.

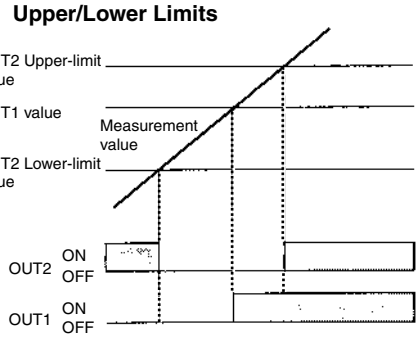
Upper Limit 2-stage Output



Threshold Output



Combination of Upper Limit and Upper/Lower Limits



Parameter Initialization

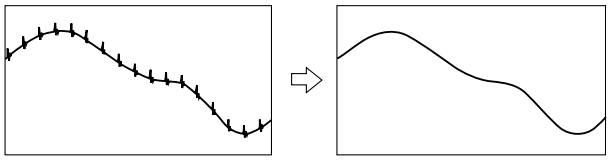
This function returns all of the parameters to their initial values.

Parameter	Setting value	Meaning
initt	oFF	---
	on	Initializes all parameters.

Use this to reset the K3MA-J after returning it to its factory-set condition.

Average Processing

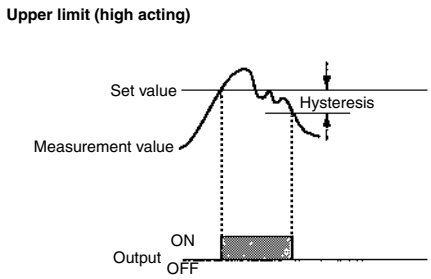
Average processing stabilizes displayed values to minimize flicker by averaging the fluctuating input signals. Average processing can be performed for the measurement values in either of four steps (OFF, 2 times, 4 times, or 8 times).



This is useful for ignoring rapid fluctuations, e.g., eliminating spike noise.

Hysteresis (Comparative Output Models Only)

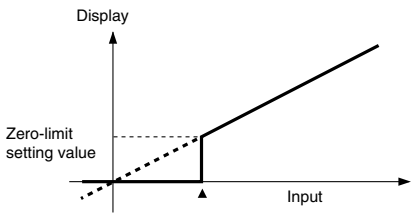
The hysteresis of comparative outputs can be set to prevent chattering in the output when the measurement value fluctuates finely near the OUT value.



Zero-limit Function

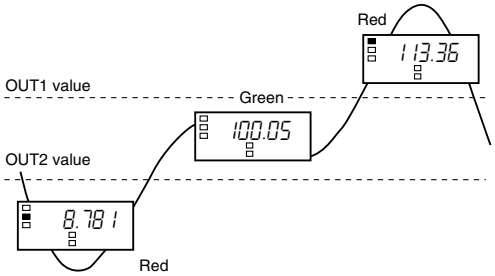
The zero-limit function changes any value below the set value to zero. This is useful when you want to change negative values to zero rather than display them, or when you want to make the display in the smallest part of the input range zero.

Parameter	Setting value	Meaning
z-lim	oFF	OFF: No zero-limit
	on	ON: Zero-limit
lim-p	0 to 99	0 to 99: Zero-limit value



Changing the Display Color

The color of the value displayed can be set to either red or green. For comparative output models, the display color can be set to change from green to red, or from red to green, according to the status of the comparison criterion.



Display Auto-return Time

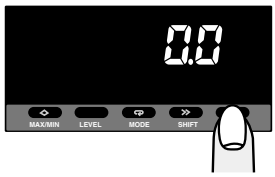
This function automatically returns the display to the operation level's current value if no keys are pressed for a preset time (called the display auto-return time).

Move-to-Protect-Level Time

The time required to shift to the protect level can be set as desired.

Forced-zero Function

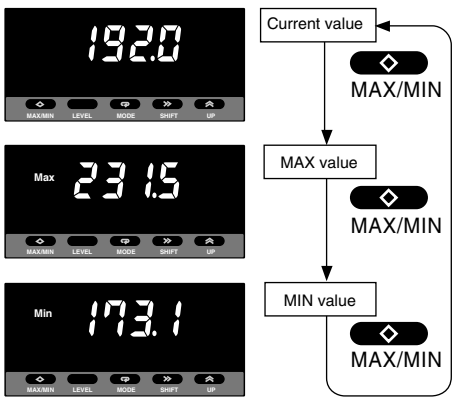
It is possible to shift from a value to the zero point with one touch of the Up Key on the front panel (for example, when adjusting reference values).



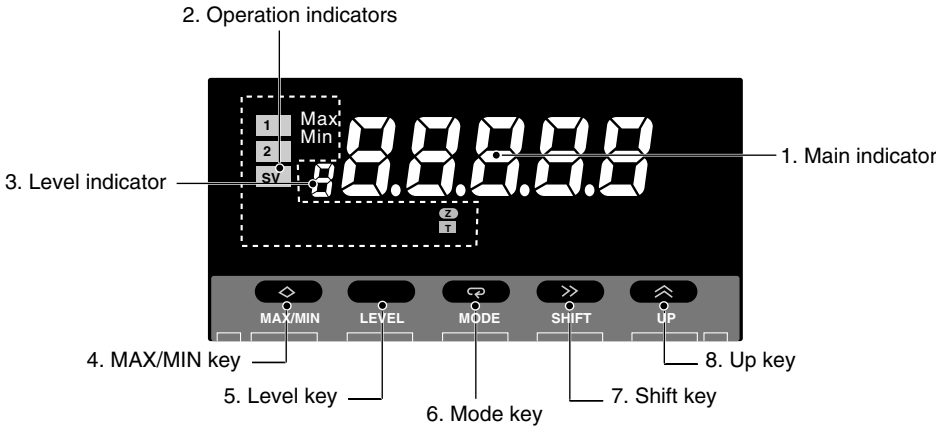
Note: Used only for releasing the forced-zero with the Protect menu.

MAX/MIN Display

The maximum and minimum measurement (display) values from the time the power is turned ON until the current time can be stored and displayed. This is useful, for example, when measuring the maximum value.



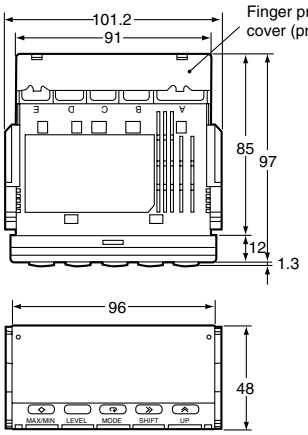
Nomenclature



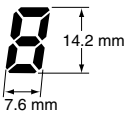
Name		Functions
1. Main indicator		Displays current values, parameters, and set values.
2. Operation indicators	1	Lit when output 1 is ON.
	2	Lit when output 2 is ON.
	SV	Lit when a set value is being displayed or changed.
	Max	Lit when the main indicator is showing the MAX value.
	Min	Lit when the main indicator is showing the MIN value.
	Z	Lit during the forced-zero operation.
	T	Lit when the teaching function is operable. Blinks while the teaching function is operating.
3. Level indicator		Displays the current level that the K3MA-J is in. (See below for details.)
4. MAX/MIN Key		Used to display the MAX and MIN values when a measurement value is being displayed.
5. Level Key		Used to change the level.
6. Mode Key		Used to allow the main indicator to indicate parameters sequentially.
7. Shift Key		Used to enable a set value to be changed. When changing a set value, this key is used to move along the digits.
8. Up Key		Used to change a set value. Used to set or clear a forced-zero function when a measurement value is being displayed.

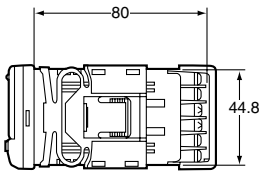
Level indicator	Level
P	Protect
Not lit	Operation
5	Initial setting
F	Advanced-function setting

Dimensions

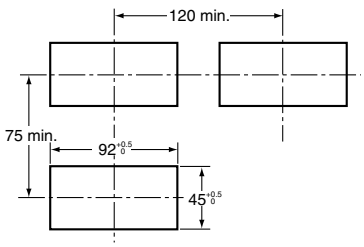


Main indicator character size





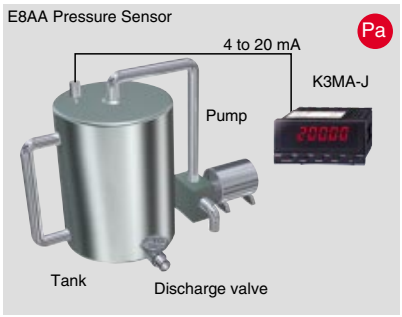
Panel cut-out



The K3MA-J uses M3 terminals.

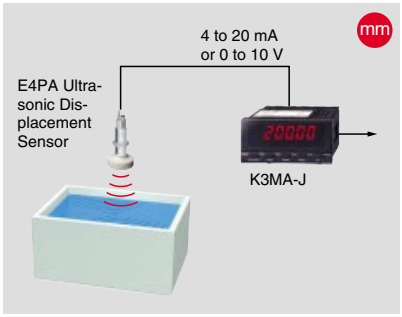
Application Examples

Monitoring interior tank pressure



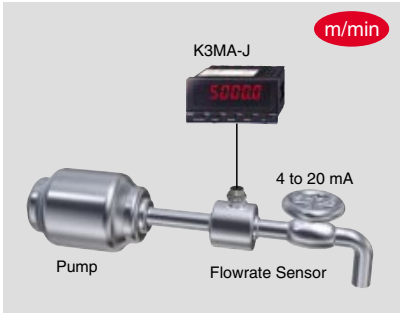
- Monitoring gas pressure
- Inspection instruments in food or pharmaceutical plants

Displaying/outputting liquid level



- Monitoring liquid level in cleaning tanks
- Water tanks, devices using chemicals, etc.

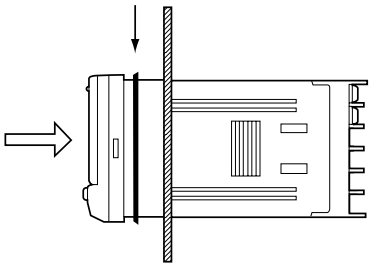
Flowrate sensor



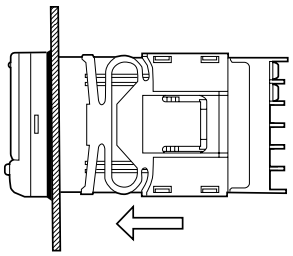
- Monitoring sendout flowrate
- Water processing devices, etc.

Installation

1. Insert the K3MA-J into the panel cut-out hole.
2. For a waterproof installation, insert the rubber gasket onto the body of the K3MA-J.



3. Fit the adaptor into the grooves on the left and right sides of the rear case, then push it until it contacts the panel to secure the K3MA-J.

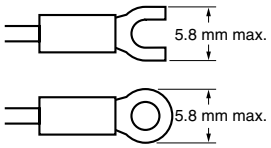


■ Wiring Precautions

- Use crimp terminals.
- Tighten the terminal screws to a torque of approximately 0.5 N·m.
- To avoid the influence of noise, route signal lines and power lines separately.

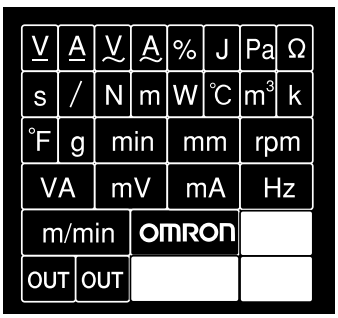
■ Wiring

- Use the following M3 crimp terminals.



■ Unit Labels (Provided)

- The unit labels are not attached to the K3MA-J. Select the desired labels from the provided sheet.



Note: For scales and gauges, use the unit labels that are specified by the relevant laws or regulations.

Precautions

⚠ WARNING

Do not touch any of the terminals while the power is being supplied. Doing so may result in electric shock.

⚠ Caution

Do not disassemble the product or touch the internal components of the product while the power is being supplied. Doing so may result in electric shock.

⚠ Caution

Do not allow metal objects or wire cuttings to enter the product. Doing so may result in electric shock, fire, or malfunction.

⚠ Caution

Perform correct settings for the product according to the control application. Failure to do so may cause unexpected operation, resulting in damage to the product or injury.

⚠ Caution

Take safety measures, such as installing a separate monitoring system, to ensure safety even if the product fails. Product failure may prevent comparative outputs from being generated, resulting in serious accidents.

Observe the following precautions to ensure safety.

1. Maintain the power supply voltage within the range specified in the specifications.
2. Maintain the load within the ratings specified in the specifications.
3. Check each terminal for correct number and polarity before connecting it. Incorrect or reverse connections may damage or burn out internal components in the product.
4. Tighten the terminal screws securely. The recommended tightening torque is 0.43 to 0.58 N·m. Loose screws may cause fire or malfunction.
5. Do not connect anything to unused terminals.
6. Provide a switch or circuit breaker so that operators can easily turn OFF the power supply when necessary. Also provide appropriate indications of such devices.
7. Do not attempt to disassemble, repair, or modify the product.
8. Do not use the product where flammable or combustible gases are present.

Application

General Precautions

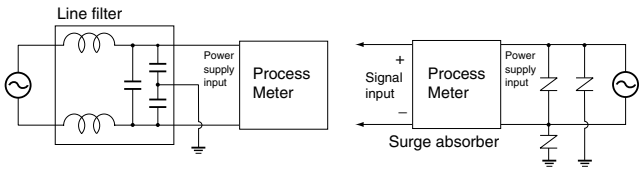
1. Do not use the product in the following locations:
   - Locations subject to direct radiant heat from heating equipment.
   - Locations subject to exposure to water, oil, or chemicals.
   - Locations subject to direct sunlight.
   - Locations subject to dust or corrosive gases (particularly sulfuric gas or ammonia gas).
   - Locations subject to severe changes in temperature.
   - Locations subject to icing or condensation.
   - Locations subject to shock or vibration.
2. Do not block heat dissipation around the product, i.e., provide sufficient space for heat dissipation.
3. Ensure that the rated voltage is reached within two seconds after the power is turned ON.
4. Conduct aging for 15 minutes min. after power is turned ON for correct measurement.
5. Do not touch the slit sections or terminals while the power is being supplied to prevent the product from being affected by static electricity.
6. Do not lay heavy objects on the product during use or storage. Doing so may deform or deteriorate the product.
7. Do not use paint thinner for cleaning. Use commercially available alcohol.

Mounting

- Mount the product to a panel that is 1 to 8 mm thick.
- Install the product in a horizontal position.
- Use crimp terminals that match screw sizes.

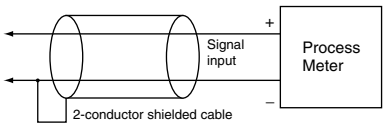
Noise Prevention

- Install the product as far as possible from devices that generate strong, high-frequency fields (such as high-frequency welders or sewing machines) or surges.
- Install surge absorbers or noise filters on nearby devices that generate noise (particularly, motors, transformers, solenoids, magnet coils, and other devices that have a high inductance component).



- To prevent inductive noise, separate the terminal block wiring for the product from high-voltage or high-current power lines. Do not route the wiring for the product in parallel with or tie it in a bundle with power lines.
  Take the following countermeasures against inductive noise in input lines.

Analog Signal Inputs



- When using a noise filter for the power supply, check for the voltage and current and install it as close as possible to the Process Meter.
- Do not install the product near radios, television sets, or wireless devices. Doing so may cause reception interference.

Increasing Service Life

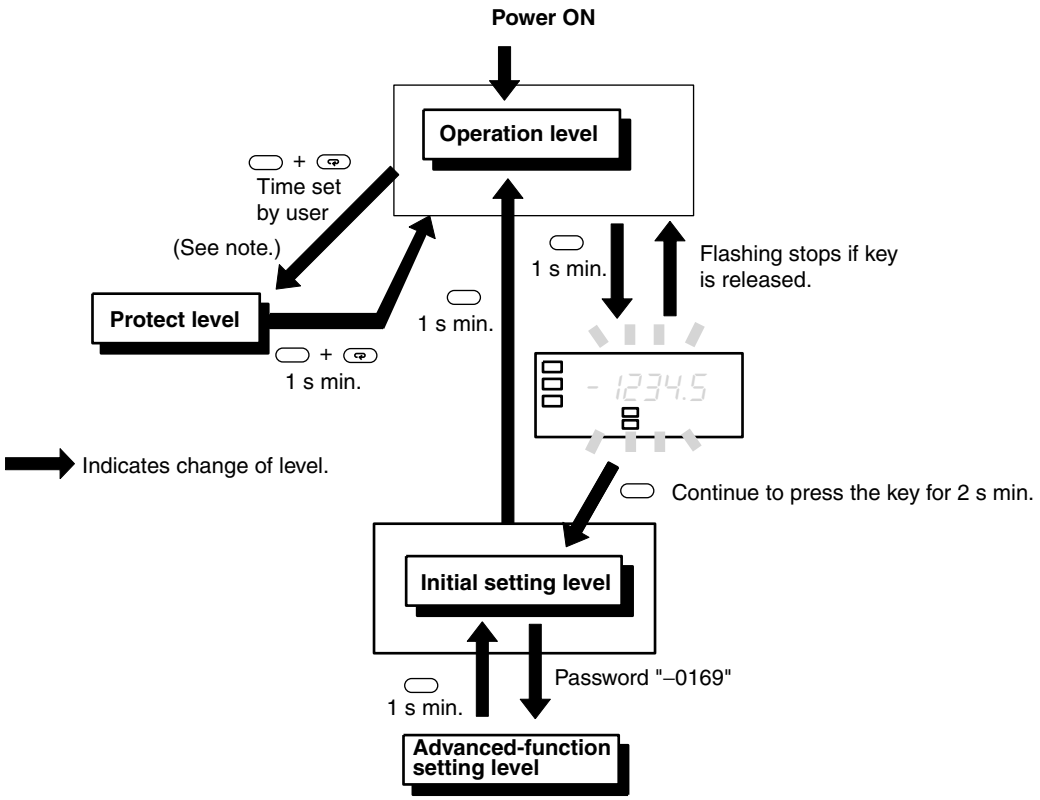
- Do not use the product in locations where the temperature or humidity exceeds the ratings or where condensation may occur. When installing the product in a panel, be sure that the temperature around the product (not the temperature around the panel) does not exceed the ratings. The product service life depends on the ambient temperature. The higher the ambient temperature, the shorter the service life. To extend the product service life, lower the temperature inside the Process Meter.
- Use and store the product within the temperature and humidity ranges given in the specifications. When gang-mounting Process Meters or arranging them vertically, heat generated by the Process Meters will cause the internal temperature to rise, reducing the service life. In such cases, consider forced cooling methods, such as using a fan to circulate air around the Process Meters. Do not, however, allow only the terminals to be cooled. Doing so will increase measurement error.
- The life of the output relays is greatly affected by the switching capacity and switching conditions. Use these relays within their rated load and electrical life. The contacts may fuse or burn if they are used past their electrical life.

Operating Procedures

■ Levels

"Level" refers to a grouping of parameters. The following table lists the operations that are possible in each of the levels, and the diagram tells how to move between levels. There are some parameters that are not displayed for certain models.

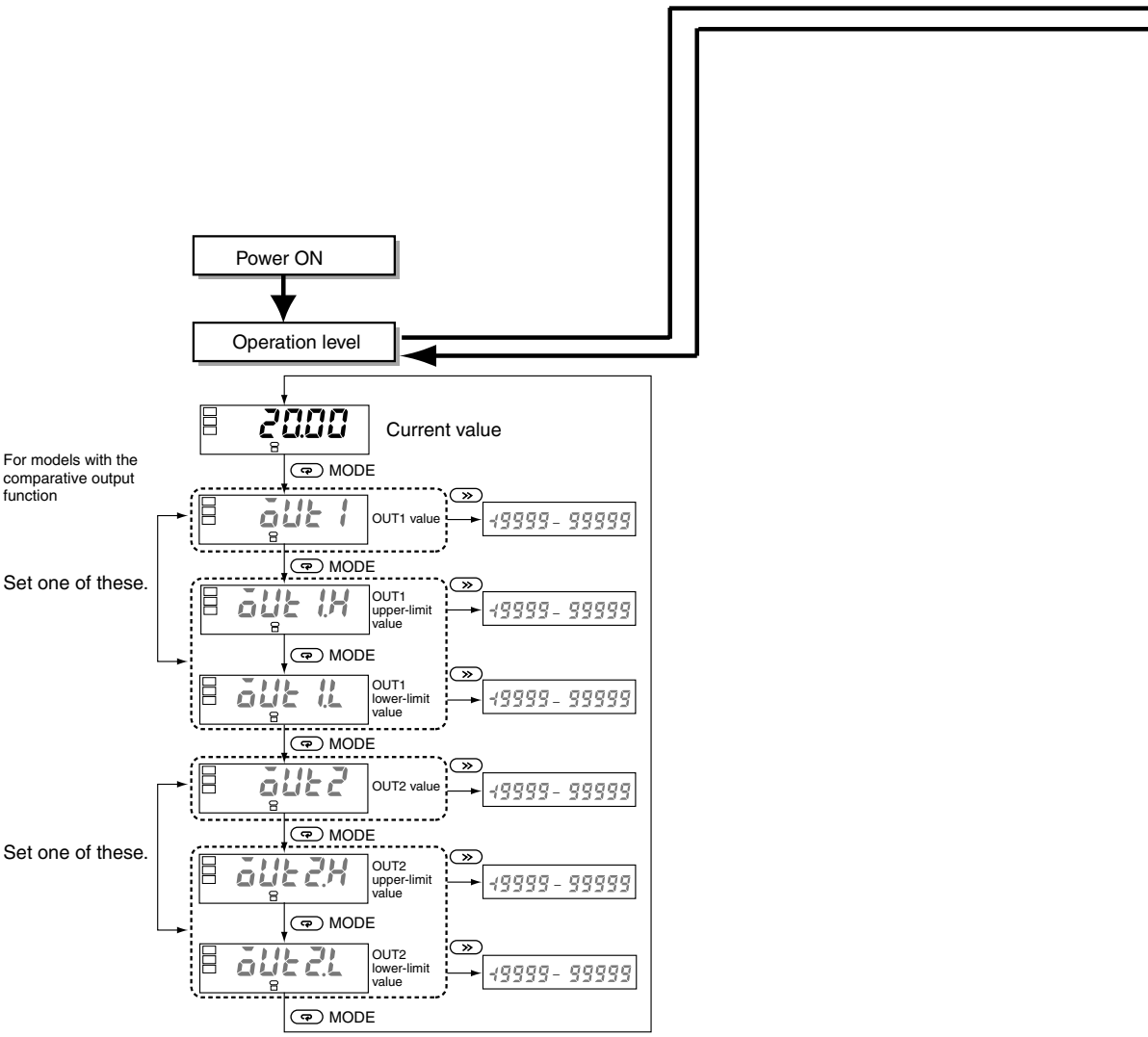
Level name	Function	Measurement
Protect	Setting lockouts.	Continue
Operation	Displaying current values, setting/clearing forced-zero function, and setting OUT 1/2 values.	Continue
Initial setting	Making initial settings of input type, scaling, output operating action, and other parameters.	Stopped
Advanced-function setting	Setting average processing, display color settings, and other advanced-function parameters.	Stopped

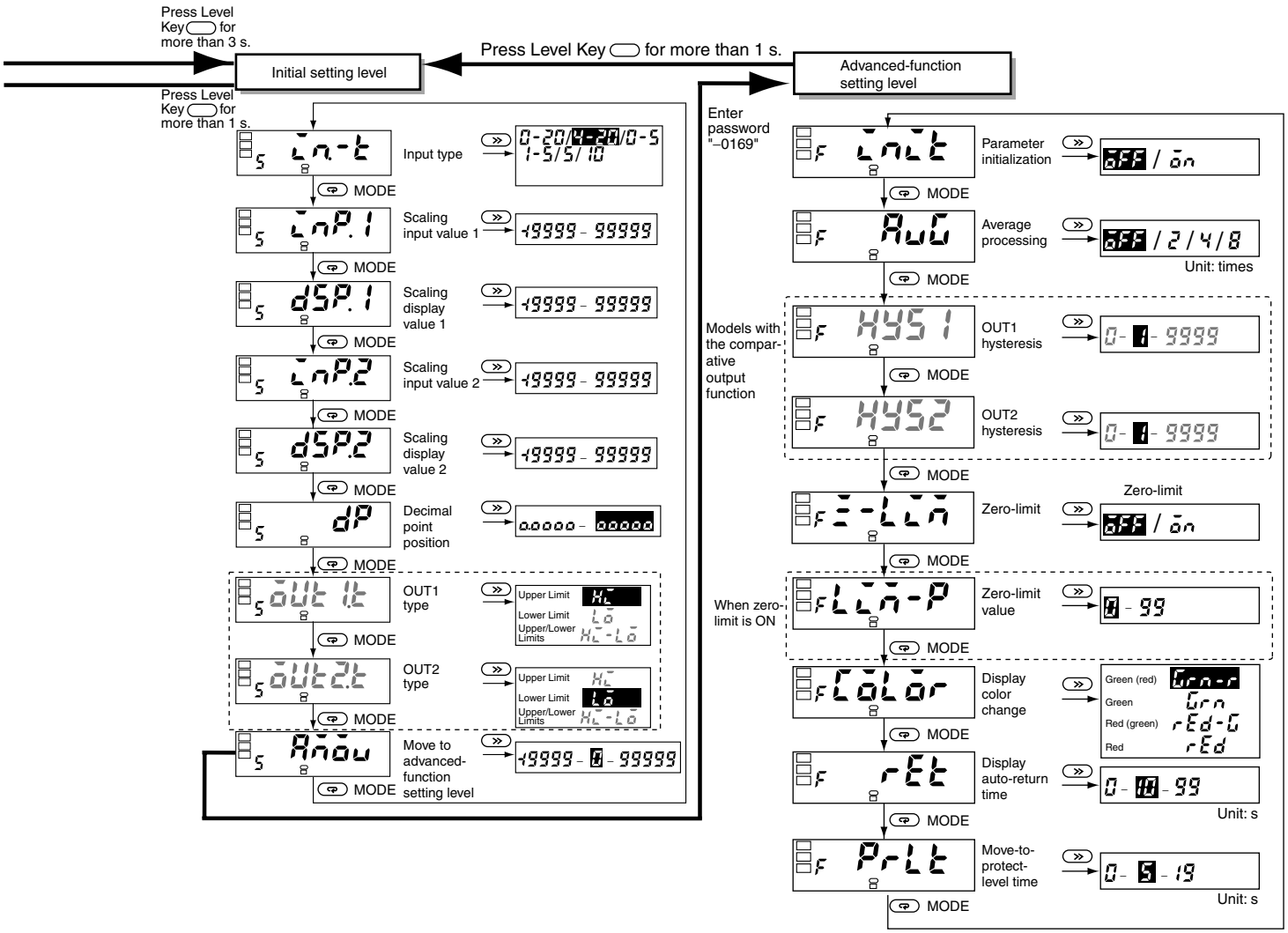


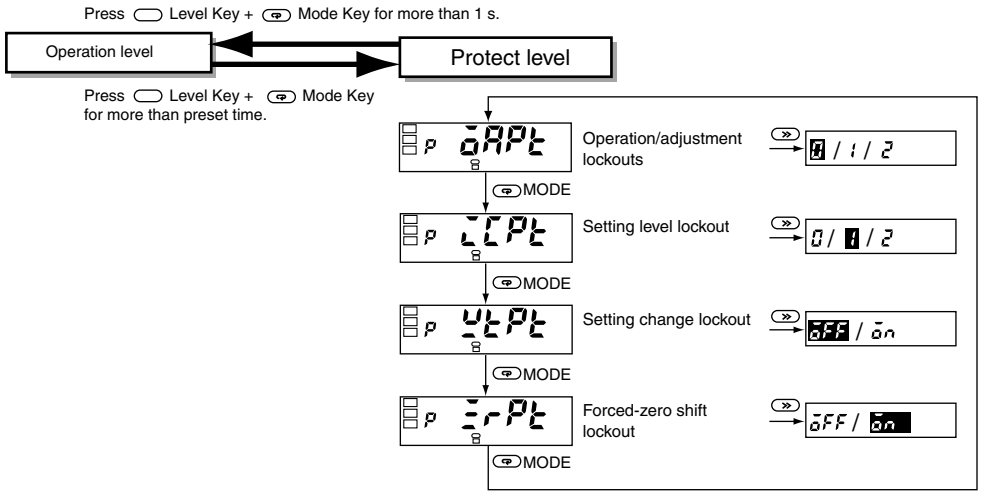
Note: The move-to-protect-level time can be set in the advanced-function setting level.

■ Parameters

Note: 1. Some parameters are not displayed for certain models.
2. The K3MA-J will stop measurement if the level is changed to the initial setting level or the advanced-function setting level.
3. If the input range is changed, some parameters are set to default values. Therefore, set the input range first.
4. Settings displayed in reversed colors are defaults.




Press Level Key for more than 3 s.
Initial setting level
Press Level Key for more than 1 s.
Press Level Key for more than 1 s.
Advanced-function setting level
Input type
MODE
Scaling input value 1
Scaling display value 1
Scaling input value 2
Scaling display value 2
Decimal point position
OUT1 type
OUT2 type
Upper Limit
Lower Limit
Upper/Lower Limits
Move to advanced-function setting level
Enter password "–0169"
Parameter initialization
Average processing
Unit: times
Models with the comparative output function
OUT1 hysteresis
OUT2 hysteresis
Zero-limit
When zero-limit is ON
Zero-limit value
Display color change
Green (red)
Green
Red (green)
Red
Display auto-return time
Unit: s
Move-to-protect-level time
Unit: s



Operation/Adjustment Lockouts

Restricts key operations for operation level and adjustment level.

Parameter	Setting	Operation level	
		Current value display	Set value display
oAPt	0	Allowed	Allowed
	1	Allowed	Allowed
	2	Allowed	Prohibited

- Initial setting is 0.
- This cannot be displayed on models not equipped with the comparative output function.

Setting Level Lockout

Restricts shifting to initial setting level or advanced-function setting level.

Parameter	Setting	Shift to initial setting level	Shift to advanced-function setting level
LCPt	0	Allowed	Allowed
	1	Allowed	Prohibited
	2	Prohibited	Prohibited

Setting Change Lockout

Restricts setting changes by key operation. When this lockout is set, it is no longer possible to shift to a setting change mode.

Parameter	Setting	Setting change by key operation
ytPt	oFF	Allowed
	on	Prohibited

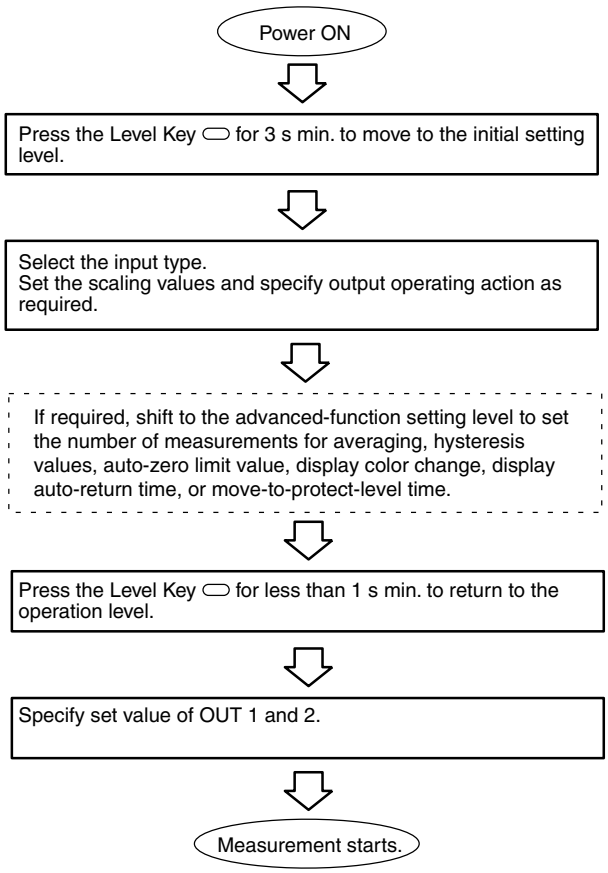
However, all protect level parameters can still be changed.

Forced-zero Lockout

Restricts the setting or release of a forced-zero by front-panel key operation.

Parameter	Setting	Setting/release of forced-zero by key operation
ErPt	oFF	Allowed
	on	Prohibited

■ Initial Settings

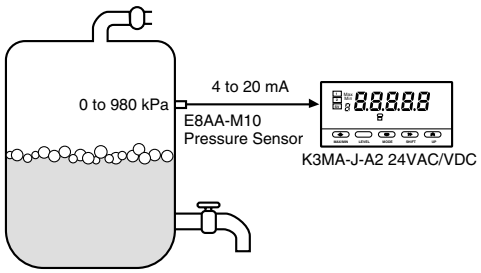


■ Setting Example

Initial Settings

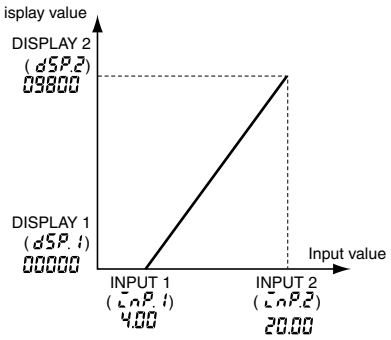
The settings for the following example are shown here.

Example: Tank pressure display



Here, the pressure inside the tank is to be displayed in units of 0.1 kPa.

- Pressure Sensor: E8AA-M10
  Measuring range: 0 to 980 kPa, output 4 to 20 mA



1. Set the K3MA-J input type to the 4 to 20 mA input range.
   Parameter: In-t (input type), Setting value: 4-20
2. Set the display values for the corresponding input values.
   Set the scaling as shown below for the following correspondence: input 4 mA-->display 0.0, input 20 mA-->display 980.0

Parameter	Setting value
InP.1 (scaling input value 1)	4.00
dSP.1 (scaling display value 1)	00000
InP.2 (scaling input value 2)	20.00
dSP.2 (scaling display value 2)	09800
dP (decimal point position)	oooo.o

Note: The decimal point position here refers to the position in the number after scaling. When setting the scaling display value, it is necessary to consider the number of digits to be displayed past the decimal point.

■ Troubleshooting

When an error occurs, error details will be displayed on the main indicator. Confirm the error from the main indicator and take the appropriate countermeasures.

Level display	Main indicator	Error contents	Countermeasures
Not lit	E111	RAM memory error	Repair is necessary. Consult your OMRON sales representative.
5	E111	EEPROM memory error	When this error is displayed, press the Level Key for 3 seconds, and the settings will be restored to the factory settings. If the error cannot be recovered, repair is necessary. Consult your OMRON sales representative.
Not lit	Flashes 5.Err	You will see this indication when turning ON the product the first time after purchase. This is because the input signal value is 0 mA at that time even though the range is factory set to 4 to 20 mA.	At the initial setting level, set the input type and other parameters according to your application.
		Input error	Promptly change the input voltage/current to a value that falls within the measurement range. If the error cannot be recovered, repair is necessary. Consult your OMRON sales representative.
Not lit	Flashes 99999	The scaling display value exceeds 99999.	Promptly change the input to a value that falls within the specified range.
			The scaling value may be inappropriate. Review the scaling value at the initial setting level.
Not lit	Flashes -19999	The scaling display value is lower than –19999.	Promptly change the input to a value that falls within the specified range.
			The scaling value may be inappropriate. Review the scaling value at the initial setting level.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. N108-E1-03

Temperature Meter
K3MA-L

Highly Visible LCD Display with 2-color (Red and Green) LEDs

- Wide input range - select from two types of platinum-resistance thermometers and ten types of thermocouples.
- Front-panel key operation for easy setting.
- Average processing function suppresses flicker.
- Temperature input shift and temperature unit selection functions.
- Easy confirmation of max/min display.
- Short 80-mm depth (measured from edge of face plate).
- Finger protective cover (standard equipment) protects against electric shock.
- Water- and dust-proof NEMA4X (IP66 equivalent) front panel.
- Recognized to conform to U.S. and Canadian requirements under the Component Recognition Program of UL.
- CE marking.

Model Number Structure

■ Model Number Legend

K3MA-L-□ □
1 2 3

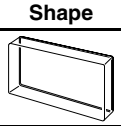
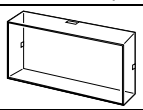
1. **Input Type**
   L: Platinum-resistance thermometer or thermocouple
2. **Output Type**
   None: No output
   C: With relay contact output (SPDT)
3. **Supply Voltage**
   100-240VAC: 100 to 240 VAC
   24VAC/VDC: 24 VAC/VDC

Ordering Information

■ List of Models

Input type	Supply voltage	Output	Model
Platinum-resistance thermometer or thermocouple	100 to 240 VAC	None	K3MA-L 100-240VAC
		1 relay contact output (SPDT)	K3MA-L-C 100-240VAC
	24 VAC/VDC	None	K3MA-L 24VAC/VDC
		1 relay contact output (SPDT)	K3MA-L-C 24VAC/VDC

■ Accessories (Order Separately)

Name	Shape	Model
Splash-proof Soft Cover		K32-49SC
Hard Cover		K32-49HC

Specifications

■ Ratings

	K3MA-L 100-240VAC, K3MA-L-C 100-240VAC	K3MA-L 24VAC/VDC, K3MA-L-C 24VAC/VDC
Supply voltage	100 to 240 VAC	24 VAC (50/60 Hz), 24 VDC
Operating voltage range	85% to 110% of the rated supply voltage	
Power consumption (under maximum load)	6 VA max.	4.5 VA max. (24 VAC) 4.5 W max. (24 VDC)
Insulation resistance	20 MΩ min. (at 500 VDC) between external terminal and case. Insulation provided between inputs, outputs, and power supply.	
Dielectric strength	2,000 VAC for 1 min between external terminal and case. Insulation provided between inputs, outputs, and power supply.	
Noise immunity	±1,500 V on power supply terminals in normal or common mode. ±1 μs, or 100 ns for square-wave noise with 1 ns.	±480 V on power supply terminals in normal mode. ±1,500 V in common mode. ±1 μs, or 100 ns for square-wave noise with 1 ns.
Vibration resistance	Vibration: 10 to 55 Hz, Acceleration: 50 m/s^2 5 min each in X, Y, and Z directions for 10 sweeps.	
Shock resistance	150 m/s^2 (100 m/s^2 for relay contact outputs) 3 times each on 3 axes, 6 directions.	
Ambient temperature	Operating: −10°C to 55°C (with no condensation or icing) Storage: −25°C to 65°C (with no condensation or icing)	
Ambient humidity	Operating: 25% to 85% (with no condensation)	
Approved safety standards	UL3121-1, conforms to EN61010-1 (Pollution degree 2/overvoltage category II) Conforms to VDE0106/P100 (finger protection)	
EMC	(EMI) EN61326+A1 Industry Emission Enclosure: CISPR 11 Group 1 class A: CISRP16-1/-2 Emission AC Mains: CISPR 11 Group 1 class A: CISRP16-1/-2 (EMS) EN61326+A1 Industry Immunity ESD: EN61000-4-2: 4 kV contact discharge, 8 kV air discharge Immunity RF-interference: EN61000-4-3: 10 V/m (amplitude-modulated, 80 MHz to 1 GHz) Electrical Fast Transient Noise: EN61000-4-4: 2 kV (power line) Immunity Burst Noise: 1 kV line to line (I/O signal line) Immunity Surge: EN61000-4-5: 1 kV (power line), 2 kV line to ground (power line) Immunity Conducted Disturbance: EN61000-4-6: 3 V (0.15 to 80 MHz) Immunity Voltage Dip/Interrupting: EN61000-4-11: 0.5 cycle, 0, 180°, 100% (rated voltage)	
Weight	Approx. 200 g	

■ Characteristics

Indication accuracy (at 23±5°C) (See note.)	Thermocouple: (±0.5% of indication value or ±1°C, whichever greater) ±1 digit max. Platinum-resistance thermometer: (±0.5% of indication value or ±1°C, whichever greater) ±1 digit max.
Input	Thermocouple: K, J, T, E, L, U, N, R, S, B Platinum-resistance thermometer: JPt100, Pt100
Measurement method	Double integral method
Sampling period	500 ms
Display refresh period	Sampling period (sampling times multiplied by number of averaging times if average processing is selected.)
Max. displayed digits	4 digits (−1999 to 9999)
Display	7-segment digital display, Character height: 14.2 mm
Polarity display	"−" is displayed automatically with a negative input signal.
Zero display	Leading zeros are not displayed.
Input shift	Input shift equivalent to the setting value supported for all points within the sensor measurement range.
Hold function	Max hold (maximum value), Min hold (minimum value)
Hysteresis setting	Programmable with front-panel key inputs (0001 to 9999).
Other functions	Display color change (green (red), green, red (green), red) Average processing (simple average OFF/2/4/8 operations) Setting change lockout Parameter initialization
Output	Relay contact (SPDT)
Delay in comparative outputs	1 s max.
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66) Rear case: IEC standard IP20 Terminals: IEC standard IP00 + finger protection (VDE0106/100)
Memory protection	Non-volatile memory (EEPROM) (possible to rewrite 100,000 times)

Note: The indication accuracy of the K thermocouple at a temperature of −200 to 1300°C is ±2°C ±1 digit maximum.
The indication accuracy of the T and N thermocouples at a temperature of −100°C or less is ±2°C ±1 digit maximum.
The indicator accuracy of the U and L thermocouples at any temperature is ±2°C ±1 digit maximum.
The indication accuracy of the B thermocouple at a temperature of 400°C or less is unrestricted.
The indication accuracy of the R and S thermocouples at a temperature of 200°C or less is ±3°C ±1 digit maximum.

■ Measuring Ranges

Platinum-resistance Thermometer

Input		Pt100			JPt100	
Range	°C	−200 to 850	−199.9 to 500.0	0.0 to 100.0	−199.9 to 500.0	0.0 to 100.0
	°F	−300 to 1500	−199.9 to 900.0	0.0 to 210.0	−199.9 to 900.0	0.0 to 210.0
Parameter		0	1	2	3	4

Thermocouple

Input		K		J		T		E	L	U		N	R	S	B
Range	°C	−200 to 1300	−20.0 to 500.0	−100 to 850	−20.0 to 400.0	−200 to 400	−199.9 to 400.0	0 to 600	−100 to 850	−200 to 400	−199.9 to 400.0	−200 to 1300	0 to 1700	0 to 1700	100 to 1800
	°F	−300 to 2300	0.0 to 900.0	−100 to 1500	0.0 to 750	−300 to 700	−199.9 to 700.0	0 to 1100	−100 to 1500	−300 to 700	−199.9 to 700.0	−300 to 2300	0 to 3000	0 to 3000	300 to 3200
Parameter		5	6	7	8	9	10	11	12	13	14	15	16	17	18

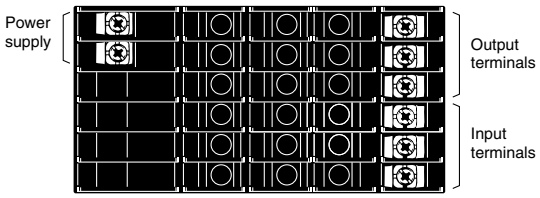
■ Input/Output Ratings

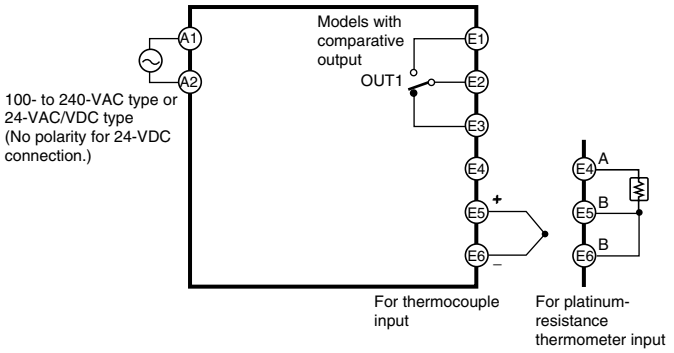
Relay Contact Output

Item	Resistive load (cosϕ = 1)	Inductive load (cosϕ = 0.4, L/R = 7 ms)
Rated load (UL ratings)	5 A at 250 VAC, 5 A at 30 VDC	1.5 A at 250 VAC, 1.5 A at 30 VDC
Rated carry current	5 A max. (at COM terminal)	
Max. contact voltage	400 VAC, 150 VDC	
Max. contact current	5 A (at COM terminal)	
Max. switching capacity	2,000 VA, 192 W	375 VA, 30 W
Min. permissible load (P level, reference value)	10 mA at 5 VDC	
Mechanical life	20,000,000 times min. (at a switching frequency of 1,200 time/min)	
Electrical life (at an ambient temperature of 20°C)	100,000 times min. (at a rated load switching frequency of 10 time/min)	

Connections

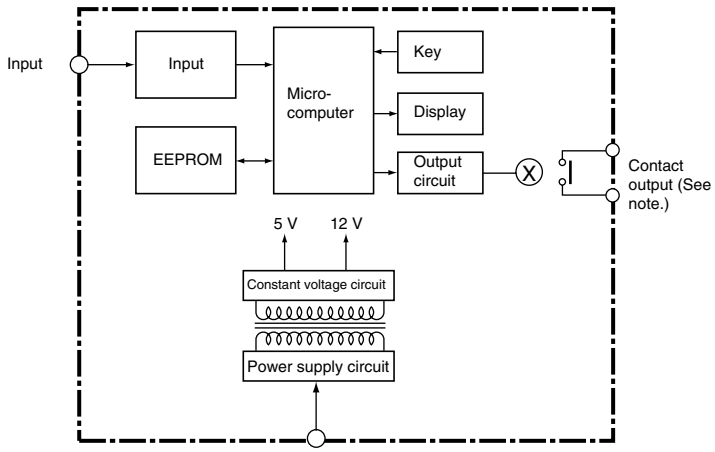
■ Terminal Arrangement





Terminal No.	Name	Description
(A1) - (A2)	Operation power	Connects the operation power supply.
(E4) - (E6) - (E5)	Thermocouple or platinum-resistance thermometer input	Connects the thermocouple or platinum-resistance thermometer input.
(E1), (E2) - (E3)	Outputs	Outputs the relay outputs.

■ Block Diagram



Note: Relay output models only.

Operation

■ Main Functions

Input Types and Ranges

Parameter	Setting	Input type	Meaning		
in-t	0	Platinum-resistance thermometer	Pt100	–200 to 850°C	–300 to 1500°F
	1			–199.9 to 500.0°C	–1999 to 900.0°F
	2			0.0 to 100.0°C	0.0 to 210.0°F
	3		JPt100	–199.9 to 500.0°C	–199.9 to 900.0°F
	4			0.0 to 100.0°C	0.0 to 210.0°F
	5	Thermocouple	K	–200 to 1300°C	–300 to 2300°F
	6			–20.0 to 500.0°C	0.0 to 900.0°F
	7		J	–100 to 850°C	–100 to 1500°F
	8			–20.0 to 400.0°C	0.0 to 750.0°F
	9		T	–200 to 400°C	–300 to 700°F
	10			–199.9 to 400.0°C	–199.9 to 700.0°F
	11		E	0 to 600°C	0 to 1100°F
	12		L	–100 to 850°C	–100 to 1500°F
	13		U	–200 to 400°C	–300 to 700°F
	14			–199.9 to 400.0°C	–199.9 to 700.0°F
	15		N	–200 to 1300°C	–300 to 2300°F
	16		R	0 to 1700°C	0 to 3000°F
	17		S	0 to 1700°C	0 to 3000°F
	18		B	100 to 1800°C	300 to 3200°F

Note: The initial value is "5: thermocouple K (–200 to 1300°C/–300 to 2300°F)."

Temperature Unit Selection

Either centigrade (°C) or fahrenheit (°F) can be selected as the temperature unit.

Parameter	Setting	Meaning
d-U	C	Display in °C.
	F	Display in °F.

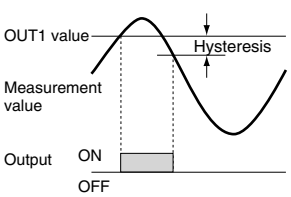
OUT Types (Comparative Output Models Only)

OUT 1 can be set to operate in one of the three following modes in accordance with the compared values:

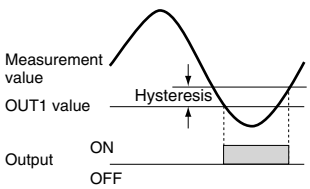
- Upper limit (High Acting):
  The output is turned ON when the measurement value is greater than its set value.
- Lower limit (Low Acting):
  The output is turned ON when the measurement value is less than its set value.
- Upper and lower limits (Outside Band Acting):
  An upper limit (H set value) and lower limit (L set value) can be set independently.
  The output is turned ON when the measurement value is greater than the upper-limit set value or less than the lower-limit set value.

Parameter	Setting	Meaning
oUt 1.t	HC	Upper limit: Alarm operates at upper limit.
	Lo	Lower limit: Alarm operates at lower limit.
	HC-Lo	Upper and lower limits: Alarm operates at upper and lower limits.

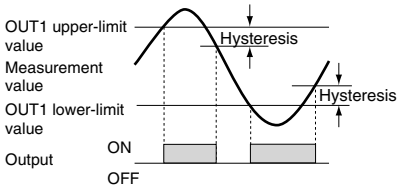
Upper Limit (High Acting)



Lower Limit (Low Acting)



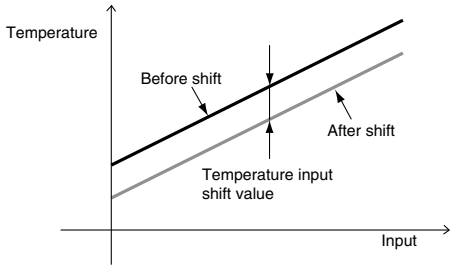
Upper and Lower Limits (Outside Band Acting)



Temperature Input Shift

Input shift equivalent to the setting value supported for all points within the sensor measurement range.

Parameter	Setting
inS	-1999 to 9999



Parameter Initialization

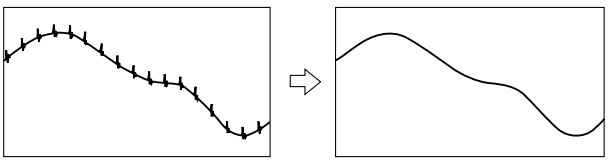
This function returns all of the parameters to their initial values.

Parameter	Setting	Meaning
InIt	oFF	---
	on	Initializes all parameters.

Use this to reset the K3MA-L after returning it to its factory-set condition.

Average Processing

Average processing stabilizes displayed values to minimize flicker by averaging the fluctuating input signals. Average processing can be performed for the measurement values in either of four steps (OFF, 2 times, 4 times, or 8 times).

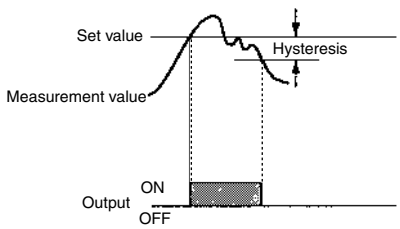


This is useful for ignoring rapid fluctuations, e.g., eliminating spike noise.

Hysteresis (Comparative Output Models Only)

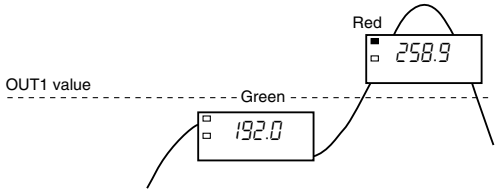
The hysteresis of comparative outputs can be set to prevent chattering in the output when the measurement value fluctuates finely near the OUT value.

Upper limit (high acting)



Changing the Display Color

The color of the value displayed can be set to either red or green. For comparative output models, the display color can be set to change from green to red, or from red to green, according to the status of the comparison criterion.



Display Auto-return Time

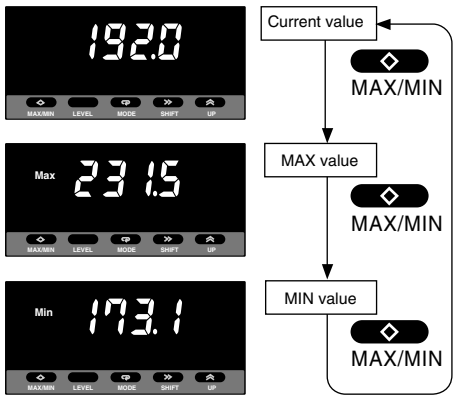
This function automatically returns the display to the operation level's current value if no keys are pressed for a preset time (called the display auto-return time).

Move-to-Protect-Level Time

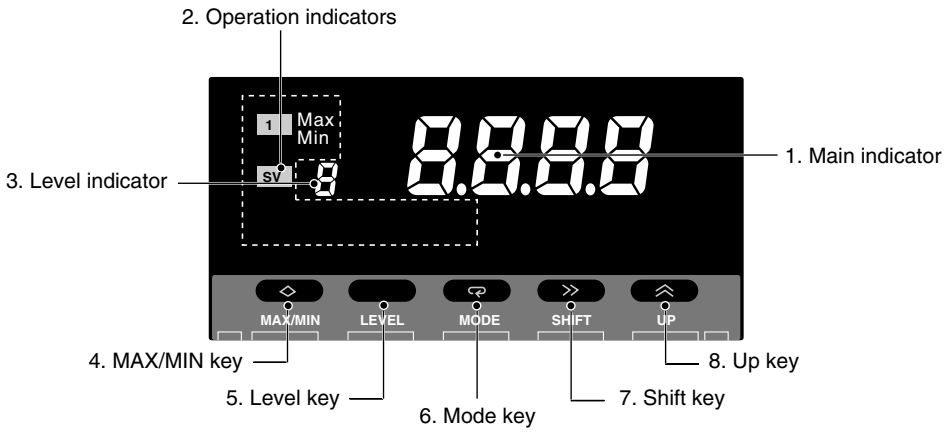
The time required to shift to the protect level can be set as desired.

MAX/MIN Display

The maximum and minimum measurement (display) values from the time the power is turned ON until the current time can be stored and displayed. This is useful, for example, when measuring the maximum value.



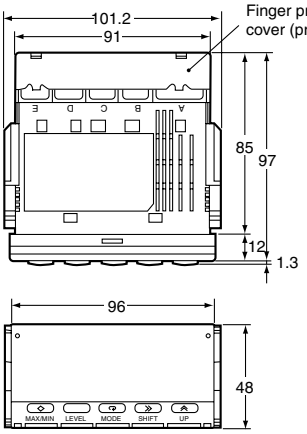
Nomenclature



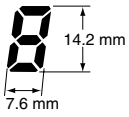
Name		Functions
1. Main indicator		Displays current values, parameters, and set values.
2. Operation indicators	1	Lit when output 1 is ON.
	SV	Lit when a set value is being displayed or changed.
	Max	Lit when the main indicator is showing the MAX value.
	Min	Lit when the main indicator is showing the MIN value.
3. Level indicator		Displays the current level that the K3MA-L is in. (See below for details.)
4. MAX/MIN Key		Used to display the MAX and MIN values when a measurement value is being displayed.
5. Level Key		Used to change the level.
6. Mode Key		Used to allow the main indicator to indicate parameters sequentially.
7. Shift Key		Used to enable a set value to be changed. When changing a set value, this key is used to move along the digits.
8. Up Key		Used to change a set value. Used to set or clear a forced-zero function when a measurement value is being displayed.

