## omron



User's Manual

Cat. No. N102-E1-04

## PREFACE

This User's Manual provides you with information necessary
for use of the K3GN series of digital panel meters.
Please read this manual carefully to ensure correct and efficient use of the product.
Keep this manual handy for future reference.

## General Precautions

If contemplating using the product in the following environments or for the following equipment, first contact a sales representative of the company and then accept responsibility for incorporating into the design fail-safe operation, redundancy, and other appropriate measures for ensuring reliability and safety of the equipment and the overall system.
(1) Environments deviating from those specified in this manual
(2) Nuclear power control systems, traffic (rail car/automobile/aircraft) control systems, medical equipment, amusement equipment, and rescue and security equipment
(3) Other equipment that demands high reliability, including those related to the safety of life and property

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(2) Specifications in the manual may be subject to change without notice.
(3) Information in the manual has been carefully checked for accuracy. If finding any suspicious or erroneous descriptions in the manual, however, you are kindly requested to contact a branch office of the company. In such a case, please let us know the Cat. No. shown on the front cover of the manual.

## Other Informations

## 1 Warranty

(1) Warranty Period

The warranty period for an OMRON Product is one year from either the date of purchase or the date on which the OMRON Product is delivered to the specified location.
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If an OMRON Product is subject to a failure for which OMRON is responsible during the warranty period, either a replacement product will be provided or the defective product will be repaired free of charge at the place of purchase, This warranty, however, will not cover problems that occur as a result of any of the following.
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b) Problems caused by something other than the OMRON Product.
c) Modifications or repairs performed by a party other than OMRON.
d) Using the OMRON Product for other than its designed purpose.
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(2) For programmable OMRON Products, OMRON does not accept responsibility for any programming that is performed by a party than OMRON, or for any results arising from that programming.

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(1) When using OMRON Products in combination with other products, it is use's responsibility to confirm the suitability of the OMRON Products for the system, devices, and equipment that are being used. OMRON accepts no responsibility for the suitability of OMRON Products used in combination with other products.
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a) Outdoor applications, applications with potential for chemical contamination or electrical interference, or application under conditions or environments not described in catalogs.
b) Nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, or equipment regulated by government or Industrial standards.
c) Other systems, machines, and equipment that may have a serious influence on human life and property.
d) Equipment requiring a high level of reliability, such as gas, water, or electrical supply systems, and systems that operate 24 hours a day.
e) Other applications requiring a high level of safety, corresponding to points a) to d), above.
(3) When OMRON Products are used in an application that could pose significant risk to human life or property, the overall system must be designed so that the required safety can be ensured by providing notice of the danger and incorporating redundancy into the design. Make sure that OMRON Products are appropriately wired and mounted to serve their intended purpose in the overall system.
(4) Application examples provided in catalogs are for reference only. Confirm functionality and safety before actually using the devices and equipment.
(5) To prevent unexpected problems from arising due to the OMRON Product being used incorrectly by the customer or any other party, make sure that you understand and carefully observe all of the relevant prohibitions and precautions.

## 4 Changes to Specifications

Specifications and accessories to the products in catalogs may be changed as needed to improve the products or for any other reason. Check with your OMRON representative for the actual specifications for OMRON Products at the time of purchase.

## 5 Applicability

The above information assumes that business and product application will be conducted in Japan. For business and application outside of Japan, consult with your OMRON representative.

## Signal Words and Safety Notices

## - Signal Words

In this manual, safety notices are divided into WARNING and CAUTION according to the hazard level.
As both of WARNING and CAUTION notices contain important information for ensuring safety, be sure to observe them.

## $\triangle$ CAUTION <br> A signal word indicating a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage.

## Symbols

| Indicates a CAUTION or WARNING with the specific contents |
| :--- | :--- |
| indicated in the triangle and described in text. The example at the left is |
| for a general precaution. |

## ACAUTION

| Do not touch the terminals while power is being supplied. <br> Doing so may possibly result in electric shock |
| :--- |
| Do not allow pieces of metal, wire clippings, or fine metallic shavings or <br> filings to enter the product. <br> Ding so may occasionally result in minor or moderate injury or in <br> property damage due to electric shock, fire, or malfunction caused by <br> internal short circulation.. <br> Do not use the product in locations where flammable or explosive gases <br> are present. Doing so may occasionally result in minor or moderate <br> explosion, causing minor or moderate injury, or property damage. <br> Do not use the equipment for measurements within Measurement <br> Categories II III or IV (according to IEC61010-1). Doing so may <br> occasionally cause unexpected operation, resulting in minor or moderate <br> injury, or damage to the equipment. Use the equipment for measurements <br> only within the Measurement Category for which the product is designed. <br> Failure to perform correct setting of the product according to the <br> application may occasionally cause unexpected operation, resulting in <br> minor or moderate injury, or damage to the equipment. <br> Ensure safety in the event of product failure by taking safety measures, <br> such as installing a separate monitoring system. <br> Ensure safety in the event of product failure by taking safety measures, <br> such as installing a separate monitoring system. <br> Product failure may occasionally prevent operation of comparative <br> outputs, resulting in damage to the connected facilities and equipment. <br> Tighten the screws on the terminal block and the connector locking <br> screws securely using a tightening torque within the following ranges. <br> Loose screws may occasionally cause fire, resulting in minor or moderate <br> injury, or damage to the equipment. <br> Terminal block screws : 0.43 to 0.58 N.m. <br> Connector locking screws : <br> Do not attempt to disassemble, repair, or modify the product. Doing so <br> may occasionally result in minor or moderate injury due to electric shock. |

## Precautions for Safe Use

## - Precautions for the environment.

(1) Do not use the product in the following locations.

- Locations subject to direct radiant heat from heating equipment
- Locations here the product may come into contact with water or oil
- Locations subject to direct sunlight
- Locations where dust or corrosive gases (in particular, sulfuric or ammonia gas) are present
- Locations subject to extreme temperature changes
- Locations where icing or condensation may occur
- Locations subject to excessive shocks or vibration
(2) Do not use the product in locations subject to temperatures or humidity levels outside the specified ranges or in locations prone to condensation. If the product is installed in a panel, ensure that the temperature around the product (not the temperature around the panel) does not go outside the specified range. Parts life is dependent on temperatures. A part life shortens when the temperature rises, and it lengthens when the temperature falls. Parts life can be lengthened by lowering the temperature inside the product.
(3) In order to prevent inductive noise, wire the lines connected to the product separately from power lines carrying high voltages or currents. Do not wire in parallel with or in the same cable as power lines. Other measures for reducing noise include running lines along separate ducts and using shield lines.
(4) Do not install the product near devices generating strong high-frequency waves or surges. When using a noise filter, check the voltage and current and install it as close to the product as possible. If several products are mounted side-by-side or arranged in a vertical line, the heat dissipation will cause the internal temperature of the product to rise, shortening the service life. If necessary, cool the products using a fan or other cooling method.
(5) Take care when cleaning the product, because the exterior of the product contains organic solvent (thinner, benzine, etc.), strong alkaline material and strong acid material.
(6) Avoid storing in high humidity or in a corrosive gas environment (including during transportation)


## - Precautions for Safe Use.

(1) Use and store within the proper temperature and humidity described in the specifications.
(2) Provide sufficient space around the product for heat dissipation.
(3) When using the product stored unused over a year after purchasing, the product features may not be utilized sufficiently.
(4) Avoid storing outdoors and in a place that receives direct sunlight (including during transportation).
(5) The service life of the output relays depends on the switching capacity and switching conditions. Consider the actual application conditions and use the product within the rated load and electrical service life. Using the product beyond its service life may result in contact welding or burning.
(6) Be sure to confirm the name and polarity for each terminal before wiring the terminal block and connectors. Faulty wiring causes destruction or burnout of internal parts.
(7) Use the product within the noted supply voltage and rated load.
(8) Do not connect anything to unused terminals.
(9) Output turns OFF when the mode is changed or settings are initialized. Take this into consideration when setting up the control system.
(10) Install an external switch or circuit breaker and label them clearly so that the operator can quickly turn OFF the power.
(11) Ensure that the rated voltage is achieved no longer than 2 s after turning the power ON. When applying a voltage gradually, power supply may not be reset or output functions indeterminately.
(12) Mount to a panel between 1 and 5 mm thick.
(13) Use the specified size of crimp terminals (M3, width : 5.8 mm max.) for wiring. To connect bare wires, use AWG 28 to AWG 16 to wire the power supply terminals and AWG 22 to AWG 14 for other terminals. (Length of exposed wire : 6 to 8 mm )
(14) Allow the product to operate without load for at least 15 minutes after the power is turned ON.

## Precautions for Correct Use

(1) Install the product horizontally. Display error has the risk of becoming larger than the standard because heat cannot be radiated.
(2) When using a noise filter on the power supply, check that the filter is suitable for the supply voltage and current ratings, and then attach the noise filter as close as possible to the K3GN.

## <Examples of noise prevention schemes>


(3) If placed near the product, radios, TVs, or other wireless devices may suffer reception interference..

## Alphabetic Characters for Setting Data

This manual uses the following alphabetic characters for setting data.

| 8 | $\square$ | [ | d | $E$ | $F$ | $\square$ | H | - | - | - | $!$ | $\therefore$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| A | B | C | D | E | F | G | H | 1 | J | K | L | M |


| $\bigcirc$ | $\square$ | $p$ | 9 | - | 5 | $t$ | U | $山$ | $\because$ | - | $\unlhd$ | $三$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| N | 0 | P | Q | R | S | T | U | V | W | X | Y | Z |

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## CHAPTER 1 INTRODUCTION

This chapter provides an overview of the product.
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### 1.1 Main Features

The K3GN is a digital panel meter that is capable of converting an input signal into a digital value and displaying it on the main indicator.
The main futures of the product include the following.

Measurement This feature measures an input signal and displays it as a digital value.
An analog value (voltage/current), a rotational speed (pulses), or digital data received via communication function can be selected as an input signal.


Scaling This feature converts an input signal into a desired physical value
The figure on the right shows a scaling example where input signals from a pressure sensor ranging from 4 to 20 mA are converted into values ranging from 0 to $100(\mathrm{kPa})$. Scaling will enable you to handle physical quantities easily
 and intuitively.

Comparative Output

This feature compares a scaled (process) value with a programmed OUT set value and produces output according to the comparison result.
This is useful in monitoring various systems for malfunction or determining whether products are within acceptance limits.


Three types of comparative outputs are available: those produced at the OUT upper-limit value, the OUT lower-limit value, and both the OUT values.


Process This feature enables a process value Value Hold to be held while the external event input stays ON.
The outputs are also retained.


Forced-zero This feature shifts a process value to zero, and can be used to evaluate and display the deviation of a process value from a reference value.
The forced-zero function can be activated by using the $\boldsymbol{N}_{\text {/zen }}$ key on the front panel, via the event input terminal, or communications.


Display Color Change

This feature allows programming of the display color. In the example shown below, the display color is programmed so that it changes from green to red when a comparative output turns ON. The display color can also be programmed so that it changes red to green or is fixed to red or green.


Communi-cation
This feature allows the host PC to read process values from the product or read/write various parameter settings from/to the host PC.
The host PC provides logging of measured data and remote control to the product.


### 1.2 Model Number Legend

K3GN- $\underset{1}{\square} \frac{\square-\square-}{2} \frac{\square}{3} \frac{24 \text { VDC }}{4}$

1. Input Type

ND: DC voltage/current, NPN
PD: DC voltage/current, PNP
2. Output Type

C: $\quad 2$ relay contact outputs (SPST-NO)
C-FLK: 2 relay contact outputs (SPST-NO) and RS-485
C-L1: 2 relay contact outputs (SPST-NO) and DC current ( 0 to $20 \mathrm{~mA}, 4$ to 20 mA )
C-L2: 2 relay contact outputs (SPST-NO) and DC voltage ( 0 to $5 \mathrm{~V}, 1$ to $5 \mathrm{~V}, 0$ to 10 V )
T1: $\quad 3$ transistor outputs (NPN open collector)
T1-FLK: 3 transistor outputs (NPN open collector) and RS-485
T1-L1: 3 transistor outputs (NPN open collector) and DC current ( 0 to $20 \mathrm{~mA}, 4$ to 20 mA )
T1-L2: 3 transistor outputs (NPN open collector) and DC voltage ( 0 to $5 \mathrm{~V}, 1$ to $5 \mathrm{~V}, 0$ to 10 V )
T2: $\quad 3$ transistor outputs (PNP open collector)
T2-FLK: 3 transistor outputs (PNP open collector) and RS-485
3. Option

None: None
-400: Normally energized relays
4. Supply Voltage

24 VDC: 24 VDC

- List of Models

| Supply voltage | Input type | Output type |  | Model |
| :---: | :---: | :---: | :---: | :---: |
|  |  | Judgement output | Data transmission output |  |
| 24 VDC | DC voltage, DC current, or NPN input | 2 relay contact outputs (SPST-NO) | None | K3GN-NDC 24 VDC |
|  |  |  | RS-485 | K3GN-NDC-FLK 24 VDC |
|  |  |  | $\begin{aligned} & \text { DC current ( } 0 \text { to } 20 \mathrm{~mA}, \\ & 4 \text { to } 20 \mathrm{~mA} \text { ) } \\ & \hline \end{aligned}$ | K3GN-NDC-L1 24 VDC |
|  |  |  | DC voltage ( 0 to 5 V , <br> 1 to $5 \mathrm{~V}, 0$ to 10 V ) | K3GN-NDC-L2 24 VDC |
|  |  | 2 relay contact outputs (SPST-NO) <br> Normally energized relays (See note.) | None | K3GN-NDC-400 24 VDC |
|  |  |  | RS-485 | K3GN-NDC-FLK-400 24 VDC |
|  |  |  | $\begin{aligned} & \text { DC current ( } 0 \text { to } 20 \mathrm{~mA}, \\ & 4 \text { to } 20 \mathrm{~mA} \text { ) } \\ & \hline \end{aligned}$ | K3GN-NDC-L1-400 24 VDC |
|  |  |  | DC voltage ( 0 to 5 V , <br> 1 to $5 \mathrm{~V}, 0$ to 10 V ) | K3GN-NDC-L2-400 24 VDC |
|  |  | 3 transistor outputs (NPN open collector) | None | K3GN-NDT1 24 VDC |
|  |  |  | RS-485 | K3GN-NDT1-FLK 24 VDC |
|  |  |  | $\begin{aligned} & \text { DC current ( } 0 \text { to } 20 \mathrm{~mA}, \\ & 4 \text { to } 20 \mathrm{~mA} \text { ) } \\ & \hline \end{aligned}$ | K3GN-NDT1-L1 24 VDC |
|  |  |  | $\begin{aligned} & \hline \text { DC voltage }(0 \text { to } 5 \mathrm{~V} \text {, } \\ & 1 \text { to } 5 \mathrm{~V}, 0 \text { to } 10 \mathrm{~V}) \\ & \hline \end{aligned}$ | K3GN-NDT1-L2 24 VDC |
|  | DC voltage, DC current, or PNP input | 2 relay contact outputs (SPST-NO) | None | K3GN-PDC 24 VDC |
|  |  |  | RS-485 | K3GN-PDC-FLK 24 VDC |
|  |  | 3 transistor outputs (PNP open collector) | None | K3GN-PDT2 24 VDC |
|  |  |  | RS-485 | K3GN-PDT2-FLK 24 VDC |

[^0]
### 1.3 I/O Circuits

## Input Circuit Diagrams

## - Analog Input



Voltage input

## - Event Input/PuIse Input




Current input


## Output Circuit Diagrams

- Contact Output



## - Transistor Output



## - Linear Output



Linear voltage output


Linear current output

## - Models with Normally Energized Relays K3GN-NDC- $\square$-400 24 VDC

- The drive operation for the output relay is reversed in these models.
- Relay contacts can be made open (i.e., OFF) when comparative set values are being judged. This is effective when constructing systems that take failsafe measures into consideration.


## List of Models

| Models with Normally Energized Relays |  |
| :--- | :--- |
| K3GN-NDC-400 $\quad 24$ VDC |  |
| K3GN-NDC-FLK-400 $\quad 24$ VDC |  |
| K3GN-NDC-L1-400 $\quad 24$ VDC |  |
| K3GN-NDC-L2-400 $\quad 24$ VDC |  |

Relation between Output Type and Relay Output Operation


## - Internal Block Diagram



### 1.4 Parts Name and Function



| Name |  | Function |
| :---: | :---: | :---: |
| Main indicator |  | Displays a process value, parameter code, or set value. |
| Operation indicator sections | OUT1 (Comparative output 1) | Is on when comparative output 1 is ON , and off when comparative output 1 is OFF. |
|  | OUT2 (Comparative output 2) | Is on when comparative output 2 is ON , and off when comparative output 2 is OFF. |
|  | SV (Set value) | Stays on while a set value is displayed or being changed, and off at all other times. |
|  | $\begin{gathered} \mathrm{T} \\ \text { (Teaching) } \end{gathered}$ | Stays on while a set value that can be taught is displayed, and blinks during teaching. <br> At the calibration level, stays on while a calibration value is displayed, and blinks while the calibration value is read. Stays off at all other times. |
|  | ZERO (Forced-zero) | Is on when zero-shifting by forced-zero operation is active. Turns off when forced-zero operation is canceled. |
|  | HOLD (Process value hold) | Stays on while the process value is held, and off at all other times. |
|  | CMW <br> (Communication writing) | Is on while data reading and writing via communication interface are both enabled. <br> Is off while data writing via communication interface is disabled. Data reading is enabled even if this indicator is off provided that the product has the communication function. <br> If the product has no communication function, this indicator is always off. |
| Level indicator |  | Indicates the current level. |
| Level key |  | Use to change one level to another. |
| Mode key |  | Use to select a parameter. |
| Shift key |  | Use to check the set value of a parameter or enter the change state when the parameter is displayed. <br> Use to select the digit that can be changed while shifting the set value. |
| Up/Zero key |  | Use to change the set value in the change state. Use to execute or cancel the forced-zero operation when a process value is displayed. |

## CHAPTER

## 2 <br> INSTALLATION AND CONNECTION

## This chapter describes how to install and connect the product before turning the power on.

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Terminal Arrangement/Terminal Connection

### 2.1 Installation

## Dimensions

## Size of characters displayed on the main indicator


$\downarrow 3.6 \mathrm{~mm}$


## Panel Cutout Dimensions

Separate mounting (units in mm)


Gang mounting (units in mm)


The products cannot be made waterproof when gang-mounted.

Fit the product into a rectangular panel cutout, put the adapter on the product from the rear end all the way to the panel, and tighten the screws of the adapter to secure the product.
When gang-mounting the products, make sure the ambient temperature of the product falls within the specified limits.
Mount to a panel that is 1 to 5 mm thick. Mounting the product to a thinner panel will reduce the resistance to shock and vibration and may result in a malfunction of the product.

## ■ Installation Procedure

(1) Fit the product into a rectangular panel cutout.
(2) If you want to make the product waterproof, use the watertight packing as shown in the figure below.
Note that the watertight packing is direction-sensitive.

(3) Put the adapter on the product from the rear end all the way to the panel.

(4) Tighten the two screws of the adapter in alternate order to a tightening torque of 0.29 to $0.39 \mathrm{~N} \cdot \mathrm{~m}$.


### 2.2 I/O Terminal Connections

Terminal Arrangement


| Terminal No. | Name | Description | Applicable model |
| :---: | :---: | :---: | :---: |
| (1)-(2) | Operation power supply | Operation power supply terminals | All models |
| (3)-(2) | Event input or pulse contact/ input | Depending on parameter setting: <br> - Hold the process value. <br> - Serve as input terminals for the forced-zero or forced-zero cancel operation. <br> - Serve as pulse input terminals when the input type is set to "pulse". | K3GN-ND_-_ 24VDC |
| (3)-(1) |  |  | K3GN-PD_-_ 24VDC |
| (4) (6)-(5) | Analog input | Voltage/current analog terminals | All models |
| (7)-8) | Communication | RS-485 communication terminals | K3GN-_D_-FLK 24VDC |
|  | Linear current output | Linear current output | K3GN- -L1 24VDC |
|  | Linear voltage output | Linear voltage output | K3GN- -L2 24VDC |
| (9)(1)-(12) | Comparative output | Provide comparative output. | K3GN-DC- 24VDC |
| (9) (1)(1)-(1) |  | Provide PASS output in addition to OUT1/OUT2 (comparative output $1 / 2$ ) when the product is of transistor output type. | $\begin{aligned} & \text { K3GN-NDT1-_ 24VDC } \\ & \text { K3GN-PDT2_-_ 24VDC } \end{aligned}$ |

## Terminal Connection

Wire the terminals using M3 crimp contacts of the type shown below.


## - Power Supply



```
(1)-(2)-(3) (4)-5-6.-6
Connect the following power supply to terminals (1) and (2).
Supply voltage: 24VDC
Operating voltage range: 85 to \(110 \%\) of the rated voltage
Power consumption: 2.5 W (at max. load)
Note that, when turned on, the product will require the operation power supply to have more power supply capacity than rated.
If multiple products are used, the power supply must be able to afford to supply power to the products.
```


## - Event Input or PuIse Input



NPN input
(-)-(9)-(1)-(1)
(0)-(2)-(3)(4)-(9)-6

PNP input

Apply the event or pulse signal to terminals (3) and (2) if the product is of NPN input type, or terminals (3) and (1) if the product is of PNP input type.


