

# Up/Down Counting Meter K3NC

## An Ideal Interface for High-speed Up/Down Counting and Serial Communications

- 50-kHz input range for high-speed signal processing.
- A wide selection of outputs: relay, transistor, BCD, linear, or communications.
- Prescale function available, which displays in units of actual physical parameters (length, volume, etc.).
- Built-in sensor power supply (12 VDC, 80 mA).
- Banks with four set values and four prescale values.
- Five-stage comparative outputs available.
- Compact 1/8 DIN size.
- Conforms to EMC standards, EN61010-1 (IEC1010-1).
- UL/CSA approved.

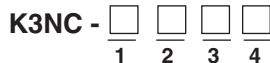


## Model Number Structure

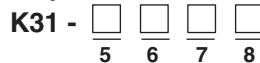
### Model Number Legend

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

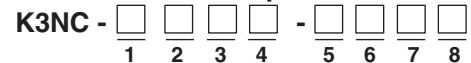
#### Base Units



#### Output Boards



#### Base Units with Output Boards



#### 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



- C2: 5 comparative relay contact outputs (OUT1, 2, 4, 5: SPST-NO; OUT3: SPDT)
- C5: 5 comparative relay contact outputs (OUT1, 2, 4, 5: SPST-NC; OUT3: 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)

- 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)

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

# Ordering Information

## ■ Base Unit

Input type Supply voltage	NPN/Voltage pulse		PNP	
	100 to 240 VAC	12 to 24 VDC	100 to 240 VAC	12 to 24 VDC
<b>Basic Models</b> 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. 	K3NC-NB1A	K3NC-NB2A	K3NC-PB1A	K3NC-PB2A
<b>Set Value LED Models</b> 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. 	K3NC-NB1C	K3NC-NB2C	K3NC-PB1C	K3NC-PB2C

## ■ Available Output Board Combinations

Output type	Output configuration	Output boards	Base units	
			Basic	Set Value LED Display
<b>Relay contact</b>	5 outputs: OUT1, 2, 4, 5 (SPST-NO), and OUT3 (SPDT)	K31-C2	Yes	Yes
	5 outputs: OUT1, 2, 4, 5 (SPST-NC), and OUT3 (SPDT)	K31-C5	Yes	Yes
<b>Transistor</b>	5 outputs (NPN open collector)	K31-T1	Yes	Yes
	5 outputs (PNP open collector)	K31-T2	Yes	Yes
<b>BCD (see note)</b>	5-digit output (NPN open collector)	K31-B2	Yes	---
<b>Linear</b>	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	---
<b>Communication boards (see note)</b>	RS-232C	K31-FLK1	Yes	---
	RS-485	K31-FLK2	Yes	---
	RS-422	K31-FLK3	Yes	---
<b>Combination output and communication boards</b>	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

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

**Note:** A K3NC with DC supply voltage requires approximately 1 A DC as control power supply current the moment the K3NC is turned ON. Do not forget to take this into consideration when using several K3NC units. When the K3NC is not in measuring operation (e.g., the K3NC has been just turned ON or is operating for startup compensation time), the display will read "00000" and all outputs will be OFF.

## ■ Characteristics

<b>Input signal</b>	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.) <b>Connectable Sensors</b> 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.
<b>Input mode</b>	Up/Down B (individual inputs), Up/Down C (phase difference inputs)
<b>Output mode</b>	ALL-H/ALL-L
<b>Max. displayed digits</b>	5 digits (-19999 to 99999)
<b>Display</b>	7-segment LED
<b>Polarity display</b>	"-" is displayed automatically with a negative input signal.
<b>Zero display</b>	Leading zeros are not displayed.
<b>Prescale function</b>	Programming via front-panel key inputs. (0.0001 x 10 <sup>-9</sup> to 9.9999 x 10 <sup>9</sup> , decimal point can be set freely) Can be set using prescale value teaching.
<b>External control</b>	RESET: 16 ms max. (external reset signal) COMPENSATION: 16 ms max. (external compensation signal) BANK 1, 2: 100 ms max. (bank switching time) Up to 4 set value or prescale value banks available
<b>Other functions</b>	Variable linear output range (for models with linear outputs only) Remote/Local processing (available for communications output models only) Counting value reset with front panel keys Security Memory power failure
<b>Output configuration</b>	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)
<b>Delay in comparative outputs</b>	1 ms max. (at transistor output), 10 ms max. (at relay output)
<b>Linear output response time</b>	20 ms max.
<b>Degree of protection</b>	Front panel: NEMA4 for indoor use (equivalent to IP66) Rear case: IEC standard IP20 Terminals: IEC standard IP00
<b>Memory protection</b>	Non-volatile memory (EEPROM) (possible to rewrite 100,000 times)

## ■ Input/Output Ratings

### Relay Contact Output

(Incorporating a G6B Relay)

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

### Transistor Output

<b>Rated load voltage</b>	12 to 24 VDC <sup>+10%</sup> / <sub>-15%</sub>
<b>Max. load current</b>	50 mA
<b>Leakage current</b>	100 μA max.

## BCD Output

I/O signal name		Item	Rating
Inputs	REQUEST, COMPENSATION, 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 <sup>+10%</sup> / <sub>-15%</sub>
		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.

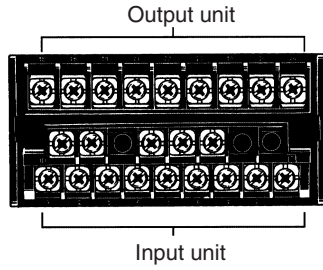
## ■ Communications Specifications

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, and other setting mode items excluding communications conditions.	
	Read	Process value, comparative set value, model data, error code, and others	

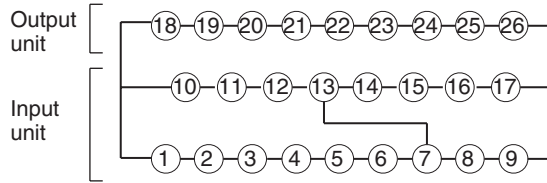
For details, refer to *Communication Operation Manual*.

# Connections

## Terminal Arrangement



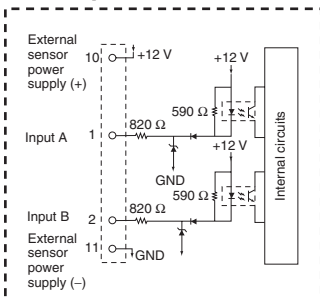
### Terminal Numbers



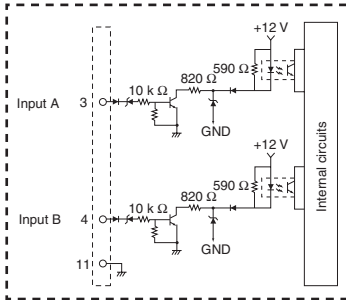
**Note:** Terminals 7 to 13 are connected internally.  
Terminals 7 and 11 are mutually isolated.

## Input Unit

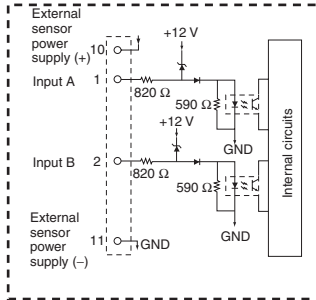
### NPN Inputs



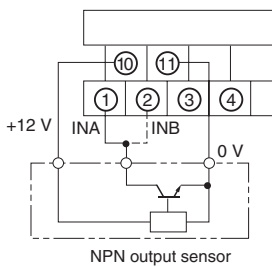
### Voltage Pulse Inputs



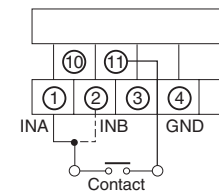
### PNP-input Models



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

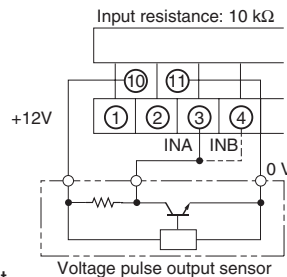


### Contact Output

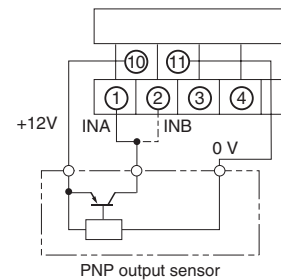


**Note:** When the contact is short-circuited, a current of approximately 13 mA will flow at a voltage of approximately 12 V.