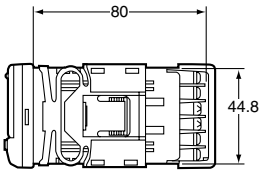
Level indicator	Level
P	Protect
Not lit	Operation
A	Adjustment
S	Initial setting
F	Advanced-function setting

Dimensions

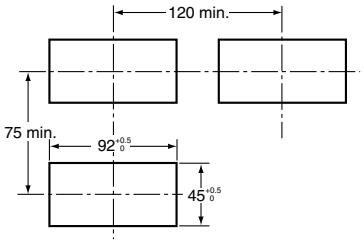


Main indicator character size





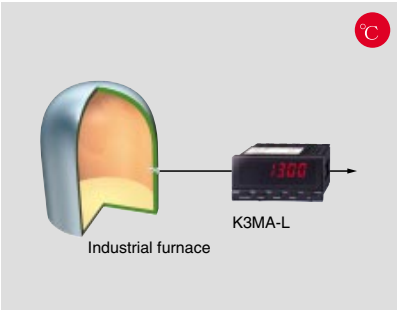
Panel cut-out



The K3MA-L uses M3 terminals.
A terminal cover is provided.

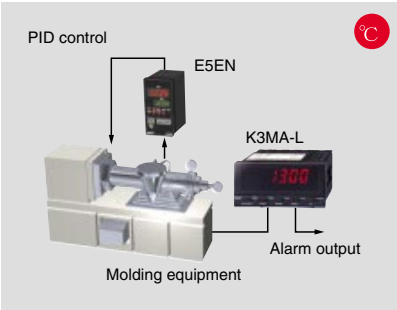
Application Examples

Monitoring the temperature of an industrial furnace



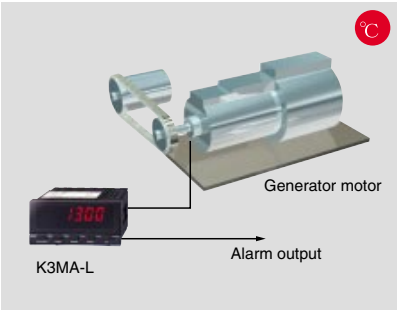
- Monitoring the temperature of an industrial furnace/sintering furnace.
- Monitoring/alarm function for disinfecting equipment.

Sending a temperature alarm for molding equipment



- Monitoring (failsafe checking) abnormal temperatures in molding equipment.
- Monitoring the liquid temperature for cleaning devices.

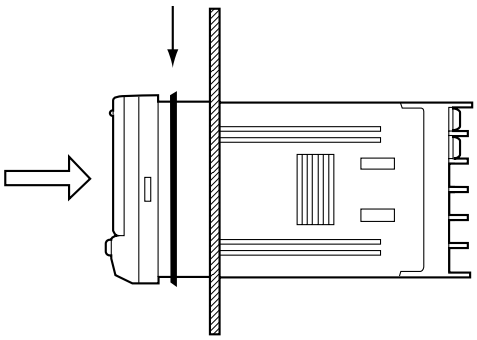
Monitoring the bearing temperature for a generator motor



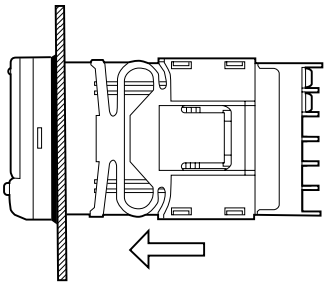
- Monitoring temperature rises in electric power generating facilities.
- Inspecting temperatures in machines and devices.

Installation

1. Insert the K3MA-L into the panel cut-out hole.
2. For a waterproof installation, insert the rubber gasket onto the body of the K3MA-L.



3. Fit the adaptor into the grooves on the left and right sides of the rear case, then push it until it contacts the panel to secure the K3MA-L.

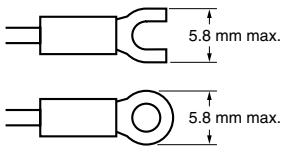


■ Wiring Precautions

- Use crimp terminals.
- Tighten the terminal screws to a torque of approximately 0.5 N·m.
- To avoid the influence of noise, route signal lines and power lines separately.

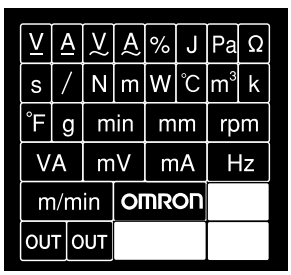
■ Wiring

- Use the following M3 crimp terminals.



■ Unit Labels (Provided)

- The unit labels are not attached to the K3MA-L. Select the desired labels from the provided sheet.



Note: For scales and gauges, use the unit labels that are specified by the relevant laws or regulations.

Precautions

⚠ WARNING

Do not touch any of the terminals while the power is being supplied. Doing so may result in electric shock.

⚠ Caution

Do not disassemble the product or touch the internal components of the product while the power is being supplied. Doing so may result in electric shock.

⚠ Caution

Do not allow metal objects or wire cuttings to enter the product. Doing so may result in electric shock, fire, or malfunction.

⚠ Caution

Perform correct settings for the product according to the control application. Failure to do so may cause unexpected operation, resulting in damage to the product or injury.

⚠ Caution

Take safety measures, such as installing a separate monitoring system, to ensure safety even if the product fails. Product failure may prevent comparative outputs from being generated, resulting in serious accidents.

Observe the following precautions to ensure safety.

1. Maintain the power supply voltage within the range specified in the specifications.
2. Maintain the load within the ratings specified in the specifications.
3. Check each terminal for correct number and polarity before connecting it. Incorrect or reverse connections may damage or burn out internal components in the product.
4. Tighten the terminal screws securely. The recommended tightening torque is 0.43 to 0.58 N·m. Loose screws may cause fire or malfunction.
5. Do not connect anything to unused terminals.
6. Provide a switch or circuit breaker so that operators can easily turn OFF the power supply when necessary. Also provide appropriate indications of such devices.
7. Do not attempt to disassemble, repair, or modify the product.
8. Do not use the product where flammable or combustible gases are present.

Application

General Precautions

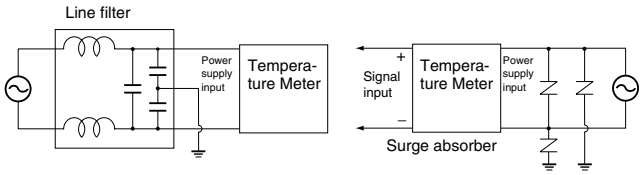
1. Do not use the product in the following locations:
   - Locations subject to direct radiant heat from heating equipment.
   - Locations subject to exposure to water, oil, or chemicals.
   - Locations subject to direct sunlight.
   - Locations subject to dust or corrosive gases (particularly, sulfuric gas or ammonia gas).
   - Locations subject to severe changes in temperature.
   - Locations subject to icing or condensation.
   - Locations subject to shock or vibration.
2. Do not block heat dissipation around the product, i.e., provide sufficient space for heat dissipation.
3. Ensure that the rated voltage is reached within two seconds after the power is turned ON.
4. Conduct aging for 15 minutes min. after power is turned ON for correct measurement.
5. Do not touch the slit sections or terminals while the power is being supplied to prevent the product from being affected by static electricity.
6. Do not lay heavy objects on the product during use or storage. Doing so may deform or deteriorate the product.
7. Do not use paint thinner for cleaning. Use commercially available alcohol.

Mounting

- Mount the product to a panel that is 1 to 8 mm thick.
- Install the product in a horizontal position.
- Use crimp terminals that match screw sizes.

Noise Prevention

- Install the product as far as possible from devices that generate strong, high-frequency fields (such as high-frequency welders or sewing machines) or surges.
- Install surge absorbers or noise filters on nearby devices that generate noise (particularly motors, transformers, solenoids, magnet coils, and other devices that have a high inductance component). Do not connect a surge absorber to the temperature sensor input section of the K3MA-L.



- To prevent inductive noise, separate the terminal block wiring for the product from high-voltage or high-current power lines. Do not route the wiring for the product in parallel with or tie it in a bundle with power lines.
  Take the following countermeasures against inductive noise in input lines.

  Temperature Inputs
  Separate the lead wire that connects the product with a temperature sensor from the load line to prevent the product from being affected by inductive noise.
- When using a noise filter for the power supply, check for the voltage and current and install it as close as possible to the Temperature Meter.
- Do not install the product near radios, television sets, or wireless devices. Doing so may cause reception interference.

Increasing Service Life

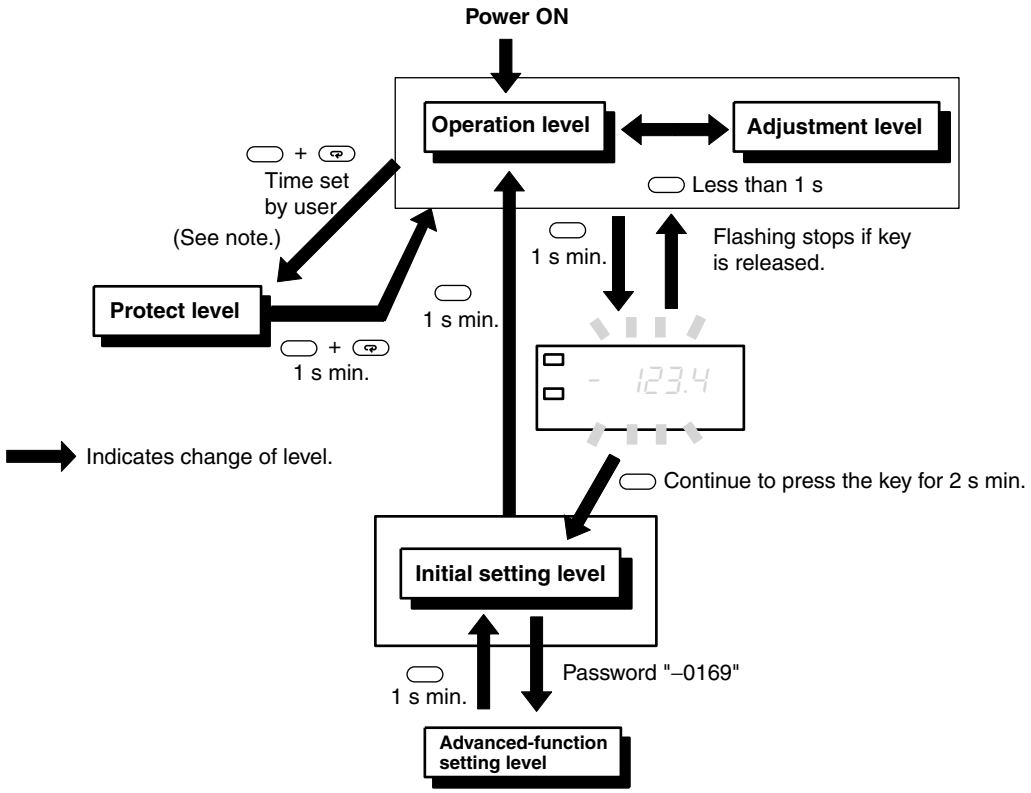
- Do not use the product in locations where the temperature or humidity exceeds the ratings or where condensation may occur. When installing the product in a panel, be sure that the temperature around the product (not the temperature around the panel) does not exceed the ratings. The product service life depends on the ambient temperature. The higher the ambient temperature, the shorter the service life. To extend the product service life, lower the temperature inside the Temperature Meter.
- Use and store the product within the temperature and humidity ranges given in the specifications. When gang-mounting Temperature Meters or arranging them vertically, heat generated by the Temperature Meters will cause the internal temperature to rise, reducing the service life. In such cases, consider forced cooling methods, such as using a fan to circulate air around the Temperature Meters. Do not, however, allow only the terminals to be cooled. Doing so will increase measurement error.
- The life of the output relays are greatly affected by the switching capacity and switching conditions. Use these relays within their rated load and electrical life. The contacts may fuse or burn if they are used past their electrical life.

Operating Procedures

■ Levels

"Level" refers to a grouping of parameters. The following table lists the operations that are possible in each of the levels, and the diagram tells how to move between levels. There are some parameters that are not displayed for certain models.

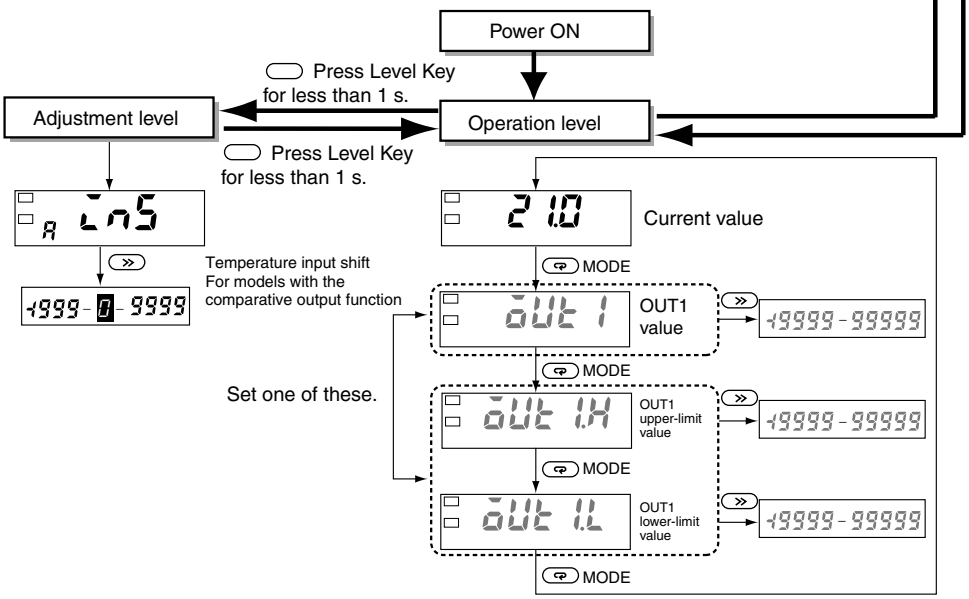
Level name	Function	Measurement
Protect	Setting lockouts.	Continue
Operation	Displaying current values, and setting OUT 1 value.	Continue
Adjustment	Setting communications writing control.	Continue
Initial setting	Making initial settings of input type, output operating action, and other parameters.	Stopped
Advanced-function setting	Setting average processing, display color settings, and other advanced function parameters.	Stopped

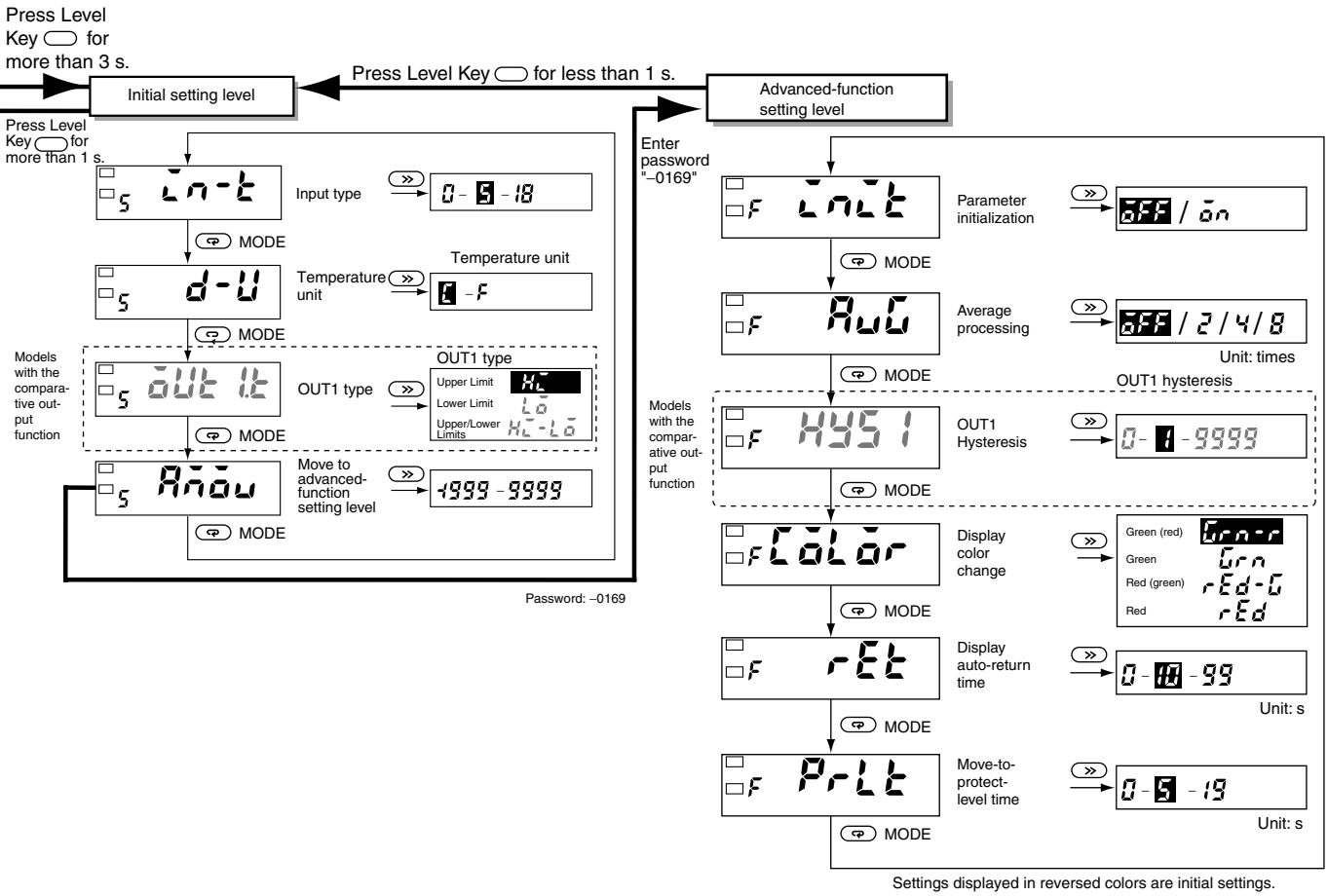


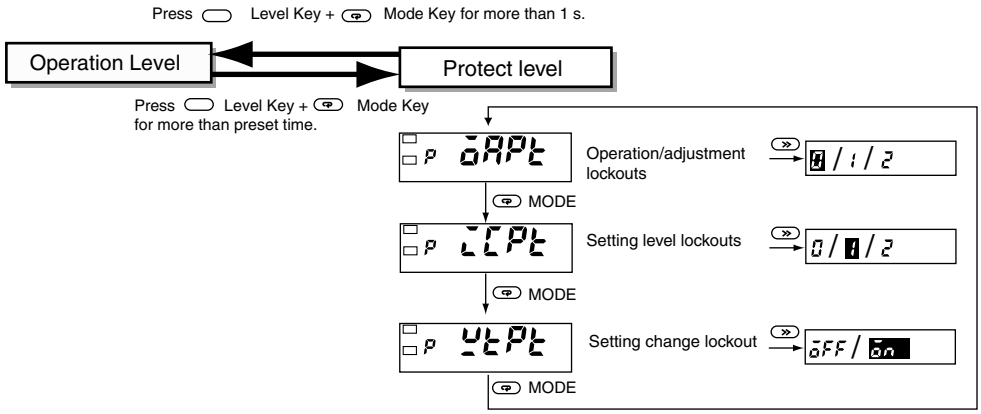
Note: The move-to-protect-level time can be set in the advanced-function setting level.

■ Parameters

Note: 1. Some parameters are not displayed for certain models.
2. The K3MA-L will stop measurement if the level is changed to the initial setting level or the advanced-function setting level.
3. If the input range is changed, some parameters are set to default values. Therefore, set the input range first.
4. Settings displayed in reversed colors are defaults.




Press Level Key for more than 3 s.
Initial setting level
Press Level Key for less than 1 s.
Advanced-function setting level
Press Level Key for more than 1 s.
Input type
MODE
Temperature unit
Temperature unit
Models with the comparative output function
OUT1 type
Upper Limit
Lower Limit
Upper/Lower Limits
Move to advanced-function setting level
Password: –0169
Enter password "–0169"
Parameter initialization
Average processing
Unit: times
OUT1 hysteresis
OUT1 Hysteresis
Display color change
Green (red)
Green
Red (green)
Red
Display auto-return time
Unit: s
Move-to-protect-level time
Unit: s
Settings displayed in reversed colors are initial settings.



Operation/Adjustment Lockouts

Restricts key operations for operation level and adjustment level.

Parameter	Setting	Operation level		Moving to adjustment level
		Process value display	Set value display	
oAPt	0	Allowed	Allowed	Allowed
	1	Allowed	Allowed	Prohibited
	2	Allowed	Prohibited	Prohibited

- Initial setting is 0.
- This cannot be displayed on models not equipped with the comparative output function.

Setting Level Lockouts

Restricts shifting to initial setting level or advanced-function setting level.

Parameter	Setting	Shift to initial setting level	Shift to advanced-function setting level
LCPt	0	Allowed	Allowed
	1	Allowed	Prohibited
	2	Prohibited	Prohibited

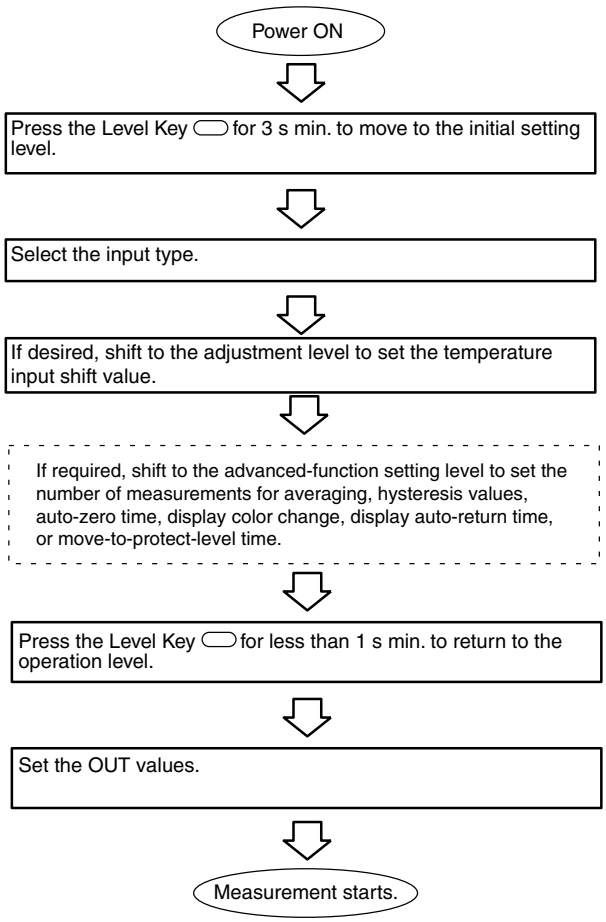
Setting Change Lockout

Restricts setting changes by key operation. When this lockout is set, it is no longer possible to shift to a setting change mode.

Parameter	Setting	Setting change by key operation
YtPt	oFF	Allowed
	on	Prohibited

However, all protect level parameters can still be changed.

■ Initial Settings

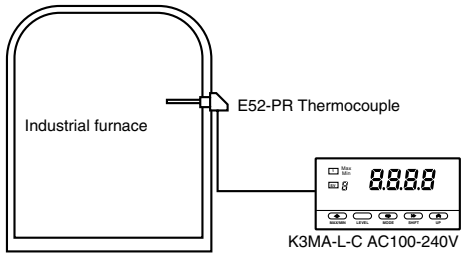


■ Setting Example

Initial Settings

The settings for the following example are shown here.

Example: Monitoring the temperature of an industrial furnace



Here, the temperature inside the furnace is to be displayed in centigrade (°C).
Temperature sensor: E52-PR Thermocouple, Measurement range: 0 to 1,400°C.

1. Set the K3MA-L input type to the thermocouple R input range.
   Parameter: in-t (input type), Setting value: 16
2. Select centigrade (°C) as the temperature unit.
   Parameter: d-U (temperature unit), Setting value: C

If you are using a comparative output model, make the setting as desired.

■ Troubleshooting

When an error occurs, error details will be displayed on the main indicator. Confirm the error from the main indicator and take the appropriate countermeasures.

Level display	Main indicator	Error contents	Countermeasures
Not lit	E111	RAM memory error	Repair is necessary. Consult your OMRON sales representative.
5	E111	EEPROM memory error	When this error is displayed, press the Level Key for 3 seconds, and the settings will be restored to the factory settings. If the error cannot be recovered, repair is necessary. Consult your OMRON sales representative.
Not lit	Flashes 5.Err	Input error	Confirm that the temperature sensor is correctly connected, and that there are no broken signal lines to the temperature sensor. If the condition does not return to normal, repair is necessary. Consult your OMRON sales representative.
Not lit	Flashes 9999	The measurement value after temperature input correction exceeds 9999.	The temperature input correction value may be inappropriate. Use the adjustment level to review the temperature input correction value.
Not lit	Flashes -1999	The measurement value after temperature input correction is lower than −1999.	The temperature input correction value may be inappropriate. Use the adjustment level to review the temperature input correction value.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. N109-E1-03

Frequency/Rate Meter
K3MA-F

Highly Visible LCD Display with 2-color (Red and Green) LEDs

- Contact, NPN, PNP, or voltage pulse input.
- Front-panel key operation for easy setting.
- Average processing function suppresses flicker.
- Includes scaling, auto-zero time, startup compensation time functions.
- Easy confirmation of max/min display.
- Short 80-mm depth (measured from edge of face plate).
- Finger protective cover (standard equipment) guards against electric shock.
- Water- and dust-proof NEMA4X (IP66 equivalent) front panel.
- Recognized to U.S. and Canadian requirements under the Component Recognition Program of UL.
- CE marking.

Model Number Structure

■ Model Number Legend

K3MA-F-□ □
1 2 3

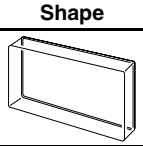
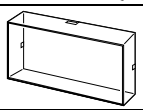
1. **Input Type**
   F: Rotary pulse
2. **Output Type**
   None: No output
   A2: 2 relay contact outputs (SPST-NO)
3. **Supply Voltage**
   100-240VAC: 100 to 240 VAC
   24VAC/VDC: 24 VAC/VDC

Ordering Information

■ List of Models

Input type	Supply voltage	Output	Model
Rotary pulse	100 to 240 VAC	None	K3MA-F 100-240VAC
		2 relay contact outputs (SPST-NO)	K3MA-F-A2 100-240VAC
	24 VAC/VDC	None	K3MA-F 24VAC/VDC
		2 relay contact outputs (SPST-NO)	K3MA-F-A2 24VAC/VDC

■ Accessories (Order Separately)

Name	Shape	Model
Splash-proof Soft Cover		K32-49SC
Hard Cover		K32-49HC

Specifications

■ Ratings

Model	K3MA-F 100-240VDC, K3MA-F-A2 100-240VAC	K3MA-F 24VAC/VDC, K3MA-F-A2 24VAC/VDC
Supply voltage	100 to 240 VAC	24 VAC/VDC
Operating voltage range	85% to 110% of the rated supply voltage	
Power consumption (under maximum load)	6 VA max.	4.5 VA max. (24 VAC) 4.5 W max. (24 VDC)
Insulation resistance	20 MΩ min. (at 500 VDC) between external terminal and case. Insulation provided between inputs, outputs, and power supply.	
Dielectric strength	2,000 VAC for 1 min between external terminal and case. Insulation provided between inputs, outputs, and power supply.	
Noise immunity	±1,500 V on power supply terminals in normal or common mode. ±1 μs, or 100 ns for square-wave noise with 1 ns.	±480 V on power supply terminals in normal mode. ±1,500 V in common mode. ±1 μs, or 100 ns for square-wave noise with 1 ns.
Vibration resistance	Vibration: 10 to 55 Hz, Acceleration: 50 m/s^2 5 min each in X, Y, and Z directions for 10 sweeps.	
Shock resistance	150 m/s^2 (100 m/s^2 for relay contact outputs) 3 times each on 3 axes, 6 directions.	
Ambient temperature	Operating: −10°C to 55°C (with no condensation or icing) Storage: −25°C to 65°C (with no condensation or icing)	
Approved safety standards	UL3121-1, conforms to EN61010-1 (Pollution degree 2/overvoltage category II) Conforms to VDE0106/P100 (finger protection)	
EMC	(EMI) EN61326+A1 Industry Emission Enclosure: CISPR 11 Group 1 class A: CISRP16-1/-2 Emission AC Mains: CISPR 11 Group 1 class A: CISRP16-1/-2 (EMS) EN61326+A1 Industry Immunity ESD: EN61000-4-2: 4 kV contact discharge, 8 kV air discharge Immunity RF-interference: EN61000-4-3: 10 V/m (amplitude-modulated, 80 MHz to 1 GHz) Electrical Fast Transient Noise: EN61000-4-4: 2 kV (power line) Immunity Burst Noise: 1 kV line to line (I/O signal line) Immunity Surge: EN61000-4-5: 1 kV (power line), 2 kV line to ground (power line) Immunity Conducted Disturbance: EN61000-4-6: 3 V (0.15 to 80 MHz) Immunity Voltage Dip/Interrupting: EN61000-4-11: 0.5 cycle, 0, 180°, 100% (rated voltage)	
Weight	Approx. 200 g	

■ Characteristics

Input signal	No-voltage contact (30 Hz max., ON/OFF pulse width: 15 ms min.) Voltage pulse (5 kHz max., ON/OFF pulse width: 90 μs min., ON voltage: 4.5 to 30 V/OFF voltage: 0 to 2 V) Open collector (5 kHz max., ON/OFF pulse width 90 μs min.) **Connectable Sensors** ON residual voltage: 2.5 V max. OFF leakage current: 0.1 mA max. Load current: Must have switching capacity of 15 mA min. Must be able to dependably switch a load current of 5 mA max.
Measuring accuracy	±0.1%FS ±1 digit (at 23±5°C)
Measurement method	Cycle measurement
Max. displayed digits	5 digits (–19999 to 99999)
Display	7-segment digital display, Character height: 14.2 mm
Polarity display	"–" is displayed automatically with a negative input signal.
Zero display	Leading zeros are not displayed.
Scaling function	Programmable with front-panel key inputs (range of display: –19999 to 99999). The decimal point position can be set as desired.
Hold function	Max hold (maximum value), Min hold (minimum value)
Hysteresis setting	Programmable with front-panel key inputs (0001 to 9999).
Other functions	Scaling teach function Display color change (green (red), green, red (green), red) OUT type change (upper limit, lower limit, upper/lower limit) Average processing (simple average OFF/2/4/8 operations) Auto-zero time Startup compensation time Setting change lockout Parameter initialization Display auto-return time
Output	Relays: 2 SPST-NO
Delay in comparative outputs	750 ms max.
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66) Rear case: IEC standard IP20 Terminals: IEC standard IP00 + finger protection (VDE0106/100)
Memory protection	Non-volatile memory (EEPROM) (possible to rewrite 100,000 times)

■ Measuring Ranges

No-voltage Contact/Open Collector Inputs

Input	Measuring range	Measuring accuracy	Displayable range
No-voltage contact (30 Hz max.) with ON/OFF pulse width of 15 ms min.	0.05 to 30.00 Hz	±0.1% FS ±1 digit max. (at 23±5°C)	–19999 to 99999 (with scaling function)
Open collector (5 kHz max.) with ON/OFF pulse width of 90 μs min.	0 to 5,000 Hz		

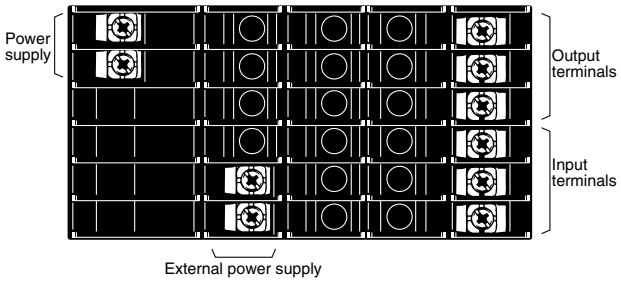
■ Input/Output Ratings

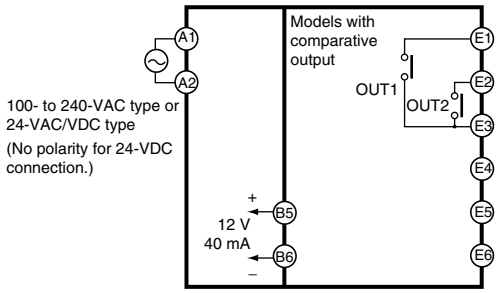
Relay Contact Output

Item	Resistive load (cosϕ = 1)	Inductive load (cosϕ = 0.4, L/R = 7 ms)
Rated load (UL ratings)	5 A at 250 VAC, 5 A at 30 VDC	1.5 A at 250 VAC, 1.5 A at 30 VDC
Rated carry current	5 A max. (at COM terminal)	
Max. contact voltage	250 VAC, 150 VDC	
Max. contact current	5 A (at COM terminal)	
Max. switching capacity	1,250 VA, 150 W	250 VA, 30 W
Min. permissible load (P level, reference value)	10 mA at 5 VDC	
Mechanical life	5,000,000 times min. (at a switching frequency of 1,200 times/min)	
Electrical life (at an ambient temperature of 20°C)	100,000 times min. (at a rated load switching frequency of 10 times/min)	

Connections

■ Terminal Arrangement

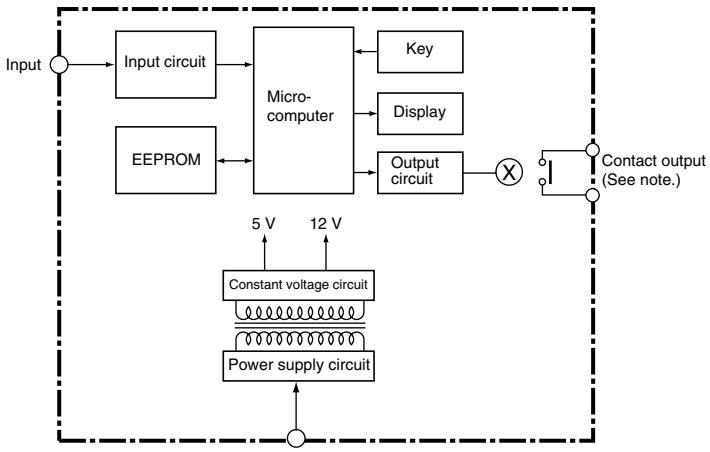




Note: Refer to *Input Circuits* on page 5.

Terminal No.	Name	Description
A1 - A2	Operation power	Connects the operation power supply.
E4, E6 - E5	Pulse input	No-voltage contact/open collector input
E1, E2 - E3	Outputs	Outputs the relay outputs.
B5 - B6	External power supply	Use as the power supply for sensors.

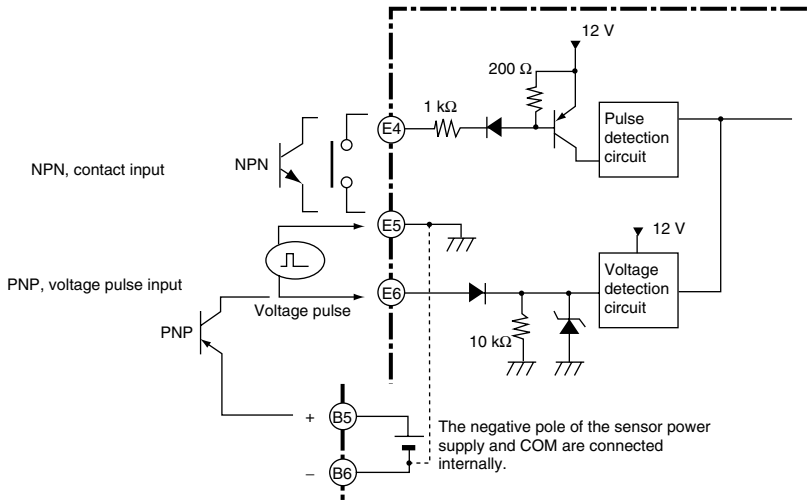
■ Block Diagram



Note: Relay output models only.

■ Input Circuits

Pulse Input



Operation

■ Main Functions

Input Types and Ranges

Frequency range (setting parameter)	Function	Input range (setting parameters)	Setting range
Pulse frequency selection (P-FrE)	Selects pulse input signal.	0.05 to 30.00 Hz (30)	Displayable from –19999 to 99999 with scaling function. The position of the decimal point can be set as desired.
		0 to 5 kHz (5P)	

Pulse Frequency Selection

Parameter	Setting value	Meaning
P-FrE	3	0.05 to 30.00 Hz measurement range
	5P	0 to 5 kHz measurement range

Note: The initial value is "0 to 5 kHz (5P)."

Scaling

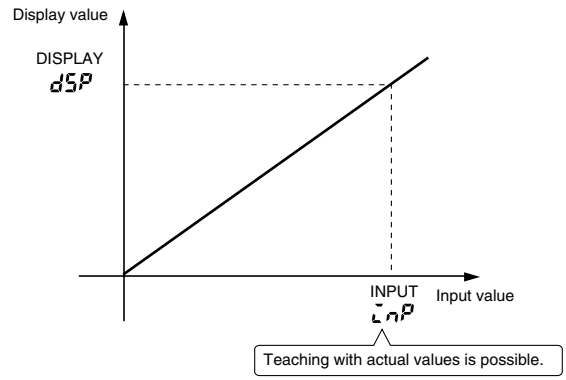
When the desired display value is set for a corresponding input, the value will be displayed on a line between two points determining the zero point.

Parameter	Setting value	Meaning
InP	0 to 99999	Input value for dSP
dSP	-19999 to 99999	Display value for InP

Parameter	Setting value	Meaning
dP	0.0000	Display four digits after decimal point
	00.000	Display three digits after decimal point
	000.00	Display two digits after decimal point
	0000.0	Display one digit after decimal point
	00000	No decimal point

Note: The initial value will change depending on the pulse frequency selection.

- The decimal point can be optionally displayed.
- When displaying the decimal point, consider the number of digits to follow the decimal point prior to setting the scaling display value.
- If P-FrE is set to 30, the initial setting for the decimal display will be 000.00.

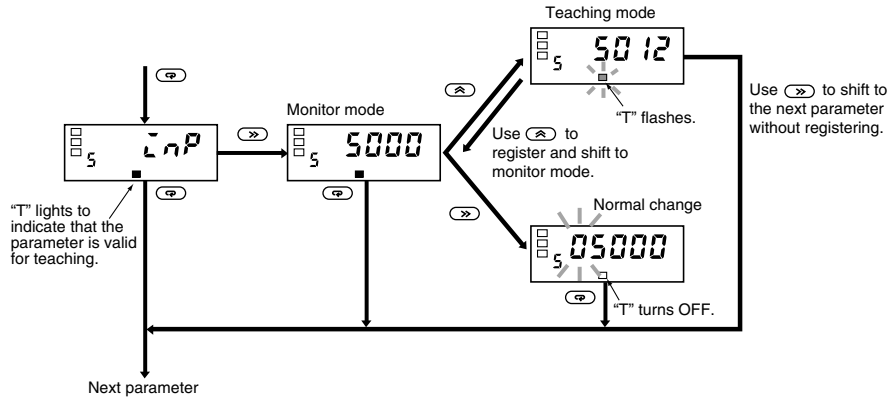


Instead of setting by inputting with the Up Key and Shift Key, current values can be input as scaling input values for teaching. This is useful for making settings while checking the operation status of the K3MA-F.

Convenient Functions

Scaling Teach

The parameter (tnP) for the K3MA-F's initial setting level can be set using actual input values with the teaching function. After displaying the parameter, the actual input settings can be made with the following operation.

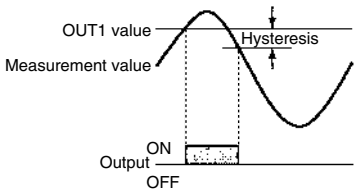


OUT Types (Comparative Output Models Only)

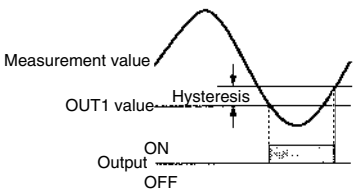
OUT 1 and OUT 2 can be set to operate in one of the three following modes in accordance with the compared values:

- Upper limit (High Acting):
  The output is turned ON when the measurement value is greater than its set value.
- Lower limit (Low Acting):
  The output is turned ON when the measurement value is less than its set value.
- Upper and lower limits (Outside Band Acting):
  An upper limit (H set value) and lower limit (L set value) can be set independently.
  The output is turned ON when the measurement value is greater than upper-limit set value or less than the lower-limit set value.

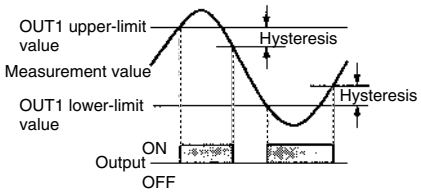
Upper Limit (High Acting)



Lower Limit (Low Acting)

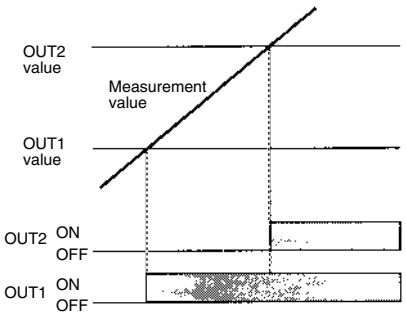


Upper and Lower Limits (Outside Band Acting)

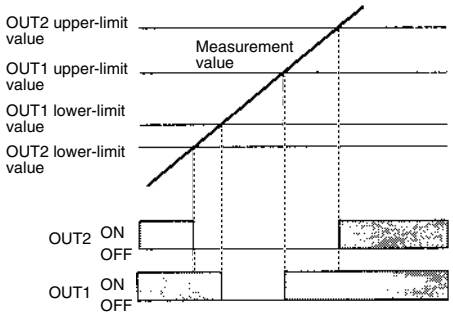


The three types of output operations shown above can be combined as desired. The following are examples of possible combinations.

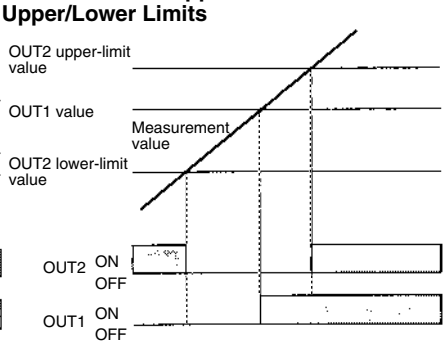
Upper Limit 2-stage Output



Threshold Output



Combination of Upper Limit and Upper/Lower Limits



Parameter Initialization

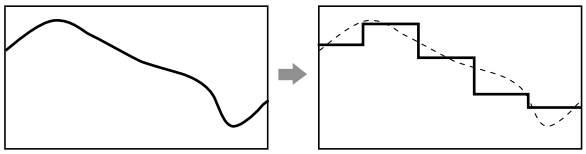
This function returns all of the parameters to their initial values.

Parameter	Setting value	Meaning
InIt	oFF	---
	on	Initializes all parameters.

Use this to reset the K3MA-F after returning it to its factory-set condition.

Average Processing

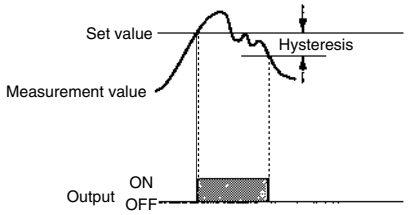
Average processing stabilizes the display by minimizing any pulsating or flicker caused by fluctuations in the pulse width of sensor input or by eccentricity in rotating shafts.



Hysteresis (Comparative Output Models Only)

The hysteresis of comparative outputs can be set to prevent chattering in the output when the measurement value fluctuates finely near the OUT value.

Upper limit (high acting)

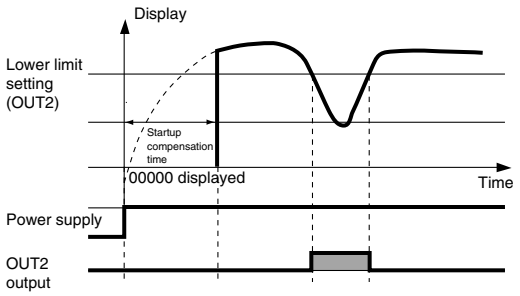


Auto-zero Time

This function sets the time for the display to return to zero when input pulses stop. Set the time longer than the expected input pulse cycle (the interval between one input pulse and the next). Proper measurement is not possible if the time is set shorter than the input pulse cycle.

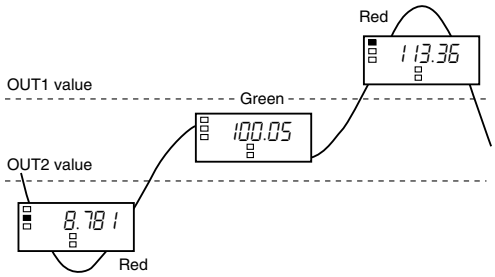
Startup Compensation Time

The startup compensation time cancels measurement for a predetermined time when turning power ON, to prevent unwanted output due to temporary input fluctuations.



Changing the Display Color

The color of the value displayed can be set to either red or green. For comparative output models, the display color can be set to change from green to red, or from red to green, according to the status of the comparison criterion.



Display Auto-return Time

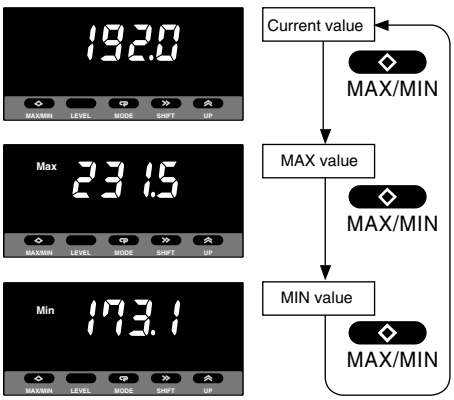
This function automatically returns the display to the operation level's current value if no keys are pressed for a preset time (called the display auto-return time).

Move-to-Protect-Level Time

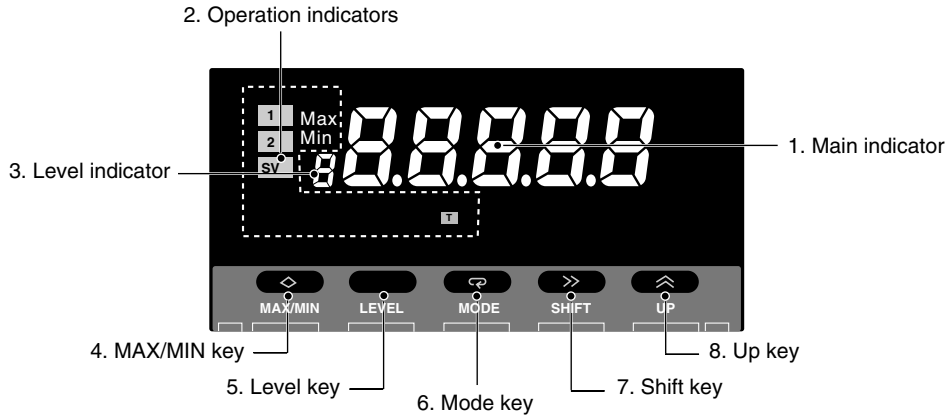
The time required to shift to the protect level can be set as desired.

MAX/MIN Display

The maximum and minimum measurement (display) values from the time the power is turned ON until the current time can be stored and displayed. This is useful, for example, when measuring the maximum value.



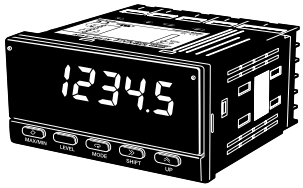
Nomenclature

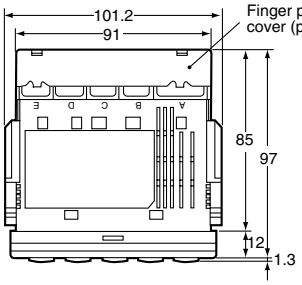


Name		Functions
1. Main indicator		Displays current values, parameters, and set values.
2. Operation indicators	1	Lit when output 1 is ON.
	2	Lit when output 2 is ON.
	SV	Lit when a set value is being displayed or changed.
	Max	Lit when the main indicator is showing the MAX value.
	Min	Lit when the main indicator is showing the MIN value.
	T	Lit when the teaching function is operable. Blinks while the teaching function is operating.
3. Level indicator		Displays the current level that the K3MA-F is in. (See below for details.)
4. MAX/MIN Key		Used to display the MAX and MIN values when a measurement value is being displayed.
5. Level Key		Used to change the level.
6. Mode Key		Used to allow the main indicator to indicate parameters sequentially.
7. Shift Key		Used to enable a set value to be changed. When changing a set value, this key is used to move along the digits.
8. Up Key		Used to change a set value. Used to set or clear a forced-zero function when a measurement value is being displayed.

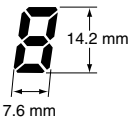
Level indicator	Level
P	Protect
Not lit	Operation
S	Initial setting
F	Advanced-function setting

Dimensions

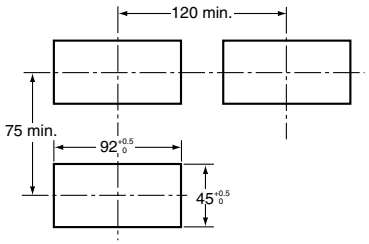


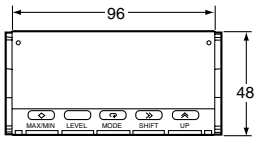


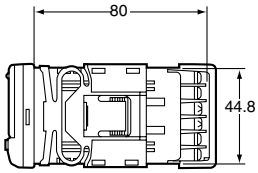
Main indicator character size



Panel cut-out



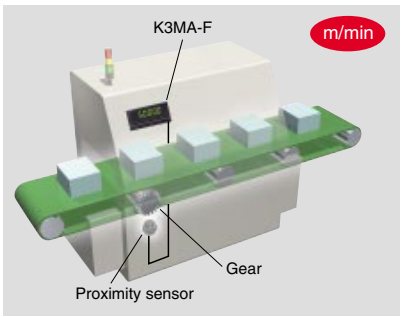




The K3MA-F uses M3 terminals.
A terminal cover is provided.

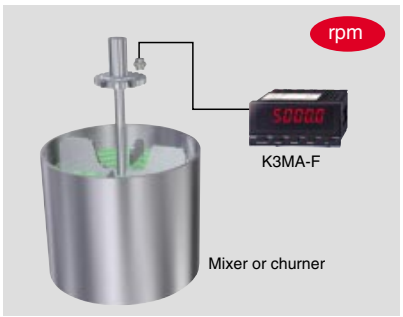
Application Examples

Displaying conveyor belt feed speed



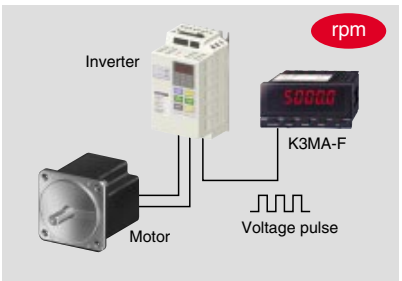
- Monitoring line speed for a reflow furnace
- Displaying feed speed for food processing, conveying, sintering

Monitoring the rotations of a mixer or churner



- Mixers for resin molding
- Powdering/pelleting machines, centrifugal separators

Displaying the monitor output from an inverter as rotations or line speed

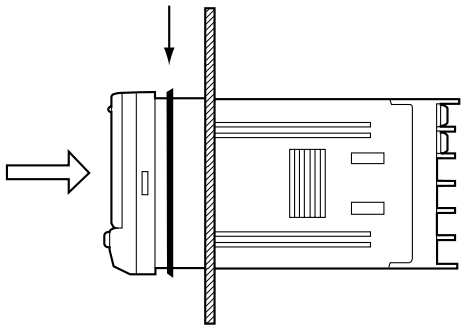


Note: If the monitor output from the inverter is analog, such as 0 to 10 V, use the K3MA-J.

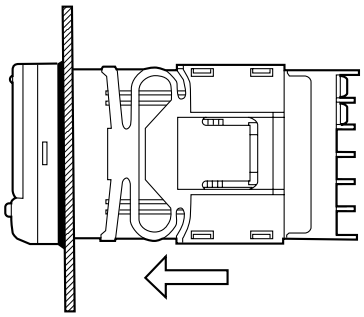
- Monitoring conveyor speed
- Machining equipment (grinders, polishers)

Installation

1. Insert the K3MA-F into the panel cut-out hole.
2. For a waterproof installation, insert the rubber gasket onto the body of the K3MA-F.



3. Fit the adaptor into the grooves on the left and right sides of the rear case, then push it until it contacts the panel to secure the K3MA-F.

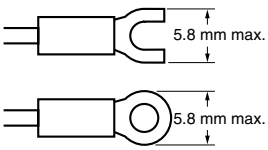


■ Wiring Precautions

- Use crimp terminals.
- Tighten the terminal screws to a torque of approximately 0.5 N·m.
- To avoid the influence of noise, route signal lines and power lines separately.

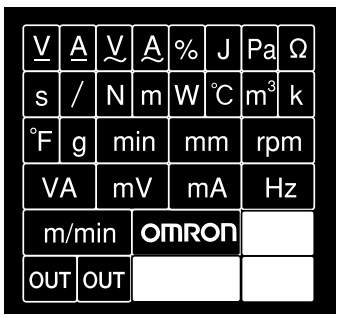
■ Wiring

- Use the following M3 crimp terminals.



■ Unit Labels (Provided)

- The unit labels are not attached to the K3MA-F. Select the desired labels from the provided sheet.



Note: For scales and gauges, use the unit labels that are specified by the relevant laws or regulations.

Precautions

⚠ WARNING

Do not touch any of the terminals while the power is being supplied. Doing so may result in electric shock.

⚠ Caution

Do not disassemble the product or touch the internal components of the product while the power is being supplied. Doing so may result in electric shock.

⚠ Caution

Do not allow metal objects or wire cuttings to enter the product. Doing so may result in electric shock, fire, or malfunction.

⚠ Caution

Perform correct settings for the product according to the control application. Failure to do so may cause unexpected operation, resulting in damage to the product or injury.

⚠ Caution

Take safety measures, such as installing a separate monitoring system, to ensure safety even if the product fails. Product failure may prevent comparative outputs from being generated, resulting in serious accidents.

Observe the following precautions to ensure safety.

1. Maintain the power supply voltage within the range specified in the specifications.
2. Maintain the load within the ratings specified in the specifications.
3. Check each terminal for correct number and polarity before connecting it. Incorrect or reverse connections may damage or burn out internal components in the product.
4. Tighten the terminal screws securely. The recommended tightening torque is 0.43 to 0.58 N·m. Loose screws may cause fire or malfunction.
5. Do not connect anything to unused terminals.
6. Provide a switch or circuit breaker so that operators can easily turn OFF the power supply when necessary. Also provide appropriate indications of such devices.
7. Do not attempt to disassemble, repair, or modify the product.
8. Do not use the product where flammable or combustible gases are present.

Application

General Precautions

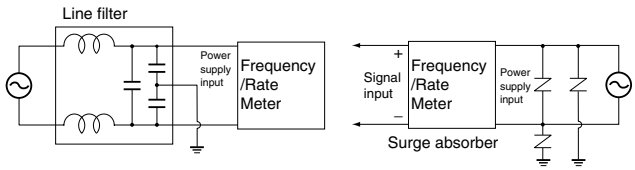
1. Do not use the product in the following locations:
   - Locations subject to direct radiant heat from heating equipment.
   - Locations subject to exposure to water, oil, or chemicals.
   - Locations subject to direct sunlight.
   - Locations subject to dust or corrosive gases (particularly sulfuric gas or ammonia gas).
   - Locations subject to severe changes in temperature.
   - Locations subject to icing or condensation.
   - Locations subject to shock or vibration.
2. Do not block heat dissipation around the product, i.e., provide sufficient space for heat dissipation.
3. Ensure that the rated voltage is reached within two seconds after the power is turned ON.
4. Conduct aging for 15 minutes min. after power is turned ON for correct measurement.
5. Do not touch the slit sections or terminals while the power is being supplied to prevent the product from being affected by static electricity.
6. Do not lay heavy objects on the product during use or storage. Doing so may deform or deteriorate the product.
7. Do not use paint thinner for cleaning. Use commercially available alcohol.