The input equipment connected to these terminals must meet the following conditions.

| Transistor output | ON residual current: | 2.5 V max. |
| :--- | :--- | :--- |
|  | OFF leakage current: <br> Current leakage with <br> transistor turned ON: | 0.1 mA max. |
| Relay output | Load current: | 15 mA min. |
|  |  | 5 mA max. |

## - Analog Input



The following table shows the analog ranges and applicable analog input terminals.

| Analog range | Positive side | Negative side |
| :---: | :---: | :---: |
| 4 to $20 \mathrm{~mA} / 0$ to 20 mA | 6 | (5) |
| 1 to $5 \mathrm{~V} / 0$ to 5 V | (4) | (5) |
| $\pm 5 \mathrm{~V}$ | $(4)$ | (5) |
| $\pm 10 \mathrm{~V}$ | (4) | (5) |

The maximum absolute ratings for analog input are as follows.
Be careful that these ratings must not be exceeded even for a moment.

$$
\begin{array}{ll}
4 \text { to } 20 \mathrm{~mA} / 0 \text { to } 20 \mathrm{mA:} & \pm 30 \mathrm{~mA} \\
1 \text { to } 5 \mathrm{~V} / 0 \text { to } 5 \mathrm{~V}: & \pm 13.5 \mathrm{~V} \\
\pm 5 \mathrm{~V}: & \pm 13.5 \mathrm{~V} \\
\pm 10 \mathrm{~V}: & \pm 26 \mathrm{~V}
\end{array}
$$



Connect the communication cable to terminals (7) and (8) if using the communication function.
RS-485 connections can be one-to-one or one-to N. A maximum of 32 units (including the host computer) can be connected in one-to-N systems.
The total length of the communication cables should be up to 500 m .
Use shielded twisted-pair cables (AWG 28 or thicker) as the communication cables.
Be sure to turn ON the terminator switches only in the devices at each end of the transmission line.


Match the communications format of the K3GN and the host computer. If a one-to-N system is being used, be sure that the communications formats of all devices in the system (except individual unit numbers) are the same.
Chapter 7 explains how to set the K3GN communication format. Refer to your computer's manual for details on changing its communications settings.

## - Comparative Output



Transistor output

(1)-(2)-(3) (4)-5-6)

Relay output
Comparative output is produced at terminals (9) to (12).
If the product is of relay output type, terminal (10) is not used.
Loads connected to the product and the power supply for the loads must be rated as follows.


Relay output type
Transistor output type
The $(\stackrel{\perp}{\top})$ connection causes the current to flow in the direction opposite to indicated by the arrows.

## - Linear Output

 (1)-(2)-(3)(4)-(0)-6

Linear currents and voltages are output between terminals 7 to 8 . Contact a load within the specified range.

## CHAPTER

# 3 <br> <br> APPLICATION <br> <br> APPLICATION EXAMPLES 

 EXAMPLES}

## This chapter shows some examples of product applications.

3.1 Monitoring the Remaining Quantity of Soup ..... 16
3.2 Monitoring the Load Current of a Motor ..... 18
3.3 Monitoring the Quantity of Dust ${ }^{*}$ ..... 20
3.4 Monitoring the Internal Pressure of a Tank ..... 22
3.5 Monitoring the Rotational Speed of a Motor ..... 24
3.6 Using the Product as a Digital Indicator for PLC ..... 26

### 3.1 Monitoring the Remaining Quantity of Soup

## Application



- The remaining quantity of soup is monitored.
- The soup level is measured with an ultrasonic displacement sensor.
- The K3GN indicates the remaining quantity of soup on a percentage basis.
- Four measurements are averaged for stable indication.
- Comparative output 1 is produced as a lower-limit action signal. When the remaining quantity of soup reaches $20 \%$ (lower limit), the "Replenish" indicator turns on.


## Wiring



Parameter Setting Set the parameters of the K3GN as follows.

| Level | Parameter | Set value |
| :---: | :---: | :---: |
| Initial setting | $\therefore \mathrm{n}-\underline{1}$ | Finfor |
|  | -Ritic | $4-30$ |
|  | $\therefore \mathrm{ImP} 1$ | 4.010 |
|  | d5P. 1 | 1615 |
|  | InP? | 20.90 |
|  | d5P. ${ }^{\text {d }}$ | $\square$ |
|  | dip | 00000 |
|  | Gut lit | 10 |
| Advanced-function setting | Hum | 4 |
| Operation setting | Gutit | $2 \square$ |

Set the analog output characteristic mode of the sensor to "decrease". For details on sensor setting, refer to the Operation Manual for the sensor.

## Operation



- Comparative output 1 turns on when the remaining quantity of soup decreases to 20\%.


### 3.2 Monitoring the Load Current of a Motor

## Application



- The load current of a motor is monitored.
- A 10:1 current transformer is used to detect the motor current.
- The current transformer K3FK-CE-1A-R is used to adapt the input current to a K3GN analog range.
- The K3GN indicates the load current in units of amperage to two decimal places.
- Comparative output 1 is used to generate an upper-limit action signal and comparative output 2 is used to generate a lower-limit action signal.
- The OUT upper-limit value is set to 6.00 A and the OUT lower-limit value is set to 3.00 A .


## Wiring



Parameter Setting
Set the parameters of the K3GN as follows.

| Level | Parameter | Set value |
| :---: | :---: | :---: |
| Initial setting | -n-t | Rnfilt |
|  | -Rincter | 4-20 |
|  | InP. 1 | 4.90 |
|  | d5P. 1 | $\square$ |
|  | $\operatorname{Ln} 9$ | 30.00 |
|  | d5P. ${ }^{\text {a }}$ | 16010 |
|  | dip | 000.00 |
|  | Gitt it | $\mathrm{H}^{-1}$ |
|  | Gutelt | 10 |
| Operation setting | gide | 5.010 |
|  | Guta | 3.80 |

For details on the parameters, refer to CHAPTER 5 OPERATION.

## Operation



- Turning the power on causes inrush current to flow through the motor. But the K3GN does not produce superfluous output in response to the inrush current because it does not perform measuring operation for approx. one second after turn-on.
- Comparative output 1 turns on when the current flowing through the motor reaches 6.00A.
Comparative output 2 turns on when the current flowing through the motor decreases to 3.00 A .


### 3.3 Monitoring the Quantity of Dust

## Application



- The quantity of dust exhausted from a dust collector into the air is monitored.
- The analog photoelectric sensor E3SA is used to detect the quantity of dust.
- A dust quantity of 0 to 1500 ppm corresponds to an E3SA output of 4 to 20 mA .
- The K3GN indicates the quantity of dust in units of ppm.
- Comparative output 1 is used to generate an upper-limit action signal that reduces the crusher power.
- Comparative output 2 is used to generate another upper-limit action signal that stops the crusher.
- The OUT 1 upper-limit value is 800 ppm and the OUT2 upper-limit value is 1000 ppm.
- Eight measurements are averaged for stable indication.
- The hysteresis is set to 10 for stable output in the vicinity of the OUT set values.


## Wiring



Parameter Setting
Set the parameters of the K3GN as follows.

| Level | Parameter | Set value |
| :---: | :---: | :---: |
| Initial setting | -n-b | Pintio |
|  | -RTEE | 4-20 |
|  | EnP. 1 | 4.96 |
|  | d5P. 1 | $\square$ |
|  | $\therefore \mathrm{AP}$ ? | 30.00 |
|  | 15P? | 15010 |
|  | dif | 00000 |
|  | Gut d.t | $\mathrm{HL}^{-1}$ |
|  | Gutz! | $\mathrm{H}^{-1}$ |
| Advanced-function setting | Fuí) | g |
|  | H45: | 19 |
|  | Hys? | 1 |
| Operation setting | Gut | 808 |
|  | Gut? | 1ater |

For details on the parameters, refer to CHAPTER 5 OPERATION.

## Operation



- Comparative output 1 turns on when the dust quantity reaches 800 ppm .
- When comparative output 1 turns on, the crusher power is reduced until the dust quantity decreases to within the specified range.
- Comparative output 2 turns on when an accident causes a sudden increase in dust quantity to 1000 ppm .
- When comparative output 2 turns on, it provides an emergency stop to the crusher.


### 3.4 Monitoring the Internal Pressure of a Tank

## Application



- The internal pressure of a tank is monitored.
- The pressure sensor E8AA-M10 is used to detect the pressure in the tank.
- A pressure of 0 to 980 kPa corresponds to an E8AA-M10 output of 4 to 20 mA .
- The K3GN indicates the pressure in units of kPa to one decimal place.
- The communication function of the K3GN enables remote monitoring of the pressure on the host PC.
- The status of comparative outputs is read by the host PC at a remote site.
- Comparative output 1 turns on when the pressure reaches 550.0 kPa , which generates an upper-limit action signal.
- Comparative output 2 turns on when the pressure decreases to 100.0 kPa , which generates a lower-limit action signal.


## Wiring



Parameter Setting Set the parameters of the K3GN as follows.

| Level | Parameter | Set value |
| :---: | :---: | :---: |
| Initial setting | -nt | Priple |
|  | -Rmbe | 4-20 |
|  | EnP. 1 | 4.90 |
|  | d5P. 1 | $\square$ |
|  | $\underline{\square 19}$ | 30.010 |
|  | dSP? | 9800 |
|  | dP | 00000 |
|  | Gut l. | $\mathrm{H}^{-1}$ |
|  | Gutelt | 10 |
| Communication setting | Li-na | 1 |
|  | 695 | 9.5 |
|  | LEn | 7 |
|  | Stit | 2 |
|  | Prey | EuEn |
| Operation setting | Gutit | 550.6 |
|  | Gut? | \%10.0 |

Set the communication parameters according to the host PC setting.
For details on the parameters, refer to CHAPTER 5 OPERATION.

## Operation



- The host PC reads the current value and the status from the K3GN at regular intervals.

Of command and response frames, only text fields are shown in the above figure.
For details on communications, refer to CHAPTER 7 COMMUNICATIONS.

### 3.5 Monitoring the Rotational Speed of a Motor

## Application



- In addition to the load current monitored in the application shown in Section 3.2, the rotational speed of a motor is also monitored with an additional K3GN.
- A four-toothed wheel is installed on the motor shaft to allow detection of its rotational speed.
- The proximity sensor E2E-X1R5E1 converts motor shaft rotations to on/off pulses.
- The K3GN indicates the rotational speed in terms of rpm.
- A startup compensation timer is used to prevent superfluous output from being produced until the motor reaches a designated speed (for five seconds after startup).
- Comparative output 1 is used to generate an upper-limit action signal.

Comparative output 2 is used to generate a lower-limit action signal.

- The OUT1 upper-limit value is set to 3500 rpm and the OUT2 lower-limit value to 1000 rpm .
- The auto-zero function is used to enhance the lower-limit response. (A speed of 150 rpm or less is automatically shifted to zero).


## Wiring



Parameter Setting Set the parameters of the K3GN as follows.

| Level | Parameter | Set value |
| :---: | :---: | :---: |
| Initial setting | $\therefore \underline{\square}$ | Put 58 |
|  | P-F,E | 5, |
|  | In | dera |
|  | 159 | 150101 |
|  | dif | 00000 |
|  | Gitt i.t | $\mathrm{H}_{2}$ |
|  | Gutat | ! |
| Advanced-function setting | PUt5.E | $\underline{1} 1$ |
|  | S-Eが | 5.9 |
| Operation setting | Gutit | 3504 |
|  | Gute | 160] |

For details on the parameters, refer to CHAPTER 5 OPERATION.

## Operation



- The startup compensation timer works for five seconds after the motor power is turned on. This prevents superfluous output from being produced by the K3GN.
- Comparative output 1 turns on when the motor speed reaches 3500 rpm . Comparative output 2 turns on when the motor speed decreases to 1000 rpm .


### 3.6 Using the Product as a Digital Indicator for PLC

## Application




- The K3GN is used as a digital indicator for PLC data.
- The display color of the K3GN main indicator is set to "always green".
- The process value is displayed without scaling.


## Wiring



## Parameter Setting

Set the parameters of the K3GN as follows.

| Level | Parameter | Set value |
| :---: | :---: | :---: |
| Initial setting | $\therefore \boldsymbol{\square}$ | rits |
|  | EnP. 1 | 19999 |
|  | dSP. 1 | 19999 |
|  | Enp. 1 | 99999 |
|  | dSP. 1 | 99999 |
|  | dip | 00000 |
| Communication setting | u-na | , |
|  | 6 OS | 9.5 |
|  | LEn | 7 |
|  | Sbit | 2 |
|  | Pr-y | EuEn |
| Advanced-function setting | Eatar | Eurn |

Set the communication parameters according to the host PC setting
For details on the parameters, refer to CHAPTER 5 OPERATION.

## Operation



|  | MRC | SRC | Variable type | Address | $\begin{aligned} & \text { Bit } \\ & \text { position } \end{aligned}$ | No. of elements | Current value |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Command(1) | "01" | "02" | "C2" | "0000" | "00" | "0001" | "FFFFFFFCB" |

FFFFFFCBH (-53 in decimal)

|  | MRC | SRC | Variable type | Address | $\begin{gathered} \text { Bit } \\ \text { position } \end{gathered}$ | No. of elements | Current value |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Command(2) | "01" | "02" | "C2" | "0000" | "00" | "0001" | "00002C4E" |


|  | MRC | SRC | Variable type | Address | $\begin{gathered} \text { Bit } \\ \text { position } \end{gathered}$ | No. of elements | Current value |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Command(3) | "01" | "02" | "C2" | "0000" | "00" | "0001" | "00006F54" |


|  | MRC | SRC | Variable type | Address | $\begin{gathered} \text { Bit } \\ \text { position } \end{gathered}$ | No. of elements | Current value |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Command(4) | "01" | "02" | "C2" | "0000" | "00" | "0001" | "0000D431" |

D431H (54321 in decimal)

## CHAPTER

## 4 INITIAL SETTING

Typical applications of the product include a process meter, a tachometer, or an indicator of digital data from PLC/PC.
This chapter explains the flow of initial setting for each of these applications.
4.1 Using the Product as a process meter ..... 30
4.2 Using the Product as a Tachometer ..... 32
4.3 Using the Product as a Digital Indicator ..... 34

### 4.1 Using the Product as a process meter

The following example shows the flow of initial setting for the product that is used as a process meter.

## Setting example:

Input signals ranging from 1 to 5 V is scaled to readouts ranging from 0 to 100 kg .
Comparative output 1 is produced when the process value (readout) reaches 70.0 kg .

Comparative output 2 is produced when the process value (readout) decreases to 50.0 kg .


Flow of Initial Setting
A. Check wiring for correct connection and power the product on.

The product is factory set to have an analog input range of 4 to 20 mA . If an input that falls outside this default range is received, the main indicator of the product will read "5.Err" and blink, indicating an "input range over" error occurs.

The input type, analog range, scaling factor, and decimal point position should be set in this order.
Otherwise, auto-initialization of parameters may result in a failure in parameter setting. If you specify the scaling factor and then the input type, for example, the analog range and the scaling factor are initialized automatically.
B. Set "input type" to "analog".

1. Make sure the main indicator displays a process value (the product is at the operation level).
Then press the $\square$ key and hold it down for at least one second. The product will move to the initial setting level.

C. Set "analog range" to " $1 \sim 5 \mathrm{~V}$ ".
2. Set parameter "r马nine" to " $\boldsymbol{- 5}$ ".
D. Specify the scaling factor.
3. Set parameter "InP. i" to " 1.010$]$ ".
4. Set parameter "d5P. 1 " to " 5 ".
5. Set parameter " $5, \square$ "

E. Specify the decimal point position.
6. Set parameter "dP" to "00000.a".

## TIPS

The number of measurements for averaging and the hysteresis can be changed if required． These parameters are to be set at the advanced－function setting level．

F．Set＂OUT1 value type＂to＂upper limit＂and＂OUT2 value type＂to＂lower limit＂．

1．Set parameter＂adt t：L＂to＂H：
2．Set parameter＂adtely to＂ $\mathbf{G}$＂．
G．Set the OUT1 value to＂ 70.0 ＂and the OUT2 value to＂ 50.0 ＂．
1．Make sure the main indicator displays an initial setting level parameter （the product is at the initial setting level）．
Then press the $\square$ key and hold it down for at least one second． The product will move to the operation level．
2．Set parameter＂aitt＇t to＂rata＂．
3．Set parameter＂配ご＂to＂505＂．
H．Bring the product into measuring operation．

## Clear All

If you are confused about how parameters have been set during initial setting， you can clear all the parameters and start all over again．
For details on how to clear all parameters，refer to Section 5．16 Clearing All Parameters．

For details on parameter setting，refer to CHAPTER 5 OPERATION．

### 4.2 Using the Product as a Tachometer

The following example shows the flow of initial setting for the product that is used as a tachometer.

## Setting example:

The speed of a conveyor belt is indicated in terms of $\mathrm{m} / \mathrm{min}$.
Four pulses are generated per rotation of the rotor.
The diameter of the rotor is 12 cm .
Comparative output 1 is produced when the speed reaches $10500 \mathrm{~m} / \mathrm{min}$.
Comparative output 2 is produced when the speed decreases to $9500 \mathrm{~m} / \mathrm{min}$.


## How to Determine the Scaling Factor

Determine the scaling factor as follows.

$$
\begin{aligned}
& \text { Rotor rotational speed }(\mathrm{rpm}) \\
& \quad=\text { Input frequency }(\mathrm{Hz}) / \text { Number of pulses per rotation } \times 60 \\
& \text { Belt Speed }(\mathrm{m} / \mathrm{min}) \\
& \quad=\pi \times \text { Rotor diameter }(\mathrm{m}) \times \text { Rotor rotational speed }(\mathrm{rpm})
\end{aligned}
$$

Hence the belt speed is given as

$$
\begin{aligned}
\text { Belt speed }(\mathrm{m} / \mathrm{min}) & =3.14159 \ldots \times 0.12 \times 60 / 4 \times \text { Input frequency }(\mathrm{Hz}) \\
& =5.654866 \ldots \times \text { Input frequency }(\mathrm{Hz})
\end{aligned}
$$

Multiply the result by 1000 to enable a readout to be displayed to three decimal places.

$$
\text { Belt speed }(\mathrm{m} / \mathrm{min})=5654.866 \ldots \times \text { Input frequency }(\mathrm{Hz})
$$

To minimize the scaling operation error, select such an input frequency that allows readouts to contain the largest possible number of digits. In this example, the input frequency is set to 10 Hz so that the readout is 56549.


Flow of Initial Setting
A. Check wiring for correct connection and power the product on.

The product is factory set to have an analog input range of 4 to 20 mA . If an input that falls outside this default range is received, the main indicator of the product will read "5, $5, r$ " and blink, indicating an "input range over" error occurs.

B．Set＂input type＂to＂pulse＂．
1．Make sure the main indicator displays a process value（the product is at the operation level）．
Then press the $\square$ key and hold it down for at least one second． The product will move to the initial setting level．
2．Set parameter＂この－上＂to＂PLILSE＂．
C．Set＂pulse frequency＂to＂ 30 Hz ＂．
1．Set initial setting level parameter＂P－F－E＂to＂30＂，
This is because this application is expected to involve an input frequency of approx． 2 Hz and not more than 30 Hz ．

D．Specify the scaling factor．
1．Set parameter＂玉n＂to＂ing＂
2．Set parameter＂$\sigma 50$＂to＂55549＂．
E．Specify the decimal point position．
1．Set parameter＂df＂to＂00．000＂．
F．Set＂OUT1 value type＂to＂upper limit＂and＂OUT2 value type＂to＂lower limit＂．

2．Set parameter＂adtely to＂！ $\mathbf{a}$＂．
G．Set the OUT1 value to＂ 10.500 ＂and the OUT2 value to＂ 9.500 ＂．
1．Make sure the main indicator displays an initial setting level parameter （the product is at the initial setting level）．
Then press the $\square$ key and hold it down for at least one second．
The product will move to the operation level．
2．Set parameter＂aitt＂to＂was＂．
3．Set parameter＂虽こ＂to＂g．5ag＂．

The number of measure－ ments for averaging and the hysteresis can be changed if required．
These parameters are to be set at the advanced－function setting level．

H．Bring the product into measuring operation．

## Clear All

If you are confused about how parameters have been set during initial setting， you can clear all the parameters and start all over again．
For details on how to clear all parameters，refer to Section 5．16 Clearing All Parameters．

For details on parameter setting，refer to CHAPTER 5 OPERATION．

### 4.3 Using the Product as a Digital Indicator for PLC Data

The following example shows the flow of initial setting for the product that is used as a digital indicator for PLC data.