### Voltage Output



### PNP Open Collector Output

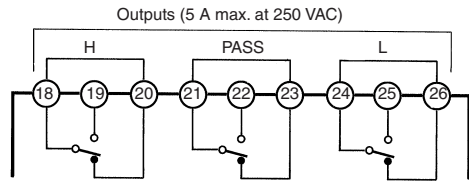


**Note:** Connect the + side of the NPN linear 2-wire input to terminal 1 and the - side to terminal 11.

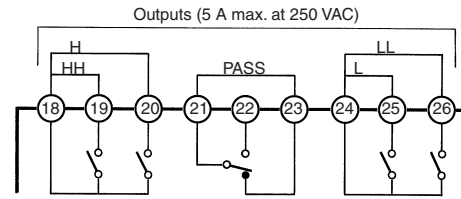
**Note:** With voltage pulse input not from a 3-wire sensor, connect the + side to terminal 3 and the - side to terminal 11.

# Output Unit

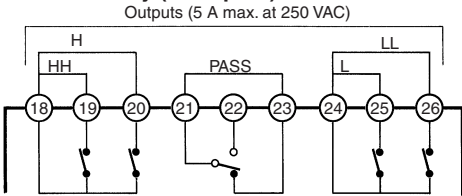
## K31-C1: Relay (3 Outputs)



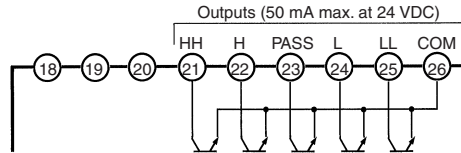
## K31-C2: Relay (5 Outputs)



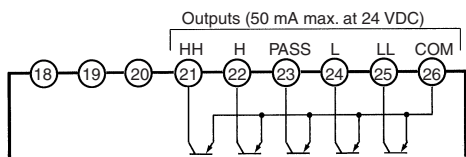
## K31-C5: Relay (5 Outputs)



## K31-T1: Transistor (NPN Open Collector)

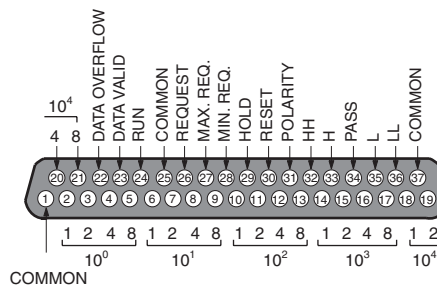


## K31-T2: Transistor (PNP Open Collector)



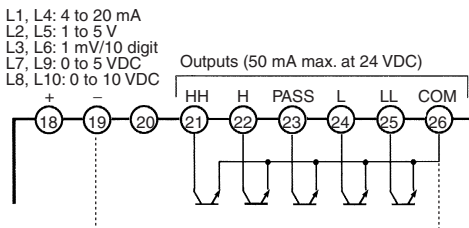
## K31-B2, -B4: BCD (NPN Open Collector)

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



## 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.)

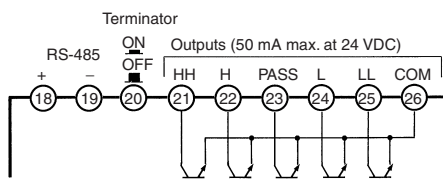


- L1, L4: 4 to 20 mA
- L2, L5: 1 to 5 V
- L3, L6: 1 mV/10 digit
- L7, L9: 0 to 5 VDC
- L8, L10: 0 to 10 VDC

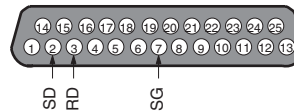
Note: With K31-L4/-L5/-L6/-L9/-L10 models, terminals 19 and 26 are connected internally.

## K31-FLK2, -FLK5: RS-485

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

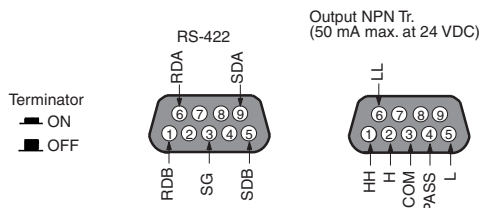


## K31-FLK1: RS-232C

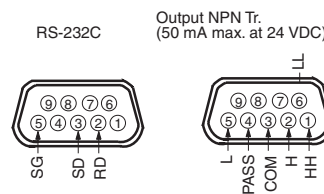


## K31-FLK3, -FLK6: RS-422

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

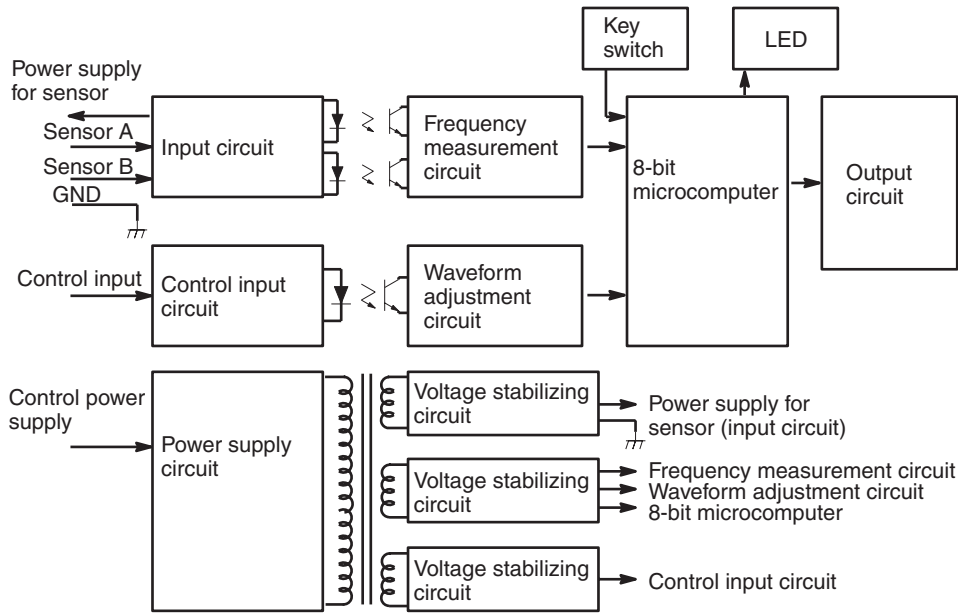


## K31-FLK4: RS-232C + Transistor (NPN Open Collector)

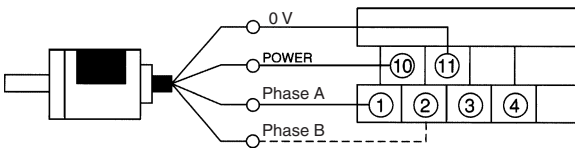


- D-sub 37P Connectors for BCD output (attachment)  
Plug: XM2A-3701  
Hood: XM2S-3711
- D-sub 25P connectors for RS-232C output (K31-FLK1) (order separately)  
Plug: XM2A-2501  
Hood: XM2S-2511
- D-sub 9P connectors for RS-422 output (K31-FLK3 and K31-FLK6) (order separately)  
Plug: XM2A-0901  
Hood: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