Mounting

- Mount the product to a panel that is 1 to 8 mm thick.
- Install the product in a horizontal position.
- Use crimp terminals that match screw sizes.

Noise Prevention

- Install the product as far as possible from devices that generate strong, high-frequency fields (such as high-frequency welders or sewing machines) or surges.
- Install surge absorbers or noise filters on nearby devices that generate noise (particularly motors, transformers, solenoids, magnet coils, and other devices that have a high inductance component).



- To prevent inductive noise, separate the terminal block wiring for the product from high-voltage or high-current power lines. Do not route the wiring for the product in parallel with or tie it in a bundle with power lines.
- When using a noise filter for the power supply, check for the voltage and current and install it as close as possible to the Frequency/Rate Meter.
- Do not install the product near radios, television sets, or wireless devices. Doing so may cause reception interference.

Increasing Service Life

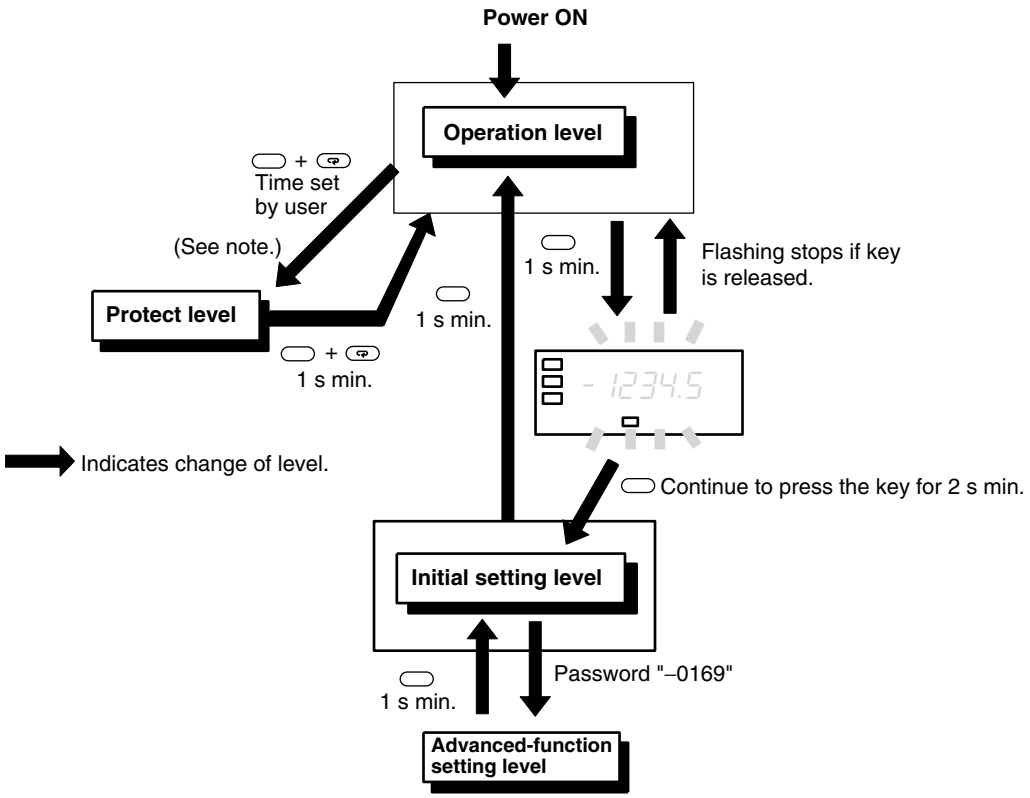
- Do not use the product in locations where the temperature or humidity exceeds the ratings or where condensation may occur. When installing the product in a panel, be sure that the temperature around the product (not the temperature around the panel) does not exceed the ratings. The product service life depends on the ambient temperature. The higher the ambient temperature, the shorter the service life. To extend the product service life, lower the temperature inside the Frequency/Rate Meter.
- Use and store the product within the temperature and humidity ranges given in the specifications. When gang-mounting Frequency/Rate Meters or arranging them vertically, heat generated by the Frequency/Rate Meters will cause the internal temperature to rise, reducing the service life. In such cases, consider forced cooling methods, such as using a fan to circulate air around the Frequency/Rate Meters. Do not, however, allow only the terminals to be cooled. Doing so will increase measurement error.
- The life of the output relays is greatly affected by the switching capacity and switching conditions. Use these relays within their rated load and electrical life. The contacts may fuse or burn if they are used past their electrical life.

Operating Procedures

■ Levels

"Level" refers to a grouping of parameters. The following table lists the operations that are possible in each of the levels, and the diagram tells how to move between levels. There are some parameters that are not displayed for certain models.

Level name	Function	Measurement
Protect	Setting lockouts.	Continue
Operation	Displaying current values, and setting OUT 1/2 set values.	Continue
Initial setting	Making initial settings of input type, scaling, output operating action, and other parameters.	Stopped
Advanced-function setting	Setting average processing, display color settings, and other advanced-function parameters.	Stopped

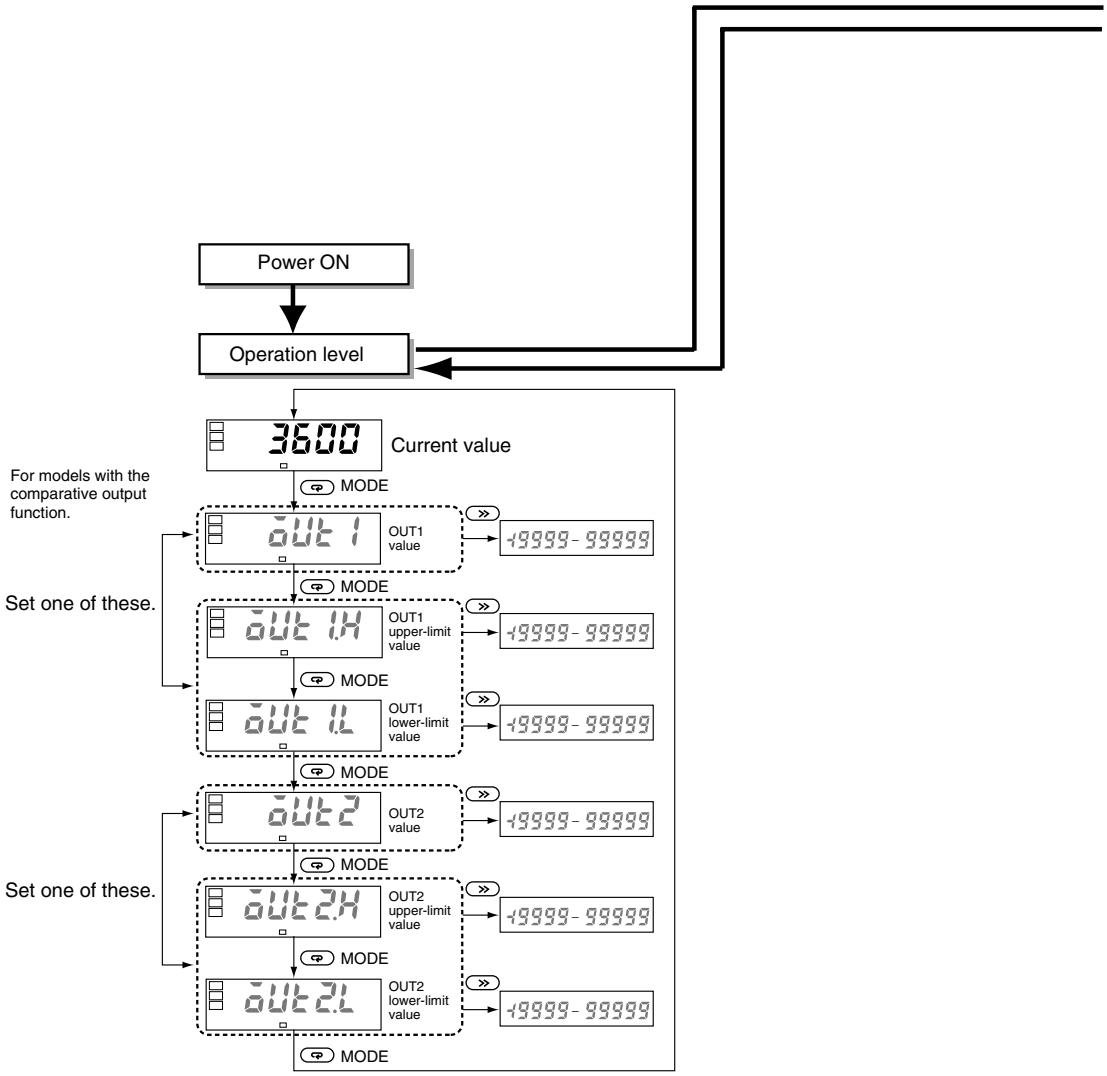


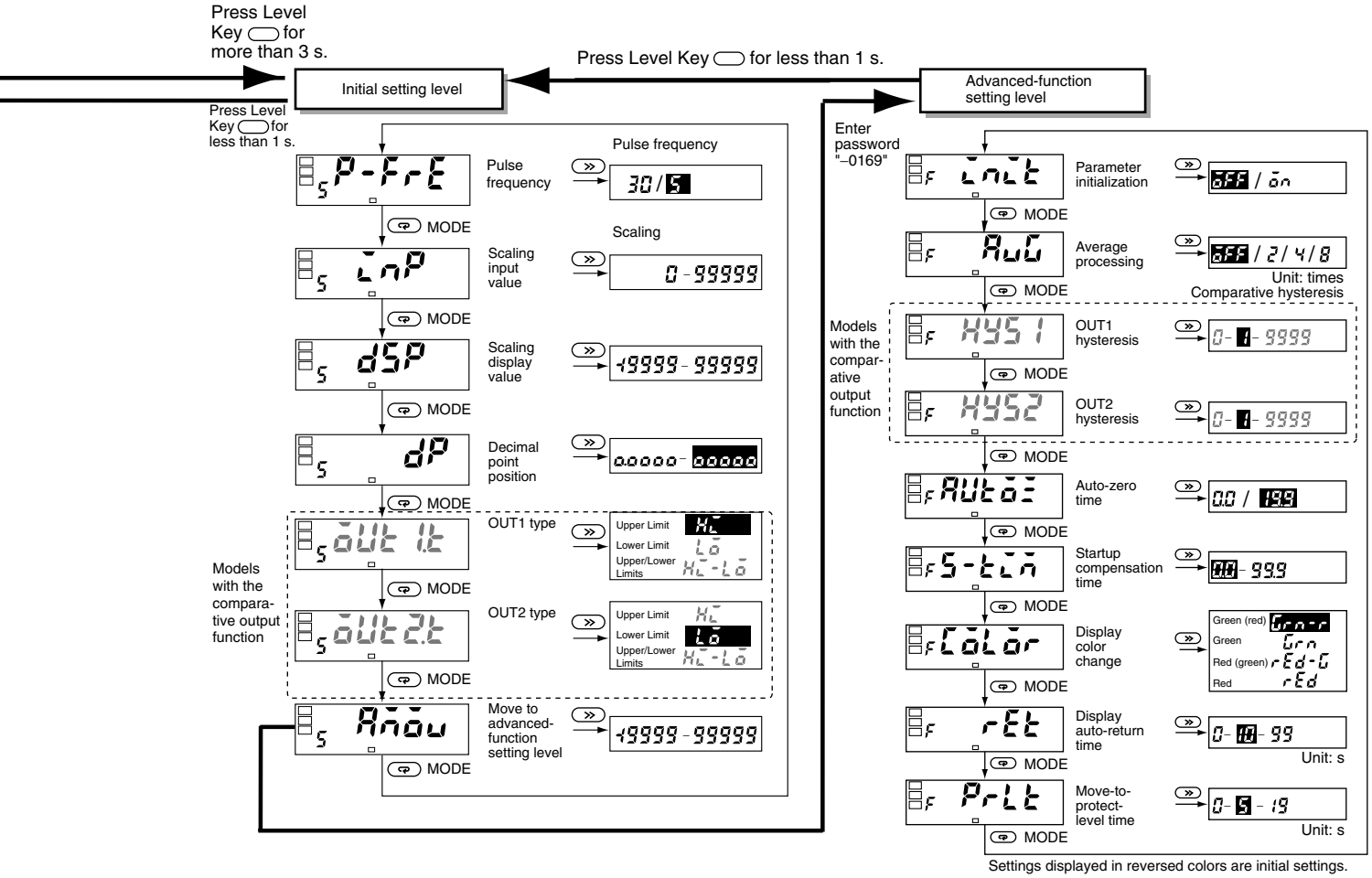
Note: The move-to-protect-level time can be set in the advanced-function setting level.

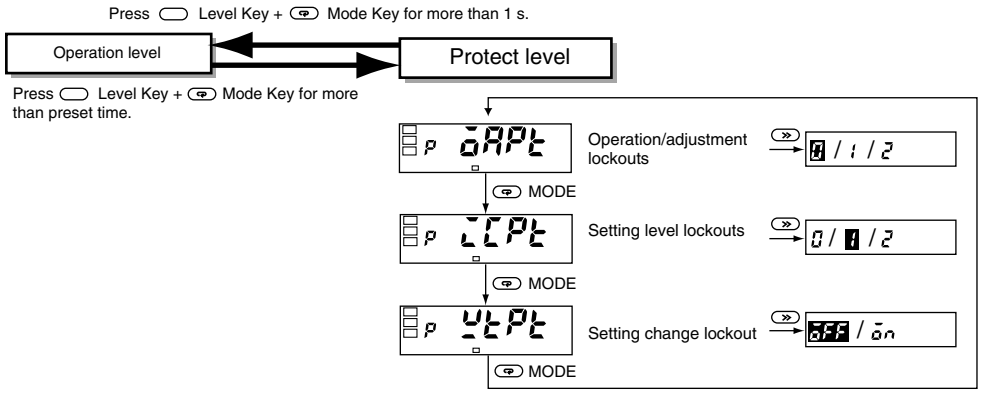
■ Parameters

Note: 1. Some parameters are not displayed for certain models.

2. The K3MA-F will stop measurement if the level is changed to the initial setting level or the advanced-function setting level.
3. If the input range is changed, some parameters are set to default values. Therefore, set the input range first.
4. Settings displayed in reversed colors are defaults.




Press Level Key for more than 3 s.
Initial setting level
Press Level Key for less than 1 s.
Press Level Key for less than 1 s.
Advanced-function setting level
Pulse frequency
Pulse frequency
30/5
MODE
Scaling
Scaling input value
0-99999
Scaling display value
-19999-99999
Decimal point position
0.0000-00000
OUT1 type
OUT2 type
Upper Limit
Lower Limit
Upper/Lower Limits
Models with the comparative output function
Move to advanced-function setting level
Enter password "-0169"
Parameter initialization
OFF / on
Average processing
OFF / 2 / 4 / 8
Unit: times
Comparative hysteresis
OUT1 hysteresis
OUT2 hysteresis
0-1-9999
Auto-zero time
0.0 / 19.9
Startup compensation time
0.0-99.9
Display color change
Green (red)
Green
Red (green)
Red
Display auto-return time
0-10-99
Unit: s
Move-to-protect-level time
0-5-19
Unit: s
Settings displayed in reversed colors are initial settings.



Operation/Adjustment Lockouts

Restricts key operations for operation level and adjustment level.

Parameter	Setting	Operation level	
		Current value display	Set value display
oAPt	0	Allowed	Allowed
	1	Allowed	Allowed
	2	Allowed	Prohibited

- Initial setting is 0.
- This is not displayed on models with no comparative output function.

Setting Level Lockouts

Restricts shifting to initial setting level or advanced-function setting level.

Parameter	Setting	Shift to initial setting level	Shift to advanced-function setting level
iCPt	0	Allowed	Allowed
	1	Allowed	Prohibited
	2	Prohibited	Prohibited

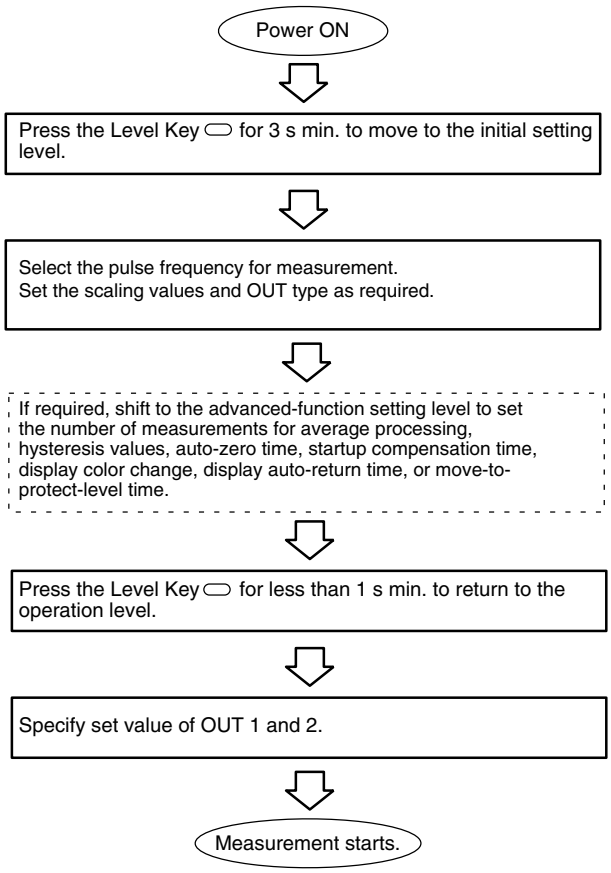
Setting Change Lockout

Restricts setting changes by key operation. When this lockout is set, it is no longer possible to shift to a setting change mode.

Parameter	Setting	Setting change by key operation
yEPt	oFF	Allowed
	on	Prohibited

However, all protect level parameters can still be changed.

■ Initial Settings

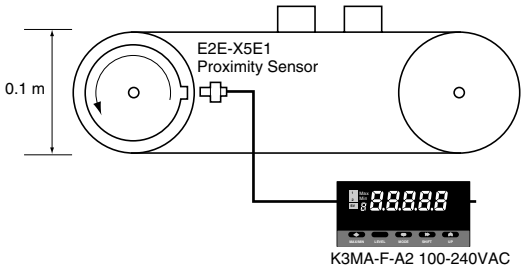


■ Setting Example

Initial Settings

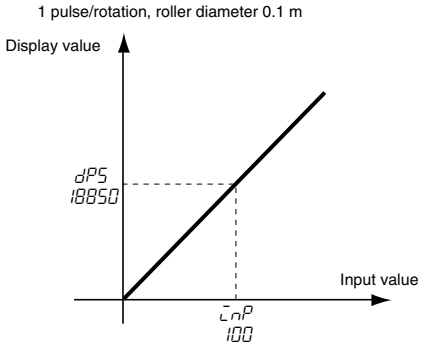
The settings for the following example are shown here.

Example: Display conveyor belt feed speed



Here, the conveyor belt feed speed is to be displayed in units of 0.1 m/min.

• Proximity Sensor: E2E-X5E1, NPN output



When displaying a flowrate (e.g., in ℓ/min or ℓ/h), make the scaling settings after confirming the I/O characteristics of the flowrate sensor. There are flowrate sensors that output analog signals. If this kind of flowrate sensor is used, consider using the K3MA-J.

1. Select the maximum input frequency for the K3MA-F.
Set the pulse frequency selection to either 30 Hz or 5 kHz. In the example, this is set to 30 Hz because the conveyor belt is turning at a slow speed.
Parameter: P-FrE (pulse frequency), Setting value: 30

2. Set the scaling. The relationship between the display value and the input value is shown in the following equation.

Rotations (rpm) = Frequency input/No. of pulses per rotation × 60

Cycle speed D (m/min) = Rotations × roll circumference
= 1/N × f × 60 × d × π
N: No. of pulses per rotation
f: Frequency (Hz)
d: Roller diameter (m)

When the input conditions are applied to this equation, we obtain the following:

Display value = 1/1 × f × 60 × 0.1 × π

For an input of 1 Hz, the display value is 18.8495 (m/min).
The scaling settings for the K3MA-F must be integers. Also, to decrease error, the scaling value is multiplied by 1,000, to obtain an input of 1000 Hz and a display value of 18850. However, because the display value in this case is displayed to the first decimal place, the scaling is set as shown in the following example so that 18850 is displayed for an input of 100 Hz.

Parameter	Setting value
InP (scaling input value)	100
dSP (scaling display value)	18850
dP (decimal point position)	0000.0

Note: The decimal point position here refers to the position in the number after scaling. When setting the scaling display value, it is necessary to consider the number of digits to be displayed past the decimal point.

■ Troubleshooting

When an error occurs, error details will be displayed on the main indicator. Confirm the error from the main indicator and take the appropriate countermeasures.

Level display	Main indicator	Error contents	Countermeasures
Not lit	E111	RAM memory error	Repair is necessary. Consult your OMRON sales representative.
5	E111	EEPROM memory error	When this error is displayed, press the Level Key for 3 seconds, and the settings will be restored to the factory settings. If the error cannot be recovered, repair is necessary. Consult your OMRON sales representative.
Not lit	Flashes 99999	The scaling display value exceeds 99999.	Promptly change the input to a value that falls within the specified range. The scaling value may be inappropriate. Review the scaling value at the initial setting level.
Not lit	Flashes -19999	The scaling display value is lower than –19999.	Promptly change the input to a value that falls within the specified range. The scaling value may be inappropriate. Review the scaling value at the initial setting level.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. N107-E1-02

Process Meter
K3NX

Advanced Process Meter Accepts Voltage/ Current Input

- Easily programmable through the front panel or via RS-232C, RS-485, or RS-422.
- Programming with easy setup and calibration.
- Multi-range function allows single Process Meter to cover a wide range of inputs.
- Easy-to-use scaling function with the key programming method.
- A wide range of Output Boards, including communications and linear boards.
- Sensor power supply of 80 mA at 12 VDC.
- NEMA4X/IP66 front panel.
- Conforms to EMC standards, EN61010-1 (IEC61010-1).
- UL/CSA approved.

Model Number Structure

■ Model Number Legend

Base Units and Output Boards can be ordered individually or as sets. Refer to the *Available Output Board Combinations* table on page 80.

Base Units

K3NX - □ □ □ □
1 2 3 4

Output Boards

K31 - □ □ □ □
5 6 7 8

Base Units with Output Boards

K3NX - □ □ □ □ -□ □ □ □
1 2 3 4 5 6 7 8

1, 2. Input Sensors Codes

VD: DC voltage input
AD: DC current input
VA: AC voltage input
AA: AC current input

3. Supply Voltage

1: 100 to 240 VAC
2: 12 to 24 VDC

4. Display

A: Basic
C: Set Value LED Display

5, 6, 7, 8. Output Type Codes

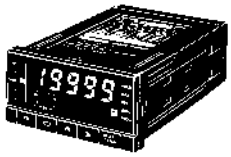
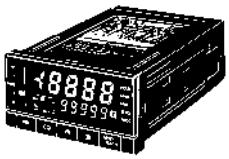
C1: 3 comparative relay contact outputs (H, PASS, L: SPDT)
C2: 5 comparative relay contact outputs (HH, H, L, LL: SPST-NO; PASS: SPDT)
C5: 5 comparative relay contact outputs (HH, H, L, LL: SPST-NC; PASS: SPDT)
T1: 5 comparative transistor outputs (NPN open collector)
T2: 5 comparative transistor outputs (PNP open collector)
B2: BCD output (NPN open collector) (see note)
B4: BCD output + 5 transistor outputs (NPN open collector)

Note: These output types are available on Basic Models only.

L1: Linear output (4 to 20 mA) (see note)
L2: Linear output (1 to 5 VDC) (see note)
L3: Linear output (1 mV/10 digits) (see note)
L4: Linear output, 4 to 20 mA + 5 transistor outputs (NPN open collector)
L5: Linear output, 1 to 5 V + 5 transistor outputs (NPN open collector)
L6: Linear output, 1 mV/10 digits+ 5 transistor outputs (NPN open collector)
L7: Linear output, 0 to 5 VDC (see note)
L8: Linear output, 0 to 10 VDC (see note)
L9: Linear output, 0 to 5 VDC + 5 transistor outputs (NPN open collector)
L10: Linear output, 0 to 10 VDC + 5 transistor outputs (NPN open collector)
FLK1: Communication RS-232C (see note)
FLK2: Communication RS-485 (see note)
FLK3: Communication RS-422 (see note)
FLK4: RS-232C + 5 transistor outputs (NPN open collector)
FLK5: RS-485 + 5 transistor outputs (NPN open collector)
FLK6: RS-422 + 5 transistor outputs (NPN open collector)

Ordering Information

■ Base Units

Model		Input type	Supply voltage	
			100 to 240 VAC	12 to 24 VDC
Basic Models These models provide a process value LED and front-panel control keys. Can be connected to available Output Board, or can be used for display only without an Output Board.		DC voltage	K3NX-VD1A	K3NX-VD2A
		DC current	K3NX-AD1A	K3NX-AD2A
		AC voltage	K3NX-VA1A	K3NX-VA2A
		AC current	K3NX-AA1A	K3NX-AA2A
Set Value LED Models These models provide a process value LED, set value LED, and front-panel control keys. Can be connected to Relay Contact, Transistor, or Combination Output Boards.		DC voltage	K3NX-VD1C	K3NX-VD2C
		DC current	K3NX-AD1C	K3NX-AD2C
		AC voltage	K3NX-VA1C	K3NX-VA2C
		AC current	K3NX-AA1C	K3NX-AA2C

■ Available Output Board Combinations

Output type	Output configuration	Output boards	Base units	
			Basic	Set Value LED Display
Relay contact	3 outputs: H, PASS, L (SPDT)	K31-C1	Yes	Yes
	5 outputs: HH, H, L, LL (SPST-NO), and PASS (SPDT)	K31-C2	Yes	Yes
	5 outputs: HH, H, L, LL (SPST-NC), and PASS (SPDT)	K31-C5	Yes	Yes
Transistor	5 outputs (NPN open collector)	K31-T1	Yes	Yes
	5 outputs (PNP open collector)	K31-T2	Yes	Yes
BCD (see note)	5-digit output (NPN open collector)	K31-B2	Yes	---
Linear	4 to 20 mA DC	K31-L1	Yes	---
	1 to 5 VDC	K31-L2	Yes	---
	1 mV/10 digits	K31-L3	Yes	---
	0 to 5 VDC	K31-L7	Yes	---
	0 to 10 VDC	K31-L8	Yes	---
Communication boards (see note)	RS-232C	K31-FLK1	Yes	---
	RS-485	K31-FLK2	Yes	---
	RS-422	K31-FLK3	Yes	---
Combination output and communication boards	BCD output + 5 transistor outputs (NPN open collector)	K31-B4	Yes	Yes
	4 to 20 mA + 5 transistor outputs (NPN open collector)	K31-L4	Yes	Yes
	1 to 5 V + 5 transistor outputs (NPN open collector)	K31-L5	Yes	Yes
	1 mV/10 digits + 5 transistor outputs (NPN open collector)	K31-L6	Yes	Yes
	0 to 5 VDC + 5 transistor outputs (NPN open collector)	K31-L9	Yes	Yes
	0 to 10 VDC + 5 transistor outputs (NPN open collector)	K31-L10	Yes	Yes
	RS-232C + 5 transistor outputs (NPN open collector)	K31-FLK4	Yes	Yes
	RS-485 + 5 transistor outputs (NPN open collector)	K31-FLK5	Yes	Yes
	RS-422 + 5 transistor outputs (NPN open collector)	K31-FLK6	Yes	Yes

Note: For details, refer to the *Communication Operation Manual.*

Specifications

■ Ratings

Supply voltage	100 to 240 VAC (50/60 Hz); 12 to 24 VDC
Operating voltage range	85% to 110% of supply voltage
Power consumption (see note)	15 VA max. (max. AC load with all indicators lit) 10 W max. (max. DC load with all indicators lit)
External power supply	80 mA at 12 VDC±10% (Use a power supply of less than 50 VAC or 70 VDC for input signals.)
Insulation resistance	20 MΩ min. (at 500 VDC) between external terminal and case. Insulation provided between inputs, outputs, and power supply.
Dielectric strength	2,000 VAC for 1 min between external terminal and case. Insulation provided between inputs, outputs, and power supply.
Noise immunity	±1,500 V on power supply terminals in normal or common mode ±1 μs, 100 ns for square-wave noise with 1 ns
Vibration resistance	Malfunction: 10 to 55 Hz, 0.5-mm for 10 min each in X, Y, and Z directions Destruction: 10 to 55 Hz, 0.75-mm for 2 hrs each in X, Y, and Z directions
Shock resistance	Malfunction: 98 m/s^2 for 3 times each in X, Y, and Z directions Destruction: 294 m/s^2 for 3 times each in X, Y, and Z directions
Ambient temperature	Operating: −10°C to 55°C (with no icing) Storage: −20°C to 65°C (with no icing)
Ambient humidity	Operating: 25% to 85% (with no condensation)
EMC	(EMI) EN61326+A1 Industry Emission Enclosure: CISPR 11 Group 1 class A: CISRP16-1/-2 Emission AC Mains: CISPR 11 Group 1 class A: CISRP16-1/-2 (EMS) EN61326+A1 Industry Immunity ESD: EN61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3) Immunity RF-interference: EN61000-4-3: 10 V/m (amplitude-modulated, 80 MHz to 1 GHz) (level 3) Immunity Fast Transient Noise: EN61000-4-4: 2 kV (power line) (level 3) Immunity Burst Noise: 1 kV line to line (I/O signal line) Immunity Surge: EN61000-4-5: 1 kV line to line 2 kV line to ground (power line) Immunity Conducted Disturbance EN61000-4-6: 3 V (0.15 to 80 MHz) (level 2) Immunity Voltage Dip/Interrupting EN61000-4-11: 0.5 cycles, 0, 180°, 100% (rated voltage)
Approved standards	UL508, CSA22.2; Conforms to EN61326+A1, EN61010-1 (IEC61010-1) Conforms to VDE0106/P100 (finger protection) when the terminal cover is mounted.
Weight	Approx. 400 g

Note: A K3NX with DC supply voltage requires approximately 1 A DC as control power supply current the moment the K3NX is turned ON. Do not forget to take this into consideration when using several K3NX units. When the K3NX is not in measuring operation (e.g., the K3NX has been just turned ON or is operating for startup compensation time), the display will read "□□□□□" and all outputs will be OFF.

■ Characteristics

Input signal	DC voltage/current, AC voltage/current
A/D conversion method	Double integral method
Sampling period	50 Hz: 12.5 times/s; 60 Hz: 15 times/s (selectable)
Display refresh period	Sampling period (sampling times multiplied by number of averaging times if simple average processing is selected.)
Max. displayed digits	5 digits (–19999 to 99999)
Display	7-segment LED
Polarity display	"–" is displayed automatically with a negative input signal.
Zero display	Leading zeros are not displayed.
Scaling function	Programmable with front-panel key inputs (range of display: –19999 to 99999). The decimal point position can be set freely.
HOLD function	Maximum hold (maximum data) Minimum hold (minimum data)
External controls	HOLD: (Process value held) RESET: (Maximum/Minimum data reset) ZERO: (Forced zero)
Comparative output hysteresis setting	Programmable with front-panel key inputs (1 to 9999).
Other functions	Variable linear output range (for models with linear outputs only) Remote/Local processing (available for communications output models only) Maximum/Minimum value data reset with front panel keys Forced-zero set with front panel keys Averaging processing function (simple or moving average) Startup compensation time (0.0 to 99.9 s) Comparative output pattern selection Security Field calibration
Output configuration	Relay contact output (3 or 5 outputs) Transistor output (NPN and PNP open collector), BCD (NPN open collector) Parallel BCD (NPN open collector) + transistor output (NPN open collector) Linear output (4 to 20 mA, 1 to 5 V) + transistor output (NPN open collector) Communication functions (RS-232C, RS-485, RS-422) Communication functions (RS-232C, RS-485, RS-422) + transistor output (NPN open collector)
Delay in comparative outputs (transistor output)	DC input: 200 ms max. AC input: 400 ms max.
Linear output response time	DC input: 220 ms max. AC input: 420 ms max.
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66) Rear case: IEC standard IP20 Terminals: IEC standard IP00
Memory protection	Non-volatile memory (EEPROM) (possible to rewrite 100,000 times)

■ Measuring Ranges

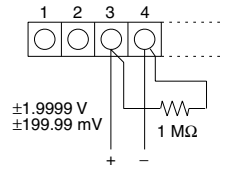
Input range		Measuring range	Input impedance	Accuracy (see note 2)	Instantaneous overload (30 seconds)
DC voltage	A	±199.99 V	10 MΩ	±0.1%rdg ±1 digit max.	±400 V
	b	±19.999 V	1 MΩ	±0.1%rdg ±1 digit max.	±200 V
	C	±1.9999 V	1 MΩ	±0.1%rdg ±1 digit max.	±200 V
	d	±199.99 mV	1 MΩ	±0.1%rdg ±1 digit max.	±200 V
	E	1.0000 to 5.0000 V	1 MΩ	±0.1%rdg ±1 digit max.	±200 V
DC current	A	±199.99 mA	1 Ω	±0.1%rdg ±1 digit max.	±400 mA
	b	±19.999 mA	10 Ω	±0.1%rdg ±1 digit max.	±200 mA
	C	±1.9999 mA	100 Ω	±0.1%rdg ±1 digit max.	±200 mA
	d	4.000 to 20.000 mA	10 Ω	±0.1%rdg ±1 digit max.	±200 mA
AC voltage	A	0.0 to 400.0 V	1 MΩ	±0.3%rdg ±5 digit max.	700 V
	b	0.00 to 199.99 V	1 MΩ	±0.3%rdg ±5 digit max.	700 V
	C	0.000 to 19.999 V	1 MΩ	±0.5%rdg ±10 digit max.	400 V
	d	0.0000 to 1.9999 V	1 MΩ	±0.5%rdg ±10 digit max.	400 V
AC current	A	0.000 to 10.000 A	(0.5 VA CT) (see note 4)	±0.5%rdg ±20 digit max.	20 A
	b	0.0000 to 1.9999 A	(0.5 VA CT) (see note 4)	±0.5%rdg ±20 digit max.	20 A
	C	0.00 to 199.99 mA	1 Ω	±0.5%rdg ±10 digit max.	2 A
	d	0.000 to 19.999 mA	10 Ω	±0.5%rdg ±10 digit max.	2 A

Note: 1. The "rdg" stands for "reading value."

2. The accuracy is guaranteed for the input frequency range of 40 Hz to 1 kHz (except for A and b ranges of AC current input) and the ambient temperature of 23±5°C.
If the actual input in each of the following measuring ranges is 10% of the maximum value or less, the following accuracy values will apply.

Input range		Accuracy
DC voltage	A, b, C, d, E	±0.15% FS
DC current	A, b, C, d	±0.1% FS
AC voltage	A	±0.15% FS
	b	±0.1% FS
	C, d	±1.0% FS
AC current	A	±0.25% FS
	b	±0.5% FS
	C, d	±0.15% FS

3. When using a DC voltage input model in the C and d range, do not open the input terminals. The input terminals can be opened, however, if a resistor of approximately 1 MΩ is connected to the input terminals.



4. "0.5 VA CT" indicates consumption VA of the internal CT.

■ Input/Output Ratings

Relay Contact Output

(Incorporating a G6B Relay)

Item	Resistive load (cosϕ = 1)	Inductive load (cosϕ = 0.4, L/R = 7 ms)
Rated load	5 A at 250 VAC; 5 A at 30 VDC	1.5 A at 250 VAC, 1.5 A at 30 VDC
Rated carry current	5 A max. (at COM terminal)	
Max. contact voltage	380 VAC, 125 VDC	
Max. contact current	5 A max. (at COM terminal)	
Max. switching capacity	1,250 VA, 150 W	375 VA, 80 W
Min. permissible load (P level, reference value)	10 mA at 5 VDC	
Mechanical life	50,000,000 times min. (at a switching frequency of 18,000 times/hr)	
Electrical life (at an ambient temperature of 23°C)	100,000 times min. (at a rated load switching frequency of 1,800 times/hr)	

Transistor Output

Rated load voltage	12 to 24 VDC $^{+10\%}/_{-15\%}$
Max. load current	50 mA
Leakage current	100 μA max.

BCD Output

I/O signal name		Item	Rating
Inputs	REQUEST, HOLD, MAX, MIN, RESET	Input signal	No-voltage contact input
		Input current with no-voltage input	10 mA
		Signal level	ON voltage: 1.5 V max. OFF voltage: 3 V min.
Outputs	DATA, POLARITY, OVERFLOW, DATA VALID, RUN	Rated load voltage	12 to 24 VDC $^{+10\%}/_{-15\%}$
		Max. load current	10 mA
		Leakage current	100 μA max.

Note: Logic method: negative logic

Linear Output

Item	4 to 20 mA	1 to 5 V	1 mV/10 digits (see note)
Resolution	4,096		
Output error	±0.5% FS		±1.5% FS
Permissible load resistance	600 Ω max.	500 Ω min.	1 KΩ min.

Note: For the 1 mV/10-digit output, the output voltage changes for every 40 to 50 increment in the display value.

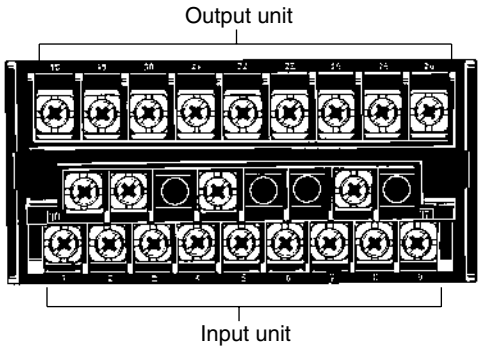
■ Communications Specifications

Item		RS-232C, RS-422	RS-485
Transmission method		4-wire, half-duplex	2-wire, half-duplex
Synchronization method		Start-stop synchronization	
Baud rate		1,200/2,400/4,800/9,600/19,200/38,400 bps	
Transmission code		ASCII (7-bit)	
Communications	**Write**	Comparative set value, scaling value, remote/local programming, forced zero control, reset control of maximum/minimum values, and other setting mode items excluding communications conditions.	
	Read	Process value, comparative set value, maximum value, minimum value, model data, error code, and others	

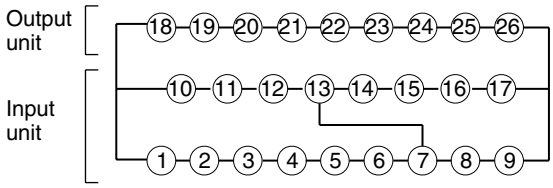
For details, refer to *Communication Operation Manual.*

Connections

■ Terminal Arrangement

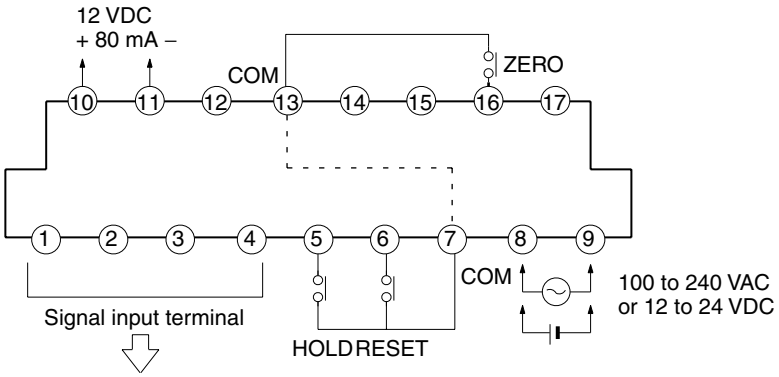


Terminal Numbers



Note: Terminals 7 to 13 are connected internally.
Terminals 4, 7, and 11 are mutually isolated.

Input Unit



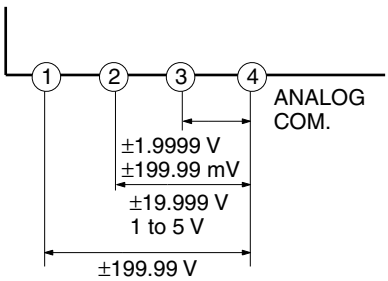
Note: Check the power supply specifications of the model used before connecting the power supply.

When inputting the external control signals through the open collector:

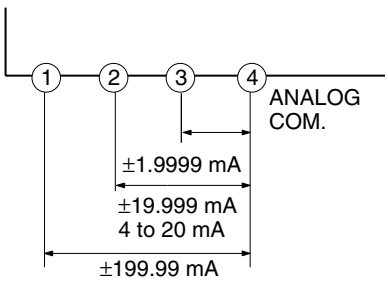
Transistor Inputs:
ON: Residual voltage must be 3 V max.
OFF: Leakage current must be 1.5 mA max.
The switching capacity must be 20 mA or greater.

When the external signal input is short-circuited, a voltage of approximately 5 V will be applied to between the terminals 5 to 7 and the COM terminal, and a current of approximately 18 mA (nominal value) will flow.

VD: DC Voltage Input

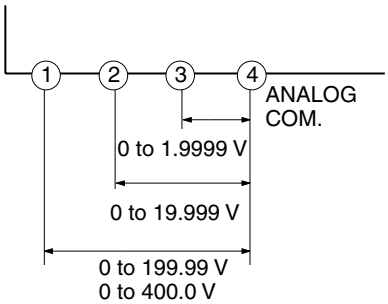


AD: DC Current Input

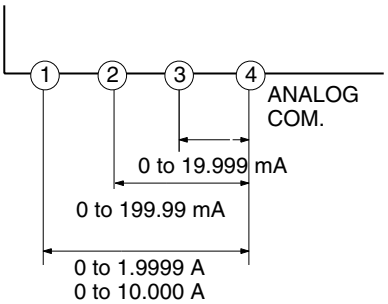


Do not apply voltages between terminals 13 and 16, 5 and 6, and 1 and 7. Doing so may break the device.

VA: AC Voltage Input



AA: AC Current Input

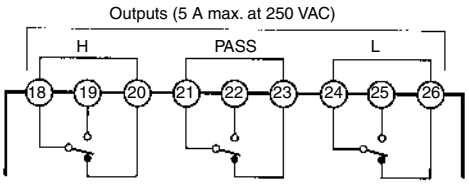


Precautions for Using the K3NX in Machinery Conforming to EN/IEC Standards

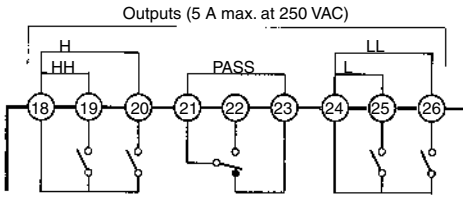
1. When using input signals of more than 100 VAC or 100 VDC with the K3NX-V□□□, connect control input (HOLD, RESET, ZERO) to devices with basic insulation.
2. Do not use input signals exceeding 50 VAC or 70 VDC with the K3NX-V□□□-B□/-FLK□/-L□/-T□ (i.e., models with BCD, communications, linear, or transistor output). If using input signals exceeding 50 VAC or 70 VDC, connect the Output Board to devices with basic insulation.

Output Unit

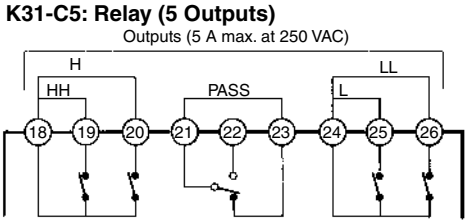
K31-C1: Relay (3 Outputs)



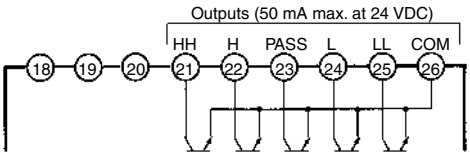
K31-C2: Relay (5 Outputs)



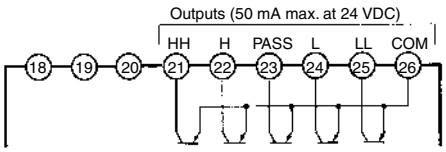
K31-C5: Relay (5 Outputs)



K31-T1: Transistor (NPN Open Collector)

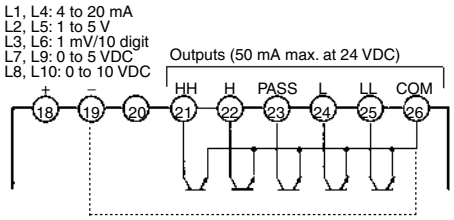


K31-T2: Transistor (PNP Open Collector)



K31-L1, L2, L3,-L4, -L5, -L6, -L7, -L8, -L9, -L10: Linear

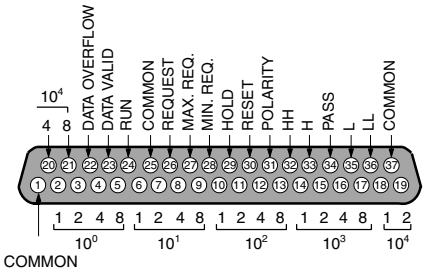
(Terminals 21 to 26 are provided only on K31-L4, -L5, -L6, -L9, -L10.)



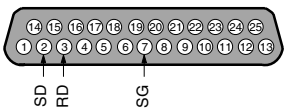
Note: With K31-L4/-L5/-L6/-L9/-L10 models, terminals 19 and 26 are connected internally.

K31-B2, -B4: BCD (NPN Open Collector)

(Terminals 32 to 36 are provided only on K31-B4.)

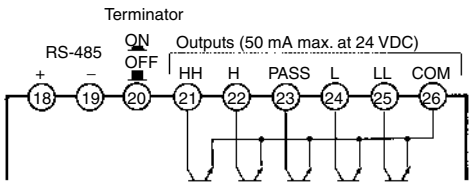


K31-FLK1: RS-232C



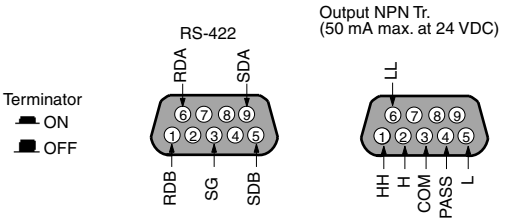
K31-FLK2, -FLK5: RS-485

(Terminals 21 to 26 are provided only on K31-FLK5.)



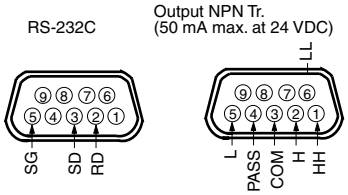
K31-FLK3, -FLK6: RS-422

(The right connector is provided only on K31-FLK6)

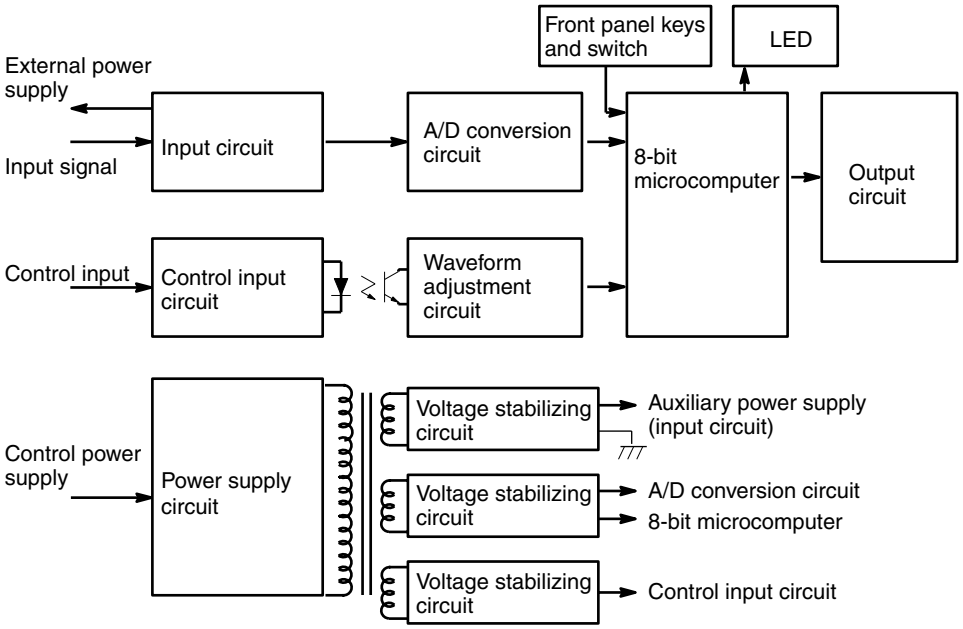


- D-sub 37P Connectors for BCD output (attachment)
  Plug: XM2A-3701
  Hood: XM2S-3711
- D-sub 25P connectors for RS-232C output (K31-FLK1) (order separately)
  Plug: XM2A-2501
  Hood: XM2S-2511
- D-sub 9P connectors for RS-422 output (K31-FLK3 and K31-FLK6) (order separately)
  Plug: XM2A-0901
  Hood: XM2S-0911
- D-sub 9P connectors for RS-232C output (K31-FLK4) (order separately)
  Plug: XM2D-0901
  Hood: XM2D-0911

K31-FLK4: RS-232C + Transistor (NPN Open Collector)



■ Block Diagram



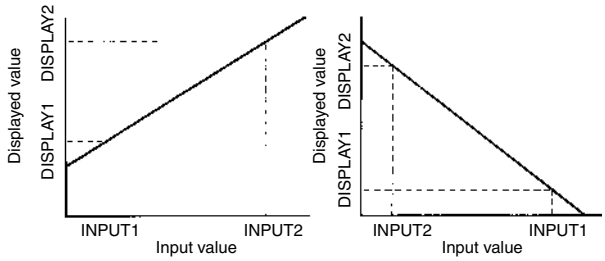
Operation

■ Main Functions

Scaling SCAL

The K3NX converts input signals into desired physical values.

INPUT2: Any input value
DISPLAY2: Displayed value corresponding to INPUT2
INPUT1: Any input value
DISPLAY1: Displayed value corresponding to INPUT1



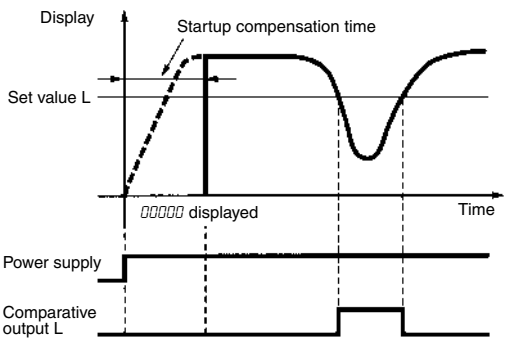
Average Processing AVG

The average processing function stabilizes displayed values by averaging the corresponding analog input signals that fluctuate dynamically or reducing the noise in the input signals.

Startup Compensation Time STIME

The startup compensation time parameter keeps the measurement operation from sending an unnecessary output corresponding to instantaneous, fluctuating input from the moment the K3NX is turned ON until the end of the preset period.

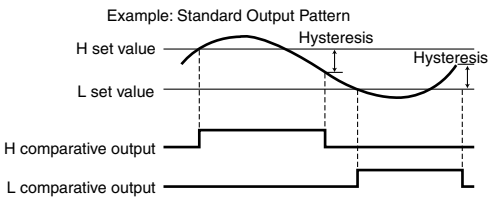
The compensation time can be set in a range from 0 to 99.9 seconds as the waiting time until the devices subject to measurement become stable after the startup of the power supply.



Hysteresis HYS

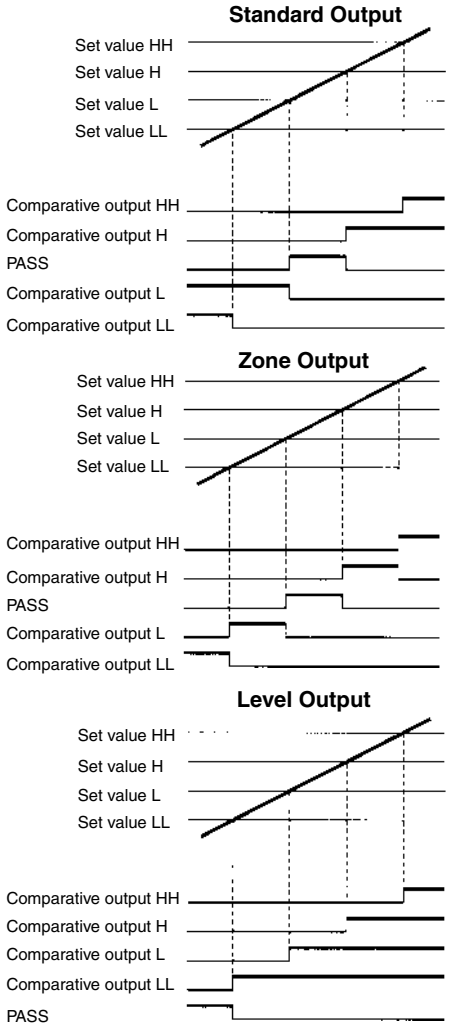
(Models with comparative outputs only)

The hysteresis of comparative outputs can be set to prevent chattering.



Output Pattern Selection C-OUT

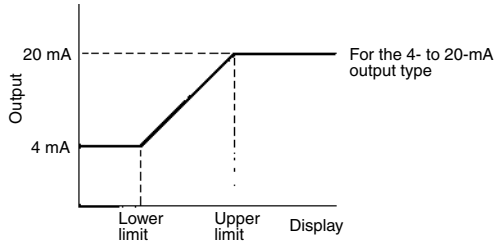
The patterns of comparative output are selectable according to the level change. Select the pattern according to the application.



Note: The following setting conditions must be satisfied, otherwise no zone output will turn ON correctly.
LL < L < H < HH

Linear Output Range LSET

A linear output range can be set as required. A value corresponding to the maximum output value and that corresponding to the minimum output value can be set.



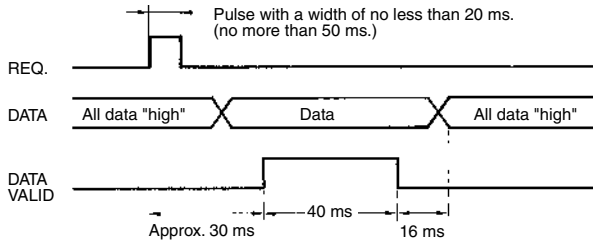
Remote/Local Selection r-L

Select remote programming when performing all settings through the host devices and select local programming when performing settings through key operation.

■ BCD Output Timing Chart

A request signal from an external device (such as a Programmable Controller) is required to read BCD data.

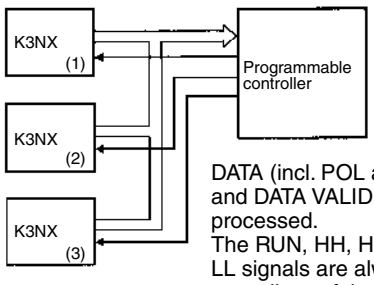
Single Sampling Data Output



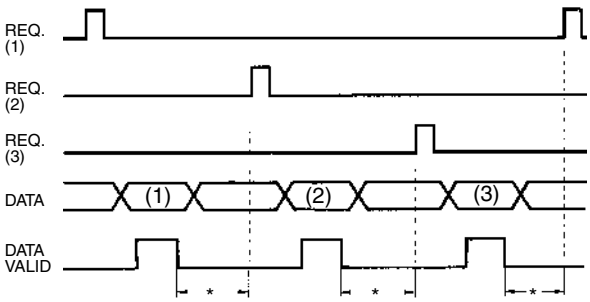
Approximately 30 ms after the REQ signal rises, a sample is taken and the DATA VALID signal is output. Read the data when the DATA VALID signal is ON.