## Setting example:

Full span 0H to 0FA0H ( 0 to 4000 in decimal) of a PLC analog input unit is scaled to 80.0 to 120.0 mm and displayed.
Comparative output 1 is produced when the process value reaches 110.0 mm . Comparative output 2 is produced when the process value decreases to 90.0 mm .


## Flow of Initial Setting

A. Check wiring for correct connection and power the product on.

The product is factory set to have an analog input range of 4 to 20 mA . If an input that falls outside this default range is received, the main indicator of the product will read "E,r" and blink, indicating an "input range over" error occurs..
B. Set "input type" to "remote".

1. Make sure the main indicator displays a process value (the product is at the operation level).
Then press the $\square$ key and hold it down for at least one second. The product will move to the initial setting level.
2. Set parameter "En-を" to "rnt".
C. Specify the scaling factor.

3. Set parameter "d5P. 1 " to "gral".

4. Set parameter "dSPD" to "
D. Specify the decimal point position.
5. Set parameter "dip" to "0000 0 ".
E. Set "OUT1 value type" to "upper limit" and "OUT2 value type" to "lower limit".
6. Set parameter "aidt i.L" to "म"".
7. Set parameter "altaly to "! a"。
F. Specify communication parameters.
8. Make sure the main indicator displays an initial setting level parameter. Then press the $\square$ key.
The product will move to the communication setting level.
9. Set parameter " $\mathbf{1}-\boldsymbol{n} \overline{\boldsymbol{a}}$ " as appropriate.

Exercise care to avoid assigning the same ID number to more than one K3GN when connecting multiple products to one host PC.
3. Set parameter " $\square \mathbf{D}$ " to the same value as in the host PC.
4. Set parameter "EEr" to the same value as in the host PC.
5. Set parameter " $5 \boxed{\Omega}$ " to the same value as in the host PC.
6. Set parameter "PrをG" to the same value as in the host PC.
G. Set the OUT1 value to " 110.0 " and the OUT2 value to " 90.0 ".

1. Make sure the main indicator displays an initial setting level parameter. Then press the $\qquad$ key and hold it down for at least one second. The product will move to the operation level.

2. Set parameter "adtz" to "grat".
H. Bring the product into measuring operation.

## Clear All

If you are confused about how parameters have been set during initial setting, you can clear all the parameters and start all over again.
For details on how to clear all parameters, refer to Section 5.16 Clearing All Parameters.

For details on parameter setting, refer to CHAPTER 5 OPERATION.

## CHAPTER

## 5

## OPERATION

This chapter describes how to move among levels, change parameters, and operate the product from the front panel.
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### 5.1 Levels

In this manual, setting items of the product are grouped into seven levels as follows.

| Level | Description | Measurement |
| :---: | :---: | :---: |
| Protect | This level allows parameter setting for protection against unauthorized or inadvertent key operation. Access to protected levels or setting items is disabled. | Yes |
| Operation | This level represents the normal operation state in which the product can accept input signals and provide comparative outputs. Not only readout of the current process value but also access to or changes of OUT set values are allowed at this level. <br> The product enters this level at power-on. | Yes |
| Adjustment | This level permits communication writing to be enabled or disabled. Even if communication writing is disabled, reading is always enabled. <br> If your product has no communication function, this level is not available. | Yes |
| Initial setting | This level allows initial setting of the input type, analog range, scaling factor and the like. Available only for the product with communication function. | No |
| Communication setting | This level allows setting of the baud rate, word length and other communication parameters. Available only for the product with communication function | No |
| Advanced-functio n setting | This level allows setting of the number of measurements for averaging. Customizations such as a change in display color are also possible at this level. | No |
| Calibration | This level allows user calibration. Note that user calibration could cause deterioration in measuring accuracy of the product. | No |

During operation of the product, the level indicator designates the current level. Alphabetic characters shown on the level indicator and their corresponding levels are shown below.


| Alphabetic character |  |
| :---: | :--- |
| $\boldsymbol{\rho}$ | Protect level |
| $($ OFF $)$ | Operation level |
| $\boldsymbol{A}$ | Adjustment level |
| $\mathbf{S}$ | Initial Setting level |
| $\mathbf{L}$ | Communication level |
| $\mathbf{F}$ | Advanced-Function level |
| $\dot{U}$ | User calibration level |

### 5.2 Moving among Levels



Power the product off and then on again to exit from calibration level.

Moving to the Press the $\square+\square$ keys simultaneously and hold them down for at least 5 seconds. protect level The main indicator starts blinking and then the product enters the protect level. The time required for moving to the protect level can be changed using the "move to protect level" parameter at the advanced-function setting level.
To return from the protect level to the operation level, press the $\square+\square$ keys simultaneously and hold them down for at least one second.

| Moving to the | Press the $\square$ key at the operation level. |
| ---: | :--- |
| adjustment | When you release the key, the product enters the adjustment level. |
| level | To return from the adjustment level to the operation level, press the $\square$ key. |

$\begin{aligned} & \text { Moving to } \text { Press the } \square \text { key and hold it down for one second. } \\ & \text { the initial } \text { The main indicator starts blinking. } \\ & \text { setting level } \text { Continues holding the key down further for at least two seconds. } \\ & \text { The product will return to the initial setting level. }\end{aligned}$
To return from the initial setting level to the operation level, press the $\square$ key and hold it down for at least one second.

## Moving to the communication setting level <br> Press the $\square$ key at the initial setting level. (Release the key within one second). When you release the key, the product enters the communication setting level. <br> To return from the communication setting level to the initial setting level, use the $\square$ key.

Moving to the Moving to the advanced-function setting level involves some particular steps. advanced-function setting level Proceed as follows.

## Procedure

A. Move to the initial setting level and press the key to display the "advanced-function setting level" parameter.

- Parameter "月ña" will appear on the main indicator.
B. Press the $\gg$ key to cause " 0 " to appear on the main indicator.
C. Press the $\gg$ key again to allow the password to be changed.
D. Use the $\gg$ and $\widehat{\lambda}_{\text {/zero }}$ keys to enter a password of " -0169 ".
E. Press the key to save the password.
- If the password is correct, the product enters the advanced-function setting level.
- If the password is incorrect, the product remains at the initial setting level and its main indicator displays the next initial setting parameter.



### 5.3 Parameters

Setting items at each level are called "parameters".
Use the key to select a parameter.
If the input range is changed, some parameters are set to default values.
Therefore, set the input range first.

*9 Displayed when parameter "initial setting/communication lockouts" is set to " 0 ".
*10 Displayed for models with linear current output.
*11 Displayed for models with linear voltage output.


### 5.4 Set Values

Parameter settings are called "set values".
Set values include those consisting of "numerics" and "alphabets".

A state in which a set value is being displayed on the main indicator is called "the monitor state".
A state in which a set value can be changed is called "the change state".

Perform the following steps to display or change a set value.

## Procedure

A. Press the $\gg$ key when a parameter is displayed on the main indicator. The product enters the monitor state and the set value of the parameter will be displayed on the main indicator.

- When the product is in the monitor state, "SV" in the operation indicator section is illuminated, indicating the readout on the main indicator is a set value.
B. If you do not want to change the set value, press the key in the monitor state to go to the next parameter.
C. Press the $\gg$ key in the monitor state to cause the product to enter the change state.
- A digit that can be changed will start blinking.

TIPS
During setting of operation or adjustment level parameters, the return action of the product varies depending on the "display auto-return time" setting.
The display auto-return time defaults to ten seconds. If the "display auto-return time" is set to less than five seconds, e.g., three seconds, no key operation for three seconds in the change state will return the product to the current value display mode, not to the monitor state.
D. Use the $\gg$ and $\widehat{\pi} / \overline{z e n o l}$ key to change the set value.

- If no key is operated for five seconds, the product saves the current value and returns to the monitor state automatically.
E. Press the key to go to the next parameter.
- The change in setting is saved in memory.



### 5.5 Operation Level

## Viewing and Changing OUT set values

Gutt :

## abt i.h

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but?

## guter

## Gute!

The operation level allows you to check and change OUT set values.
The product continues measuring in the middle of checking and changing OUT set values.
Procedure
A. Press the key several times until parameter OUT2 is displayed on the main indicator.
B. Press the $\gg$ key to display the OUT2 value on the main indicator.

- The product enters the monitor state and shows the OUT2 value on the main indicator.
- "SV" in the operation indicator section is illuminated, indicating the value shown on the main indicator is a set value.
- If you simply want to check the set value, proceed to step $\mathbf{E}$.
C. Press the $\gg$ key in the monitor state to cause the product to enter the change state.
- A digit that can be changed will start blinking.
D. Use the $\gg$ and $\widehat{\lambda} /$ zero $k$ key to change the set value.
- If no key is operated for five seconds, the product saves the current value and returns to the monitor state automatically.
E. Press the key several times to return to the current value display mode.
- The change in setting is saved in memory.


Available OUT set values and their indications are as follows.

| OUT set value | Indication | Description |
| :---: | :---: | :---: |
| OUT1 value | gitt | When the process value increases or decreases to this value, comparative output 1 is provided. |
| OUT1 upper-limit value | dith if | When the process value falls outside the range specified by these values, comparative output 1 is provided. |
| OUT1 lower-limit value | aut \% |  |
| OUT2 value | dite | When the process value increases or decreases to this value, comparative output 2 is provided. |
| OUT2 upper-limit value | adter | When the process value falls outside the range specified by these values, comparative output 2 is provided. |
| OUT2 lower-limit value | abtel |  |

## Forced-zero operation

## Note

The forced-zero operation is not available if the input type is set to "pulse".

## TIPS

If the $\widehat{/ 2 / z E 0}$ key on the front panel is used for executing the forced-zero operation, the forced-zero process is stored in EEPROM. But if the forced-zero operation is executed via the event input terminal or communications, the process is not stored.

If the current value is not normal (e.g., the input signal is invalid, the process value is outside the displayable range, or no measurements are made), the forced-zero function is inoperative.

The forced-zero operation allows you to shift the current value to zero forcedly. For details, refer to CHAPTER 6 FUNCTION DESCRIPTION.

Procedure (for forced-zero operation)
A. Press the $\widehat{\text { /zero }}$ key when a current value is displayed on the main indicator. (Release the key within one second).

- The current value will be shifted to zero.
- "ZERO" in the operation indicator section is illuminated, indicating the current value has been shifted to zero.

Procedure (for forced-zero release operation)
B. Press the 匂/zerol key and hold it down for at least one second when a shifted value is displayed.

- The shifted value will be restored to the current value.
- "ZERO" in the operation indicator section will go off, indicating the current value is no longer shifted.



### 5.6 Communication Writing Control

## Adjustment level

Cite
(CMWT)

TIPS
No operation for ten seconds at the adjustment level causes the product to return to the current value display mode at the operation level automatically.

Communication writing can be enabled or disabled.
Communication reading is always enabled, irrespective of this parameter setting.

| Parameter | Set value | Description |
| :---: | :---: | :--- |
| $\arg$ | arf | Communication writing is <br> disabled. |
|  | an | Communication writing is <br> enabled. |

## Procedure

A. Press the $\square$ key at the operation level to move to the adjustment level.

- "r" will appear on the level indicator, indicating the product has entered the adjustment level.
B. Press the $\gg$ key to display the set value of the parameter on the main indicator.

- The current set value will appear on the main indicator.
C. Press the $\gg$ key again.

- The set value will start blinking, indication the product is in the change state.
D. Use the $\widehat{\pi} /$ zero 0 key to change the set value.

E. Press the key to save the change.

- The change is saved and then the main indicator returns to the parameter display mode.
F. Press the $\square$ key to return to the operation level.


### 5.7 Key Protect Setting

Protect level

## anP:

[PR

E15 E

EREE

## Operation/

 Adjustment LockoutsInitial Setting/ Communication Lockouts

Key protect includes "operation/adjustment lockouts", "initial setting/communication lockouts", "setting change lockout" and "forced-zero lockout", and allows restrictions on various setting changes.

This types of key protect restrict the key operation at the operation and adjustment levels.

| Parameter | Set value | Operation level |  | Move to adjustment level |
| :---: | :---: | :---: | :---: | :---: |
|  |  | Current value display | OUT set value display |  |
| aHPL | $\square$ | Enable | Enable | Enable |
|  | 1 | Enable | Enable | Disable |
|  | 2 | Enable | Disable | Disable |

This types of key protect restrict the "moving among levels" operation.

| Parameter | Set value | Move to initial setting level | Move to communication setting level | Move to advanced-functio n setting level |
| :---: | :---: | :---: | :---: | :---: |
| EPt | 0 | Enable | Enable | Enable |
|  | 1 | Enable | Enable | Disable |
|  | 2 | Disable | Disable | Disable |

Setting Change Lockout

This type of key protect restricts the key operation for setting changes.
It prohibits the product from entering the change state, except that the following operation is allowed.

- Changes in set values of all parameters at the protect level
- Move to the advanced-function level
- Move to the calibration level

| Parameter | Set value | Key operation for <br> setting changes |
| :---: | :---: | :---: |
| $\boldsymbol{U L} \boldsymbol{\square}$ | arF | Enable |
|  | an | Disable |

Forces-zero Lockout

This type of key protect restricts the key operation that activates or deactivates the forced-zero function.
It has no effect on forced-zero operation via the event input terminal.

| Parameter | Set value | Key operation for activating or deactivating the forced-zero function |
| :---: | :---: | :---: |
| E-PG | arf | Enable |
|  | an | Disable |

## Procedure

## TIPS

Appropriate setting of the "move-to-protect-level time" parameter allows you to change the time required for the product to move to the protect level.
The move-to-protect-level time is factory set to 5 seconds.
A. When the product is at the operation level, press the $\square+\square$ keys and hold them down for at least five seconds to enter the protect level.


- "F" will appear on the level indicator, indicating the product has entered the protect level.
B. Press the key several times until the desired parameter appears on the main indicator.

C. Press the $\gg$ key to display the set value of the parameter on the main indicator.
- The current set value will appear on the main indicator.
D. Press the $\gg$ key again.
- The current set value will start blinking, indicating the product is in the change state.
E. Use the $\widehat{\wedge} /$ zero key to change the set value.

F. Press the key to go to the next parameter.
- The change is saved.

G. Press the $\square+\square$ keys and hold then down for at least one second to return to the operation level.



### 5.8 Selecting an Input Type

Initial setting level
This parameter allows you to select one from three input types.

| Parameter | Set value | Description |
| :---: | :---: | :---: |
| $\therefore n-t$ | Fintib | Analog: The product can be used as a process meter. |
|  | Put 58 | Pulse: The product can be used as a tachometer. |
|  | rit | Remote: The product can be used as a digital data indicator. |

## Procedure

## TIPS

A change in input type initializes some parameters.

- When the input type is set to "analog":
Parameters ":np. i ",
"d5P. '", "LnP?", "d5P?" and "dp" are initialized according to the current analog range.
The forced-zero function is deactivated.
$\square$ When the input type is set to "pulse":
Parameter "dp" is initialized according to the current input-pulse frequency range.
- When the input type is set to "remote".
Parameters " 5,9 . I" and
"d5.p. i" are set to "-19999"
 are set to "99999".
Parameter "d" is set to
"00000".
The forced-zero function is deactivated.
Data downloading is set to "enable".
A. When the product is at the operation level, press the $\square$ key and hold it down for at least three seconds to enter the initial setting level.

- " 5 " will appear on the level indicator, indicating the product has entered the initial setting level.
- The first parameter at the initial setting level is "In-t".
B. Press the $>$ key to display the set value of the parameter on the main indicator.

- The current set value will appear on the main indicator.
C. Press the $\gg$ key again.
- The current set value will start blinking,
 indicating the product is in the change state.
D. Use the $\widehat{\Lambda}^{/ 2}$ zeoo key to change the set value.

E. Press the key to go to the next parameter.

- The change is saved.
F. Specify the values of other parameters related to the input type. (Refer to the Appendix).
G. Press the $\square$ key and hold it down for at least one second to return to the operation level.


1 sec .

### 5.9 Selecting an Analog Range

## Initial setting level

This parameter allows you to select an analog input range.
Before selecting an analog range, you must set the input type parameter to "analog".

| Parameter | Set value | Measuring range |
| :---: | :---: | :---: |
| -Rnce | $4-20$ | 4.00 to $20.00 \mathrm{~mA} /$ <br> 0.00 to 20.00 mA |
|  | 1-5 | $\begin{aligned} & 1.000 \text { to } 5.000 \mathrm{~V} / \\ & 0.000 \text { to } 5.000 \mathrm{~V} \\ & \hline \end{aligned}$ |
|  | 5 | -5.000 to 5.000 V |
|  | 18 | -10.000 to 10.000 V |

## Procedure

A. When the product is at the operation level, press the $\square$ key and hold it down for at least three seconds to enter the initial setting level.

initializes some parameters.

- Parameters " 50 ? $t$ ", "d5P. f", "EnP?", "dSp.?" and "dr" are initialized according to the current analog range.
The forced-zero function is deactivated.
- " 5 " will appear on the level indicator, indicating the product has entered the initial setting level.
B. Press the key several times until parameter "r-RmE" appears on the main indicator.

C. Press the $\gg$ key to display the set value of the parameter on the main indicator.

- The set value representing the current analog range will appear on the main indicator.
D. Press the $\gg$ key again.

- The set value will start blinking, indicating the product is in the change state.
E. Use the $\widehat{\star} /$ zero key to change the set value.

F. Press the key to go to the next parameter.
- The change is saved.
G. Specify the values of other parameters related to the analog range. (Refer to the Appendix).
H. Press the $\square$ key and hold it down for at least one second to return to the operation level.



### 5.10 Selecting an Input-pulse Frequency Range

## Initial setting level

## $E-E, E$

This parameter allows you to select an input-pulse frequency range. The value of the parameter represents the upper limit of available ranges.
Before selecting an input-pulse frequency range, you must set the input type parameter to "pulse".

| Parameter | Set value | Description |
| :---: | :---: | :--- |
| $\boldsymbol{P}-\boldsymbol{F} \boldsymbol{- E}$ | $\boldsymbol{Z a}$ | Measuring range: 0.05 to 30.00 Hz |
|  | $\mathbf{5}, \boldsymbol{-}$ | Measuring range: 0.1 to 5000.0 Hz |

If input signals come from relay contacts, set the range to " 30 Hz ". Doing so eliminates chattering noise from input signals.

## Procedure

## TIPS

A change in input-pulse frequency range initializes some parameters.
■ Parameters " $\leq n$ " ", "dj" and "dp" are initialized according to the current input-pulse frequency range.
A. When the product is at the operation level, press the $\square$ key and hold it down for at least three seconds.

- " 5 " will appear on the level indicator, indicating the product has entered the initial setting level.
B. Press the key several times until parameter

"P-F-E" appears on the main indictor.
C. Press the $\gg$ key to display the set value of the parameter on the main indicator.
- The current set value of the input-pulse frequency range will appear on the main indicator.
D. Press the $\gg$ key again.
- The set value will start blinking, indicating the product is in the change state.
E. Use the $\widehat{\wedge}_{\text {/zero }}$ key to change the set value.
- The change is saved.
名
G. Specify the values of other parameters related to the input-pulse frequency range. (Refer to the Appendix).
H. Press the $\square$ key and hold it down for at least one second to return to the operation level.

F. Press the key to go to the next parameter.


### 5.11 Specifying the Scaling Factor for AnalogInput/Digital Data Display

## Initial setting level



These parameters allow you to specify the scaling factor.
Before specifying the scaling factor, you must set the input type parameter to "analog" or "remote".

| Parameter | Set value | Description |
| :---: | :---: | :---: |
| -nro 1 | -19999 ~ 99999 | Any input value |
| -150. 1 | -19999~99999 |  |
| $\underline{-10} 9$ | -19999 - 99999 | Any input value |
| -150, | -19999~99999 | Output value (readout) corresponding to |

## TIPS

The decimal point position of parameters $\therefore 10$ and $i n$ is automatically set as follows.

- When the input type is set to "analog":
4 to $20 \mathrm{~mA}: 000.00$
1 to 5V: 00.000 $\pm 5 \mathrm{~V}$ : 00.000 $\pm 10 \mathrm{~V}$ : 000.00
- When the input type is set to "remote":

00000



The input value can be set by teaching.
Inverse scaling where readout decreases with increasing input is also possible.
To allow a readout of 0.0 when the input value is 4.2 mA and a readout of 100.0 when the input value is 20 mA , for example, set the parameters as follows.

- $\operatorname{En} \boldsymbol{F}$ : $=4.20$
$-15 P \cdot i=0$
- $\boldsymbol{\operatorname { C n }} \boldsymbol{\square}=20.00$
- $-\mathbb{S N O}_{2} \boldsymbol{B}=1000$

Specify the decimal point position of the display value with parameter $\boldsymbol{d}^{\boldsymbol{P}}$.
For details, refer to Section 6.2 Scaling.
Procedure
A. When the product is at the operation level, press the $\square$ key and hold it down for at least three seconds to enter the initial setting level.


- " 5 " will appear on the level indicator, indicating the product has entered the initial setting level.
B. Press the key several times until parameter "InP. $!$ " appears on the main indicator.