## ■ Block Diagram



## ■ Rotary Encoder Connection Example



<b>INA/INB</b>	Counts input signals. Accepts Up/Down (individual or phase difference) inputs.																	
<b>RESET</b>	Resets the present value to zero. No counting inputs are accepted when a RESET input is ON. RESET is lit when a RESET input is ON. <b>Note:</b> External reset minimum signal width: 16 ms																	
<b>COMPENSATION</b>	Resets the present counting value to the compensation value at the rising edge of a compensation input. In the compensation value setting parameter, it is possible to set to "Effective during incrementing and decrementing a count" or to "Effective only during incrementing a count." <b>Note:</b> External compensation input minimum signal width: 16 ms																	
<b>BANK 1, 2</b>	Selects one of the four banks. <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th rowspan="2">Bank no.</th> <th colspan="2">Control input</th> </tr> <tr> <th>Bank 1</th> <th>Bank 2</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>2</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>3</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>4</td> <td>ON</td> <td>ON</td> </tr> </tbody> </table> <b>Note:</b> Bank switching minimum signal width: 100 ms max.	Bank no.	Control input		Bank 1	Bank 2	1	OFF	OFF	2	ON	OFF	3	OFF	ON	4	ON	ON
Bank no.	Control input																	
	Bank 1	Bank 2																
1	OFF	OFF																
2	ON	OFF																
3	OFF	ON																
4	ON	ON																

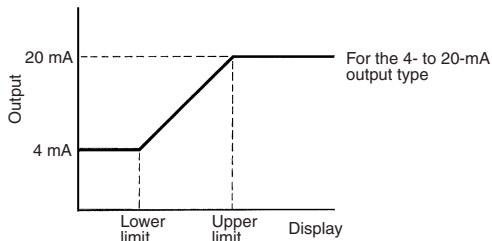


# Operation

## ■ Main Functions

### Linear Output Range *LSEL*

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.



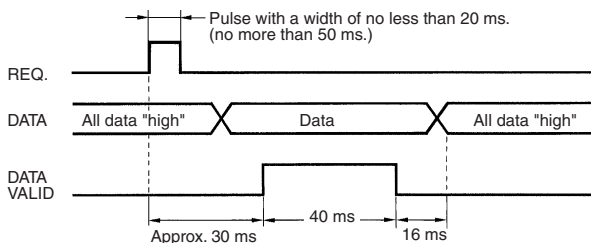
### Remote/Local Selection *r-L*

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.

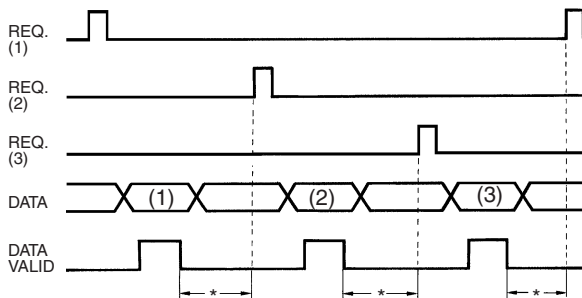
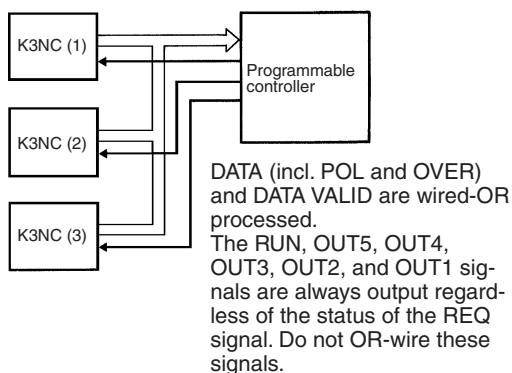
### Single Sampling Data Output



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.

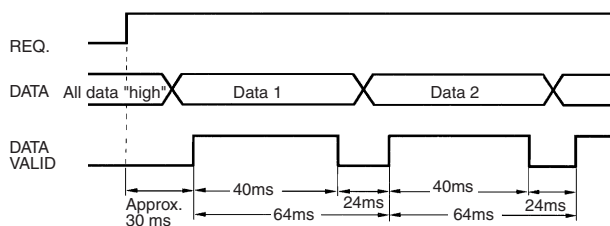
The DATA VALID signal will turn OFF in 40 ms, and then in 16 ms, the data will go OFF.

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



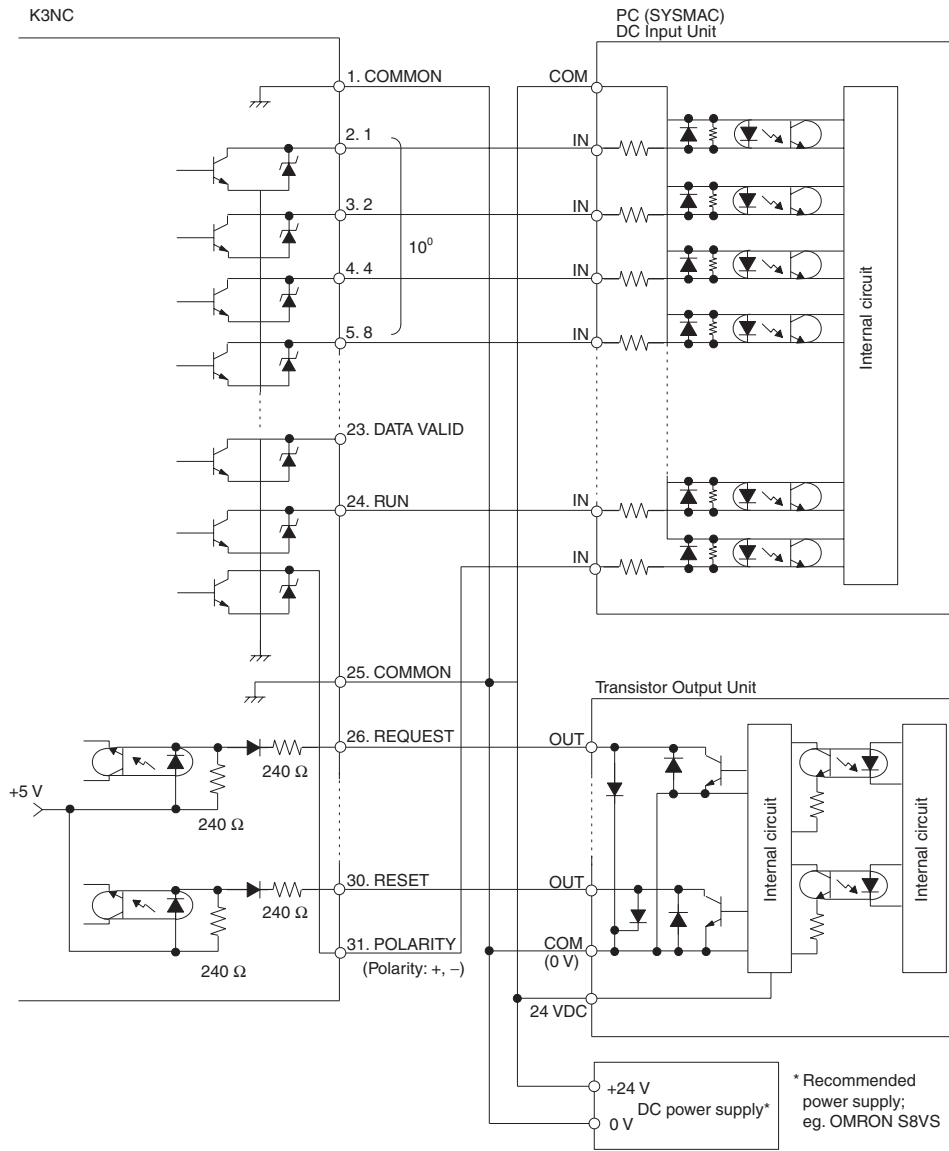
\*The period between the DATA VALID signal and the REQ signal should be no less than 20 ms max.

### Continuous Data Output

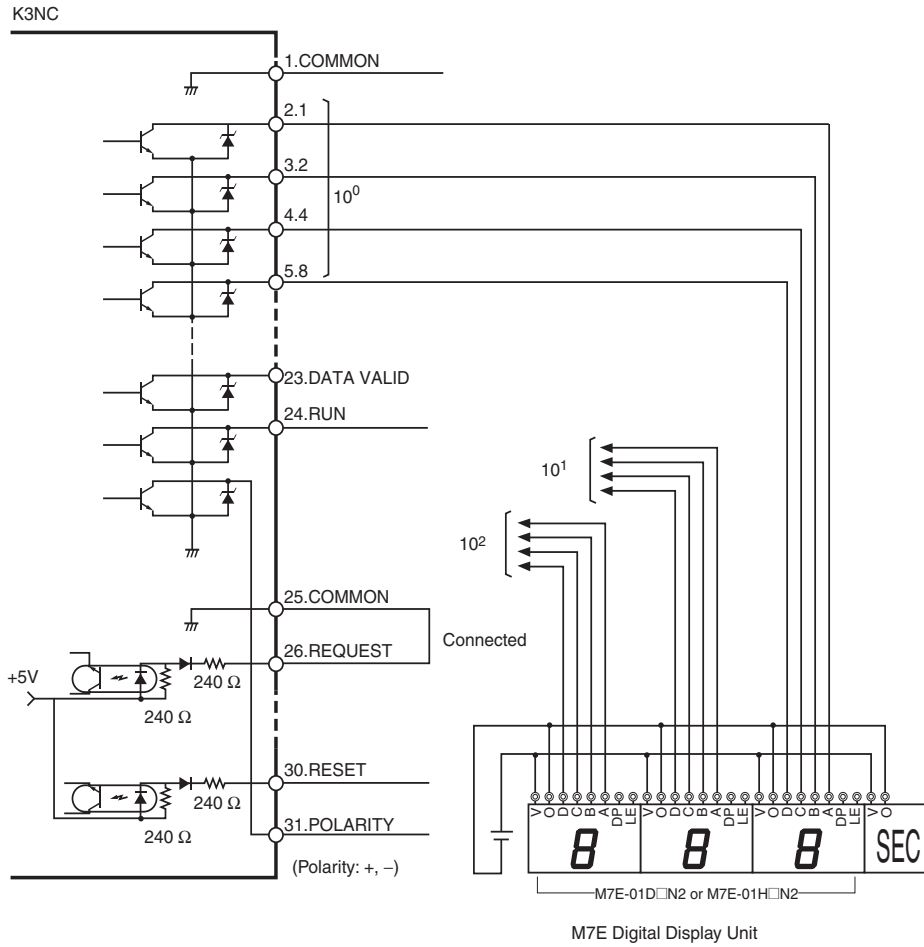


The K3NC outputs each measurement at an interval of 64 ms when a REQ signal is ON continuously.

**Example of Connection to Programmable Controller**



**Example of Connection to Display Unit**



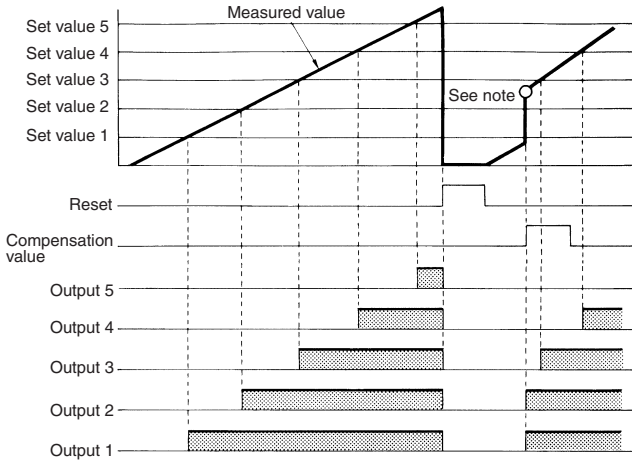
Counters

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

The K3NC can output the results of Up/Down counting as comparative outputs. The output mode can be set to the ALL-H mode or the ALL-L mode.

### ALL-H

If the ALL-H output mode is selected, outputs 1 to 5 will be ON when the measured value exceeds set values 1 to 5.



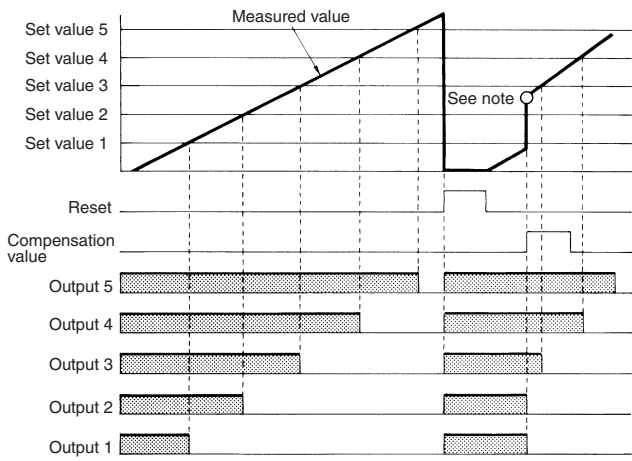
**Note:** Set value 2 < compensation value < set value 3

While the reset signal is ON, the counting value will return to zero.

When the compensation signal is ON, the K3NC will be in counting operation starting with the preset compensation value. Depending on the setting conditions, the compensation value will be effective only for the incrementing operation.

### ALL-L

If the ALL-L output mode is selected, outputs 1 to 5 will be ON when the measured value is less than set values 1 to 5.



**Note:** Set value 2 < compensation value < set value 3

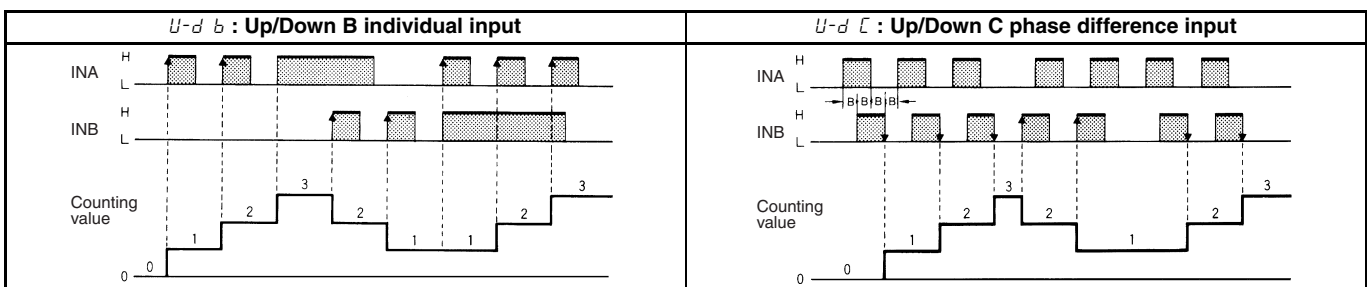
## ■ Output Delay (Reference Value)

The following table shows the time required for a K3NC in a system to go into reverse output operation after the counting value reaches the value preset with the K3NC, and is due to the output processing time of the K3NC, signal transmission time of the system, and the relay connected to the K3NC.

Control I/O	Output or response delay time
Relay contact output	3.0 to 10.0 ms
NPN/PNP transistor output	0.1 to 0.6 ms
Reset input	12.0 to 16.0 ms
Compensation input	12.0 to 16.0 ms
Bank switch	60.0 to 100.0 ms

**Note:** Output delay time varies with the operating environment. If the output delay time will possibly have a serious influence on your system, check the actual output delay time before applying the K3NC to the system.

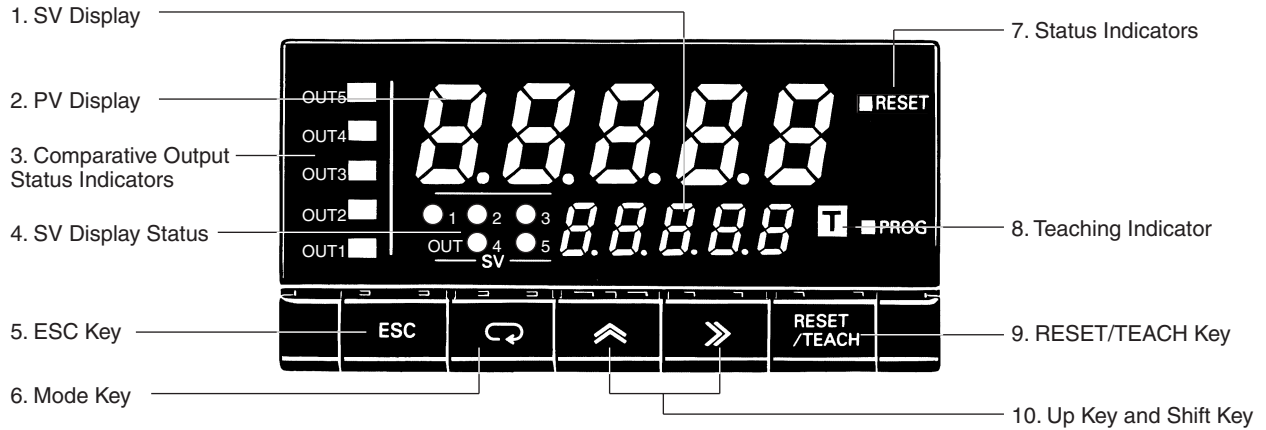
## ■ Input Mode and Counting Values



**Note:** 1. "B" must be larger than half the minimum signal width. If it is smaller, an error of  $\pm 1$  count may occur.  
2. Refer to the following for the meanings of the H and L characters in the above timing charts.

Signal	No-voltage input
H	Short-circuit
L	Open

# Nomenclature



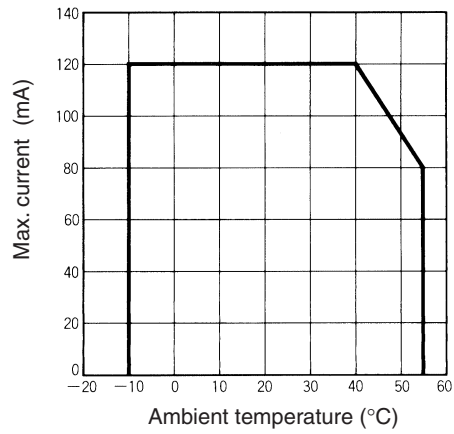
Name	Functions
<b>1. SV display</b>	Displays the set value or parameter. Available for Set Value LED Models only.
<b>2. PV display</b>	Displays the process value or parameter.
<b>3. Comparative output status indicators</b>	Displays the status of comparative output.
<b>4. SV display status</b>	Indicates which comparative set value is currently on the SV display.
<b>5. ESC Key</b>	Used to return to the RUN mode from the Setting, Protect or Maintenance mode.
<b>6. Mode Key</b>	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.
<b>7. Status indicator</b>	RESET: Lit when the RESET input is ON. PROG: Lit or flashes while parameters are being set.
<b>8. Teaching indicator</b>	Lit when the teaching function is enabled and flashes when the K3NC is in teaching operation.
<b>9. RESET/TEACH Key</b>	The counting value is reset by pressing this key. Teaching is available when the teaching function is enabled.
<b>10. Up Key and Shift Key</b>	The digit being set is scrolled by pressing the Shift Key. The set value increases by one whenever the Up Key is pressed.

Counters

# Engineering Data

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## Derating Curve for Sensor Power Supply

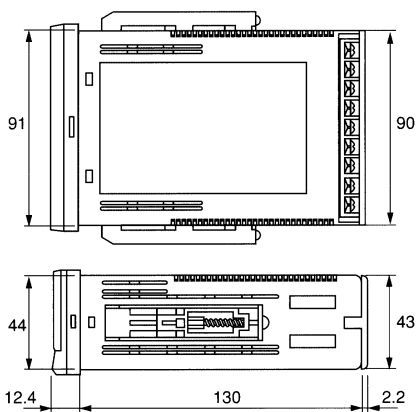
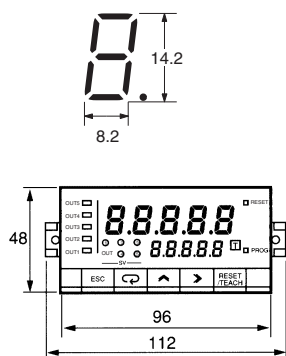


**Note:** The derating curve shown is for standard installation.  
The derating curve depends on the mounting direction.

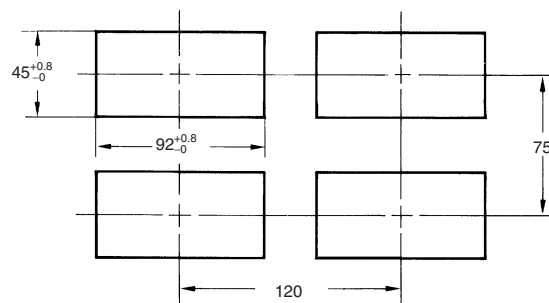
# Dimensions

Note: All units are in millimeters unless otherwise indicated.

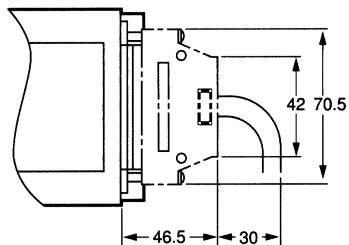
## PV Display



## Panel Cutouts



Note: The K3NC uses M3.5 terminals.  
A terminal cover is provided.



# 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 deposition 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 Counting Meters are mounted close together (either horizontally or vertically), the internal temperature of the Counting Meters may rise, leading to a reduction in the lifetime. In this case, take measures to cool the Counting 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.

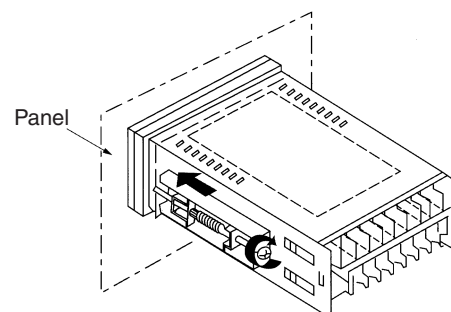
### Operation

When using models with comparative outputs, if an error occurs at the Counting 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 Counting 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 Counting Meter as horizontally as possible.

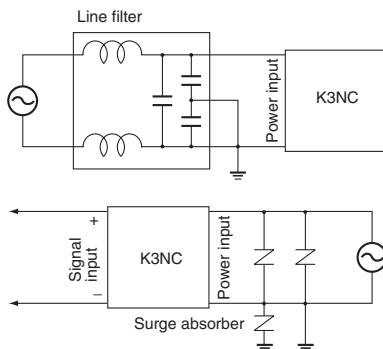
### Waterproof Specifications

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).

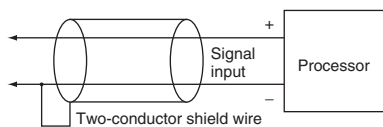


In order to prevent inductive noise, wire the lines connected to the terminal block separately from power lines carrying high voltages or large currents. Also, do not wire in parallel to, or in the same cable as power lines. There are other methods that are effective for reducing noise, such as running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

A	μA	mA	MA	V	kV	s	m <sup>2</sup>	cm <sup>2</sup>	rad
V	mV	mV	W	kW	S	S	L	kL	L/s
VA	kVA	var	kvar	Ω	L/min	L/h	kN	mN	Pa
°C	°F	K	Hz	rpm	kPa	mPa	N·m	kN·m	mN·m
m	mm	cm	μm	km	kg·m <sup>2</sup>	lx	cPs	°	rph
ℓ	kℓ	t	TON	ℓx	r/s	r/min	r/h	min <sup>-1</sup>	h <sup>-1</sup>
m <sup>2</sup>	cm <sup>3</sup>	mm <sup>3</sup>	kg	g	秒	時	分	度	h.min.s
mg	kg/m <sup>3</sup>	g/cm <sup>3</sup>	m <sup>2</sup> /kg	m/s <sup>2</sup>	min.s/10s	時.分.秒	分.秒/10秒	omron	
G	N	mmHG	mmH <sub>2</sub> O	kgf/cm <sup>2</sup>					
kgf/mm <sup>2</sup>	J	kJ	kgf-cm	gf-cm					
PS	hp	cal	kcal	kg/h					
t/h	kg/s	m <sup>3</sup> /min	m <sup>3</sup> /h	m <sup>3</sup> /s					
ℓ/s	ℓ/min	ℓ/h	m/min	mm/s					
m/s	%	dB	φ-mm	SCCM					
sec	ms	min	counts	×10					
×100	×1000	pH	ppm	pcs					
deg	cP	cSt	kΩ	MΩ					
kHz	rps								

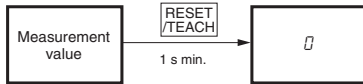
Counters

# Operating Procedures


## ■ Operation in RUN Mode

### Reset

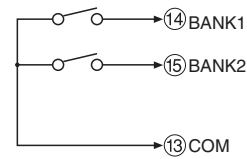
Press the RESET/TEACH Key  for 1 s min. to reset the counting value to 0. (Enabled when key protection is cleared.)



### 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




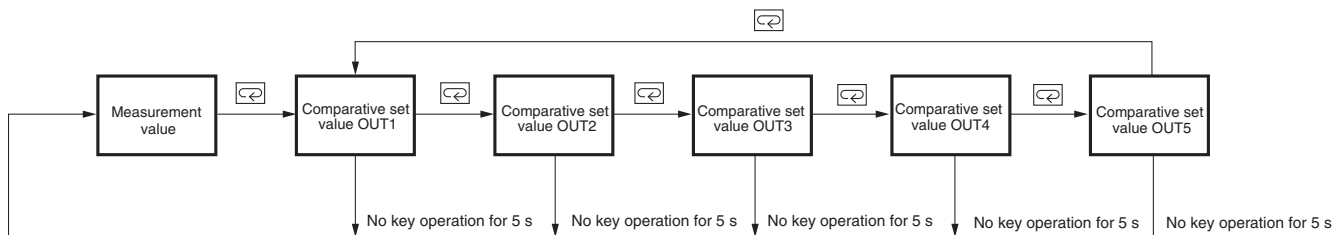
- Switch between the comparative set values and the prescaling values for banks 1 to 4 using the BANK 1 and BANK 2 signals.
- The relationship between the BANK 1 and BANK 2 signals and the bank numbers is shown in the following table.



Bank number	BANK 1	BANK 2	Comparative set value	Prescaling value
1	OFF	OFF	Sw 1.**	P5 1.**
2	ON	OFF	Sw 2.**	P5 2.**
3	OFF	ON	Sw 3.**	P5 3.**
4	ON	ON	Sw 4.**	P5 4.**

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

### Confirming and Setting Comparative Set Values

During measurement display, press the Mode Key  repeatedly to display the comparative set values in the order OUT1, OUT2, OUT3, OUT4, and OUT5. (With models that have an SV display, the comparative set values are displayed in the SV display.)

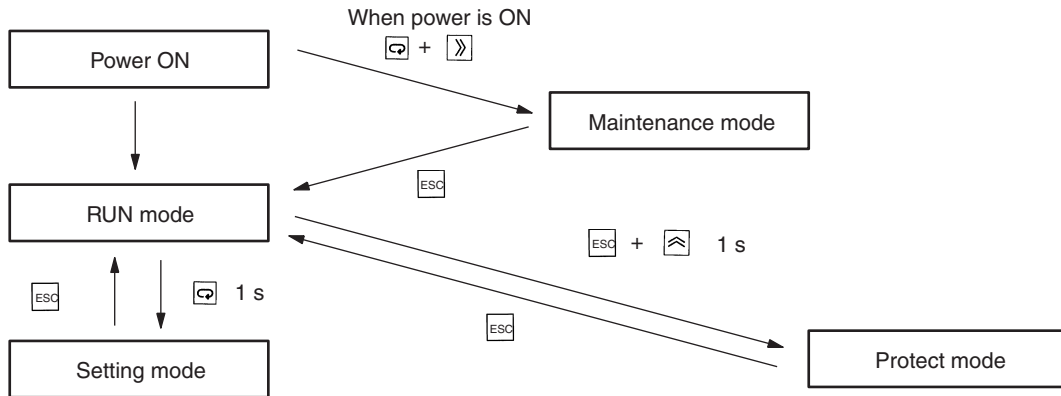


**Note:** When a comparative set value is displayed, it can be changed using the Up Key  and Shift Key  (if key protection is OFF).

## Setting Procedures

The K3NC 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 K3NC will vary depending on the Output Board installed. Refer to the *K3NC Operation Manual* for details.

- RUN Mode:** Remains in this mode under normal operation.  
The process value can be monitored.  
Using the front panel keys, the comparative set value can be changed and counting value reset can be performed.
- Setting Mode:** Used for making initial settings.  
Includes settings for four menus (Set value (*S<sub>u</sub>SEt*), prescaling (*P<sub>5</sub>CL*), setup (*SEtUP*), option (*ōP<sub>t</sub>*)) and the output test.
- Protect Mode:** Used for locking the front key operation or parameter changes.
- Maintenance Mode:** Used for initializing set values.



### *S<sub>u</sub>SEt* - Program set values

- S<sub>b</sub>RR<sub>H</sub>* Select bank no. of set values
- S<sub>u</sub>\*.01* Enter set value OUT1 of bank 1
- S<sub>u</sub>\*.02* Enter set value OUT2 of bank 1
- S<sub>u</sub>\*.03* Enter set value OUT3 of bank 1
- S<sub>u</sub>\*.04* Enter set value OUT4 of bank 1
- S<sub>u</sub>\*.05* Enter set value OUT5 of bank 1

- rESEt* Enable prohibition of counting value reset using the front panel keys
- SECr* Specify the menus to be protected against setting in the setting mode

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

### *P<sub>5</sub>CL* - Display prescaling

- P<sub>b</sub>RR<sub>H</sub>* Select bank no. of prescale values
- P<sub>5</sub>\*.R<sub>0</sub>* Set the mantissa (X) of the prescale value
- P<sub>5</sub>\*.R<sub>Y</sub>* Set the exponent (Y) of the prescale value
- dECP.\** Select decimal point

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

### *SEtUP* - Program input mode/input sensor/serial communications

- ĈōUn<sub>t</sub>* Specify input mode
- Ĉn* Select a sensor type
- U-nō* Enter the unit no. for the host
- bPS* Select the baud rate
- LEn* Select the word bit length
- SbĈt* Select the stop bits
- P<sub>r</sub>tY* Select the parity bits

### *ōP<sub>t</sub>* - Supplementary settings related to display or control

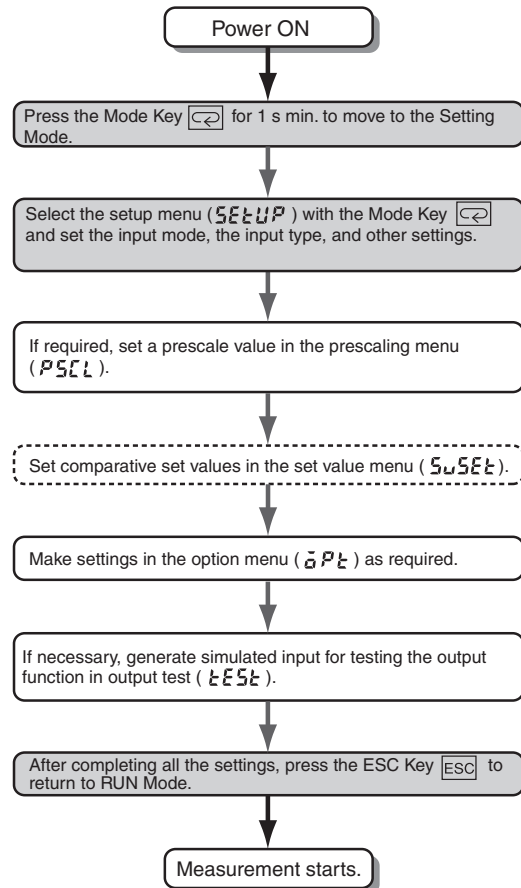
- nĒnō* Select power failure memory function
- Ĉōn<sub>P</sub>n* Set compensation value
- Ĉōn-P* Select conditions that allow compensation input
- ōUt* Select output mode
- LSEt.H* Enter the upper limit (H) of linear output range
- LSEt.L* Enter the lower limit (L) of linear output range
- r-L* Select the remote/local programming

### *tESEt* - Generating simulated input for testing the output function

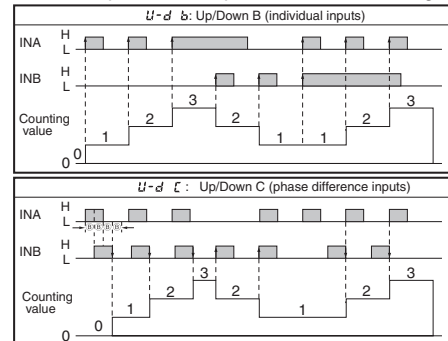
### *P<sub>r</sub>ōt* - Program lock-out configuration

- RLL* Enable all key protection
- S<sub>u</sub>SEt* Enable set value change prohibition

## Initial Settings



Relationship between Input Mode and Counting Value



Note 1: The meaning of H and L in the graphs:

Symbol	No-voltage input
H	Closed
L	Open

2: At least 1/2 of the first signal width is required for B. Otherwise a counting error of ±1 may occur.

Selecting the Sensor Type

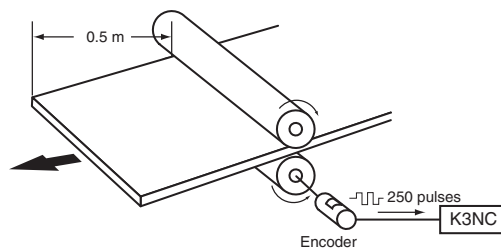
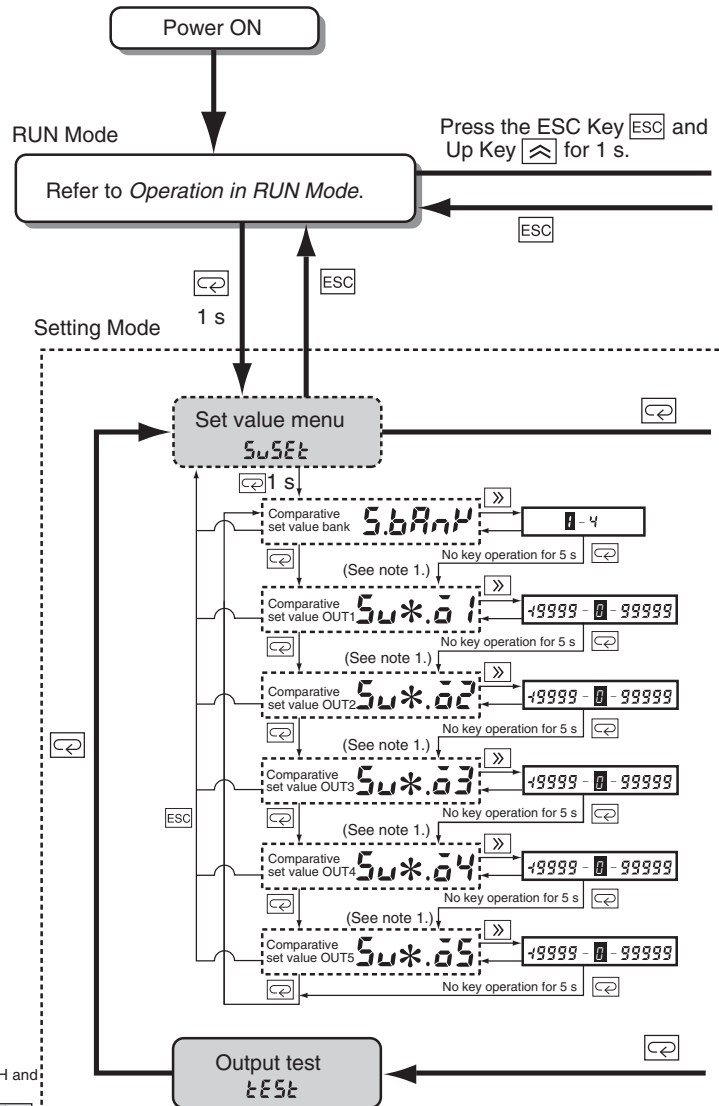
	NO: Voltage pulse H	NC: Voltage pulse L
No-contact or voltage pulse input	00	01
Contact input	10	11

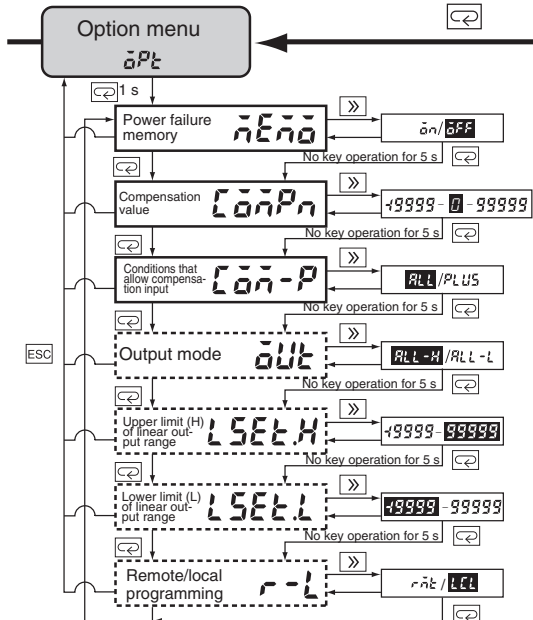
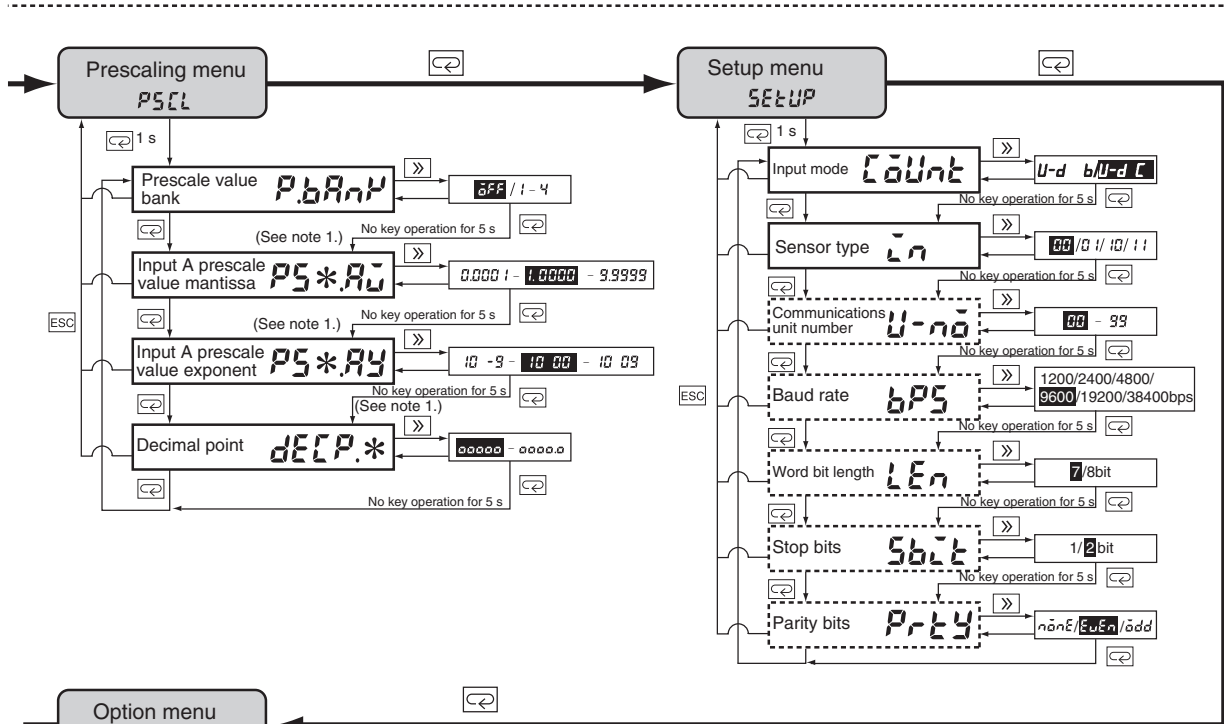
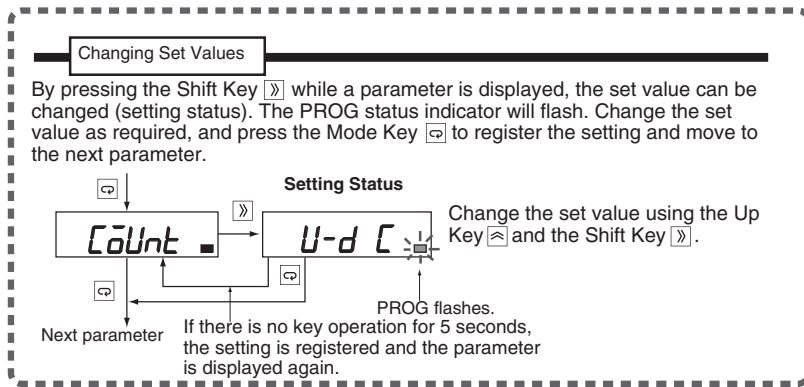
### Prescaling

The prescale function makes it possible to convert the counting value of the K3NC into an appropriate value. For example, the system shown in the illustration outputs 250 pulses when the object is advanced 0.5 m. To enable the K3NC to display 0000.0 (mm), obtain the advanced length of the object per pulse from the following formula.  $500 \text{ mm} (0.5 \text{ m}) / 250 = 2$

- The prescale value is set by the mantissa X multiplied by the exponent Y as follows:  
 Prescale value =  $2.0000 \times 10^0$   
 X = 2.0000, Y = 00
- Set the decimal point to the left of the rightmost digit.

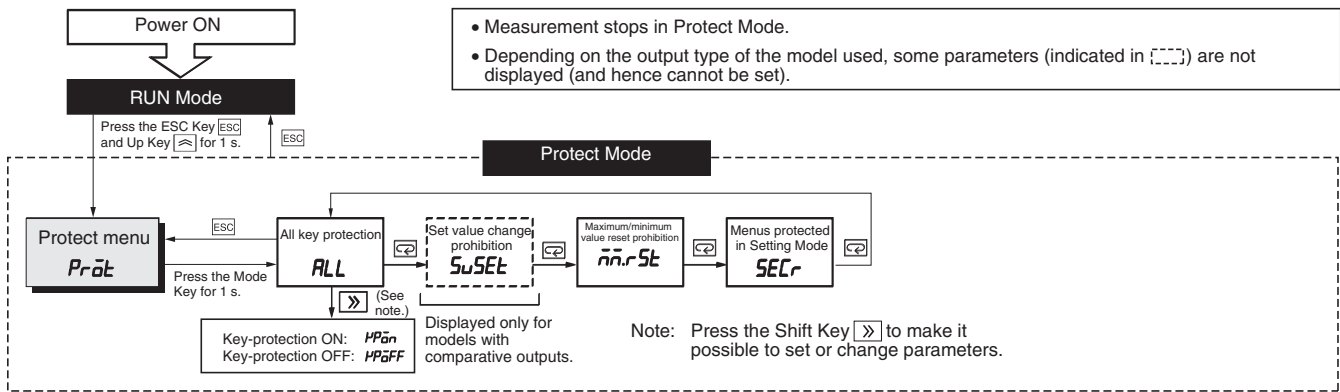
## Parameters





- In the Setting Mode, the measurement value is reset (i.e., to 0) and outputs turn OFF.
  - The measurement value will be reset if the Setting Mode is entered during measurement.
  - Depending on the output type of the model used, some parameters (indicated in [dashed box]) 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.
- Note 1:** 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.)																								
<b>Pröt</b> Press the Mode Key [M] to display the parameter.  Press the ESC Key [ESC] to return to the menu.	<b>ALL</b> Setting: [>] Next parameter: [M]	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: <b>HPön</b> Key protection OFF: <b>HPöFF</b>	Use the Up Key [↑] to change the setting. (HPön → HPöFF)  Use the Mode Key [M] to enable the setting and move to the next parameter.																								
	[---] <b>SuSEt</b> Setting: [>] Next parameter: [M]	Set value change prohibition: Changes to comparative set values are prohibited in RUN Mode. (Displayed only for models with comparative outputs.)																										
	<b>rESEt</b> Setting: [>] Next parameter: [M]	Reset prohibition: Resetting the counting value using the front panel keys is prohibited. (Resetting by external signals is not prohibited.)																										
	<b>SECr</b> Setting: [>] Next parameter: [M]	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 [M] to enable the setting and move to the next parameter.																								
		<table border="1"> <thead> <tr> <th>Setting menu</th> <th colspan="3">Setting</th> </tr> <tr> <td></td> <td>0</td> <td>1</td> <td>2</td> </tr> </thead> <tbody> <tr> <td>Set value menu</td> <td></td> <td></td> <td>×</td> </tr> <tr> <td>Scaling menu</td> <td></td> <td></td> <td>×</td> </tr> <tr> <td>Setup menu</td> <td></td> <td>×</td> <td>×</td> </tr> <tr> <td>Option menu</td> <td></td> <td></td> <td>×</td> </tr> </tbody> </table>	Setting menu	Setting				0	1	2	Set value menu			×	Scaling menu			×	Setup menu		×	×	Option menu			×		
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**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	
$\bar{n}1ERR$ (M1.ERR) $\bar{n}2ERR$ (M2.ERR) $\bar{n}3ERR$ (M3.ERR)	Memory error	OFF	OFF (all outputs in "H" status)	OFF	OFF	Reset the power. If the same error occurs, repair is necessary.
		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.
$ERR-\bar{o}$ (ERR-O) $CHG-\bar{o}$ (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.
$r\bar{n}L$ (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. N089-E1-02

In the interest of product improvement, specifications are subject to change without notice.