The DATA VALID signal will turn OFF in 40 ms, and then in 16 ms, the data will go OFF.

Models with a BCD output have an open collector output configuration so that wired-OR connection is possible.

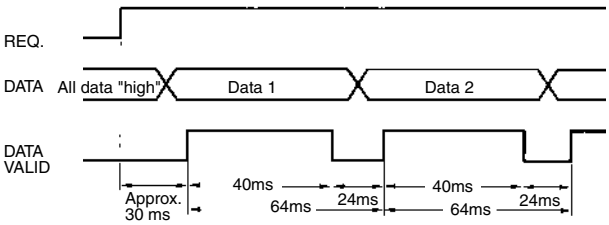


DATA (incl. POL and OVER) and DATA VALID are wired-OR processed.
The RUN, HH, H, PASS, L, and LL signals are always output regardless of the status of the REQ signal. Do not OR-wire these signals.



*The period between the DATA VALID signal and the REQ signal should be no less than 20 ms max.

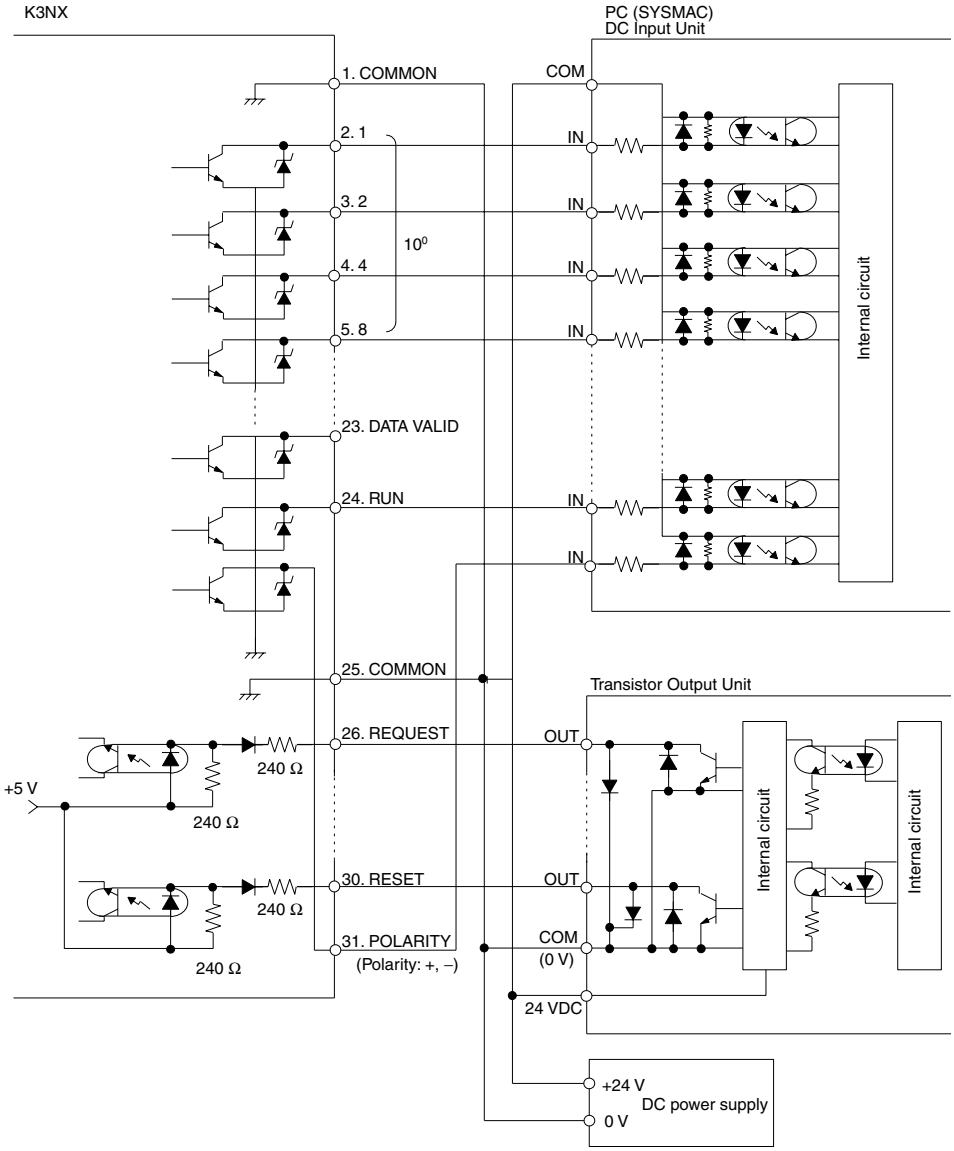
Continuous Data Output



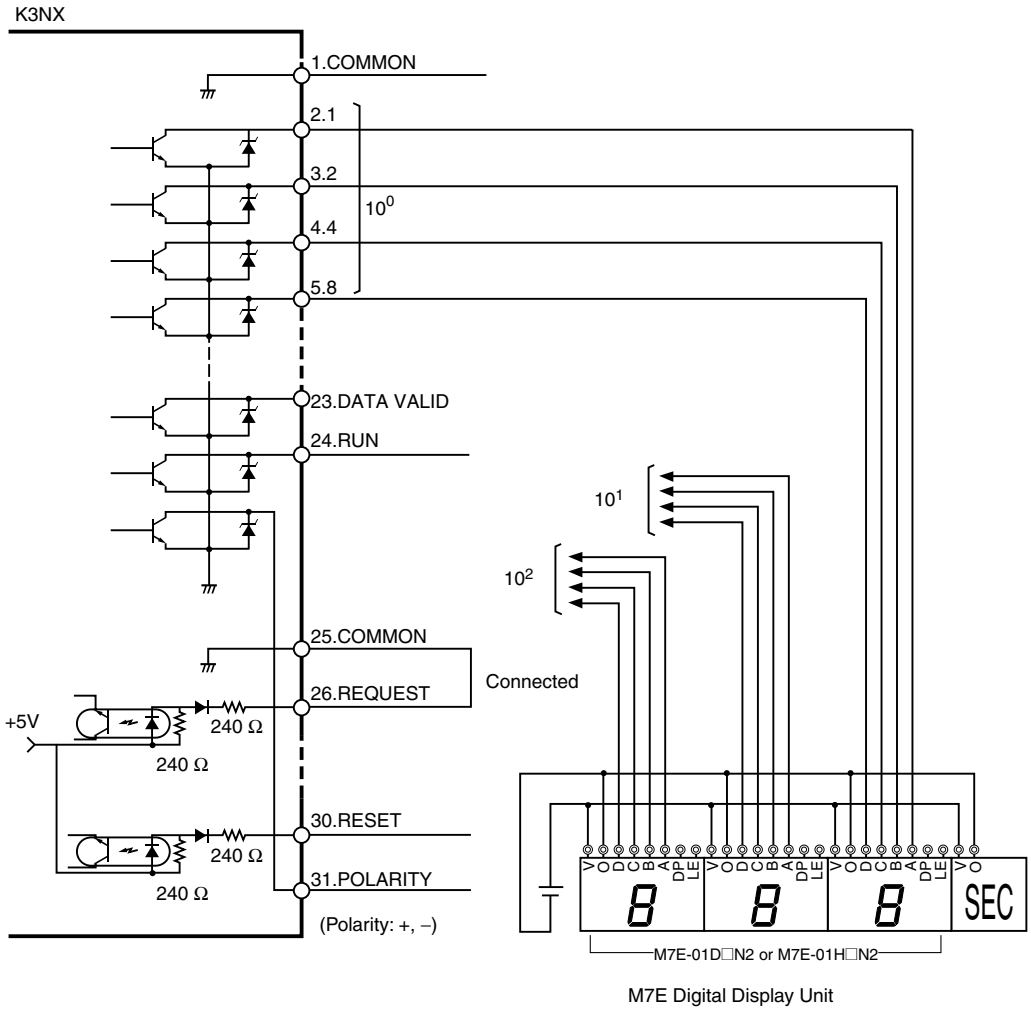
The K3NX outputs each measurement at an interval of 64 ms when a REQ signal is ON continuously.

If the HOLD signal is ON at the moment the DATA output is switched from data 1 to data 2 or vice versa, the output BCD data will be either data 1 or data 2 according to the timing of the HOLD signal. However, output data will never below.

Example of Connection to Programmable Controller

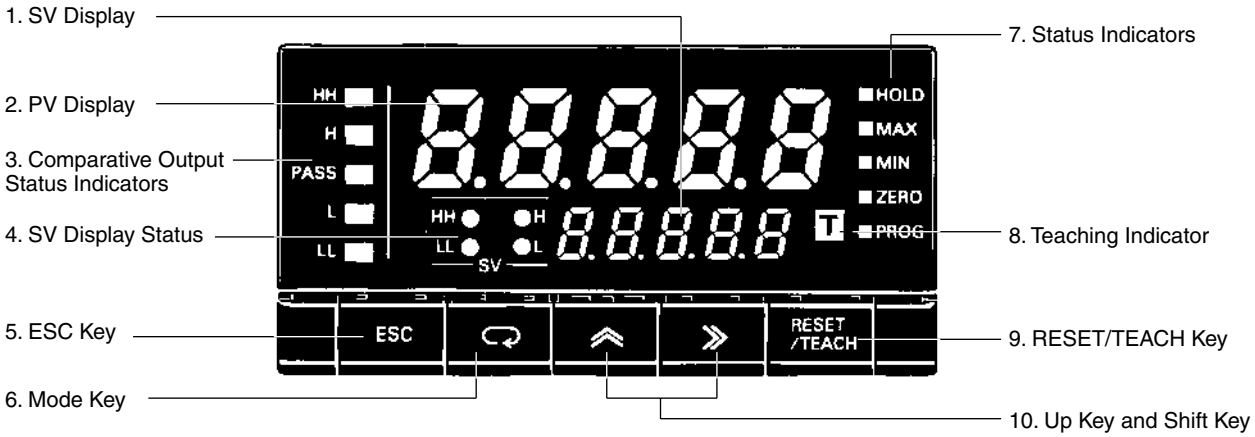


Example of Connection to Display Unit



M7E Digital Display Unit

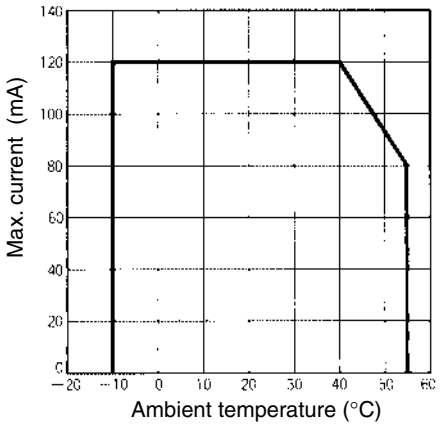
Nomenclature



Name	Functions
1. SV display	Displays the set value or parameter. Available for Set Value LED Models only.
2. PV display	Displays the process value in addition to the max./min. value or parameter.
3. Comparative output status indicators	Displays the status of comparative output.
4. SV display status	Indicates which comparative set value is currently on the SV display.
5. ESC Key	Used to return to the RUN mode from the Setting, Protect, or Maintenance mode. The process value, maximum value, or minimum value to be displayed can be selected.
6. Mode Key	Used to enter the Setting mode. Used to allow the PV display to indicate set values sequentially. Available for Basic Models only. Used to indicate set values sequentially on the SV display. Available for Set Value LED Models only.
7. Status indicators	HOLD: Lit when HOLD input is ON. MAX: Lit when the maximum value is indicated on the PV display. MIN: Lit when the minimum value is indicated on the PV display. ZERO: Lit when the forced zero function is activated. PROG: Lit or flashes while parameters are being set.
8. Teaching indicator	Lit when the teaching function is enabled and flashes when the K3NX is in teaching operation.
9. RESET/TEACH Key	The forced zero, maximum value, and minimum value are reset by pressing this key. Teaching is available when the teaching function is enabled.
10. Up Key and Shift Key	The digit being set is scrolled by pressing the Shift Key. The set value increases by one whenever the Up Key is pressed.

Engineering Data

Derating Curve for Sensor Power Supply

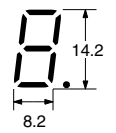


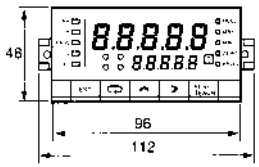
Note: The derating curve shown is for standard installation.
The derating curve depends on the mounting direction.

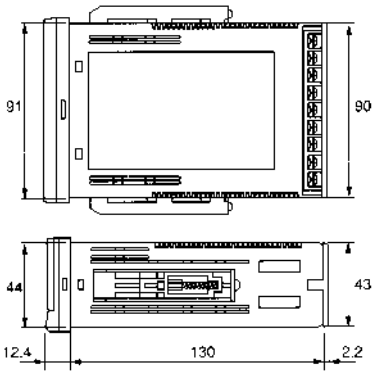
Dimensions

Note: All units are in millimeters unless otherwise indicated.

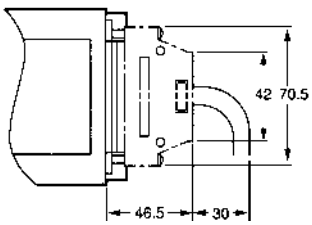
PV Display



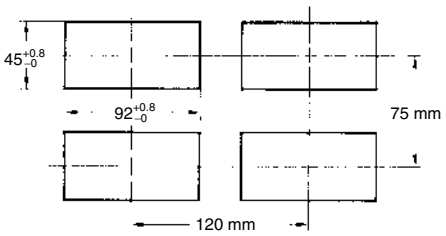




Note: The K3NX uses M3.5 terminals.
A terminal cover is provided.



Panel Cutouts

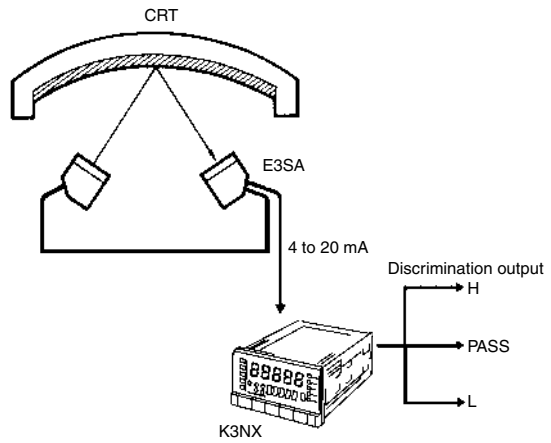


Application Examples

Detection of Aluminum Deposition

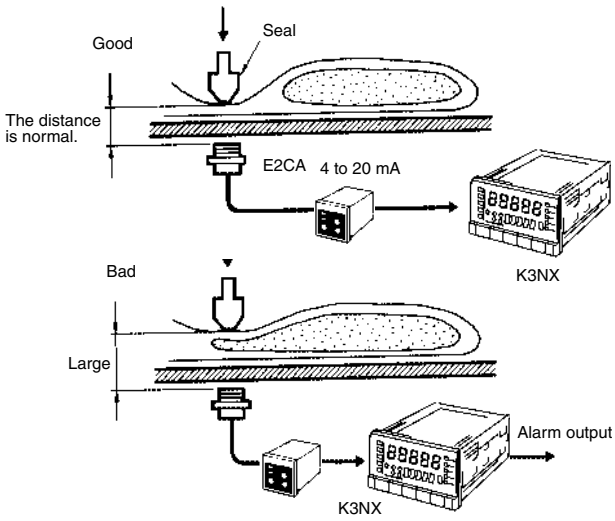
Detects via the E3SA the change in reflected light according to the amount of aluminum deposition on the CRT.

The input is processed and displayed in percentage by the scaling function.



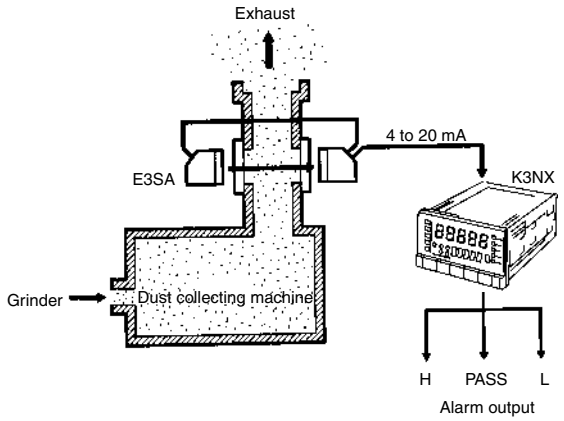
Detection of Improper Packing

Detects the difference between a good and bad seal.



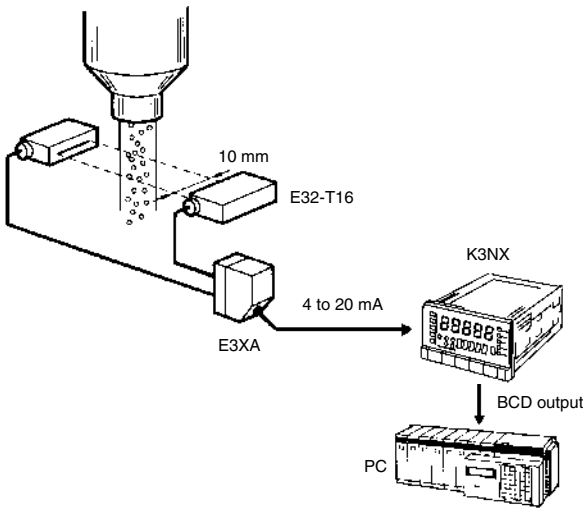
Detection of Dust Exhaust

The change in the density of the dust is detected via the E3SA and discriminated by the K3NX.



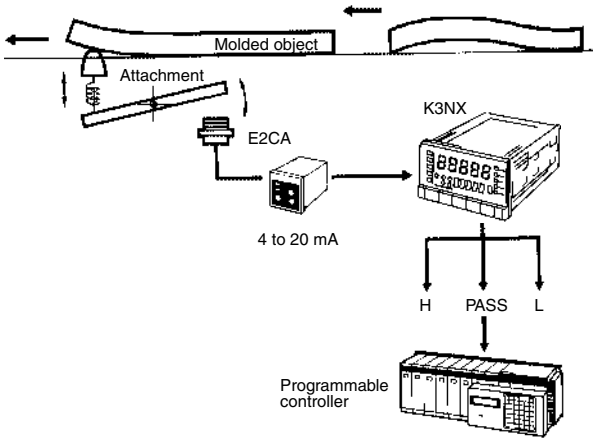
Detection of Discharged Powder

The output of the analog photoelectric sensor is processed and displayed after scaling. Monitoring the powder level is possible with the BCD data sent to the PC.



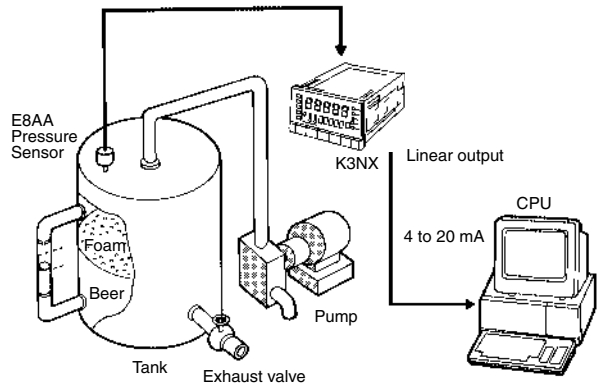
Detection of Warped Object

The warp of the object is converted into the movement of the attachment which the linear proximity sensor detects. The result is displayed and discriminated by the K3NX

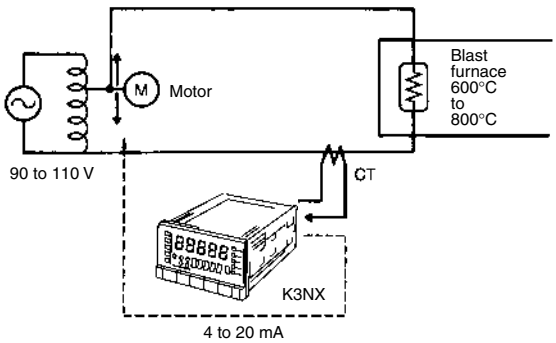


Monitoring of Tank Pressure

The output of the pressure sensor is processed and the pressure is displayed. The integrated monitoring of the operation is possible by sending the linear output data to the CPU.



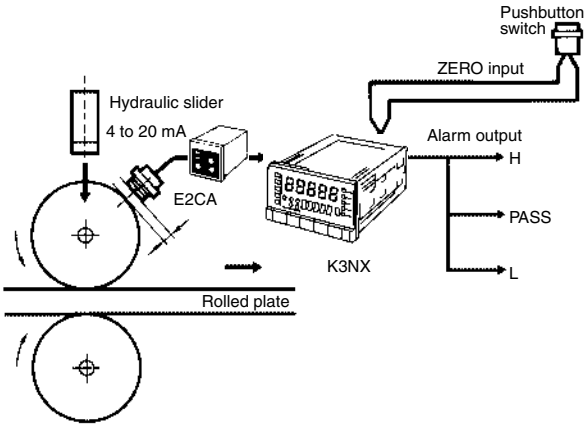
Monitoring and Controlling Blast Furnace Temperature



Display of Pressure Roller Position and Detection of Dislocation

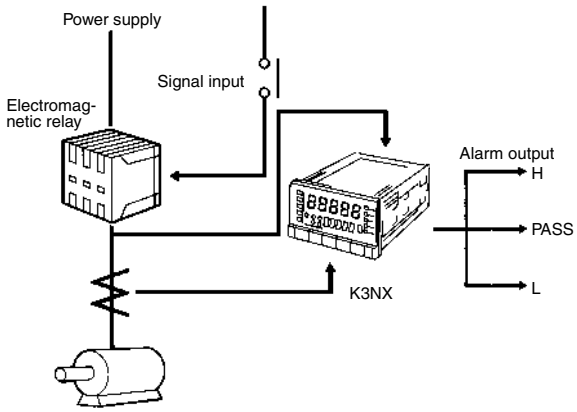
The linear proximity sensor detects and processes the position of the roller that varies according to the thickness of the plate. From the displayed result, the dislocation of the plate is detected.

With the forced zero input parameter, the level setting can be made with ease.



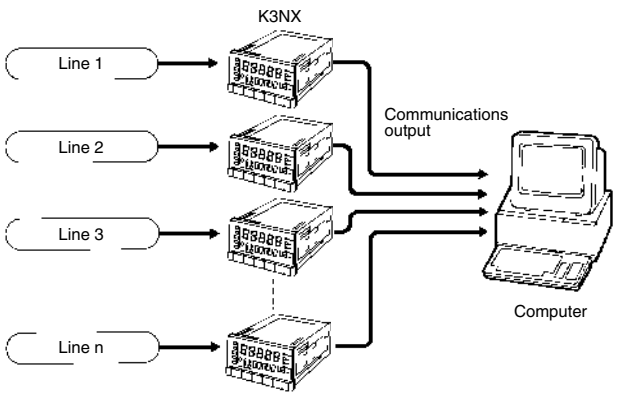
Monitoring of Motor Load Current

If the startup time compensation of the K3NX is enabled, the K3NX will not be influenced by the inrush current from starting the motor, and no signal will be output from the K3NX.



Concentrated Monitoring of Supply Voltage for Each Line

The voltage of the power supply for each line is locally displayed and the data is transferred to the CPU for careful monitoring.



Precautions

⚠ WARNING

Do not touch any of the terminals while the power is being supplied. Doing so may result in electric shock.

⚠ Caution

Do not allow metal objects or conductive wire cuttings to enter the product. Doing so may result in electric shock, fire, or malfunction.

⚠ Caution

Do not attempt to take the product apart or touch any internal parts while the power is being supplied. Doing so may result in electric shock.

⚠ Caution

Do not use the product in locations subject to flammable or explosive gases. Doing so may result in explosion.

⚠ Caution

The lifetime of output relays varies greatly with the switching capacity and conditions. Consider the actual operating conditions, and use the relays within the rated load without exceeding the number of operations specified as the rated electrical life. Using relays beyond their rated electrical life may result in contact deposit or burning.

⚠ Caution

Do not use loads exceeding the rated value. Doing so may result in damage or burning.

⚠ Caution

Use a power supply voltage within the specified range. Not doing so may result in damage or burning.

⚠ Caution

Use settings that are appropriate for the control system. Discrepancies between the settings and the actual control conditions may result in unexpected operation leading to damage or accidents.

⚠ Caution

Be sure to tighten terminal screws to the specified torque.
Specified torque for M3.5 screws: 0.74 to 0.90 N·m
Loose screws may result in burning or malfunction.

■ Application Precautions

- Use a power supply voltage within the specified range. Not doing so may result in damage or burning.
- Be sure to perform wiring correctly, verifying the terminal names. Incorrect wiring may result in burning.
- Be sure to tighten the screws on the terminal block properly.
- Do not connect anything to unused terminals.

■ Correct Use

Long-term Use

Use all products within the specified ranges. When using inside a control panel, ensure that the temperature around the product, rather than the temperature around the control panel, does not exceed the specified temperature range. Electronic products, such as this product, have a lifetime that is dependent on the lifetime of internal electronic components, as opposed to the lifetime related to the number of relay switching operations. The lifetime of these components varies with the temperature; the higher the temperature, the shorter the lifetime. Therefore, the product lifetime can be extended by lowering the internal temperature of the product.

When several Process Meters are mounted close together (either horizontally or vertically), the internal temperature of the Process Meters may rise, leading to a reduction in the lifetime. In this case, take measures to cool the Process Meters, such as installing fans. Ensure, however, that the terminals are not cooled as this may lead to incorrect measurement.

Operating Environment

Do not use the product in locations subject to temperatures or humidity levels above the specified ranges, or in locations subject to condensation.

Do not use the product in locations subject to severe shocks or vibrations.

Separate the product from machines that generate high-frequency noise, such as high-frequency welding machines and high-frequency sewing machines.

Do not use the product in locations subject to dust or corrosive gases.

Do not use the product outdoors or in locations subject to direct sunlight.

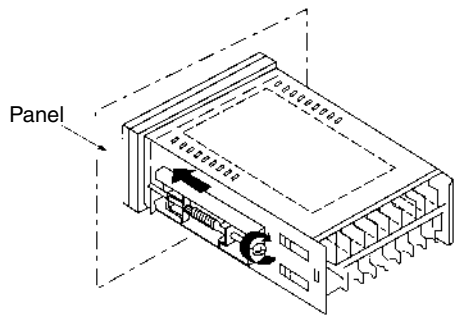
Operation

When using models with comparative outputs, if an error occurs at the Process Meter comparative output may not operate correctly. We therefore recommend that you consider providing an alarm system separately as a countermeasure.

Parameter settings that allow the functions to operate properly are made, using the setting menu, at the factory prior to delivery. When using the product, change the settings as required for the application.

Mounting

Recommended panel thickness is 1 to 3.2 mm.



Attach the mounting bracket on the left and right sides of the Process Meter as shown in the illustration above and gradually tighten each screw evenly in turn by considering the balance of the tightening force until the ratchets start slipping without being further tightened.

Mount the Process Meter as horizontally as possible.

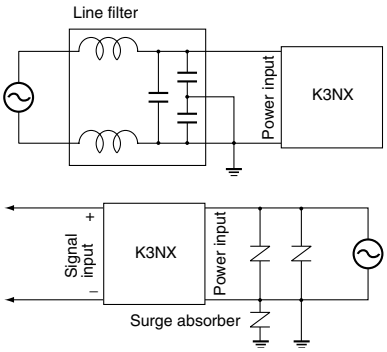
Waterproof Specifications

Products for which the degree of protection is not specified or models with IP□0 degree of protection do not have waterproof specifications.

Noise Countermeasures

Separate the product as far as possible from machines that generate high-frequency noise, such as high-frequency welding machines and high-frequency sewing machines, and machines that generate surges.

Attach surge absorbers or noise filters to noise-generating peripheral devices (in particular, devices with inductance such as motors, transformers, solenoids, and magnet coils).

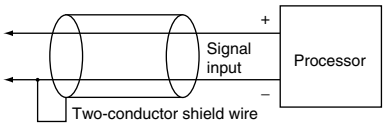


In order to prevent inductive noise, wire the lines connected to the terminal block separately from power lines carrying high voltages or large currents. Also, do not wire in parallel to, or in the same cable as power lines. There are other methods that are effective for reducing noise, such as running wires along ducts and using shield lines.

When using a noise filter for the power supply, check the voltage and current and install as close to the Process Meter as possible.

Inductive Noise Countermeasure for Input Line

Analog Input



Temperature Input

In order to prevent the influence of induction, separate the lead wire joining the temperature sensor and the Process Meter from power and load lines.

Using the product near radios, television sets, or other wireless devices may result in reception interference.

Unit Label (Provided)

No product is shipped with the unit label attached. Select a unit label from the sheet provided and attach it to the Process Meter.

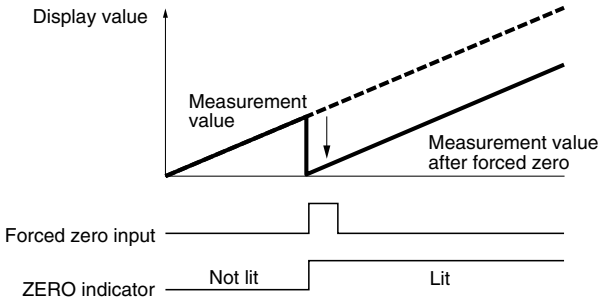
Operating Procedures

■ Operation in RUN Mode

Forced Zero and Clearing Forced Zero

Forced Zero

Reference points can be adjusted to 0 easily.



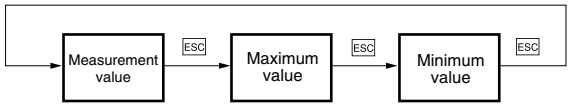
- Press the RESET/TEACH Key [RESET /TEACH] during measurement display to shift the previous display value to 0 and continue measurement.
- Forced zero using the RESET/TEACH Key [RESET /TEACH] is not possible if forced zero was prohibited in Protect Mode. The initial setting for prohibition of forced zero is ON.
- The ZERO indicator is lit while the forced zero function is activated.
- The measurement value when forced zero is activated (i.e., the shift value) is saved when the power is turned OFF.

Clearing Forced Zero

- Press the RESET/TEACH Key [RESET /TEACH] for 1 s min. to clear the forced zero. The ZERO indicator will turn OFF.

Confirming Maximum and Minimum Values

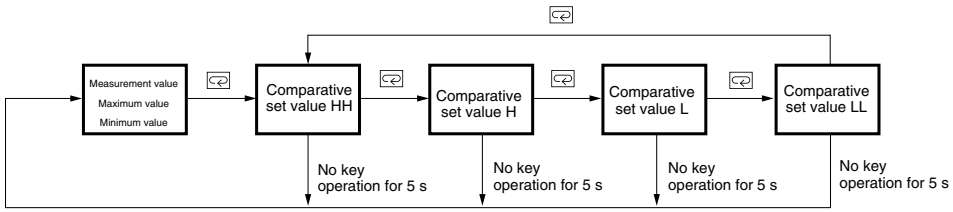
Press the ESC Key [ESC] during measurement to display the maximum and minimum values.



Press the RESET/TEACH Key [RESET /TEACH] while the maximum or minimum value is displayed to reset the value. (This is not possible, however, if maximum/minimum value reset was prohibited in Protect Mode.)

Confirming and Setting Comparative Set Values

When the measurement value, the maximum value, or the minimum value is displayed, press the Mode Key [↺] repeatedly to display the comparative set values in the order HH, H, L, and LL. (With models that have an SV display, the comparative set values are displayed in the SV display.)



Note: When a comparative set value is displayed, it can be changed using the Up Key [∧] and Shift Key [»] (if key protection is OFF).

■ Setting Procedures

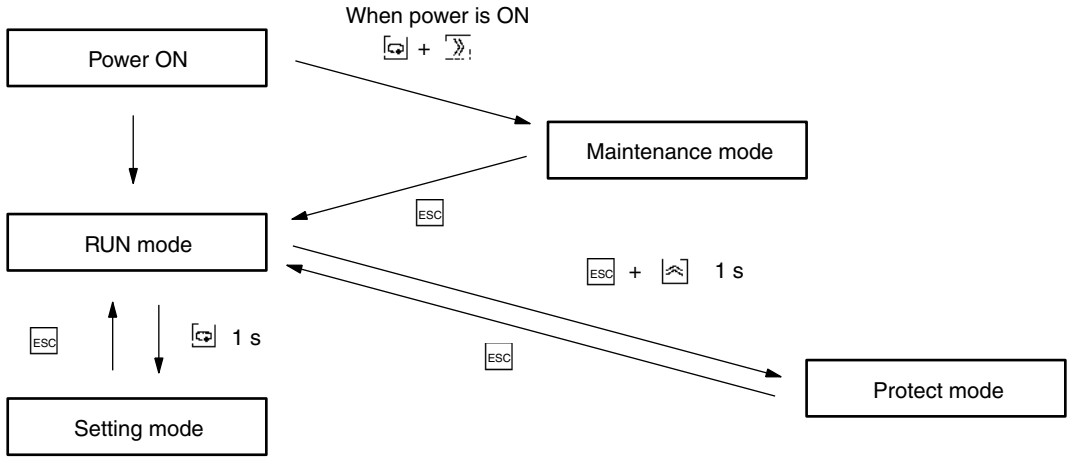
The K3NX has four modes: RUN mode for normal operations, Setting mode for initial parameter input, Protect mode for lock-out configuration, and Maintenance mode for initializing set values and user calibration. The parameters that are accessible on any individual K3NX will vary depending on the Output Board installed. Refer to the *K3NX Operation Manual* for details.

RUN Mode: Remains in this mode under normal operation.
The process value or the max./min. value can be monitored.
Using the front panel keys, the comparative set value can be changed and forced-zero reset or max./min. values reset can be performed.

Setting Mode: Used for making initial settings.
Includes four menus (Set value (SuSEt), scaling (SCALE), setup (SEtUP), option (oPt)) and the output test.

Protect Mode: Used for locking the front key operation or parameter changes.

Maintenance Mode: Used for initializing set values and user calibration of the inputs.
The user calibration is valid for selected input ranges.



SuSEt - Program set values

- Su.HH Enter set value HH
- Su. H Enter set value H
- Su. L Enter set value L
- Su.LL Enter set value LL

SCALE - Display scaling

- inP.2 Enter signal level for scaling point #2
- dSP.2 Enter display reading for scaling point #2
- inP. 1 Enter signal level for scaling point #1
- dSP. 1 Enter display reading for scaling point #1
- dEC-P Select decimal point

SEtUP - Program input range/Serial communications

- in-t Specifying input range
- Fr E Select the supply frequency to eliminate inductive noise
- U-no Enter the unit no. for the host
- bPS Select the baud rate
- LEn Select the word bit length
- Sbit Select the stop bits
- PrtY Select the parity bits

oPt - Supplementary settings related to display or control

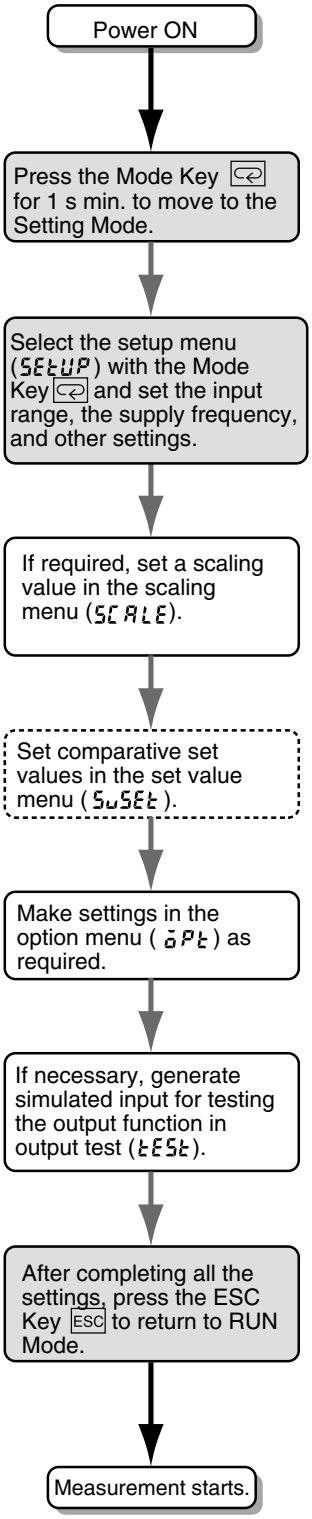
- AvG Set for averaging process value
- Stini Set startup compensation time
- HYS Enter hysteresis value
- C-oUt Select the output pattern
- LSEt.H Enter the upper limit (H) of linear output range
- LSEt.L Enter the lower limit (L) of linear output range
- r-L Select the remote/local programming

tESt - Generating simulated input for testing the output function

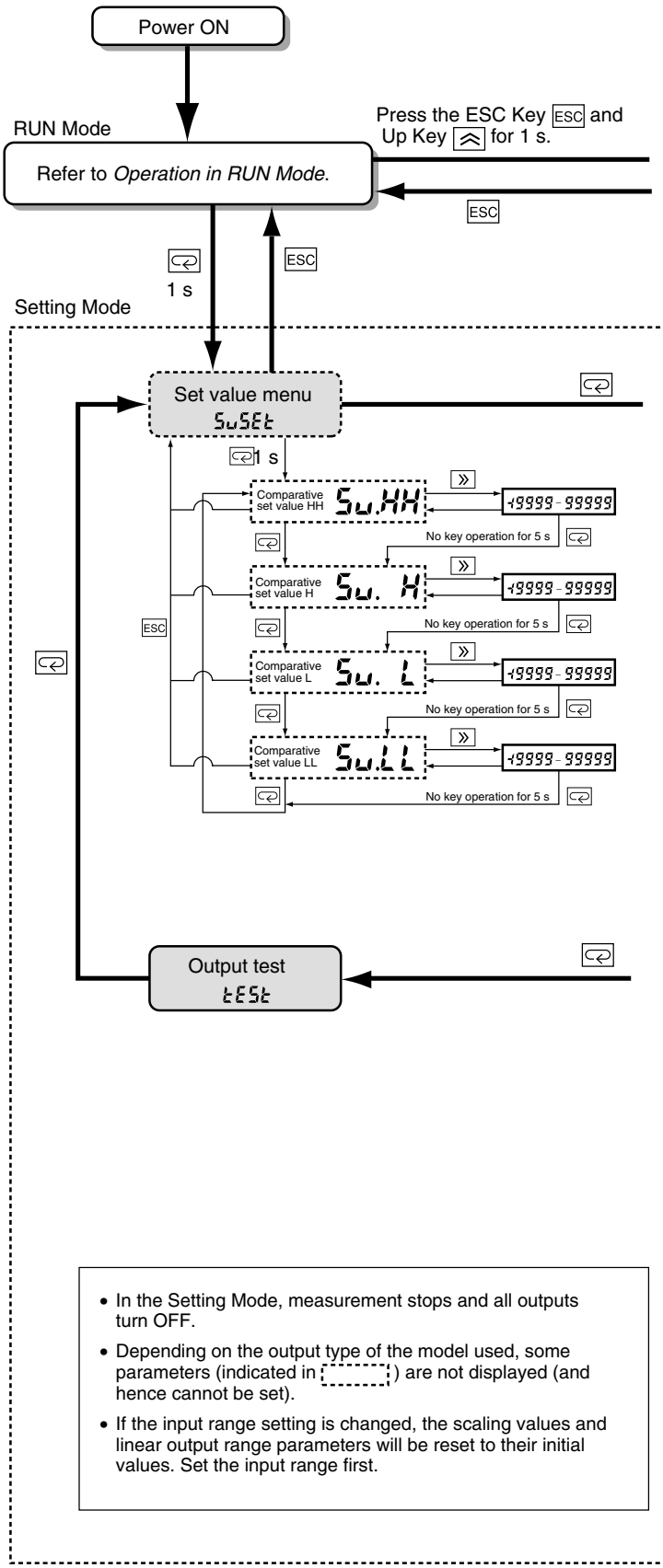
Prot - Program lock-out configuration

- ALL Enable all key protection
- SuSEt Enable set value change prohibition
- ZEro Enable prohibition of forced-zero reset using the front panel keys
- mm.rSt Enable prohibition of max./min. value reset using the front panel keys
- SECr Specify the menus to be protected against setting in the setting mode.

■ Initial Settings



■ Parameters

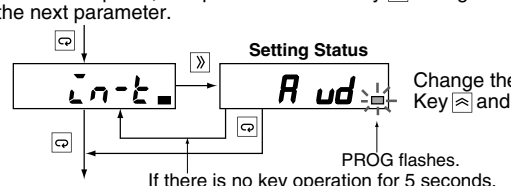


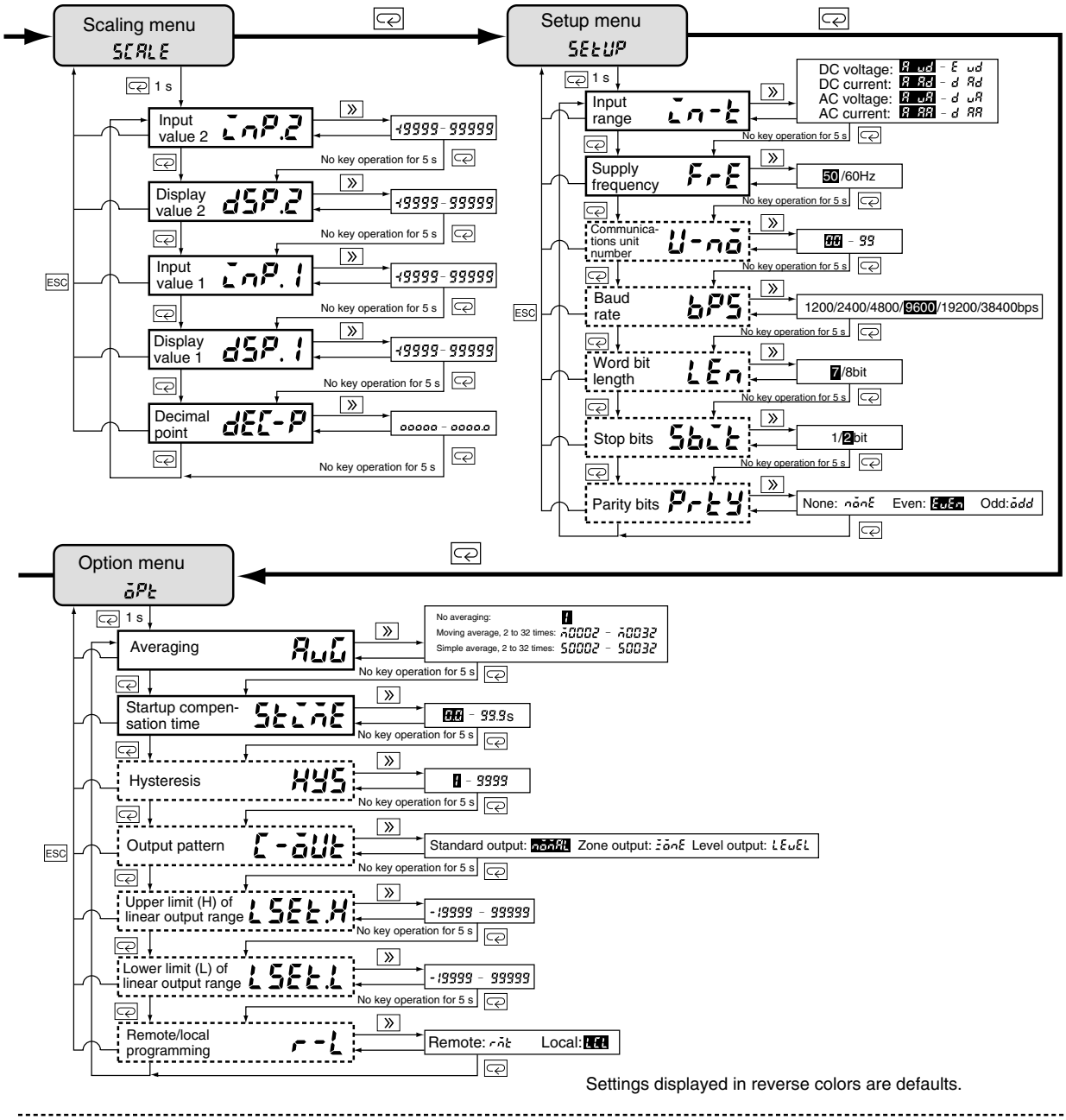
- In the Setting Mode, measurement stops and all outputs turn OFF.
- Depending on the output type of the model used, some parameters (indicated in [ ]) are not displayed (and hence cannot be set).
- If the input range setting is changed, the scaling values and linear output range parameters will be reset to their initial values. Set the input range first.

Protect Mode

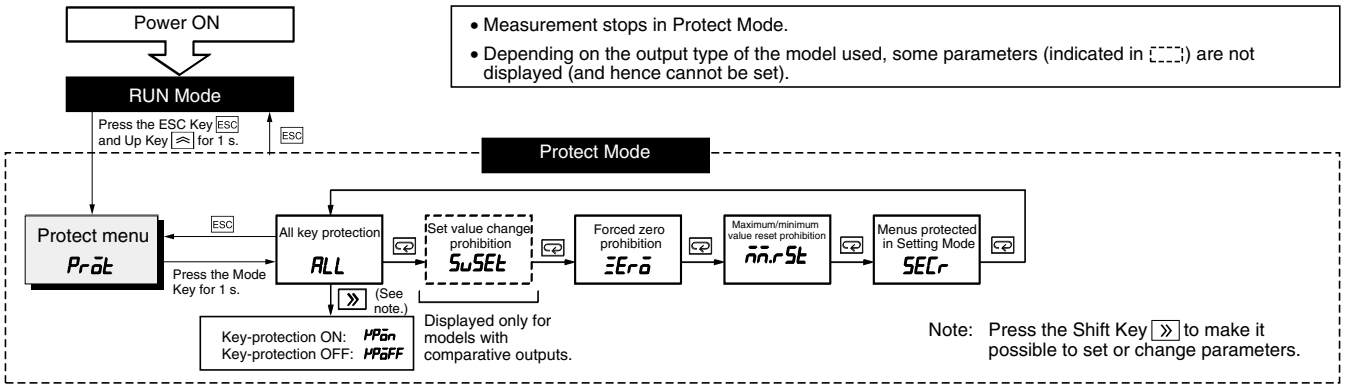
Changing Set Values

By pressing the Shift Key » while a parameter is displayed, the set value can be changed (setting status). The PROG status indicator will flash. Change the set value as required, and press the Mode Key to register the setting and move to the next parameter.





Settings displayed in reverse colors are defaults.



■ Protect Mode Settings

Settings displayed in reverse colors are defaults.

Menu display	Parameter display	Meaning of parameter	Setting range	Setting key (See note.)
Prot Press the Mode Key to display the parameter. Press the ESC Key to return to the menu.	ALL Setting: » Next parameter: ↺	All key protection: All key operations are prohibited in RUN Mode. (If all key protection is ON, only the key for going to Protect Mode is enabled.)	Key protection ON: HPon Key protection OFF: HPoFF	Use the Up Key ^ to change the setting. HPon → HPoFF Use the Mode Key ↺ to enable the setting and move to the next parameter.
	SuSEt Setting: » Next parameter: ↺	Set value change prohibition: Changes to comparative set values are prohibited in RUN Mode. (Displayed only for models with comparative outputs.)		
	ZEro Setting: » Next parameter: ↺	Forced zero prohibition: Forced zero operations using the front panel keys are prohibited. (Forced zero operations using external signals are not prohibited.)	Key protection ON: HPon Key protection OFF: HPoFF	
	MM.rSt Setting: » Next parameter: ↺	Maximum/minimum value reset prohibition: Resetting of maximum and minimum values using the front panel keys is prohibited. (Resetting by external signals is not prohibited.)	Key protection ON: HPon Key protection OFF: HPoFF	
	SECr Setting: » Next parameter: ↺	Menus protected in Setting Mode: Setting operations in Setting Mode are prohibited in the way shown below.	0 / 1/2	Use the Up Key ^ to change the setting. 0 → 1 → 2 Use the Mode Key ↺ to enable the setting and move to the next parameter.

Setting menu	Setting		
	0	1	2
Set value menu			×
Scaling menu			×
Setup menu		×	×
Option menu			×

Note: If there is no key operation for 5 seconds, the setting is automatically registered.

■ Troubleshooting

When an error occurs, error details will be displayed in the PV display. Take the appropriate countermeasures according to the error displayed.

Error display	Error contents	Output status				Countermeasure
		Comparative output	BCD output	Communications output	Linear output	
M1.Err (M1.ERR) M2.Err (M2.ERR)	Memory error	OFF	OFF (all outputs in "H" status)	OFF	OFF	Reset the power. If the same error occurs, repair is necessary.
M3.Err (M3.ERR)		OFF	OFF (all outputs in "H" status)	OFF	OFF	Reset the power while holding down the ESC Key, the Up Key, and the RESET/TEACH Key. The settings will be returned to their initial values. Redo the settings. If the same error occurs, repair is necessary.
Ad.Err (AD.ERR)	AD converter error	OFF	OFF (all outputs in "H" status)	OFF	OFF (minimum value)	Reset the power. If the same error occurs, repair is necessary.
Err-o (ERR-O) CHG-o (CHG-O)	Output error	OFF	OFF (all outputs in "H" status)	OFF	OFF (minimum value)	
(Display value flashes.)	The input range and display range were exceeded.	Continues	Continues The OVER signal turns ON.	Continues The OVER or UNDER signal turns ON.	Continues	Take steps to ensure that the input values and display values are within the allowable ranges.
rmt (RMT) (Flashes for 3 s.)	The remote/local section is set to remote.	Continues	Continues	Continues	Continues	If an attempt to change a setting using key operations is made with the remote/local selection set to remote, this error will flash for 3 s. To enable settings to be changed, set the remote/local selection to local.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. N084-E1-02

Temperature Meter
K3NH

High-performance Temperature Meter Accepts Temperature/Analog Inputs

- Multi-range capability: a single processor connects to 14 different types of sensor and current/voltage.
- Easily programmable through the front panel or via RS-232C, RS-485, or RS-422.
- Programming with easy setup and calibration.
- A wide range of Output Boards, including communications and linear boards.
- High accuracy: 100-ms sampling for analog input
- High visibility: 14.2-mm-high red LED display
- °C/°F display selection.
- NEMA4X/IP66 front panel.
- Conforms to EMC standards, EN61010-1 (IEC61010-1).
- UL/CSA approved.

Model Number Structure

■ Model Number Legend

Base Units and Output Boards can be ordered individually or as sets. Refer to the *Available Output Board Combinations* table on page 106.

Base Units

K3NH - □ □ □ □
1 2 3 4

1, 2. Input Sensors Codes

TA: Current series

3. Supply Voltage

1: 100 to 240 VAC
2: 12 to 24 VDC

4. Display

A: Basic Model
C: Set value LED display

5, 6, 7, 8. Output Type Codes

C1: 3 comparative relay contact outputs (H, PASS, L: SPDT)
C2: 5 comparative relay contact outputs (HH, H, L, LL: SPST-NO; PASS: SPDT)
C5: 5 comparative relay contact outputs (HH, H, L, LL: SPST-NC; PASS: SPDT)
T1: 5 comparative transistor outputs (NPN open collector)
T2: 5 comparative transistor outputs (PNP open collector)
B2: BCD output (NPN open collector) (see note)
B4: BCD output + 5 transistor outputs (NPN open collector)
L1: Linear output (4 to 20 mA) (see note)

Note: These output types are available on Basic Models only.

Output Boards

K31 - □ □ □ □
5 6 7 8

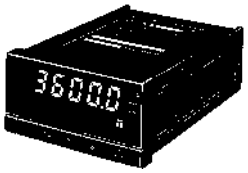
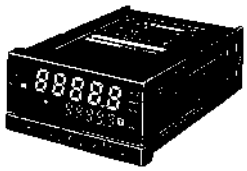
L2: Linear output (1 to 5 VDC) (see note)
L3: Linear output (1 mV/10 digits) (see note)
L4: Linear output, 4 to 20 mA + 5 transistor outputs (NPN open collector)
L5: Linear output, 1 to 5 V + 5 transistor outputs (NPN open collector)
L6: Linear output, 1 mV/10 digits+ 5 transistor outputs (NPN open collector)
L7: Linear output, 0 to 5 VDC (see note)
L8: Linear output, 0 to 10 VDC (see note)
L9: Linear output, 0 to 5 VDC + 5 transistor outputs (NPN open collector)
L10: Linear output, 0 to 10 VDC + 5 transistor outputs (NPN open collector)
FLK1: Communication RS-232C (see note)
FLK2: Communication RS-485 (see note)
FLK3: Communication RS-422 (see note)
FLK4: RS-232C + 5 transistor outputs (NPN open collector)
FLK5: RS-485 + 5 transistor outputs (NPN open collector)
FLK6: RS-422 + 5 transistor outputs (NPN open collector)

Base Units with Output Boards

K3NH - □ □ □ □ **-** □ □ □ □
1 2 3 4 5 6 7 8

Ordering Information

■ Base Unit

Model	Supply voltage	
	100 to 240 VAC	12 to 24 VDC
Basic Models These models provide a present value LED and front-panel control keys. Can be connected to any Output Board, or can be used for display only without an Output Board. 	K3NH-TA1A	K3NH-TA2A
Set Value LED Models These models provide a present value LED, set value LED, and front-panel control keys. Can be connected to Relay, Transistor, or Combination Output Boards. 	K3NH-TA1C	K3NH-TA2C

■ Available Output Board Combinations

Output type	Output configuration	Output boards	Base units	
			Basic	Set Value LED Display
Relay contact	3 outputs: H, PASS, L (SPDT)	K31-C1	Yes	Yes
	5 outputs: HH, H, L, LL (SPST-NO), and PASS (SPDT)	K31-C2	Yes	Yes
	5 outputs: HH, H, L, LL (SPST-NC), and PASS (SPDT)	K31-C5	Yes	Yes
Transistor	5 outputs (NPN open collector)	K31-T1	Yes	Yes
	5 outputs (PNP open collector)	K31-T2	Yes	Yes
BCD (see note)	5-digit output (NPN open collector)	K31-B2	Yes	---
Linear	4 to 20 mA DC	K31-L1	Yes	---
	1 to 5 VDC	K31-L2	Yes	---
	1 mV/10 digits	K31-L3	Yes	---
	0 to 5 VDC	K31-L7	Yes	---
	0 to 10 VDC	K31-L8	Yes	---
Communication boards (see note)	RS-232C	K31-FLK1	Yes	---
	RS-485	K31-FLK2	Yes	---
	RS-422	K31-FLK3	Yes	---
Combination output and communication boards	BCD output + 5 transistor outputs (NPN open collector)	K31-B4	Yes	Yes
	4 to 20 mA + 5 transistor outputs (NPN open collector)	K31-L4	Yes	Yes
	1 to 5 V + 5 transistor outputs (NPN open collector)	K31-L5	Yes	Yes
	1 mV/10 digits + 5 transistor outputs (NPN open collector)	K31-L6	Yes	Yes
	0 to 5 VDC + 5 transistor outputs (NPN open collector)	K31-L9	Yes	Yes
	0 to 10 VDC + 5 transistor outputs (NPN open collector)	K31-L10	Yes	Yes
	RS-232C + 5 transistor outputs (NPN open collector)	K31-FLK4	Yes	Yes
	RS-485 + 5 transistor outputs (NPN open collector)	K31-FLK5	Yes	Yes
	RS-422 + 5 transistor outputs (NPN open collector)	K31-FLK6	Yes	Yes

Note: For details, refer to the *Communication Operation Manual.*

Specifications

■ Ratings

Supply voltage	100 to 240 VAC (50/60 Hz); 12 to 24 VDC
Operating voltage range	85% to 110% of supply voltage
Power consumption (see note)	15 VA max. (max. AC load with all indicators lit) 10 W max. (max. DC load with all indicators lit)
Insulation resistance	20 MΩ min. (at 500 VDC) between external terminal and case. Insulation provided between inputs, outputs, and power supply.
Dielectric strength	2,000 VAC for 1 min between external terminal and case. Insulation provided between inputs, outputs, and power supply.
Noise immunity	±1,500 V on power supply terminals in normal or common mode ±1 μs, 100 ns for square-wave noise with 1 ns
Vibration resistance	Malfunction: 10 to 55 Hz, 0.5-mm for 10 min each in X, Y, and Z directions Destruction: 10 to 55 Hz, 0.75-mm for 2 hrs each in X, Y, and Z directions
Shock resistance	Malfunction: 98 m/s^2 for 3 times each in X, Y, and Z directions Destruction: 294 m/s^2 for 3 times each in X, Y, and Z directions
Ambient temperature	Operating: −10°C to 55°C (with no icing) Storage: −20°C to 65°C (with no icing)
Ambient humidity	Operating: 25% to 85% (with no condensation)
EMC	(EMI) EN61326+A1 Industry Emission Enclosure: CISPR 11 Group 1 class A: CISRP16-1/-2 Emission AC Mains: CISPR 11 Group 1 class A: CISRP16-1/-2 (EMS) EN61326+A1 Industry Immunity ESD: EN61000-4-2: 4 kV contact discharge (level 2), 8 kV air discharge (level 3) Immunity RF-interference: EN61000-4-3: 10 V/m (amplitude-modulated, 80 MHz to 1 GHz) (level 3) Immunity Fast Transient Noise: EN61000-4-4: 2 kV (power line) (level 3) Immunity Burst Noise: 1 kV line to line (I/O signal line) Immunity Surge: EN61000-4-5: 1 kV line to line, 2 kV line to ground (power line) Immunity Conducted Disturbance EN61000-4-6: 3 V (0.15 to 80 MHz) (level 2) Immunity Voltage Dip/Interrupting EN61000-4-11: 0.5 cycles, 0, 180°, 100% (rated voltage)
Approved standards	UL508, CSA22.2; Conforms to EN61326+A1, EN61010-1 (IEC61010-1) Conforms to VDE0106/P100 (finger protection) when the terminal cover is mounted.
Weight	Approx. 400 g

Note: A K3NH with DC supply voltage requires approximately 1 A DC as control power supply current the moment the K3NH is turned ON. Do not forget to take this into consideration when using several K3NH units. When the K3NH is not in measuring operation (e.g., the K3NH has been just turned ON or is operating for startup compensation time), the display will read "*-----*" and all outputs will be OFF.

■ Characteristics

Indication accuracy (at 23±5°C) (see note)	Thermocouple: (±0.3% of indication value or ±1°C, whichever greater) ±1 digit max. Platinum resistance thermometer: (±0.2% of indication value or ±0.8°C, whichever greater) ±1 digit max. Analog input: ±0.2% FS ±1 digit max.
Input	Thermocouple: K, J, T, E, L, U, N, R, S, B, W, PLII Platinum resistance thermometer: JPt100, Pt100 Current input: 4 to 20 mA, 0 to 20 mA Voltage input: 1 to 5 V, 0 to 5 V, 0 to 10 V
Sampling period	Temperature input: 250 ms Analog input: 100 ms
Input shift	Two-point settings (upper limit and lower limit)
Max. displayed digits	5 digits (–19999 to 99999)
Display	7-segment LED
Polarity display	"–" is displayed automatically with a negative input signal.
Zero display	Leading zeros are not displayed.
HOLD function	Maximum hold (maximum data) Minimum hold (minimum data)
External controls	HOLD: (Process value held) RESET: (Maximum/Minimum data reset)
Comparative output hysteresis setting	Programmable with front-panel key inputs (1 to 9999).
Other functions	Variable linear output range (for models with linear outputs only) Remote/Local processing (available for communications output models only) Maximum/Minimum value data reset with front panel keys °C/°F display selection Averaging processing function (simple or moving average) Comparative output pattern selection Standby sequence Security Field calibration
Output configuration	Relay contact output (5 outputs) Transistor output (NPN and PNP open collector), BCD (NPN open collector) Parallel BCD (NPN open collector) + transistor output (NPN open collector) Linear output (4 to 20 mA, 1 to 5 V) + transistor output (NPN open collector) Communication functions (RS-232C, RS-485, RS-422) Communication functions (RS-232C, RS-485, RS-422) + transistor output (NPN open collector)
Delay in comparative outputs (transistor output)	500 ms max.
Linear output response time	520 ms max.
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66) Rear case: IEC standard IP20 Terminals: IEC standard IP00
Memory protection	Non-volatile memory (EEPROM) (possible to rewrite 100,000 times)

Note: The indication accuracy of the K1, T, and N thermocouples at a temperature of -100°C or less is ±2°C ±1 digit maximum. The indication accuracy of the U, L1, and L2 thermocouples at any temperature is ±2°C ±1 digit maximum.
The indication accuracy of the B thermocouple at a temperature of 400°C or less is unrestricted.
The indication accuracy of the R and S thermocouples at a temperature of 200°C or less is ±3°C ±1 digit maximum.
The indication accuracy of the W thermocouple at any temperature is (±0.3% of the indicated value or ±3°C, whichever is greater) ±1 digit maximum.
The indication accuracy of the PLII thermocouple at any temperature is (±0.3% or ±2°C, whichever is greater) ±1 digit maximum.

■ Input Ranges

Platinum Resistance Thermometer

Input		JPt100	Pt100
Range	**°C**	–199.9 to 650.0	–199.9 to 650.0
	°F	–199.9 to 999.9	–199.9 to 999.9
Parameter		JPt	Pt

Thermocouple

Input (see note)		K1	K2	J1	J2	T	E	L1	L2	U	N	R	S	B	W	PLII
Range	°C	–200 to 1,300	0.0 to 500.0	–100 to 850	0.0 to 400.0	–199.9 to 400.0	0 to 600	–100 to 850	0.0 to 400.0	–199.9 to 400.0	–200 to 1,300	0 to 1,700	0 to 1,700	100 to 1,800	0 to 2,300	0 to 1,300
	°F	–300 to 2,300	0.0 to 900.0	–100 to 1,500	0.0 to 750.0	–199.9 to 700.0	0 to 1,100	–100 to 1,500	0.0 to 750.0	–199.9 to 700.0	–300 to 2,300	0 to 3,000	0 to 3,000	300 to 3,200	0 to 4,100	0 to 2,300
Parameter		P1 CR	P2 CR	J1 CC	J2 CC	t CC	E Cr	L1 CC	L2 CC	U CC	n	r Pr	S Pr	b Pr	W526	PL 2

Note: Thermocouple W is W/Re5-26 (tungsten rhenium 5, tungsten rhenium 26).

Current/Voltage

Input	Current input		Voltage input		
	4 to 20 mA	0 to 20 mA	1 to 5 V	0 to 5 V	0 to 10 V
Range	One of following ranges depending on results of scaling –1999 to 9999 –199.9 to 999.9 –19.99 to 99.99 –1.999 to 9.999				
Parameter	4-20	0-20	1-5	0-5	0-10

■ Input/Output Ratings

Relay Contact Output

(Incorporating a G6B Relay)

Item	Resistive load (cosϕ = 1)	Inductive load (cosϕ = 0.4, L/R = 7 ms)
Rated load	5 A at 250 VAC; 5 A at 30 VDC	1.5 A at 250 VAC, 1.5 A at 30 VDC
Rated carry current	5 A max. (at COM terminal)	
Max. contact voltage	380 VAC, 125 VDC	
Max. contact current	5 A max. (at COM terminal)	
Max. switching capacity	1,250 VA, 150 W	375 VA, 80 W
Min. permissible load (P level, reference value)	10 mA at 5 VDC	
Mechanical life	50,000,000 times min. (at a switching frequency of 18,000 times/hr)	
Electrical life (at an ambient temperature of 23°C)	100,000 times min. (at a rated load switching frequency of 1,800 times/hr)	

Transistor Output

Rated load voltage	24 VDC max.
Max. load current	50 mA
Leakage current	100 μA max.

BCD Output

I/O signal name		Item	Rating
Inputs	REQUEST, HOLD, MAX, MIN, RESET	Input signal	No-voltage contact input
		Input current with no-voltage input	10 mA
		Signal level	ON voltage: 1.5 V max. OFF voltage: 3 V min.
Outputs	DATA, POLARITY, OVERFLOW, DATA VALID, RUN	Rated load voltage	12 to 24 VDC $^{+10\%}/_{-15\%}$
		Max. load current	10 mA
		Leakage current	100 μA max.

Note: Logic method: negative logic

Linear Output

Item	4 to 20 mA	1 to 5 V	1 mV/10 digits (see note)
Resolution	4,096		
Output error	±0.5% FS		±1.5% FS
Permissible load resistance	600 Ω max.	500 Ω min.	1 KΩ min.

Note: For the 1 mV/10-digit output, the output voltage changes for every 40 to 50 increment in the display value.

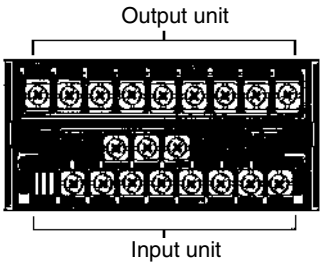
■ Communications Specifications

Item		RS-232C, RS-422	RS-485
Transmission method		4-wire, half-duplex	2-wire, half-duplex
Synchronization method		Start-stop synchronization	
Baud rate		1,200/2,400/4,800/9,600/19,200/38,400 bps	
Transmission code		ASCII (7-bit)	
Communications	**Write**	Comparative set value, input shift value, scaling value, remote/local programming, reset control of maximum/minimum values, and other setting mode items excluding communications conditions.	
	Read	Process value, comparative set value, maximum value, minimum value, model data, error code, and others	

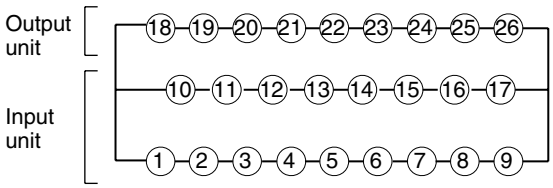
For details, refer to *Communication Operation Manual.*

Connection

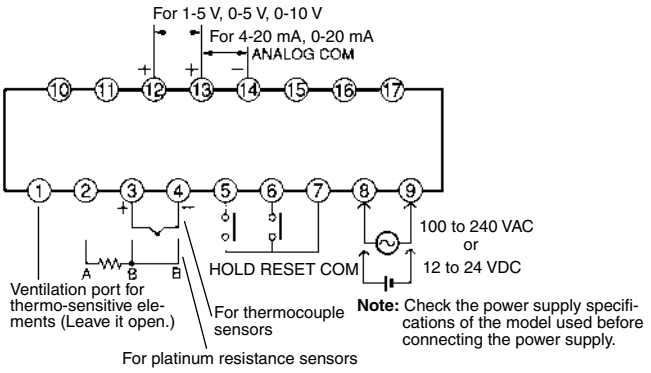
Terminal Arrangement



Terminal Numbers



Input Unit



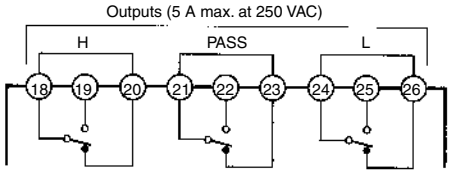
When inputting the external control signals through the open collector:

Transistor Inputs:
ON:Residual voltage must be 3 V max.
OFF:Leakage current must be 1.5 mA max.
The switching capacity must be 20 mA or greater.

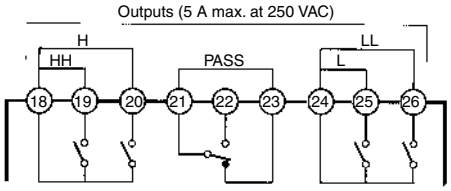
When the external signal input is short-circuited, a voltage of approximately 5 V will be applied to between the terminals 5 to 7 and the COM terminal, and a current of approximately 18 mA (nominal value) will flow.

Output Units

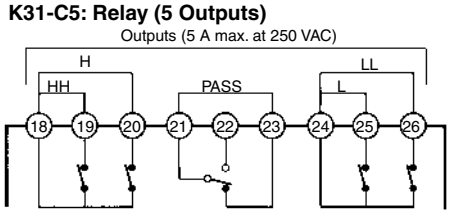
K31-C1: Relay (3 Outputs)



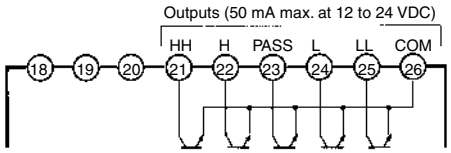
K31-C2: Relay (5 Outputs)



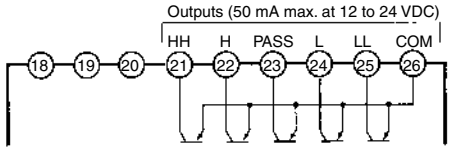
K31-C5: Relay (5 Outputs)



K31-T1: Transistor (NPN Open Collector)

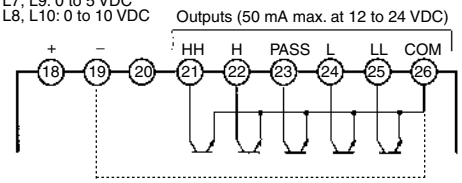


K31-T2: Transistor (PNP Open Collector)



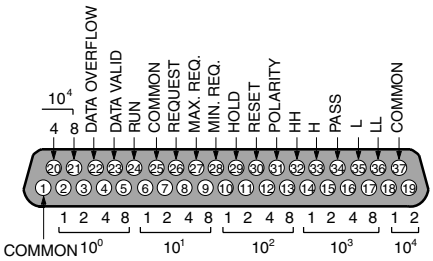
K31-L1, L2, L3,-L4, -L5, -L6, -L7, -L8, -L9, -L10: Linear
(Terminals 21 to 26 are provided only on K31-L4, -L5, -L6, -L9, -L10.)

L1, L4: 4 to 20 mA
L2, L5: 1 to 5 V
L3, L6: 1 mV/10 digit
L7, L9: 0 to 5 VDC
L8, L10: 0 to 10 VDC

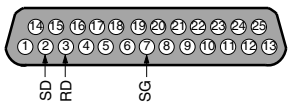


Note: With K31-L4/-L5/-L6/-L9/-L10 models, terminals 19 and 26 are connected internally.

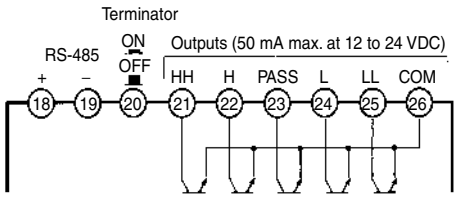
K31-B2, -B4: BCD (NPN Open Collector)
(Terminals 32 to 36 are provided only on K31-B4.)



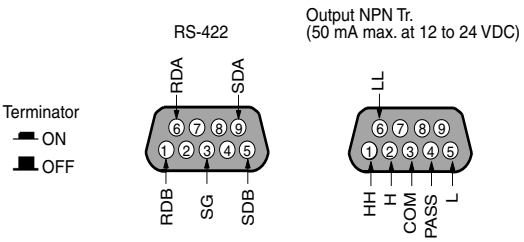
K31-FLK1: RS-232C



K31-FLK2, -FLK5: RS-485
(Terminals 21 to 26 are provided only on K31-FLK5.)

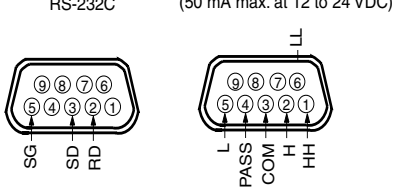


K31-FLK3, -FLK6: RS-422
(The right connector is provided only on K31-FLK6)

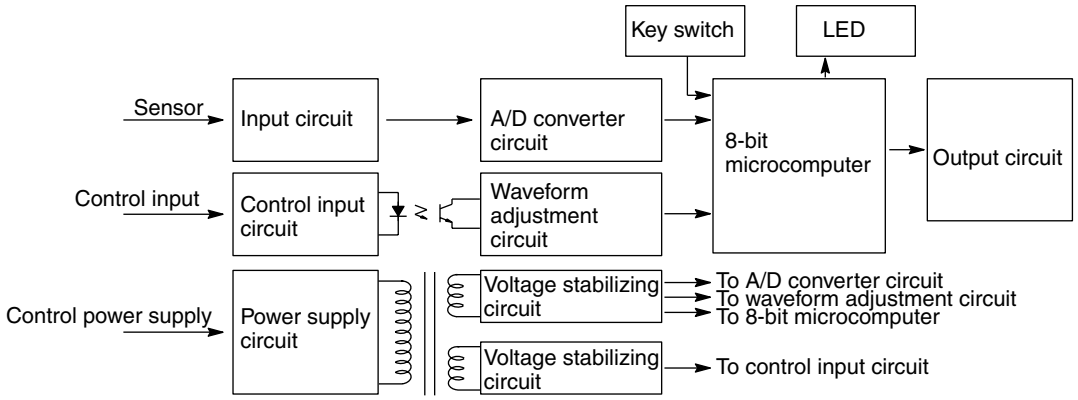


- D-sub 37P Connectors for BCD output (attachment)
  Plug: XM2A-3701
  Hood: XM2S-3711
- D-sub 25P connectors for RS-232C output (K31-FLK1) (order separately)
  Plug: XM2A-2501
  Hood: XM2S-2511
- D-sub 9P connectors for RS-422 output (K31-FLK3 and K31-FLK6) (order separately)
  Plug: XM2A-0901
  Hood: XM2S-0911
- D-sub 9P connectors for RS-232C output (K31-FLK4) (order separately)
  Plug: XM2D-0901
  Hood: XM2D-0911

K31-FLK4: RS-232C + Transistor (NPN Open Collector)



■ Block Diagram



Operation

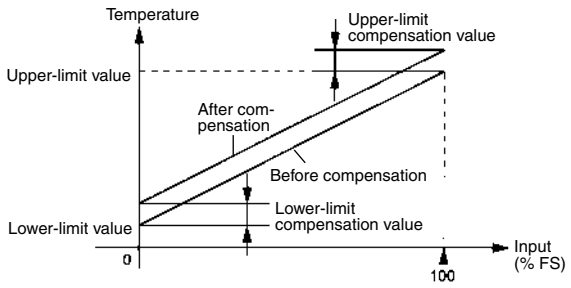
■ Main Functions

Average Processing AVG

The average processing function stabilizes displayed values by averaging the corresponding analog input signals that fluctuate dynamically or reducing the noise in the input signals.

Input Shift INSH/INSL

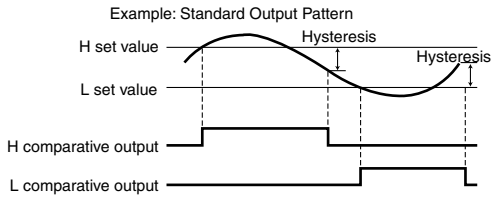
When temperature input is selected, scaling is not required. This is because input is treated as the “temperature” as it is matched to the input type. However, note that the upper- and lower-limit values of the sensor can be shifted. For example, if both the upper- and lower-limit values are shifted by 1.2°C, the process value (before shift) is regarded as 201.2°C after shift when input is 200°C before shift.



Hysteresis HYS

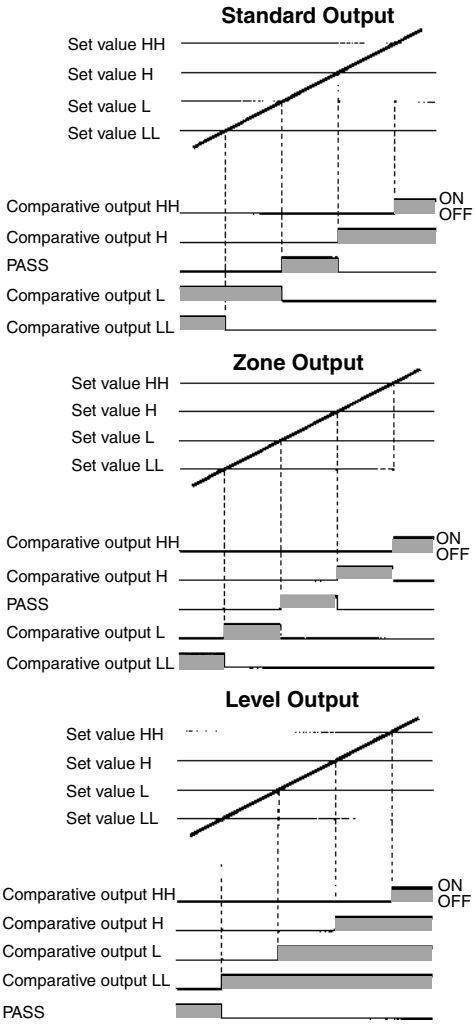
(Models with comparative outputs only)

The hysteresis of comparative outputs can be set to prevent chattering.



Output Pattern Selection C-OUT

The patterns of comparative output are selectable according to the level change. Select the pattern according to the application.

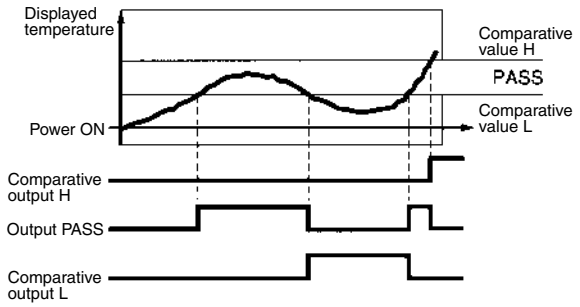


Note: The following setting conditions must be satisfied, otherwise no zone output will turn ON correctly.
LL < L < H < HH

Standby Sequence StdbY

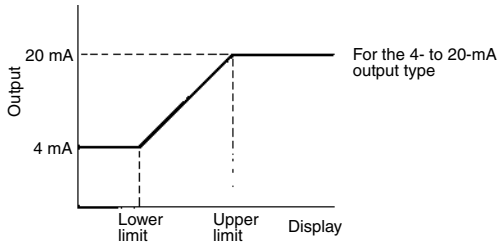
The comparative output operation can be disabled from when the power supply is turned ON to when it enters the PASS range. This is effective for avoiding any unnecessary output until the output reaches the measurement range after the power is turned ON.
(Since other comparative output operations are disabled until the output falls within the PASS range, comparative output operation may not be performed if the settings are incorrect. Therefore, be careful when selecting the comparative output pattern and setting various comparative values.)

Example: When the standby sequence function is ON.



Linear Output Range LSEt

A linear output range can be set as required. A value corresponding to the maximum output value and that corresponding to the minimum output value can be set.



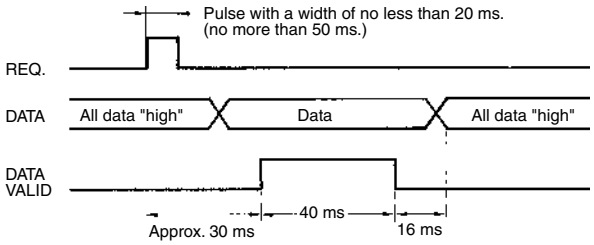
Remote/Local Selection r-L

Select remote programming when performing all settings through the host devices and select local programming when performing settings through key operation.

■ BCD Output Timing Chart

A request signal from an external device (such as a Programmable Controller) is required to read BCD data.

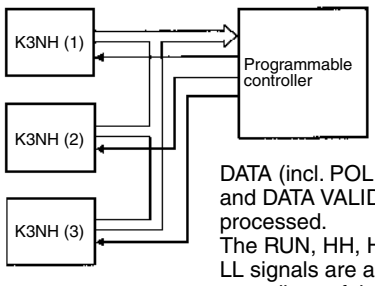
Single Sampling Data Output



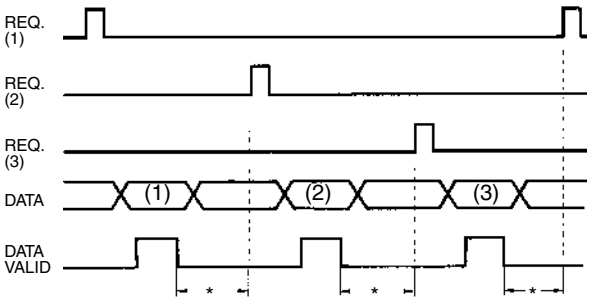
Approximately 30 ms after the REQ signal rises, a sample is taken and the DATA VALID signal is output. Read the data when the DATA VALID signal is ON.

The DATA VALID signal will turn OFF in 40 ms, and then in 16 ms, the data will go OFF.

Models with a BCD output have an open collector output configuration so that wired-OR connection is possible.

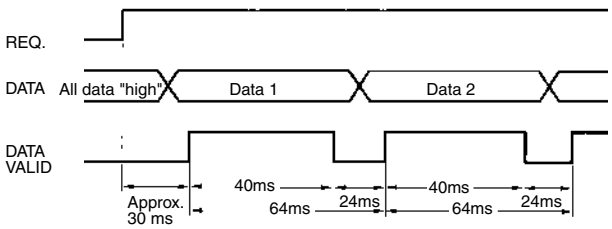


DATA (incl. POL and OVER) and DATA VALID are wired-OR processed.
The RUN, HH, H, PASS, L, and LL signals are always output regardless of the status of the REQ signal. Do not OR-wire these signals.



*The period between the DATA VALID signal and the REQ signal should be no less than 20 ms max.

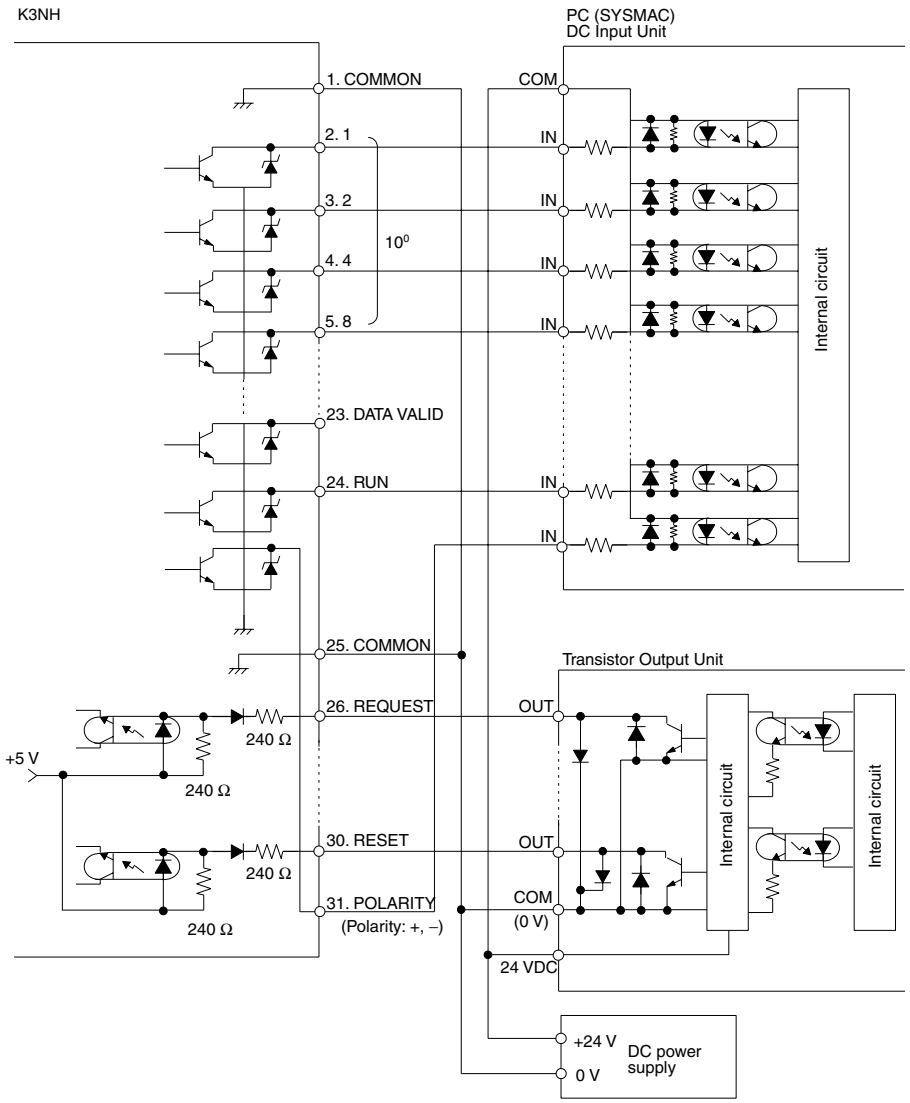
Continuous Data Output



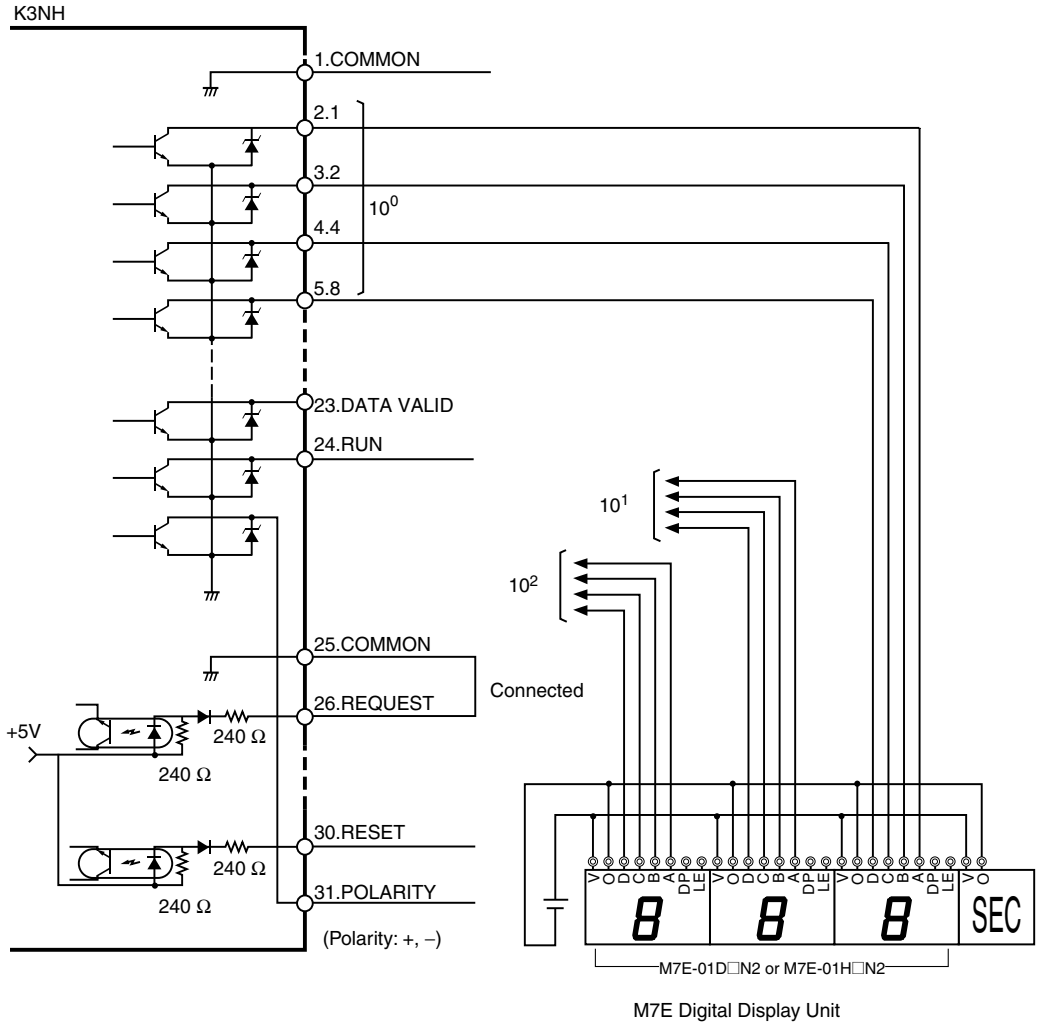
The K3NH outputs each measurement at an interval of 64 ms when a REQ signal is ON continuously.

If the HOLD signal is ON at the moment the DATA output is switched from data 1 to data 2 or vice versa, the output BCD data will be either data 1 or data 2 according to the timing of the HOLD signal. However, output data will never below.

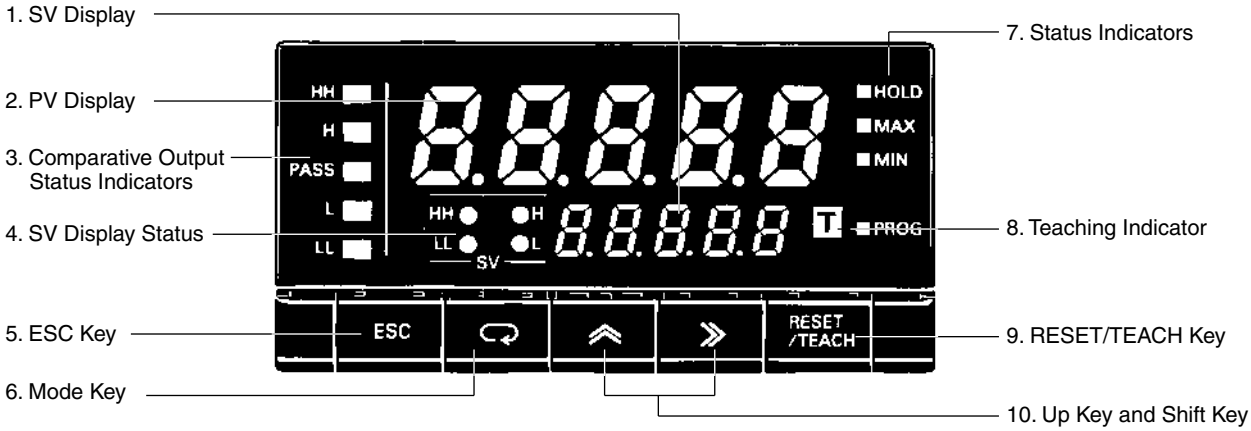
Example of Connection to Programmable Controller



Example of Connection to Display Unit



Nomenclature

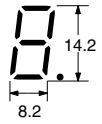


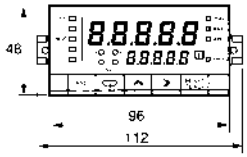
Name	Functions
1. SV display	Displays the set value or parameter. Available for Set Value LED Models only.
2. PV display	Displays the process value in addition to the max/min value or parameter.
3. Comparative output status indicators	Displays the status of comparative output.
4. SV display status	Indicates which comparative set value is currently on the SV display.
5. ESC Key	Used to return to the RUN mode from the Setting Protect, or Maintenance mode. The process value, maximum value, or minimum value to be displayed can be selected.
6. Mode Key	Used to enter the Setting mode. Used to allow the PV display to indicate set values sequentially. Available for Basic Models only. Used to indicate set values sequentially on the SV display. Available for Set Value LED Models only.
7. Status indicators	HOLD: Lit when HOLD input is ON. MAX: Lit when the maximum value is indicated on the PV display. MIN: Lit when the minimum value is indicated on the PV display. PROG: Lit or flashes while parameters are being set.
8. Teaching indicator	Lit when the teaching function is enabled and flashes when the K3NH is in teaching operation.
9. RESET/TEACH Key	The maximum value and minimum value are reset by pressing this key. Teaching is available when the teaching function is enabled.
10. Up Key and Shift Key	The digit being set is scrolled by pressing the Shift Key. The set value increases by one whenever the Up Key is pressed.

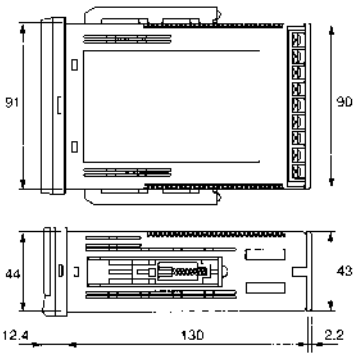
Dimensions

Note: All units are in millimeters unless otherwise indicated.

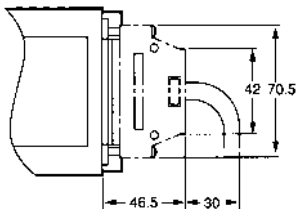
PV Display



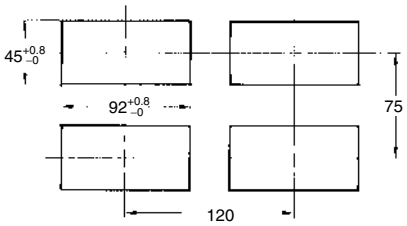




Note: The K3NH uses M3.5 terminals.
A terminal cover is provided.

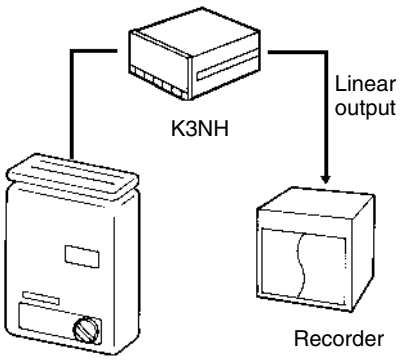


Panel Cutouts

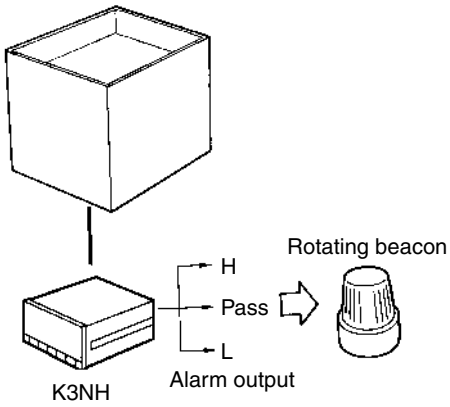


Application Examples

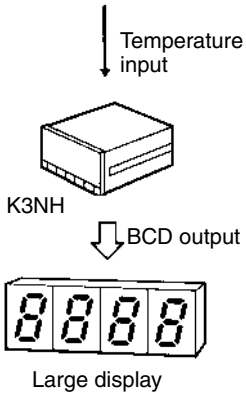
Inspection Lines for Gas Appliances



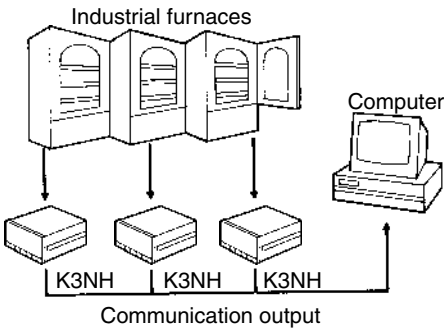
Temperature Monitoring for Plating and Coating Baths



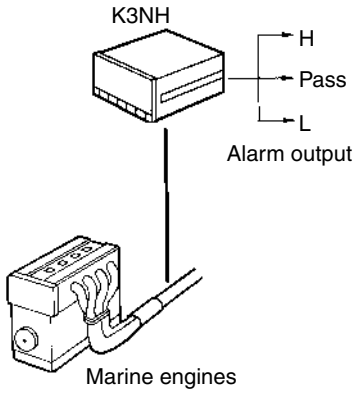
Interfacing Large External Displays



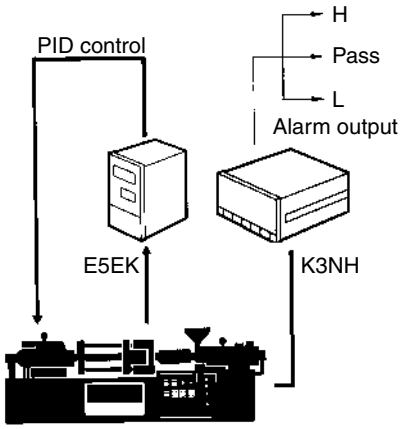
Centralized Temperature Monitoring for Industrial Furnaces



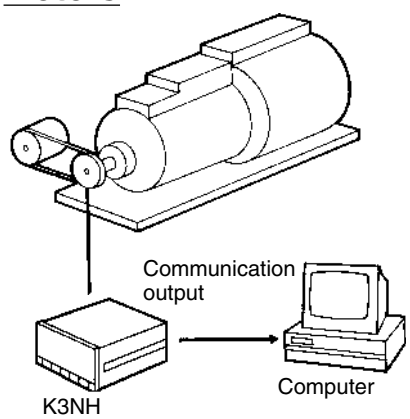
Monitoring Exhaust Temperatures on Marine Engines



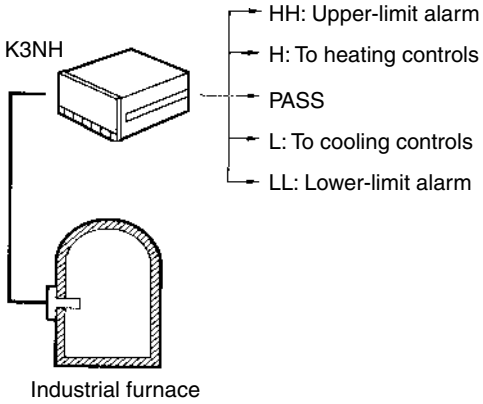
Temperature Display and Alarms for Forming Equipment



Monitoring Bearing Temperature on Generators and Motors



Temperature Monitoring and Control Interfaces for Multi-level Alarms



Precautions

⚠ WARNING

Do not touch any of the terminals while the power is being supplied. Doing so may result in electric shock.

⚠ Caution

Do not allow metal objects or conductive wire cuttings to enter the product. Doing so may result in electric shock, fire, or malfunction.

⚠ Caution

Do not attempt to take the product apart or touch any internal parts while the power is being supplied. Doing so may result in electric shock.

⚠ Caution

Do not use the product in locations subject to flammable or explosive gases. Doing so may result in explosion.

⚠ Caution

The lifetime of output relays varies greatly with the switching capacity and conditions. Consider the actual operating conditions, and use the relays within the rated load without exceeding the number of operations specified as the rated electrical life. Using relays beyond their rated electrical life may result in contact deposit or burning.

⚠ Caution

Do not use loads exceeding the rated value. Doing so may result in damage or burning.

⚠ Caution

Use a power supply voltage within the specified range. Not doing so may result in damage or burning.

⚠ Caution

Use settings that are appropriate for the control system. Discrepancies between the settings and the actual control conditions may result in unexpected operation leading to damage or accidents.

⚠ Caution

Be sure to tighten terminal screws to the specified torque.
Specified torque for M3.5 screws: 0.74 to 0.90 N·m
Loose screws may result in burning or malfunction.

■ Application Precautions

- Use a power supply voltage within the specified range. Not doing so may result in damage or burning.
- Be sure to perform wiring correctly, verifying the terminal names. Incorrect wiring may result in burning.
- Be sure to tighten the screws on the terminal block properly.
- Do not connect anything to unused terminals.

■ Correct Use

Long-term Use

Use all products within the specified ranges. When using inside a control panel, ensure that the temperature around the product, rather than the temperature around the control panel, does not exceed the specified temperature range. Electronic products, such as this product, have a lifetime that is dependent on the lifetime of internal electronic components, as opposed to the lifetime related to the number of relay switching operations. The lifetime of these components varies with the temperature; the higher the temperature, the shorter the lifetime. Therefore, the product lifetime can be extended by lowering the internal temperature of the product.

When several Temperature Meters are mounted close together (either horizontally or vertically), the internal temperature of the Temperature Meter may rise, leading to a reduction in the lifetime. In this case, take measures to cool the Temperature Meters, such as installing fans. Ensure, however, that the terminals are not cooled as this may lead to incorrect measurement.

Operating Environment

Do not use the product in locations subject to temperatures or humidity levels above the specified ranges, or in locations subject to condensation.

Do not use the product in locations subject to severe shocks or vibrations.

Separate the product from machines that generate high-frequency noise, such as high-frequency welding machines and high-frequency sewing machines.

Do not use the product in locations subject to dust or corrosive gases.

Do not use the product outdoors or in locations subject to direct sunlight.

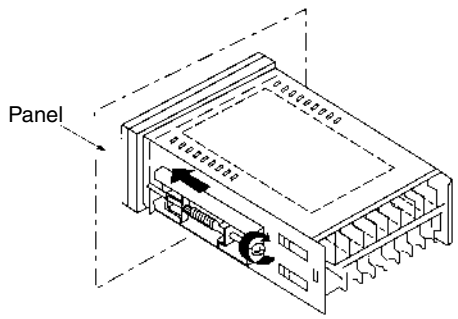
Operation

When using models with comparative outputs, if an error occurs at the Temperature Meter, comparative output may not operate correctly. We therefore recommend that you consider providing an alarm system separately as a countermeasure.

Parameter settings that allow the functions to operate properly are made, using the setting menu, at the factory prior to delivery. When using the product, change the settings as required for the application.

Mounting

Recommended panel thickness is 1 to 3.2 mm.



Attach the mounting bracket on the left and right sides of the Temperature Meter as shown in the illustration above and gradually tighten each screw evenly in turn by considering the balance of the tightening force until the ratchets start slipping without being further tightened.

Mount the Temperature Meter as horizontally as possible.

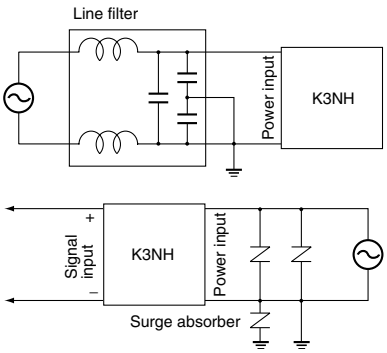
Waterproof Specifications

Products for which the degree of protection is not specified or models with IP□0 degree of protection do not have waterproof specifications.

Noise Countermeasures

Separate the product as far as possible from machines that generate high-frequency noise, such as high-frequency welding machines and high-frequency sewing machines, and machines that generate surges.

Attach surge absorbers or noise filters to noise-generating peripheral devices (in particular, devices with inductance such as motors, transformers, solenoids, and magnet coils).



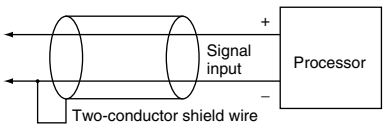
With the K3NH, do not connect a surge absorber to the temperature sensor input.

In order to prevent inductive noise, wire the lines connected to the terminal block separately from power lines carrying high voltages or large currents. Also, do not wire in parallel to, or in the same cable as power lines. There are other methods that are effective for reducing noise, such as running wires along ducts and using shield lines.

When using a noise filter for the power supply, check the voltage and current and install as close to the Temperature Meter as possible.

Inductive Noise Countermeasure for Input Line

Analog Input



Temperature Input

In order to prevent the influence of induction, separate the lead wire joining the temperature sensor and the Temperature Meter from power and load lines.

Using the product near radios, television sets, or other wireless devices may result in reception interference.

Unit Label (Provided)

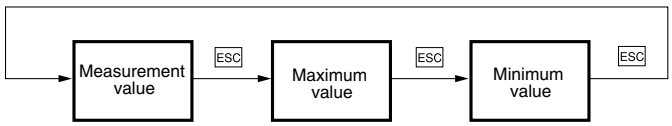
No product is shipped with the unit label attached. Select a unit label from the sheet provided and attach it to the Temperature Meter.

Operating Procedures

■ Operation in RUN Mode

Confirming Maximum and Minimum Values

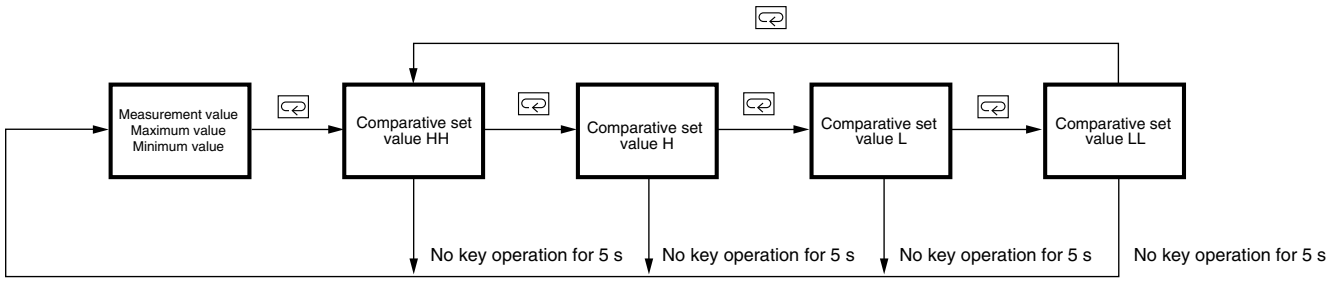
Press the ESC Key [ESC] during measurement to display the maximum and minimum values.



Press the RESET/TEACH Key [RESET /TEACH] while the maximum or minimum value is displayed to reset the value. (This is not possible, however, if maximum/minimum value reset was prohibited in Protect Mode.)

Confirming and Setting Comparative Set Values

When the measurement value, the maximum value, or the minimum value is displayed, press the Mode Key [↺] repeatedly to display the comparative set values in the order HH, H, L, and LL. (With models that have an SV display, the comparative set values are displayed in the SV display.)



Note: When a comparative set value is displayed, it can be changed using the Up Key [∧] and Shift Key [»] (if key protection is OFF).

■ Setting Procedures

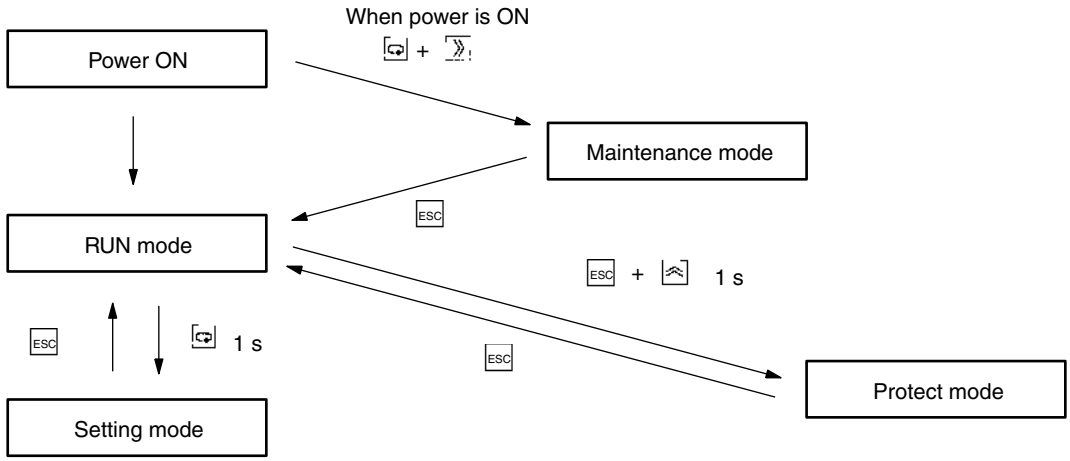
The K3NH has four modes: RUN mode for normal operations, Setting mode for initial parameter input, Protect mode for lock-out configuration, and Maintenance mode for initializing set values and user calibration. The parameters that are accessible on any individual K3NH will vary depending on the Output Board installed. Refer to the *K3NH Operation Manual* for details.

RUN Mode: Remains in this mode under normal operation.
The process value or the max./min. value can be monitored.
Using the front panel keys, the comparative set value can be changed and max./min. values reset can be performed.

Setting Mode: Used for making initial settings.
Includes settings for three menus (Set value (SuSEt), setup (SEtUP), option (oPt)) and the output test.

Protect Mode: Used for locking the front key operation or parameter changes.

Maintenance Mode: Used for initializing set values and user calibration of the inputs.
The user calibration is valid for selected input ranges.



SuSEt - Program set values

Su.HH	Enter set value HH
Su. H	Enter set value H
Su. L	Enter set value L
Su.LL	Enter set value LL

SEtUP - Program input type/Serial communications

in-t	Determine input type
C--F	Select the °C/°F display
in-H	Scaling upper limit
in-L	Scaling lower limit
dEC-P	Select decimal point
U-no	Enter the unit no. for the host
bPS	Select the baud rate
LEn	Select the word bit length
Sbit	Select the stop bits
PrtY	Select the parity bits

oPt - Supplementary settings related to display or control

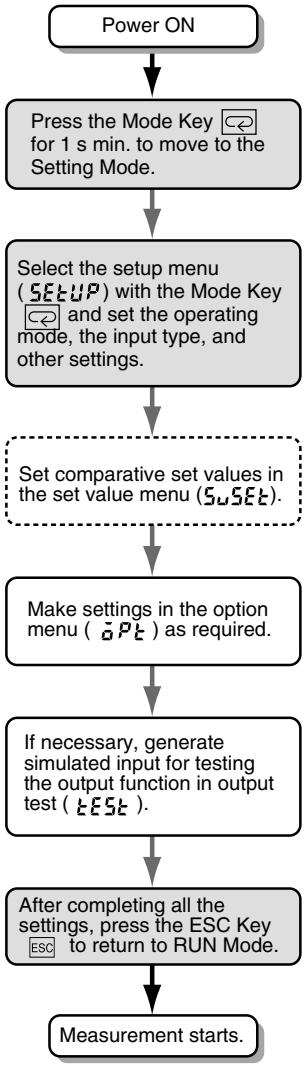
AuG	Set for averaging process value
diGit	Select the number of digits to be displayed
inSH	Select shift amounts of input shift upper limit values
inSL	Select shift amounts of input shift lower limit values
HYS	Enter hysteresis value
C-oUt	Select the output pattern
StdbY	Enable standby sequence
LSEt.H	Enter the upper limit (H) of linear output range
LSEt.L	Enter the lower limit (L) of linear output range
r-L	Select the remote/local programming

tESt - Generating simulated input for testing the output function

Prot - Program lock-out configuration

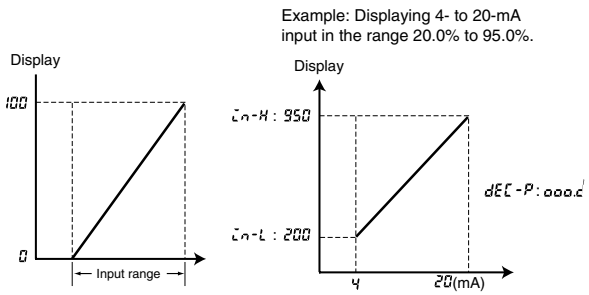
ALL	Enable all key protection
SuSEt	Enable set value change prohibition
mm.rSt	Enable prohibition of max./min. value reset using the front panel keys
SECr	Specify the menus to be protected against setting in the setting mode

■ Initial Settings

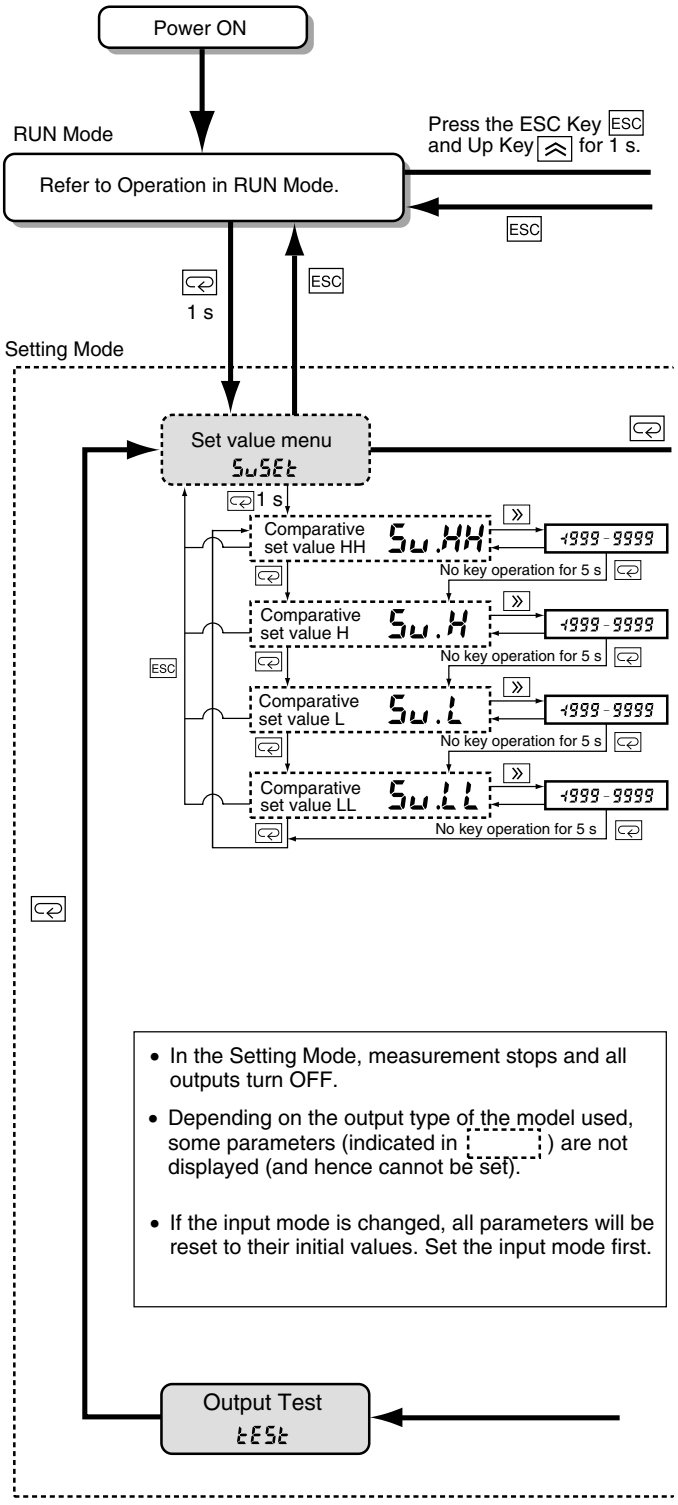


Scaling

When the input type is set to analog input (current/voltage input), input signals can be converted and displayed in the desired display value. The setting can be made by inputting display values that correspond to the upper-limit input value (initial value: 0000) and lower-limit input value (initial value: 0 100) for the selected input type. The decimal point can be set to any position.



■ Parameters

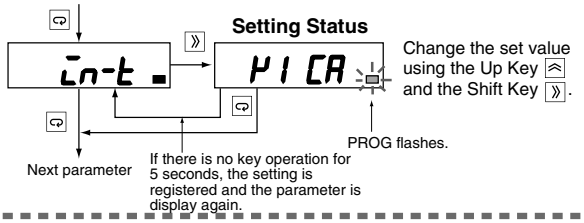


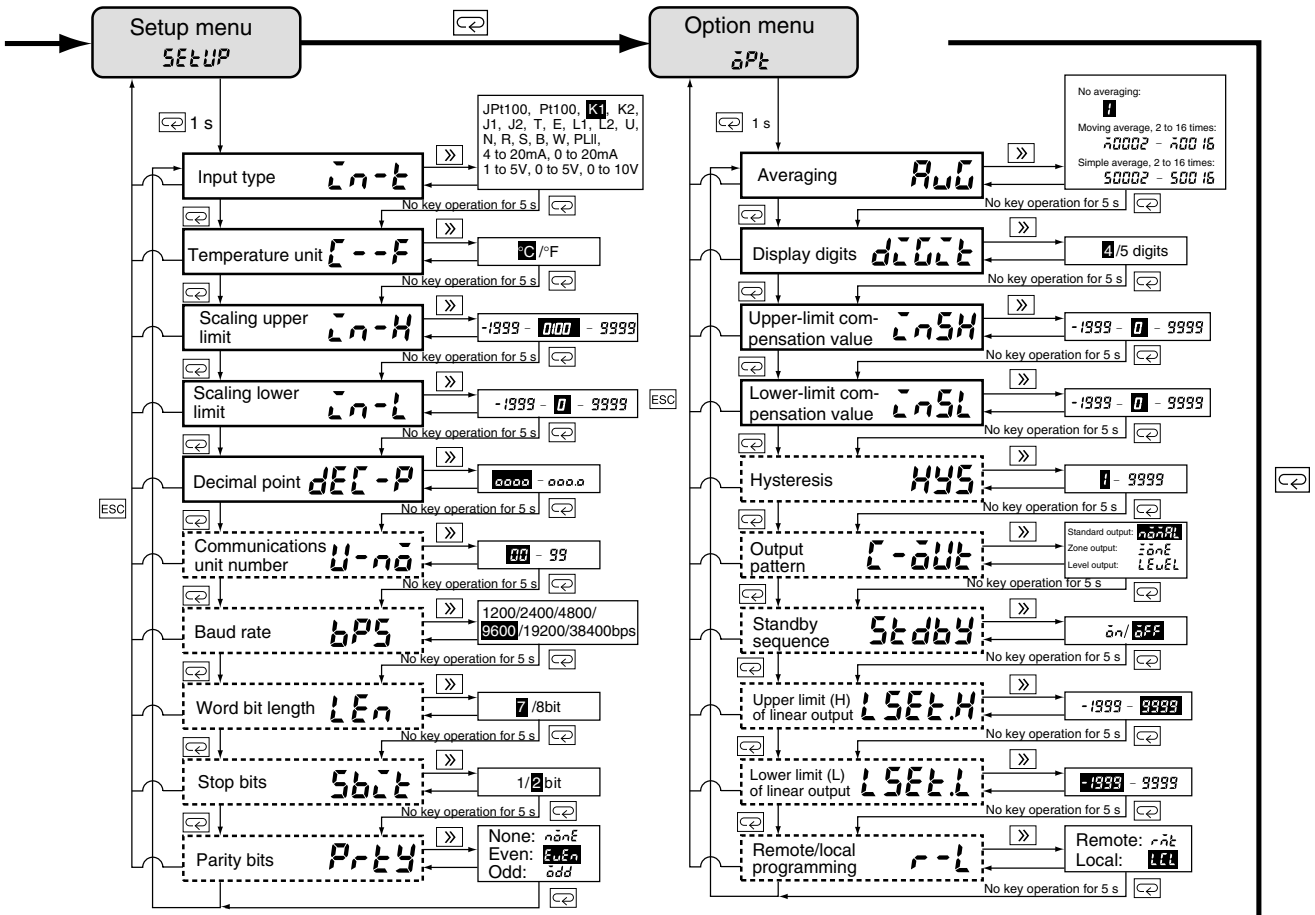
- In the Setting Mode, measurement stops and all outputs turn OFF.
- Depending on the output type of the model used, some parameters (indicated in [ ]) are not displayed (and hence cannot be set).
- If the input mode is changed, all parameters will be reset to their initial values. Set the input mode first.

Protect Mode

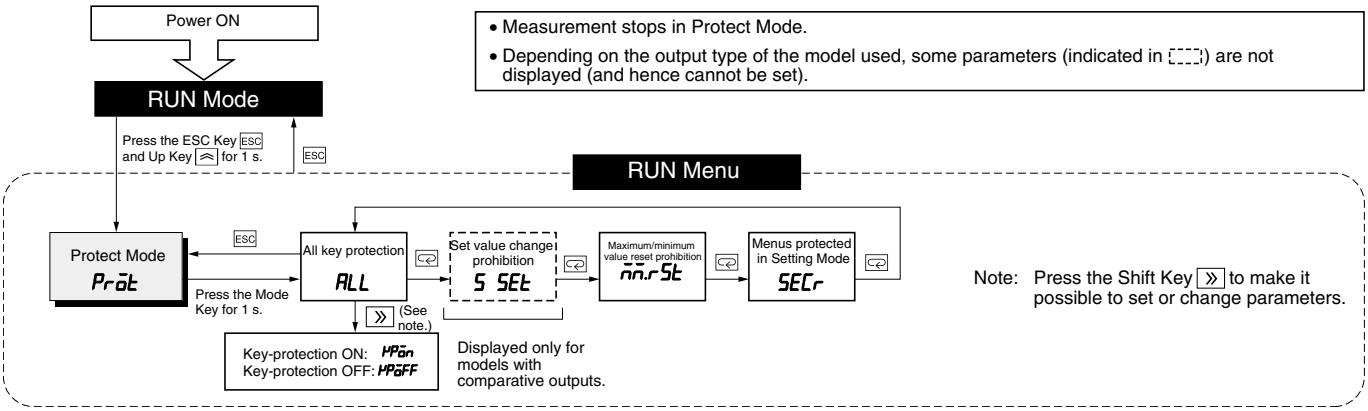
Changing Set Values

By pressing the Shift Key » while a parameter is displayed, the set value can be changed (setting status). The PROG status indicator will flash. Change the set value as required, and press the Mode Key to register the setting and move to the next parameter.





Settings displayed in reverse colors are defaults.



■ Protect Mode Settings

Settings displayed in reverse colors are defaults.

Menu display	Parameter display	Meaning of parameter	Setting range	Setting key (See note.)
Prot Press the Mode Key to display the parameter. Press the ESC Key to return to the menu.	ALL Setting: » Next parameter:	All key protection: All key operations are prohibited in RUN Mode. (If all key protection is ON, only the key for going to Protect Mode is enabled.)	Key protection ON: HPon Key protection OFF: HPoFF	Use the Up Key to change the setting. HPon → HPoFF Use the Mode Key to enable the setting and move to the next parameter.
	SuSEt Setting: » Next parameter:	Set value change prohibition: Changes to comparative set values are prohibited in RUN Mode. (Displayed only for models with comparative outputs.)		
	mn.rSt Setting: » Next parameter:	Maximum/minimum value reset prohibition: Resetting of maximum and minimum values using the front panel keys is prohibited. (Resetting by external signals is not prohibited.)		
	SECr Setting: » Next parameter:	Menus protected in Setting Mode: Setting operations in Setting Mode are prohibited in the way shown below.	0 / 1/2	Use the Up Key to change the setting. 1 → 2 → 3 Use the Mode Key to enable the setting and move to the next parameter.

Setting menu	Setting		
	0	1	2
Set value menu			×
Setup menu		×	×
Option menu			×

Note: If there is no key operation for 5 seconds, the setting is automatically registered.

■ Troubleshooting

When an error occurs, error details will be displayed in the PV display. Take the appropriate countermeasures according to the error displayed.

Error display	Error contents		Comparative output			Countermeasure
		Output status	BCD output	Communications output	Linear output	
M1.Err (M1.ERR) M2.Err (M2.ERR)	Memory error	OFF	OFF (all outputs in "H" status)	OFF	OFF	Reset the power. If the same error occurs, repair is necessary.
M3.Err (M3.ERR)		OFF	OFF (all outputs in "H" status)	OFF	OFF	Reset the power while holding down the ESC Key, the Up Key, and the RESET/TEACH Key. The settings will be returned to their initial values. Redo the settings. If the same error occurs, repair is necessary.
Ad.Err (AD.ERR)	AD converter error	OFF	OFF (all outputs in "H" status)	OFF	OFF (minimum value)	Reset the power. If the same error occurs, repair is necessary.
Err-O (ERR-O) CHG-O (CHG-O)	Output error	OFF	OFF (all outputs in "H" status)	OFF	OFF (minimum value)	
S.Err (S.ERR)	Input error	OFF	OFF (all outputs in "H" status)	OFF (An error response is returned.)	OFF (minimum value)	Check for incorrect input wiring, for disconnected power lines, for short-circuiting, and the input type.
(Display value flashes.)	The display range was exceeded.	Continues	Continues The OVER signal turns ON.	Continues The OVER or UNDER signal turns ON.	Continues	Take steps to ensure that the input values and display values are within the allowable ranges.
rmt (RMT) (Flashes for 3 s.)	The remote/local section is set to remote.	Continues	Continues	Continues	Continues	If an attempt to change a setting using key operations is made with the remote/local selection set to remote, this error will flash for 3 s. To enable settings to be changed, set the remote/local selection to local.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. N086-E1-02

Frequency/Rate Meter
K3NR

High-speed, Intelligent Interface Modules with Seven Operating Modes Convert Single or Dual Input Pulses to Display Values

- 50-kHz input range and 0.006% accuracy for sophisticated control.
- A wide selection of outputs: relay, transistor, BCD, linear, or communications.
- Maximum/Minimum value hold, set value write protection, and more.
- Banks with four comparative output values and four prescale values.
- Prescale function available, which displays in units of actual physical parameters (length, volume, etc.).
- Set value teaching, linear output range teaching, and prescale teaching are available using actual measured values.
- Displays values in hours, minutes, and seconds in operating mode 6.
- A startup compensation time parameter keeps the measurement operation from sending an unnecessary output for a preset period up to 99.9 s.
- Built-in sensor power supply (12 VDC, 80 mA).
- Compact 1/8 DIN size.
- Conforms to EMC standards, EN61010-1 (IEC61010-1).
- UL/CSA approved.

Model Number Structure

■ Model Number Legend

Base Units and Output Boards can be ordered individually or as sets. Refer to the *Output Board Combinations* table on page 130.

Base Units

K3NR - □ □ □ □
1 2 3 4

1, 2. Input Sensors Codes

NB: NPN inputs/Voltage pulse inputs
PB: PNP inputs

3. Supply Voltage

1: 100 to 240 VAC
2: 12 to 24 VDC

4. Display

A:Basic
C:Set Value LED Display

5, 6, 7, 8. Output Type Codes

C1: 3 comparative relay contact outputs (H, PASS, L: SPDT)
C2: 5 comparative relay contact outputs (HH, H, L, LL: SPST-NO; PASS: SPDT)
C5: 5 comparative relay contact outputs (HH, H, L, LL: SPST-NC; PASS: SPDT)
T1: 5 comparative transistor outputs (NPN open collector)
T2: 5 comparative transistor outputs (PNP open collector)
B2: BCD output (NPN open collector) (see note)
B4: BCD output + 5 transistor outputs (NPN open collector)
L1: Linear output (4 to 20 mA) (see note)

Note: These output types are available on Basic Models only.

Output Boards

K31 - □ □ □ □
5 6 7 8

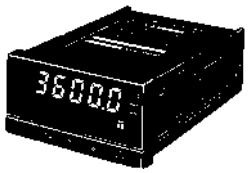
L2: Linear output (1 to 5 VDC) (see note)
L3: Linear output (1 mV/10 digits) (see note)
L4: Linear output, 4 to 20 mA + 5 transistor outputs (NPN open collector)
L5: Linear output, 1 to 5 V + 5 transistor outputs (NPN open collector)
L6: Linear output, 1 mV/10 digits+ 5 transistor outputs (NPN open collector)
L7: Linear output, 0 to 5 VDC (see note)
L8: Linear output, 0 to 10 VDC (see note)
L9: Linear output, 0 to 5 VDC + 5 transistor outputs (NPN open collector)
L10: Linear output, 0 to 10 VDC + 5 transistor outputs (NPN open collector)
FLK1: Communication RS-232C (see note)
FLK2: Communication RS-485 (see note)
FLK3: Communication RS-422 (see note)
FLK4: RS-232C + 5 transistor outputs (NPN open collector)
FLK5: RS-485 + 5 transistor outputs (NPN open collector)
FLK6: RS-422 + 5 transistor outputs (NPN open collector)

Base Units with Output Boards

K3NR - □ □ □ □ -□ □ □ □
1 2 3 4 5 6 7 8

Ordering Information

■ Base Unit

Input type		NPN/Voltage pulse		PNP	
Supply voltage		100 to 240 VAC	12 to 24 VDC	100 to 240 VAC	12 to 24 VDC
Basic Models These models provide a present value LED and front-panel control keys. Can be connected to any Output Board, or can be used for display only without an Output Board.		K3NR-NB1A	K3NR-NB2A	K3NR-PB1A	K3NR-PB2A
Set Value LED Models These models provide a present value LED, set value LED, and front-panel control keys. Can be connected to Relay, Transistor, or Combination Output Boards.		K3NR-NB1C	K3NR-NB2C	K3NR-PB1C	K3NR-PB2C

■ Available Output Board Combinations

Output type	Output configuration	Output boards	Base units	
			Basic	Set Value LED Display
Relay contact	3 outputs: H, PASS, L (SPDT)	K31-C1	Yes	Yes
	5 outputs: HH, H, L, LL (SPST-NO), and PASS (SPDT)	K31-C2	Yes	Yes
	5 outputs: HH, H, L, LL (SPST-NC), and PASS (SPDT)	K31-C5	Yes	Yes
Transistor	5 outputs (NPN open collector)	K31-T1	Yes	Yes
	5 outputs (PNP open collector)	K31-T2	Yes	Yes
BCD (see note)	5-digit output (NPN open collector)	K31-B2	Yes	---
Linear	4 to 20 mA DC	K31-L1	Yes	---
	1 to 5 VDC	K31-L2	Yes	---
	1 mV/10 digits	K31-L3	Yes	---
	0 to 5 VDC	K31-L7	Yes	---
	0 to 10 VDC	K31-L8	Yes	---
Communication boards (see note)	RS-232C	K31-FLK1	Yes	---
	RS-485	K31-FLK2	Yes	---
	RS-422	K31-FLK3	Yes	---
Combination output and communication boards	BCD output + 5 transistor outputs (NPN open collector)	K31-B4	Yes	Yes
	4 to 20 mA + 5 transistor outputs (NPN open collector)	K31-L4	Yes	Yes
	1 to 5 V + 5 transistor outputs (NPN open collector)	K31-L5	Yes	Yes
	1 mV/10 digits + 5 transistor outputs (NPN open collector)	K31-L6	Yes	Yes
	0 to 5 VDC + 5 transistor outputs (NPN open collector)	K31-L9	Yes	Yes
	0 to 10 VDC + 5 transistor outputs (NPN open collector)	K31-L10	Yes	Yes
	RS-232C + 5 transistor outputs (NPN open collector)	K31-FLK4	Yes	Yes
	RS-485 + 5 transistor outputs (NPN open collector)	K31-FLK5	Yes	Yes
	RS-422 + 5 transistor outputs (NPN open collector)	K31-FLK6	Yes	Yes

Note: For details, refer to the *Communication Operation Manual.*

Specifications

■ Ratings

Supply voltage	100 to 240 VAC (50/60 Hz); 12 to 24 VDC
Operating voltage range	85% to 110% of supply voltage
Power consumption (see note)	15 VA max. (max. AC load with all indicators lit) 10 W max. (max. DC load with all indicators lit)
Sensor power supply	80 mA at 12 VDC±10%
Insulation resistance	20 MΩ min. (at 500 VDC) between external terminal and case. Insulation provided between inputs, outputs, and power supply.
Dielectric strength	2,000 VAC for 1 min between external terminal and case. Insulation provided between inputs, outputs, and power supply.
Noise immunity	±1,500 V on power supply terminals in normal or common mode ±1 μs, 100 ns for square-wave noise with 1 ns
Vibration resistance	Malfunction: 10 to 55 Hz, 0.5-mm for 10 min each in X, Y, and Z directions Destruction: 10 to 55 Hz, 0.75-mm for 2 hrs each in X, Y, and Z directions
Shock resistance	Malfunction: 98 m/s^2 for 3 times each in X, Y, and Z directions Destruction: 294 m/s^2 for 3 times each in X, Y, and Z directions
Ambient temperature	Operating: −10°C to 55°C (with no icing) Storage: −20°C to 65°C (with no icing)
Ambient humidity	Operating: 25% to 85% (with no condensation)
EMC	(EMI) EN61326+A1 Industry Emission Enclosure: CISPR 11 Group 1 class A: CISRP16-1/-2 Emission AC Mains: CISPR 11 Group 1 class A: CISRP16-1/-2 (EMS) EN61326+A1 Industry Immunity ESD: EN61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3) Immunity RF-interference: EN61000-4-3: 10 V/m (amplitude-modulated, 80 MHz to 1 GHz) (level 3) Immunity Fast Transient Noise: EN61000-4-4: 2 kV (power line) (level 3) Immunity Burst Noise: 1 kV line to line (I/O signal line) Immunity Surge: EN61000-4-5: 1 kV line to line 2 kV line to ground (power line) Immunity Conducted Disturbance EN61000-4-6: 3 V (0.15 to 80 MHz) (level 2) Immunity Voltage Dip/Interrupting EN61000-4-11: 0.5 cycles, 0, 180°, 100% (rated voltage)
Approved standards	UL508, CSA22.2; Conforms to EN61326+A1, EN61010-1 (IEC61010-1) Conforms to VDE0106/P100 (finger protection) when the terminal cover is mounted.
Weight	Approx. 400 g

Note: A K3NR with DC supply voltage requires approximately 1 A DC as control power supply current the moment the K3NR is turned ON. Do not forget to take this into consideration when using several K3NR units. When the K3NR is not in measuring operation (e.g., the K3NR has been just turned ON or is operating for startup compensation time), the display will read "*□□□□*" and all outputs will be OFF.

■ Characteristics

Input signal	No-voltage contact (30 Hz max., ON/OFF pulse width: 15 ms min.) Voltage pulse (50 kHz max., ON/OFF pulse width: 9 μs min., ON voltage: 4.5 to 30 V/OFF voltage: −30 to 2 V) Open collector (50 kHz max., ON/OFF pulse width: 9 μs min.) **Connectable Sensors** ON residual voltage: 3 V max. OFF leakage current: 1.5 mA max. Load current: Must have switching capacity of 20 mA min. Must be able to dependably switch a load current of 5 mA max.
Measuring accuracy (at 23±5°C)	Operating modes 1 and 6: ±0.006%rdg±1 digit Operating modes 2 to 5: ±0.02%rdg±1 digit
Measuring modes and ranges (Operating modes 1 to 6 are for no-contact sensor models)	Operating mode 1: Rotational/circumferential speed 0.0005 to 50,000 Hz Operating mode 2: Absolute ratio 0.0005 to 50,000 Hz Operating mode 3: Error ratio 0.0005 to 50,000 Hz Operating mode 4: Rotational difference 0.0005 to 50,000 Hz Operating mode 5: Flow rate ratio 0.0005 to 50,000 Hz Operating mode 6: Passing time 0.0005 to 50,000 Hz Operating mode 7: Pulse counting 0 to 4G count (32-bit counter)
Max. displayed digits	5 digits (−19999 to 99999)
Display	7-segment LED
Polarity display	"−" is displayed automatically with a negative input signal.
Zero display	Leading zeros are not displayed.
Prescale function	Programming via front-panel key inputs. (0.0001×10^{-9} to 9.9999×10^{9}, decimal point can be set freely) Can be set using prescale value teaching.
HOLD functions (see note 2)	Max. value (peak) hold, Min. value (bottom) hold
External control	HOLD (Process value held) RESET (Maximum/minimum data reset, counting value reset) BANK (Selection of one bank out of 4 banks of set values) (Selection of one bank out of 4 banks of prescale values)
Comparative output hysteresis setting	Programmable with front-panel key inputs (1 to 9999).
Other functions	Variable linear output range (for models with linear outputs only) (note 1) Remote/Local processing (available for communications output models only) Maximum/Minimum value data reset with front panel keys Comparative output pattern selection Process time for averaging measured values Startup compensation time (0.0 to 99.9 s) Time unit display Security Memory power failure
Output configuration	Relay contact output (3 or 5 outputs) Transistor output (NPN and PNP open collector), BCD (NPN open collector) Parallel BCD (NPN open collector) + transistor output (NPN open collector) Linear output (4 to 20 mA, 1 to 5 V) + transistor output (NPN open collector) Communication functions (RS-232C, RS-485, RS-422) Communication functions (RS-232C, RS-485, RS-422) + transistor output (NPN open collector)
Delay in comparative outputs (at transistor output)	Operating modes 1 to 6: 200 ms max. Operating mode 7: 1 ms max.
Linear output response time	Operating modes 1 to 6: 220 ms max. Operating mode 7: 20 ms max.
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66) Rear case: IEC standard IP20 Terminals: IEC standard IP00
Memory protection	Non-volatile memory (EEPROM) (possible to rewrite 100,000 times)

Note: 1. The linear output range cannot be set when connected to a 1 mV/10-digit Linear Output Board.

2. Not effective for operating mode 7.

■ Input/Output Ratings

Relay Contact Output

(Incorporating a G6B Relay)

Item	Resistive load (cosϕ = 1)	Inductive load (cosϕ = 0.4, L/R = 7 ms)
Rated load	5 A at 250 VAC; 5 A at 30 VDC	1.5 A at 250 VAC, 1.5 A at 30 VDC
Rated carry current	5 A max. (at COM terminal)	
Max. contact voltage	380 VAC, 125 VDC	
Max. contact current	5 A max. (at COM terminal)	
Max. switching capacity	1,250 VA, 150 W	375 VA, 80 W
Min. permissible load (P level, reference value)	10 mA at 5 VDC	
Mechanical life	50,000,000 times min. (at a switching frequency of 18,000 times/hr)	
Electrical life (at an ambient temperature of 23°C)	100,000 times min. (at a rated load switching frequency of 1,800 times/hr)	

Transistor Output

Rated load voltage	24 VDC max.
Max. load current	50 mA
Leakage current	100 μA max.

BCD Output

I/O signal name		Item	Rating
Inputs	REQUEST, HOLD, MAX, MIN, RESET	Input signal	No-voltage contact input
		Input current with no-voltage input	10 mA
		Signal level	ON voltage: 1.5 V max. OFF voltage: 3 V min.
Outputs	DATA, POLARITY, OVERFLOW, DATA VALID, RUN	Rated load voltage	24 VDC max.
		Max. load current	10 mA
		Leakage current	100 μA max.

Note: Logic method: negative logic

Linear Output

Item	4 to 20 mA	1 to 5 V	1 mV/10 digits (see note)
Resolution	4,096		
Output error	±0.5% FS		±1.5% FS
Permissible load resistance	600 Ω max.	500 Ω min.	1 KΩ min.

Note: For the 1 mV/10-digit output, the output voltage changes for every 40 to 50 increment in the display value.

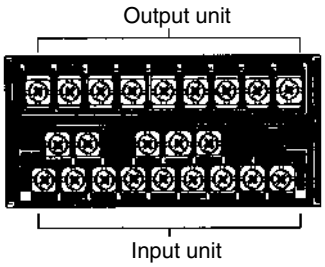
■ Communications Specifications

Item		RS-232C, RS-422	RS-485
Transmission method		4-wire, half-duplex	2-wire, half-duplex
Synchronization method		Start-stop synchronization	
Baud rate		1,200/2,400/4,800/9,600/19,200/38,400 bps	
Transmission code		ASCII (7-bit)	
Communications	**Write**	Comparative set value, prescaling value, remote/local programming, reset control of maximum/minimum values, and other setting mode items excluding communications conditions.	
	Read	Process value, comparative set value, maximum value, minimum value, model data, error code, and others	

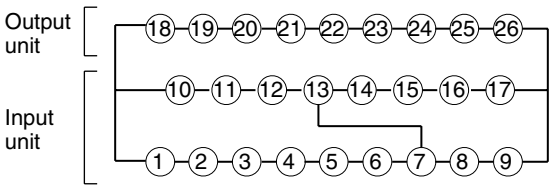
For details, refer to *Communication Operation Manual.*

Connections

■ Terminal Arrangement

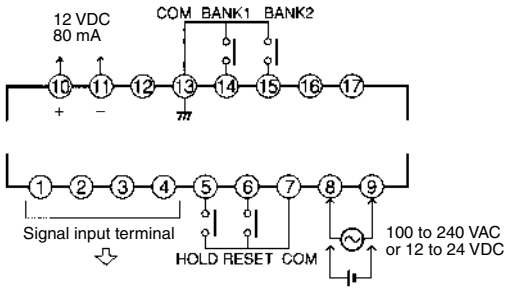


Terminal Numbers



Note: Terminals 7 to 13 are connected internally.
Terminals 7 and 11 are mutually isolated.

Input Unit



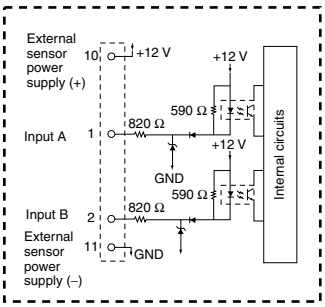
Note: Check the power supply specifications of the model used before connecting the power supply.

When inputting the external control signals and input signals through the open collector:

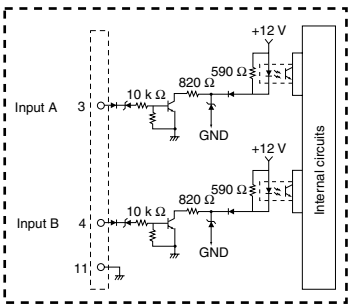
Transistor Inputs:
ON: Residual voltage must be 3 V max.
OFF: Leakage current must be 1.5 mA max.
The switching capacity must be 20 mA or greater.

When the external signal input is short-circuited, a voltage of approximately 5 V will be applied to between the terminals 5 to 7 and the COM terminal, and a current of approximately 18 mA (nominal value) will flow.

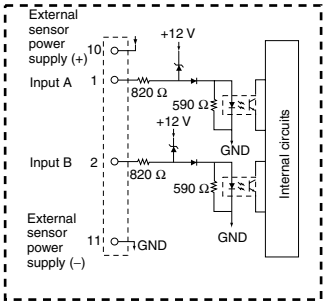
NPN Inputs



Voltage Pulse Inputs

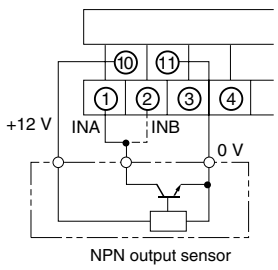


PNP-Inputs



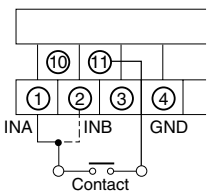
K3NR-NB (NPN Input/Voltage Pulse Input)

NPN Open Collector Output (NPN Linear 2-wire Output)



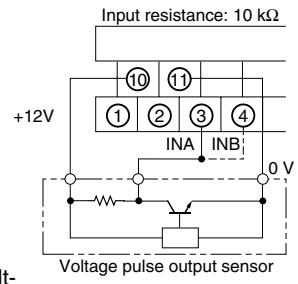
Note: Connect the + side of the NPN linear 2-wire input to terminal 1 and the – side to terminal 11.

Contact Output



Note: When the contact is short-circuited, a current of approximately 13 mA will flow at a voltage of approximately 12 V.

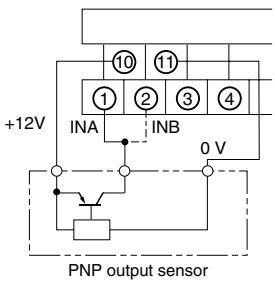
Voltage Output



Note: With voltage pulse input not from a 3-wire sensor, connect the + side to terminal 3 and the – side to terminal 11.

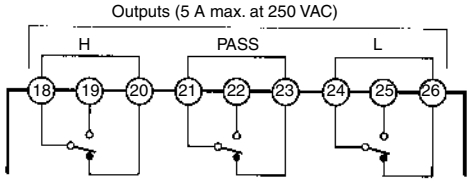
K3NR-PB (PNP Input)

PNP Open Collector Output

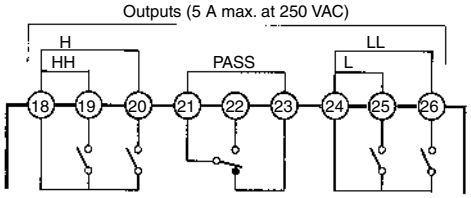


Output Units

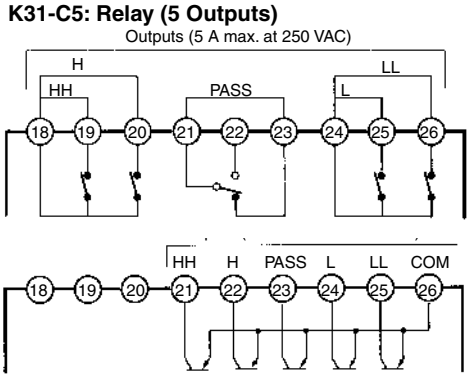
K31-C1: Relay (3 Outputs)



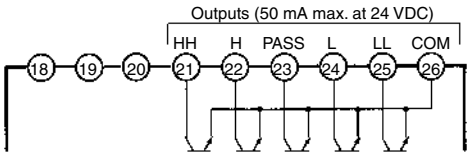
K31-C2: Relay (5 Outputs)



K31-C5: Relay (5 Outputs)



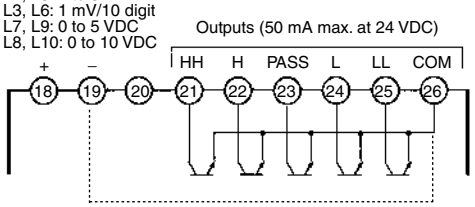
K31-T1: Transistor (NPN Open Collector)



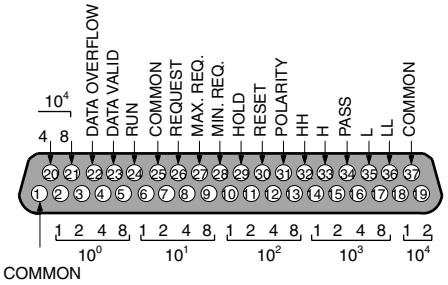
K31-L1, L2, L3,-L4, -L5, -L6, -L7, -L8, -L9, -L10: Linear

(Terminals 21 to 26 are provided only on K31-L4, -L5, -L6, -L9, -L10.)

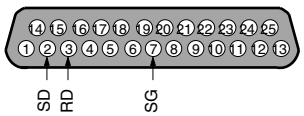
L1, L4: 4 to 20 mA
L2, L5: 1 to 5 V
L3, L6: 1 mV/10 digit
L7, L9: 0 to 5 VDC
L8, L10: 0 to 10 VDC



Note: With K31-L4/-L5/-L6/-L9/-L10 models, terminals 19 and 26 are connected internally.

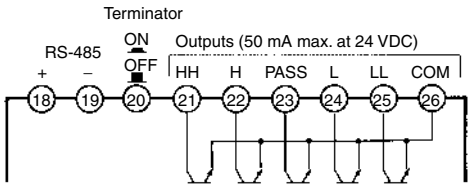


K31-FLK1: RS-232C



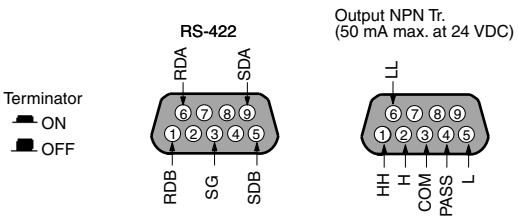
K31-FLK2, -FLK5: RS-485

(Terminals 21 to 26 are provided only on K31-FLK5.)

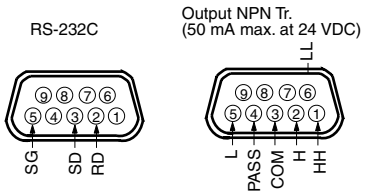


K31-FLK3, -FLK6: RS-422

(The right connector is provided only on K31-FLK6)

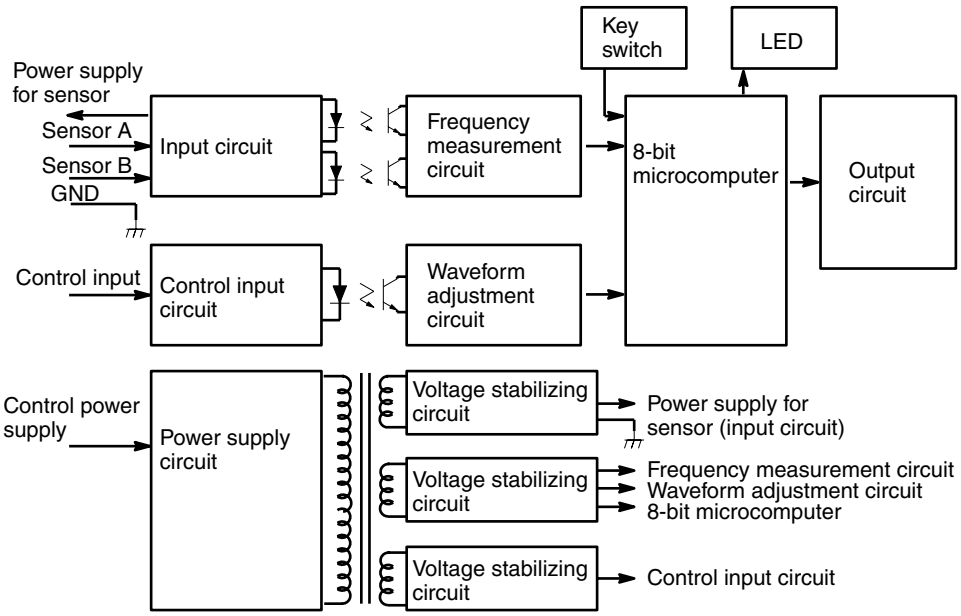


K31-FLK4: RS-232C + Transistor (NPN Open Collector)



- D-sub 37P Connectors for BCD output (attachment)
  Plug: XM2A-3701
  Hood: XM2S-3711
- D-sub 25P connectors for RS-232C output (K31-FLK1) (order separately)
  Plug: XM2A-2501
  Hood: XM2S-2511
- D-sub 9P connectors for RS-422 output (K31-FLK3 and K31-FLK6) (order separately)
  Plug: XM2A-0901
  Hood: XM2S-0911
- D-sub 9P connectors for RS-232C output (K31-FLK4) (order separately)
  Plug: XM2D-0901
  Hood: XM2D-0911

■ Block Diagram

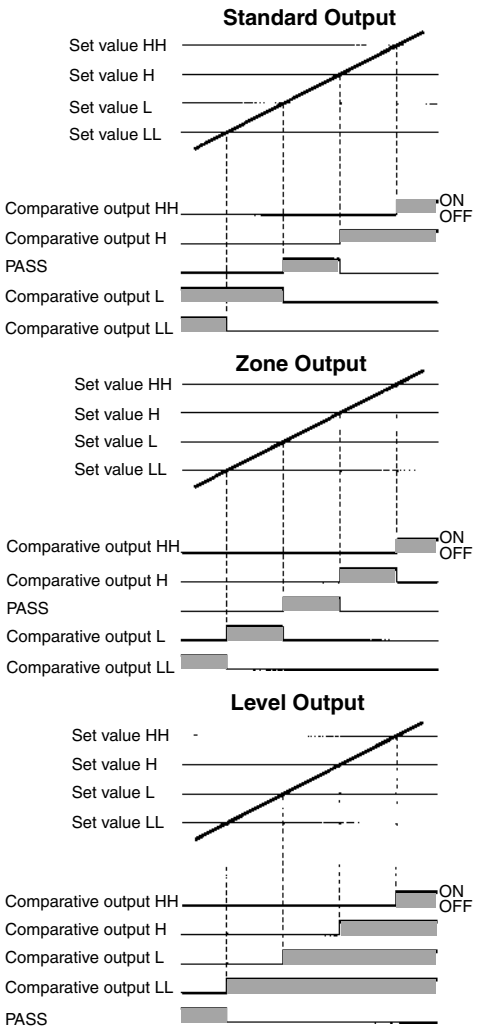


Operation

■ Main Functions

Output Pattern Selection C-oUt

The patterns of comparative output are selectable according to the level change. Select the pattern according to the application.

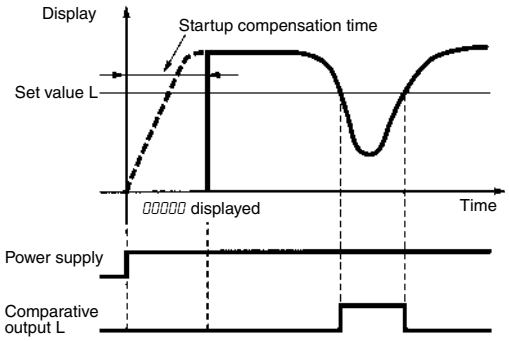


Note: The following setting conditions must be satisfied, otherwise no zone output will turn ON correctly.
LL < L < H < HH

Startup Compensation Time StCmP

The startup compensation time parameter keeps the measurement operation from sending an unnecessary output corresponding to instantaneous, fluctuating input from the moment the K3NR is turned ON until the end of the preset period.

The compensation time can be set in a range from 0.0 to 99.9 seconds as the waiting time until the devices subject to measurement become stable after the startup of the power supply.

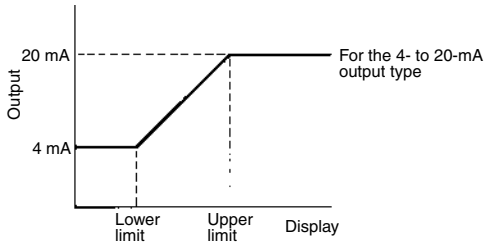


Hysteresis HYS

The hysteresis of comparative outputs can be set to prevent the chattering of comparative outputs. Refer to page 152 for more details.

Linear Output Range LSEt

A linear output range can be set as required. A value corresponding to the maximum output value and that corresponding to the minimum output value can be set.



Remote/Local Selection r-L

Select remote programming when performing all settings through the host devices and select local programming when performing settings through key operation.

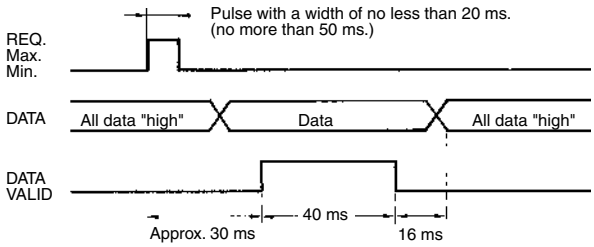
Process Time for Averaging Measured Value

Process time for averaging measured value is the time over which the measured values will be averaged. If this time is shorter than the input pulse interval, processing will be based on the input pulse interval.

■ BCD Output Timing Chart

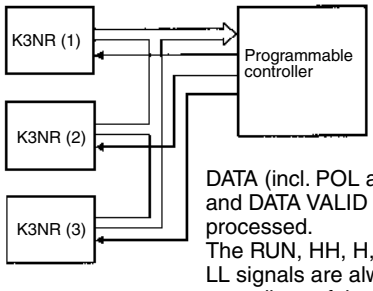
A request signal from an external device (such as a Programmable Controller) is required to read BCD data.

Single Sampling Data Output

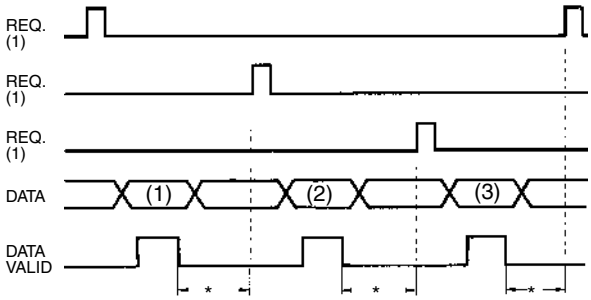


Approximately 30 ms after the REQ signal rises, a sample is taken and the DATA VALID signal is output. Read the data when the DATA VALID signal is ON.
The DATA VALID signal will turn OFF in 40 ms, and then in 16 ms, the data will go OFF.

Models with a BCD output have an open collector output configuration so that wired-OR connection is possible.

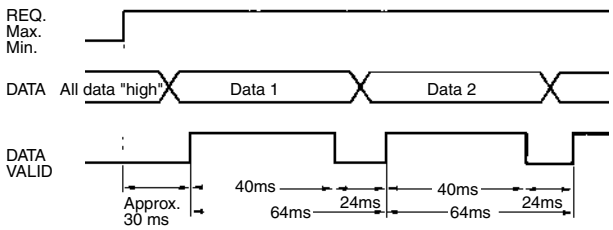


DATA (incl. POL and OVER) and DATA VALID are wired-OR processed.
The RUN, HH, H, PASS, L, and LL signals are always output regardless of the status of the REQ signal. Do not OR-wire these signals.



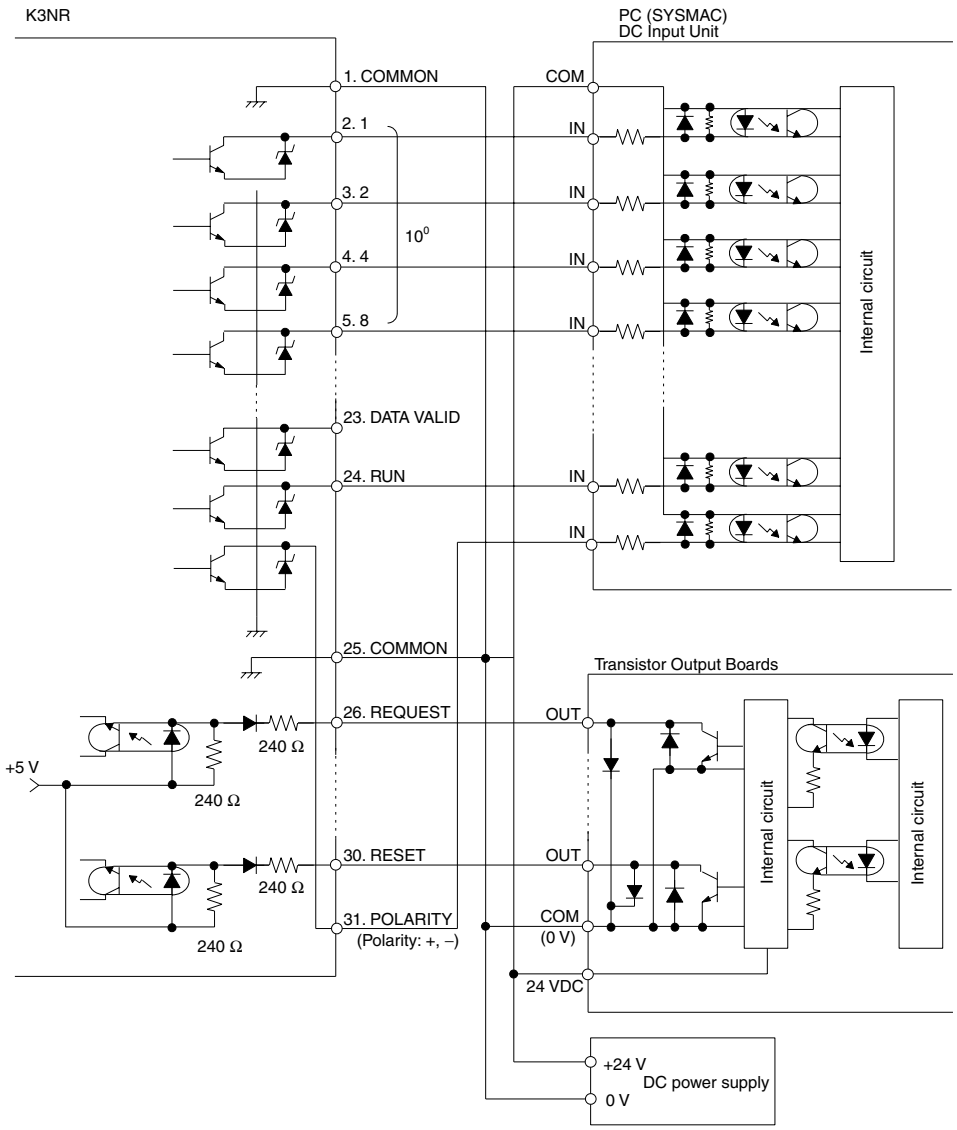
*The period between the DATA VALID signal and the REQ signal should be no less than 20 ms max.

Continuous Data Output

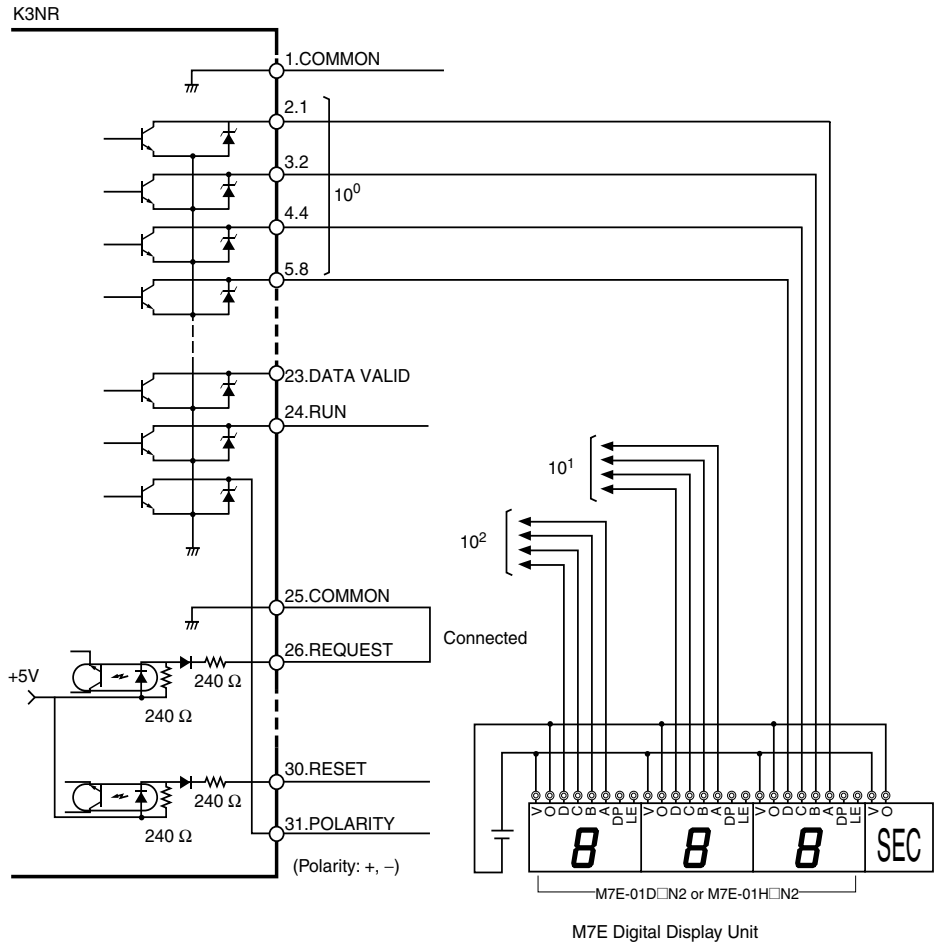


The K3NR outputs each measurement at an interval of 64 ms when a REQ signal is ON continuously.
If the HOLD signal is ON at the moment the DATA output is switched from Data 1 to Data 2 or vice versa, the output BCD data will be either Data 1 or Data 2 according to the timing of the HOLD signal. However, output data will never be below.

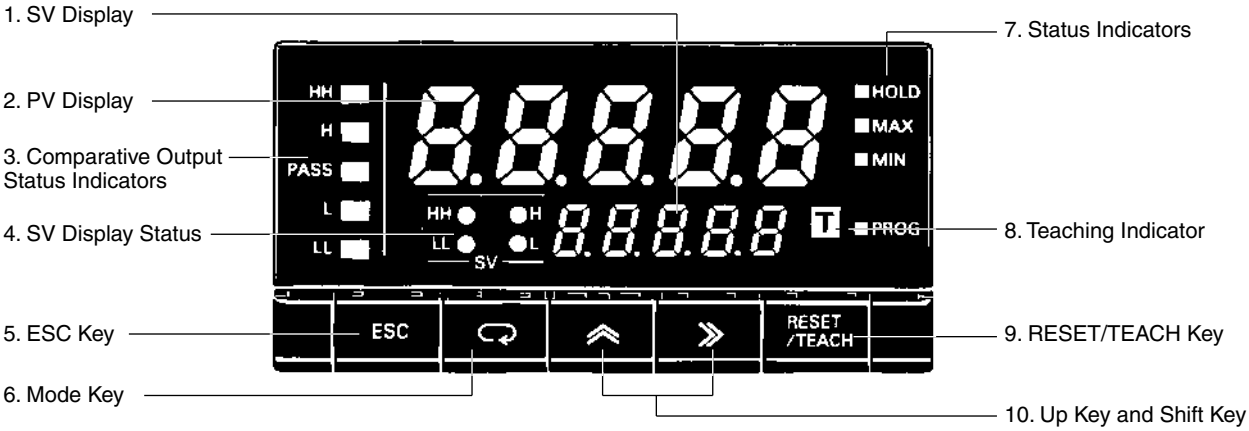
Example of Connection to Programmable Controller



Example of Connection to Display Unit



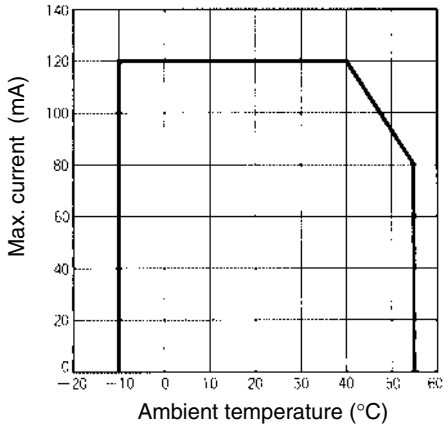
Nomenclature



Name	Functions
1. SV display	Displays the set value or parameter. Available for Set Value LED Models only.
2. PV display	Displays the process value in addition to the max./min. value or parameter.
3. Comparative output status indicators	Displays the status of comparative output.
4. SV display status	Indicates which comparative set value is currently on the SV display.
5. ESC Key	Used to return to the RUN mode from the Setting, Protect, or Maintenance mode. The process value, maximum value, or minimum value to be displayed can be selected.
6. Mode Key	Used to enter the Setting mode. Used to allow the PV display to indicate set values sequentially. Available for Basic Models only. Used to indicate set values sequentially on the SV display. Available for Set Value LED Models only.
7. Status indicators	HOLD: Lit when HOLD input is ON. MAX: Lit when the maximum value is indicated on the PV display. MIN: Lit when the minimum value is indicated on the PV display. PROG: Lit or flashes while parameters are being set.
8. Teaching indicator	Lit when the teaching function is enabled and flashes when the K3NR is in teaching operation.
9. RESET/TEACH Key	The maximum value, minimum value, and counting values are reset by pressing this key. Teaching is available when the teaching function is enabled.
10. Up Key and Shift Key	The digit being set is scrolled by pressing the Shift Key. The set value increases by one whenever the Up Key is pressed.

Engineering Data

Derating Curve for Sensor Power Supply

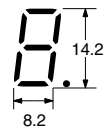


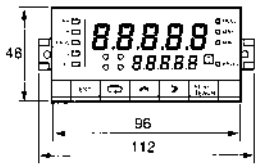
Note: The derating curve shown is for standard installation.
The derating curve depends on the mounting direction.

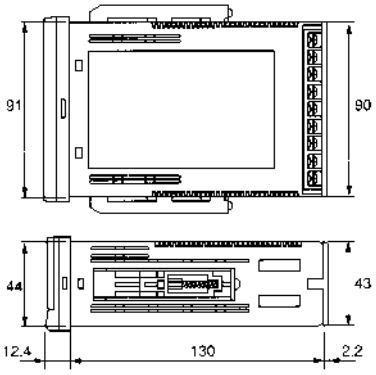
Dimensions

Note: All units are in millimeters unless otherwise indicated.

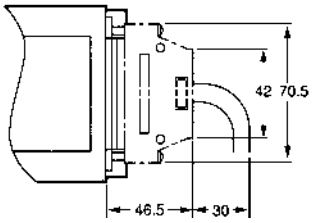
PV Display



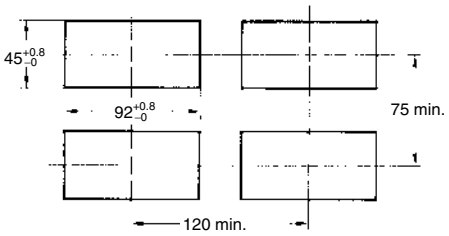




Note: The K3NR uses M3.5 terminals.
A terminal cover is provided.



Panel Cutouts



Precautions

⚠ WARNING

Do not touch any of the terminals while the power is being supplied. Doing so may result in electric shock.

⚠ Caution

Do not allow metal objects or conductive wire cuttings to enter the product. Doing so may result in electric shock, fire, or malfunction.

⚠ Caution

Do not attempt to take the product apart or touch any internal parts while the power is being supplied. Doing so may result in electric shock.

⚠ Caution

Do not use the product in locations subject to flammable or explosive gases. Doing so may result in explosion.

⚠ Caution

The lifetime of output relays varies greatly with the switching capacity and conditions. Consider the actual operating conditions, and use the relays within the rated load without exceeding the number of operations specified as the rated electrical life. Using relays beyond their rated electrical life may result in contact deposit or burning.

⚠ Caution

Do not use loads exceeding the rated value. Doing so may result in damage or burning.

⚠ Caution

Use a power supply voltage within the specified range. Not doing so may result in damage or burning.

⚠ Caution

Use settings that are appropriate for the control system. Discrepancies between the settings and the actual control conditions may result in unexpected operation leading to damage or accidents.

⚠ Caution

Be sure to tighten terminal screws to the specified torque.
Specified torque for M3.5 screws: 0.74 to 0.90 N·m
Loose screws may result in burning or malfunction.

■ Application Precautions

- Use a power supply voltage within the specified range. Not doing so may result in damage or burning.
- Be sure to perform wiring correctly, verifying the terminal names. Incorrect wiring may result in burning.
- Be sure to tighten the screws on the terminal block properly.
- Do not connect anything to unused terminals.

■ Correct Use

Long-term Use

Use all products within the specified ranges. When using inside a control panel, ensure that the temperature around the product, rather than the temperature around the control panel, does not exceed the specified temperature range. Electronic products, such as this product, have a lifetime that is dependent on the lifetime of internal electronic components, as opposed to the lifetime related to the number of relay switching operations. The lifetime of these components varies with the temperature; the higher the temperature, the shorter the lifetime. Therefore, the product lifetime can be extended by lowering the internal temperature of the product.

When several Frequency/Rate Meters are mounted close together (either horizontally or vertically), the internal temperature of the Frequency/Rate Meters may rise, leading to a reduction in the lifetime. In this case, take measures to cool the Frequency/Rate Meters, such as installing fans. Ensure, however, that the terminals are not cooled as this may lead to incorrect measurement.

Operating Environment

Do not use the product in locations subject to temperatures or humidity levels above the specified ranges, or in locations subject to condensation.

Do not use the product in locations subject to severe shocks or vibrations.

Separate the product from machines that generate high-frequency noise, such as high-frequency welding machines and high-frequency sewing machines.

Do not use the product in locations subject to dust or corrosive gases.

Do not use the product outdoors or in locations subject to direct sunlight.

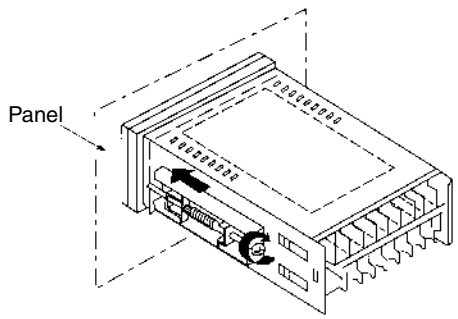
Operation

When using models with comparative outputs, if an error occurs at the Frequency/Rate Meter, comparative output may not operate correctly. We therefore recommend that you consider providing an alarm system separately as a countermeasure.

Parameter settings that allow the functions to operate properly are made, using the setting menu, at the factory prior to delivery. When using the product, change the settings as required for the application.

Mounting

Recommended panel thickness is 1 to 3.2 mm.



Attach the mounting bracket on the left and right sides of the Frequency/Rate Meter as shown in the illustration above and gradually tighten each screw evenly in turn by considering the balance of the tightening force until the ratchets start slipping without being further tightened.

Mount the Frequency/Rate Meter as horizontally as possible.

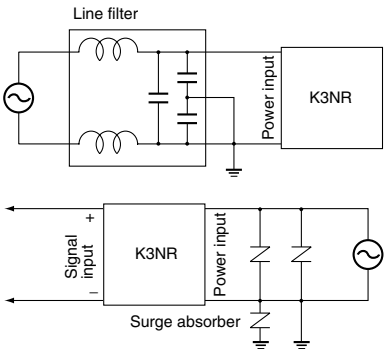
Waterproof Specifications

Products for which the degree of protection is not specified or models with IP□0 degree of protection do not have waterproof specifications.

Noise Countermeasures

Separate the product as far as possible from machines that generate high-frequency noise, such as high-frequency welding machines and high-frequency sewing machines, and machines that generate surges.

Attach surge absorbers or noise filters to noise-generating peripheral devices (in particular, devices with inductance such as motors, transformers, solenoids, and magnet coils).

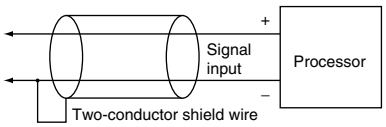


In order to prevent inductive noise, wire the lines connected to the terminal block separately from power lines carrying high voltages or large currents. Also, do not wire in parallel to, or in the same cable as power lines. There are other methods that are effective for reducing noise, such as running wires along ducts and using shield lines.

When using a noise filter for the power supply, check the voltage and current and install as close to the Frequency/Rate Meter as possible.

Inductive Noise Countermeasure for Input Line

Analog Input



Temperature Input

In order to prevent the influence of induction, separate the lead wire joining the temperature sensor and the Frequency/Rate Meter from power and load lines.

Using the product near radios, television sets, or other wireless devices may result in reception interference.

Unit Label (Provided)

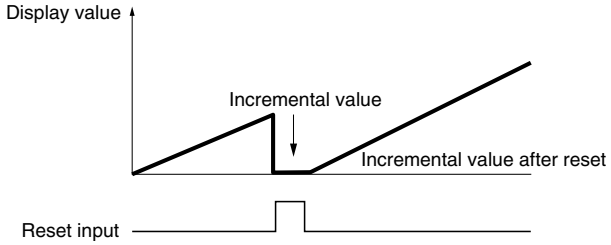
No product is shipped with the unit label attached. Select a unit label from the sheet provided and attach it to the Frequency/Rate Meter.

Operating Procedures

■ Operation in RUN Mode

Reset (Enabled in operating mode 7 only.)

The incremental display value can be reset using key operations.

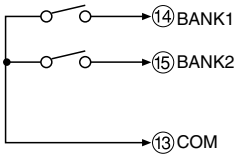


- Press the RESET/TEACH Key [RESET/TEACH] during incremental display to reset the incremental value and continue incremental counting operation.
- Reset using the RESET/TEACH Key [RESET/TEACH] is not possible if reset of counting values was prohibited in Protect Mode.

Checking the Bank Number

Press the Shift Key [»] for 1 s min. during measurement to display the bank number in the PV display. (The display will return to the measurement value if there is no key operation for 5 seconds.)

Bank Selection



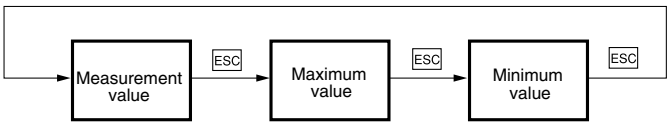
- Switch between the comparative set values and the prescaling values for banks 1 to 4 using the BANK 1 and BANK 2 signals.
- The relationship between the BANK 1 and BANK 2 signals and the bank numbers is shown in the following table.

Bank number	BANK 1	BANK 2	Comparative set value	Prescaling value
1	OFF	OFF	Su 1.**	PS 1.**
2	ON	OFF	Su2.**	PS2.**
3	OFF	ON	Su3.**	PS3.**
4	ON	ON	Su4.**	PS4.**

Note: If the prescale value bank is set to OFF, then the prescaling value for each bank is fixed.

Confirming Maximum and Minimum Values

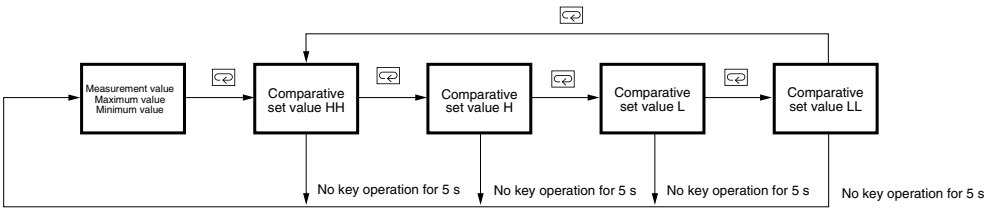
Press the ESC Key [ESC] during measurement to display the maximum and minimum values.



Press the RESET/TEACH Key [RESET/TEACH] while the maximum or minimum value is displayed to reset the value. (This is not possible, however, if maximum/minimum value reset was prohibited in Protect Mode.)

Confirming and Setting Comparative Set Values

When the measurement value, the maximum value, or the minimum value is displayed, press the Mode Key [↩] repeatedly to display the comparative set values in the order HH, H, L, and LL. (With models that have an SV display, the comparative set values are displayed in the SV display.)

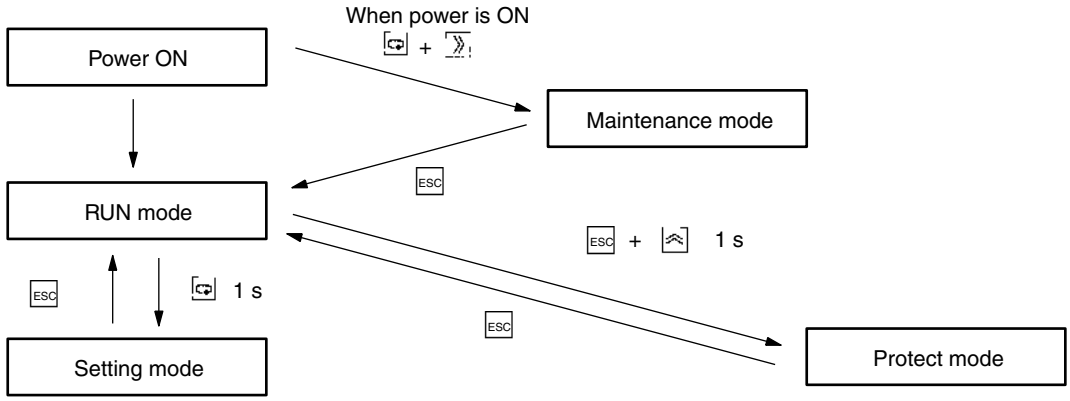


Note: When a comparative set value is displayed, it can be changed using the Up Key [^] and Shift Key [»] (if key protection is OFF).

■ Setting Procedures

The K3NR has four modes: RUN mode for normal operations, Setting mode for initial parameter input, Protect mode for lock-out configuration, and Maintenance mode for initializing set values. The parameters that are accessible on any individual K3NR will vary depending on the Output Board installed. Refer to the *K3NR Operation Manual* for details.

RUN Mode:	Remains in this mode under normal operation. The process value or the max./min. value can be monitored. Using the front panel keys, the comparative set value can be changed and max./min. value and counting value reset can be performed.
Setting Mode:	Used for making initial settings. Includes settings for four menus (Set value (SuSEt), prescaling (PSCL), setup (SEtUP), option (oPt)) and the output test.
Protect Mode:	Used for locking the front key operation or parameter changes.
Maintenance Mode:	Used for initializing set values.



SuSEt - Program set values

- S.bAnK Select bank no. of set values
- Su*.HH Enter set value HH of bank 1
- Su*. H Enter set value H of bank 1
- Su*. L Enter set value L of bank 1
- Su*. LL Enter set value LL of bank 1

Note: The above is an example when the bank number is set to 1.

PSCL - Display prescaling

- P.bAnK Select bank no. of prescale values
- PS*.Au Set the mantissa (X) of the prescale value of input A
- PS*.AY Set the exponent (Y) of the prescale value of input A
- PS*.bu Set the mantissa (X) of the prescale value of input B
- PS*.bY Set the exponent (Y) of the prescale value of input B
- dECP.* Select decimal point

Note: The above is an example when the bank number is set to 1.

SEtUP - Program operating mode/input sensor/serial communications

- FUnC Specify operating mode
- InA Select a sensor type of input A
- Inb Select a sensor type of input B
- Zro.Au Set the mantissa (X) of the auto zero time of input A
- Zro.AY Set the exponent (Y) of the auto zero time of input A
- Zro.bu Set the mantissa (X) of the auto zero time of input B
- Zro.bY Set the exponent (Y) of the auto zero time of input B

oPt - Supplementary settings related to display or control

- AuG Set the process time for averaging measured value
- StIntE Set startup compensation time
- nEno Select power failure memory function
- HYS Enter hysteresis value
- C-oUt Select the output pattern
- LSEt.H Enter the upper limit (H) of linear output range
- LSEt.L Enter the lower limit (L) of linear output range
- r-L Select the remote/local programming

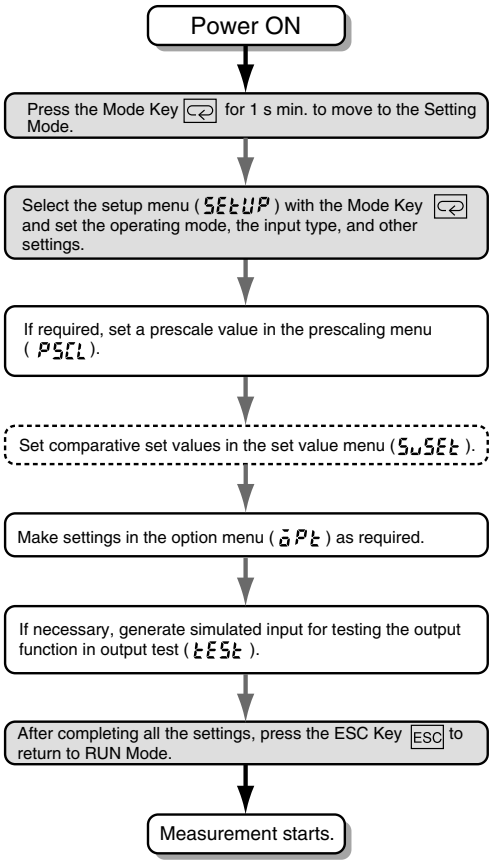
tESt - Generating simulated input for testing the output function

PrOt - Program lock-out configuration

- ALL Enable all key protection
- SuSEt Enable set value change prohibition
- rESEt Enable prohibition of counting value reset using the front panel keys
- nn.rSt Enable prohibition of max./min. value reset using the front panel keys
- SECr Specify the menus to be protected against setting in the setting mode

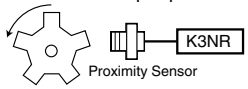
- tIntE Select the display time unit
- U-no Enter the unit no. for the host
- bPS Select the baud rate
- LEn Select the word bit length
- Sbit Select the stop bits
- PrtY Select the parity bits

■ Initial Settings



Prescaling

To display rotational speeds, circumferential speeds, or other values based on input pulse calculations, the rotational speed must be multiplied by a factor input before the input pulses are measured. This factor is called a prescale value.



Rotation speed (rpm) = f × 60 × a
Where,
f: Input pulse frequency (p/s)
a: Prescale value
If there are 5 pulses per rotation, then an accurate rotation speed can be calculated if a = 1/5 (= 0.2 = 2×10^{-1}).
In actual application, input as follows:
Mantissa X = 2.0000
Exponent Y = 10^{-1}

Auto-zero Time (Set before use.)

In operation modes 1 to 6, the time to force-zero the frequency if no pulse is received for a specified period can be set. This time is called the auto-zero time. Set the auto-zero time to a value that is somewhat longer than the longest input pulse interval. (If the time setting is too long or if the factory-set value is used, the display may not return to zero even if no input pulse is received.)

Time Unit Setting

Setting	Meaning
SCAL	Set in the prescaling menu
SEC	Seconds
nin	Minutes
H.nn.SS	Minutes and seconds
nn.SS.d	Hours, minutes, and seconds

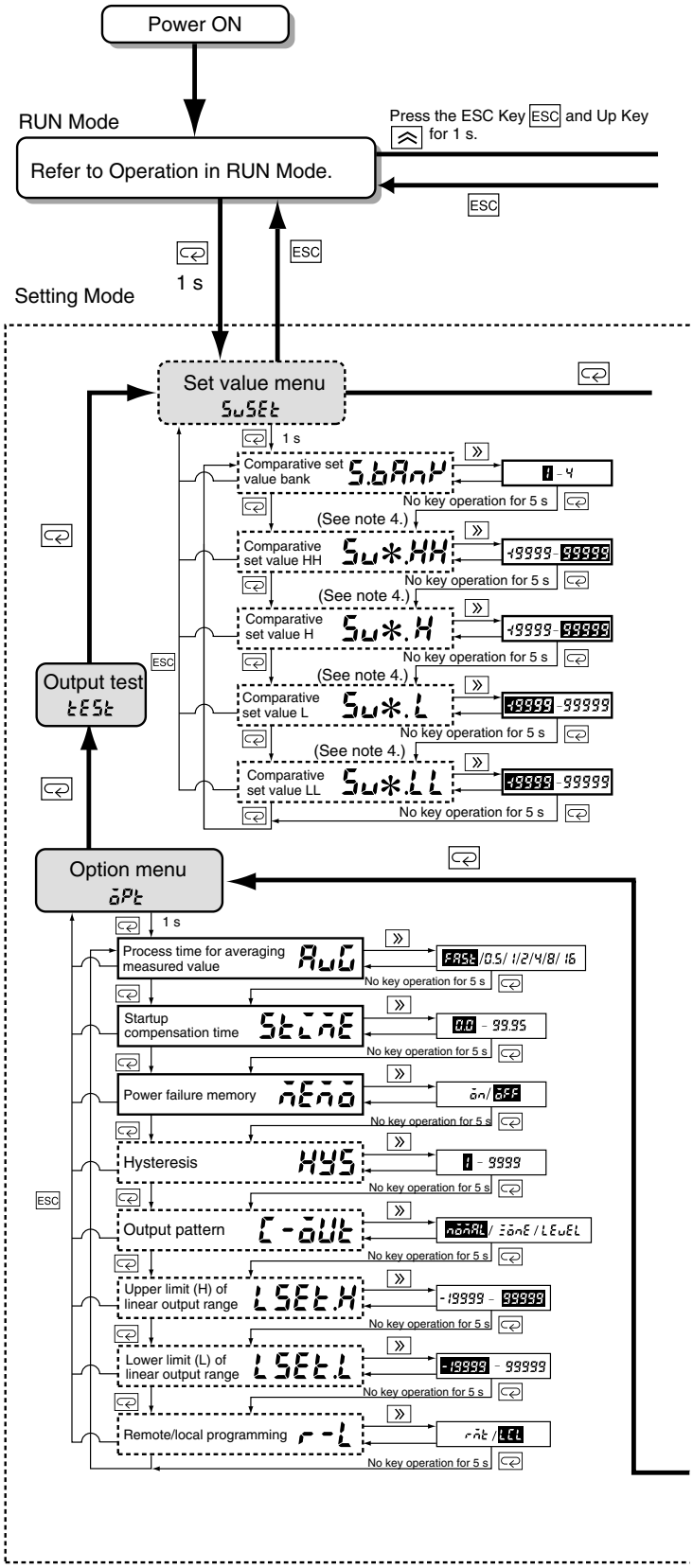
Note: The time unit can be set only if operating mode 6 (passing time) is selected.

Selecting the Sensor Type

	NO: Voltage pulse H	NC: Voltage pulse L
No-contact or voltage pulse input	00	01
Contact input	10	11

Note: If there are large discrepancies in the display select 10 or 11. Note, however, that the maximum counting frequency is 30 Hz.

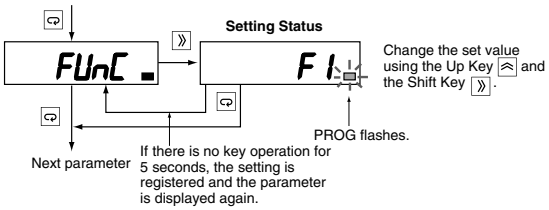
■ Parameters

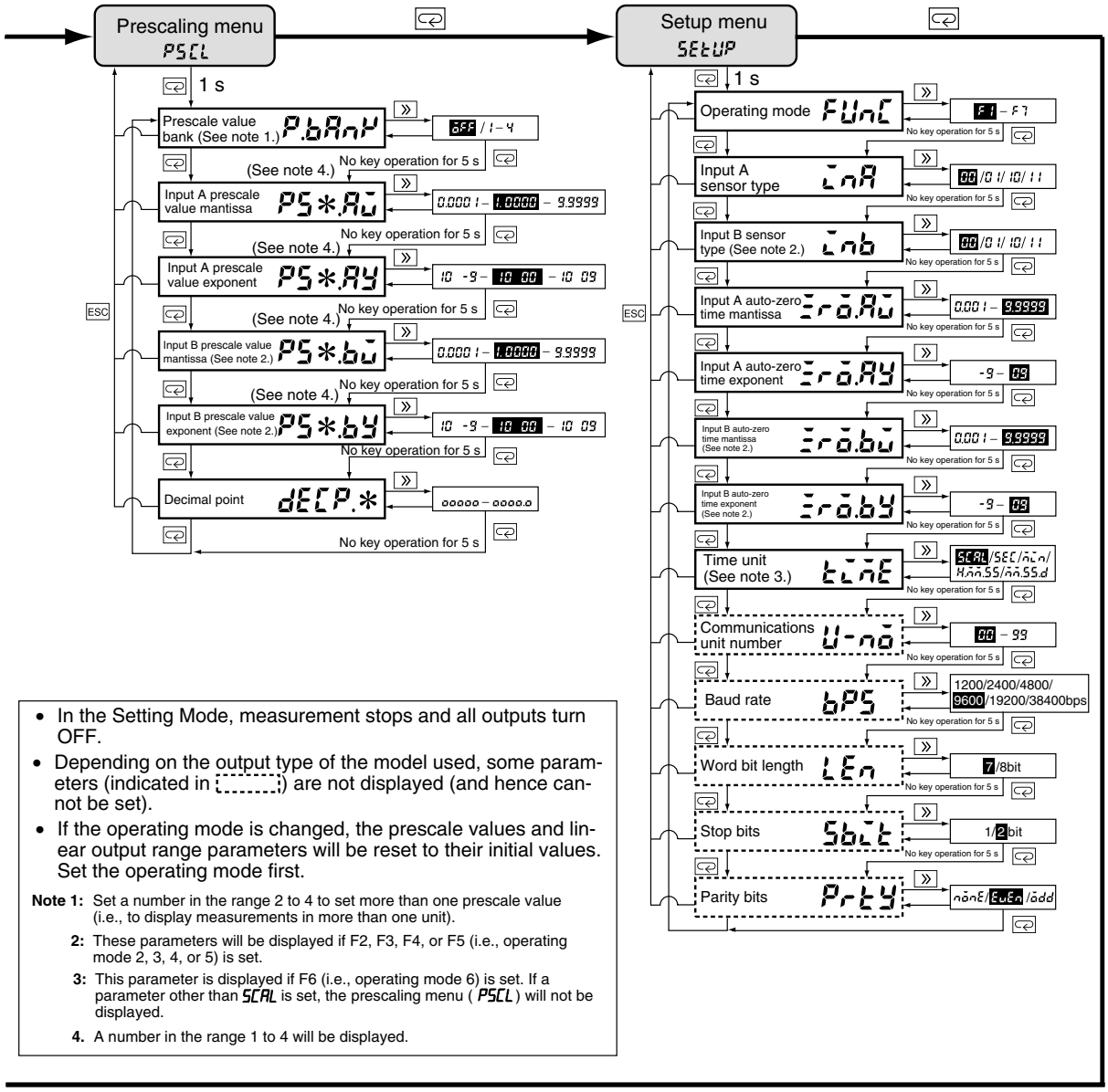


Protect Mode

Changing Set Values

By pressing the Shift Key » while a parameter is displayed, the set value can be changed (setting status). The PROG status indicator will flash. Change the set value as required, and press the Mode Key to register the setting and move to the next parameter.





- In the Setting Mode, measurement stops and all outputs turn OFF.
- Depending on the output type of the model used, some parameters (indicated in [ ]) are not displayed (and hence cannot be set).
- If the operating mode is changed, the prescale values and linear output range parameters will be reset to their initial values. Set the operating mode first.

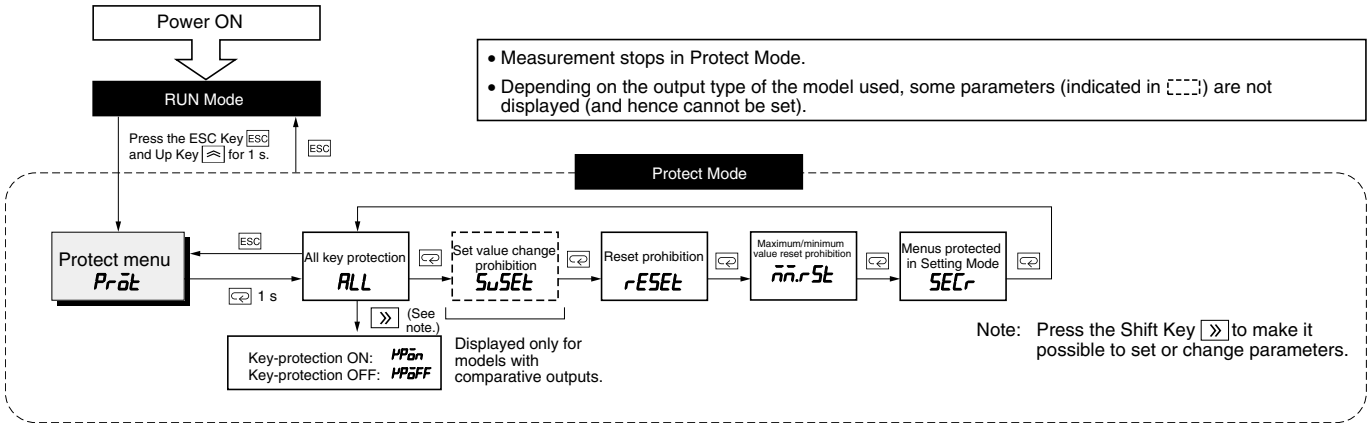
Note 1: Set a number in the range 2 to 4 to set more than one prescale value (i.e., to display measurements in more than one unit).

2: These parameters will be displayed if F2, F3, F4, or F5 (i.e., operating mode 2, 3, 4, or 5) is set.

3: This parameter is displayed if F6 (i.e., operating mode 6) is set. If a parameter other than SCAL is set, the prescaling menu (PSCL) will not be displayed.

4. A number in the range 1 to 4 will be displayed.

Settings displayed in reverse colors are defaults.



Menu display	Parameter display	Meaning of parameter	Setting range	Setting key (See note.)
Prot Press the Mode Key to display the parameter. Press the ESC Key to return to the menu.	ALL Setting: » Next parameter:	All key protection: All key operations are prohibited in RUN Mode. (If all key protection is ON, only the key for going to Protect Mode is enabled.)	Key protection ON: Hon Key protection OFF: HoFF	Use the Up Key to change the setting. Hon → HoFF Use the Mode Key to enable the setting and move to the next parameter.
	SuSEt Setting: » Next parameter:	Set value change prohibition: Changes to comparative set values are prohibited in RUN Mode. (Displayed only for models with comparative outputs.)		
	rESEt Setting: » Next parameter:	Reset prohibition: Resetting using the front panel keys is prohibited. (Resetting by external signals is not prohibited.)		
	mm.rSt Setting: » Next parameter:	Maximum/minimum value reset prohibition: Resetting of maximum and minimum values using the front panel keys is prohibited. (Resetting by external signals is not prohibited.)		
	SECr Setting: » Next parameter:	Menus protected in Setting Mode: Setting operations in Setting Mode are prohibited in the way shown below.	0 / 1/2	Use the Up Key to change the setting. 0 → 1 → 2 Use the Mode Key to enable the setting and move to the next parameter.

Setting menu	Setting		
	0	1	2
Set value menu			×
Prescaling menu			×
Setup menu		×	×
Option menu			×

Note: If there is no key operation for 5 seconds, the setting is automatically registered.

■ Troubleshooting

When an error occurs, error details will be displayed in the PV display. Take the appropriate countermeasures according to the error displayed.

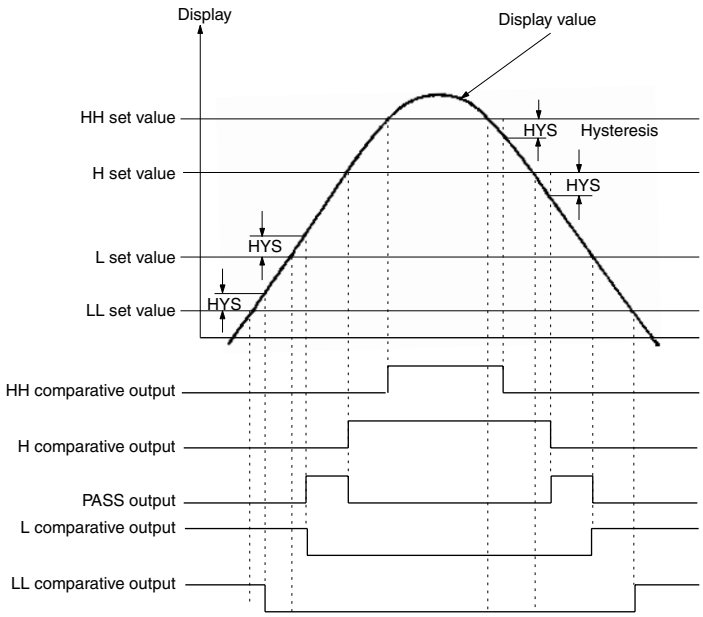
Error display	Error contents	Output status				Countermeasure
		Comparative output	BCD output	Communications output	Linear output	
M1.Err (M1.ERR) M2.Err (M2.ERR)	Memory error	OFF	OFF (all outputs in "H" status)	OFF	OFF	Reset the power. If the same error occurs, repair is necessary.
M3.Err (M3.ERR)		OFF	OFF (all outputs in "H" status)	OFF	OFF	Reset the power while holding down the ESC Key, the Up Key, and the RESET/TEACH Key. The settings will be returned to their initial values. Redo the settings. If the same error occurs, repair is necessary.
Err-O (ERR-O) CHG-O (CHG-O)	Output error	OFF	OFF (all outputs in "H" status)	OFF	OFF (minimum value)	Reset the power. If the same error occurs, repair is necessary. If normal operation is restored, it is possible that the original error was caused by the influence of noise. Check that there are no sources of noise in the vicinity.
(Display value flashes.)	The input range and display range were exceeded.	Continues	Continues The OVER signal turns ON.	Continues The OVER or UNDER signal turns ON.	Continues	Take steps to ensure that the input values and display values are within the allowable ranges.
rmt (RMT) (Flashes for 3 s.)	The remote/local section is set to remote.	Continues	Continues	Continues	Continues	If an attempt to change a setting using key operations is made with the remote/local selection set to remote, this error will flash for 3 s. To enable settings to be changed, set the remote/local selection to local.

Additional Information

■ Output Operation Timing in RUN Mode (Relay or Transistor Outputs)

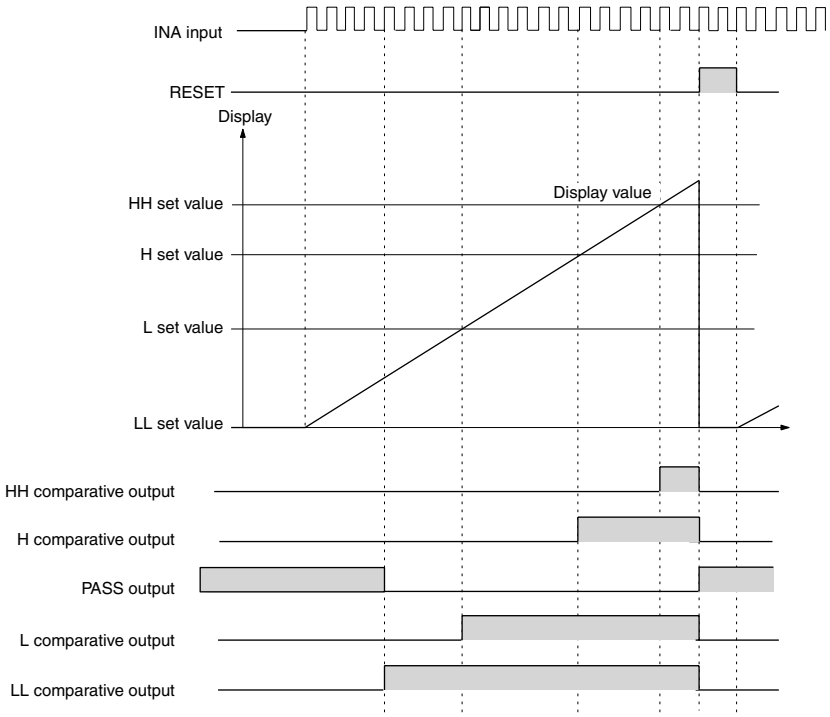
The following timing chart is for a 5-comparative Output Board when the standard output pattern is selected.

For Operating Mode 1 to 6



Note: The hysteresis is set in setting mode and the hysteresis value will be applied to all set values.

For Operating Mode 7



Note: Comparative output L or LL turns ON when the measured value exceeds the set value.

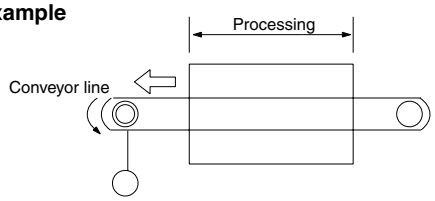
■ Operating Modes

The K3NR provides 7 operating modes for converting input pulses to display values. The mode can be selected via key operations on the front panel.
Basically, the operating modes can be divided into the following two groups.

Operating Modes 1 to 6

Rotational speed and other displays are based on calculations for continuous pulses (frequency).

Example



Operating mode no.	Use
01	Rotational/Circumferential speed
02	Absolute ratio
03	Error ratio
04	Rotation difference
05	Flow rate ratio
06	Passing time

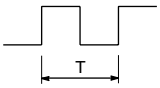
Mode No. 1: Rotational or circumferential speed display for 1 input

Mode No. 2 to 5: Display of calculations for two rotational speeds

Mode No. 6: Passing time display based on 1 input frequency and processing length

Basic Principles of Rotational Speed Displays
The ON/OFF time (T) of a sensor input or other input is measured with the internal system clock to automatically calculate the frequency. This frequency is multiplied by 60 and displayed as a rotational speed.

Input sensor pulse ON/OFF time (T) =



Frequency (f) = 1/T

Rotational speed (rpm) = f x 60

Circumferential speed = Circumference x Rotational speed

Passing time = Processing length/Circumferential speed

Automatic measuring by the K3NR is enabled simply by providing an input pulse.

Operating Mode 7

The number of pulses is measured. Each pulse is counted as 1 count up to a maximum of 99,999 counts. Decrementing the count is not possible. Although the limits of the display enables displaying only up to 99,999 counts, prescaling can be used to count up to 4 gigacounts.

Operating mode no.	Use
07	Pulse counting

The count is reset by shorting terminals 6 and 7 (RESET ON) or by pressing the RESET/TEACH Key on the front panel

Because only incrementing is possible, the L and LL comparative outputs turn ON when the measured values exceed set values.

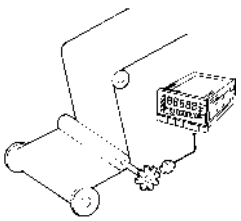
Operating Mode 1: Rotational/Circumferential Speed

The frequency of input A is calculated and displayed as a rotational or circumferential speed.

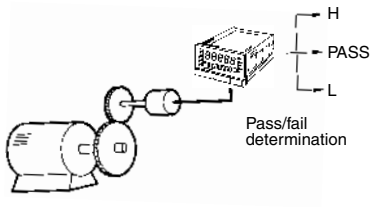
Units: rpm; rps; rph; Hz; kHz; mm/s; m/s; m/min; km/h; /min; /h; etc.

Application Example

Measuring Roller Winding Speed



Measuring Motor Speed (for Product Testing)



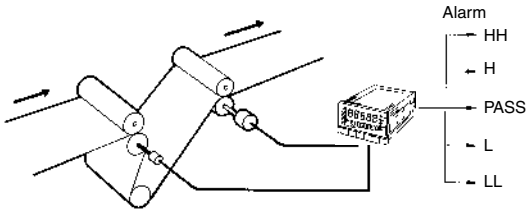
Operating Mode 2: Absolute Ratio

Input B is divided by input A (B/A) and then multiplied by 100 for display as a percentage.

Unit: %

Application Example

Measuring Ratio between Rotational Speed of Two Rollers



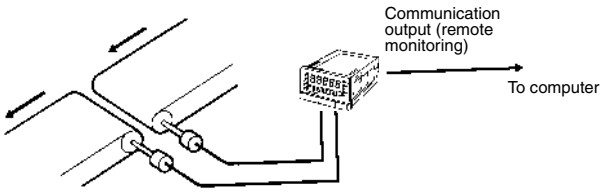
Operating Mode 3: Error Ratio

The error between input A and input B (B/A − 1) is multiplied by 100 for display as a percentage.

Unit: %

Application Example

Measuring Difference between Two Line Speeds (Two Conveyors)



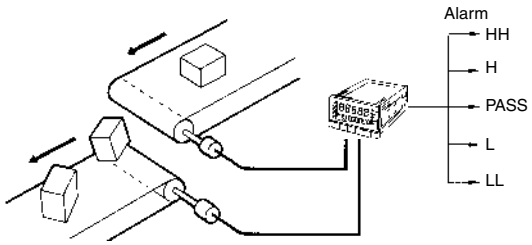
Operating Mode 4: Rotational Difference

The difference between input B and input A (B − A) is displayed as a rotational speed error or circumferential speed error.

Units: rpm; rps; rph; Hz; kHz; mm/s; m/s; m/min; km/h; ⁄/min; ⁄/h; etc.

Application Example

Measuring the Absolute Difference between the Speeds of Two Conveyors



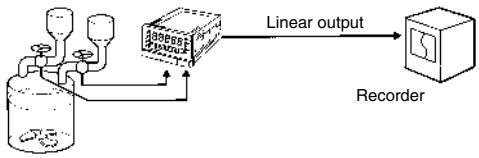
Operating Mode 5: Flow Rate Ratio

Input A and input B are used to find the concentration (B/(A+B)) as a percentage.

Unit: %

Application Example

Monitoring the Concentration of a Liquid Mixture



Operating Mode 6: Passing Time

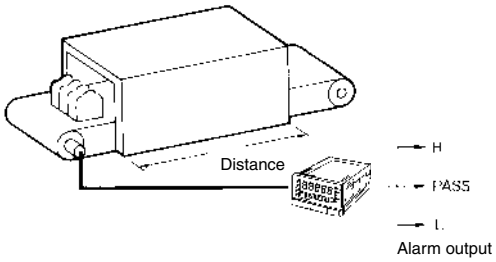
The pulse frequency of input A is calculated and is displayed as the passing time for a preset distance.

Units: s; min; h, min, s; min, s, 1/10 s; etc.

The passing time measurement operation in operating mode 6 is ideal for measuring time corresponding to a frequency change. Operating mode 6 allows the real-time, continuous time measurement of the revolutions of any rotating object without recovery time.

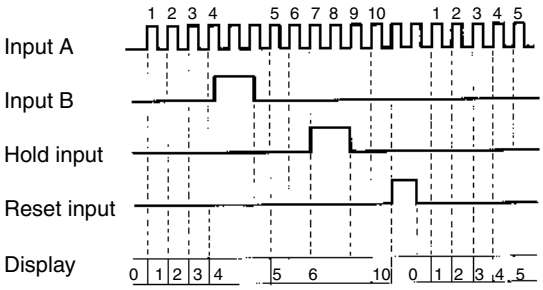
Application Example

Passing Time for a Conveyor Line



Operating Mode 7: Pulse Counting

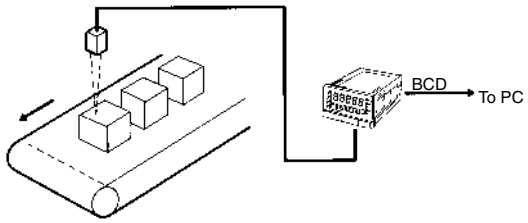
The total number of pulses on input A is displayed.



Units: count; mm; cm; m; l; kl; etc.

Application Example

Counting Workpieces



Note: The operation of comparative outputs in operating mode 7 is different to that in other modes. Because only incrementing is possible, the L and LL comparative outputs turn ON when the measured values exceed set values.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. N087-E1-02

Weighing Meter
K3NV

Highly Functional Weighing Meter with Easy-to-read LED

- Easily programmable through the front panel or via RS-232C, RS-485, or RS-422.
- Programming with easy setup and calibration.
- Easy-to-use scaling function with the key programming method.
- A wide range of Output Boards, including communications and linear boards.
- Tare function allows zero adjustment at the reference position.
- Load cell power supply of 100 mA at 10 VDC.
- NEMA4X/IP66 front panel.
- Conforms to EMC standards, EN61010-1 (IEC61010-1).
- UL/CSA approved.

Model Number Structure

■ Model Number Legend

Base Units and Output Boards can be ordered individually or as sets. Refer to the *Available Output Board Combinations* table on page 158.

Base Units

K3NV - □ □ □ □
1 2 3 4

Output Boards

K31 - □ □ □ □
5 6 7 8

Base Units with Output Boards

K3NV - □ □ □ □ - □ □ □ □
1 2 3 4 5 6 7 8

1, 2. Input Sensors Codes

LC: Load cell input

3. Supply Voltage

1: 100 to 240 VAC
2: 12 to 24 VDC

4. Display

A: Basic
C: Set Value LED Display

5, 6, 7, 8. Output Type Codes

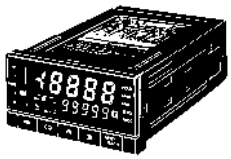
C1: 3 comparative relay contact outputs (H, PASS, L: SPDT)
C2: 5 comparative relay contact outputs (HH, H, L, LL: SPST-NO; PASS: SPDT)
C5: 5 comparative relay contact outputs (HH, H, L, LL: SPST-NC; PASS: SPDT)
T1: 5 comparative transistor outputs (NPN open collector)
T2: 5 comparative transistor outputs (PNP open collector)
B2: BCD output (NPN open collector) (see note)
B4: BCD output + 5 transistor outputs (NPN open collector)
L1: Linear output (4 to 20 mA) (see note)

Note: These output types are available on Basic Models only.

L2: Linear output (1 to 5 VDC) (see note)
L3: Linear output (1 mV/10 digits) (see note)
L4: Linear output, 4 to 20 mA + 5 transistor outputs (NPN open collector)
L5: Linear output, 1 to 5 V + 5 transistor outputs (NPN open collector)
L6: Linear output, 1 mV/10 digits+ 5 transistor outputs (NPN open collector)
L7: Linear output, 0 to 5 VDC (see note)
L8: Linear output, 0 to 10 VDC (see note)
L9: Linear output, 0 to 5 VDC + 5 transistor outputs (NPN open collector)
L10: Linear output, 0 to 10 VDC + 5 transistor outputs (NPN open collector)
FLK1: Communication RS-232C (see note)
FLK2: Communication RS-485 (see note)
FLK3: Communication RS-422 (see note)
FLK4: RS-232C + 5 transistor outputs (NPN open collector)
FLK5: RS-485 + 5 transistor outputs (NPN open collector)
FLK6: RS-422 + 5 transistor outputs (NPN open collector)

Ordering Information

■ Base Units

Model	Supply voltage	
	100 to 240 VAC	12 to 24 VDC
Basic Models These models provide a process value LED and front-panel control keys. Can be connected to available Output Board, or can be used for display only without an Output Board. 	K3NV-LC1A	K3NV-LC2A
Set Value LED Models These models provide a process value LED, set value LED, and front-panel control keys. Can be connected to Relay Contact, Transistor, or Combination Output Boards. 	K3NV-LC1C	K3NV-LC2C

■ Available Output Board Combinations

Output type	Output configuration	Output boards	Base units	
			Basic	Set Value LED Display
Relay contact	3 outputs: H, PASS, L (SPDT)	K31-C1	Yes	Yes
	5 outputs: HH, H, L, LL (SPST-NO), and PASS (SPDT)	K31-C2	Yes	Yes
	5 outputs: HH, H, L, LL (SPST-NC), and PASS (SPDT)	K31-C5	Yes	Yes
Transistor	5 outputs (NPN open collector)	K31-T1	Yes	Yes
	5 outputs (PNP open collector)	K31-T2	Yes	Yes
BCD (see note)	5-digit output (NPN open collector)	K31-B2	Yes	---
Linear	4 to 20 mA DC	K31-L1	Yes	---
	1 to 5 VDC	K31-L2	Yes	---
	1 mV/10 digits	K31-L3	Yes	---
	0 to 5 VDC	K31-L7	Yes	---
	0 to 10 VDC	K31-L8	Yes	---
Communication boards (see note)	RS-232C	K31-FLK1	Yes	---
	RS-485	K31-FLK2	Yes	---
	RS-422	K31-FLK3	Yes	---
Combination output and communication boards	BCD output + 5 transistor outputs (NPN open collector)	K31-B4	Yes	Yes
	4 to 20 mA + 5 transistor outputs (NPN open collector)	K31-L4	Yes	Yes
	1 to 5 V + 5 transistor outputs (NPN open collector)	K31-L5	Yes	Yes
	1 mV/10 digits + 5 transistor outputs (NPN open collector)	K31-L6	Yes	Yes
	0 to 5 VDC + 5 transistor outputs (NPN open collector)	K31-L9	Yes	Yes
	0 to 10 VDC + 5 transistor outputs (NPN open collector)	K31-L10	Yes	Yes
	RS-232C + 5 transistor outputs (NPN open collector)	K31-FLK4	Yes	Yes
	RS-485 + 5 transistor outputs (NPN open collector)	K31-FLK5	Yes	Yes
	RS-422 + 5 transistor outputs (NPN open collector)	K31-FLK6	Yes	Yes

Note: For details, refer to the *Communication Operation Manual.*

Specifications

■ Ratings

Supply voltage	100 to 240 VAC (50/60 Hz); 12 to 24 VDC
Operating voltage range	85% to 110% of supply voltage
Power consumption (see note)	15 VA max. (max. AC load with all indicators lit) 10 W max. (max. DC load with all indicators lit)
External power supply	100 mA at 10 VDC±5%
Insulation resistance	20 MΩ min. (at 500 VDC) between external terminal and case. Insulation provided between inputs, outputs, and power supply.
Dielectric strength	2,000 VAC for 1 min between external terminal and case. Insulation provided between inputs, outputs, and power supply.
Noise immunity	±1,500 V on power supply terminals in normal or common mode ±1 μs, 100 ns for square-wave noise with 1 ns
Vibration resistance	Malfunction: 10 to 55 Hz, 0.5-mm for 10 min each in X, Y, and Z directions Destruction: 10 to 55 Hz, 0.75-mm for 2 hrs each in X, Y, and Z directions
Shock resistance	Malfunction: 98 m/s^2 for 3 times each in X, Y, and Z directions Destruction: 294 m/s^2 for 3 times each in X, Y, and Z directions
Ambient temperature	Operating: −10°C to 55°C (with no icing) Storage: −20°C to 65°C (with no icing)
Ambient humidity	Operating: 25% to 85% (with no condensation)
EMC	(EMI) EN61326+A1 Industry Emission Enclosure: CISPR 11 Group 1 class A: CISRP16-1/-2 Emission AC Mains: CISPR 11 Group 1 class A: CISRP16-1/-2 (EMS) EN61326+A1 Industry Immunity ESD: EN61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3) Immunity RF-interference: EN61000-4-3: 10 V/m (amplitude-modulated, 80 MHz to 1 GHz) (level 3) Immunity Fast Transient Noise: EN61000-4-4: 2 kV (power line) (level 3) Immunity Burst Noise: 1 kV line to line (I/O signal line) Immunity Surge: EN61000-4-5: 1 kV line to line 2 kV line to ground (power line) Immunity Conducted Disturbance EN61000-4-6: 3 V (0.15 to 80 MHz) (level 2) Immunity Voltage Dip/Interrupting EN61000-4-11: 0.5 cycles, 0, 180°, 100% (rated voltage)
Approved standards	UL508, CSA22.2; Conforms to EN61326+A1, EN61010-1 (IEC61010-1) Conforms to VDE0106/P100 (finger protection) when the terminal cover is mounted.
Weight	Approx. 400 g

Note: A K3NV with DC supply voltage requires approximately 1 A DC as control power supply current the moment the K3NV is turned ON. Do not forget to take this into consideration when using several K3NV units. When the K3NV is not in measuring operation (e.g., the K3NV has been just turned ON or is operating for startup compensation time), the display will read "*-----*" and all outputs will be OFF.

■ Characteristics

Input signal	DC voltage
A/D conversion	16-bit resolution double integral method
Sampling period	50 Hz: 12.5 times/s; 60 Hz: 15 times/s (selectable)
Display refresh period	Sampling period (sampling times multiplied by number of averaging times if simple average processing is selected.)
Max. displayed digits	5 digits (–19999 to 99999)
Display	7-segment LED
Polarity display	"–" is displayed automatically with a negative input signal.
Zero display	Leading zeros are not displayed.
Scaling function	Programmable with front-panel key inputs (range of display: –19999 to 99999). The decimal point position can be set freely.
HOLD function	Maximum hold (maximum data) Minimum hold (minimum data)
External controls	HOLD: (Process value held) RESET: (Maximum/Minimum data reset) ZERO: (Forced zero)
Comparative output hysteresis setting	Programmable with front-panel key inputs (1 to 9999).
Other functions	Variable linear output range (for models with linear outputs only) Remote/Local processing (available for communications output models only) Maximum/Minimum value data reset with front panel keys Tare (forced-zero) set with front panel keys Averaging processing function (simple or moving average) Startup compensation time (0.0 to 99.9 s) Comparative output pattern selection Security Field calibration
Output configuration	Relay contact output (3 or 5 outputs) Transistor output (NPN and PNP open collector), BCD (NPN open collector) Parallel BCD (NPN open collector) + transistor output (NPN open collector) Linear output (4 to 20 mA, 1 to 5 V) + transistor output (NPN open collector) Communication functions (RS-232C, RS-485, RS-422) Communication functions (RS-232C, RS-485, RS-422) + transistor output (NPN open collector)
Delay in comparative outputs (transistor output)	400 ms max.
Linear output response time	420 ms max.
Degree of protection	Front panel: NEMA4X for indoor use (equivalent to IP66) Rear case: IEC standard IP20 Terminals: IEC standard IP00
Memory protection	Non-volatile memory (EEPROM) (possible to rewrite 100,000 times)

■ Measuring Ranges

Input range		Measuring range	Input impedance	Accuracy (see note 2)	Instantaneous overload (30 seconds)
DC voltage	A	0.00 to 199.99 mV	10 MΩ min.	±0.1%rdg ±5 digit max.	±200 V
	b	0.000 to 19.999 mV	10 MΩ min.	±0.1%rdg ±5 digit max.	±200 V
	C	±100.00 mV	10 MΩ min.	±0.1%rdg ±3 digit max.	±200 V

Note: 1. The "rdg" stands for "reading value."

2. The accuracy is guaranteed at the ambient temperature of 23±5°C.
The reliability becomes ±0.1% FS for values smaller than 10% of the maximum input value for any input range.

■ Input/Output Ratings

Relay Contact Output

(Incorporating a G6B Relay)

Item	Resistive load (cosϕ = 1)	Inductive load (cosϕ = 0.4, L/R = 7 ms)
Rated load	5 A at 250 VAC; 5 A at 30 VDC	1.5 A at 250 VAC, 1.5 A at 30 VDC
Rated carry current	5 A max. (at COM terminal)	
Max. contact voltage	380 VAC, 125 VDC	
Max. contact current	5 A max. (at COM terminal)	
Max. switching capacity	1,250 VA, 150 W	375 VA, 80 W
Min. permissible load (P level, reference value)	10 mA at 5 VDC	
Mechanical life	50,000,000 times min. (at a switching frequency of 18,000 times/hr)	
Electrical life (at an ambient temperature of 23°C)	100,000 times min. (at a rated load switching frequency of 1,800 times/hr)	

Transistor Output

Rated load voltage	24 VDC max.
Max. load current	50 mA
Leakage current	100 μA max.

BCD Output

I/O signal name		Item	Rating
Inputs	REQUEST, HOLD, MAX, MIN, RESET	Input signal	No-voltage contact input
		Input current with no-voltage input	10 mA
		Signal level	ON voltage: 1.5 V max. OFF voltage: 3 V min.
Outputs	DATA, POLARITY, OVERFLOW, DATA VALID, RUN	Rated load voltage	24 VDC
		Max. load current	10 mA
		Leakage current	100 μA max.

Note: Logic method: negative logic

Linear Output

Item	4 to 20 mA	1 to 5 V	1 mV/10 digits (see note)
Resolution	4,096		
Output error	±0.5% FS		±1.5% FS
Permissible load resistance	600 Ω max.	500 Ω min.	1 KΩ min.

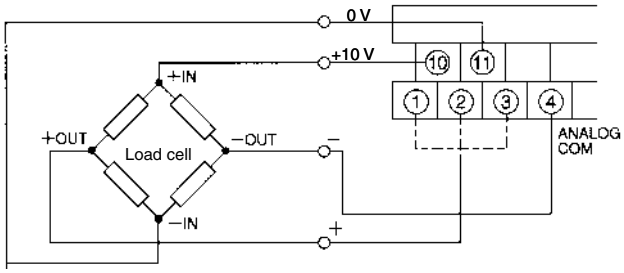
Note: For the 1 mV/10-digit output, the output voltage changes for every 40 to 50 increment in the display value.

■ Communications Specifications

Item		RS-232C, RS-422	RS-485
Transmission method		4-wire, half-duplex	2-wire, half-duplex
Synchronization method		Start-stop synchronization	
Baud rate		1,200/2,400/4,800/9,600/19,200/38,400 bps	
Transmission code		ASCII (7-bit)	
Communications	**Write**	Comparative set value, scaling value, remote/local programming, forced zero control, reset control of maximum/minimum values, and other setting mode items excluding communications conditions.	
	Read	Process value, comparative set value, maximum value, minimum value, model data, error code, and others	

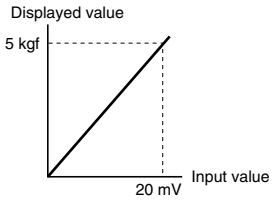
For details, refer to *Communication Operation Manual.*

■ Load Cell Connection Example



■ Scaling Example (for Range A)

In order to display a range of 0 to 5 kgf with the K3NV for load cell specifications (rated load: 5 kgf; recommended applied voltage: 10 V; rated output: 2 mV/V (see note)) use the following scaling values.

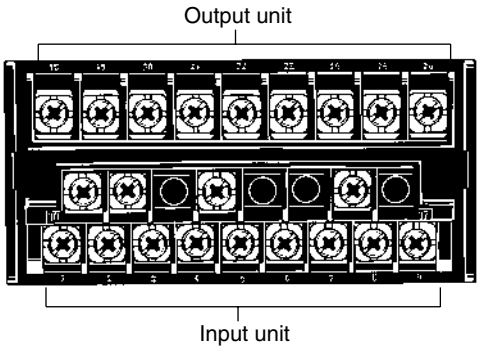


Scaling values
INPUT1 = 000.00
DISPLAY1 = 00000
INPUT2 = 020.00
DISPLAY2 = 05000
Decimal point position = □□.□□□

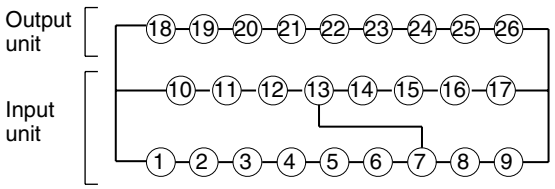
Note: "2 mV/V" means that at the rated load (in this case, when there is a load of 5 kgf applied), the load cell outputs 2 mV for an applied voltage of 1 mV. If the applied voltage is 10 V, then the load cell will output 20 mV (2 mV × 10).

Connections

■ Terminal Arrangement

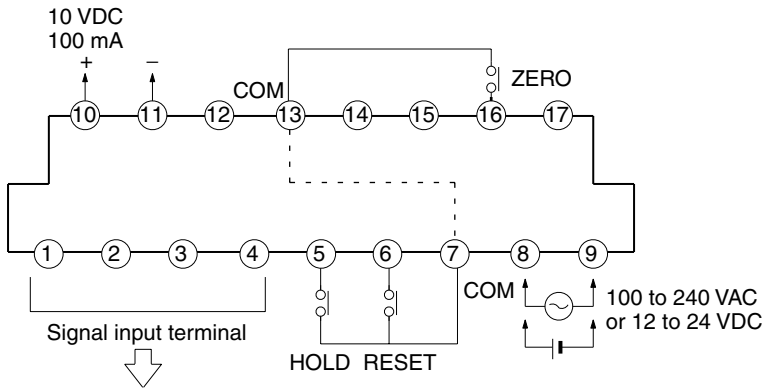


Terminal Numbers



Note: Terminals 7 to 13 are connected internally.
Terminals 4, 7, and 11 are mutually isolated.

Input Unit



Note: Check the power supply specifications of the model used before connecting the power supply.

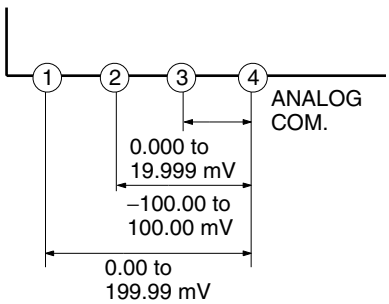
Note: Terminals 7 to 13 are connected internally.

When inputting the external control signals through the open collector:

Transistor Inputs:
ON: Residual voltage must be 3 V max.
OFF: Leakage current must be 1.5 mA max.
The switching capacity must be 20 mA or greater.

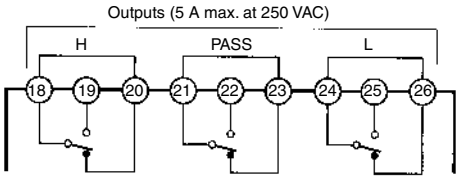
When the external signal input is short-circuited, a voltage of approximately 5 V will be applied to between the terminals 5 to 7 and the COM terminal, and a current of approximately 18 mA (nominal value) will flow.

LC: Load Cell Input

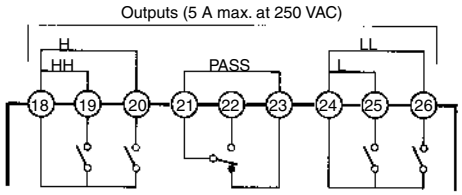


Output Unit

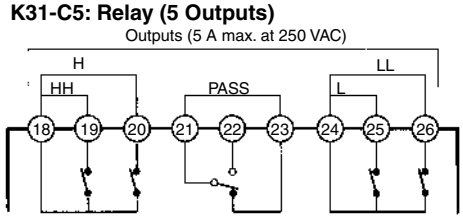
K31-C1: Relay (3 Outputs)



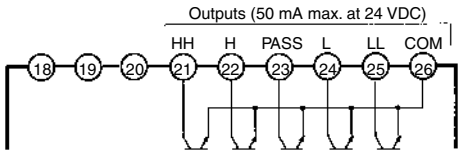
K31-C2: Relay (5 Outputs)



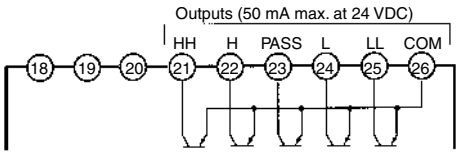
K31-C5: Relay (5 Outputs)



K31-T1: Transistor (NPN Open Collector)

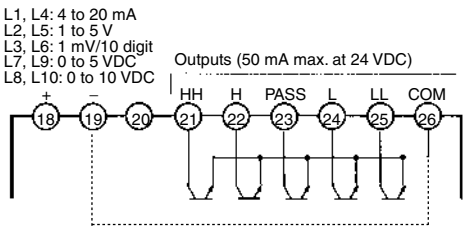


K31-T2: Transistor (PNP Open Collector)



K31-L1, L2, L3,-L4, -L5, -L6, -L7, -L8, -L9, -L10: Linear

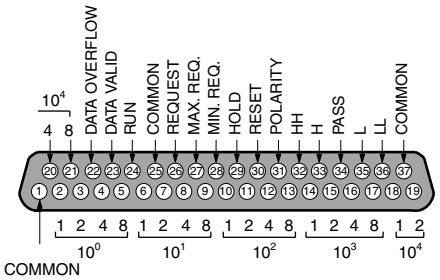
(Terminals 21 to 26 are provided only on K31-L4, -L5, -L6, -L9, -L10.)



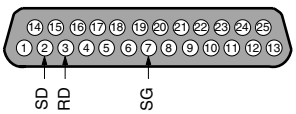
Note: With K31-L4/-L5/-L6/-L9/-L10 models, terminals 19 and 26 are connected internally.

K31-B2, -B4: BCD (NPN Open Collector)

(Terminals 32 to 36 are provided only on K31-B4.)

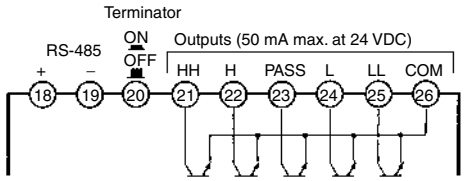


K31-FLK1: RS-232C



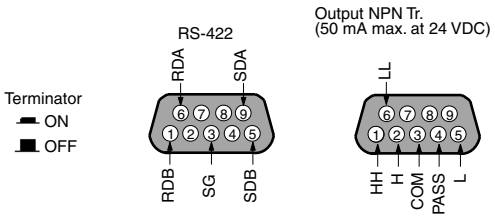
K31-FLK2, -FLK5: RS-485

(Terminals 21 to 26 are provided only on K31-FLK5.)



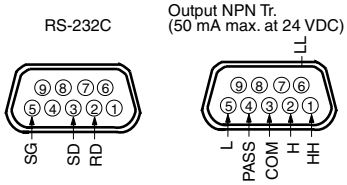
K31-FLK3, -FLK6: RS-422

(The right connector is provided only on K31-FLK6)

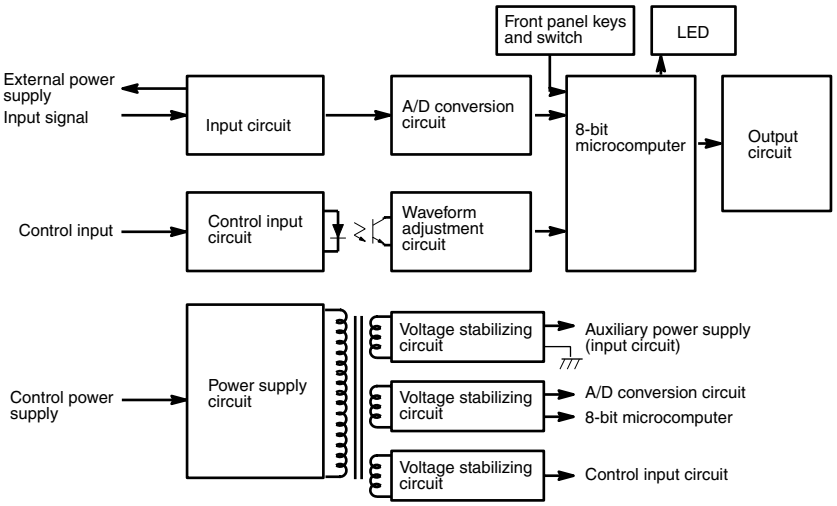


- D-sub 37P Connectors for BCD output (attachment)
  Plug: XM2A-3701
  Hood: XM2S-3711
- D-sub 25P connectors for RS-232C output (K31-FLK1) (order separately)
  Plug: XM2A-2501
  Hood: XM2S-2511
- D-sub 9P connectors for RS-422 output (K31-FLK3 and K31-FLK6) (order separately)
  Plug: XM2A-0901
  Hood: XM2S-0911
- D-sub 9P connectors for RS-232C output (K31-FLK4) (order separately)
  Plug: XM2D-0901
  Hood: XM2D-0911

K31-FLK4: RS-232C + Transistor (NPN Open Collector)



■ Block Diagram



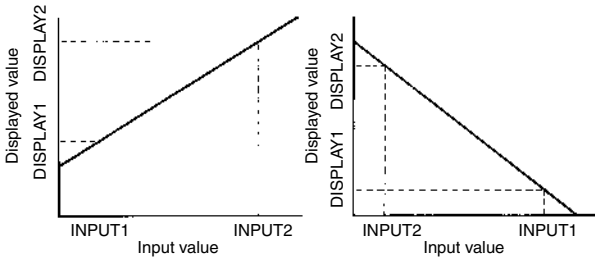
Operation

■ Main Functions

Scaling SCAL

The K3NV converts input signals into desired physical values.

INPUT2: Any input value
DISPLAY2: Displayed value corresponding to INPUT2
INPUT1: Any input value
DISPLAY1: Displayed value corresponding to INPUT1



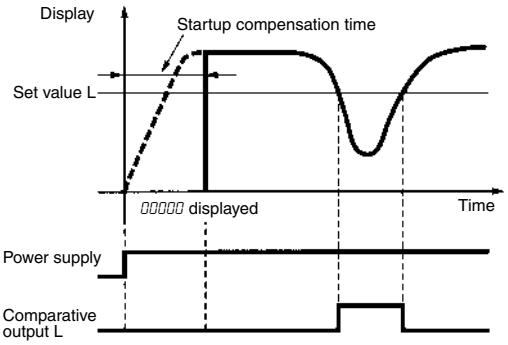
Average Processing AVG

The average processing function stabilizes displayed values by averaging the corresponding analog input signals that fluctuate dynamically or reducing the noise in the input signals.

Startup Compensation Time STIME

The startup compensation time parameter keeps the measurement operation from sending an unnecessary output corresponding to instantaneous, fluctuating input from the moment the K3NX is turned ON until the end of the preset period.

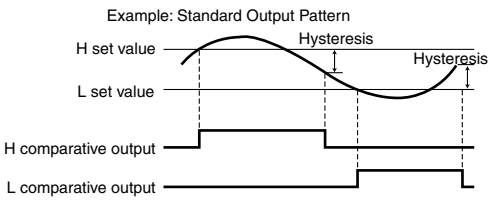
The compensation time can be set in a range from 0 to 99.9 seconds as the waiting time until the devices subject to measurement become stable after the startup of the power supply.



Hysteresis HYS

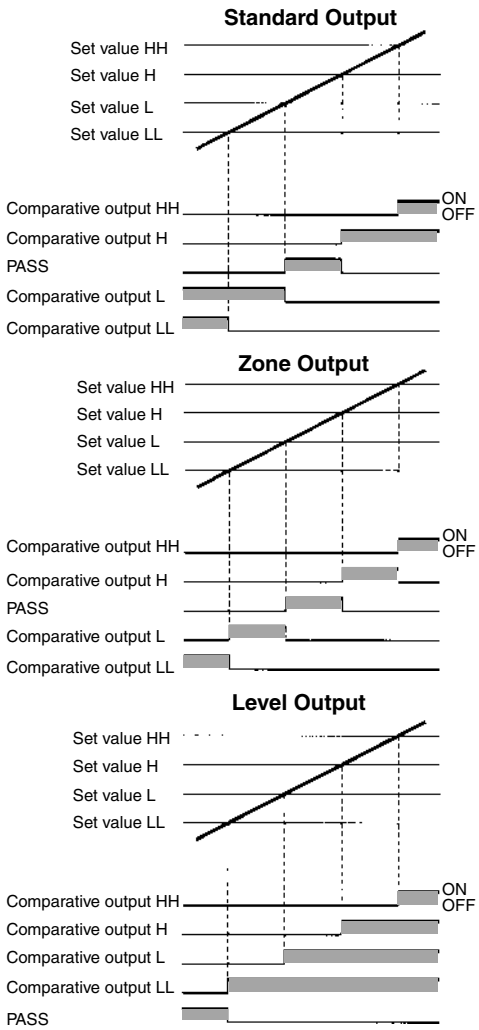
(Models with comparative outputs only)

The hysteresis of comparative outputs can be set to prevent chattering.



Output Pattern Selection C-OUT

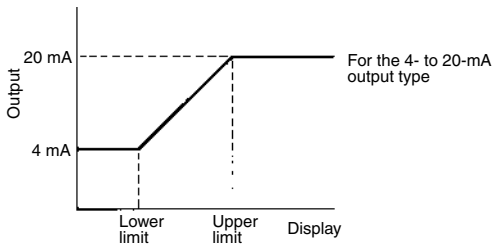
The patterns of comparative output are selectable according to the level change. Select the pattern according to the application.



Note: The following setting conditions must be satisfied, otherwise no zone output will turn ON correctly.
LL < L < H < HH

Linear Output Range LSET

A linear output range can be set as required. A value corresponding to the maximum output value and that corresponding to the minimum output value can be set.



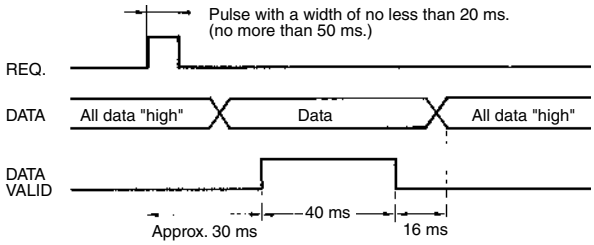
Remote/Local Selection r-L

Select remote programming when performing all settings through the host devices and select local programming when performing settings through key operation.

■ BCD Output Timing Chart

A request signal from an external device (such as a Programmable Controller) is required to read BCD data.

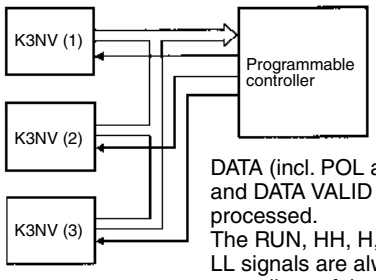
Single Sampling Data Output



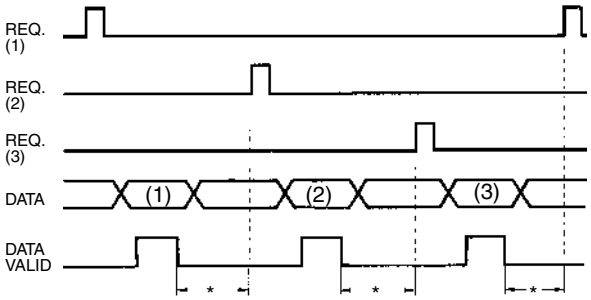
Approximately 30 ms after the REQ signal rises, a sample is taken and the DATA VALID signal is output. Read the data when the DATA VALID signal is ON.

The DATA VALID signal will turn OFF in 40 ms, and then in 16 ms, the data will go OFF.

Models with a BCD output have an open collector output configuration so that wired-OR connection is possible.

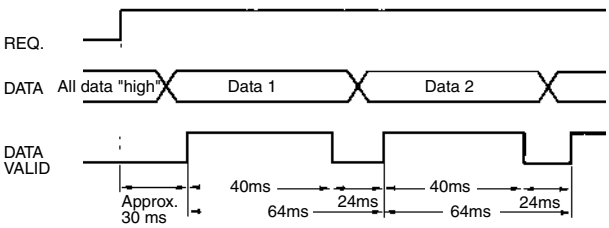


DATA (incl. POL and OVER) and DATA VALID are wired-OR processed.
The RUN, HH, H, PASS, L, and LL signals are always output regardless of the status of the REQ signal. Do not OR-wire these signals.



*The period between the DATA VALID signal and the REQ signal should be no less than 20 ms max.

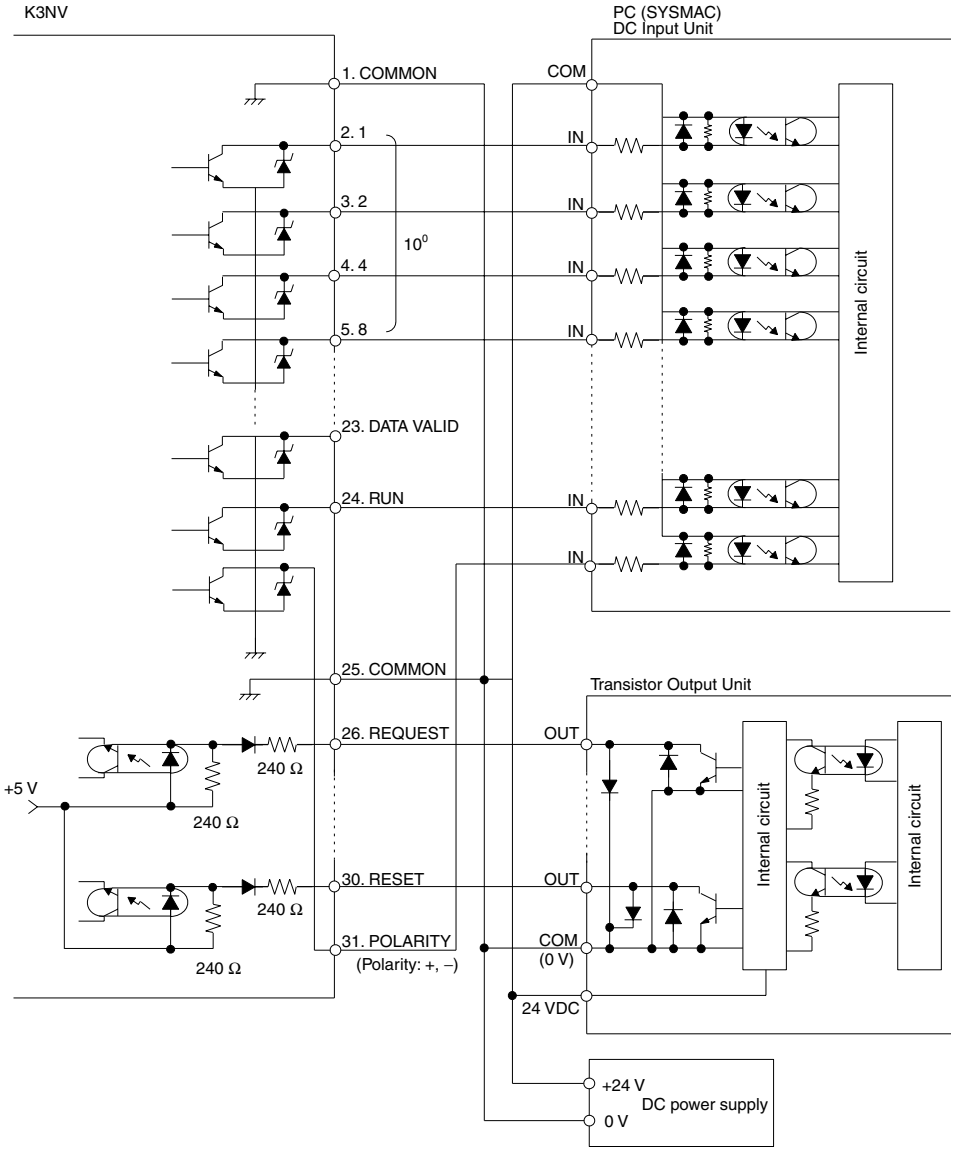
Continuous Data Output



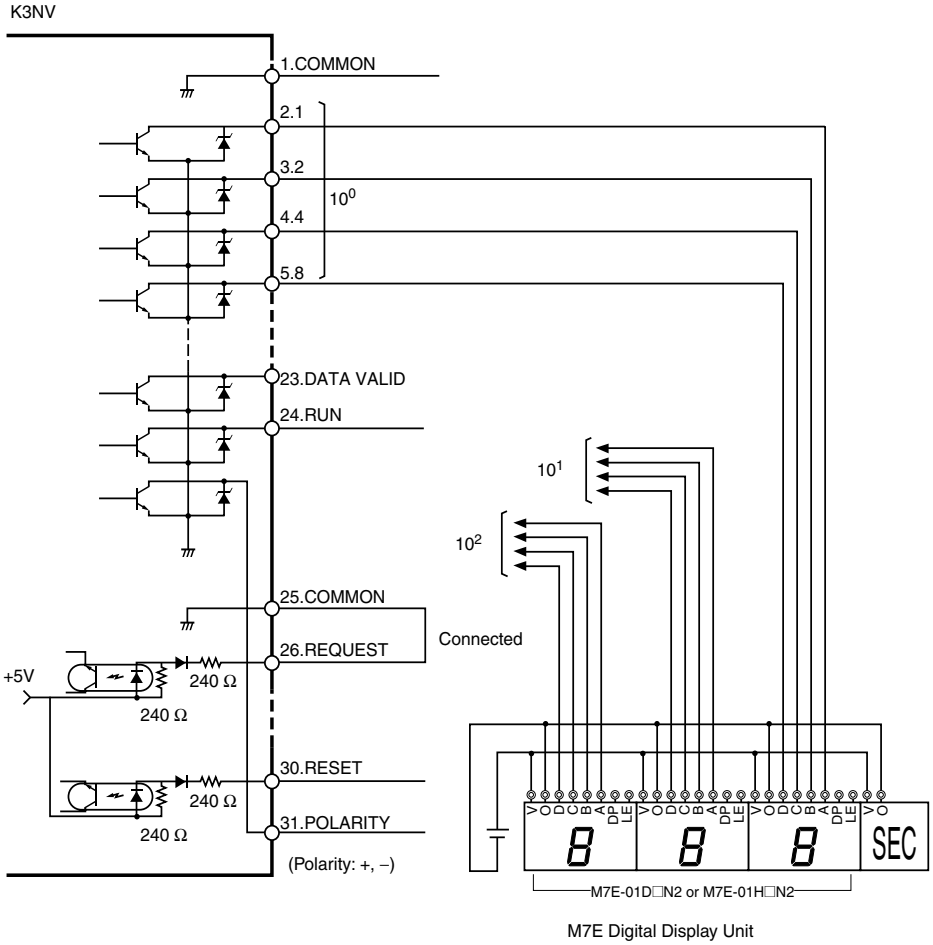
The K3NV outputs each measurement at an interval of 64 ms when a REQ signal is ON continuously.

If the HOLD signal is ON at the moment the DATA output is switched from data 1 to data 2 or vice versa, the output BCD data will be either data 1 or data 2 according to the timing of the HOLD signal. However, output data will never below.

Example of Connection to Programmable Controller

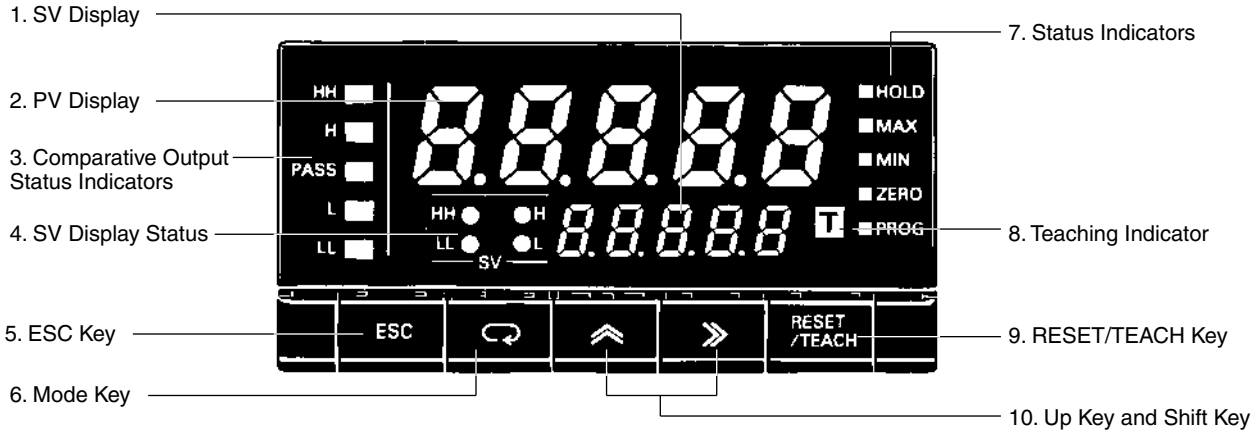


Example of Connection to Display Unit



M7E Digital Display Unit

Nomenclature

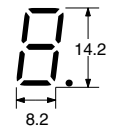


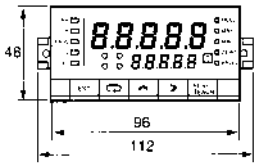
Name	Functions
1. SV display	Displays the set value or parameter. Available for Set Value LED Models only.
2. PV display	Displays the process value in addition to the max./min. value or parameter.
3. Comparative output status indicators	Displays the status of comparative output.
4. SV display status	Indicates which comparative set value is currently on the SV display.
5. ESC Key	Used to return to the RUN mode from the Setting Protect, or Maintenance mode. The process value, maximum value, or minimum value to be displayed can be selected.
6. Mode Key	Used to enter the Setting mode. Used to allow the PV display to indicate set values sequentially. Available for Basic Models only. Used to indicate set values sequentially on the SV display. Available for Set Value LED Models only.
7. Status indicators	HOLD: Lit when HOLD input is ON. MAX: Lit when the maximum value is indicated on the PV display. MIN: Lit when the minimum value is indicated on the PV display. ZERO: Lit when the forced zero function is activated. PROG: Lit or flashes while parameters are being set.
8. Teaching indicator	Lit when the teaching function is enabled and flashes when the K3NV is in teaching operation.
9. RESET/TEACH Key	The forced zero, maximum value, and minimum value are reset by pressing this key. Teaching is available when the teaching function is enabled.
10. Up Key and Shift Key	The digit being set is scrolled by pressing the Shift Key. The set value increases by one whenever the Up Key is pressed.

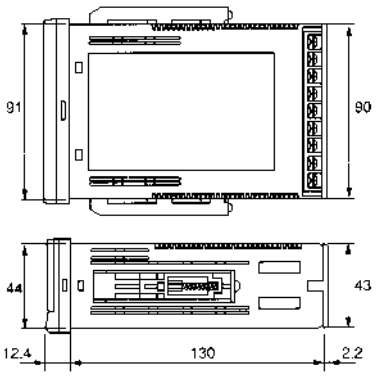
Dimensions

Note: All units are in millimeters unless otherwise indicated.

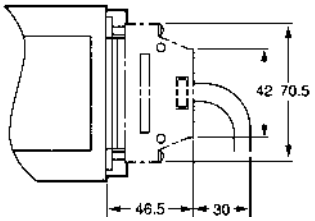
PV Display



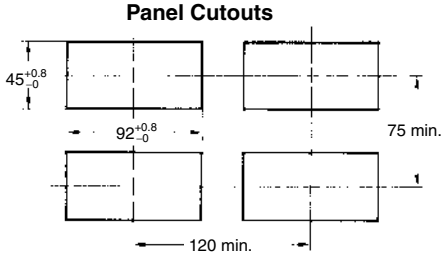




Note: The K3NV uses M3.5 terminals.
A terminal cover is provided.



Panel Cutouts



Precautions

⚠ WARNING

Do not touch any of the terminals while the power is being supplied. Doing so may result in electric shock.

⚠ Caution

Do not allow metal objects or conductive wire cuttings to enter the product. Doing so may result in electric shock, fire, or malfunction.

⚠ Caution

Do not attempt to take the product apart or touch any internal parts while the power is being supplied. Doing so may result in electric shock.

⚠ Caution

Do not use the product in locations subject to flammable or explosive gases. Doing so may result in explosion.

⚠ Caution

The lifetime of output relays varies greatly with the switching capacity and conditions. Consider the actual operating conditions, and use the relays within the rated load without exceeding the number of operations specified as the rated electrical life. Using relays beyond their rated electrical life may result in contact deposit or burning.

⚠ Caution

Do not use loads exceeding the rated value. Doing so may result in damage or burning.

⚠ Caution

Use a power supply voltage within the specified range. Not doing so may result in damage or burning.

⚠ Caution

Use settings that are appropriate for the control system. Discrepancies between the settings and the actual control conditions may result in unexpected operation leading to damage or accidents.

⚠ Caution

Be sure to tighten terminal screws to the specified torque.
Specified torque for M3.5 screws: 0.74 to 0.90 N·m
Loose screws may result in burning or malfunction.

■ Application Precautions

- Use a power supply voltage within the specified range. Not doing so may result in damage or burning.
- Be sure to perform wiring correctly, verifying the terminal names. Incorrect wiring may result in burning.
- Be sure to tighten the screws on the terminal block properly.
- Do not connect anything to unused terminals.

■ Correct Use

Long-term Use

Use all products within the specified ranges. When using inside a control panel, ensure that the temperature around the product, rather than the temperature around the control panel, does not exceed the specified temperature range. Electronic products, such as this product, have a lifetime that is dependent on the lifetime of internal electronic components, as opposed to the lifetime related to the number of relay switching operations. The lifetime of these components varies with the temperature; the higher the temperature, the shorter the lifetime. Therefore, the product lifetime can be extended by lowering the internal temperature of the product.

When several Weighing Meters are mounted close together (either horizontally or vertically), the internal temperature of the Weighing Meters may rise, leading to a reduction in the lifetime. In this case, take measures to cool the Weighing Meters, such as installing fans. Ensure, however, that the terminals are not cooled as this may lead to incorrect measurement.

Operating Environment

Do not use the product in locations subject to temperatures or humidity levels above the specified ranges, or in locations subject to condensation.

Do not use the product in locations subject to severe shocks or vibrations.

Separate the product from machines that generate high-frequency noise, such as high-frequency welding machines and high-frequency sewing machines.

Do not use the product in locations subject to dust or corrosive gases.

Do not use the product outdoors or in locations subject to direct sunlight.

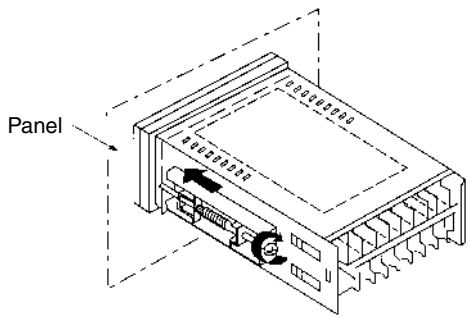
Operation

When using models with comparative outputs, if an error occurs at the Weighing Meter, comparative output may not operate correctly. We therefore recommend that you consider providing an alarm system separately as a countermeasure.

Parameter settings that allow the functions to operate properly are made, using the setting menu, at the factory prior to delivery. When using the product, change the settings as required for the application.

Mounting

Recommended panel thickness is 1 to 3.2 mm.



Attach the mounting bracket on the left and right sides of the Weighing Meter as shown in the illustration above and gradually tighten each screw evenly in turn by considering the balance of the tightening force until the ratchets start slipping without being further tightened.

Mount the Weighing Meter as horizontally as possible.

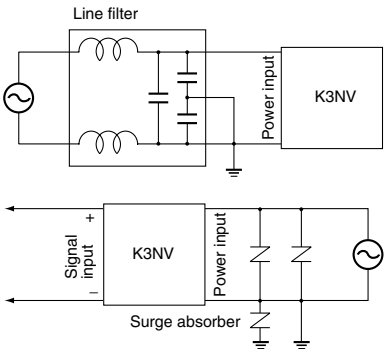
Waterproof Specifications

Products for which the degree of protection is not specified or models with IP□0 degree of protection do not have waterproof specifications.

Noise Countermeasures

Separate the product as far as possible from machines that generate high-frequency noise, such as high-frequency welding machines and high-frequency sewing machines, and machines that generate surges.

Attach surge absorbers or noise filters to noise-generating peripheral devices (in particular, devices with inductance such as motors, transformers, solenoids, and magnet coils).

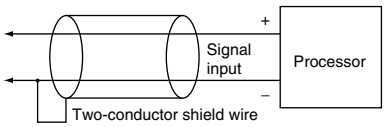


In order to prevent inductive noise, wire the lines connected to the terminal block separately from power lines carrying high voltages or large currents. Also, do not wire in parallel to, or in the same cable as power lines. There are other methods that are effective for reducing noise, such as running wires along ducts and using shield lines.

When using a noise filter for the power supply, check the voltage and current and install as close to the Weighing Meter as possible.

Inductive Noise Countermeasure for Input Line

Analog Input



Temperature Input

In order to prevent the influence of induction, separate the lead wire joining the temperature sensor and the Weighing Meter from power and load lines.

Using the product near radios, television sets, or other wireless devices may result in reception interference.

Unit Label (Provided)

No product is shipped with the unit label attached. Select a unit label from the sheet provided and attach it to the Weighing Meter.

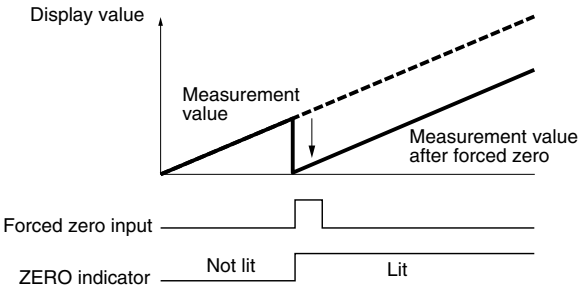
Operating Procedures

■ Operation in RUN Mode

Forced Zero and Clearing Forced Zero

Forced Zero

Reference points can be adjusted to 0 easily.



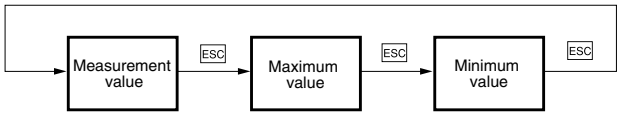
- Press the RESET/TEACH Key [RESET/TEACH] during measurement display to shift the previous display value to 0 and continue measurement.
- Forced zero using the RESET/TEACH Key [RESET/TEACH] is not possible if forced zero was prohibited in Protect Mode. The initial setting for prohibition of forced zero is ON.
- The ZERO indicator is lit while the forced zero function is activated.
- The measurement value when forced zero is activated (i.e., the shift value) is saved when the power is turned OFF.

Clearing Forced Zero

- Press the RESET/TEACH Key [RESET/TEACH] for 1 s min. to clear the forced zero. The ZERO indicator will turn OFF.

Confirming Maximum and Minimum Values

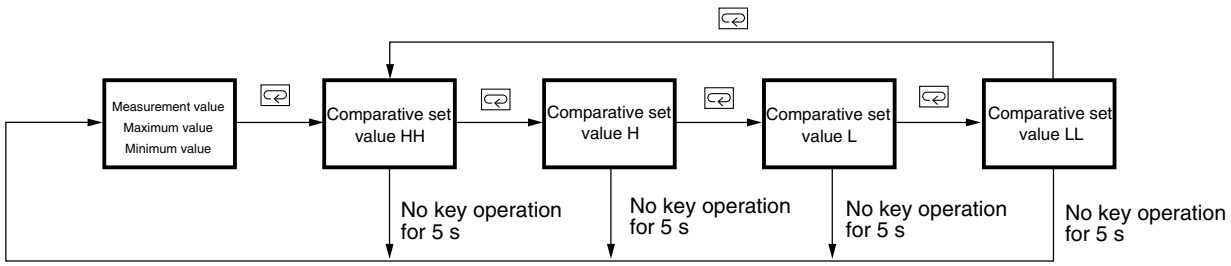
Press the ESC Key [ESC] during measurement to display the maximum and minimum values.



Press the RESET/TEACH Key [RESET/TEACH] while the maximum or minimum value is displayed to reset the value. (This is not possible, however, if maximum/minimum value reset was prohibited in Protect Mode.)

Confirming and Setting Comparative Set Values

When the measurement value, the maximum value, or the minimum value is displayed, press the Mode Key [⊂⊃] repeatedly to display the comparative set values in the order HH, H, L, and LL. (With models that have an SV display, the comparative set values are displayed in the SV display.)



Note: When a comparative set value is displayed, it can be changed using the Up Key [≪] and Shift Key [≫] (if key protection is OFF).

■ Setting Procedures

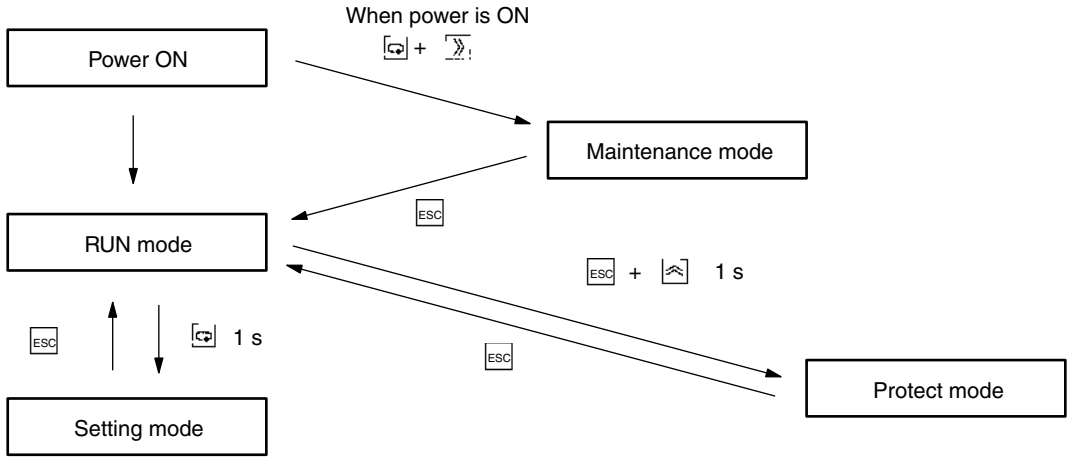
The K3NV has four modes: RUN mode for normal operations, Setting mode for initial parameter input, Protect mode for lock-out configuration, and Maintenance mode for initializing set values and user calibration. The parameters that are accessible on any individual K3NV will vary depending on the Output Board installed. Refer to the *K3NV Operation Manual* for details.

RUN Mode: Remains in this mode under normal operation.
The process value or the max./min. value can be monitored.
Using the front panel keys, the comparative set value can be changed and forced-zero reset or max./min. values reset can be performed.

Setting Mode: Used for making initial settings.
Includes four menus (Set value (SuSEt), scaling (SCALE), setup (SEtUP), option (oPt)) and the output test.

Protect Mode: Used for locking the front key operation or parameter changes.

Maintenance Mode: Used for initializing set values and user calibration of the inputs.
The user calibration is valid for selected input ranges.



SuSEt - Program set values

- Su.HH Enter set value HH
- Su. H Enter set value H
- Su. L Enter set value L
- Su.LL Enter set value LL

SCALE - Display scaling

- inP.2 Enter signal level for scaling point #2
- dSP.2 Enter display reading for scaling point #2
- inP. 1 Enter signal level for scaling point #1
- dSP. 1 Enter display reading for scaling point #1
- dEC-P Select decimal point

SEtUP - Program input range/Serial communications

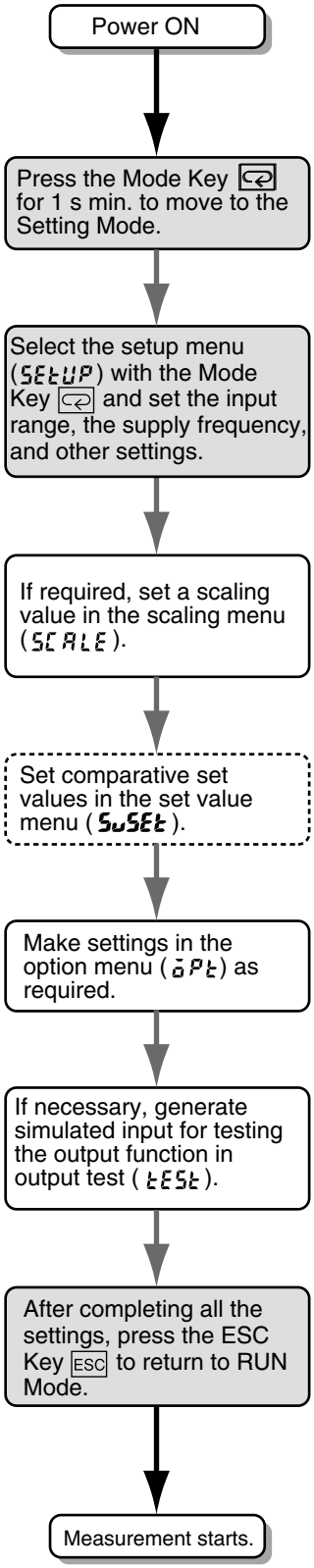
- in-t Specifying input range
- Fr-E Select the supply frequency to eliminate inductive noise
- U-no Enter the unit no. for the host
- bPS Select the baud rate
- LEn Select the word bit length
- Sbit Select the stop bits
- PrtY Select the parity bits

oPt - Supplementary settings related to display or control

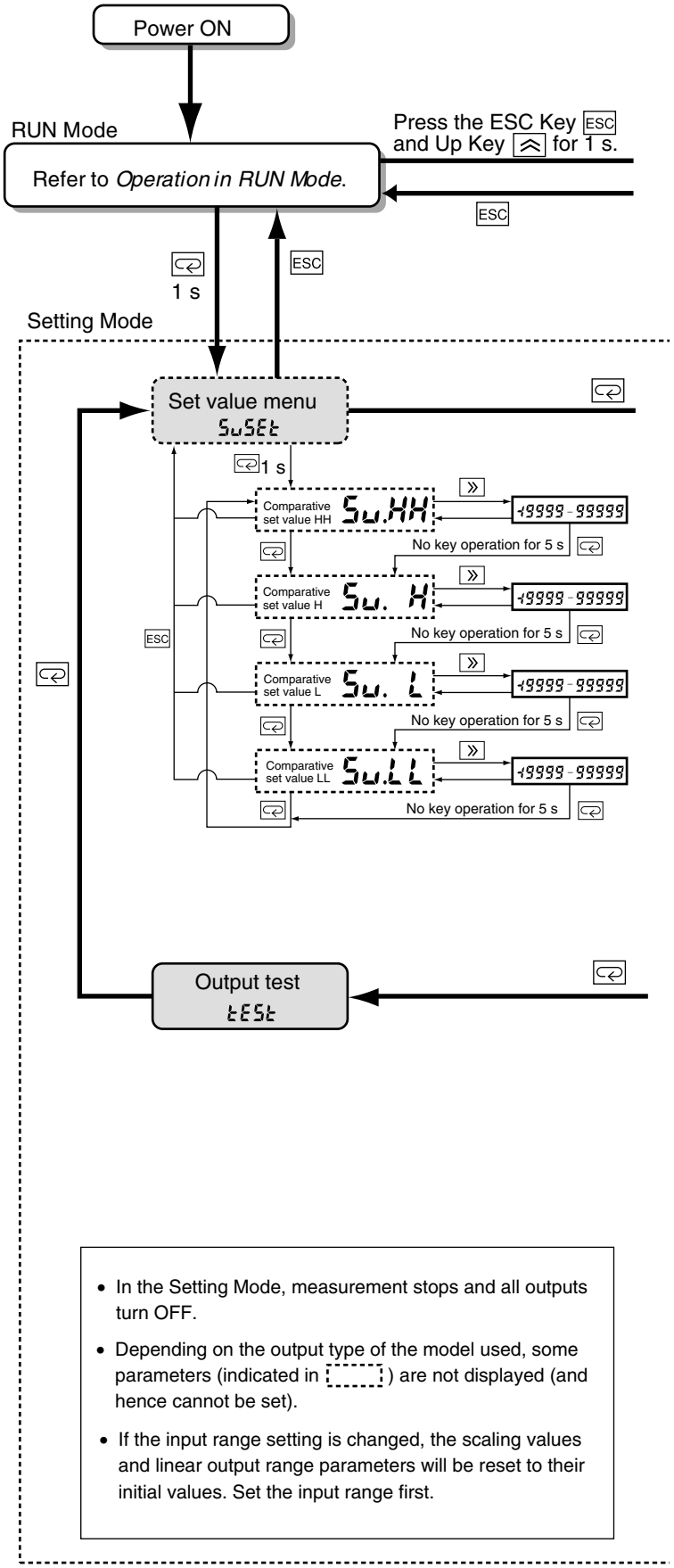
- AvG Set for averaging process value
- Stini Set startup compensation time
- HYS Enter hysteresis value
- C-oUt Select the output pattern
- LSEt.H Enter the upper limit (H) of linear output range
- LSEt.L Enter the lower limit (L) of linear output range
- r-L Select the remote/local programming

tESt - Generating simulated input for testing the output function

■ Initial Settings



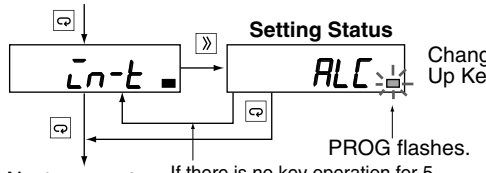
■ Parameters



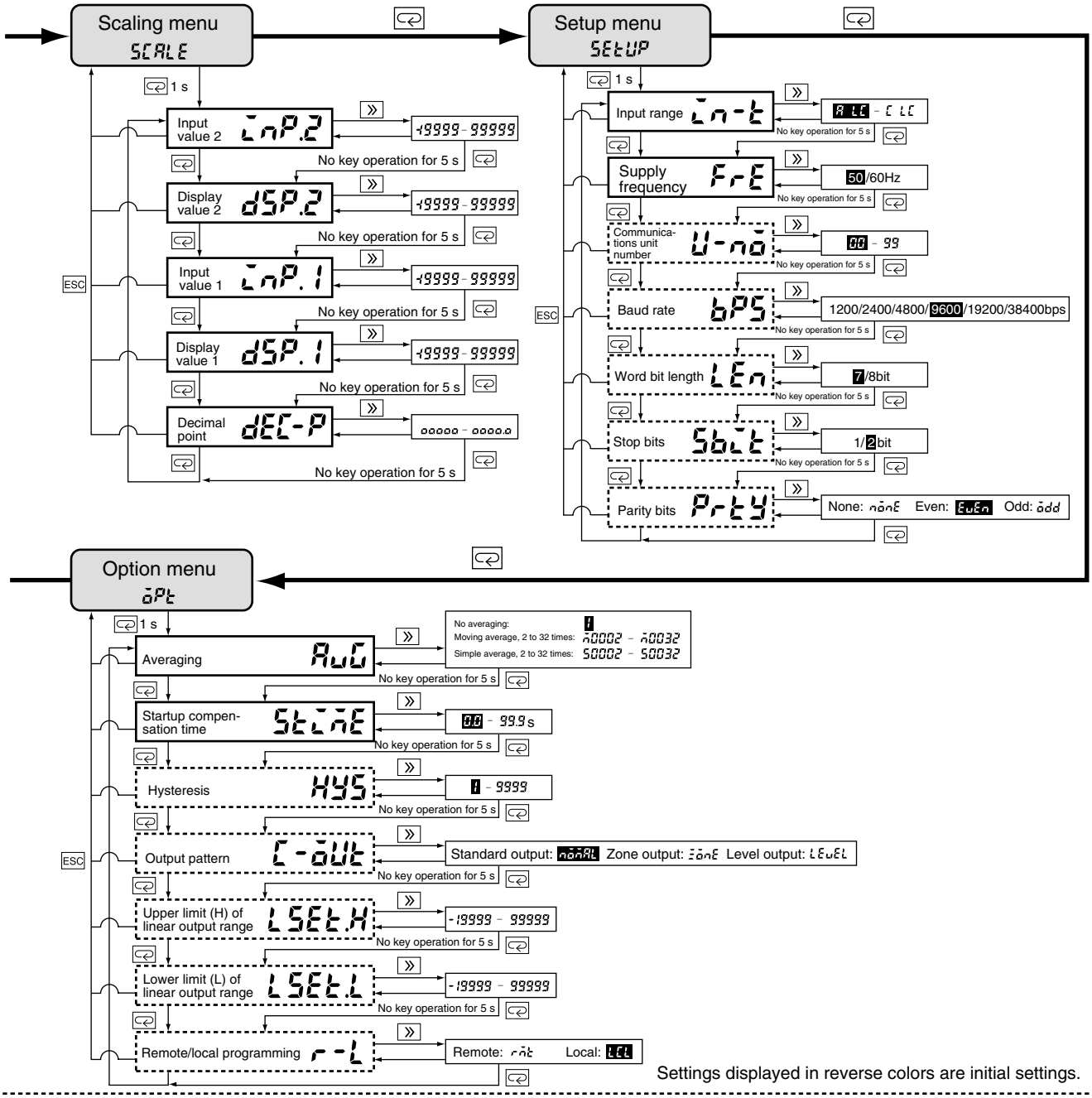
- In the Setting Mode, measurement stops and all outputs turn OFF.
- Depending on the output type of the model used, some parameters (indicated in [ ]) are not displayed (and hence cannot be set).
- If the input range setting is changed, the scaling values and linear output range parameters will be reset to their initial values. Set the input range first.

Changing Set Values

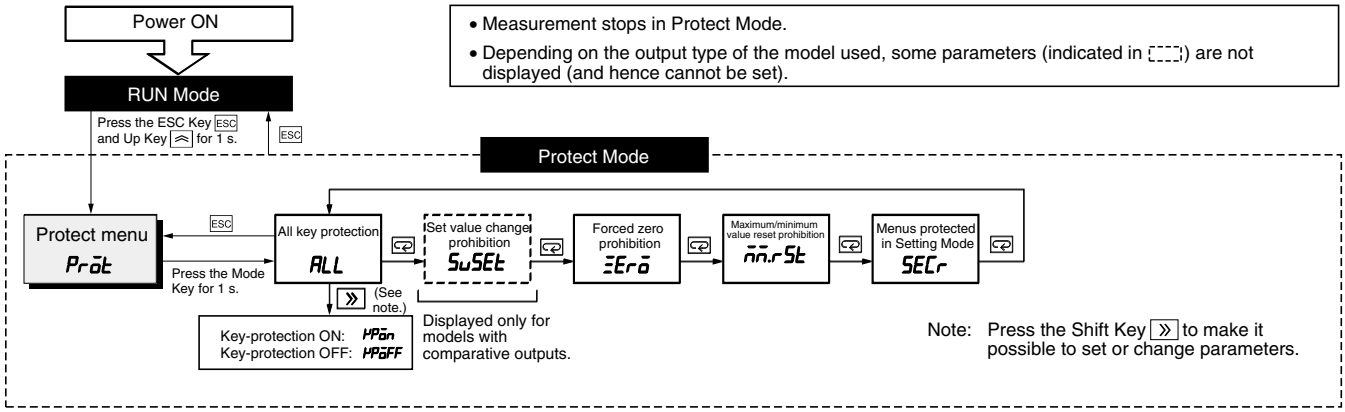
By pressing the Shift Key » while a parameter is displayed, the set value can be changed (setting status). The PROG status indicator will flash. Change the set value as required, and press the Mode Key to register the setting and move to the next parameter.



Protect Mode



Settings displayed in reverse colors are initial settings.



■ Protect Mode Settings

Settings displayed in reverse colors are initial settings.

Menu display	Parameter display	Meaning of parameter	Setting range	Setting key (See note.)
Prot Press the Mode Key to display the parameter. Press the ESC Key to return to the menu.	ALL Setting: Next parameter:	All key protection: All key operations are prohibited in RUN Mode. (If all key protection is ON, only the key for going to Protect Mode is enabled.)	Key protection ON: HPon Key protection OFF: HPoFF	Use the Up Key to change the setting. HPon → HPoFF Use the Mode Key to enable the setting and move to the next parameter.
	SuSEt Setting: Next parameter:	Set value change prohibition: Changes to comparative set values are prohibited in RUN Mode. (Displayed only for models with comparative outputs.)		
	ZEro Setting: Next parameter:	Forced zero prohibition: Forced zero operations using the front panel keys are prohibited. (Forced zero operations using external signals are not prohibited.)	Key protection ON: HPon Key protection OFF: HPoFF	
	mm.rSt Setting: Next parameter:	Maximum/minimum value reset prohibition: Resetting of maximum and minimum values using the front panel keys is prohibited. (Resetting by external signals is not prohibited.)	Key protection ON: HPon Key protection OFF: HPoFF	
	SECr Setting: Next parameter:	Menus protected in Setting Mode: Setting operations in Setting Mode are prohibited in the way shown below.	0/ 1/2	Use the Up Key to change the setting. 0→1→2→3 Use the Mode Key to enable the setting and move to the next parameter.

Setting menu	Setting		
	0	1	2
Set value menu			×
Scaling menu			×
Setup menu		×	×
Option menu			×

Note: If there is no key operation for 5 seconds, the setting is automatically registered.

■ Troubleshooting

When an error occurs, error details will be displayed in the PV display. Take the appropriate countermeasures according to the error displayed.

Error display	Error contents	Output status				Countermeasure
		Comparative output	BCD output	Communications output	Linear output	
M1.Err (M1.ERR) M2.Err (M2.ERR)	Memory error	OFF	OFF (all outputs in "H" status)	OFF	OFF	Reset the power. If the same error occurs, repair is necessary.
M3.Err (M3.ERR)		OFF	OFF (all outputs in "H" status)	OFF	OFF	Reset the power while holding down the ESC Key, the Up Key, and the RESET/TEACH Key. The settings will be returned to their initial values. Redo the settings. If the same error occurs, repair is necessary.
Ad.Err (AD.ERR)	AD converter error	OFF	OFF (all outputs in "H" status)	OFF	OFF (minimum value)	Reset the power. If the same error occurs, repair is necessary.
Err-O (ERR-O) CHG-O (CHG-O)	Output error	OFF	OFF (all outputs in "H" status)	OFF	OFF (minimum value)	
(Display value flashes.)	The input range and display range were exceeded.	Continues	Continues The OVER signal turns ON.	Continues The OVER or UNDER signal turns ON.	Continues	Take steps to ensure that the input values and display values are within the allowable ranges.
rmt (RMT) (Flashes for 3 s.)	The remote/local section is set to remote.	Continues	Continues	Continues	Continues	If an attempt to change a setting using key operations is made with the remote/local selection set to remote, this error will flash for 3 s. To enable settings to be changed, set the remote/local selection to local.