- "T" will be illuminated, indicating teaching of this parameter is possible.
- For the procedure of teaching, refer to the next page.
C. Press the $\gg$ key to display the set value of the parameter on the main indicator.

- The current set value of parameter " $[n P$. 8 " will appear on the main indicator.
D. Press the $\gg$ key again.
- The set value starts blinking, indicating the product is in the change state.
E. Use the $\gg$ and $\widehat{\wedge}_{\text {ZzeO }}$ keys to change the set value.
F. Press the key to go to the next parameter "d5P. i".

- The change is saved and then "d5P. 4 " will appear on the main indicator.
G. Repeat steps $\mathbf{C}$ to $\mathbf{F}$ for parameters "LnP $\mathbf{L}$ " and "d5P.2".

- When you finish setting of parameter "d5P.?", parameter "dF" will appear on the main indicator.
H. Press the $\square$ key and hold it down for at least one second to return to the operation level.


Teaching The teaching function allows you to specify the value of parameters " $\mathbf{I n} \mathbb{\square}$. $\mathbf{i}$ " and


## Procedure

I. Following step $\mathbf{C}$ (the product is in the monitor state), press the $\widehat{\wedge}_{\text {/zero }}$ key.

- "T" will start blinking, indicating the product is in teaching mode.
- Key entry permits the actual process value to be displayed on the main indicator.


## J. Press the $\widehat{\omega}_{\text {zeen }}$ key again.

- The actual process value is set as the input value and then the product will return to the monitor state.
- Pressing the key instead of the 迕/zeo key in teaching mode cancels the teaching mode and the display on the main indicator changes to the next parameter.



### 5.12 Specifying the Scaling Factor for Input Pulse Frequency

## Initial setting level



## TIPS

The decimal point position of parameter ": 5 " " is automatically set depending on setting of the input-pulse frequency range as follows.

## $30 \mathrm{~Hz}: \quad 000.00$

5 kHz : 00000

These parameters allow you to specify the scaling factor.
Before specifying the scaling factor, you must set the input type parameter to "pulse".

| Parameter | Set value | Description |
| :---: | :---: | :---: |
| $\square 0^{\square}$ | -19999~99999 | Any input value |
| -15 | -19999~99999 | Output value (readout) corresponding to |



The input value can be set by teaching.
To allow a readout of 10.000 when the input value is $4.2 \mathrm{kHz}(=4200 \mathrm{~Hz})$, for example, set the parameters as follows.
$-\therefore \boldsymbol{\square} \boldsymbol{\square}=4200$
$-\boldsymbol{d} \boldsymbol{5}=10000$
Specify the decimal point position of the display value with parameter .
For details, refer to Section 6.2 Scaling.

## Procedure

$$
3 \mathrm{sec} .
$$

 press the $\square$ key and hold it down for at least three seconds to enter the initial setting level.

- " 5 " will appear on the level indicator, indicating the product has entered the initial setting level.
B. Press the key several times until parameter "- $\boldsymbol{n}^{\boldsymbol{D}}$ " appears on the main indicator.

- " T " will be illuminated, indicating teaching of this parameter is possible.
- For the procedure of teaching, refer to the next page.
C. Press the $>$ key to display the set value of the parameter on the main indicator.

- The current set value of parameter "G, ${ }^{\square}$ " " will appear on the indicator.
D. Press the $\gg$ key again.
- The set value will start blinking, indicating the product is in the change state.
E. Use the $\gg$ and 这/zeol keys to change the set value.

F. Press the key to go to the next parameter.

- The change is saved and then "d5p" will appear on the main indicator.
G. Press the $\square$ key and hold it down for at least one second to return to the operation level.


Teaching The teaching function allows you to specify the value of parameter "Ln " $\boldsymbol{\square}$ " without the need for front panel key input.

## Procedure



- " T " will start blinking, indicating the product is in teaching mode.
- Key entry permits the actual process value to be displayed on the main indicator.
I. Press the $\widehat{/ 1 / z e r 0}$ key again.
- The actual process value is set as the input value and then the product will return to the monitor state.
- Pressing the $\square$ key instead of the $\widehat{\Lambda} /$ zzeo key in teaching mode cancels the teaching mode and the display on the main indicator changes to the next parameter.


How to Determine Appropriate Scaling Factors

To minimize the scaling operation error, select such a scaling factor that permits the largest possible number of digits to be contained in scaling display values (DSP).

The relationship between the scaling input and display values for input pulse frequency is represented by the following equation.
Scaling display value $=\alpha$ (multiplication factor) $\times$ input frequency $(\mathrm{Hz})$
Where $\alpha=\mathrm{DSP} / \mathrm{INP}$
$\alpha$ is often an indivisible number such as $5.654866 \ldots$ particularly when the input value is converted to a circumferential velocity. This is because such a conversion involves $\pi$.
There are innumerable combinations of scaling input values (INP) and scaling display values (DSP) that result in $\alpha=5.654866 \ldots$ as follows.

| INP $(\mathrm{Hz})$ | DSP |
| :--- | :--- |
| 1 | $5.654866 \cdots$ |
| 2 | $11.30973 \cdots$ |
| 5 | $28.27433 \cdots$ |
| 10 | $56.54866 \cdots$ |
| $\cdots$ |  |

On the other hand, DSPs that are programmable are limited to 5 -digit integers. This means that DSPs must be rounded off to the nearest integers as follows.

| INP (Hz) | Programmable DSP |
| :--- | :--- |
| 1 | 00006 |
| 2 | 00011 |
| 5 | 00028 |
| 10 | 00057 |

Hence, if the input frequency is 1000 Hz , the error between the scaling result and the ideal value increases with the decreasing number of digits contained in the DSP.

| INP (Hz) | Programmable DSP | Scaling result <br> (readout) | Ideal value | $\mid$ Error \| |
| :--- | :--- | :--- | :--- | :--- |
| 1 | 00006 | 6000 | 5655 | 345 |
| 2 | 00011 | 5500 | 5655 | 155 |
| 5 | 00028 | 5600 | 5655 | 55 |
| 10 | 00057 | 5700 | 5655 | 45 |

Select a combination of the DSP and INP so that the scaling output contains the largest possible number of digits. Doing so minimizes the scaling operation error.

## 5．13 Specifying the Decimal Point Position

Initial setting level
This parameter allows you to specify the decimal point position of the display value．

| Parameter | Set value | Description |
| :---: | :---: | :---: |
| －r | 0.00001 | Readouts are given to four decimal places． |
|  | 00.0000 | Readouts are given to three decimal places． |
|  | 000.00 | Readouts are given to two decimal places． |
|  | ロanaia | Readouts are given to one decimal place． |
|  | ロロロロロ | Readouts are given as integers． |

## Procedure

A．When the product is at the operation level， press the $\square$ key and hold it down for at least three seconds to enter the initial setting level．

－＂ 5 ＂will appear on the level indicator，indicating the product has entered the initial setting level．

B．Press the key several times until parameter ＂dP＂appears on the main indicator．


C．Press the $\gg$ key to display the set value of the parameter．
－The current set value for the decimal point position will appear on the main indicator．

D．Press the $\gg$ key again
－The set value will start blinking，indicating the product is in the change state．

E．Use the $\widehat{\Lambda} /$ ZERO key to change the set value．

F．Press the key to go to the next parameter．
－The change is saved．
G．Press the $\square$ key and hold it down for at least one second to return to the operation level．


T

＿＂SV＂is illuminated．


1 sec ．

## 5．14 Selecting the Output Operating Action

Initial setting level

## at it i． 2

## duel

## TIPS

－To specify the OUT set value for the upper or lower－limit action，use parameters ait 1 and adz．
－To specify the OUT set values for the outside－the－range action， use parameters out t IH， att I．，atte．H and outed．

These parameters allow you to select the operating action of outputs 1 and 2 respectively．


For details，refer to Section 6．8 Comparative Output．

## Procedure

A．When the product is at the operation level， press the $\square$ key and hold it down for at least three seconds to enter the initial setting level．

－＂ 5 ＂will appear on the level indicator，indicating the product has entered the initial setting level．

B．Press the key several times until parameter ＂䣲t $\mathbb{t}$＂appears on the main indicator．

－The current set value for the type of comparative output will appear on the main indicator．

D．Press the $\gg$ key again．

－The set value will start blinking，indicating the product is in the change state．

E．Use the $\widehat{\wedge}_{\text {／zero }}$ key to change the set value．


F．Press the key to display parameter ＂aldEZ．E＂on the main indicator．

－The change is saved and then the next parameter ＂alitele＂will appear on the main indicator．

G．Repeat steps $\mathbf{C}$ to $\mathbf{F}$ for parameter＂GULE $\mathbf{Z}!$＂．


－Parameter＂Ria＂will appear on the main indicator when you finish setting of parameter ＂outer＂．

H．Press the $\square$ key and hold it down for at least one second to return to the operation level．

吕・ジジージ』
1 sec ．

### 5.15 Performing Linear Output

## Linear output level

## 15EE.

## 15EE.U

## 15EE.H

## :5EE!

The linear output function outputs currents or voltages proportional to measurement values as they change.
Select the type of linear output. Set the maximum and minimum output measurement values to output the current or voltage for those measurement values.

| Parameter | Set value | Description |
| :---: | :---: | :---: |
| LSEE. 5 | 0 -30 | 0 to 20 mA |
|  | 4-20 | 4 to 20 mA |
| LESt.a | 2-5 | 0 to 5 V |
|  | 1-5 | 1 to 5 V |
|  | 0-10 | 0 to 10 V |
| 15Et.H | - 19999 to 99999 | -19999 to 99999 |
| LSEE. | - 19999 to 99999 | -19999 to 99999 |

* When a linear output is mounted, the "linear current type" or "linear voltage type" parameter can be set according to the type of linear output..


## Voltage Output




## Current Output




* Areas marked with an asterisk (*) are input error areas. If the "operation at input error" parameter is set to "input error," then the output would be like Line B. Otherwise, the output would be like Line A.
* If operation stops without performing a measurement, then the minimum value (e.g., 4 mA for the 4 to 20 mA range) is output.
* The value set for the upper limit does not necessarily have to be higher than the value set for the lower limit. The following is an example of reverse scaling.

* If the upper and lower limit are set to the same value, then the upper limit will equals the lower limit plus 1 for linear output.


## Procedure

A. Press the $\square$ key for at least 3 s in RUN (or operation) level to move to the initial setting level.


- " 5 " is displayed on the level display to indicate the initial setting level.
B. Press the key several times to display "LELE".

- The set value for linear current type is displayed.
D. Press the $\gg$ key again.
- The setting can be changed when SV display
 starts to flash.
E. Use the $\widehat{\lambda}_{\text {Zzee }}$ key to change the set value.

F. Press the key to switch to " $L$ SEL. 5 " "

- The set value is registered and then the next parameter "L5ELH".
G. Press the $>$ key to display the set value.


$\uparrow$ _SV" is illuminated.
- The set value for linear output upper limit value is displayed.
H. Press the $\gg$ key again.

- The setting can be changed when SV display starts to flash.

I．Use the $>$ 这／zeno ［UP］key to change the set value．


J．Press the key to switch to＂ 5 SEL：＂．

－The set value is registered．
K．Repeat steps $\mathbf{G}$ to $\mathbf{J}$ to set＂ $\mathbf{L} \mathbf{5 E E}$ ！＂．
－The next parameter is displayed after＂$\lfloor 5 E L!$＂ is set．

L．Press the $\square$ key for at least 1 s to return to RUN（or operation）level．


### 5.16 Specifying Communication Parameters

## Communication setting level



Communication parameters are to be specified at the communication setting level.

| Parameter | Set value | Description |
| :---: | :---: | :---: |
| 亿!-na | : $\sim 99$ | Communication unit No. |
| 8 OL | $\begin{array}{\|l} \hline 1.5 / 2.4 / 4.8 \\ 19.6 / 19.2 \\ \hline \end{array}$ | $\begin{aligned} & \text { Baud rate }(1,200,2,400, \\ & 4,800,9,600,19,200 \mathrm{bps}) \\ & \hline \end{aligned}$ |
| LEn | $7 / 8$ | Word length (7 or 8) |
| Stit | 1/2 | Stop bit length (1 or 2) |
| Prty | nanE/EuEn /add | Parity bits (None, Even, or Odd) |

When connecting multiple products to one host PC, exercise care to avoid assigning the same ID number to more than one product.
Set other communication parameters according to the host PC setting.

## Procedure

M. When the product is at the operation level, press the $\square$ key and hold it down for at least three seconds to enter the initial setting level.


- " 5 " will appear on the level indicator, indicating the product has entered the initial setting level.
N. Press the $\square$ key at the initial setting level.
- " $\boldsymbol{\Gamma}$ " will appear on the level indicator, indicating
 the product has entered the communication setting level.
O. Press the key several times until the desired parameter appears on the main indicator.

P. Press the $\gg$ key to display the set value of the desired parameter on the main indicator.

- The current set value will appear on the main indicator.
Q. Press the $\gg$ key again.
- The set value will start blinking, indicating the
 product is in the change state.
R. Use the $\widehat{\widehat{N}}_{\text {/zero }}$ key to change the set value.

S. Press the key to go to the next parameter.

- The change is saved.
T. Repeat steps $\mathbf{0}$ to for the remaining communication parameters.

U. Press the $\square$ key to return to the initial setting
 level.
V. Press the $\square$ key and hold it down for at least one second to return to the operation level.


## 5．17 Clearing All Parameters

## Advanced－function setting level

The clear all function can be used to initialize all parameters to factory settings．

| Parameter | Set value | Description |
| :---: | :---: | :---: |
| Ent | $\overline{a r F}$ | - |
|  | an | Parameters are all initialized． |

This function is useful in restarting the setup of the product from the default state．

## Procedure

A．When the product is at the operation level， press the $\square$ key and hold it down for at least three seconds to enter the initial setting level．

－＂ 5 ＂will appear on the level indicator，indicating the product has entered the initial setting level．

B．Press the key several times until parameter ＂月ーロール＂is displayed，and then enter password ＂－0169＂．
－＂F＂will appear on the level indicator，indicating the product has entered the advanced－function setting level．
－The first parameter at the advanced－function setting level is＂Lnit＂．
－For details on how to move to the advanced－function setting level，refer to Section 5．2 Moving among Levels．

C．Press the $\gg$ key to display the set value of parameter＂Lnに゙と＂on the main indicator．

－Set value＂arF＂will appear on the main indicator．

D．Press the $\gg$ key again．

－The set value will start blinking，indicating the product is in the change state．

E．Use the 人／zero $^{0}$ key to change the set value to ＂ar＂．


F．Press the key to go to the next parameter．

－All parameters are initialized．
－Parameter＂Lnit＂is also set to＂arF＂．
G．Press the $\square$ key and hold it down for at least one second to return to the initial setting level．

H．Press the $\square$ key and hold it down for at least one second to return to the operation level．

# 5．18 Specifying the Number of Measurements for Averaging 

## Advanced－function setting level

（AVG）

This parameter allows you to specify the number of measurements for averaging．

| Parameter | Set value | Description |
| :---: | :---: | :---: |
|  | arf | No average processing |
| Pum | こ／4／8 | Number of measurements for averaging （2，4，or 8 times） |

For details，refer to Section 6．4 Average Processing．

## Procedure

A．When the product is at the operation level， press the $\square$ key and hold it down for at least three seconds to enter the initial setting level．．

－＂ 5 ＂will appear on the level indicator，indicating the product has entered the initial setting level．

B．Press the key several times until parameter ＂Fingu＂is displayed，and then enter password ＂－0169＂．

－＂F＂will appear on the level indicator，indicating the product has entered the advanced－function setting level．
－For details on how to move to the advanced－function setting level，refer to Section 5．2 Moving among Levels．

C．Press the key several times until parameter ＂FLL゙灾＂appears on the main indicator．


D．Press the $\gg$ key to display the set value of parameter＂掘灾＂。

－The current set value for the number of measurements for averaging will appear on the main indicator．

E．Press the $\gg$ key again．
－The set value will start blinking，indicating the product is in the change state．

F．Press the $\widehat{/ \pi / \text { zero }}$ key to change the set value．


G．Press the key to go to the next parameter．


－The change is saved．
H．Press the $\square$ key and hold it down for at least one second to return to the initial setting level．


I．Press the $\square$ key and hold it down for at least one second to return to the operation level．


## 5．19 Specifying the Function of the Event Input

## Advanced－function setting level

Eurnt
（EVENT）

When the input type has been set to＂analog＂or＂remote＂，this parameter allows you to specify the function of the event input（terminal（3）．
Before specifying the function of the event input，you must set the input type to ＂analog＂or＂remote＂．

| Parameter | Set value | Description |
| :---: | :---: | :---: |
|  | Hold | HOLD：The current process value is held． |
| EuEnt | EEra | ZERO：The current process value is forcedly shifted to zero． |

For details，refer to Section 6．5 Process Value Hold．

## Procedure

A．When the product is at the operation level， press the $\square$ key and hold it down for at least three seconds to enter the initial setting level．．

－＂ 5 ＂will appear on the level indicator，indicating the product has entered the initial setting level．

B．Press the key several times until parameter ＂月゙ロール＂is displayed，and then enter password ＂－0169＂．

－＂F＂will appear on the level indicator，indicating the product has entered the advanced－function setting level．
－For details on how to move to the advanced－function setting level，refer to Section 5．2 Moving among Levels．

C．Press the key several times until parameter ＂EuEnt＂appears on the main indicator．



D．Press the $\gg$ key to display the set value of parameter＂EuEnt＂on the main indicator．

＂SV＂is illuminated．
－The current set value will appear on the main indicator．

E．Press the $\gg$ key again．

－The set value will start blinking，indicating the product is in the change state．

F．Use the $\widehat{\kappa}_{\text {／zERO }}$ key to change the set value．


G．Press the key to go to the next parameter．
－The change is saved．
H．Press the $\square$ key and hold it down for at least one second to return to the initial setting level．
I. Press the $\square$ key and hold it down for at least one second to return to the operation level.

## 5．20 Specifying the Hysteresis

## Advanced－function setting level

H5：
Huse

## TIPS

A hysteresis setting of＂ 0 ＂is assumed to be a hysteresis setting of＂ 1 ＂．

These parameters allow you to specify the hysteresis for each of comparative outputs 1 and 2.

| Parameter | Set value | Description |
| :---: | :---: | :---: |
| $\mathbf{H 5 5} *$ | $\boxed{5} \sim 999$ | 0 to 9999：Hysteresis |

The setting of the decimal point position parameter at the initial setting level is reflected on the decimal point position of the hysteresis．
For details，refer to Section 6．9 Hysteresis．

## Procedure

A．When the product is at the operation level， press the $\square$ key and hold it down for at least three seconds to enter the initial setting level．

－＂ 5 ＂will appear on the level indicator，indicating the product has entered the initial setting level．

B．Press the key several times until parameter
＂月пロール＂is displayed，and then enter password ＂－0169＂．

－＂F＂will appear on the level indicator，indicating the product has entered the advanced－function setting level．
－For details on how to move to the advanced－function setting level，refer to Section 5．2 Moving among Levels．

C．Press the key several times until parameter ＂HUS：＂appears on the main indicator．


D．Press the $\gg$ key to display the set value of parameter＂मリヒ $!$＂on the main indicator．

－The current set value will appear on the main indicator．

E．Press the $\gg$ key again．

－The set value will start blinking，indicating the product is in the change state．

F．Use the $\gg$ and $\widehat{\Lambda}_{\text {／zero }}$ keys to change the set value．



－The change is saved．
H．Repeat steps $\mathbf{D}$ to $\mathbf{G}$ for parameter＂मリエロ＂

－The next parameter will appear on the main indicator when you finish setting of parameter ＂H55？＂．

I．Press the $\square$ key and hold it down for at least one second to return to the initial setting level．

J．Press the $\square$ key and hold it down for at least one second to return to the operation level．

## 5．21 Specifying the Auto－zero Time

## Advanced－function setting level

## 

（AUTO．Z）

When the input type has been set to＂pulse＂，this parameter allows you to specify the auto－zero time．

Before specifying the auto－zero time，you must set the input type to＂pulse＂．

| Parameter | Set value | Description |
| :---: | :---: | :---: |
| P0tas．E | 20．8～ 9.9 | 0.0 to 19.9 seconds：Auto－zero time |

The auto－zero time is the length of time required for the product to return the readout to zero after pulse input interruption．
Set this parameter to a larger value than the expected time interval of input pulses （interval between input pulses）．Failure to do so will result in incorrect measurements．
If the auto－zero time is too long，on the other hand，a long delay in lower－limit action in response to a stop of rotation may result．
In the following application where a pulse is produced per rotation，for example， the input pulse frequency is 0.2 to 100 Hz ，which means the time interval of input pulses is 0.01 to 5 seconds．
The auto－zero time should therefore be set to five seconds or longer．


$$
12 \sim 6000 \mathrm{rpm}
$$

For details，refer to Section 6．3 Auto－zero／Startup Compensation．

## Procedure

A．When the product is at the operation level， press the $\square$ key and hold it down for at least three seconds to enter the initial setting level．

－＂ 5 ＂will appear on the level indicator，indicating the product has entered the initial setting level．

B．Press the key several times until parameter
＂月，ロール＂is displayed，and then enter password ＂－0169＂．

－＂F＂will appear on the level indicator，indicating the product has entered the advanced－function setting level．
－For details on how to move to the advanced－function setting level，refer to Section 5．2 Moving among Levels．

C．Press the key several times until parameter



D．Press the $\gg$ key to display the set value of parameter＂R10ti．E＂on the main indicator．

－The current set value will appear on the main indicator．
E. Press the $\gg$ key again.


- The set value will start blinking, indicating the product is in the change state.
F. Use the $\gg$ and $\widehat{\lambda}_{\text {/zeo }}$ keys to change the set value.

G. Press the key to go to the next parameter.

- The change is saved and the next parameter will appear on the main indicator.
H. Press the $\square$ key and hold it down for at least one second to return to the initial setting level.

I. Press the $\square$ key and hold it down for at least one second to return to the operation level.



## 5．22 Specifying the Startup Compensation Time

## Advanced－function setting level


（S－TMR）

When the input type has been set to＂pulse＂，this parameter allows you to specify the startup compensation time．
Before specifying the startup compensation time，you must set the input type to ＂pulse＂．

| Parameter | Set value | Description |
| :---: | :---: | :---: |
| 5－tir | 0．9～ 99.9 | 0.0 to 99.9 seconds：Startup compensation time |

The startup compensation time is a delay between power－on of the product and the start of measurement．This function is useful in preventing output from being produced until a rotator reaches a prescribed speed．
For details，refer to Section 6．3 Auto－zero／Startup Compensation．

## Procedure

A．When the product is at the operation level， press the $\square$ key and hold it down for at least three seconds to enter the initial setting level．

－＂ 5 ＂will appear on the level indicator，indicating the product has entered the initial setting level．

B．Press the key several times until parameter
＂月⿱⿱一𫝀口亍七＂＂is displayed，and then enter password ＂－0169＂．

－＂F＂will appear on the level indicator，indicating the product has entered the advanced－function setting level．
－For details on how to move to the advanced－function setting level，refer to Section 5．2 Moving among Levels．

C．Press the key several times until parameter ＂ $5-\leq \pi-"$ appears on the main indicator．


D．Press the $\gg$ key to display the set value of parameter＂5－！ラー＂on the main indicator．

－The current set value of the startup compensation timer will appear on the main indicator．

E．Press the $\gg$ key again．
－The set value will start blinking，indicating the product is in the change state．

F．Use the $\gg$ and $\widehat{\wedge}_{\text {／zeo }}$ keys to change the set value．

G．Press the $\sigma$ key to go to the next parameter．

－The change is saved．
H．Press the $\square$ key and hold it down for at least one second to return to the initial setting level．

I. Press the $\square$ key and hold it down for at least one second to return to the operation level.

## 5．23 Changing the Display Color

## Advanced－function setting level

Ealar
This parameter allows you to change the display color of the main indicator．

| Parameter | Set value | Description |  |
| :---: | :---: | :---: | :---: |
| Eabr | Ernor | Green - red: | The display color is normally green，and changes to red at comparative output ON． |
|  | Lirn | Green： | The display color is always green． |
|  | －Ed－E | Red－green： | The display color is normally red，and changes to green at comparative output ON． |
|  | red | Red： | The display color is always red． |

For details，refer to Section 6．10 Display Color Change．

## Procedure

A．When the product is at the operation level， press the $\square$ key and hold it down for at least three seconds to enter the initial setting elvel．

－＂ 5 ＂will appear on the level indicator，indicating the product has entered the initial setting level．

B．Press the $冖$ key several times until parameter ＂Rinau＂is displayed，and then enter password ＂－0169＂．

－＂F＂will appear on the level indicator，indicating the product has entered the advanced－function setting level．
－For details on how to move to the advanced－function setting level，refer to Section 5．2 Moving among Levels．

C．Press the key several times until parameter ＂配品＂appears on the main indicator．


D．Press the $\gg$ key to display the set value of parameter＂Lar＂on the main indicator．

－The current set value of the display color will appear on the main indicator．

E．Press the $\gg$ key again．

－The set value will start blinking，indicating the product is in the change state．

F．Use the $\widehat{\lambda}_{\text {／zeeo }}$ key to change the set value．


G．Press the key to go to the next parameter．

－The change is saved．
H．Press the $\square$ key and hold it down for at least one second to return to the initial setting level．


1 sec ．
I. Press the $\square$ key and hold it down for at least one second to return to the operation level.

### 5.24 Changing the Display Auto-return Time

## Advanced-function setting level

res

## TIPS

If the display auto-return function is activated in the middle of parameter setting, the product saves the current value of the parameter and then returns to the current value display mode.

This parameter allows you to change the display auto-return time.

| Parameter | Set value | Description |
| :---: | :---: | :---: |
| ret | $\square$ | 0 second: Display auto-return is not available. |
|  | 1~99 | 1 to 99 seconds: Display auto-return time |

If no key is operated for a prescribed time, the product returns to the current value display mode at the operation level.
This prescribed time is called the display auto-return time.

## Procedure

A. When the product is at the operation level, press the $\square$ key and hold it down for at least three seconds to enter the initial setting level.


- " 5 " will appear on the level indicator, indicating the product has entered the initial setting level.
B. Press the key several times until parameter "月ña" is displayed, and then enter password "-0169".

- "F" will appear on the level indicator, indicating the product has entered the advanced-function setting level.
- For details on how to move to the advanced-function setting level, refer to Section 5.2 Moving among Levels.
C. Press the key several times until parameter "rEL" appears on the main indicator.

D. Press the $\gg$ key to display the set value of parameter "rEL" on the main indicator.
- The current set value of the display auto-return time will appear on the main indicator.
E. Press the $\gg$ key again.
- The set value will start blinking, indicating the product is in the change state.
F. Use the $>$ and $\widehat{\wedge}_{\text {/zeeo }}$ keys to change the set value.
G. Press the key to go to the next parameter.

- The change is saved.
H. Press the $\square$ key and hold it down for at least one second to return to the initial setting level.
I. Press the $\square$ key and hold it down for at least one second to return to the operation level.


## 5．25 Changing the Move－to－Protect－Level Time

## Advanced－function setting level

This parameter allows you to change the move－to－protect－level time．

| Parameter | Set value | Description |
| :---: | :---: | :---: |
| $P r \boldsymbol{I}$ | $\boldsymbol{a} \sim \mathbf{I}$ | 0 to 19 seconds：Move－to－protect－level time |

If you press the $\square+\square$ keys simultaneously and hold them down for a prescribed time（default： 5 seconds），the product enters the protect level．
This prescribed time is called the move－to－protect－level time．
Depending on the setting of the parameter，the product moves from the operation level to the protect levels as follows．


## Procedure

A move－to－protect－level time setting of＂ 0 ＂is assumed to be a setting of＂ 1 ＂．

A．When the product is at the operation level， press the $\square$ key and hold it down for at least three seconds to enter the initial setting level．

－＂ 5 ＂will appear on the level indicator，indicating the product has entered the initial setting level．

B．Press the key several times until parameter ＂月ーロール＂is displayed，and then enter password ＂－0169＂．

－＂F＂will appear on the level indicator，indicating the product has entered the advanced－function setting level．
－For details on how to move to the advanced－function setting level，refer to Section 5．2 Moving among Levels．

C．Press the key several times until parameter ＂Pr－t：＂appears on the main indicator．


D．Press the $\gg$ key to display the set value of parameter＂Pr－Lt＂on the main indicator．

－The current set value of the move－to－protect－level time will appear on the main indicator．

E．Press the $\gg$ key again．

－The set value will start blinking，indicating the product is in the change state．

F．Use the $\gg$ and $\widehat{\wedge}_{\text {／zeo }}$ keys to change the set value．

G. Press the key to go to the next parameter.

- The change is saved.
H. Press the $\square$ key and hold it down for at least one second to return to the initial setting level.

I. Press the $\square$ key and hold it down for at least one second to return to the operation level.


### 5.26 Changing the Send Waiting Time

## Advanced-function setting level

5des
(SDWT)

This parameter allows you to change the send waiting time.

| Parameter | Set value | Description |
| :---: | :---: | :---: |
| Sdelt | 0 ~ 99 | 0 to 99 milliseconds: Send waiting time |

The send waiting time is the time between reception of a command frame from the host PC and return of a response frame to the host PC.
To optimize the responsivity, you should set the send waiting time somewhat longer than the processing time that is required for the host PC to be ready for reception of a response frame after it sends a command frame.


Procedure
A. When the product is at the operation level, press the $\square$ key and hold it down for at least three seconds to enter the initial setting level.


- "5" will appear on the level indicator, indicating the product has entered the initial setting level.
B. Press the key several times until parameter "䛧品" is displayed, and then enter password "-0169".

- "F" will appear on the level indicator, indicating the product has entered the advanced-function setting level.
- For details on how to move to the advanced-function setting level, refer to Section 5.2 Moving among Levels.
C. Press the key several times until parameter "5d'L" appears on the main indicator.

D. Press the $\gg$ key to display the set value of parameter " $5 \sigma^{\prime \prime}: 5$ " on the main indicator.

- The current set value of the send waiting time will appear on the main indicator.
E. Press the $\gg$ key again.

- The set value will start blinking, indicating the product is in the change state.
F. Use the $>$ and $\widehat{\wedge}_{\text {zero }}$ keys to change the set value.
G. Press the key to go to the next parameter.
- The change is saved.
H. Press the $\square$ key and hold it down for at least one second to return to the initial setting level.
I. Press the $\square$ key and hold it down for at least one second to return to the operation level.


## CHAPTER

## 6 <br> FUNCTION DESCRIPTION

## This chapter describes available functions of the product.

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### 6.1 Measurement

## Analog Input Signal



- Input signals are sampled in synchronization with internal timings generated at intervals of 250 ms .
- The input signal is scaled and the process value is updated according to the scaling result. The updated process value is displayed on the main indicator.
- Comparative output is provided based on the process value.
- The process value and comparative output are updated per sampling.


## Pulse Input Signal



- When the input pulse frequency is 4 Hz or more, it is measured in synchronization with internal timings generated at intervals of 250 ms .
- The input pulse frequency is scaled and the process value is updated according to the scaling result. The updated process value is displayed on the main indicator.
- Comparative output is provided based on the process value.
- The process value and comparative output are updated at intervals of 250 ms .
- When the input pulse frequency is less than 4 Hz , it is measured with pulse input timings; the intervals at which the process value and comparative output are updated lengthen in accordance with the decreasing input pulse frequency.


## ■ Digital Data from PLC/PC



When the product is used as a remote indicator, the host PC not only provides logging of measured data and remote control to the product but also acts as input equipment for the product. The product performs measurement, scaling and comparative output processing.

The product measures serial data as follows.


- Data from the host PC is stored with timings of data transmission. When new data is received, old data is replaced with the new one.
- Stored data is fetched as input values in synchronization with internal timings generated at intervals of 250 ms , irrespective of timing signals received from the host PC.
- The input value is scaled and the process value is updated according to the scaling result. The updated process value is displayed on the main indicator.
- Comparative output is provided based on the process value.
- The process value and comparative output are updated with internal timings generated at intervals of 250 ms .


### 6.2 Scaling

Scaling is to convert sampled input values to process values in sequence using a predetermined scaling formula.


Scaling allows conversion of input values to process values in easy-to-understand notation.

## Scaling Formula for Analog Input and Digital Data

The scaling formula for analog input and digital data is as follows.

$$
d s p=\frac{D S P 2-D S P 1}{I N P 2-I N P 1} \operatorname{inp}+\frac{I N P 1 \cdot D S P 2-I N P 2 \cdot D S P 1}{I N P 2-I N P 1}
$$

Where;
INP1: Input value
DSP1: Process value corresponding to input value INP1
INP2: Input value
DSP2: Process value corresponding to input value INP2
inp: Input value sampled
dsp: Process value corresponding to inp
Enter INP1, DSP1, INP2 and DSP2 to specify the scaling factor.
This way of specifying the scaling factor permits flexible scaling; inverse scaling where the process value decreases with the increasing input value is also possible.


For details on how to specify the scaling factor, refer to Section 5.11 Specifying the Scaling Factor for Analog Input/Digital Data Display.

## Scaling Formula for Pulse Input

TIPS
Unit conversion $\mathrm{rps}=\mathrm{rpm} / 60$


## TIPS

Unit conversion
$\mathrm{m} / \mathrm{s}=(\mathrm{m} / \mathrm{min}) / 60$
$\mathrm{mm} / \mathrm{s}=\{(\mathrm{m} / \mathrm{min}) \times 1000\} / 60$

$$
d s p=\frac{D S P}{I N P} i n p
$$

Where;
INP: Input pulse frequency ( Hz )
DSP: Process value corresponding to input pulse frequency INP
inp: Input pulse frequency sampled (Hz)
dsp: Process value corresponding to inp

Enter INP and DSP to specify the scaling factor.


Conversion of the input pulse frequency to the rotational speed involves the following scaling formula.

$$
d s p(\mathrm{rpm})=\frac{60}{P} \operatorname{inp}
$$

Where;
P: Number of pulses per rotation
The scaling formula for pulse input is as follows.
inp: Input pulse frequency $(\mathrm{Hz})$
dsp: Rotational speed (rpm)

Conversion of the input pulse frequency to the circumferential speed involves the following scaling formula.

$$
d s p(\mathrm{~m} / \mathrm{min})=\pi \cdot R \cdot \frac{60}{P} \mathrm{inp}
$$

Where;
$\pi$ : $\quad$ Circular constant
P: $\quad$ Number of pulses per rotation
R: Diameter of rotator (m)
inp: Input pulse frequency $(\mathrm{Hz})$
dsp: Circumferential speed (m/min)

### 6.3 Auto-zero/Startup Compensation

## Auto-zero

The product has an input-pulse frequency range of 0.05 to 30 Hz or 0.1 to 5 kHz , and hence the maximum interval between pulses is 20 seconds.
This means that the product may provide a lower-limit action signal as late as a maximum of 20 seconds after receiving the last pulse, which results in a poor responsivity for the lower-limit action.


To eliminate such a situation, the product has an auto-zero function that shifts the input pulse frequency to zero forcedly when no pulse is received for a predetermined time.
This function improves the product responsivity for the lower-limit action.
The time between reception of the last pulse and zero-shifting of the input pulse frequency is called the auto-zero time. The auto-zero time can be specified using the "auto-zero time" parameter.
Specify the auto-zero time somewhat longer than the expected longest interval between input pulses.

## ■ Startup Compensation

The product has a startup compensation timer that prevents measurement for a predetermined time after power-on.
This function is useful in keeping the product in wait state until a rotator reaches the steady-state speed.
The time between power-on the product and the start of measurement can be specified using the "startup compensation time" parameter.


### 6.4 Average Processing

This function averages a specified number of measurements.
It is useful for preventing readouts from fluctuating due to unstable input.


The average processing of the product provides a simple average (an arithmetic mean).
The number of measurements for averaging that can be specified is as follows.

- No average processing (the number of measurements for averaging: 1)
- 2
- 4
- 8

The number of measurements for averaging is the number of times the process value is updated as described in Section 6.1.
The following shows the relationship between the number of measurements for averaging and the interval at which the process value and comparative output are updated.

- Analog signal input/Digital data from PC/PLC

| Number of measurements for averaging | Update interval |
| :---: | :---: |
| No average processing | 250 ms |
| 2 | 500 ms |
| 4 | 1 second |
| 8 | 2 seconds |

- Pulse frequency

| Number of <br> measurements for <br> averaging | Update interval |  |
| :---: | :---: | :---: |
|  | Input pulse frequency $\geq 4 \mathrm{~Hz}$ | Input pulse frequency $<4 \mathrm{~Hz}$ |
| 2 | 250 ms | Every input pulse |
| 4 | 500 ms | Every 2 input pulses |
| 8 | 1 second | Every 4 input pulses |
| 2 | 2 seconds | Every 8 input pulses |



### 6.5 Event Input/Pulse Input

## Minimum Pulse Width

Terminal (3) acts as the event input terminal when the input type is set to "analog" or "remote" and as the pulse input terminal when the input type is set to "pulse".
The event input terminal can be assigned the task of "process value hold" or "forced-zero". This assignment depends on setting of the "event input" parameter at the advanced-function setting level.


The minimum pulse width of ON/OFF signals recognizable to the product varies between the event and pulse inputs.

- For event input

When terminal (3) is used for event input, chattering noise is removed from input signals and therefore devices of contact output type can be connected to the terminal.
The chattering noise removal processing suppresses signal fluctuations that occur within 30 to 40 ms after the input signal turns on or off.
Both ON and OFF pulses must therefore have at least 40 ms in width.


- For pulse input

When terminal (3) is used for pulse input, devices of low-speed contact output type or high-speed transistor output type can be connected to the terminal depending on parameter setting.
When using a device of low-speed contact output type, set the input pulse frequency to " 30 Hz ". In this case, chattering noise is removed and accordingly both ON and OFF pulses must have at least 15 ms in width.
When using a device of high-speed transistor output type, set the input pulse frequency to " 5 kHz ". In this case, both ON and OFF pulses must have at least $90 \mu \mathrm{~s}$ in width.


### 6.6 Process Value Hold

## Tips

The "process value hold" function is available only when the input type is set to "analog" or "remote" and terminal (3) is assigned the task of "process value hold".

This function detects the process value at the instant when the event input turns on, and holds the value as long as the event input is on.
It can be used to hold the process value detected when a failure occurs.
"Process value hold" takes place via the event input terminal.
The following illustrates the "process value hold" operation.


- When the event input (HOLD) turns on, the process value is detected and held.
- If the input value changes, the process value continues to be held as long as the event input is on.
- When the event input (HOLD) turns off, the "process value hold" function is canceled and the display returns to the current value.


### 6.7 Forced-zero

## Note

The forced-zero function is not available when the input type is set to "pulse". Key entry for the forced-zero operation is also ignored.

## TIPS

The forced-zero function is available via the event input terminal only when the input type is set to "analog" or "remote" and terminal (3) is assigned the task of "forced-zero execution".

This feature shifts a process value to zero, and can be used to evaluate and display the deviation of a process value from a reference value.
The forced-zero function can be activated by using the $\mathrm{T}_{\text {/zero }}$ key on the front panel, via the event input terminal, or communications
The following illustrates the forced-zero and forced-zero cancel operation.


- When ZERO input turns on, the current process value is shifted to zero forcedly.
- Thereafter, measurements are made relative to the zero point.
- When ZERO input turns on while the forced-zero function has been activated, the current process value is further shifted to zero.
- When ZERO input is on for one second, the forced-zero operation is canceled.

Because the forced-zero and forced-zero cancel operation using the $\mathrm{N}_{\text {/zero }}$ key is stored in EEPROM, the forced-zero state is alive even if the power is turned off and on again.
In contrast, the forced-zero and forced-zero cancel operation via event input terminal is not stored in EEPROM.

If the forced-zero operation is executed via the event input terminal after it is activated by key entry, the forced-zero operation via the event input terminal takes effect.


The forced-zero cancel operation is ignored if the forced-zero function has already been deactivated.

### 6.8 Comparative Output

Comparative outputs 1 and 2 can be produced as three types of action signals: upper-limit action signal, lower-limit action signal, and outside-the-range action signal.

Upper-limit
Action
Upper-limit
Action

Lower-limit Action

Comparative output turns on when the process value reaches the OUT set value.
Comparative output turns off when the process value decreases to (OUT set value - hysteresis).


Comparative output turns on when the process value decreases to the OUT set value.
Comparative output turns off when the process value reaches (OUT set value + hysteresis).


Comparative output turns on when the process value reaches the OUT upper-limit value or decreases to the OUT lower-limit value.
Comparative output turns off when the process value falls inside the range of (OUT upper-limit value - hysteresis) to (OUT lower-limit value + hysteresis).

Combinations of comparative outputs 1 and 2 offer the possibility of producing a wide variety of actions including upper-limit + another upper-limit actions, lower-limit + another lower-limit actions, and two-level outside-the-range actions.


### 6.9 Hysteresis

In this manual, hysteresis refers to a range that is provided above or below an OUT set value in order to avoid comparative output from turning off unless the process value falls outside the range, once the comparative output has turned on at the OUT set value.
Specifying the hysteresis suppresses chattering of comparative output caused by fluctuations of the process value in the vicinity of the OUT set value.


Comparative output ON/OFF conditions are as follows.

- Upper-limit action

ON: Process value $\geq$ OUT set value
OFF: Process value $\leq$ OUT set value - Hysteresis

- Lower-limit action

ON: Process value $\leq$ OUT set value
OFF: Process value $\geq$ OUT set value + Hysteresis

Set the hysteresis to a value ranging from 1 to 9999 at the advanced-function setting level.
For the procedure for hysteresis setting, refer to Section 5.19 Specifying the Hysteresis.

### 6.10 Display Color Change

The display color of the main indicator can be changed.
This feature can be used to vary the display color of the gang-mounted products depending on their importance or to give greater prominence to indications on the main indicator of certain products in an emergency.


Four display color change options are available.
Green to red: The display color of the main indicator is green when both of comparative outputs 1 and 2 is off, and changes to red when either of the comparative outputs turns on.
Always green: The display color is always green.
Always red: The display color is always red.
Red to green: The display color is red when both of comparative outputs 1 and 2 is off, and changes to green when either of the comparative outputs turns on.

Select one among these options at the advanced-function setting level.
For the procedure for programming of display colors, refer to Section 5.22 Changing the Display Color.

## CHAPTER

## 7

## COMMUNICATIONS

This chapter describes commands and responses conforming to the CompoWay/F serial communication format and how to control the product by the host PC via communications.
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### 7.1 Communication Protocols

## ■ CompoWay/F Communication Protocol

## TIPS

The program for communications is created on the host PC, and K3GN's parameters are monitored or set from the host PC. In this manual, consequently, an explanation for communications is given from the standpoint of the host PC.

CompoWay/F is an OMRON's standard communication format for general serial communications. It uses a standard frame format as well as FINS commands that have been proven in data exchange between OMRON's programmable logic controllers. The CompoWay/F format facilitates serial communications between components or a PC and components.

FINS (Factory Interface Network Service)
FINS is a protocol for message communications between controllers in OMRON FA networks.

## Communication Specification

| Transmission line connection: | Multipoint |
| :--- | :--- |
| Communications method: | Two-wire, half-duplex |
| Synchronization method: | Start-stop synchronization |
| Baud rate: | $1,200,2,400,4,800,9,600$, or 19.200 bps |
| Communication code: | ASCII |
| Word length: | 7 or 8 bits |
| Stop bit length: | 1 or 2 bits |
| Parity check: | Vertical parity - Non, Odd, or Even |
|  | BCC (block check character) |
|  | Start-stop synchronization data composition |
| Flow control: | Non |
| Interface: | RS-485 |
| Retry function: | Non |

## Transmission Procedure

Comminations between the product and the host PC are implemented on a frame-by-frame basis.
When the host PC sends a command frame to the product, the product returns to the host PC a response frame that corresponds to the command frame.
Command and response frames are transmitted as follows.

Host PC


### 7.2 Data Format Structure

Comminations conforming to the CompoWay/F serial communication format involve transmission of blocks of data that are called frames. Those sent from the host PC are command frames and those from the product are response frames.
The structure of these frames is shown below.

In the following frame description, suffix H added to a numeric value, as in 02 H , means the value is a hexadecimal number. And double quotation marks in which an alphanumeric value is enclosed, as in " 00 ", mean that the value is an ASCII character set.

The number underneath each delimiter in a frame indicates the number of bytes.

## Command Frame



| STX | Code indicating the start of a command frame (02H). <br> Be sure to place this code in the first byte of a command <br> frame. |
| :---: | :--- |
| Node No | Node ID specifying the destination of a command frame. <br> Set this No. to the "unit No." of the product. <br> If you want to broadcast a command, set this No. to "XX". <br> Note that, in this case, no response is given from the <br> products. |
| Sub-address | Not used for K3GN. Always set the sub-address to "00". |
| SID <br> (Service ID) | Not used for K3GN. Always set the SID to "0". |
| Command text | Command text |
| ETX | Code indicating the end of text (03H) <br> BCCBlock check character. <br> The result of block check on the BCC calculation range is <br> stored in this filed. |

## TIPS

How to determine BCC: BCC is determined by XOR operation, on a byte-by-byte basis, of the values within the range from the Node No. field to the ETX field. The result ( 36 H in the example shown right) is placed in the BCC field.

$\oplus$ : XOR (exclusive OR) operation

## Response Frame

| STX | Node No. | Sub-address | End code | Response text |  | ETX |  | BCC |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $02 H$ |  | $" 00 "$ |  |  | 03 H |  |  |  |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 byte |  |  |

The product does not respond to such a command frame that does not end in ETX and BCC characters.

| STX | Code indicating the start of a response frame (02H). <br> Be sure to place this code in the first byte of a response <br> frame. |
| :---: | :--- |
| Node No | The Node No. is set to the value that was specified in the <br> corresponding command frame. <br> The unit No. of the product that returns the response is set in <br> this field. |
| Sub-address | Not used for K3GN. This field is always set to "00". |
| End code | This field contains the result of execution of the correspond- <br> ing command frame. |
| Response text | Response text |
| ETX | Code indicating the end of text $(03 \mathrm{H})$ |
| BCC | Block check character. <br> The result of block check on the BCC calculation range is <br> stored in this field. |

- End code

| End <br> code | Code name | Description |
| :---: | :--- | :--- |
| $" 11 "$ | Framing error | A framing error the stop bits represented 0) <br> occurred in one of the characters received. |
| $" 10 "$ | Parity error | The sum of the bits of "1" in the received data <br> does not match the specified number. |
| $" 12 "$ | Overrun error | An attempt was made to transfer new data when <br> the buffer was full. |
| $" 18 "$ | Frame length error | The size of the received frame exceeded the <br> specified number of bytes. |
| $" 13 "$ | BCC error | The received BCC was different from the <br> calculated BCC. |
| $" 16 "$ | Sub-address error | - No sub-address, SID, and command text. <br> This error is not covered by the echoback test. <br> - The size of the sub-address was less than two <br> characters, and no SID and command text were <br> found. |
| " $14 "$ | Format error | The command text contains characters other <br> than "0 thru "9" and "A" thru "F". <br> Echoback Test excepted. (See Echoback Test <br> for details.) <br> - No SID and command text. <br> - MRC and SRC in the command text were not <br> included in the command text.. |
| $" 0$ "" | FINS command <br> error | The specified FINS command could not executed. <br> (The FINS response code may provide a <br> suggestion about the reason of the failure in <br> command execution.) |
| " $00 "$ | Normal completion | The command was successfully executed. |

### 7.3 Structure of Command/Response Text

The command/response text constitutes the main body of a command/response frame.

The structure of the command/response text is as follows.

## Command Text

## Response Text

The command text consists of MRC (Main Request Code) and SRC (Sub Request Code) followed by the required data.


The response text consists of MRC and SRC followed by MRES (Main Response Code) and SRES (Sub Response Code) and the required data.


If the product fails to execute a specified command, it generates a response consisting of MRC/SRC and MRES and SRES only.

- List of services

| MRC | SRC | Service name | Description |
| :---: | :---: | :--- | :--- |
| $" 01 "$ | $" 01 "$ | Read from variable area | This service reads from the variable <br> area. |
| $" 01 "$ | $" 02 "$ | Write to variable area | This service writes to the variable <br> area. |
| $" 05 "$ | $" 03 "$ | Read controller attribute | This service reads the model No. and <br> the communications buffer size. |
| $" 06 "$ | $" 01 "$ | Read controller status | This service reads the run status of the <br> controller. |
| $" 08 "$ | $" 01 "$ | Echoback test | This service carries out the echoback <br> test. |
| $" 30 "$ | $" 05 "$ | Operation instructions | This service carries out forced-zero <br> (cancel) operation, etc. |

### 7.4 Variable Area

A section of memory in the product that holds data to be transmitted is called the variable area.

The variable area is used for reading of current process values or reading/writing of various parameters.


In contrast, the variable area is not used for operation instructions or reading of controller attributes.

To specify the position of a variable in the variable area, use a variable type and an address.

Append to each variable type an access-size-based address that is expressed in 2-byte hexadecimal code
A variable has an eight-digit value in hexadecimal. A negative variable is expressed in two's complement. When the current value of a variable is read as 165.5 on the main indicator of the product, for example, its hexadecimal notation is 0000041 AH (the decimal point is ignored; $105.0 \rightarrow 1050 \rightarrow 0000041 \mathrm{AH}$ ), and the variable is read in this form.



The variable area is mapped as follows. The variable type is converted to a 2-byte ASCII code and loaded to the frame. Available variable types are also shown below.
Variable type C0: Read-only data including process values and status
Variable type C1: Protect level parameters
Variable type C2: Operation level parameters (OUT set values and remote input values)
Variable type C3: Initial setting, communication setting, and advanced-function setting level parameters

### 7.5 Read from Variable Area

This service reads data from the variable areas.

## Command

## Response

Command text


| Item | Description |
| :--- | :--- |
| MRC/SRC | Set these items to "01"/"01" ("Read from Variable Area" <br> service). |
| Variable type | Set this item to one among "C0" thru "C3". |
| Read start address | Specify the read start address at this field. |
| Bit position | Not used for K3GN. Always set this item to "00". |
| No. of elements | Set this item to the quantity of variables that are to be read <br> (up to 10). |

Response text


| Item | Description |
| :--- | :--- |
| MRC/SRC | This field contains the same value ("01"/"01") as specified <br> in the command text. |
| Response code | This field contains the result of execution of the command. |
| Data to be read | This field contains the data that is read and to be read. |

Response codes

| Response <br> code | Code name | Description |
| :---: | :--- | :--- |
| $" 1001 "$ | Command length over | The command is too long. |
| $" 1002 "$ | Command length short | The command is too short. |
| $" 1101 "$ | Area type error | The specified variable type is invalid. |
| $" 1103 "$ | Start address <br> out-of-range error | The specified start address is outside the <br> valid range. |
| $" 110 \mathrm{~B} "$ | Response length over | The No. of elements exceeds 10. |
| $" 1100 "$ | Parameter error | The bit position is set to a value other than <br> "00". |
| $" 2203 "$ | Operation error | EEPROM error |
| $" 0000 "$ | Normal completion | The command was successfully executed. |

### 7.6 Write to Variable Area

This service writes data to the variable area.

## Command

Command text


| Item | Description |
| :--- | :--- |
| MRC/SRC | Set these items to "01"""02" ("Write to Variable Area" <br> service). |
| Area type | Set this item to one among "C1" thru "C3". |
| Write start address | Specify the write start address at this field. |
| Bit position | Not used for K3GN. Always set this item to "00". |
| No. of elements | Set this item to the quantity of variables that are to be <br> written (up to 10). |
| Data to be written | Place the desired data in this field. |

## Response

Response text


| Item | Description |
| :--- | :--- |
| MRC/SRC | This field contains the same value ("01"/"02") as <br> specified in the command text. |
| Response code | This field contains the result of execution of the <br> command. |

Response codes

| Response <br> code | Code name | Description |
| :---: | :--- | :--- |
| $" 1002 "$ | Command length short | The command is too short. |
| $" 1101 "$ | Area type error | The specified variable type is invalid. |
| $" 1103 "$ | Start address error | The specified start address is outside the valid range. |
| $" 1104 "$ | End address error | The specified start address is outside the valid range. |
| $" 1003 "$ | Data quantity mismatch <br> error | A mismatch between the No. of elements and the quantity of <br> variables occurs. |
| $" 1100 "$ | Parameter error | - The bit position is set to a value other than "00". <br> • The value of data to be written is outside the valid range. |
| $" 3003 "$ | Read only error | An attempt is made to write data to an address of variable type C0. |
| $" 2203 "$ | Operation error | - Communication writing is disabled. <br> - An attempt is made to write data from setting area 0 to setting <br> area 1. <br> - An attempt is made to write a protect level parameter at a level <br> other than protect level. <br> - An attempt is made to write data to an address of variable type <br> C3 at the calibration level. <br> - An error occurs in EEPROM. |
| $" 0000 "$ | Normal completion | The command was successfully executed. |

### 7.7 Operation Instructions

Command

Response

To issue an operation instruction to the product, set the items in the command text as follows.

Command text


| Item | Description |
| :--- | :--- |
| MRC/SRC | Set these item to "30"/"05" (Operation Instruction service). |
| Instruction code | Place an instruction code in this field. |
| Related information | Place information related to the operation instruction in this <br> field. |

Instruction codes

| Instruction <br> code | Operation | Related information |
| :---: | :--- | :--- |
| $" 00 "$ | Communication writing | $" 00 ":$ Off (disable) |
|  |  | $" 01 ":$ On (enable) |
| $" 03 "$ | Forced-forced-zero <br> execution/ <br> Forced-zero cancel | $" 00 ":$ Cancel |
| $" 01 ":$ Execute |  |  |
| $" 06 "$ | Software reset | $" 00 "$ |
| $" 07 "$ | Move to setting area 1 | $" 00 "$ |
| $" 08 "$ | Move to protect level | $" 00 "$ |

Response text


| Item | Description |
| :--- | :--- |
| MRC/SRC | This field contains the same value ("30"/"05") as specified <br> in the command text. |
| Response code | This field contains the result of execution of the command. |

Response codes

| Response <br> code | Code name | Description |
| :---: | :--- | :--- |
| $" 1001 "$ | Command length over | The command is too long. |
| $" 1002 "$ | Command length short | The command is too short. |
| $" 1100 "$ | Parameter error | The instruction code or related information <br> is invalid. |
| $" 2203 "$ | Operation error | - Communication writing is disabled. <br> - The specified operation cannot be <br> executed. <br> For details, refer to Section 7.9 <br> Commands and Responses. |
| $" 0000 "$ | Normal completion | An error occurs in EEPROM. <br> The command was successfully executed. |

### 7.8 Setting Areas

The K3GN series of products can assume two states that are refereed to as setting area 0 and setting area 1 in this manual.

In setting area 0 , the product is carrying out a measurement.
In this state, you can therefore perform such operations that are permitted only during measuring, or that cause no trouble even if a measurement is in progress. These operations include "process value reading", "parameter writing" and "forced-zero execution".
On the contrary, this state prohibits such operations that exert an effect on measurement in progress, including "parameter writing at the initial setting level" (parameter reading is always allowed).

In setting area 1 , measurement is suspended.
In this state, you can therefore perform such operations that are not allowed in setting area 0 . These operations include "parameter writing at the initial setting, communication setting, and advanced-function setting levels".

At power-on, the product is in setting area 0 . To move to setting area 1 , use the "move-to-setting area 1 " instruction. To return to setting area 0 , power the product off and on again, or use the "software reset" instruction.

The figure on the right shows the setting areas and the levels contained in each setting area.

A transition to the initial setting level by key operation implies a transition from setting area 0 to setting area 1 . This enables the host PC to operate the product in setting area 1.
A transition to setting area 1 by remote control from the host PC causes the level indicator on the front panel to indicate the product is at the initial setting level. To return to the operation level, use the $\square$ key.


* At the calibration level, the product refuses control from the host PC.


### 7.9 Commands and Responses

Various commands for application layer are available for implementing the services, such as "variable area read/write" and "operation instructions", offered by the CompoWay/F communication format.

This section contains description of the available commands for the application layer.

## Read Process Value

| Variable |  |  |  | Bit |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| MRC | SRC |  | type | Address | position |  | No. of elements |
| $" 01 "$ | $" 01 "$ | $" C 0 "$ | $" 0001 "$ | $" 00 "$ | $" 0001 "$ |  |  |

This command reads the current process value.
Use this command when the product is in setting area 0 .
(If the product is in setting area 1 when receiving the command, it returns a response with the "unknown" current value data).

| MRC | SRC |  | Response code | Data |
| :---: | :---: | :---: | :---: | :---: |
| $" 01 "$ | $" 01 "$ | "0000" | Process value |  |

Response code: The code shown above represents normal completion. For details on the response code, refer to Section 7.5 Read from Variable Area .

## Read Status

## Command

|  | Variable |  |  |  | Bit |
| :---: | :---: | :---: | :---: | :---: | :---: |
| MRC | SRC | type | Address | position |  |
| No. of elements |  |  |  |  |  |

This command reads the status of comparative outputs or the like.
Use this command when the product is in setting area 0 .
(If the product is in setting area 1 when receiving the command, it returns a response with the "unknown" status data).

## Response

| MRC | SRC | Response code |  | Data |
| :---: | :---: | :---: | :---: | :---: |
| "01" | "01" | "0000" | Status |  |

For details on the status, refer to Section 7.10 Variable Area Map.

Response code: The code shown above represents normal completion. For details on the response code, refer to Section 7.5 Read from Variable Area .

## Read Remote Input Value

| MRC | SRC | Variable type | Address | Bit position | No. of elements | Data |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| "01" | "02" | "C2" | "0000" | "00" | "0001" | Remote input value |

This command supplies an input value to the product that is used as a digital data display for PLC/PC.
Use this command when the product is in setting area 0 .
(If the product is in setting area 1 when receiving the command, no change occurs on the main indicator as measurement is suspended).
Before issuing the command, use an operation instruction to enable "communication writing".

| MRC | SRC | Response code |
| :---: | :---: | :---: |
| $" 01 "$ | "02" | "0000" |

Response code: The code shown above represents normal completion. For details on the response code, refer to Section 7.6 Write to Variable Area .

## Read OUT Set Value

## Command



| Address | Parameter |
| :---: | :---: |
| "0001" | OUT1 value |
| $" 0002 "$ | OUT1 upper-limit value |
| $" 0003 "$ | OUT1 lower-limit value |
| $" 0004 "$ | OUT2 value |
| $" 0005 "$ | OUT2 upper-limit value |
| $" 0006 "$ | OUT2 lower-limit value |

This command reads an OUT set value.
(Even if the type of the OUT set value is "upper" or "lower", OUT upper and lower-limit values can be read. Even if the type of the OUT set value is "upper/lower", an OUT set value can be read).

## Response

| MRC |  | SRC | Response code |  |
| :---: | :---: | :---: | :---: | :---: |
| "01" | "01" | "0000" | ,$\ldots$, Threshold |  |
| 1 |  |  |  |  |

Response code: The code shown above represents normal completion. For details on the response code, refer to Section 7.5 Read from Variable Area .

## Write OUT Set Value

Command

| Address | Parameter |
| :---: | :---: |
| "0001" | OUT1 value |
| "0002" | OUT1 upper-limit value |
| "0003" | OUT1 lower-limit value |
| "0004" | OUT2 value |
| "0005" | OUT2 upper-limit value |
| "0006" | OUT2 lower-limit value |

This command writes an OUT set value.
It can be used when the product is in either setting area 0 or 1 .
(Even if the type of the OUT set value is "upper" or "lower", OUT upper and lower-limit values can be written. Doing so exerts no effect on comparative output. Likewise, even if the type of the OUT set value is "upper/lower", an OUT set value can be written).
If you want to write both OUT1 and OUT2 values at a time, use block access to the variable area. For details, refer to the tip shown in Section 7.10 Variable Area Map.
Before issuing the command, use an operation instruction to enable "communication writing".

| MRC | SRC | Response code |
| :---: | :---: | :---: |
| $" 01 "$ | "02" | "0000" |

Response code: The code shown above represents normal completion. For details on the response code, refer to Section 7.6 Write to Variable Area .

## Read Parameter

## Command

| MRC | SRC | Variable type | Address | $\begin{gathered} \text { Bit } \\ \text { position } \end{gathered}$ | No. of elements |
| :---: | :---: | :---: | :---: | :---: | :---: |
| "01" | "01" |  |  | "00" | "0001" |


| Variable type | Address | Parameter |
| :---: | :---: | :---: |
| "C1" | "0000" to "0003" | Protect level parameters |
| "C3" | "0000" to "000B" | Initial setting level parameters |
|  | "000C" to "0010" | Communication setting level parameters |
|  | "0011" to "001D" | Advanced-function setting level parameters |

This command reads a parameter.
For details on how to specify the variable type and the address, refer to Section 7.10 Variable Area Map.

This command can be used when the product is in either setting area 0 or 1 .
("Analog range", "input pulse frequency", "scaling input values 1 and 2 ", "scaling display values 1 and 2 ", "scaling input value", and "scaling display value" can be read, irrespective of input type setting).

| MRC | SRC | Response code |  | Data |
| :---: | :---: | :---: | :---: | :---: |
| "01" | "01" | "0000" | Parameter |  |

Response code: The code shown above represents normal completion. For details on the response code, refer to Section 7.5 Read from Variable Area .

## ■ Write Protect Level Parameter

Command


| Address | Parameter |
| :---: | :---: |
| "0000" | Operation/adjustment lockouts |
| "0001" | Initial setting/communication lockouts |
| "0002" | Setting change lockout |
| "0003" | Forced-zero lockout |

This command writes a protect level parameter.
Use this command when the product is in setting area 0 . If the product is in setting area 1 when receiving the command, it returns an error.
Before issuing the command, use operation instructions to enable "writing" and to enter the protect level.

Response

| MRC | SRC | Response code |
| :---: | :---: | :---: |
| "01" | "02" | "0000" |

Response code: The code shown above represents normal completion. For details on the response code, refer to Section 7.6 Write to Variable Area .

## Write Parameter (Setting Area 1)

| MRC | SRC | Variable type | Address | $\begin{gathered} \text { Bit } \\ \text { position } \end{gathered}$ | No. of elements | Data |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| "01" | "02" | "C3" |  | "00" | "0001" | Parameter (setting area 1) |


| Address | Parameter |
| :---: | :---: |
| "0000" to "000B" | Initial setting level parameters |
| "000C" to "0010" | Communication setting level parameters |
| "0011" to "001D" | Advanced-function setting level parameters |

This command writes an initial setting level parameter, a communication setting level parameter, or an advanced-function setting level parameter.
For detains on addressing, refer to Section 7.10 Variable Area Map.
Use this command when the product is in setting area 1. If the product is in setting area 0 when receiving the command, it returns an error.
Before issuing the command, use operation instructions to enable "communication writing" and to enter setting area 1.

Response

| MRC | SRC | Response code |
| :---: | :---: | :---: |
| "01" | "02" | "0000" |

Response code: The code shown above represents normal completion. For details on the response code, refer to Section 7.6 Write to Variable Area .

## Communication Writing

Command

## Response



| Related information | Description |
| :---: | :---: |
| "00" | Communication writing disable |
| "01" | Communication writing enable |

This command enables/disables communication writing.
It rewrites the value of the adjustment level parameter "communication writing". If communication writing is disabled, operation instructions for parameter rewriting, forced-zero execution/forced-zero cancel and the like are rejected.
This command can be used when the product is in either setting area 0 or 1 .

| MRC | SRC | Response code |
| :---: | :---: | :---: |
| $" 30 "$ | $" 05 "$ | " $0000 "$ |

Response code: The code shown above represents normal completion. For details on the response code, refer to Section 7.7 Operation Instructions.

## Forced-zero Execution/Cancel

## Command

## Response

| MRC | SRC | Instruction code | n Related information |
| :---: | :---: | :---: | :---: |
| "30" | "05" | "03" |  |


| Forced-zero | Description |
| :---: | :---: |
| $" 00 "$ | Forced-zero cancel |
| $" 01 "$ | Forced-forced-zero execution |

This command executes/cancels the forced-zero operation.
Use this command when the product is in setting area 0 . If product is in setting area 1 when receiving the command, it returns an error.
If the product has no measured value, suffers input anomalies, or encounters a "display range over" error when receiving the command, it returns an error. If the event input is used for "process value hold" when receiving the command, it also returns an error.

Before issuing the command, use an operation instruction to enable "communication writing".

| MRC | SRC | Response code |
| :---: | :---: | :---: |
| "30" | "05" | "0000" |

Response code: The code shown above represents normal completion. For details on the response code, refer to Section 7.7 Operation Instructions.

## Software Reset

Command

|  |  |  | Instruction |  | Related <br> MRC | SRC |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| code |  |  |  |  |  |  |
| information |  |  |  |  |  |  |

This command triggers a software reset, which returns the product to its initial state when it was powered on.
It can be used when the product is in either setting area 0 or 1 .
Before issuing the command, use an operation instruction to enable "communication writing".

The software reset command does not require the product to return a response.

## Move to Setting Area 1

## Command

| MRC | SRC |  |  |
| :---: | :---: | :---: | :---: |
| Instruction <br> code | Related <br> information |  |  |
| $" 30 "$ | $" 05 "$ | $" 07 "$ | $" 00 "$ |

This command provides a transition of the product to setting area 1.
Use this command in setting area 0 . If the product is in setting area 1 when receiving the command, the command is ignored.
If the set value of the "initial setting/communication lockouts" parameter is 2 indicating "move to initial setting level" and "move to communication setting level" are disabled (refer to Section 5.7 Key Protect Setting) when the product receives the command, the product returns an error.
Before issuing this command, use an operation instruction to enable "communication writing".

## Response

| MRC | SRC | Response code |
| :---: | :---: | :---: |
| "30" | "05" | "0000" |

Response code: The code shown above represents normal completion. For details on the response code, refer to Section 7.7 Operation Instructions.

## Move to Protect Level



Response

| MRC | SRC | Instruction code | Related information |
| :---: | :---: | :---: | :---: |
| "30" | "05" | "08" | "00" |

This command moves the product to the protect level.
Use this command when the product is in setting area 0 . If the product is in setting area 1 when receiving the command, it returns an error.
Before issuing the command, use an operation instruction to enable "communication writing".

| MRC | SRC | Response code |
| :---: | :---: | :---: |
| $" 30 "$ | "05" | "0000" |

Response code: The code shown above represents normal completion. For details on the response code, refer to Section 7.7 Operation Instructions.

## ■ Read Controller Attribute

Command

| MRC | SRC |
| :---: | :---: |
| "05" | "03" |

This command reads the model name and communication buffer size of the product.
For addressing, refer to Section 7.10 Variable Area Map.
The command can be used, irrespective of what state the product is in.

## Response

| MRC | SRC | Response code |  | Model name |  | Buffer size |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| "05" | "03" |  |  |  |  | "0068" |
| Model name |  | Buffer size | Input type | Output type | No. of contacts | Optional feature |
| "K3GN-NDC" |  | $48 \times 24$ | NPN transistor | Relay | 2 | Communication |
| "K3GN-PDC" |  | $48 \times 24$ | PNP transistor | Relay | 2 | Communication |
| "K3GN-NDT1" |  | $48 \times 24$ | NPN transistor | NPN transistor | 3 | Communication |
| "K3GN-PDT2" |  | $48 \times 24$ | PNP transistor | PNP transistor | 3 | Communication |

The model name is expressed in 10-byte ASCII code. If the model name length is less than 10 bytes, blanks are used for padding in the model name field.
A fixed value of " 0068 H " ( 104 bytes) in buffer size is returned.
Response code

| Response code | Error name | Description |
| :---: | :---: | :--- |
| "1001" | Command length over | The command is too long. |
| "2203" | Operation error | An error occurs in EEPROM. |
| "0000" | Normal completion | The command is successfully executed. |

## ■ Read Controller Status

## Command



This command reads the operation status of the product.
The command can be used, irrespective of what state the product is in.

## Response



| Operation status | Description |
| :---: | :--- |
| $" 00$ " | Measurement is in progress normally. |
| "01" | • Measurement is suspended. <br> - The product has no measured value, suffers input <br> anomalies, or encounters a "display range over" error. |

Related information


If the product is in setting area 1 when receiving the command, it returns a response with the "unknown" related information.

Response code

| Response code | Error name | Description |
| :---: | :---: | :--- |
| "1001" | Command length over | The command is too long. |
| "2203" | Operation error | An error occurs in EEPROM. |
| "0000" | Normal completion | The command is successfully executed. |

## Read Version

## Command

## Response

| Variable |  |  |  | Bit |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| MRC | SRC |  | type | Address | position |  | No. of elements |
| $" 01 "$ | $" 01 "$ | $" \mathrm{C0"}$ | "0000" | $" 00 "$ | $" 0001 "$ |  |  |

This command reads the product software version.
The command can be used, irrespective of the state of the product.

| MRC | SRC | Response code |  | Data |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $" 01 "$ | $" 01 "$ | "0000" | Version No. |  |  |

Response code: The code shown above represents normal completion. For details on the response code, refer to Section 7.5 Read from Variable Area .

## ■ Echoback Test

Command

| MRC | SRC | Data to be tested |
| :---: | :---: | :---: |
| "08" | "01" | 0 to 87 bytes |

This command performs an echoback test.
The command can be used, irrespective of the state of the product.
Data to be checked must not exceed communication data in length.

| Communication data length | Description |
| :---: | :--- |
| 7 bits | 20 H to 7 EH converted to ASCII code |
| 8 bits | 20 H to 7 EH or A1H to FEH converted to ASCII code |

Response

| MRC | SRC | Response code | Data to be tested |
| :---: | :---: | :---: | :---: |
| $" 08 "$ | $" 01 "$ | $, \ldots, \ldots$ | 0 to 87 bytes |

Response code

| Response code | Error name | Description |
| :---: | :---: | :--- |
| $" 1001 "$ | Command length over | The command is too long. |
| $" 2203 "$ | Operation error | An error occurs in EEPROM. |
| $" 0000 "$ | Normal completion | The command is successfully executed. |

### 7.10 Variable Area Map

The variable area of the product is mapped in terms of variable types and addresses as described below.

Variable type C0: Read-only data including process values and status
Variable type C1: Protect level parameters
Variable type C2: Operation level parameters (OUT set values and remote input values)
Variable type C3: Initial setting, communication setting, and advanced-function setting level parameters

The address and parameter assignments to each variable type are shown below.

| Variable type | Address | Parameter | Meaning of set value/Valid range/Description |
| :---: | :---: | :---: | :---: |
| C0 | 0000 | Version | 00000100H |
|  | 0001 | Current value | FFFFB1E1H to 0001869FH ( -19999 to 99999): Valid  <br> 0001869 FH (99999): Input anomalous/outside the display range upper <br>  limit |
|  | 0002 | Status | Refer to the figure below. |

Status description


| Variable type | Address | Parameter | Meaning of set value/Valid range/Description |
| :---: | :---: | :---: | :---: |
| C1 | 0000 | Operation/ adjustment lockouts | $00000000 \mathrm{H}(0):$ No restriction at the operation/adjustment levels $00000001 \mathrm{H}(1):$ "Move to adjustment level" is disabled. $00000002 \mathrm{H}(2)$ : Only the process value can be displayed. <br> Access via communications is enabled, irrespective of the value of this parameter. |
|  | 0001 | Initial setting/ communication lockouts | $00000000 \mathrm{H}(0):$ "Move to initial setting/communication setting/advanced-function setting levels" is enabled. <br> $00000001 \mathrm{H}(1):$ "Move to advanced-function setting level" is disabled. <br> 00000002 H (2): "Move to initial setting/communication setting levels" is disabled. <br> Access via communications is enabled, irrespective of the value of this parameter. |
|  | 0002 | Setting change lockout | $00000000 \mathrm{H}(0):$ OFF: A parameter change by key operation is enabled. <br> $00000001 \mathrm{H}(1): \mathrm{ON}$ : A parameter change by key operation is disabled. <br> Communication writing is enabled, irrespective of the value of this parameter. |
|  | 0003 | Forced-zero lockout | $00000000 \mathrm{H}(0):$ OFF: Forced-zero execution/forced-zero cancel is enabled. <br> $00000001 \mathrm{H}(1):$ ON: Forced-zero execution/forced-zero cancel is disabled. <br> Communication writing is enabled, irrespective of the value of this parameter. |
| C2 | 0000 | Remote input value | FFFFB1E1H to 0001869FH ( -19999 to 99999) <br> An input value is written to this variable when the product is used as a digital data display for PLC/PC. |
|  | 0001 | OUT1 value | FFFFB1E1H to 0001869FH (-19999 to 99999) |
|  | 0002 | OUT1 upper-limit value | FFFFB1E1H to 0001869FH (-19999 to 99999) |
|  | 0003 | OUT1 lower-limit value | FFFFB1E1H to 0001869FH (-19999 to 99999) |
|  | 0004 | OUT2 value | FFFFB1E1H to 0001869FH (-19999 to 99999) |
|  | 0005 | OUT2 upper-limit value | FFFFB1E1H to 0001869FH (-19999 to 99999) |
|  | 0006 | OUT2 lower-limit value | FFFFB1E1H to 0001869FH (-19999 to 99999) |


| Variable type | Address | Parameter | Meaning of set value/Valid range/Description |
| :---: | :---: | :---: | :---: |
| C3 | 0000 | Input type | 00000000 H (0): Analog 00000001H (1): Pulse 00000002H (2): Remote |
|  | 0001 | Analog range | $\begin{aligned} & 00000000 \mathrm{H}(0): 4 \text { to } 20 \mathrm{~mA} / 0 \text { to } 20 \mathrm{~mA} \\ & 00000001 \mathrm{H}(1): 1 \text { to } 5 \mathrm{~V} / 0 \text { to } 5 \mathrm{~V} \\ & 00000002 \mathrm{H}(2): \pm 5 \mathrm{~V} \\ & 00000003 \mathrm{H}(3): \pm 10 \mathrm{~V} \end{aligned}$ |
|  | 0002 | Input pulse frequency | $\begin{aligned} & \text { 00000000H (0): } 30 \mathrm{~Hz} \\ & 00000001 \mathrm{H}(1): 5 \mathrm{kHz} \end{aligned}$ |
|  | 0003 | Scaling input value 1 | FFFFB1E1H to 0001869FH (-19999 to 99999) |
|  | 0004 | Scaling display value 1 | FFFFB1E1H to 0001869FH (-19999 to 99999) |
|  | 0005 | Scaling input value 2 | FFFFB1E1H to 0001869FH (-19999 to 99999) |
|  | 0006 | Scaling display value 2 | FFFFB1E1H to 0001869FH (-19999 to 99999) |
|  | 0007 | Scaling input value | FFFFB1E1H to 0001869FH ( -19999 to 99999 ): When the input type is set to "pulse" |
|  | 0008 | Scaling display value | FFFFB1E1H to 0001869FH ( -19999 to 99999 ): <br> When the input type is set to "pulse" |


| Variable type | Address | Parameter | Meaning of set value/Valid range/Description |
| :---: | :---: | :---: | :---: |
| C3 | 0009 | Decimal point position | 00000000H (0): 0 acooo 00000001H (1): 0000.0 00000002H (2): 0.00 .00 00000003H (3): 00.0000 00000004H (4): 0.00000 |
|  | 000A | OUT1 type | 000000000H (0): Upper-limit action 00000001H (1): Lower-limit action 00000002 H (2): Outside-the-range action |
|  | 000B | OUT2 type | $00000000 \mathrm{H}(0)$ : Upper-limit action 00000001 H (1): Lower-limit action 00000002 H (2): Outside-the-range action |
|  | 000C | Communication unit No | $00000000 \mathrm{H} \sim 00000063 \mathrm{H}(0 \sim 99)$ |
|  | 000D | Baud rate | $00000000 \mathrm{H}(0): 1.2 \mathrm{kbps}$ $00000001 \mathrm{H}(1): 2.4 \mathrm{kbps}$ 00000002H (2): 4.8 kbps $00000003 \mathrm{H}(3): 9.6 \mathrm{kbps}$ 00000004H (4): 19.2 kbps |
|  | 000E | Word length | 00000000H (0): 7 bits 00000001H (1): 8 bits |
|  | 000F | Stop bit length | $00000000 \mathrm{H}(0): 1$ bit 00000001H (1): 2 bits |
|  | 0010 | Parity bits | 00000000H (0): Non 00000001H (1): Even 00000002H (2): Odd |
|  | 0011 | No. of measurements for averaging | $00000000 \mathrm{H}(0):$ OFF 00000001 H (1): 2 00000002 H (2): 4 00000003 H (3): 8 |
|  | 0012 | Event input function | $\begin{aligned} & 00000000 \mathrm{H}(0): \text { HOLD } \\ & 00000001 \mathrm{H}(1): \text { ZERO } \\ & \hline \end{aligned}$ |
|  | 0013 | OUT1 hysteresis | 00000000 H to 0000270 FH (0 to 9999) |
|  | 0014 | OUT2 hysteresis | 00000000 H to 0000270 FH ( 0 to 9999 ) |
|  | 0015 | Auto-zero time | 00000000 H to 000000 C 7 H ( 0.0 to 19.9) |
|  | 0016 | Startup compensation time | 00000000 H to 000003 E 7 H ( 0.0 to 99.9) |
|  | $\begin{gathered} 0017 \\ \text { to } 0019 \\ \hline \end{gathered}$ | (Not assigned) | 00000000H (0) |
|  | 001A | Display color change | 00000000H (0): Green to red 00000001 H (1): Always green 00000002 H (2): Red to green 00000003 H (3): Always red |
|  | 001B | Display auto-return time | 00000000 H to 00000063 H ( 0 to 99) |
|  | 001C | Move-to-protect-level time | 00000000 H to 00000013 H (0 to 19) |
|  | 001D | Send waiting time | 00000000 H to 00000063 H (0 to 99) |

Block access to the variable area

A number of contiguously addressed variables of the same type in the variable area can be accessed at a time. For example, you can read the current value and the status simultaneously by setting the read start address to the address of the current value and setting the No. of elements to 2 .

Such an access method is called "block access".


### 7.11 Communications Control Flow

This section describes the control flow of comminations between the product and the host PC. Information in this section will help you make up a program for controlling the product.

## ■ Communication Reading

Communication reading is performed according to the following flow. It involves no response from the product to the host PC.


Commands applicable to this flow are shown below.

| Applicable commands |
| :---: |
| Read process value |
| Read status |
| Read OUT set value |
| Read parameter |
| Read controller attribute |
| Read controller status |
| Read version |
| Echoback test |

## Communication Writing (Setting Area 0)

When the product is in setting area 0 , communication writing is performed according the following flow.


Commands applicable to this flow are as follow.

| Applicable commands |
| :---: |
| Write remote input value |
| Write OUT set value |

Remote input values would often be written with a high frequency. You should therefore keep "communication writing" in "enable" state and then continuously write input values. Doing so will shorten the time for communication writing.


## Protect Level Parameter Writing

A protect level parameter is written according to the following flow.


The following command is applicable to this flow.

| Applicable command |
| :---: |
| Write protect level parameter |

## Parameter Writing (Setting Area 1)

When the product is in setting area 1, a parameter is written according to the following flow.


The following command is applicable to this flow.

| Applicable command |
| :---: |
| Write parameter (setting area 1 ) |

## Operation Instruction

An operation instruction is performed according to the following flow.


Commands applicable to this flow are shown below.

| Applicable commands |
| :---: |
| Forced-forced-zero execution/cancel |
| Move to setting area 1 |
| Move to protect level |

### 7.12 Programming Example

N88 BASIC
The section shows a programming example where a response from the product is displayed on the screen on the host PC when a command is entered from the keyboard.

This program is created with N88 BASIC.

```
1000
1 0 1 0
1020
|}\mathrm{ (C) Copyright
1040
1050
1060
1070
1080
1090
1100
1 1 1 0
1120
1130
1140
1 1 5 0
1 1 6 0
1 1 7 0
1 1 8 0
1 1 9 0
1200
1 2 1 0
1220
1230
1240
1250
1260
1270
1280
1 2 9 0
1300
1 3 1 0
1320
1330
1340
1350
1 3 6 0
1370
1380
1 3 9 0
1400 IF TIMEOUT > 2000 THEN RESP$ = "NO Response":GOTO *REND
1410
1420
1430
1440 RDATA$ = RDATA$+INPUT$ (LOC (1) ,#1)
1450 IF LEN(RDATA$) < 2 THEN *LOOP
1460 IF MID$ (RDATA$,LEN(RDATA$) -1,1) <> CHR$ (3) THEN *LOOP
1470 RESP$ = MID$(RDATA$,2,LEN(RDATA$)-2)
1480 *REND
```

```
1490
1500 '-------Received data display----------
1510 PRINT "RESPONSE:";RESP$
1520 GOTO *REPEAT
1530
1540 *EXIT
1550 '========= Termination ==========
1560 CLOSE #1
1570 END
```

- Execution example

The current value of unit No. 00 is read.

```
RUN[
SEND DATA:000000101C000010000001/
RESPONSE:000000010100000000014F
```



## Protocol Macro


#### Abstract

What is the The protocol macro is a ladder routine that, using a PMCR command, provides protocol macro? control to the sequence (protocol) of data communications between PLCs or other communication devices connected via RS-232C or RS-422A/485 interface. OMRON's CS1W series of serial communication boards come standard with a standard system protocol that allows control of OMRON's components. For details on the protocol macro, refer to the User's Manual for Model CS1W-SCB21/41/-SCU21 (Cat. No. W336-01).


Connection The serial communication board CS1W-SCB41 has two ports, port 2 of which allows direct connection via RS-485 interface.
Use this port to connect the board to the product.


Set the TERM switch to "ON" and the WIRE switch to " 2 " and connect a terminator to the K3GN.

Ladder Example The following example is a ladder diagram in which the current process value is read through communications (with responses) with No. 600 ASCII conversion according to the standard system protocol "CompoWay/F for Master Station".


Placing the "read process value" command in D0100 or a higher-numbered location causes the process value to be stored in D0152 ~ D0153.
If a communication error occurs, an FAL command (fault analysis command) is executed.

- Data transmission word assignment

- Data reception word assignment



## CHAPTER

# 8 <br> <br> USER <br> <br> USER CALIBRATION 

 CALIBRATION}

The product allows the user to perform analog input calibration.
This chapter outlines user calibration and describes how to calibrate the product.
8.1 User Calibration ..... 128
8.2 User Calibration Processes ..... 130Connection of the Product to a STV/Calibration Procedure

### 8.1 User Calibration

As the product has been calibrated at the factory, it does not need to be calibrated in normal use.
The product has the capability of analog input calibration, which enables user calibration as needed.
OMRON assumes no responsibility for the result of user calibration.
Note that, once user calibration is performed, original calibration data is overwritten and cannot be restored.

Devices and tools necessary for user calibration must be made available by the user. For handling of these devices, refer to their respective manuals.

Entry of Calibration
data

First store both of calibration values 1 and 2 temporarily. Then save them while the product is in the change state.
Calibration data cannot be saved normally unless calibration values 1 and 2 are both specified.
If calibration data is saved normally, the product keeps a record of the user calibration. When you enters the user calibration level, a calibration record mark will appear on the main indicator as shown below.


Calibration record mark

Calibration The following shows the flow of user calibration.
Flow


In the above flow, a range specified by the "analog range" parameter undergoes calibration.
If you want to calibrate another range, change the analog range to the desired one at the initial setting level and then perform calibration according to the above flow.
To exit from the calibration level, power the product off and on again.

### 8.2 User Calibration Processes

■ Connection of the Product to a STV


Connect a STV (standard voltage/current generator) to appropriate terminals as shown above.

Use a STV that has accuracy appropriate to the precision of the product.

## ■ Calibration Procedure

Take the following steps for user calibration.

## Move to the Calibration

 Level
## Procedure

A. At the advanced-function setting level, press the key.

- Parameter [ĩou will appear on the main indicator.
- If you cannot move to the calibration level at the first attempt after purchasing the product, set the "initial setting/communication lockout" parameter to " 0 " at the protect level and then move to the advanced-function setting level.
B. Press the $\gg$ key.
- The set value (password) of the parameter will appear on the main indicator.
C. Press the $\gg$ key again to allow the password to be changed.
D. Use the $\gg$ and $\widehat{\wedge}_{\text {/zero }}$ keys to enter a password of " 01201 ".
E. Press the key to save the password.
- If the password is correct, the product enters the calibration level.
- If the password is incorrect, the product remains at the advanced-function setting level and its main indicator displays the next parameter.



## At the <br> Calibration Level

## Procedure

A. Follow the above steps to move to the calibration level.


- An aging timer count will appear on the main indicator.
- The aging timer is a 30 -minute timer and counts down to 0 .
- If a user calibration record is found, a calibration record mark will appear.
B. Perform aging until the aging timer counts down to 0 .
(If the STV needs an aging time longer than 30 minutes, continue aging until the aging requirement of the STV is satisfied).
- If you press the $\square$ key in the middle of timer counting, aging is skipped and the parameter of calibration value 1 is displayed on the main indicator.
C. Press the key to display the parameter of calibration value 1 .

- The parameter corresponding to the current analog range will appear on the main indicator. For the relationship between the analog range and the parameter, refer to the table on the next page.
D. Press the $\gg$ key to display the set value of the parameter.
- The calibration value 1 will appear in hexadecimal on the main indicator.
E. Use the STV to provide a reference signal corresponding to calibration value 1 .
- For the value of reference signals, refer to the table on the next page.

F．Press the $\widehat{\lambda} /$ zero l

－The teaching indicator will start blinking， indicating the reference signal is given to the product．

G．Press the 唋／zeol key again to temporarily store calibration value 1 ．
－If you press the $\square$ key instead of the 这zeol key， calibration value 1 is not stored and the parameter of calibration value 2 is displayed on the main indicator．

H．Press the key to display the parameter of calibration value 2 ．

I．Repeat steps $\mathbf{D}$ to $\mathbf{H}$ to temporarily store calibration value 2 ．
－Parameter St，will appear on the main indicator， indicating the temporal calibration values can be saved．
－This parameter does not appear unless both calibration values 1 and 2 have been stored temporarily．

J．Press the $\gg$ key to display the set value．

－no will appear on the main indicator．
K．Press the $\gg$ key again．
－The set value will start blinking，indicating the product is in the change state．

L．Press the $\widehat{\widehat{N}} /$ zero key．

－UES will appear on the main indicator．
M．Press the key．
－The calibration values are saved．

－The aging timer count will appear on the main indicator．

N．Power the product off and on again to exit from the calibration level，and check for proper operation．
－Analog ranges and parameters／reference signals

| Analog range | Calibration value 1 |  | Calibration value 2 |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Parameter | Reference signal | Parameter | Reference signal |
| 4 to 20 mA | 4.00 mA | 20.00 mA |  |  |
| 1 to 5 V | 4.00 | 5.000 V |  |  |
| $\pm 5 \mathrm{~V}$ | 5.000 V | 5 | -5.000 V |  |
| $\pm 10 \mathrm{~V}$ | 5.000 V | $-5 \mathbf{L}$ | -10.000 V |  |

## CHAPTER

# 9 <br> TROUBLESHOOTING GUIDE 

This chapter shows the meanings of error indications and the remedial actions to be taken in the event of error. It also contains a troubleshooting table that will be helpful in case a trouble may arise.
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### 9.1 Error Indications

| Level indicator | Main indicator | Error description | Remedy |
| :---: | :---: | :---: | :---: |
| (Off) | E1: | RAM error | Turn the K3GN off and on again. <br> - If the error persists, RAM needs to be replaced. <br> - If the product is restored to normal operation, the error was possibly caused by noise interference. Check for noise source near the product. |
| 5 | E1: | EEPROM error | Turn the K3GN off and on again. <br> - If the error persists, EEPROM needs to be replaced. <br> - If the product is restored to normal operation, the error was possibly caused by noise interference. Check for noise source near the product. |
| (Off) | SEr blinking at intervals of 0.5 s | The product received an analog value that fell outside the measuring range of the selected analog range. | Supply analog values that fall within the measuring range. <br> The measuring range of each analog range is as follows. |
|  |  | You will see this indication when turning on the product at the first time after purchasing. 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, select an input type and an analog range according to your application. |
| (Off) | 99999 <br> blinking at intervals of 0.5 s | The scaling display value exceeds 99999. | Enter an appropriate scaling input value. |
|  |  |  | The scaling factor may be inappropriate. Review the scaling factor at the initial setting level. |
| (Off) | $+9999$ <br> blinking at intervals of 0.5 s | The scaling display value is lower than -19999. | Enter an appropriate scaling input value. |
|  |  |  | The scaling factor may be inappropriate. Review the scaling factor at the initial setting level. |

### 9.2 Troubleshooting Table

| Symptom | Probable cause | Remedy | Reference page |
| :---: | :---: | :---: | :---: |
| The forced-zero function is inoperative even though the , | The "input type" parameter is set to "pulse". | The forced-zero function is not available. | $\begin{aligned} & 50 \\ & 92 \end{aligned}$ |
|  | Forced-zero lockout is active. | At the protect level, set the forced-zero function to "enable". | 48 |
| The product does not enter the protect level even though the $\square$ $+\square$ is held down for 5 seconds. | The "move-to-protect-level" parameter is set to a value more than 5. | Set the "move-to-protect-level" parameter to an appropriate value. | 79 |
| Readouts vary greatly or decrease with increasing rotational speed. | The "input-pulse frequency range" parameter is set to " 30 Hz ". | If the input pulse frequency exceeds 30 Hz , set the "input-pulse frequency range" parameter to " 5 kHz ". | $\begin{aligned} & 52 \\ & 90 \end{aligned}$ |
|  | The input pulse frequency exceeds 5 kHz . | Lower the input pulse frequency to 5 kHz or less. <br> Note that the product does not generate an out-of-range error if the input pulse frequency exceeds 5 kHz . |  |
| Readouts vary or are incorrect even when the rotational speed is low. | The pulse width of ON/OFF signals is too small. | Supply the product with pulses that have a width specified in this manual. <br> The product cannot recognize input pulses correctly unless their width is as specified, even if the rotational speed is low. | 90 |
| The main indicator reads 0 when the rotational speed is low. | The "auto-zero time" parameter is set to a value that is not more than the maximum time interval of input pulses. | Set the "auto-zero time" parameter to a value exceeding the maximum time interval of input pulses. <br> Otherwise, the auto-zero function may be triggered improperly. | $71$ <br> 88 |


| Symptom | Probable cause | Remedy <br> page |  |
| :--- | :--- | :--- | :--- |
| The product continues to read <br> "00000" on the main indicator <br> since powered on. | The set value of the "startup <br> compensation timer" parameter <br> is too large. | Set the "startup compensation <br> timer" parameter to an <br> appropriate value. <br> When the input type is set to <br> "pulse", the startup <br> compensation time can be set to <br> up to 99.9 seconds. | 73 |
|  |  | The "process value hold" <br> function is active. | Cancel "process value hold". <br> If the event input terminal is <br> used for "process value hold", <br> powering on the product in the <br> ON state of the terminal will <br> result in a readout of "00000", <br> which is retained unless the <br> terminal turns off. |

## APPENDIX

## Specifications

## Ratings

| Supply voltage | 24 VDC |
| :--- | :--- |
| Operating voltage range | $85 \%$ to 110\% of the rated supply voltage |
| Power consumption <br> (see note) | 2.5 W max. (at max. DC load with all indicators lit) |

Note: A operation 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 " 00000 " and all outputs will be OFF.

## ■ Input/Output Ratings

## Relay Contact Output

(Incorporating G6K Relays)

| Item | Resistive load $(\cos \varnothing=1)$ |
| :--- | :--- |
| Rated load | 1 A at 30 VDC |
| Rated carry current | $1 \mathrm{~A} \mathrm{max}. \mathrm{(at} \mathrm{COM} \mathrm{terminal)}$ |
| Max. contact voltage | 60 VDC |
| Max. contact current | $1 \mathrm{~A}($ at COM terminal) |
| Max. switching capacity | 30 VA |
| Min. permissible load <br> (P level, reference value) | $10 \mathrm{mV}, 10 \mu \mathrm{~A}$ |
| Mechanical life | $50,000,000$ times min. (at a switching frequency of 36,000 times $/ \mathrm{hr})$ |
| Electrical life <br> (at an ambient temperature of $23^{\circ} \mathrm{C}$ ) | 100,000 times min. (at the rated load with a switching frequency of 1,800 <br> times $/ \mathrm{hr}$ ) |

## Transistor Output

| Rated load voltage | 24 VDC |
| :--- | :--- |
| Max. load current | 50 mA |
| Leakage current | $100 \mu \mathrm{~A}$ max. |

## Linear current output

| Item | 0 to $20 \mathrm{~mA} \mathrm{DC}, 4$ to 20 mADC |
| :--- | :--- |
| Load | $500 \Omega \mathrm{max}$. |
| Resolution | Approx. $10,000$. |
| Output error | $\pm 0.5 \%$ of F.S. |

## Linear voltage output

| Item | 0 to $5 \mathrm{~V} \mathrm{DC}, 1$ to $5 \mathrm{~V} \mathrm{DC}$,0 to 10 V DC |
| :--- | :--- |
| Load | $5 \mathrm{k} \Omega$ min. |
| Resolution | Approx. $10,000$. |
| Output error | $\pm 0.5 \%$ of F.S. (but $\pm 0.15 \mathrm{~V}, 0 \mathrm{~V}$ for 1 V or less) |

## Communications

$\left.\begin{array}{|l|l|}\hline \text { Item } & \text { RS-485 } \\ \hline \text { Transmission method } & \text { 2-wire, half-duplex } \\ \hline \text { Synchronization method } & \text { Start-stop synchronization } \\ \hline \text { Baud rate } & 1,200 / 2,400 / 4,800 / 9,600 / 19,200 \mathrm{bps} \\ \hline \text { Transmission code } & \text { ASCII } \\ \hline \text { Communications } & \begin{array}{l}\text { Reading/Writing } \\ \text { to the K3GN }\end{array}\end{array} \begin{array}{l}\text { Read/write set values, read/write scaling values, enable/disable the writing } \\ \text { of data through communications, forced-zero control, and other data. }\end{array}\right]$.

## Measuring Ranges

Process Voltage/Current Inputs

| Input | Measuring range | Measuring accuracy | Input impedance | Display range |
| :---: | :--- | :--- | :---: | :--- |
| DC voltage | 1.000 to $5.000 \mathrm{~V} /$ | $\pm 0.1 \% \mathrm{FS} \pm 1$ digit | $1 \mathrm{M} \Omega$ min. | -19999 to 99999 |
|  | 0.000 to 5.000 V | max. (at $23 \pm 3^{\circ} \mathrm{C}$ ) |  | (with scaling |
|  | -5.000 to 5.000 V | $\pm 0.1 \% \mathrm{FS} \pm 1$ digit |  | function) |
|  | -10.00 to 10.00 V | max. (at $23 \pm 5^{\circ} \mathrm{C}$ ) |  |  |
| DC current | 4.00 to $20.00 \mathrm{~mA} /$ | $\pm 0.1 \% \mathrm{FS} \pm 1$ digit <br>  0.00 to 20.00 mA | max. (at $23 \pm 3^{\circ} \mathrm{C}$ ) | $60 \Omega$ |
|  |  |  |  |  |  |

## No-voltage Contact/Open Collector Inputs

| Input | Measuring range | Measuring accuracy <br> (at $\left.23 \pm 5^{\circ} \mathrm{C}\right)$ | Displayable range |
| :--- | :---: | :---: | :---: |
| No-voltage contact (30 Hz max.) with <br> ON/Off pulse width of 16 ms min. | 0.05 to 30.00 Hz | $\pm 0.1 \% \mathrm{FS} \pm 1$ digit max. | -19999 to 99999 <br> (with scaling function) |
| Open collector $(5 \mathrm{kHz}$ max.) with <br> ON/OFF pulse width of $90 \mu$ s min. | 0.1 to 5000.0 Hz |  |  |

## Digital Data Display (By RS-485 Communication)

| Displayable range | -19999 to 99999 |
| :--- | :--- |

## Characteristics

| Input signal | Process voltage <br> ( 1 to $5 \mathrm{~V}, 0$ to $5 \mathrm{~V}, \pm 5 \mathrm{~V}, \pm 10 \mathrm{~V}$ ) <br> Process current <br> (4 to $20 \mathrm{~mA}, 0$ to 20 mA ) | No-voltage contact <br> ( 30 Hz max. with ON/OFF pulse width of 16 ms min.) <br> Open collector <br> ( 5 kHz max. with ON/OFF <br> pulse width of $90 \mu \mathrm{~s}$ min.) | Digital data display (by RS-485 communication) |
| :---: | :---: | :---: | :---: |
| A/D conversion method | Double integral method | - |  |
| 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. <br> OFF leakage current: 0.1 mA max. <br> Load current: Must have a switching capacity of 15 mA min. Must be able to reliably switch load currents of 5 mA max. |  |
| Max. diaplayed 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)``` |  | ```HOLD: (Measurement value held) ZERO: (Forced-zero)``` |
| Hysteresis setting | Programmable with front-panel key inputs (0001 to 9999) |  |  |
| Other functions | Programmable Color Display <br> Selectable output operating action <br> Teaching set values <br> Average processing (simple average) <br> Lockout configuration <br> 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) <br> Auto-zero time ( 0.0 to 19.9 s ) | Forced-zero set with front panel keys Control inputs (HOLD/ ZERO) selection via front panel keys |
| Output | Relays: 2 SPST-NO <br> Transistors: 3 NPN open collector <br>  3 PNP open collector <br> Linear: Current output <br>  <br>  <br> Voltage output |  | - |
|  | Combinations: <br> Communications output (RS-485) + relay outputs (2 SPST-NO); <br> Communications output (RS-485) + transistor outputs (3 NPN open collector); <br> Communications output (RS-485) + transistor outputs (3 PNP open collector); <br> Linear current output + relay outputs ( 2 SPST-NO); <br> Linear voltage output + relay outputs (2 SPST-NO); <br> Linear current output + transistor outputs (3NPN open collector); <br> Linear voltage output + transistor outputs (3NPN open collector) |  |  |
| Communications | Communications function: RS-485 |  |  |
| Delay in comparative outputs (transistor outputs) | 750 ms max. |  |  |
| Enclosure ratings | Front panel: NEMA4X for indoor use (equivalent to IP66) <br> Rear case: IEC standard IP20 <br> 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 .

## Parameter List

Use this list to note your set values．

| Level | Parameter | Indication | Setting range | Default | Unit | Set value |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Protect | Operation／adjustment lockouts | appl | $0 \sim 2$ | 0 |  |  |
|  | Initial setting／communication lockouts | CTPL | $8 \sim 3$ | 1 |  |  |
|  | Setting change lockout | UPPE | arfan | arf |  |  |
|  | Forced－zero lockout | ErPG | arfon | arF |  |  |
| Operation | OUT1 value | cutt | 19999～99999 | 99999 |  |  |
|  | OUT1 upper－limit value | Gut ith | －19999～99999 | 99999 |  |  |
|  | OUT1 lower－limit value | Gut $1:$ | －19999～99999 | 49999 |  |  |
|  | OUT2 value | －${ }^{\text {dez }}$ | 49999～99999 | 19999 |  |  |
|  | OUT2 upper－limit value | Gut | 19999～99999 | 99999 |  |  |
|  | OUT2 lower－limit value | Gutel | 49999～99999 | 19999 |  |  |
| Adjustment | Communication writing | ［nut | affon | arf |  |  |
| （1） | Input type | In－t | Pnotitiput 5E／rit | Pinfot |  |  |
|  | Analog range | －RILE | 4－20／1－5／5／ 6 | 4－20 |  |  |
|  | Input－pulse frequency range | P－FrE | 38／510 | 5， | Hz |  |
|  | Scaling input value 1 | EnP． 1 | －19999～99999 | 4.010 |  |  |
|  | Scaling display value 1 | d5P． 1 | －19999～99999 | 408 |  |  |
|  | Scaling input value 2 | $\therefore \mathrm{mP}$ | －19999～99999 | 20．00 |  |  |
|  | Scaling display value 2 | d5P？ | 19999～99999 | 3008 |  |  |
|  | Scaling input value | En | ＋19999～99999 | 50 ma |  |  |
|  | Scaling display value | 159 | －19999～99999 | 50000 |  |  |
|  | Decimal point position | $d^{P}$ | 0．0000／00．000／000．00／ 0000．0／00000 | 000000 |  |  |
|  | OUT1 type | aut it | H／L $\mathrm{H}^{-1} / \mathrm{HL}^{-1}-\mathrm{La}$ | $\mathrm{H}^{-}$ |  |  |
|  | OUT2 type | Gutz！ |  | 10 |  |  |
|  | Linear current model | 15EL． | $0-3014-30$ | 4－20 |  |  |
|  | Linear voltage model | 15Et．a | ［5－5／i－5／8－18 | －5 |  |  |
|  | Linear output upper limit | LSEE．H | 19999～99999 | $\begin{gathered} \text { ewrig } \\ \text { (current) } \end{gathered}$ |  |  |
|  |  |  |  | $\begin{gathered} 5[100 \\ \text { (voltage) } \end{gathered}$ |  |  |
|  | Linear output lower limit | 15Et． | 49999～99999 | $\begin{gathered} 4010 \\ \text { (current) } \end{gathered}$ |  |  |
|  |  |  |  | $\begin{gathered} 1010 \\ \text { (voltage) } \end{gathered}$ |  |  |
|  | Move to advanced－function setting level | Pinau | 49999～99999 | 0 |  |  |
| Communication setting | Communication unit No． | U－ma | －$\sim$－ 9 | 1 |  |  |
|  | Baud rate | bPG | 1．2／2．4／4．8／9．5／ 9.5 | 9.5 | kbps |  |
|  | Word length | LEn | $7 / 8$ | 7 | bit |  |
|  | Stop bit length | Sbit | $1 / 2$ | 2 | bit |  |
|  | Parity check | Prisy | nont／EuEn／Gdid | EuEn |  |  |
| Advanced－ function setting | Parameter initialization | Int | afran | arF |  |  |
|  | No．of measurements for averaging | Hum | aFF／E／4／g | ary | times |  |
|  | Event input function selection | EuFCt | HoLdizera | Hoid |  |  |
|  | OUT1 hysteresis | Hy5 | \％～ 9999 | 1 |  |  |
|  | OUT2 hysteresis | H452 | 6～9999 | 1 |  |  |
|  | Auto－zero time | RUED．E | 019～ 19.9 | 19.9 | S |  |
|  | Startup compensation timer | 5－દバー | 7．9～99．9 | 0.6 | s |  |
|  | Display color change | Eatar | Lirn－r／Lrom／rEd－E／rEd | LIrロー， |  |  |
|  | Display auto－return time | ret | 0～99 | 15 | S |  |
|  | Move－to－protect－level time | Prit | ［ $\sim 19$ | 5 | s |  |
|  | Send waiting time | 5del | －～ 99 | 20 | ms |  |
|  | Move to calibration level | Enัu | －9999～99999 | $\square$ |  |  |

## ASCII Code Table

| Lower Upper | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | NUL | DLE | SPACE | 0 | @ | P |  | p |
| 1 | SOH | DC1 | ! | 1 | A | Q | a | q |
| 2 | STX | DC2 | " | 2 | B | R | b | $r$ |
| 3 | ETX | DC3 | \# | 3 | C | S | C | S |
| 4 | EOT | DC4 | \$ | 4 | D | T | d | t |
| 5 | ENQ | NAK | \% | 5 | E | U | e | u |
| 6 | ACK | SYN | \& | 6 | F | V | f | v |
| 7 | BEL | ETB | , | 7 | D | W | g | w |
| 8 | BS | CAN | $($ | 8 | H | X | h | x |
| 9 | HT | EM | ) | 9 | I | Y | i | y |
| A | LF | SUB | * | : | J | Z | j | z |
| B | VT | ESC | + | ; | K | [ | k | \{ |
| C | FF | FS | , | $<$ | L | ¥ | I | \| |
| D | CR | GS | - | $=$ | M | ] | m | \} |
| E | so | RS | . | > | N | $\wedge$ | n | $\sim$ |
| F | SI | US | / | $?$ | 0 | - | 0 | DEL |

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[^1]
[^0]:    Note: Refer to page 6 for information on models with normally energized relays.

[^1]:    Authorized Distributor:

