# *F370* *DIGITAL INDICATOR*

*OPERATION MANUAL*

UNIPULSE

**20 Jul. 2011**
**Rev. 1.19**

# Cautions and Requests for Use

● Do not disassemble the main body for modifications or repair.

● Be sure to use crimp contacts for connection to terminal blocks, and do not to connect bare wires as they are.

● Be sure to ground the protective ground terminal.

● Be sure to disconnect the power cable when performing the following.
- Attachment/detachment of connectors of options.
- Wiring/connection of cables to terminal blocks.
- Connection of the ground line.

● Carefully check wiring, etc. before applying power.

● Take an interval of more than 5 seconds when repeating ON/OFF.

● Take adequate shielding measures when using at the following locations.
- Near a power line.
- Where a strong electric field or magnetic field is formed.
- Where static electricity, relay noise or the like is generated.

● Do not install in the following environments.
- Place s exposed to direct sunlight.
- Where the temperature and/or humidity exceeds the range in the specifications.
- Place s containing corrosive gas or flammable gas.
- Place s with large quantities of dust, salt or iron powder.
- Where the product may be splashed with water, oil or chemicals.
- Where the main body is directly affected by vibration or shock.

● Set the correct Excitation Voltage for the sensor. （2.5V is set when F370 is dispatched from us.）

# Safety Precautions

## ● Indications for safe use and their meanings

In this manual, precautions for using the F370 digital indicator safely are indicated as follows. Be sure to follow the precautions given here because they are important descriptions relating to safety.

Indications and their meanings are as follows:

| | |
|---|---|
| ⚠WARNING | Misuse may cause the risk of death or serious injury to persons. |

| | |
|---|---|
| ⚠ CAUTION | Misuse may cause the risk of injury to persons or damage to property. |

## ● Explanation of pictographs

The △ means a caution (or warning).

A specific description is written in the △ .

The illustration on the left-hand side shows "Caution: May explode".

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The △ means a caution (or warning).

A specific description is written in the △ .

The illustration on the left-hand side shows a general caution.

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## ● About the built-in lithium battery

### ⚠ WARNING

Never disassemble, deform under pressure or throw the battery into fire.The battery may explode, catch fire or leak.

- Battery

Model: CR2477-1HF made by Matsushita Battery Industrial Co., Ltd.

Nominal voltage: 3V

Nominal electric capacity: 1000mAh

## ● About the signal I/O terminal block

### ⚠ CAUTION

For connection to the signal I/O terminal block, wire correctly after checking the signal names and terminal block numbers.

Also, turn off the power of the main body before connection/wiring to the signal I/O terminal block.

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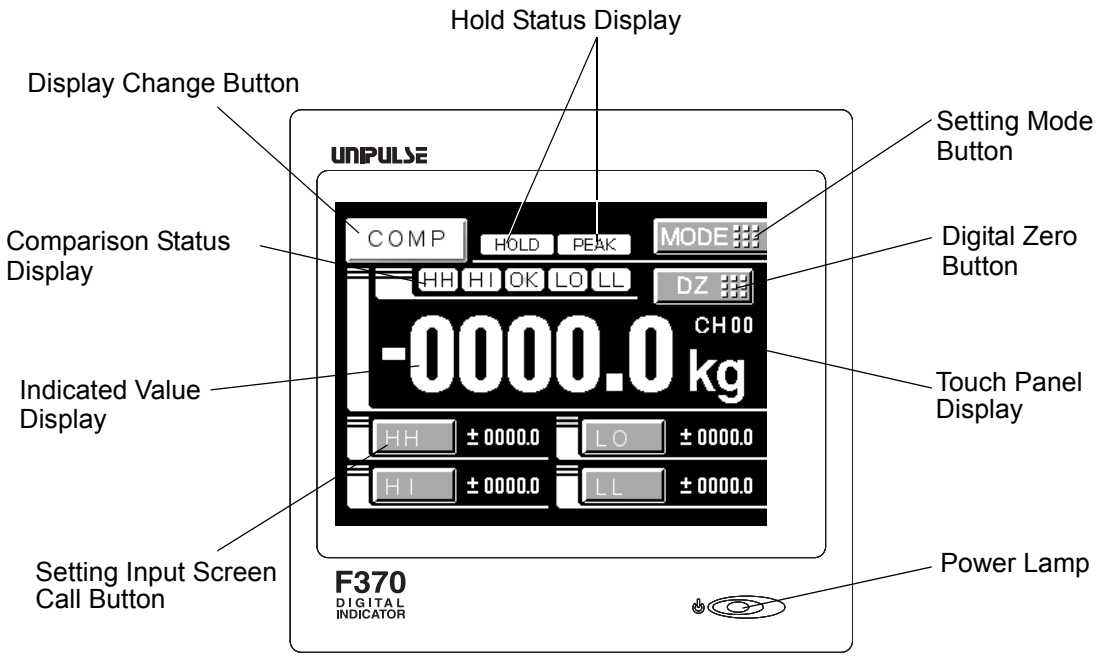
# 1. APPEARANCE DESCRIPTION

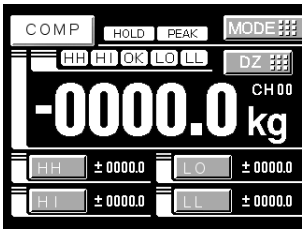
## 1-1. Front Panel



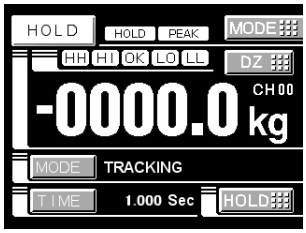

### 1-1-1. Touch Panel Display

This is the touch panel display for displaying an indicated value and graph set value and for setting various setting items of the F370. During measurement, a comparison display, hold display and graph display can be selected according to the function in use.

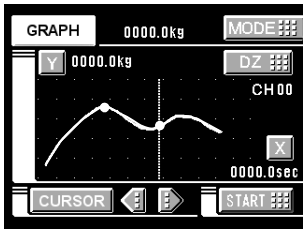
Comparison Display




Hold Display



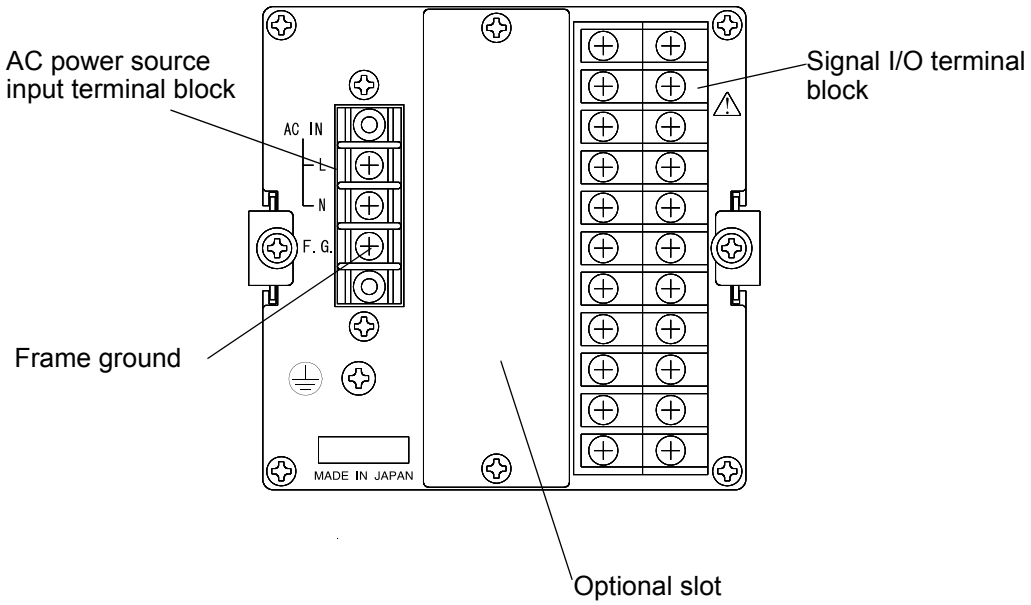

Graph Display




### 1-1-2. Power Lamp

This lamp lights when the power to the F370 is on.

## 1-2. Rear Panel




### 1-2-1. Signal I/O Terminal Block

Pin assignments

| | | | | | |
|---|---|---|---|---|---|
| D/Z | In | A11 | B11 | SIF | Out |
| H/M | In | A10 | B10 | SIF | Out |
| T/H | In | A9 | B9 | ST/SP | In |
| CODE2 | In | A8 | B8 | CODE3 | In |
| CODE0 | In | A7 | B7 | CODE1 | In |
| COM2 | ※ | A6 | B6 | H/E | Out |
| HH | Out | A5 | B5 | LL | Out |
| HI | Out | A4 | B4 | LO | Out |
| COM1 | ※ | A3 | B3 | OK | Out |
| -EXC | Out | A2 | B2 | -SIG | In |
| +EXC | Out | A1 | B1 | +SIG | In |

| | |
|---|---|
| +EXC<br>-EXC<br>+SIG<br>-SIG | The terminal for connecting to a strain-gage sensor. |

See the section on Load Cell Connection page 10 for connection.

| | |
|---|---|
| COM1 | The terminal common to output signals. |
| OK<br>HI<br>LO<br>HH<br>LL | Outputs the OK signal.<br>Outputs the HI signal.<br>Outputs the LO signal.<br>Outputs the HH signal.<br>Outputs the LL signal.<br>→ page 37 「COMPARISON FUNCTIONS」 |
| H/E | Outputs the hold end signal.<br>→ page44 「HOLD FUNCTIONS」 |

See the section on External I/O Connection page 12 for connection.

| | |
|---|---|
| COM2 | The terminal common to input signals. |
| CODE0<br>CODE1<br>CODE2<br>CODE3 | Selects the CH No. for the multi-hold function.<br>→ page65 「MULTI-HOLD FUNCTION」 |
| T/H<br>H/M | The input for controlling the hold signal.<br>→ page44 「HOLD FUNCTIONS」 |
| D/Z | The input for digital zero (making the indicated value zero).<br>→ page28 「Digital Zero」 |
| ST/SP | The graphic display start/stop signal.<br>→ page69 「Graph Plotting」 |

See the section on External I/O Connection page 12 for connection.

| | |
|---|---|
| SI/F | The 2-wire serial interface for coupling a UNIPULSE printer, external display, etc. |

See the section on SI/F Connection page 11 for connection.

**Caution**

Use TMEV1.25-3S crimp contacts (attached) made by NTM or equivalent for connection to the signal I/O terminal block and the AC power source input terminal block.

### 1-2-2. AC Power Source Input Terminal Block

Connect the AC power cord. The input voltage is 100V - 240V AC, and the frequency is 50/60Hz.

### 1-2-3. Frame Ground (Functional ground)

This is a ground terminal block. Be sure to ground the F.G. terminal to prevent electric shocks and failures due to static electricity.

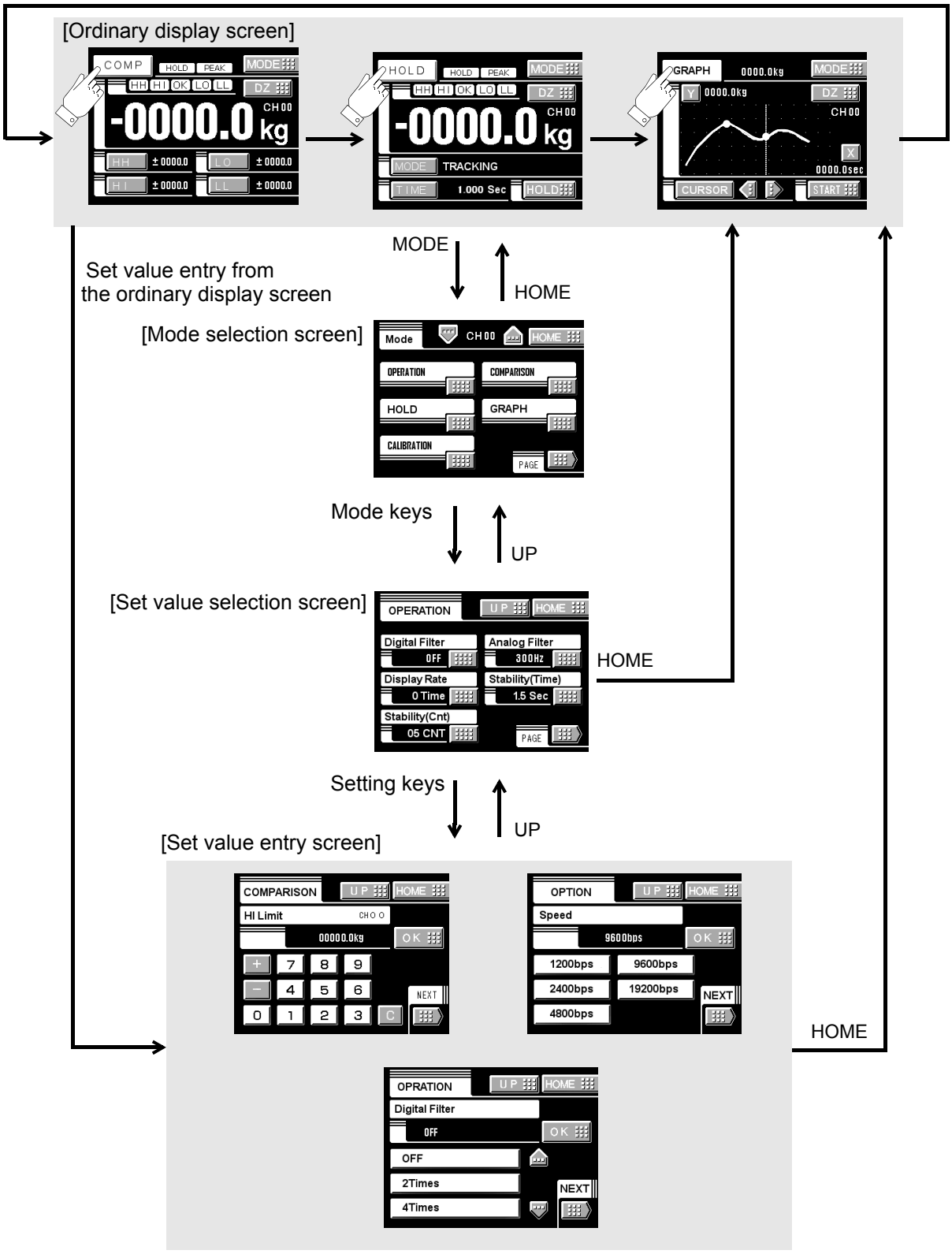
### 1-2-4. Optional Slot

Any one of the following optional boards can be mounted.

- BCD data output
- RS-232C communication interface
- D/A converter
- RS-485
- CC-Link interface
  (CC-Link is an abbreviation for "Control & Communication Link".)
- Device Net interface

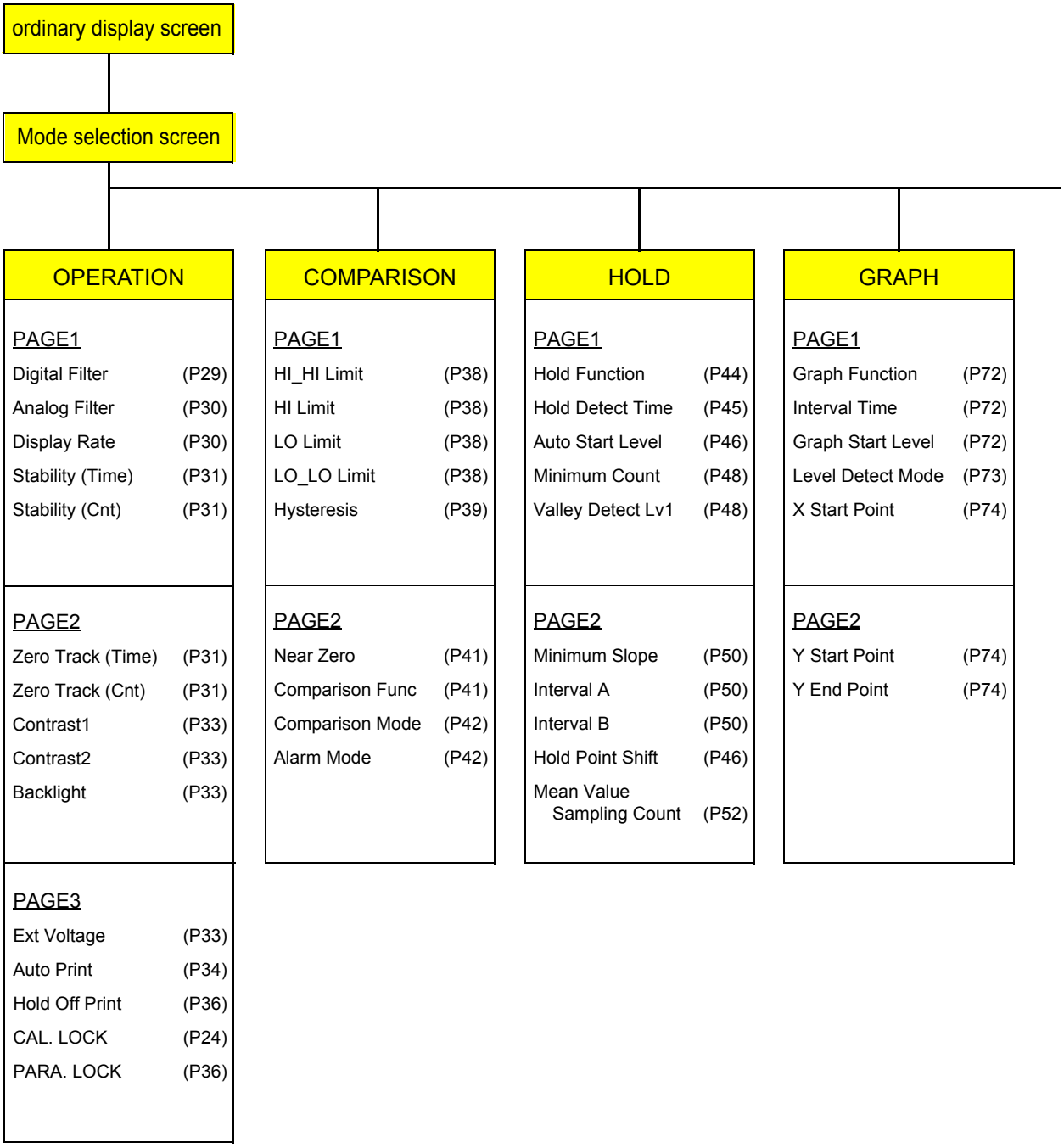
# 2. SETTING MODES

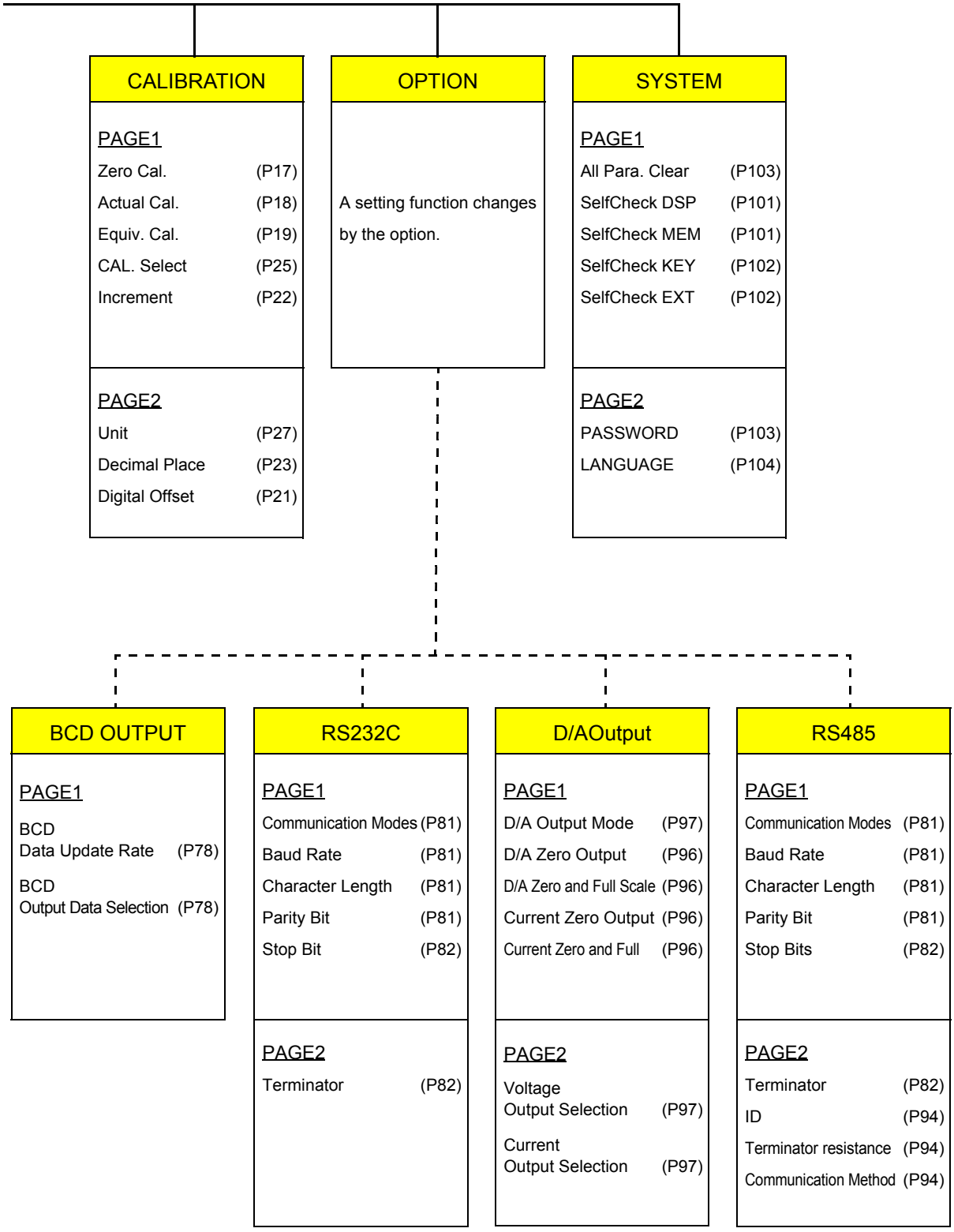
## 2-1. F370 Screen Configuration




With the NEXT key on the set value entry screen, the next set value entry screen appears.

## 2-2. Setting Modes Tree




CALIBRATION
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Terminator resistance (P94)
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## 2-3. About a Setting Call

In this manual, a setting function call is described as follows.

Calibration Protection

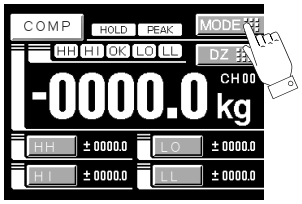
Setting call → Operation setting → Page 3

↑ Mode ↑ Page

This call can be made by the following procedure.

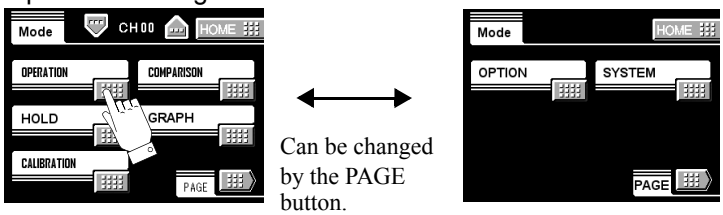
1） Press the MODE button on the ordinary display screen.

Setting call




2） The mode setting screen appears. Select the mode.

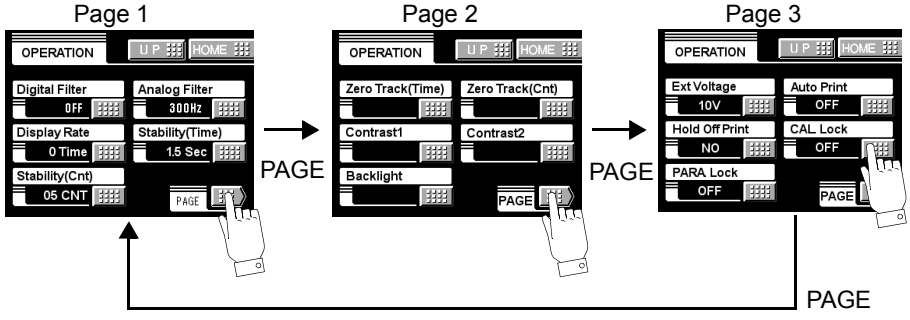
Operation setting




Modes are as follows:

- Operation setting
- Hold
- Calibration
- System
- Comparison setting
- Graph setting
- Option

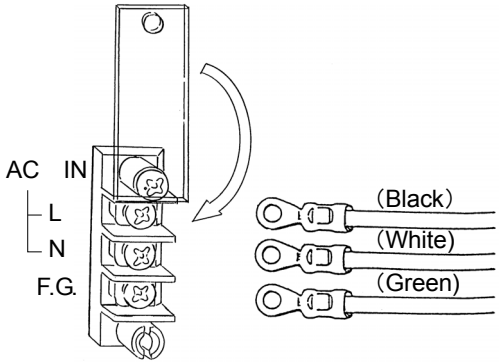
3） The setting function setting screen appears. Select the function.



# 3. CONNECTION

## 3-1. Connection with Power Source Input Terminal

**AC spec.**



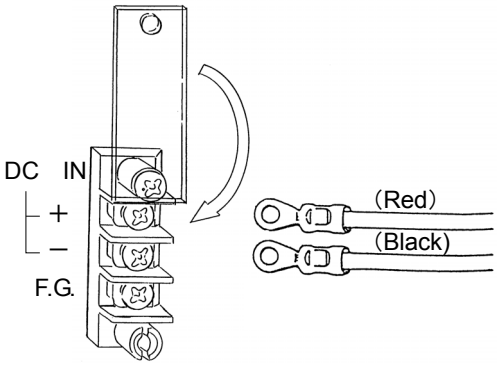

Connect AC power code attached to the terminal.

Voltage input : AC100V - 240V  Frequency :  50/ 60Hz

CAUTION

Check the wiring precisely before power source is turned on.

**DC spec. (Depending on the request at the time of order)**



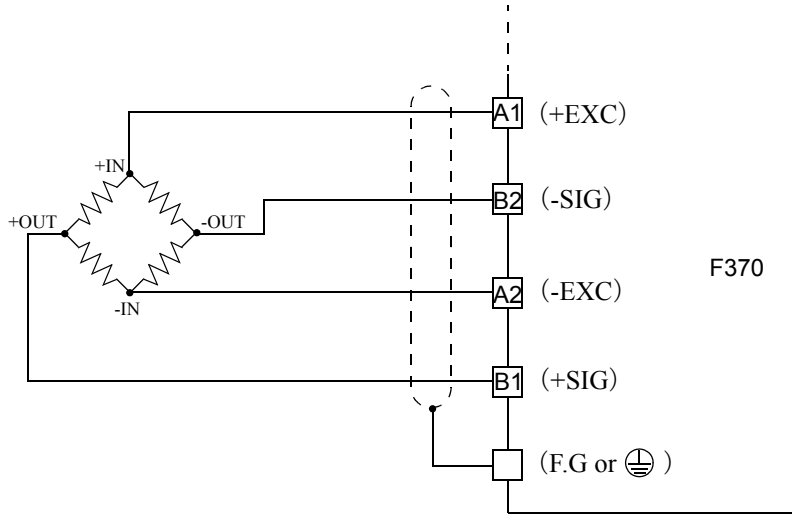

Connect the positive (+) side of the power source to the red screw side of the terminal block on the back of the F370, and its negative (-) side to the black screw side. The input voltage is 12V - 24V DC.

CAUTION

Be aware that the voltage drops depending on the wire thickness and length. Also, never input an AC power source. Doing so will cause a failure.

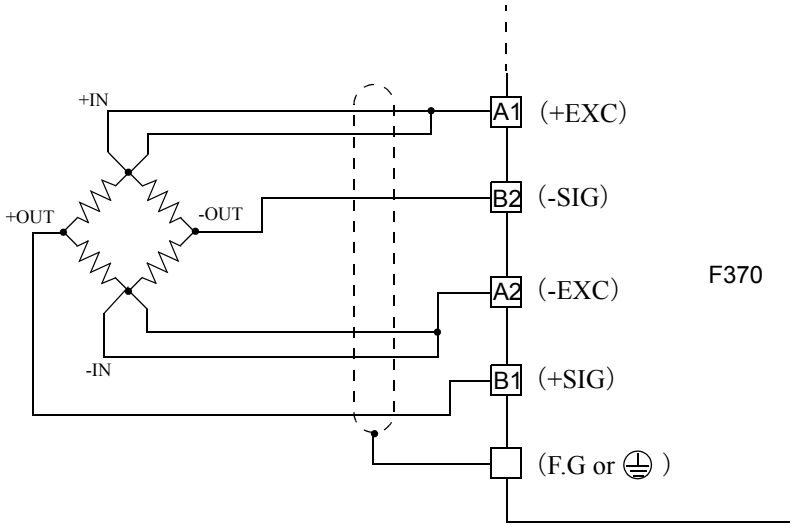
## 3-2. Load Cell Connection

**▪ 4-wire sensor**



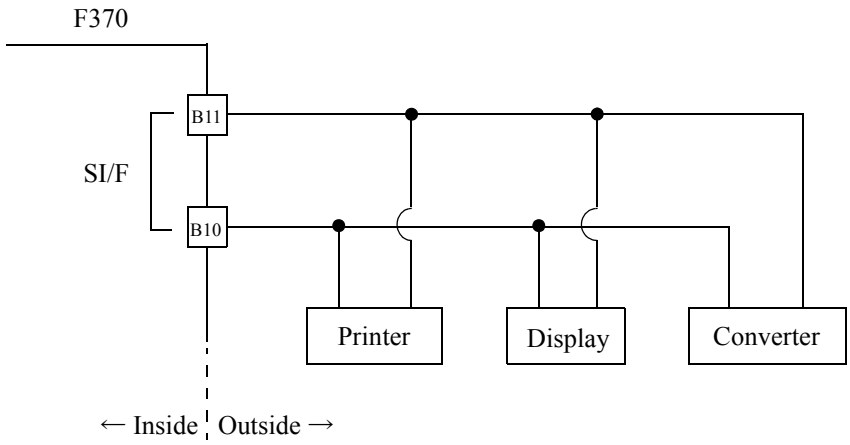

**▪ 6-wire sensor**

Short-circuit +EXC with +S and -EXC with -S for connecting a 6-wire strain-gage sensor.



## 3-3. SI/F Connection

The 2-wire serial interface has connective ability for coupling a UNIPULSE printer, external display, etc.
The interface is nonpolarized and up to three external instruments may be connected.
A two-core parallel cable or a cabtyre cable may be used for connection.

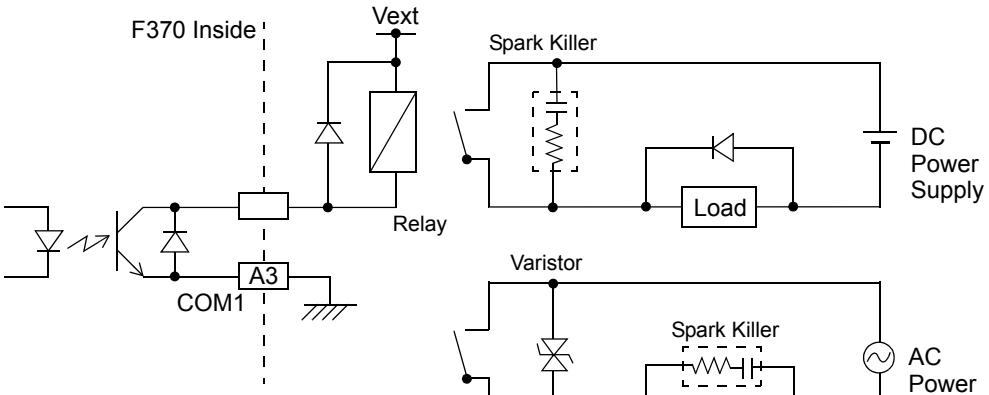


# 3-4. External I/O Connection

## 3-4-1. External Output Connection

The external output circuit is operated through an open collector. A3 COM1 is the common terminal. The open collector output capacity is 30mA and the withstand voltage is up to 30V.

▪ Equivalent circuit



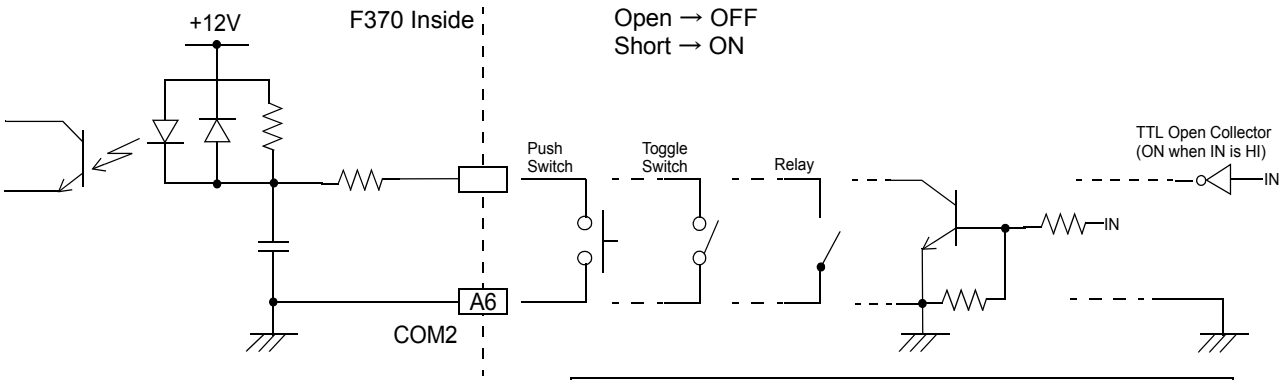

● Output Transistor Status

| Output Data | Tr |
|---|---|
| 0 | OFF |
| 1 | ON |

Supply an external power source for a relay drive power source (Vext).

## 3-4-2. External Input Connection

A signal is inputted to the signal input circuit by short-circuiting or opening the input terminal and the COM2 terminal. Short-circuiting is effected by means of a contact (such as a relay or a switch) or a noncontact (such as a transistor or an open-collector TTL).

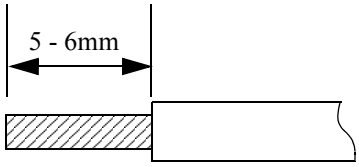



- The external element is required to withstand Ic=10mA.
- Leakage from the external element is required to be 100 $\mu$ A or below.

### 3-4-3. Connecting to Cage Clamp Terminal Block

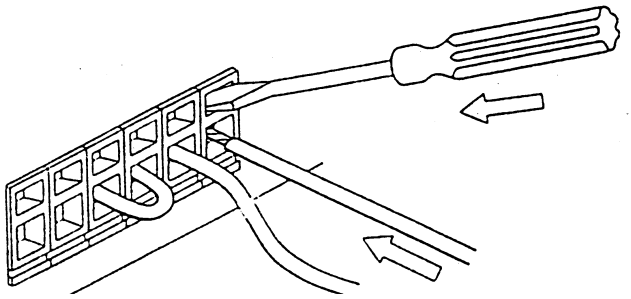
The output terminal D/A option and RS-485 option is using the cage clamp system terminal stand. Please connect in the following procedure.

1.Strip the casing 0.2inch (6mm) on the cable to be connected.



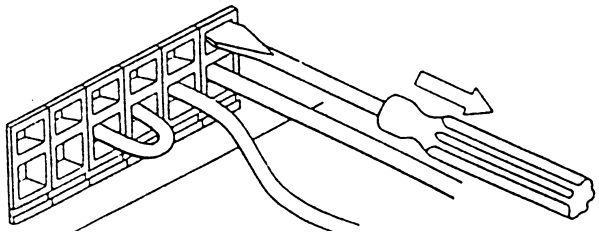

2.Twist the bare wire to fit the terminal hole.

3.Insert the supplied screwdriver into the upper hole and lift upward.



4.Insert the twisted wires into the lower hole.

5.Make sure cable is clamped securely and does not come out with a slight tug.



CAUTION

- Cable can be from 24 to 14AWG (0.2 to 2.5mm$^2$)
- It is not necessary to solder the cable wires or to fix a solderless terminal.
- If several cables to be inserted to the same hole,twist those cable wires together and insert.
- If you connect a cable (a load cell, SI/F, external input and output), please turn off and be sure to perform the power supply of a main part.

# 4. CALIBRATION

Calibration is performed for matching the F370 to a strain-gage sensor. The following two types of calibration are available for the F370.

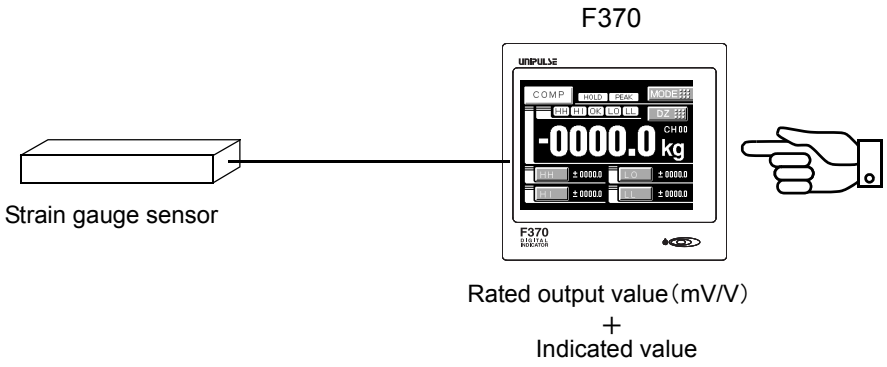
◇ Equivalent Input Calibration

Calibration is performed without an actual load by entering the rated output value (mV/V) and the capacity (to be indicated) of the strain-gage sensor by the keys. Calibration is easily performed when no actual load is available.

For example, the gain is automatically determined by entering:

2.001mV/V (rated output) - 100.0kg (capacity)

as indicated for a load.




A data sheet is attached to a strain-gage sensor at the time of purchase.

The data sheet provides data including:

capacity load (in kg, t, etc.)

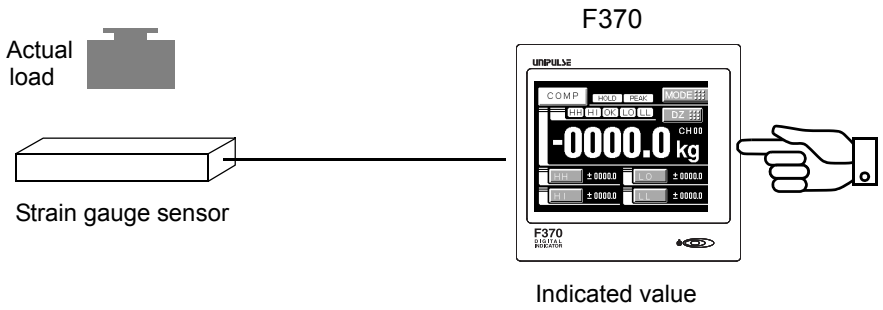
rated output voltage (in mV/V)

non-linearity, hysteresis,input resistance,output resistance and zero balance.

Enter the capacity and the rated output value required for equivalent input calibration into the F370.

◇ Actual Load Calibration

Apply an actual load to the strain-gage sensor and enter the actual load value by the keys for calibration. Calibration is accurately performed with reductions in errors.



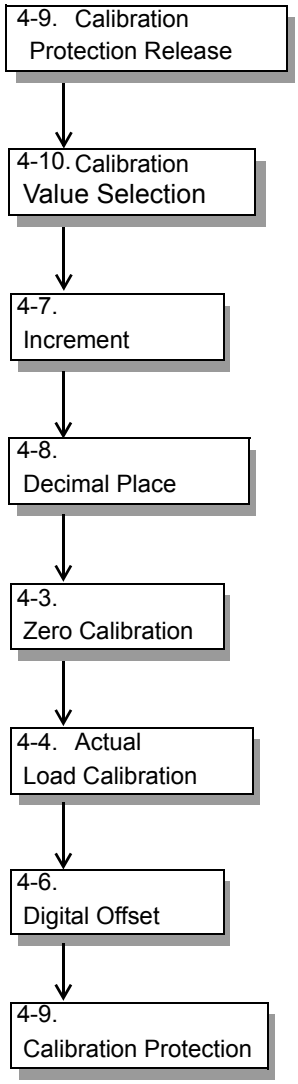

## 4-1. Equivalent Input Calibration Procedure

Follow the steps below to perform equivalent input calibration.

| | |
|---|---|
| 4-9. Calibration Protection Release | Release the calibration protection. |
| 4-10. Calibration Value Selection | Set the calibration value No.<br>(This step may be omitted for use with only one selection.) |
| 4-7. Increment | Enter the minimum value of digital increments.<br>(This step may be omitted if there is no change.) |
| 4-8. Decimal Place | Determine the decimal point place of the indicated value.<br>(This step may be omitted if there is no change.) |
| 4-3. Zero Calibration | Set the zero point of the strain-gage sensor in no-load condition (with the sensor unloaded). |
| 4-5. Equivalent Input Calibration | Enter the rated output value and reading of the strain-gage sensor. |
| 4-6. Digital Offset | The calibrated value can be offset in advance.<br>(This step may be omitted if there is no change.) |
| 4-9. Calibration Protection | Turn on the calibration protection for preventing misoperation. |

## 4-2. Actual Load Calibration Procedure

Follow the steps below to perform equivalent input calibration.




Release the calibration protection.

Set the calibration value No.
(This step may be omitted for use with only one selection.)

Enter the minimum value of digital increments.
(This step may be omitted if there is no change.)

Determine the decimal point place of the indicated value.
(This step may be omitted if there is no change.)

Set the zero point of the strain-gage sensor in no-load condition (with the sensor unloaded).

Enter the span (gain) point of the strain-gage sensor with a load applied to the sensor.

The calibrated value can be offset in advance.
(This step may be omitted if there is no change.)

Turn on the calibration protection for preventing misoperation.

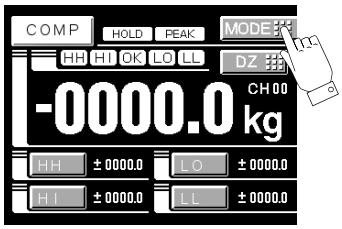
## 4-3. Zero Calibration

Set the zero point in no-load condition.

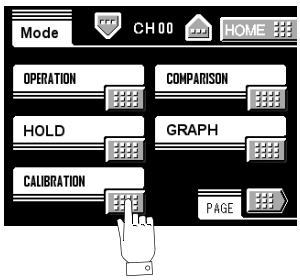
### How to set

Setting call → Calibration → Page 1

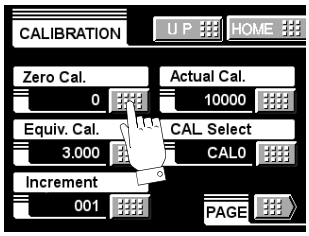
1) Press the MODE button.



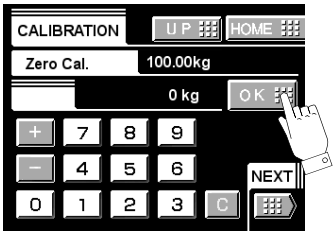

2) Press the CALIBRATION button.




3) Press the Zero Cal. button.




4) Press OK button after confirming no-load was applied to the sensor.



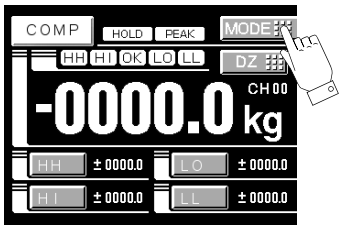
## 4-4. Actual Load Calibration

Set the actual load value under an actual load.

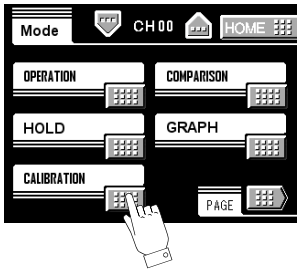
### How to set

Setting call → Calibration → Page 1

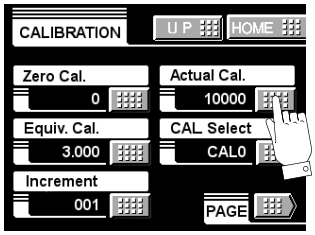
1) Press the MODE button.



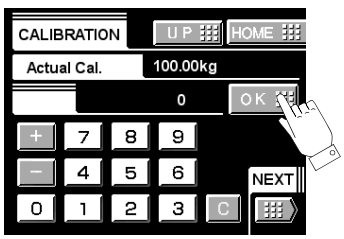

2) Press the CALIBRATION button.




3) Press the Actual Cal. button.




4) Apply an actual load to the sensor, enter the actual load value by the numerical keys and determine with the OK button.



## 4-5. Equivalent Input Calibration

Set the rated output value and reading of the sensor.

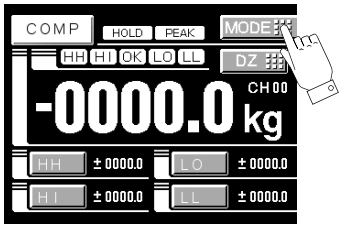
Rated output value: 0.000 - 3.000mV/V

Rated value: 00000 - 99999

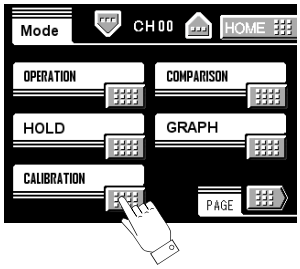
### How to set

Setting call → Calibration → Page 1

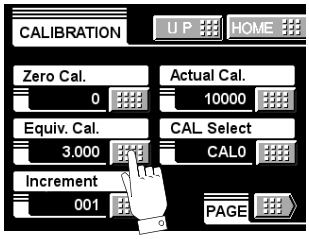
1） Press the MODE button.



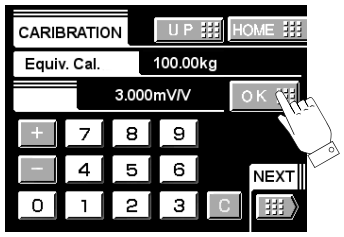

2） Press the CALIBRATION button.



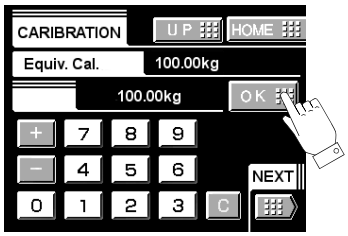

3） Press the Equiv.Cal. button.



4）Enter the rated output of the sensor by the numerical keys and determine with the OK button. The decimal point is fixed.




5） Enter the rated value by the numerical keys and determine with the OK button.



## 4-6. Digital Offset

By using the digital offset function, the value obtained by subtracting the set value from the indicated value is displayed.

This function is convenient when zero cannot be obtained with no load for some reason or for offsetting.

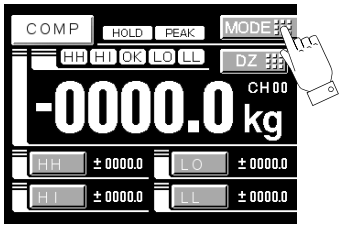
(displayed value)=(actual indicated value)-(offset value)

↳ Setting range:
− 99999 - 99999

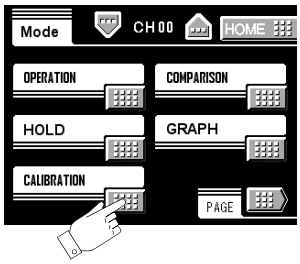
### How to set

Setting call → Calibration → Page 2

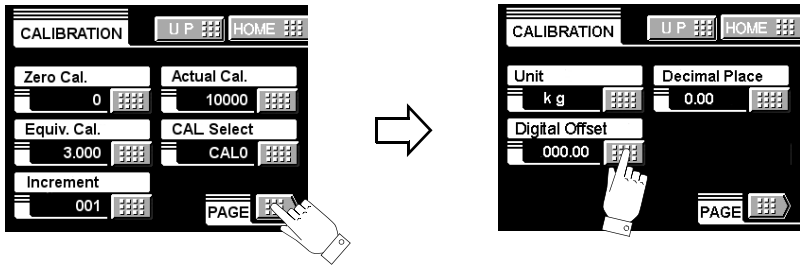
1） Press the MODE button.



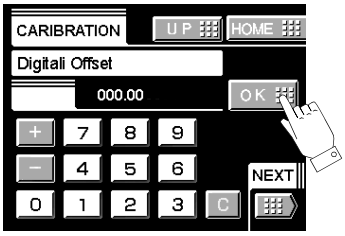

2） Press the CALIBRATION button.




3） Press the PAGE button to select the page and press the Digital Offset button.




4）Enter the digital offset value by the numerical keys and determine with the OK button.



## 4-7. Increment (This step may be omitted if there is no change.)

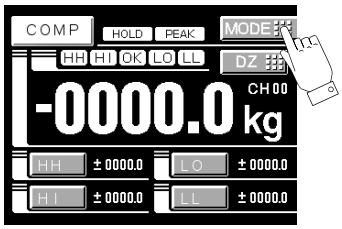
Set the increment of the indicated value.

Input range: 001 - 100

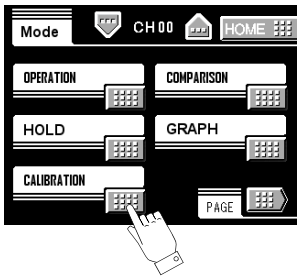
### How to set

Setting call → Calibration → Page 1

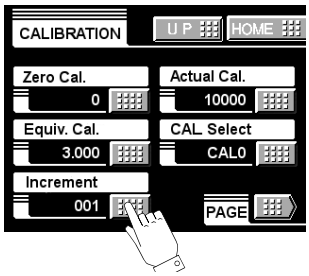
1) Press the MODE button.



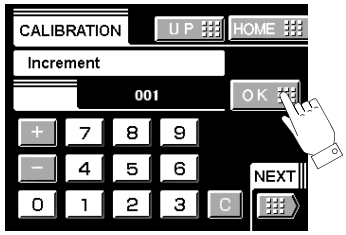

2) Press the CALIBRATION button.




3) Press the INCREMENT button.




4) Enter the increment by the numerical keys and determine with the OK button.



## 4-8. Decimal Place

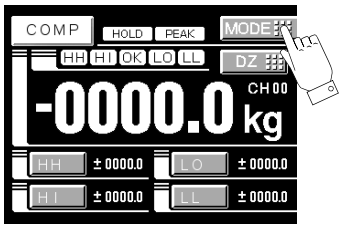
Set the decimal point place of the indicated value. Selection can be made from the following.

0, 0.0, 0.00, 0.000, 0.0000

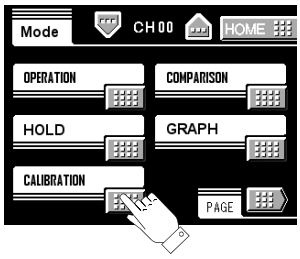
### How to set

Setting call → Calibration → Page 2

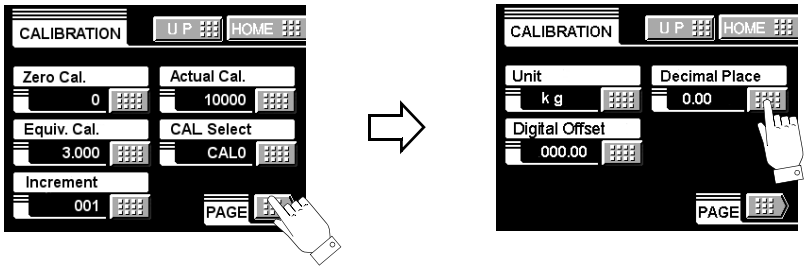
1) Press the MODE button.



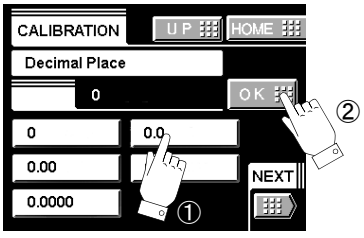

2) Press the CALIBRATION button.




3) Press the PAGE button to select the page and press the DECIMAL PLACE button.




4) Select the decimal place and determine with the OK button.



## 4-9. Calibration Protection

Calibration-related set values can be protected so that they will not be changed by misoperation. When Cal. Protect is ON, no change can be made while the alarm sounds.

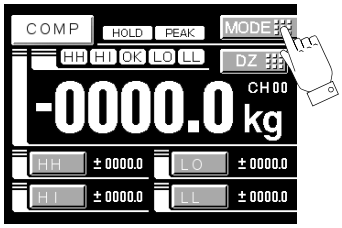
ON: Protected

OFF: Unprotected

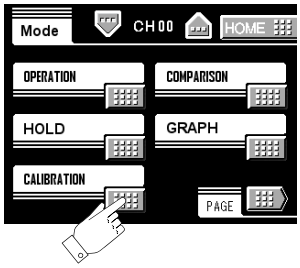
### How to set

Setting call → Calibration → Page 3

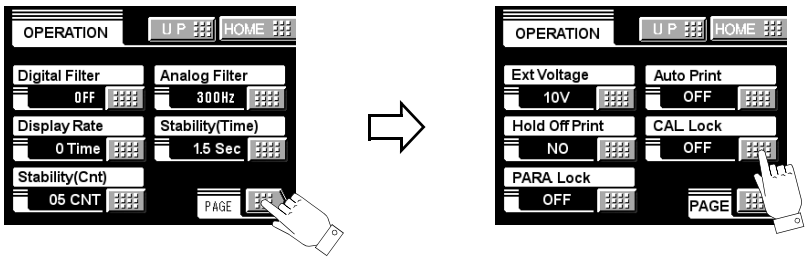
1) Press the MODE button.



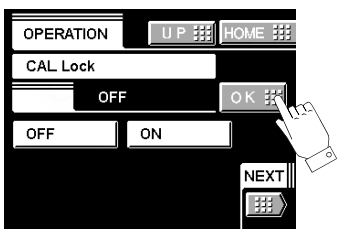

2) Press the CALIBRATION button.




3) Press the PAGE button to select the page twice and press the Cal Lock button.




4) Select the decimal place and determine with the OK button.



## 4-10. Calibration Value Selection

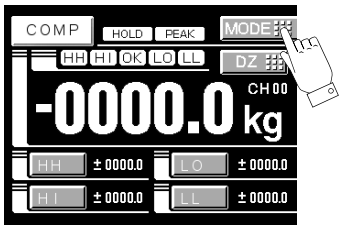
By storing up to four calibration values in the memory, the desired calibration value can be called to switch the indicated value. Setting values that can be switched are as follows:

| Calibration Mode Setting | Operation Mode Setting |
|---|---|
| Zero Calibration | Excitation Voltage |
| Actual Load Calibration | |
| Equivalent Input Calibration | |
| Minimum Slope | |
| Unit | |
| Decimal Place | |
| Digital Offset | |

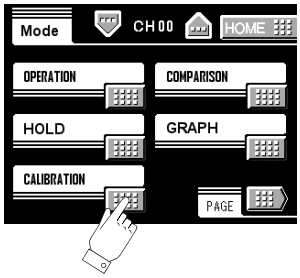
**How to set**

Setting call → Calibration → Page 1

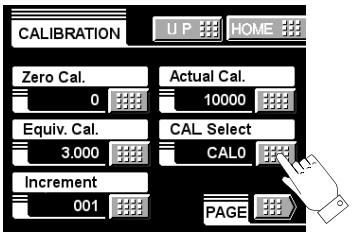
1） Press the MODE button.



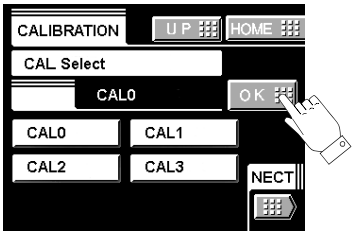

2） Press the CALIBRATION button.



3）Press the CAL. SELECT button.




4）Select the calibration value from 0 - 3 and determine with the OK button.



## 4-11. Unit

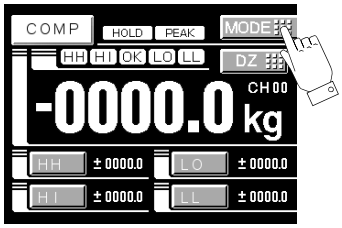
Set the unit of the load to be displayed. Selection can be made from the following.

None, kg, g, t, N, kN, Nm, N/m$^2$, Pa, kPa, MPa, bar

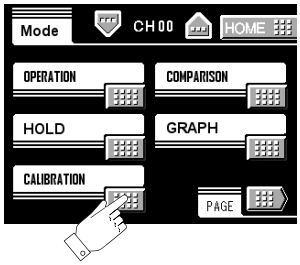
### How to set

Setting call → Calibration → Page 2

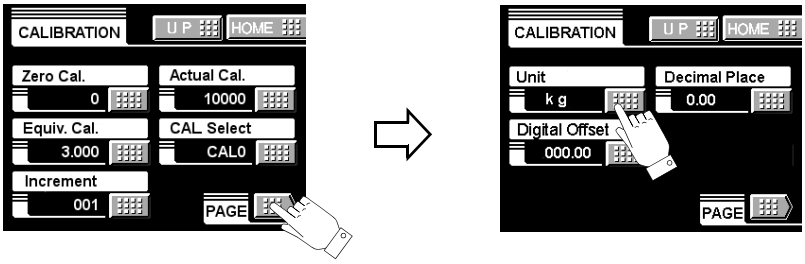
1) Press the MODE button.



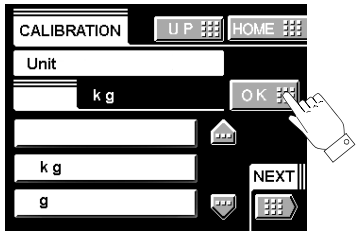

2) Press the CALIBRATION button.




3) Press the PAGE button to select the page and press the UNIT button.




4) Select the unit and determine with the OK button.




Scroll with the  and  buttons.

* A change of unit does not affect the indicated value (calibration value).

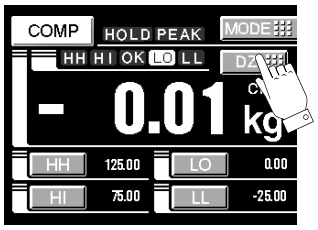
# 5. SETTING OF FUNCTIONS

## 5-1. Digital Zero

This function zeros the value currently indicated.

**Digital Zero by key input**

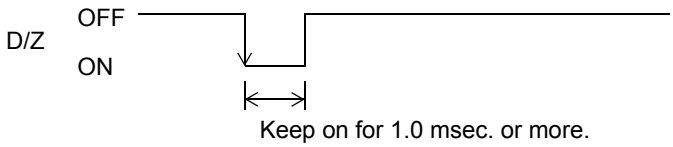
1）Press the DZ button on the ordinary display screen.




2）Digital Zero is activated by pressing OK button then indicated value becomes zero. By pressing CANCEL The screen returns to the ordinary display screen.

**Digital Zero conducted by External signal (D/Z input)**

Digital Zero activates in the moment when the connection of the external input terminal D/Z on the rear panel and COM2 is switched from Open to Short-circuit then the indicated value becomes Zero.




CAUTION

In case of power interruption Digital Zero is released.
After recovering from power interruption, carry out the digital zero again if necessary.

## 5-2. Digital Filter

The digital filter is a function for reducing drifts of the indicated value by means of a moving average of data converted from analog to digital. The number of the moving averages can be selected a range between 0 and 512.
With an increase in the number of filterings, the indicated value becomes more stable,but the response to inputs becomes slower.

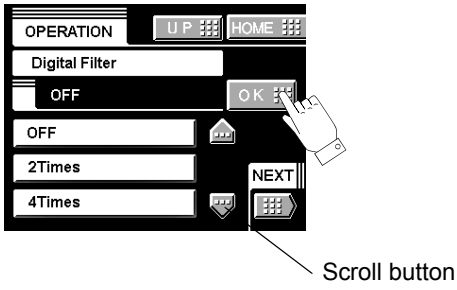
Number of settings:OFF, 2, 4, 8, 16, 32, 64, 128, 256, 512

**How to set**

Setting call → Operation Setting → Page 1

* See the section on About a Setting Call page 8 .

The value of a digital filter is scrolled with a button.



## 5-3. Analog Filter

A low-pass filter is provided for filtering input signals from the strain-gage sensor and canceling noise components.

The cut-off frequency can be selected in a range between 10Hz and 300Hz. With an increase in the cut-off frequency, the response becomes faster, but noise components may be indicated.

Cut-off frequency: 10Hz, 30Hz, 100Hz, 300Hz

**How to set**

Setting call → Operation Setting → Page 1

## 5-4. Display Rate

Enter the rate of rewriting the display.

The display rate can be selected in a range between 1 and 10 times/sec. The internal operation speed does not change.

**How to set**

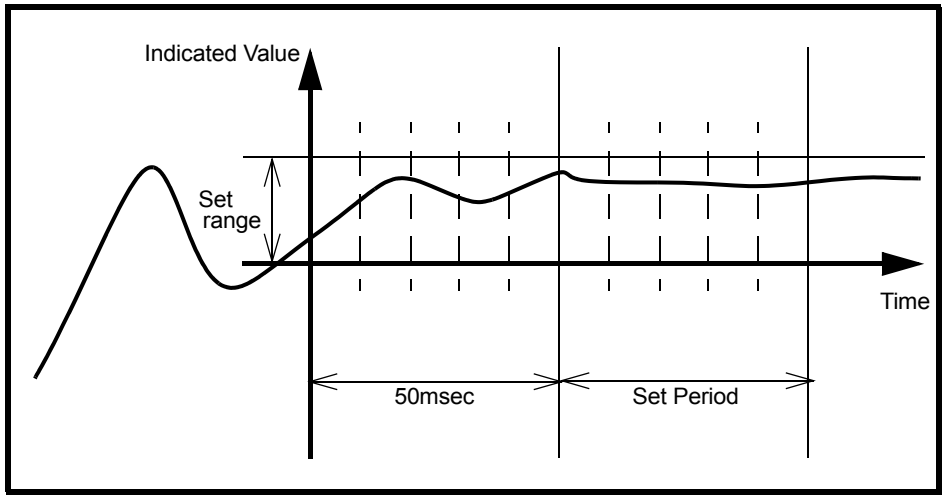
Setting call → Operation Setting → Page 1

## 5-5. Stability

Enter the parameters to detect stability.

If the difference between the current indicated value and the 50-msec-previously indicated value is less than the set count and the duration of the condition is more than the set time, the indicated value is regarded to be stable.

When stability is detected, a digital filter (fixed 16 times) to control instability in weight value is automatically inserted. This stable-time digital filter differs from the digital filter setting in the operation mode.




**Setting range**

- MD (time): 0.1 - 9.9 sec.
- MD (width): 01 - 99

### How to set

Setting call → Operation Setting → Page 1

CAUTION

When the time is 0.0 sec. and the width is 00 markings, stability is not detected. At this time, the stable-time digital filter is normally off.

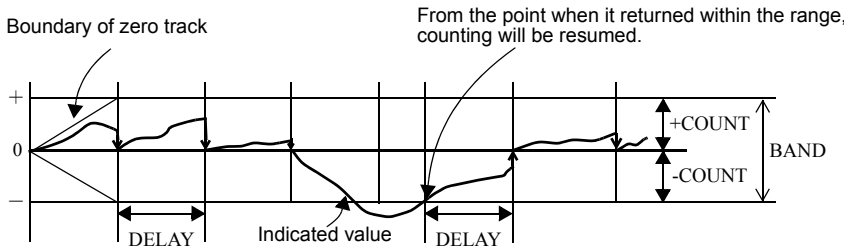
Turning on/off the near zero function is closely related to the auto print function and HI-LO limit comparison mode.

For details, see the sections on Auto Print page 34 and HI-LO Limit Comparison Mode page 41.

## 5-6. Zero Track

Gradual changes in the zero point due to drifts etc., are automatically tracked for correction.

- When displacement of the zero point is within the set count of tracking and it continues more than the set time, it is automatically made zero by Zero Tracking function.
- The time (tracking delay) is set in the range of 0.1 - 9.9 sec., and the band (tracking band) is set in the range of 01 to 99.
  If the time is set at 0.0 sec. and the band at 00, the zero tracking function does not work.




Band=count × 2

**Setting range**

ZT (time): 0.0 - 9.9 sec.

ZT (width): 00 - 99

CAUTION

Since the zero track function works from the calibrated zero point of the indicated value, it does not work if the indicated value is beyond the track band. In such a case, obtain the zero point again by zero calibration.

**How to set**

Setting call → Operation Setting → Page 2

## 5-7. Contrast Adjustment

Adjust the contrast of the touch panel display.

Brightness can be adjusted by CONTRAST1.

Screen flickering can be adjusted by CONTRAST2.

### How to set

Setting call → Operation Setting → Page 2

## 5-8. Backlight

The backlight is turned off if no button operation is performed for the set time (minutes).

The backlight is turned on by touching the panel. Setting 00 disables this function.

Setting range: 00 - 99 min.

### How to set

Setting call → Operation Setting → Page 2

## 5-9. Excitation Voltage

Select the bridge voltage to be supplied to the strain-gage sensor.

The bridge voltage is selectable from 10V, 5V and 2.5V.

Be sure to perform calibration after changing this setting.

### How to set

Setting call → Operation Setting → Page 3

## 5-10. Auto Print

The indicated value is automatically printed to the UNIPULSE printer coupled with the F370 through the SI/F. A print is made when the indicated value is stable. (Set the stability parameters by the stability operation.)

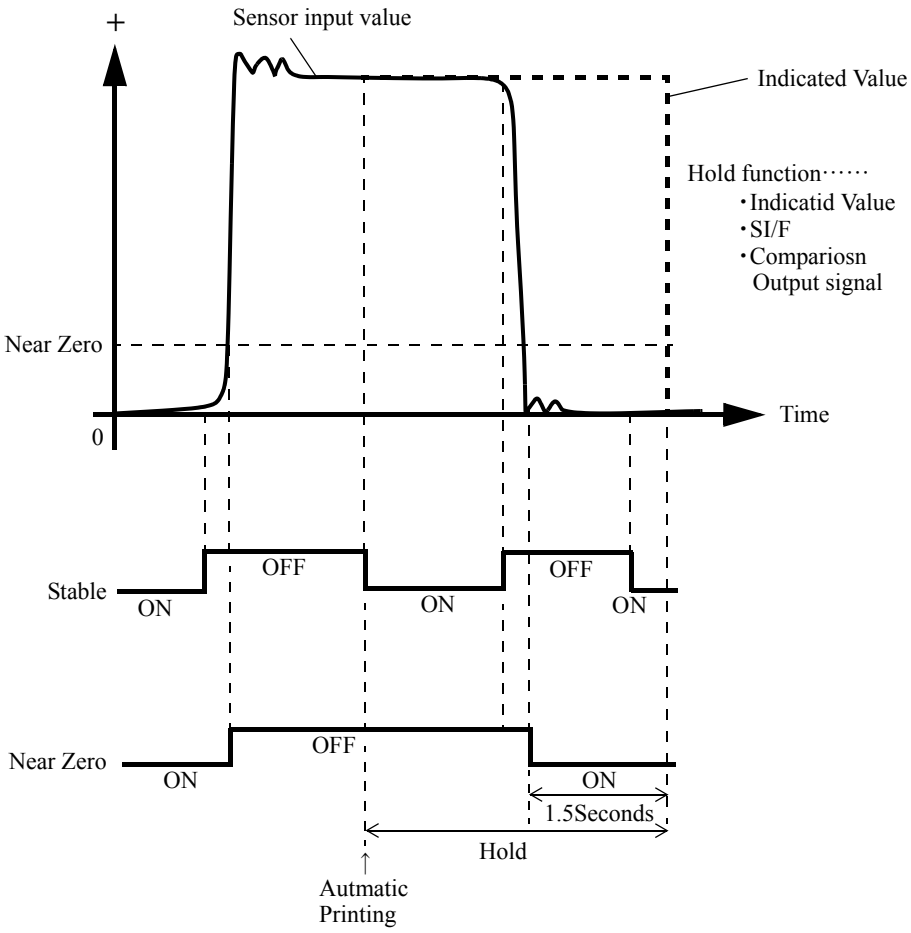
When Near Zero is OFF, Indicated value is held until Near Zero turns ON after Stability turned ON.

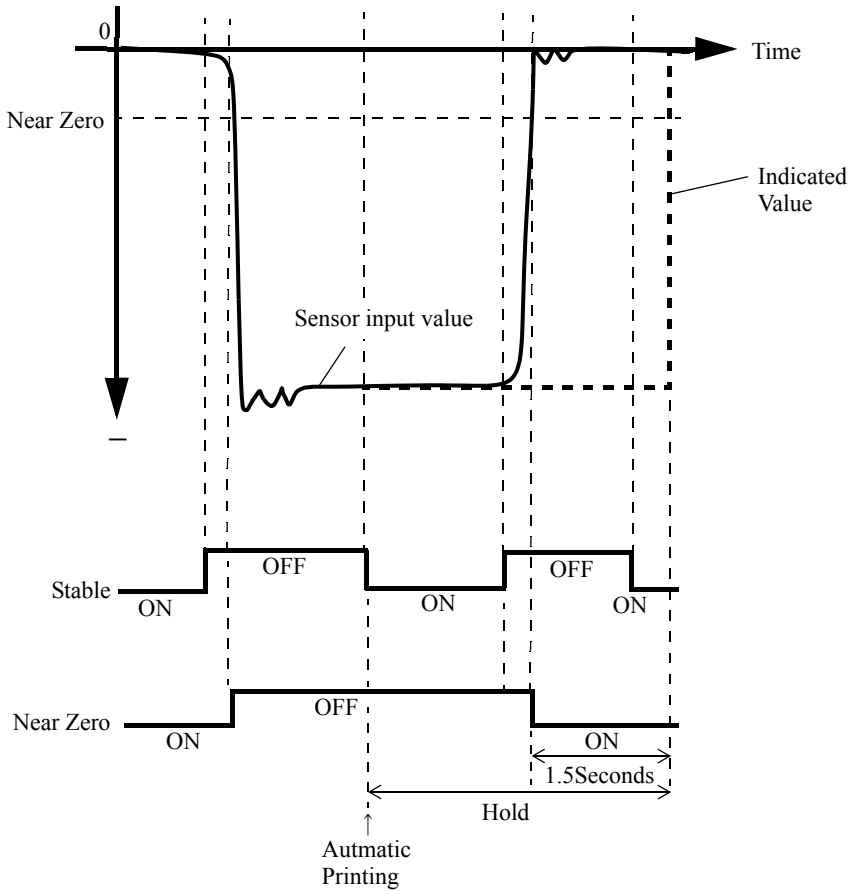
(Hold will be released when 1.5 sec. is passed after Near Zero is ON.)

### How to set

Setting call → Calibration → Page 3

- Operation of the indicated value hold function






Auto Print is not performed under the following conditions.

- Motion Detect
  Time: 0.0 sec. Width: 0.0 of divisions is set.
- Print while hold is released.
  When Print is set.
- Hold Mode
  When any items except Tracking is selected.

## 5-11. Hold Off Print

At hold-off time, the held value is automatically printed to the UNIPULSE printer coupled with the F370 through the SI/F.
(The hold is released by the T/H signal off timing when the period setting is all interval in various hold modes by hold functions, and by the T/H signal of timing when other periods are set.)

### How to set

Setting call → Calibration → Page 3

## 5-12. Parameter Protection

Parameters are protected from being changed by misoperation.

### How to set

Setting call → Calibration → Page 3

For the parameters which are protected by parameter protection, see the section on SETTING ITEM CHART page 113.

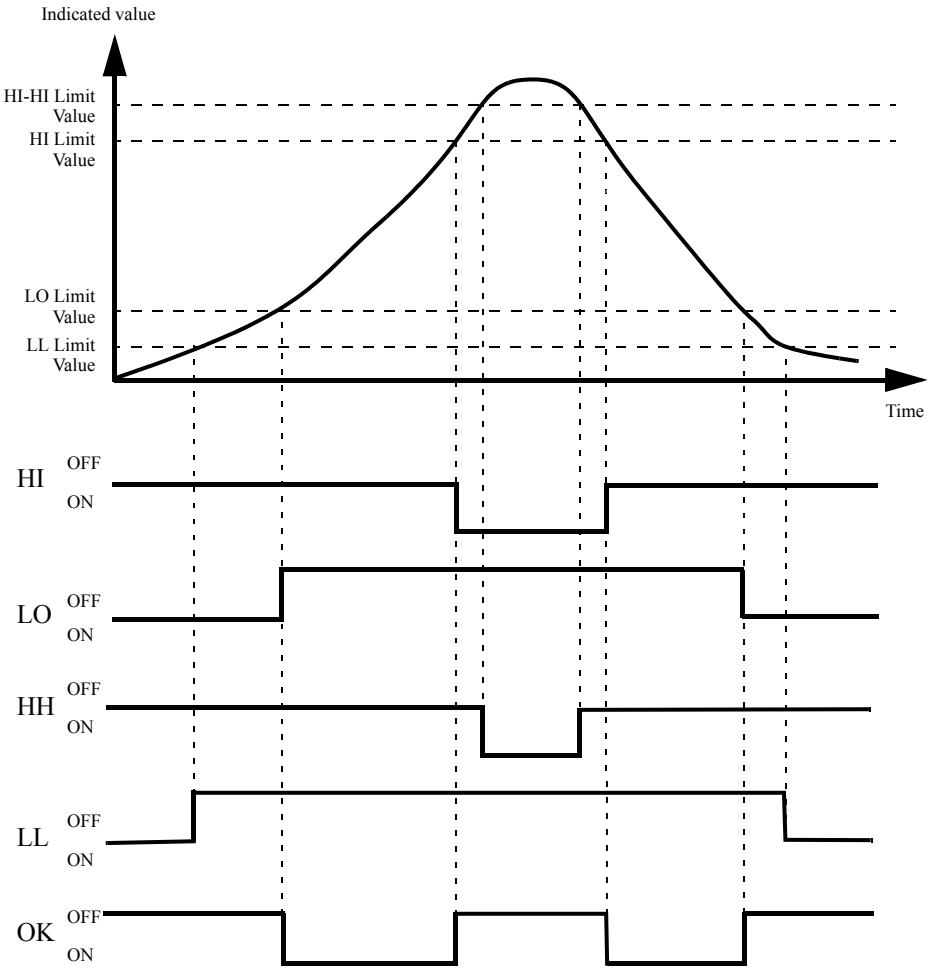
# 6. COMPARISON FUNCTIONS

By the comparison function, the HI limit and LO limit values are set, and when the indicated value exceeds the HI limit, the HI output is turned on, and when the indicated value falls below the LO limit, the LO output is turned on. Also, HI-HI limit and LO-LO limit values may be set outside the HI-LO limit comparison. When the indicated value exceeds the HI-HI limit, the HH output is turned on, and when the indicated value falls below the LO-LO limit, the LL output is turned on. When the HI, HH, LO and LL outputs are all off, the OK output is turned on.

<HI/LO output conditions>
HI: indicated value > HI limit value
LO: indicated value < LO limit value

<HH/LL output conditions>
HH: indicated value > HI-HI limit value
LL: indicated value < LO-LO limit value

<OK output conditions>
OK: All conditions of HH, HI, LO and LL are off.



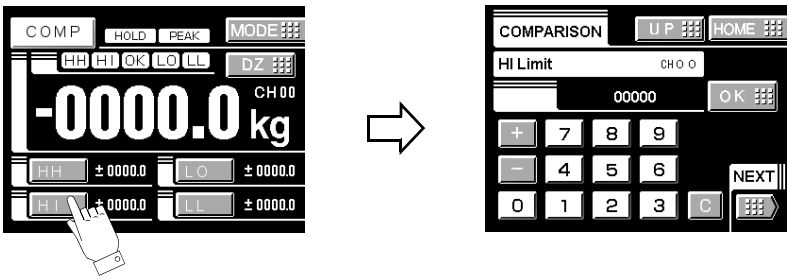
# 6-1. HI Limit/LO Limit/HI-HI Limit/LO-LO Limit

## How to set

Setting call → Comparison setting → Page 1

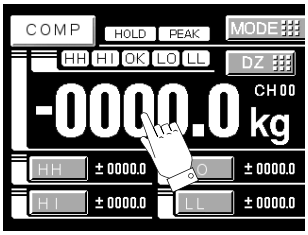
**Simple setting call**

Press any of the HI-HI, HI, LO and LO-LO buttons at the bottom of the indicated value display screen to go direct to the entry screen.




### About the indicated value display color

The display color can be changed by pressing the indicated value display section. Every time it is pressed, State 1 and State 2 are changed.




・State 1

The indicated value display color is fixed (yellow).

・State 2

The indicated value display color changes following the comparison status.

OK: green

HI, LO: yellow

HH, LL: red

## 6-2. Hysteresis

The hysteresis value may be determined so as to allow a margin for timing the turning off of the HI-LO limit comparison. Normally, it is turned on when the indicated value exceeds the HI limit and is turned off when the indicated value falls below it. However, by setting the hysteresis, it is turned off when the indicated value falls below the HI limit further lowered by the hysteresis value.
This function is effective to prevent chattering in such a case where signals fluctuate (vibrate) subtly.

〈Comparison conditions〉

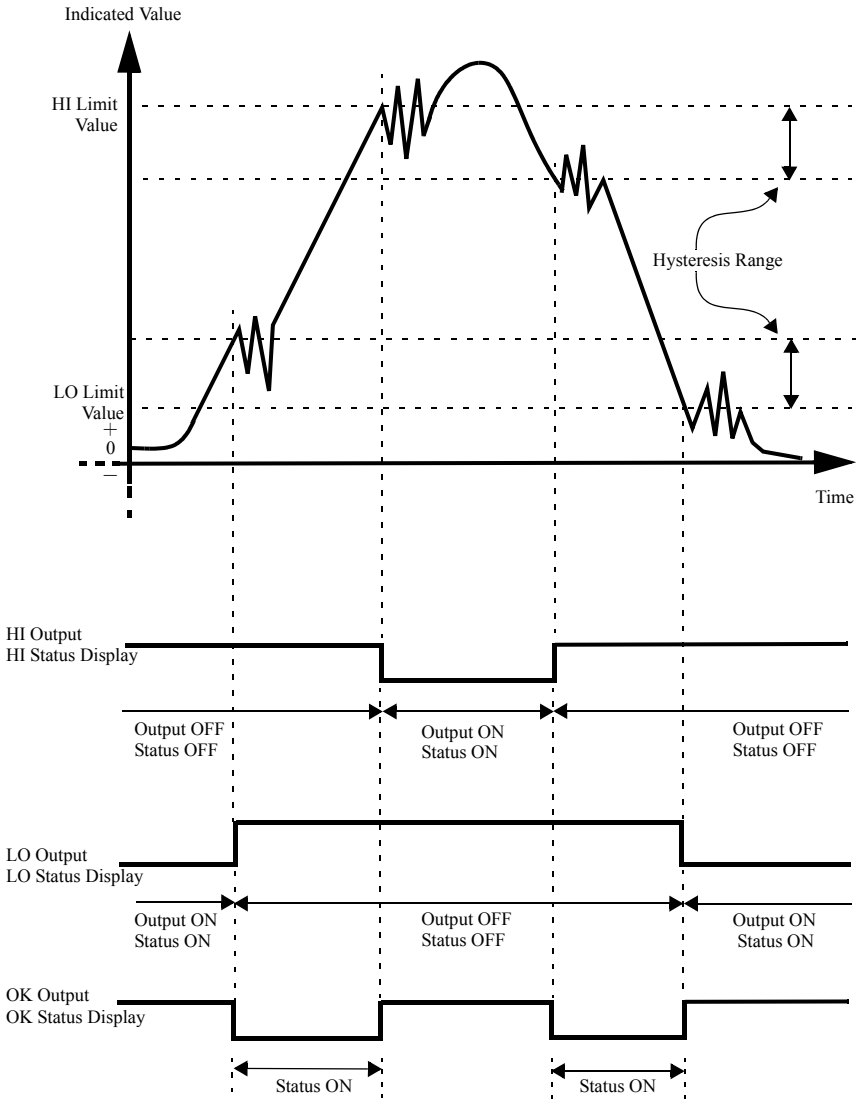
- HI limit
  ON condition: indicated value>HI limit value
  OFF condition: indicated value<=(HI limit value-hysteresis value)

- LO limit
  ON condition: indicated value<LO limit value
  OFF condition: indicated value>=(LO limit value+hysteresis value)

- HI-HI limit
  ON condition: indicated value>HI-HI limit value
  OFF condition: indicated value<=(HI-HI limit value-hysteresis value)

- LO-LO limit
  ON condition: indicated value<LO-LO limit value
  OFF condition: indicated value>=(LO-LO limit value+hysteresis value)

**▪ Hysteresis operation**




（Exsample：HI Output and LO Output and OK Output）

## How to set

Setting call → Comparison setting → Page 1

Hysteresis setting value is common to all HI limit value.

## 6-3. Near Zero

By this function, it is detected that the indicated value is near zero.

Near-zero ON: indicated value <=near zero set value

Near-zero OFF: indicated value > near zero set value

Setting range: 00000 - 99999

Turning on/off the near zero function is closely related to the auto print function and HI-LO limit comparison.

For details, see the sections on HI-LO Limit Comparison Mode page 41 and Auto Print page 34.

**How to set**

Setting call → Comparison setting → Page 2

## 6-4. HI-LO Limit Comparison Mode

Set the operating condition of HI-LO limit comparison. Select the condition from the following.

| | |
|---|---|
| Continuous | : HI-LO limit comparison is performed continuously. |
| MD | : HI-LO limit comparison is performed when the indicated value is stable. Set the stability parameters by the stability operation. |
| NZ | : HI-LO limit comparison is performed when the indicated value is not near zero. Set the near zero parameters by the near zero operation. |
| MD+NZ | : HI-LO limit comparison is performed when the indicated value is stable and not near zero. |

**How to set**

Setting call → Comparison setting → Page 2

## 6-5. HI-LO Limit Output Mode

The number of HI-LO limits can be changed.

| Mode | HI Limit Operation | LO Limit Operation |
|---|---|---|
| Mode 0 | HI-HI Limit, HI Limit, LO Limit, LO-LO Limit | None |
| Mode 1 | HI-HI Limit, HI Limit, LO Limit | LO-LO Limit |
| Mode 2 | HI-HI Limit, HI Limit | LO Limit, LO-LO Limit |
| Mode 3 | HI-HI Limit | HI Limit, LO Limit, LO-LO Limit |
| Mode 4 | None | HI-HI Limit, HI Limit, LO Limit, LO-LO Limit |

The HI limit output is turned on when the indicated value becomes larger than the set value.
The LO limit output is turned on when the indicated value becomes smaller than the set value.

Caution

Even if any mode other than MODE 2 is selected, the name of each setting does not change. Only the operation differs.

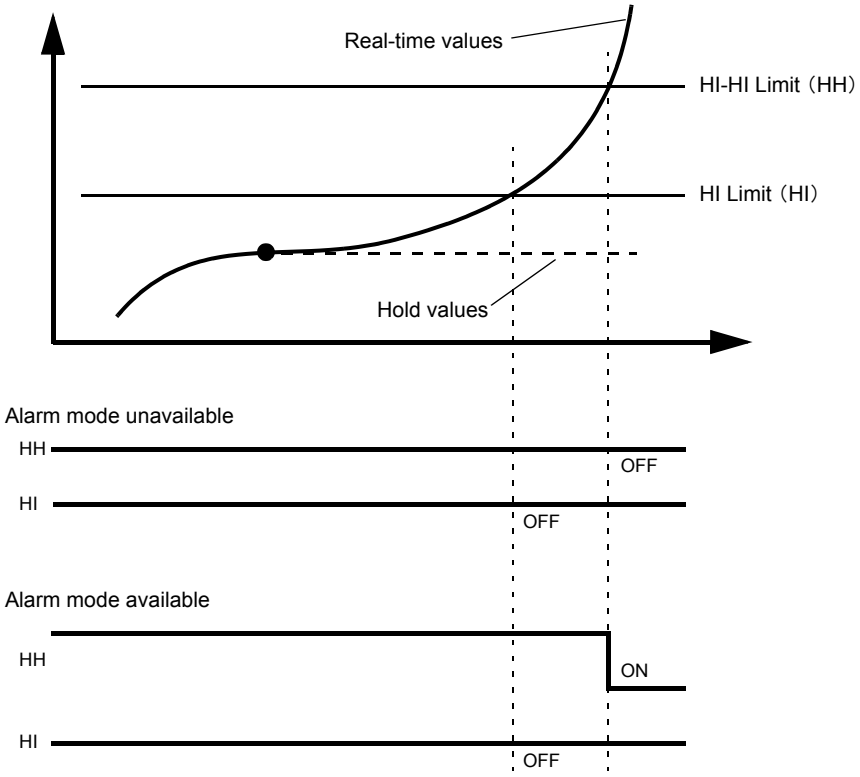
**How to set**

Setting call → Comparison setting → Page 2

## 6-6. Alarm Mode

The comparison target of the HI-HI limit and LO-LO limit set values can be changed from “hold value” to “real-time value”. By this function, whether or not the indicated value becomes abnormal during hold can be monitored.

Unavailable : Comparison operation is performed with hold values.
Available : Comparison operation is performed with real-time values.




When the comparison output mode is “mode 0: HI limit operation for all of HI-HI limit/HI limit/LO limit/ LO-LO limit”, the alarm mode operation can only be performed with the HI-HI limit.
In a like manner, when the mode is “mode 4: LO limit operation for all of HI-HI limit/HI limit/LO limit/LO-LO limit”, the alarm mode operation can only be performed with the low-low limit.

**How to set**

Setting call → Comparison setting → Page 2

# 7. HOLD FUNCTIONS

By the hold function including sample hold, peak hold, valley hold, peak-to-peak hold, relative maximum and minimum hold and inflection point hold, a specific point in a waveform is taken out for HI-LO limit comparison.
The operation of each hold will be described in detail.

## 7-1. Hold Setting --- common ---

### 7-1-1. Hold Mode

The F370 includes nine hold modes as shown in the table below.
In the peak, valley, peak-to-peak and mean value modes, period setting is required. Select all period, external signal, time, or time with trigger.
If you do not use any hold function, be sure to set the hold mode to tracking. (In tracking condition, hold operation is not performed but input values are always displayed.)

| HOLD MODE | HOLD PERIOD SETTING |
|---|---|
| Tracking | None |
| Sample | None |
| Peak<br>Valley<br>P-P | Required |
| Relative maximum<br>Relative minimum<br>Inflection Point | None |
| Mean value | Required |

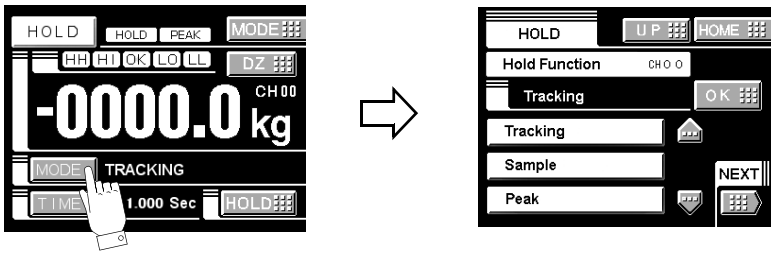
There is a section setup.
- All Period
- External Signal
- Time
- Time with trigger

**How to set**

Setting call → Hold → Page 1

Simple setting call

Press the MODE button at the bottom of the indicated value display screen to go direct to the hold mode entry screen.




## 7-1-2. Hold Detection Time

If you set the hold period setting in the hold function setting to Time or Time with Trigger, set the time.

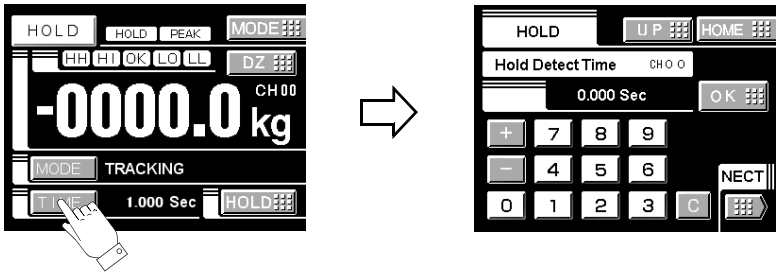
Setting range: 0.001 - 9.999 sec.

**How to set**

Setting call → Hold → Page 1

Simple setting call

Press the TIME button at the bottom of the indicated value display screen to go direct to the hold detection time entry screen.



### 7-1-3. Auto Start Level

If you select the time specified period mode with trigger, or relative maximum, relative minimum or inflection point hold in the hold mode setting, set the start level.

Setting range: -99999 - 99999

**How to set**

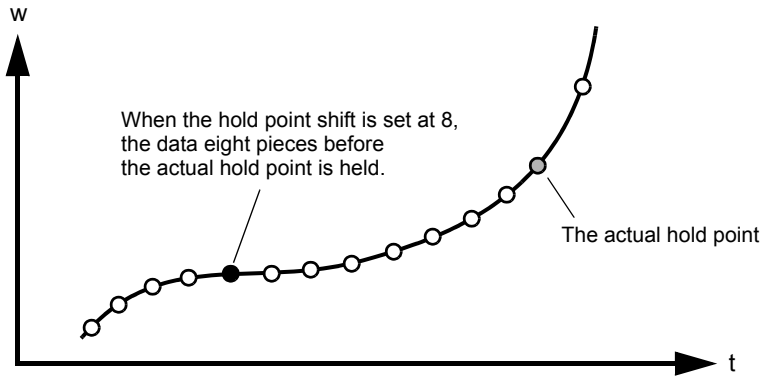
Setting call → Hold → Page 1

In each hold mode of relative maximum/relative minimum/inflection point, if the auto start level is set at 99999, the hold operation starts only with the period signal H/M without performing level detection.

### 7-1-4. Hold Point Shift

In the “sample hold” and “inflection point hold”, the sampling data is held retroactively by the numerical value set under hold point shift.

Setting range: -99999 - 99999




Caution

- This does not work for other holds.
- The retroactive sampling data is held irrespective of the hold period. If the set numerical value is too large, point(s) out of the period may be held.

**How to set**

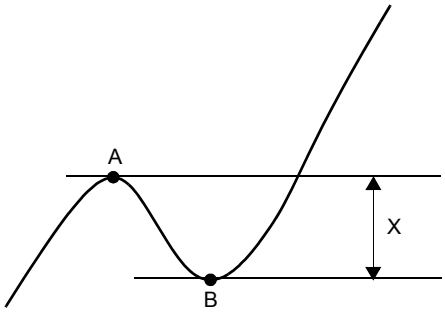
Setting call → Hold → Page 2

## 7-2. Hold Setting --- relative maximum and relative minimum ---

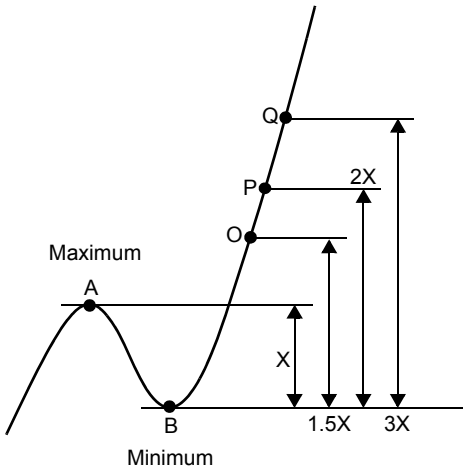
If you select the relative maximum and relative minimum hold in the hold function setting, set the relative maximum and relative minimum value detection parameters "minimum count" and "valley detection level".
Set referring to the principle of operation only when the value cannot be held successfully with the factory settings or when further adjustments are required.

### Detection of the relative maximum value and relative minimum value

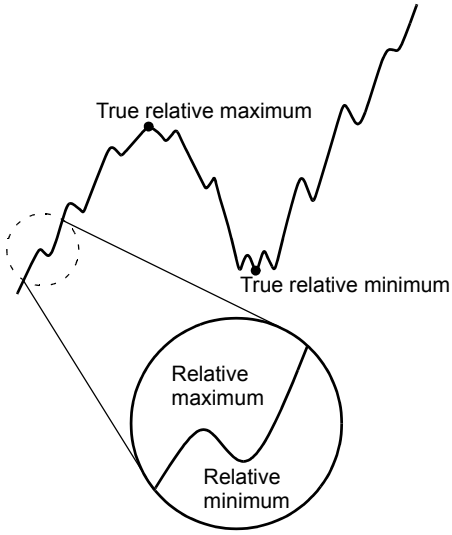
The logic of detecting the relative maximum value and relative minimum value is given below.




First, when difference X between point A and point B is larger than the minimum count, point A is judged to be the relative maximum value and point B is judged to be the relative minimum value.




When difference X between detected relative maximum value A and relative minimum value B exceeds the predetermined detection levels (1.5, 2 and 3 times), A is displayed in the maximum value hold mode at respective points O, P and Q and the value is held.




If the minimum count is too small, when the waveform includes noise as shown on the left-hand side, the noise is regarded as the relative maximum value or relative minimum value and a correct value may not be held. In such a case, set the minimum count somewhat large.

### 7-2-1. Minimum Count

Setting range: 0001 - 9999

**How to set**

Setting call → Hold → Page 1

### 7-2-2. Valley Detection Level

Level: 1/4, 1/2, 3/4, 1, 1.25, 1.5, 2, 3 times

**How to set**

Setting call → Hold → Page 1

## 7-3. Hold Setting --- inflection point ---

If you select the inflection point hold in the hold function setting, set the inflection point detection parameters "minimum slope", "interval A" and "interval B".
Set referring to the principle of operation only when the value cannot be held successfully with the factory settings or when further adjustments are required.

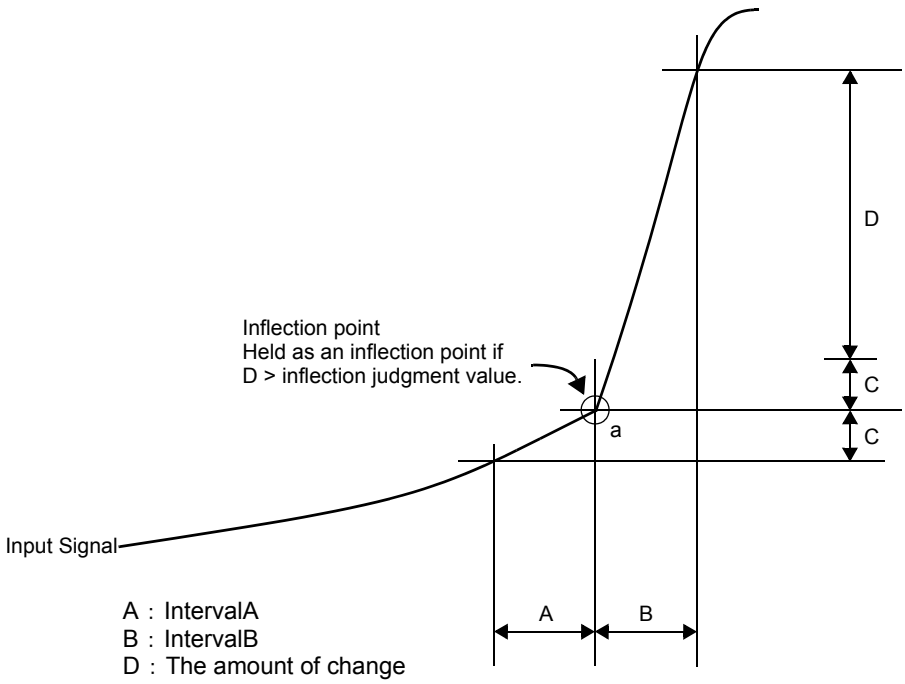
### Detection of the inflection point

The logic of detecting the inflection point is given below.

Assuming that the remainder obtained by subtracting the amount of change C of the indicated value over interval A from the amount of change of the indicated value over interval B is D, when the amount of change D exceeds the inflection point judgment value, point a is held as an inflection point.

If there are two or more inflection points in the hold period, the point having a larger change is held.

The inflection point is normally detected by A=B, but it may easily be detected with A<B where the slope is gradual.



## 7-3-1. Minimum Slope

Setting range: 00001 - 99999

**How to set**

Setting call → Hold → Page 2

## 7-3-2. Interval A and Interval B

Setting range:

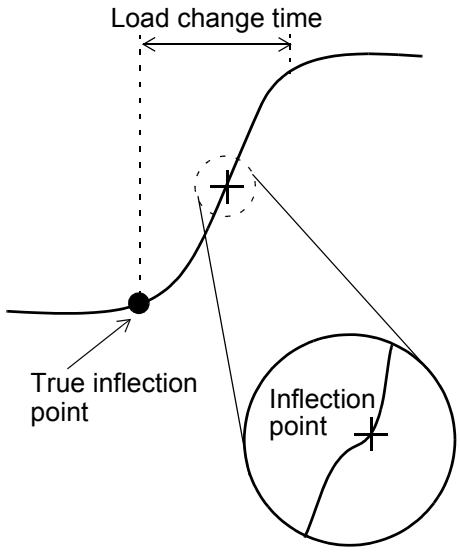
- Interval A+Interval B ≦ 1000
- 10 ≦ Interval A(B) ≦ 990

**How to set**

Setting call → Hold → Page 2

The interval setting is the number of samplings. Since the F370's sampling speed is 2000 times/sec., one sampling is 0.5msec. Therefore, setting of the interval at 100 means setting of 50msec.

**Caution regarding inflection point hold**

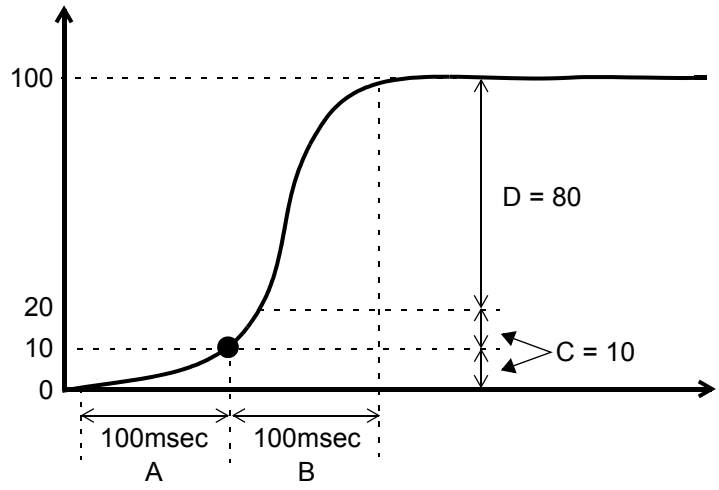



If the detection interval A and B are set too short, fine load changes may be detected as shown in the illustration on the left-hand side, so that a correct value cannot be held.

In this case, set the detection interval B large enough to bring it as close to the load change time as possible, and also set the inflection point judgment value large according to the amount of change at that time, so that the inflection point is held at a correct position.

**Example of inflection point hold setting**

● Example of ideal waveform setting

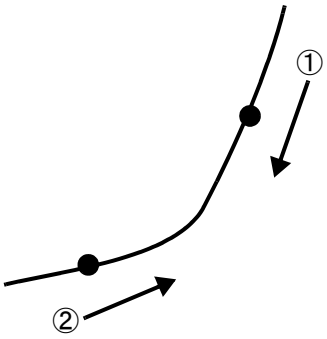



① Set the load change time (between the inflection point and when the change stops) to interval B.
In the example, it is set to 200 since it is 100 msec.

② Set the same value as interval B to interval A.

③ Set load D obtained by subtracting load C changing with interval A from the load changing with interval B to the inflection point judgment value.
In the example, set load change D=80 obtained by subtracting load C=10 changing with A from load 90 changing with B to the inflection point judgment value.
However, since an inflection point is not judged until load change D exceeds the inflection point judgment value, actually set the inflection point judgment value a slightly smaller than D.

● If the inflection point cannot be located successfully




① When holding above the inflection point and moving downward

1） It is considered that the inflection point judgment value is small with respect to load change D. Set the inflection point judgment value larger.

2） If lowering is insufficient in 1), increase interval A.

② When holding below the inflection point and moving upward Interval B is too long and the inflection point judgment value is too large.

Shorten interval B and decrease the inflection point judgment value.

# 7-4. Hold Setting --- mean value ---

## 7-4-1. Mean Value Sampling Count

If the mean value sampling count is set at 2 or more in the mean value hold, the representative value of the sampling values by the set count (mean value by the count) is adopted as the sampling data used for mean value calculation.
The maximum mean value detection time with the setting "1" is 5 sec., but the mean value detection time can be extended by this setting.

Maximum mean value detection time
= Mean value sampling count × 5 [sec.],

where the number of updates of the mean value will decrease.

Number of updates of the mean value
= 2000 / Mean value sampling count [times/sec.]

Setting range: 1 - 999Times

**How to set**

Setting call → Hold → Page 2

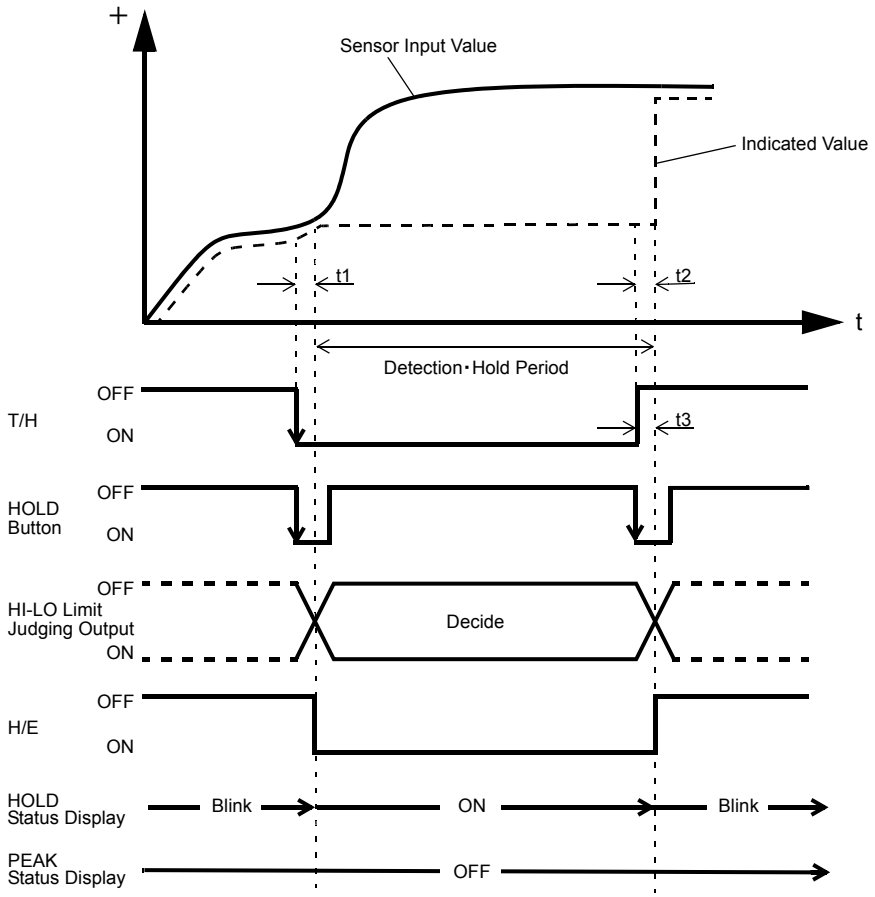
About the maximum mean value detection time

Although the detection period is specified by the H/M signal, etc., detection cannot be carried out exceeding the maximum mean value detection time set according to the mean value sampling count. If the maximum mean value detection time is exceeded, detection ends automatically, when the mean value is held.

# 7-5. Hold Operation

## 7-5-1. Sample Hold

When the T/H signal is inputted, a desired point is held, and the H/E output is turned on. Hold of the value continues as long as the T/H signal is on.




t1 : A delay time between the instant when the T/H signal is inputted and the instant when the indicated value is held
1.0ms (max.)

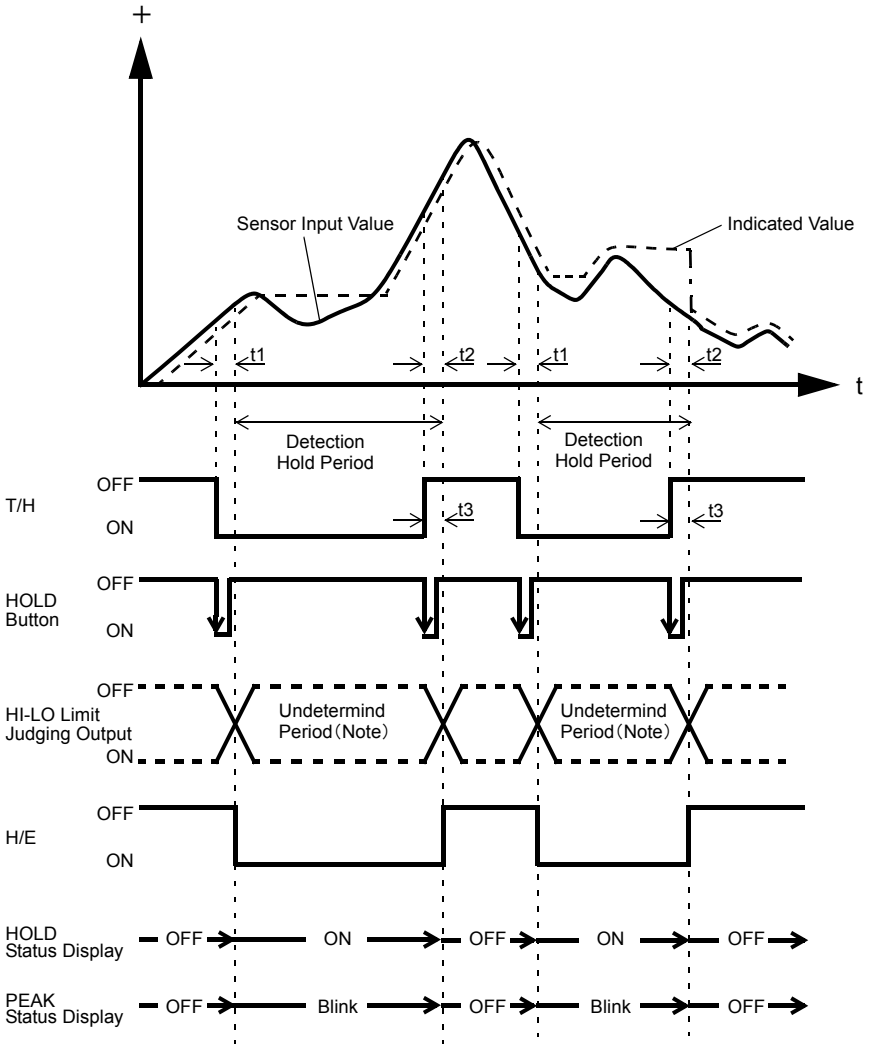
t2 : A delay time between the instant when the T/H signal is released and the instant when the indicated value returns to tracking
1.0ms (max.)

t3 : A minimum reset signal width required for releasing the hold
1.0ms (min.)

## 7-5-2. Peak Hold

The maximum value (peak) in the positive direction of the specified period is held.
The period is specified by the setting of “all period”, “external signal”, “time”, or “time with trigger”.

(Example) All Period Peak Hold




Note: During the undetermined period, the judging output varies with fluctuations in the input waveform. However, the H/E output remains on during the undetermined period. Read the judging result when the indicated value becomes stable (immediately before the T/H signal rises).

t1 : A delay time between the instant when the T/H signal is inputted and the instant when the indicated value is held
1.0ms (max.)

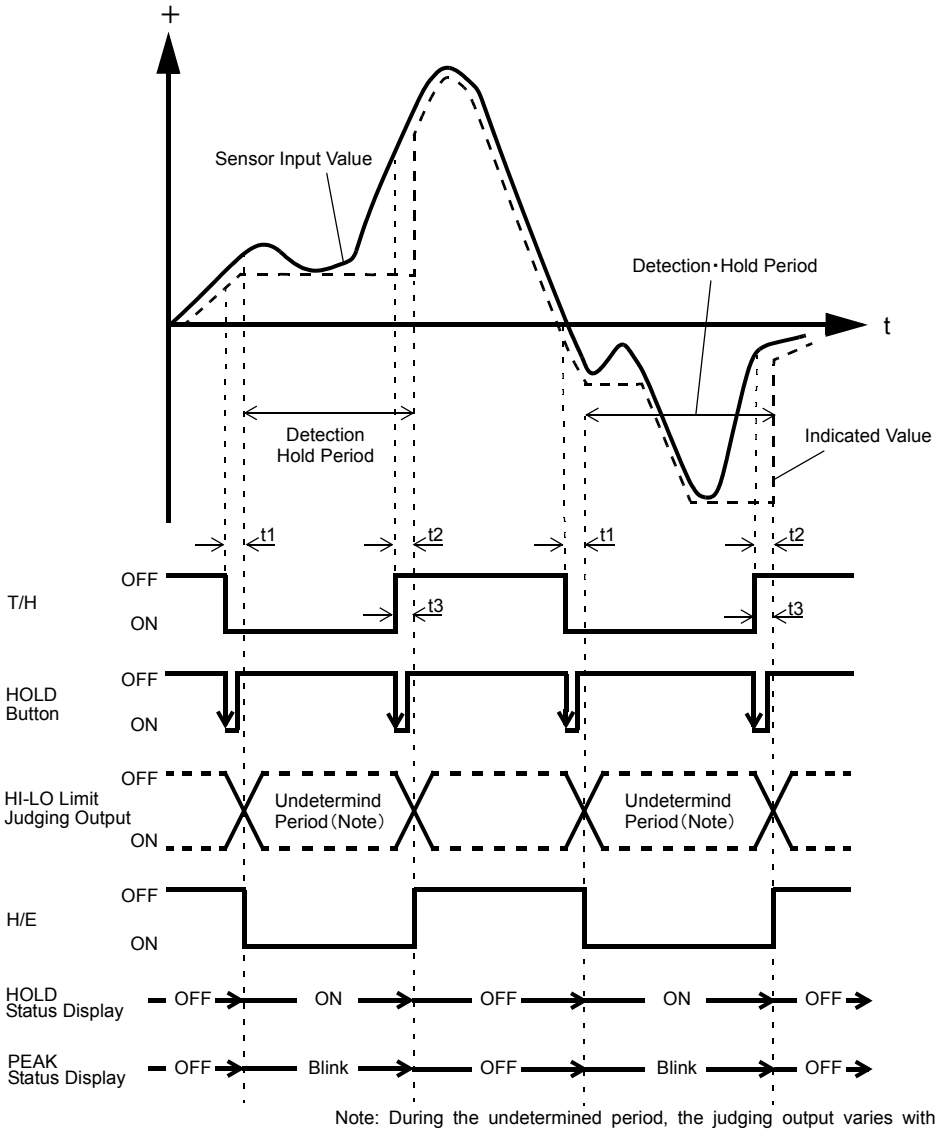
t2 : A delay time between the instant when the T/H signal is released and the instant when the indicated value returns to tracking
1.0ms (max.)

t3 : A minimum reset signal width required for releasing the hold
1.0ms (min.)

## 7-5-3. Valley Hold

The maximum value (valley) in the negative direction of the specified period is held. The period is specified by the setting of “all period”, “external signal”, “time”, or “time with trigger”.

(Example) All Period Valley Hold




Note: During the undetermined period, the judging output varies with fluctuations in the input waveform. However, the H/E output remains on during the undetermined period. Read the judging result when the indicated value becomes stable (immediately before the T/H signal rises).

t1 : A delay time between the instant when the T/H signal is inputted and the instant when the indicated value is held
1.0ms (max.)

t2 : A delay time between the instant when the T/H signal is released and the instant when the indicated value returns to tracking
1.0ms (max.)

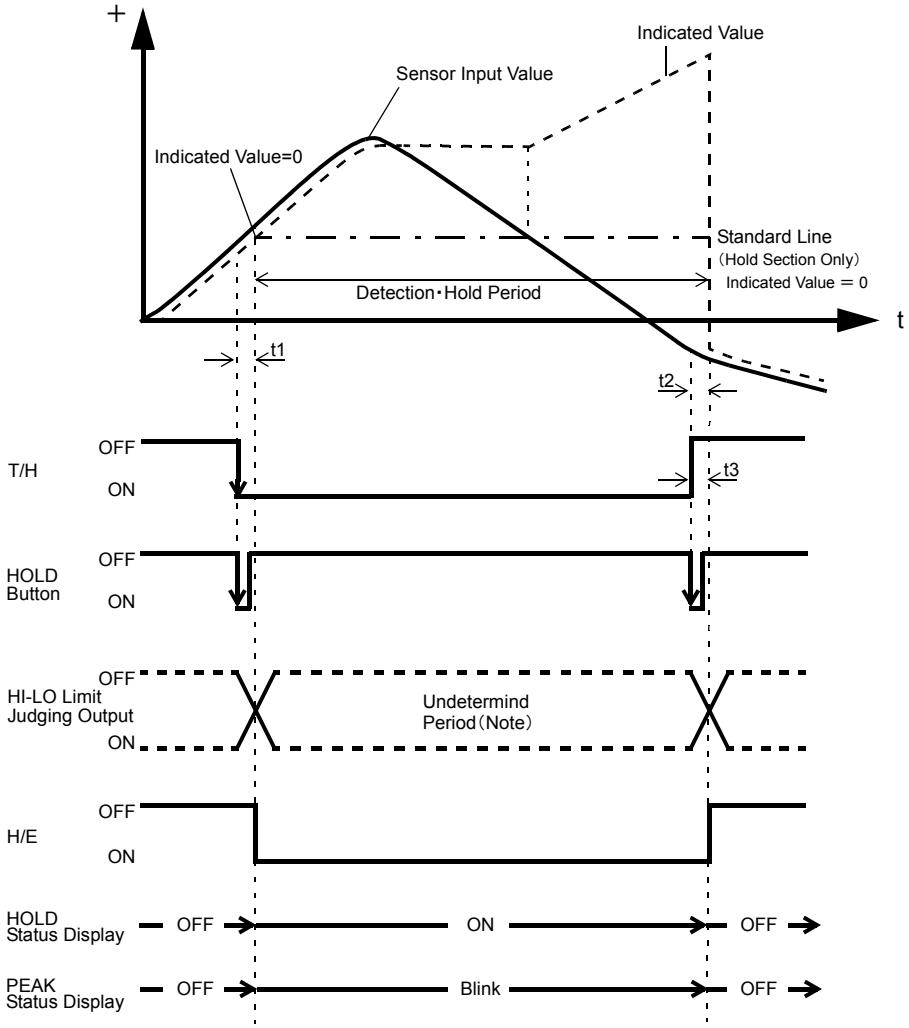
t3 : A minimum reset signal width required for releasing the hold
1.0ms (min.)

## 7-5-4. Peak-to-Peak (P-P) Hold

The maximum value of the difference between the peak and valley over the specified period is held.

The period is specified by the setting of “all period”, “external signal”, “time”, or “time with trigger”.

(Example) All Period Peak-to-Peak (P-P) Hold




Note: During the undetermined period, the judging output varies with fluctuations in the input waveform. However, the H/E output remains on during the undetermined period. Read the judging result when the indicated value becomes stable (immediately before the T/H signal rises).

t1 : A delay time between the instant when the T/H signal is inputted and the instant when the indicated value is held
1.0ms (max.)

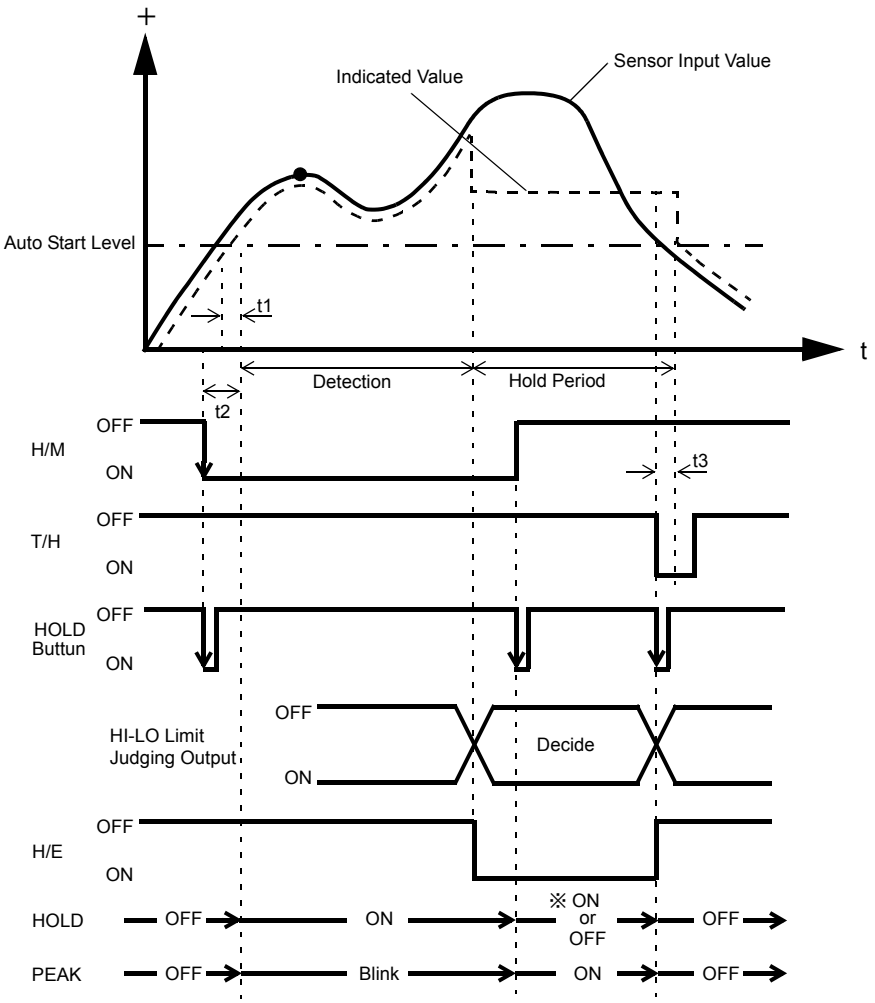
t2 : A delay time between the instant when the T/H signal is released and the instant when the indicated value returns to tracking
1.0ms (max.)

t3 : A minimum reset signal width required for releasing the hold
1.0ms (min.)

## 7-5-5. Relative Maximum and Relative Minimum Hold

Detection starts when the indicated value crosses the auto start level with the H/M signal inputted. Detection is performed as long as the H/M signal is on.
The hold is released by turning on the T/H signal as a reset signal.
The H/E output signal is on between the instant when the hold starts and the instant when the T/H signal is turned on.
If the auto start level is not needed as a starting condition of the detection period, set 99999.

(Example) Relative Maximum Hold




※ Comes on if a value is held with conditions met in the detection period, and goes out if a value is not held.

t1 : A delay time between the instant when the indicated value exceeds the auto start level and the instant when the value to be held is detected
0.5ms (max.)

t2 : A delay time between the instant when the H/M signal is inputted and the instant when the value to be held is detected
1.0ms (max.)

t3 : A minimum reset signal width required for releasing the hold
1.0ms (min.)

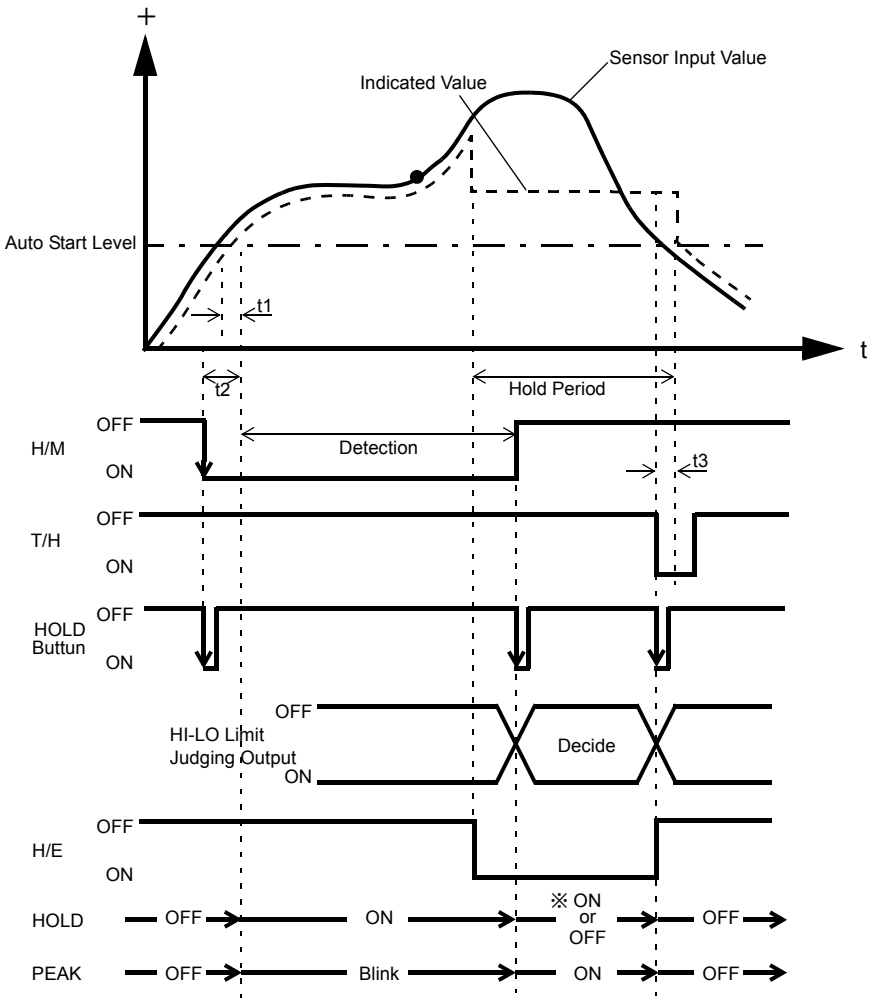
The Hold Function in General

- The delay times of the judging signal and the H/E signal do not include a delay time of the analog circuit (low-pass filter). Also, the delay times are calculated without the digital filter. Since the judging signal and the H/E signal are generated for the value produced through the analog and digital filters, transmission of the signals becomes slower and the delay of each output signal increases with enhancement of the filters.
- If the H/M signal is continuously input, the previously held value is reset by the on timing, and hold operation newly starts.

## 7-5-6. Inflection Point Hold

Detection starts when the indicated value crosses the auto start level with the H/M signal inputted. Detection is performed as long as the H/M signal is on.
The hold is released by turning on the T/H signal as a reset signal.
The H/E output signal is on between the instant when the hold starts and the instant when the T/H signal is turned on.
If the auto start level is not needed as a starting condition of the detection period, set 99999.

(Example) Inflection Point Hold




※ Comes on if a value is held with conditions met in the detection period, and goes out if a value is not held.

t1 : A delay time between the instant when the indicated value exceeds the auto start level and the instant when the value to be held is detected
0.5ms (max.)

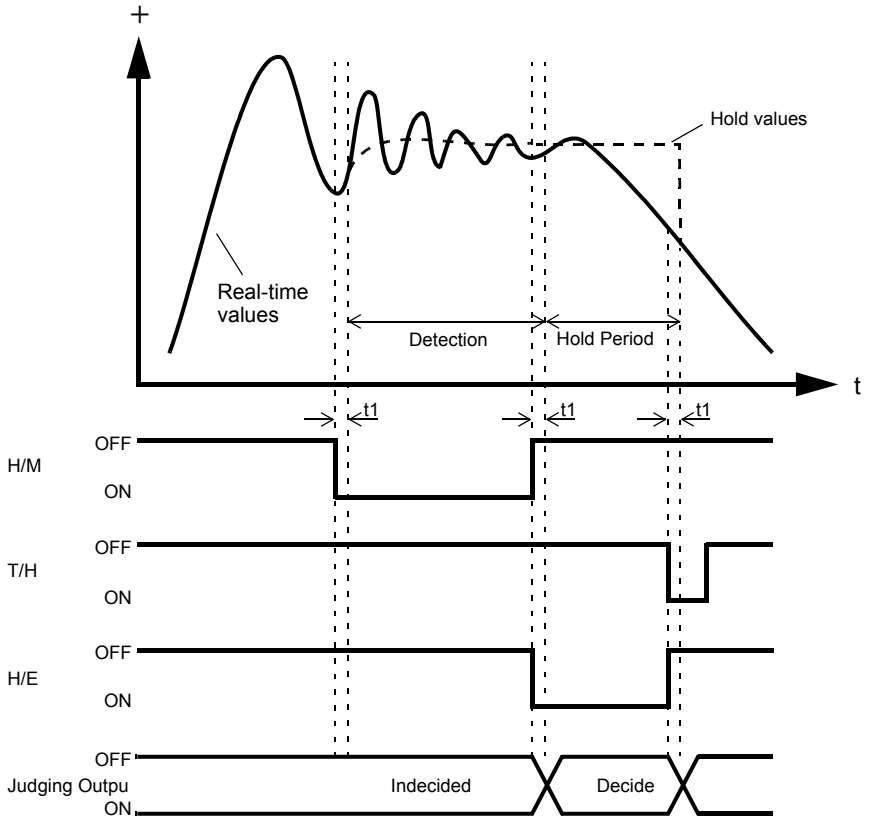
t2 : A delay time between the instant when the H/M signal is inputted and the instant when the value to be held is detected
1.0ms (max.)

t3 : A minimum reset signal width required for releasing the hold
1.0ms (min.)

## 7-5-7. Mean Value Hold

The mean value of the sampling values over the specified period is calculated and updated to perform comparison operation.
The period is specified by the setting of “all period”, “external signal”, “time”, or “time with trigger”.

(Example) Externally Specified Period Mean Value Hold




t1 : A delay time between the instant when the T/H or H/M signal is inputted and the instant when operation is performed.
1.0mS（MAX.）

The detection period is limited by the maximum mean value detection time set according to the “mean value sampling count”.
For details, see the section on Mean Value Sampling Count page 52.

# 7-6. How to Specify the Hold Detection Period

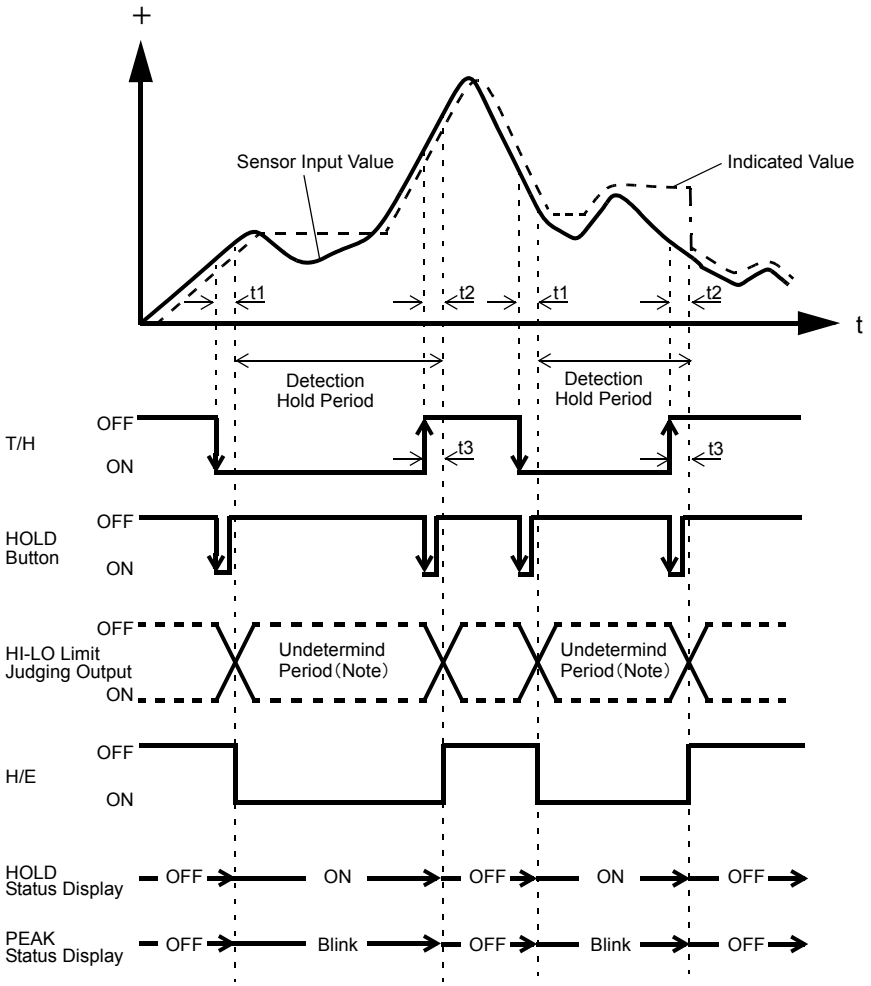
## 7-6-1. All Period

By this method, the hold detection period is externally specified by the T/H signal.

Detection starts with the T/H signal ON to perform each hold operation.

Detection ends with the T/H signal OFF to reset the hold.

(Example) All Period Peak Hold




Note: During the undetermined period, the judging output varies with fluctuations in the input waveform. However, the H/E output remains on during the undetermined period. Read the judging result when the indicated value becomes stable (immediately before the T/H signal rises).

t1 : A delay time between the instant when the T/H signal is inputted and the instant when the indicated value is held
1.0ms (max.)

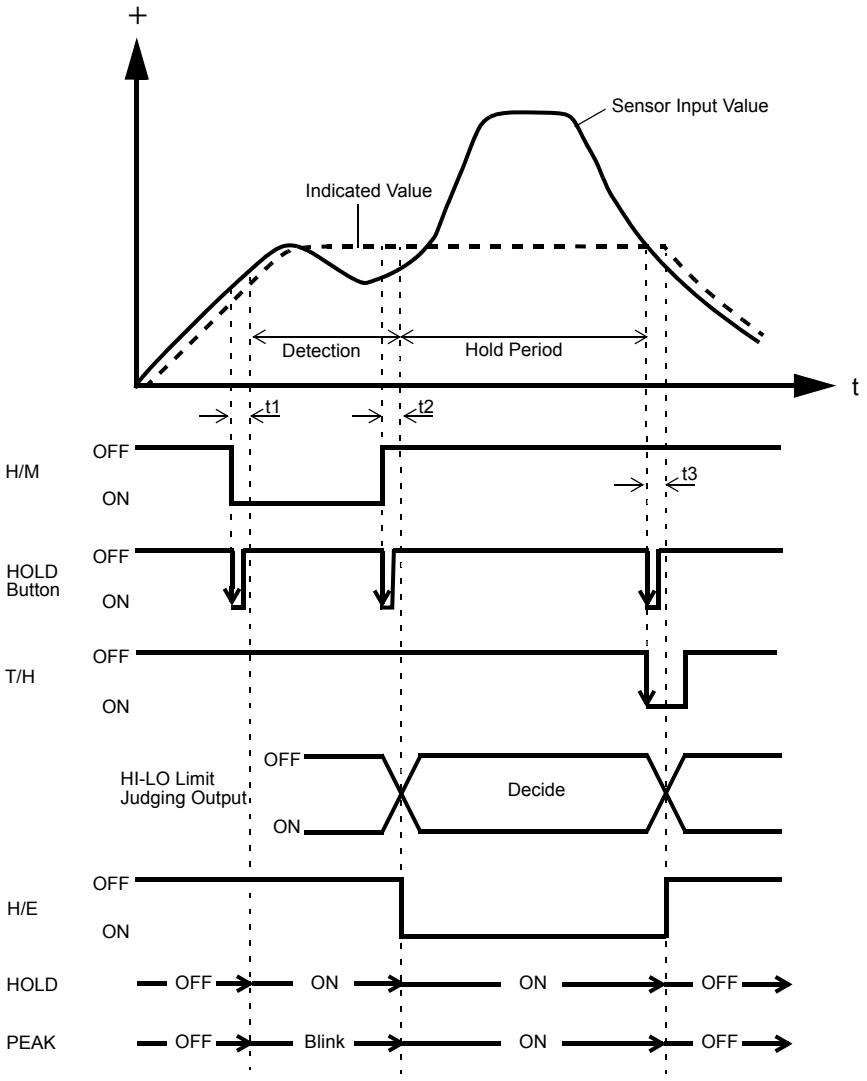
t2 : A delay time between the instant when the T/H signal is released and the instant when the indicated value returns to tracking
1.0ms (max.)

t3 : A minimum reset signal width required for releasing the hold
1.0ms (min.)

## 7-6-2. Externally Specified Period Hold (Peak, Valley, Peak-to-Peak and Mean Value)

By this method, the hold detection period is externally specified by the H/M signal to maintain the hold value until the reset signal is turned on.
The hold is released by turning on the T/H signal as a reset signal.
The H/E output signal is on between the instant when the H/M signal is turned off and the instant when the T/H signal is turned on.

(Example) Period Specified Peak Hold




t1 : A delay time between the instant when the H/M signal is inputted and the instant when the value to be held is detected
1.0ms (max.)

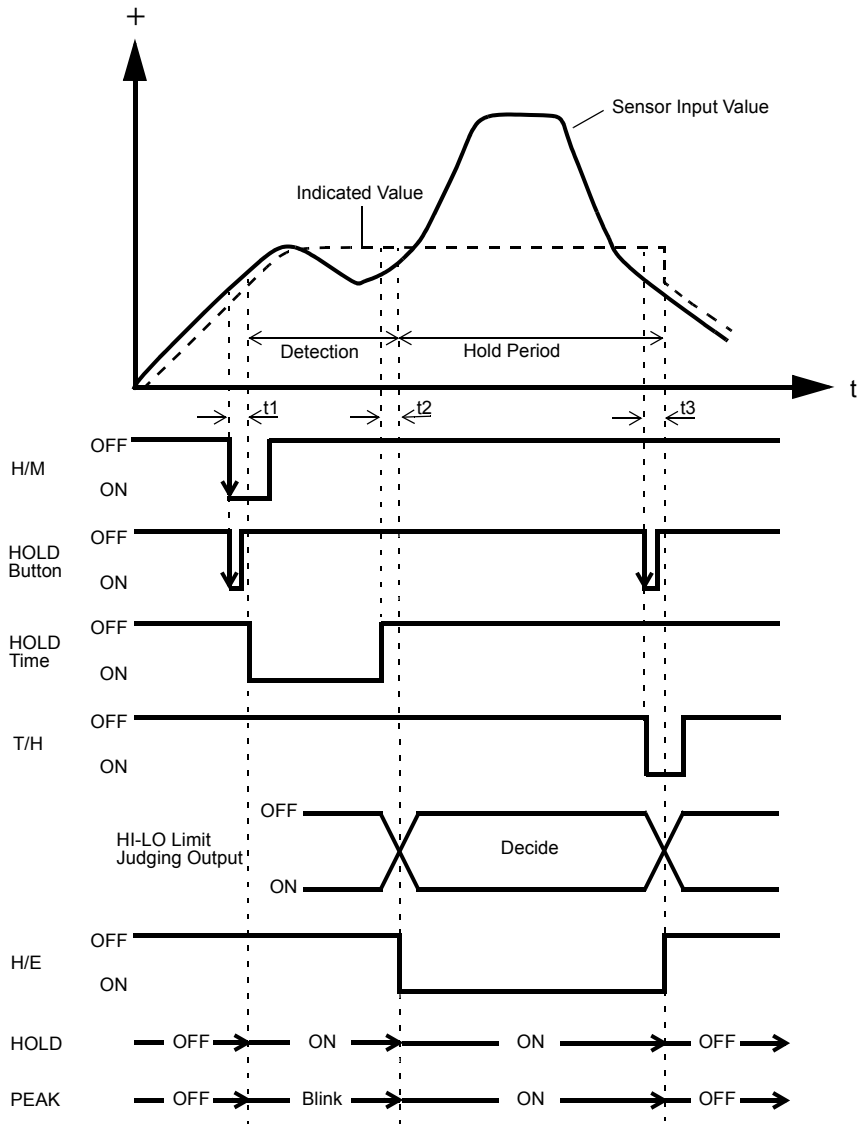
t2 : A delay time between the instant when the H/M signal is released and the instant when the value to be held is determined
1.08ms (max.)

t3 : A minimum reset signal width required for releasing the hold
1.0ms (min.)

## 7-6-3. Time Specified Period Hold (Peak, Valley, Peak-to-Peak and Mean Value)

Hold is detected during the predetermined time (hold detection time) from the point in time when the H/M signal is turned on. The hold is released by turning on the T/H signal as a reset signal.
The H/E output signal is on between the instant when the H/M signal is turned off and the instant when the T/H signal is turned on.

(Example) Time Specified Period Peak Hold




t1 : A delay time between the instant when the H/M signal is inputted and the instant when the value to be held is detected
1.0ms (max.)

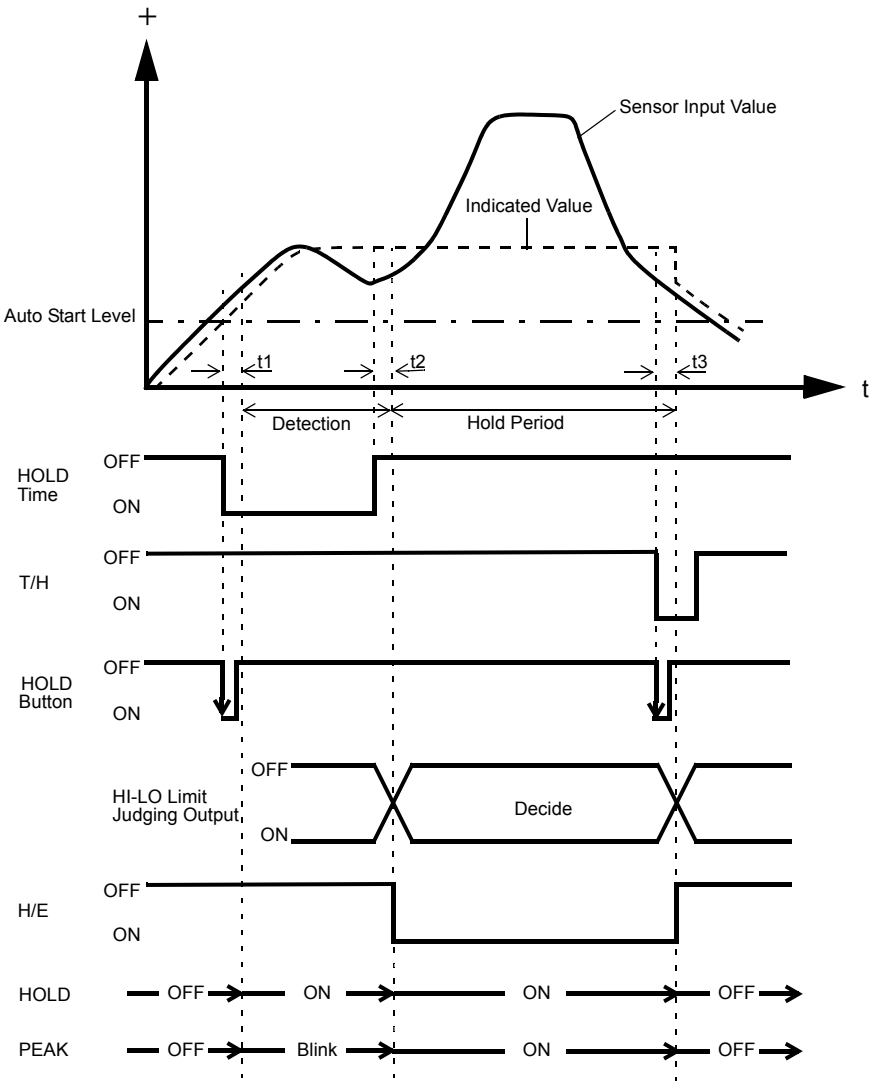
t2 : A delay time between the instant when the hold detection time is expired and the instant when the value to be held is determined
1.0ms (max.)

t3 : A minimum reset signal width required for releasing the hold
1.0ms (min.)

## 7-6-4. Time Specified Period Hold with Trigger (Peak, Valley, Peak-to-Peak and Mean Value)

Hold is detected during the predetermined time (hold detection time) from the point in time when the indicated value crosses the auto start level. The hold is released by turning on the T/H signal as a reset signal.
The H/E output signal is on between the instant when the hold detection time ends and the instant when the T/H signal is turned on.

(Example) Time Specified Period Peak Hold with Trigger




t1 : A delay time between the instant when the indicated value exceeds the auto start level and the instant when the value to be held is detected
0.5ms (max.)

t2 : A delay time between the instant when the hold detection time is expired and the instant when the value to be held is determined
1.0ms (max.)

t3 : A minimum reset signal width required for releasing the hold
1.0ms (min.)

# 8. MULTI-HOLD FUNCTION

By this function, up to 16 types of hold and comparison set values can be stored and selected with external switching signals of CODE0 - CODE3.

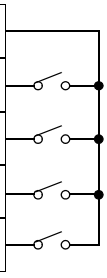
Normally, if there is no entry for CODE0 - CODE3, the set value of CH0 is selected, but when CODE0 - CODE3 are in the following conditions, the set value of each setting CH is selected.

| CODE3 | CODE2 | CODE1 | CODE0 | SettingCH |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | SettingCH00 |
| 0 | 0 | 0 | 1 | SettingCH01 |
| 0 | 0 | 1 | 0 | SettingCH02 |
| 0 | 0 | 1 | 1 | SettingCH03 |
| 0 | 1 | 0 | 0 | SettingCH04 |
| 0 | 1 | 0 | 1 | SettingCH05 |
| 0 | 1 | 1 | 0 | SettingCH06 |
| 0 | 1 | 1 | 1 | SettingCH07 |
| 1 | 0 | 0 | 0 | SettingCH08 |
| 1 | 0 | 0 | 1 | SettingCH09 |
| 1 | 0 | 1 | 0 | SettingCH10 |
| 1 | 0 | 1 | 1 | SettingCH11 |
| 1 | 1 | 0 | 0 | SettingCH12 |
| 1 | 1 | 0 | 1 | SettingCH13 |
| 1 | 1 | 1 | 0 | SettingCH14 |
| 1 | 1 | 1 | 1 | SettingCH15 |

(0: open, 1: short)

I/O terminal block

| | |
|---|---|
| A6 | COM2 |
| A7 | CODE0 |
| B7 | CODE1 |
| A8 | CODE2 |
| B8 | CODE3 |



**Caution**

It takes 15msec at the maximum for the changed CH to become effective. During this period, which CH is used for comparison is undefined.

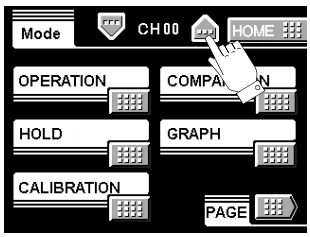
Also, when the CH is switched, the hold and graph functions are reset to wait for starting with the after-switching CH conditions irrespective of the previous operation.

## 8-1. About Changing of the Setting CH

When changing the hold or comparison set value of each CH, set the CH No. with the CH change key on the mode selection screen, and change the set value.

### How to set

1） Select the setting CH on the mode setting screen.

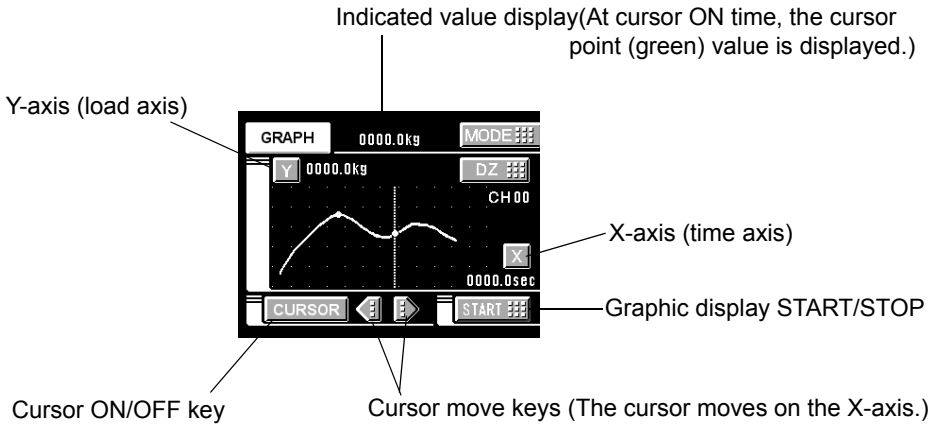



2） Then, enter each set value in a likewise manner.

# 9. WAVEFORM DISPLAY

## 9-1. Graphic Display Screen

Graph is updated while usually operating on the display screen (a comparison ,a hold ,graph ).



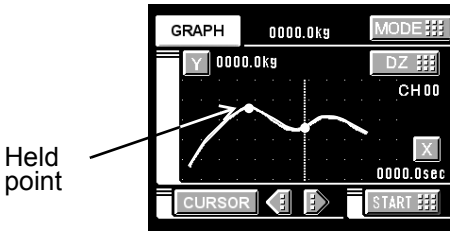

**Caution**

When the cursor display is on and when the setting screen is open, the graph is not upgraded.

## 9-1-1. Hold Point Plotting

By using the hold function and the graph plotting function together, the held point (red) can be plotted.

Example) Relative maximum hold




## 9-1-2. X-axis and Y-axis on the Graph Plotting Screen

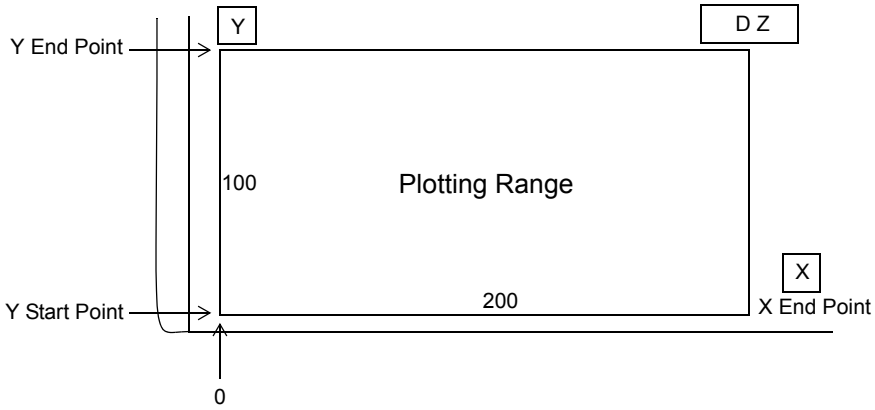
### X-axis

The X-axis is a time setting axis. One graph screen is plotted between the start signal input point and the X start point.

There are 200 plotting points, and typical values for the predetermined time divided by this number of plotting points are plotted.

### Y-axis

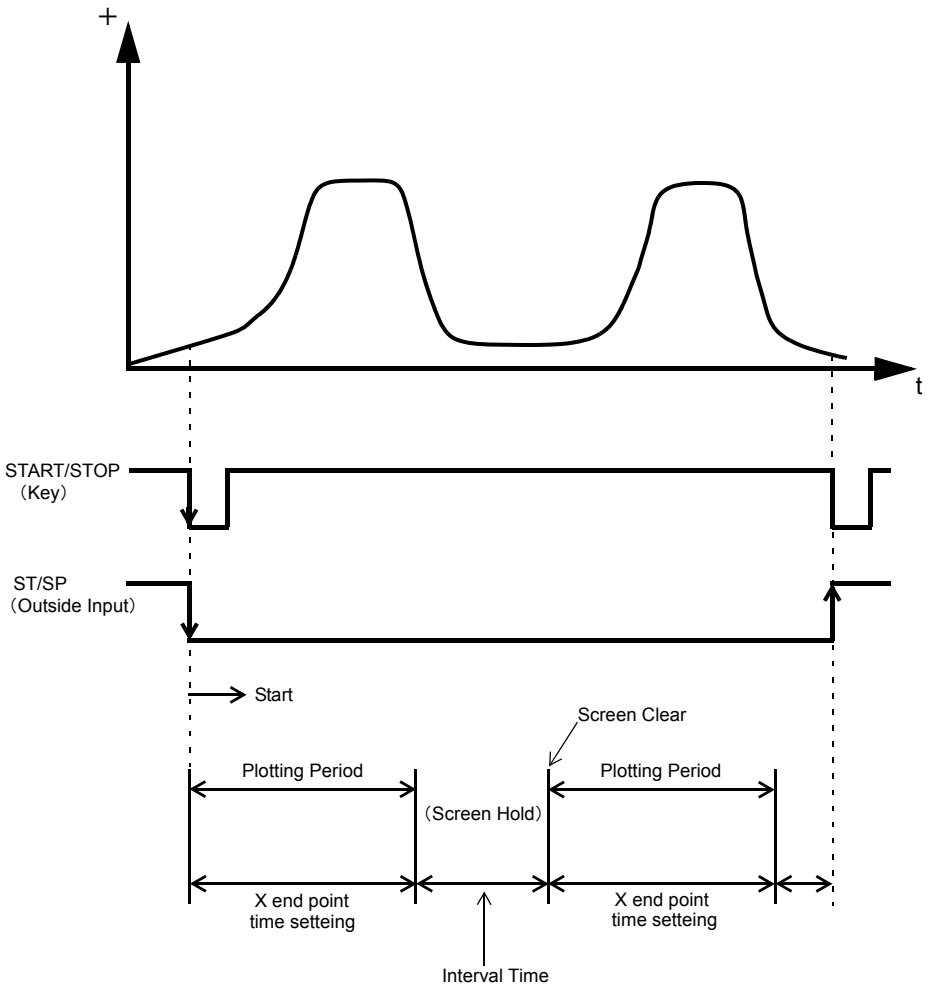
The Y-axis is a load setting value. A graph is plotted between the Y start point and the Y end point. (There are 100 plotting points.)



# 9-2. Graph Plotting

## 9-2-1. Continuous

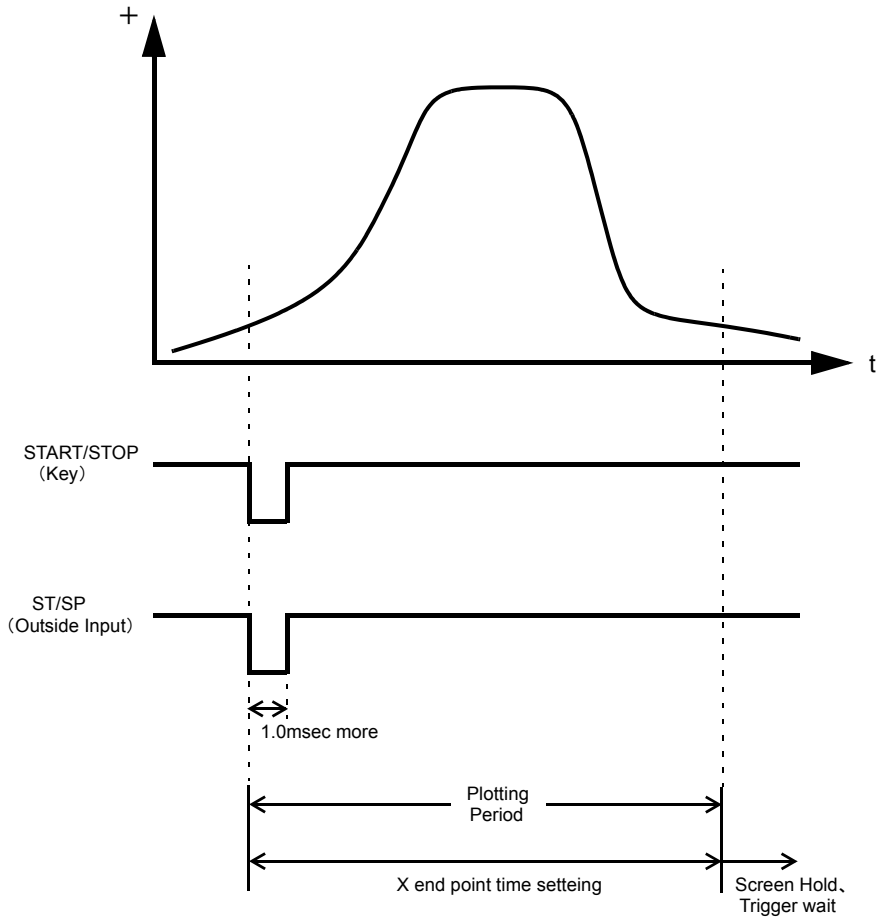
Graph plotting is started by turning on the START/STOP key or turning on the ST/SP external input. When it ends on one screen, the screen is cleared after expiration of the interval time and graph plotting restarts on the next screen. It is ended by turning off the START/STOP key or turning off the ST/SP external input.



## 9-2-2. External

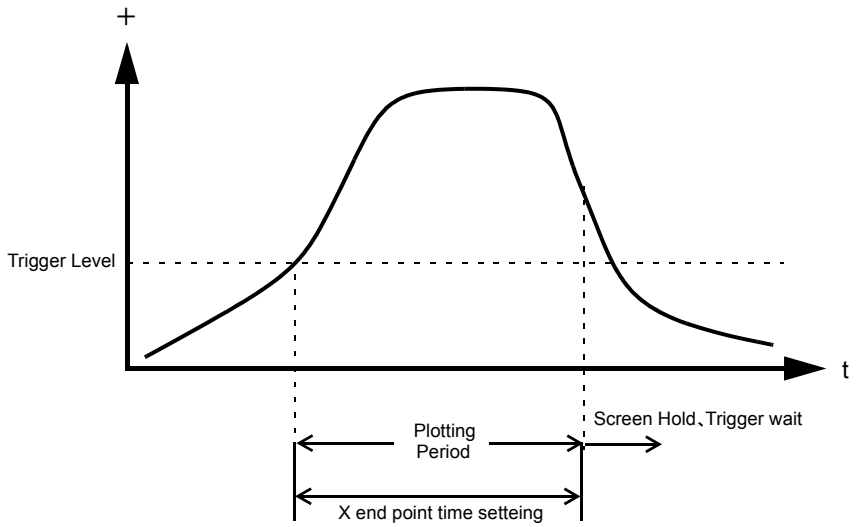
Plotting is started by turning on the START/STOP key or turning on the ST/SP external input.

Plotting ends on one screen at the predetermined time of the X end point.



## 9-2-3. Level

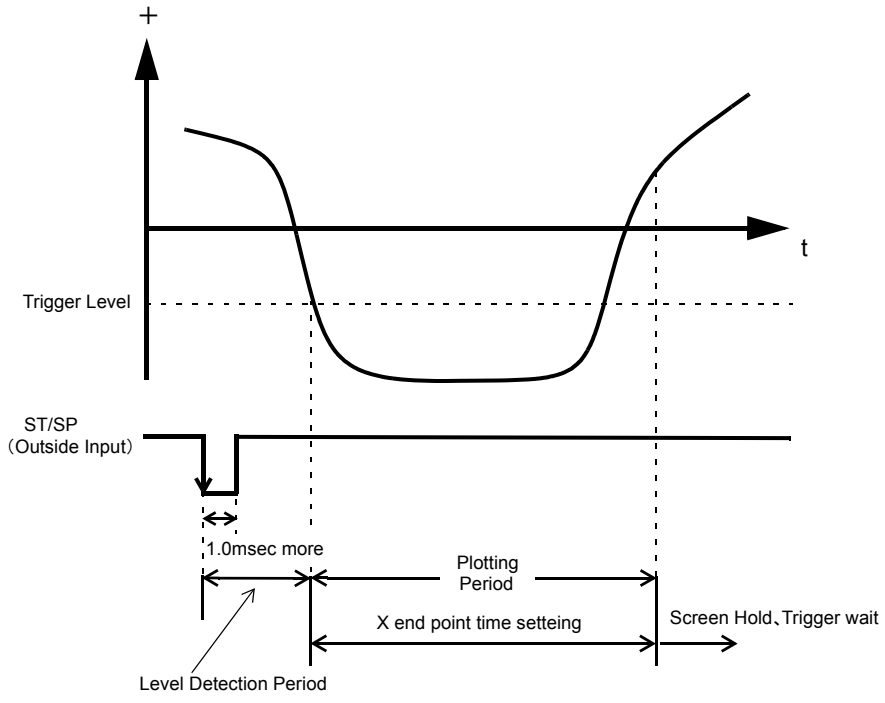
Plotting is started when the conditions of the detection mode are met in comparison of the trigger level set value and indicated value.
Plotting ends on one screen at the predetermined time of the X end point.




## 9-2-4. External + Level

Plotting is started according to the conditions of the level detection mode in comparison of the trigger level and indicated value after the ST/SP external input is turned on.
Plotting ends on one screen at the predetermined time of the X end point.

(Example) Level Detection Mode → Passing under.



## 9-3. Graph Function

Set the graph plotting mode.

Modes

Continuous, external, level, external + level

**How to set**

Setting call → Graph → Page 1

## 9-4. Interval Time

If you select "continuous" in the graph function setting, set the graph plotting operation interrupting time from clearing the screen until moving to the next graph plotting operation. During this time, the graph screen is held.

Setting range: 00.0 - 99.9 sec.

**How to set**

Setting call → Graph → Page 1

## 9-5. Graph Start Level

If you select [level] or [external + level] in the graph function setting, set the graph plotting start level.

Setting range: -99999 - 99999

**How to set**

Setting call → Graph → Page 1

## 9-6. Level Detection Mode

If you select [level] or [external + level] in the graph function setting, set the graph plotting start level comparison conditions.

Conditions: passing, passing over, passing under, large, small

**How to set**

Setting call → Graph → Page 1

- Passing

  Graph plotting starts when the indicated value crosses the level set value.

- Passing over

  Graph plotting starts when the indicated value crosses the level set value upward.

- Passing under

  Graph plotting starts when the indicated value crosses the level set value downward.

- Large

  Graph plotting starts when the indicated value is larger than the level set value.

- Small

  Graph plotting starts when the indicated value is smaller than the level set value.

## 9-7. X Start Point

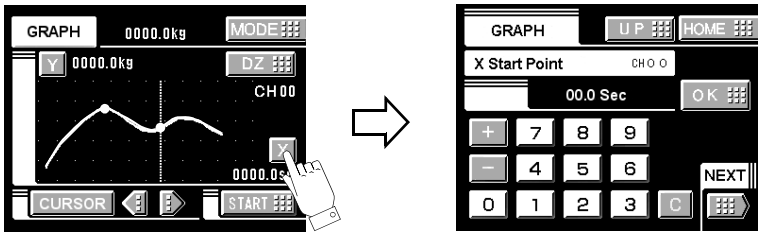
Set the time to display by one screen in the range between 0.1 sec. and 99.9 sec.

**How to set**

Setting call → Graph → Page 1

Simple setting call

Press the X button on the graph display to go direct to the X end point entry screen.




## 9-8. Y (Load) Start Point and Y (Load) End Point

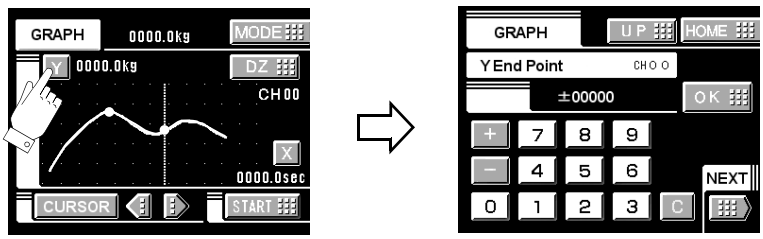
Setting range: -99999 - 99999 (where Y start point < Y end point)

**How to set**

Setting call → Graph → Page 2

Simple setting call

Press the Y button on the graph display to go direct to the Y end point entry screen.



# 10. BCD DATA OUTPUT(OPTION)

The BCD data output is an interface to extract the indicated value of the F370 as BCD data. This interface is convenient to process controls, totals, records, etc., by connecting the F370 to a computer, process controller, sequencer or the like.

The I/O and internal circuits are electrically insulated by photocoupler.

The data output rate can be selected from once/sec., 10 times/sec., 100 times/sec., and 1000 times/sec.

## 10-1. Connector Pin Assignment

Anphenol Connector（36-Pin）

| No. | | Signal | No. | | Signal |
|---|---|---|---|---|---|
| 1 | ⁎ | COM | 19 | ⁎ | COM |
| 2 | Out | 1 | 20 | Out | 20000 |
| 3 | Out | 2 | 21 | Out | 40000 |
| 4 | Out | 4 | 22 | Out | 80000 |
| 5 | Out | 8 | 23 | Out | Minus(Polarity) |
| 6 | Out | 10 | 24 | Out | OVER |
| 7 | Out | 20 | 25 | Out | P.C（Stable） |
| 8 | Out | 40 | 26 | Out | STROBE |
| 9 | Out | 80 | 27 | In | BCD Data Hold |
| 10 | Out | 100 | 28 | In | Logic Switching |
| 11 | Out | 200 | 29 | | |
| 12 | Out | 400 | 30 | | |
| 13 | Out | 800 | 31 | | |
| 14 | Out | 1000 | 32 | | |
| 15 | Out | 2000 | 33 | | |
| 16 | Out | 4000 | 34 | | |
| 17 | Out | 8000 | 35 | | |
| 18 | Out | 10000 | 36 | | |

Compatible connector is DDK57-30360 or equivalent.

## 10-2. Logic Change

Select the logic of output signals with pin No. 28.

When COM and pin No. 28 are open: negative logic

When they are short-circuited: positive logic

## 10-3. BCD Data Hold

The BCD data output signal is held. Switching is carried out by pin No. 27.

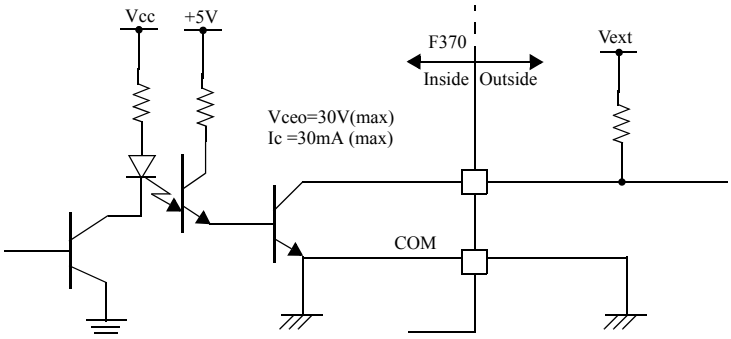
When COM and pin No. 27 are open: hold cancel

When they are short-circuited: hold on

## 10-4. Equivalent Circuit

**・Output**

The signal output circuit is operated through a TTL open collector.




● Internal transistor status

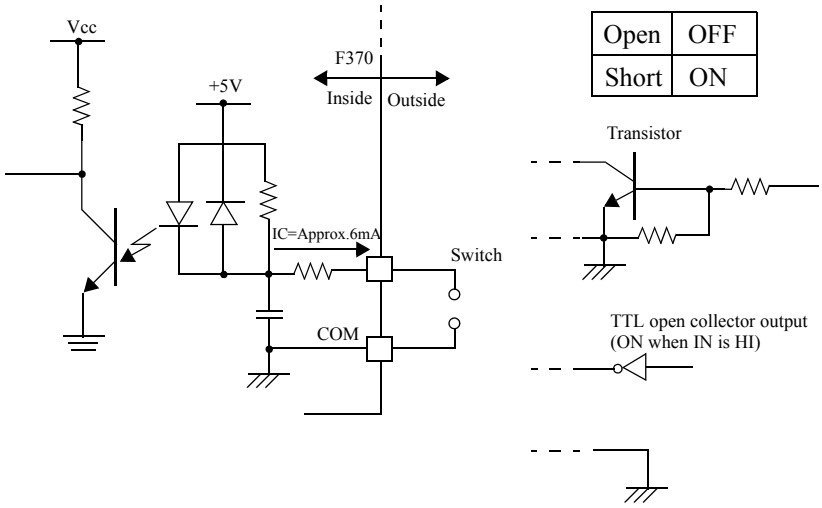
| Output data | Negative | Positive |
|---|---|---|
| 0 | OFF | ON |
| 1 | ON | OFF |

● Output pin level

| Output data | Negative | Positive |
|---|---|---|
| 0 | H | L |
| 1 | L | H |

Through logic switching (pin28)

▪ **Input**




| | |
|---|---|
| Open | OFF |
| Short | ON |

**NOTE**

- Do not apply external voltage to the signal input circuit.
- The external element is required to withstand Ic=10mA.
- Leakage from the external element is required to be 30 $\mu$ A or below.

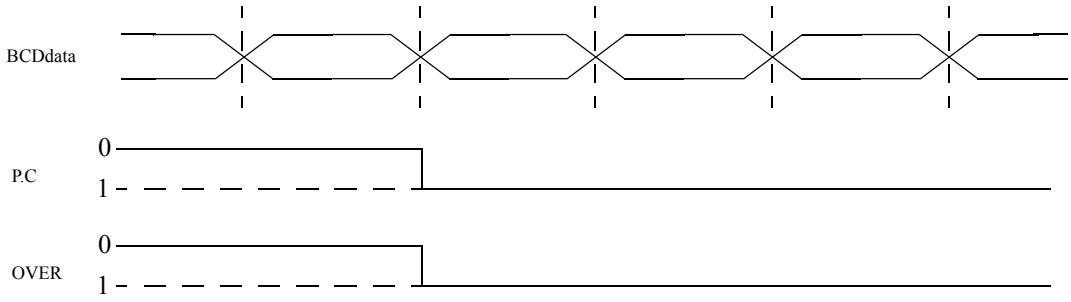
## 10-5. Signal Timing

▪ **PC**

This signal turns on at the same time as BCD data when stable.

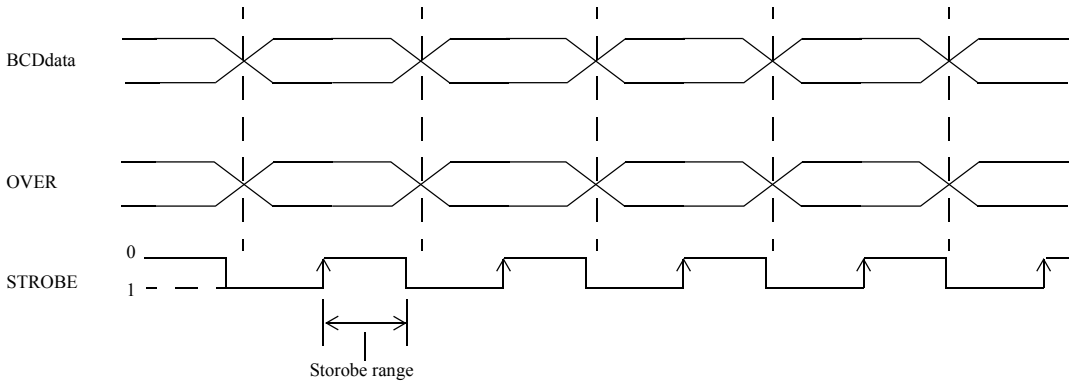
▪ **OVER**

This signal is outputted at the time of -ADC OVER, +ADC OVER, +overflow or -overflow.



▪ **STROBE**

Strobe pulses are outputted in synchronization with BCD data. Read data using the rising edges of the pulses. The BCD data update rate setting can be changed.




## 10-6. BCD Data Update Rate Selection

Output rate: 1, 10, 100, 1000 times

**How to set**

Setting call → Option → Page 1

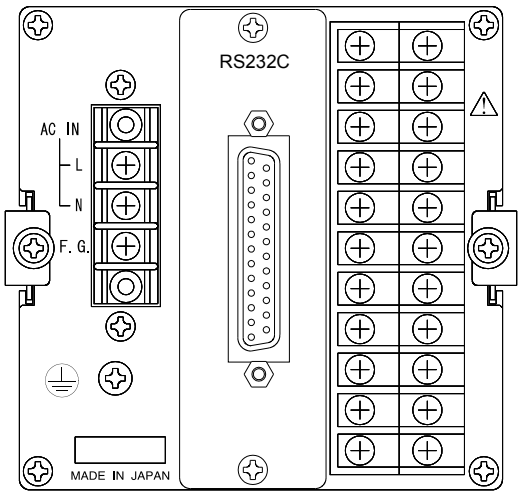
## 10-7. BCD Output Data Selection

Output data: Hold values, Real-time values

**How to set**

Setting call → Option → Page 1

# 11. RS-232C INTERFACE(OPTION)




## 11-1. Communication Specifications

### 11-1-1. Specifications

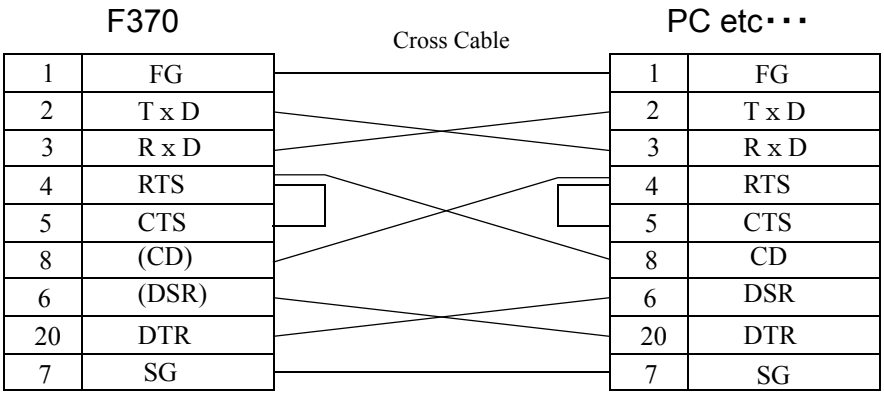
| | |
|---|---|
| Signal level： | Based on RS-232C |
| Transmitting distance： | Approx.15m |
| Transmitting method： | Asynchronous， Full duplex |
| Transmitting speed： | 1200，2400，4800，9600 or 19200bps Selectable |
| Bit configuration： | |
| Start bit | 1bit |
| Character length | 7 or 8 bit Selectable |
| Stop bit | 1 or 2 bit Selectable |
| Parity | Parity none， odd or even Selectable |
| Terminator | CR，CR+LF Selectable |
| Code： | ASCII |

### 11-1-2. Connector Pin Assignment

Adaptable plug：25-pin D-sub connector（JAE make DB-25P-N etc）

| | | | | | |
|---|---|---|---|---|---|
| 1 | * | FG | 14 | | |
| 2 | out | TxD | 15 | | |
| 3 | in | RxD | 16 | | |
| 4 | out | RTS | 17 | | |
| 5 | in | CTS | 18 | | |
| 6 | | | 19 | | |
| 7 | * | SG | 20 | out | DTR |
| 8 | | | 21 | | |
| 9 | | | 22 | | |
| 10 | | | 23 | | |
| 11 | | | 24 | | |
| 12 | | | 25 | | |
| 13 | | | | | |

### 11-1-3. Cable




* This connection diagram shows an example of connecting a DTE (data terminal equipment) personal computer.
  Use a straight cable for connecting a DCE (data circuit terminating equipment) such as a modem.

* Before preparing a cable, check the connector shape and pin assignment of the equipment to be connected again.

## 11-2. RS-232C Interface Setting

Set the RS-232C communication conditions of the F370.

### 11-2-1. Communication Mode

Communication mode 0, communication mode 1, communication mode 2

**How to set**

Setting call → Option → Page 1

### 11-2-2. Baud Rate

1200, 2400, 4800, 9600, 19200bps

**How to set**

Setting call → Option → Page 1

### 11-2-3. Character Length

7bit, 8bit

**How to set**

Setting call → Option → Page 1

### 11-2-4. Parity Bit

None, odd, even

**How to set**

Setting call → Option → Page 1

### 11-2-5. Stop Bit

1 bit, 2 bit

**How to set**

Setting call → Option → Page 1

### 11-2-6. Terminator

CR, CR + LF

**How to set**

Setting call → Option → Page 2

## 11-3. Communication Modes

#### 1.Communication Mode 0

Communications are carried out by commands from the host computer.

The indicated value, status and parameters can be read, and parameters can be written.

#### 2. Communication Mode 1

The indicated value and status are continuously transmitted.

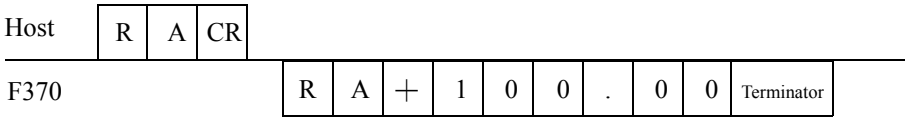
#### 3. Communication Mode 2

The indicated value is transmitted upon printing.

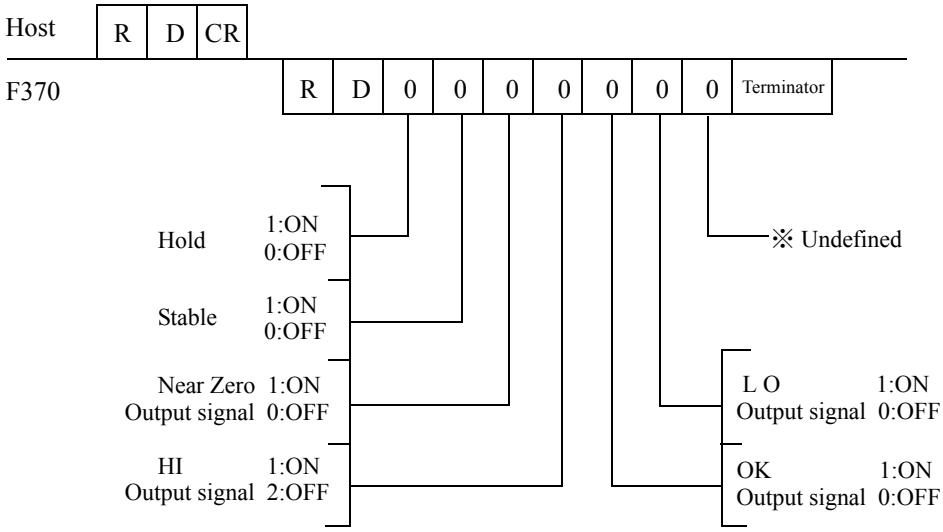
# 11-4. Communication Format

### 1. Communication Mode 0

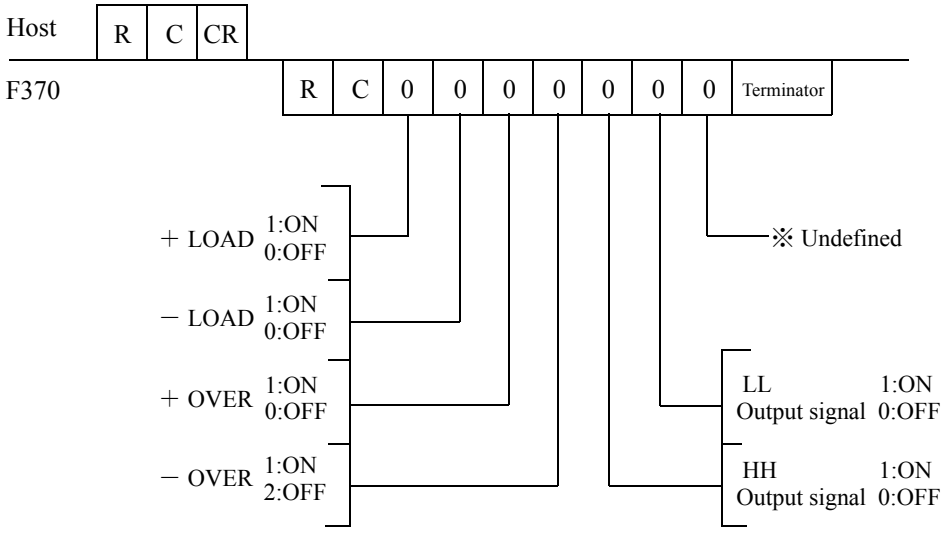
**- Reading the indicated value (sign, 5-digit indicated value, decimal point)**




**- Reading the status (7-digit)**




※ The hold bit is operated at the same timing as the H/E signal.



**- Writing parameters**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HI-HI Limit | W | 1 | 1 | ± | | | | | | CR | LF | (Set Value Lock) |
| HI limit | W | 1 | 2 | ± | | | | | | CR | LF | (Set Value Lock) |
| LO limit | W | 1 | 3 | ± | | | | | | CR | LF | (Set Value Lock) |
| LO-LO Limit | W | 1 | 4 | ± | | | | | | CR | LF | (Set Value Lock) |
| Hysteresis | W | 1 | 5 | 0 | 0 | | | | | CR | LF | (Set Value Lock) |
| Calibration Value Selection | W | 4 | 4 | 0 | 0 | 0 | 0 | 0 | ⑥ | CR | LF | (Calibrationt Value Lock) |
| Digital Offset Setting | W | 4 | 8 | ± | | | | | | CR | LF | (Calibrationt Value Lock) |
| Near Zero | W | 1 | 6 | 0 | | | | | | CR | LF | (Set Value Lock) |
| Hold mode | W | 2 | 1 | 0 | 0 | 0 | 0 | 0 | ① | CR | LF | (Set Value Lock) |
| Hold Section Setup | W | 7 | 1 | 0 | 0 | 0 | 0 | 0 | ② | CR | LF | |
| Hold Detect Time | W | 2 | 2 | 0 | 0 | | | | | CR | LF | (Set Value Lock) |
| Auto Start Level | W | 2 | 3 | ± | | | | | | CR | LF | (Set Value Lock) |
| Minimum Count | W | 2 | 4 | 0 | 0 | 0 | | | | CR | LF | 1 ~ 999 |
| valley Detect Level | W | 2 | 5 | 0 | 0 | 0 | 0 | 0 | ③ | CR | LF | 0 ~ 3 |
| Minimum Slope | W | 2 | 6 | 0 | | | | | | CR | LF | |
| IntervalA | W | 2 | 7 | 0 | 0 | 0 | | | | CR | LF | 010 ~ 120 |
| IntervalB | W | 2 | 8 | 0 | 0 | 0 | | | | CR | LF | 010 ~ 120 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Graph Function | W | 3 | 1 | 0 | 0 | 0 | 0 | 0 | ④ | CR | LF | |
| Interval Time | W | 3 | 2 | 0 | 0 | 0 | | | | CR | LF | |
| Graph Start Level | W | 3 | 3 | 0 | | | | | | CR | LF | (Set Value Lock) |
| Level Detect Mode | W | 3 | 4 | 0 | 0 | 0 | 0 | 0 | ⑤ | CR | LF | (Set Valu Lock) |
| CH | W | 1 | F | 0 | 0 | 0 | 0 | | | CR | LF | |
| Hold Point Shift | W | 2 | 9 | 0 | 0 | 0 | | | | CR | LF | |

Set value correspondence table

① Hold mode

0 : tracking
1 : sample
2 : peak
3 : valley
4 : peak-to-peak
5 : relative maximum
6 : relative minimum
7 : inflection point
8 : mean value

② Hold period setting

0 : all period
1 : external signal
2 : time
3 : time with trigger

③ Valley detection level

0 : 1/4 times
1 : 1/2 times
2 : 3/4 times
3 : 1 time
4 : 1.25 times
5 : 1.5 times
6 : 2 times
7 : 3 times

④ Graph mode

0 : continuous
1 : external
2 : level
3 : external + level

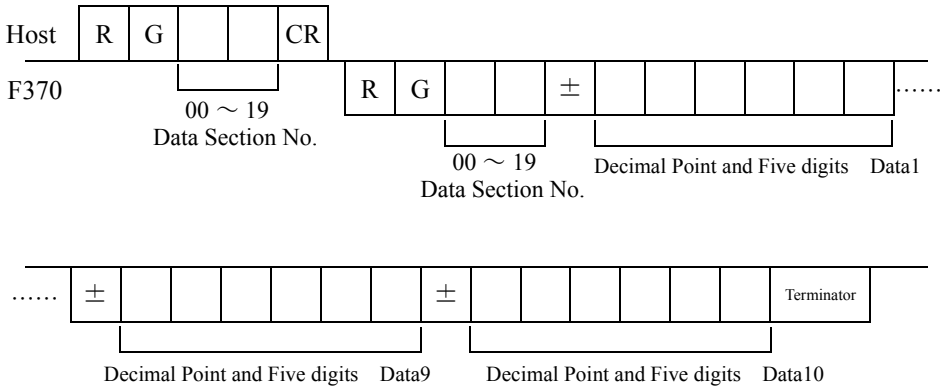
⑤ Level detection mode

0 : passing
1 : passing over
2 : passing under
3 : large
4 : small

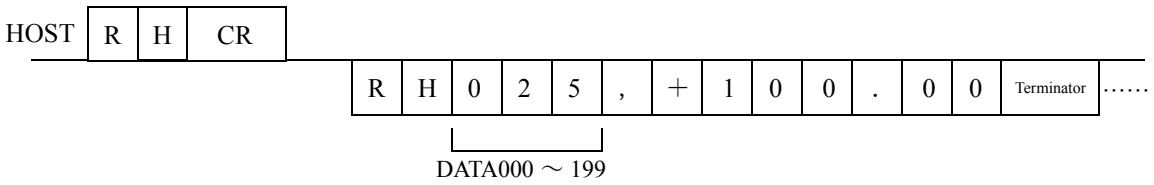
⑥ Calibration Value Selection

0 : calibration value 0
1 : calibration value 1
2 : calibration value 2
3 : calibration value 3

**- Reading waveform data**

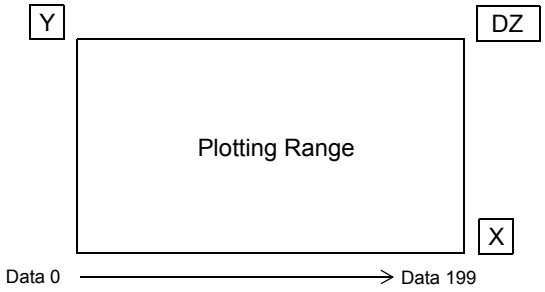



**· Wave form hold point data read-out(data No, a mark, a decimal point,5 figures of directions value)**



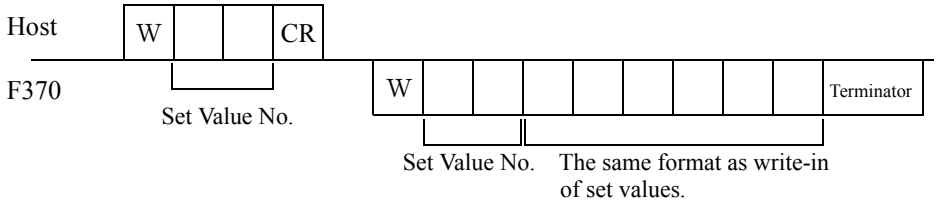

## Data Section No.

One graph plotting screen includes 200 pieces of data. In reading waveform data, data can be read by being divided into 20 sections (by 10 pieces).




Section 00 Data 0 ~ Data 9
Section 01 Data 10 ~ Data 19
≀
Section 19 Data 190 ~ Data 199

**- Reading parameters**

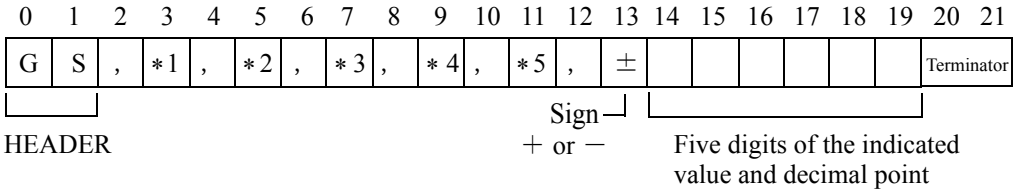



**- Commands (Host → F370)**

| | | |
|---|---|---|
| Digital Zero | C G CR | (This is effctive only when the set value LOCK is "1.") |
| Digital Zero reset | C F CR | (This is effctive only when the set value LOCK is "1.") |
| Print instruction | C I CR | (This will issue print a command onto SIF.) |

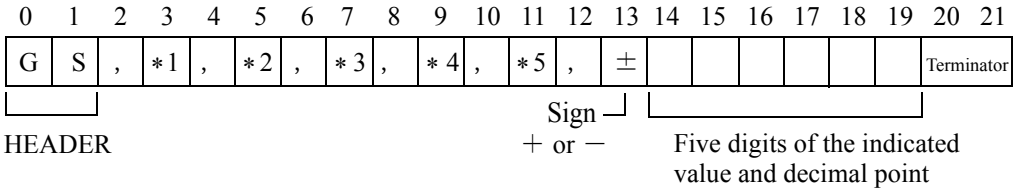
**2. Communication mode 1**

The indicated value is continuously transmitted.




**3. Communication mode 2**

The indicated value is transmitted upon printing.



＊1

O.....Over Load（LOAD，OFL）
S .....Stable
M.....Not Stable
H.....Hold

＊1Priority　H＞O＞（S or M）

＊2

A.....Zero Tracking OFF
T .....Zero Tracking ON

＊3

H.....High Limit ON
L .....Low Limit ON
G.....High Limit and Low Limit OFF
N.....High Limit and Low Limit ON
F .....Compare OFF

＊3Priority　　N＞（H or L） F＞G

＊4

H.....High High Limit ON
L .....Low Low Limit ON
G.....High High Limit and Low Low Limit OFF
N.....High High Limit and Low Low Limit ON
F .....Compare OFF

＊Priority　N＞（H or L）F＞G

＊5

N.....Near Zero OFF
Z .....Near Zero ON

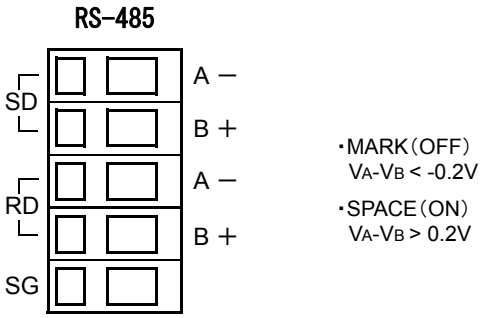
# 12. RS-485 COMMUNICATION INTERFACE(OPTION)

## 12-1. Communication Specifications

- Specifications

| | | |
|---|---|---|
| Signal level | Based on RS-485 | |
| Transmitting distance | Approx 1km | |
| Transmitting method | Asynchronous, Full duplex | |
| Transmitting speed | 1200, 2400, 4800, 9600 or 19200bps Selectable | |
| Bit configuration | Start | 1bit |
| | Character length | 7 or 8bits Selectable |
| | Stop | 1 or 2bits Selectable |
| | Parity | None,Odd or Even Selectable |
| Terminator | CR+LF/CR Selectable | |
| Code | ASCII | |

- Connector Pin Assignment




## 12-2. RS-485 connection

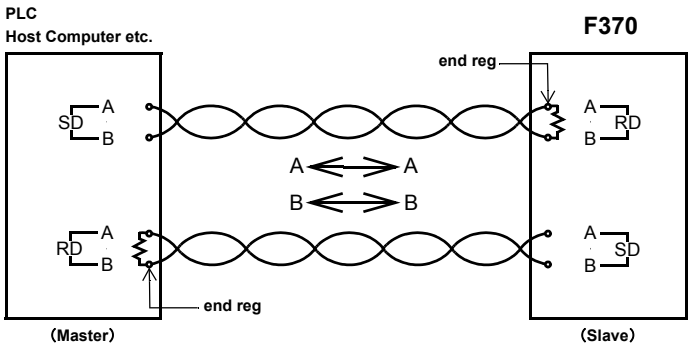
### 1.Connection of transmitting and receiving lines

#### ① 4-wire connection

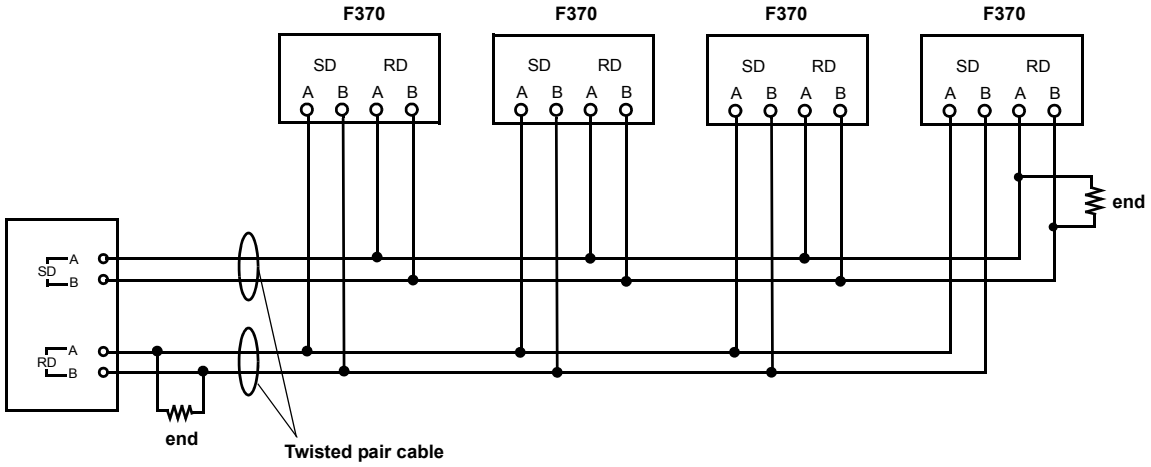
Set the communications mode of the F370 to “4-wire.”

Connect the “SD” (sending side) of the equipment on the other end (master), such as a programmable controller, to “RD” (receiving side) of the F370 (slave), and “RD” of the master to “SD” of the F370.

- One-to-One Connection




- One-to-more Connection




Use a twisted pair cable for connection. (The noise margin will increase.) However, a twin cable is sufficient for short-distance connection. Couple a terminal resistor of 100 - 200Ω to the receiving end.

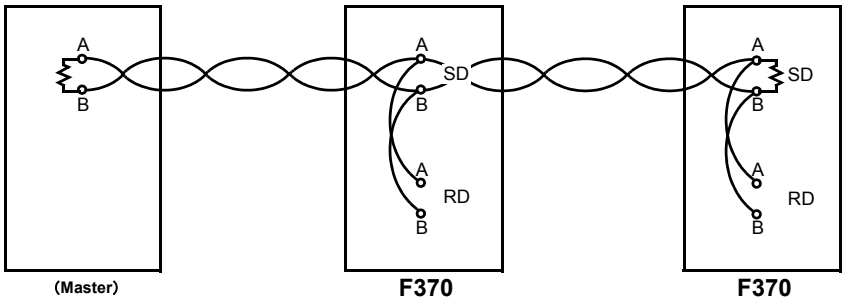
(The terminus resistance by the side of F370 can be switched by setup.120 ohms is conncted when terminus resistance is set as ON.)

### ② 2-wire connection

Set the communications mode of the F370 to “2-wire.”

First, connect “A-” of “RD” and “SD”, and “B+” of “RD” and “SD” of the F370.

Next, connect the target equipment with the same polarity. (See "2. Polarity")




### 2. Polarity

Basically, connect “A” or “-” of the equipment on the other end to “A-” of the F370, and “B” or “+” of the equipment on the other end to “B+” of the F370.

(In some rare cases, the signal polarity (A/B notation) may be reversed, so that communications cannot be made even with correct connection. In such cases, connect by reversing the signal polarity.)

### 3. Terminal resistor

Mount a terminal resistor of approx. 100 – 200 Ω on the receiving side.

(The F370 can also be set to connect 120 Ω internally.)

In the case of 2-wire, it should be connected to both ends because the sending and receiving signal lines are the same. (See the connection diagram.)

### 4. SG terminal

This is the ground for signal lines. When connecting to the SG terminal of the equipment on the other end, connect after checking the specifications of the equipment on the other end.

## 12-3. Communication Method

1. For connecting more than one F370, assign an ID number to each F370.

2. Send the start command including the ID number from the host, whereby communications are allowed with one F370, enabling reading of indicated value, reading and changing of set values (parameters), sending of commands and so on.

3. The format is the same as the RS-232C format except for the ID number.

**Communication Format**

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HOST | I | D | 0 | 0 | 0 | 1 | R | A | CR | | | | | | | | | | |
| F370 | | | | | | | | | | I | D | 0 | 0 | 0 | 1 | R | A | + | 1 | 0 | 0 | . | 0 | 0 | Terminator |

# 12-4. RS-485 Interface Setting

## 12-4-1. ID

Setting range: 0000 - 9999

**How to set**

Setting call → Option → Page 2

## 12-4-2. Terminator Resistance

Without terminator resistance / with terminator resistance

**How to set**

Setting call → Option → Page 2

## 12-4-3. Communication Method

2-wire / 4-wire

**How to set**

Setting call → Option → Page 2

Caution

For other settings, see the section of RS-232C Option. However, the communication mode setting is fixed at 0.

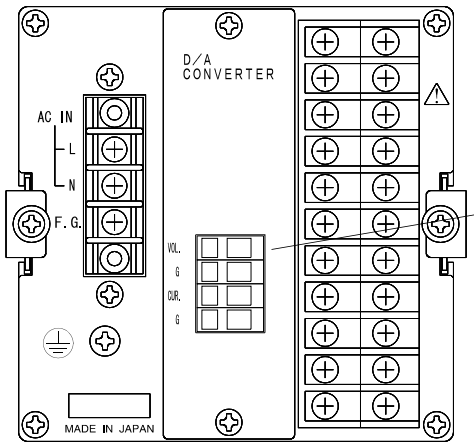
# 13. D/A CONVERTER(OPTION)

A D/A converter is provided for obtaining analog output synchronized with the indicated value of the F370.

The analog output ranges are -10 - 10V output and 4 - 20mA constant-current output.

By using the D/A zero setting and D/A full scale setting functions, analog output can be obtained between zero (0V, 4mA) and full scale (10V, 20mA) with respect to the predetermined digital value.

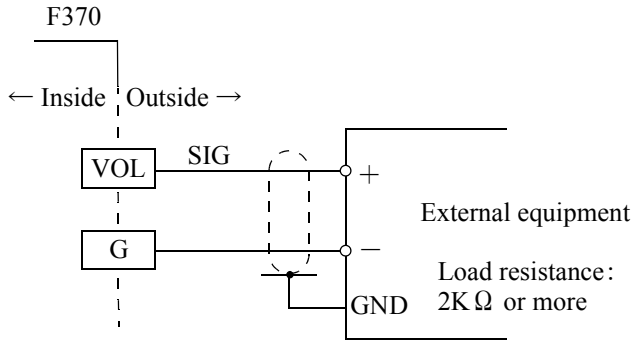
The output circuit and the main unit circuit are isolated. The resolution is 1/10000 to -10 - 10V, and the conversion rate is 2000 times/sec. The maximum voltage output range are about ± 11V, the maximum current output range are about 2.4 - 21.6 mA.




Voltage/current output terminals:
Terminals to extract voltage or current signals.
VOL and CUR indicate signals and G indicates ground.
-10 - 10V and 4 - 20mA can be obtained between VOL and G and between CUR and G, respectively.

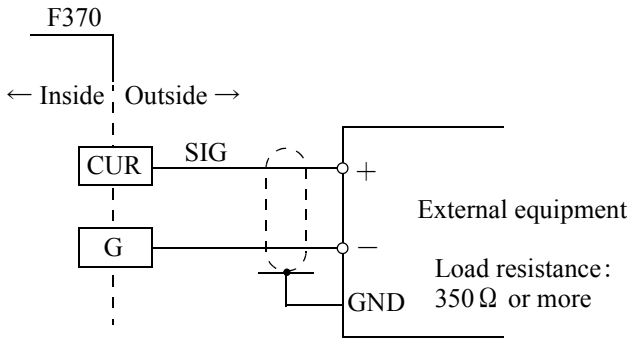
**- Taking voltage output signals**

Connect external equipment (2K Ω or more load resistance) to VOL and G of the F370.



**- Taking current output signals**

Connect external equipment (350Ω or less load resistance) to CUR and G of the F370.




**- Resolution**

The D/A converter has a resolution of 1/10000 to -10 - 10V (4 - 20mA).

**NOTE**

* The D/A converter is optional.
* Do not apply external voltage because it will break.
* Do not short-circuit the voltage output because a failure will occur.
  Also, connecting a capacitive load may cause oscillation.

## 13-1. Voltage Zero and Full Scale, Current Zero and Full Scale

Setting range: -99999 - 99999 (where zero set value < full scale set value)

Voltage zero: Set the indicated value for the time of output of 0V.

Voltage full scale: Set the indicated value for the time of output of 10V.

Current zero: Set the indicated value for the time of output of 4mA.

Current full scale: Set the indicated value for the time of output of 20mA.

**How to set**

Setting call → Option → Page 1

## 13-2. D/A Output Mode

In synchronization with the indicated value / Fixed at 0V /
Fixed at 10V / Fixed at 4mA / Fixed at 20mA

| | |
|---|---|
| In synchronization with the indicated value | Outputs in synchronization with the indicated value. |
| Fixed at 0V | : The voltage output is fixed at zero output (0V). |
| Fixed at 10V | : The voltage output is fixed at full scale (10V). |
| Fixed at 4mA | : The current output is fixed at zero output (4mA). |
| Fixed at 20mA | : The current output is fixed at full scale (20mA). |

**How to set**

Setting call → Option → Page 1

## 13-3. Voltage Output Selection

Output selection: Hold values / Real-time values

**How to set**

Setting call → Option → Page 2

## 13-4. Current Output Selection

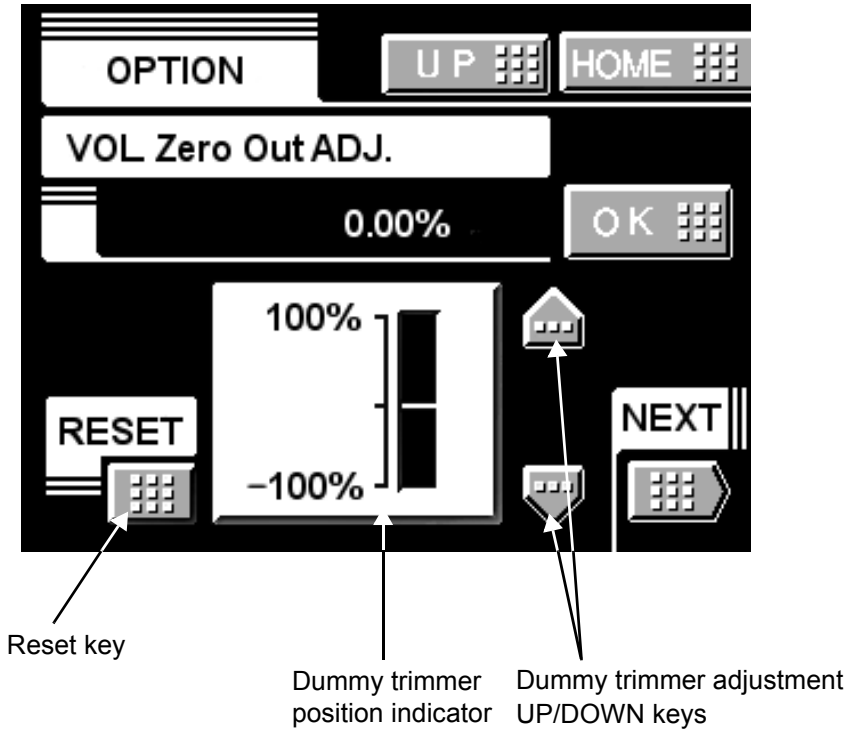
Output selection: Hold values / Real-time values

**How to set**

Setting call → Option → Page 2

## How to output adjust

Adjust the output with the dummy trimmer that appears on the adjustment screen after selecting each fixed output in the D/A output mode setting and pressing the [OK] key. While monitoring the output value, finely adjust the output with the dummy trimmer UP/ DOWN keys, and press the [OK] key to confirm, so that the trimmer position is entered.



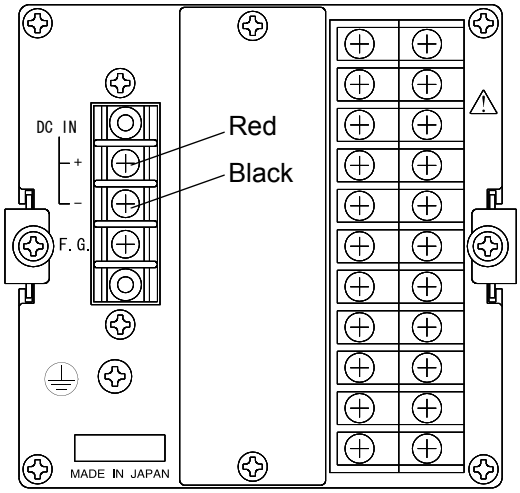

*Pressing the dummy trimmer UP/DOWN keys continuously performs continuous operation.

*The trimmer adjusting ranges are as follows: voltage output; about ± 2.0V, and current output; about ± 1.6mA.

*The reset key resets the dummy trimmer position to the trimmer center point (0%).

# 14. DC POWER SOURCE

The F370 can be used on a DC power source by specification at delivery time.




Connect the positive (+) side of the power source to the red screw side of the terminal block on the back of the F370, and its negative (-) side to the black screw side.

**Input voltage range (voltage between terminals of the F370)**

12 - 24V DC ( ± 15%)

**Caution**

Be aware that the voltage drops depending on the wire thickness and length. Also, never input an AC power source. Doing so will cause a failure.

**Power consumption**

20W max

**Caution**

Use a source power (or battery) of 3A DC or more.

# 15. ERROR MESSAGES

### ADC+OVER or ADC-OVER

This message indicates that the inputted electric signal exceeds the input voltage range of the element (ADC) which converts the inputted electric signal to a digital value whereby the signal cannot be converted to a correct digital value.
ADC+OVER and ADC-OVER indicate that the inputted electric signal exceeds the input range in the positive direction and negative direction, respectively.
This message may also be displayed when an excessive load is applied to the sensor or the input terminals are opened due to a break in the cable.

### +OVER or -OVER

This message indicates that the value to be displayed except the decimal point and sign exceeds five digits. The message and a value of as much as five digits appear alternately.
+OVER and -OVER indicate that the value to be displayed exceeds five digits in the positive direction and negative direction, respectively.
This message is displayed in such a case wherein a load larger than expected is applied or calibration is performed below the measuring range. Check calibration and the measuring object.

### Zero calibration error

This message indicates that calibration cannot be performed because the inputted electric signal exceeds the input voltage range.
Check the cables for breaks or miswiring.

### Span calibration error

The span calibration error occurs under the following conditions.

1) An actual load set value of zero is inputted.
2) An electric signal in the negative direction is inputted.
3) An electric signal of 0.05mV/V or less in the positive direction is inputted.

In the case of 1), check the set value, and perform calibration again.
In the case of 2) or 3), check that the actual load is properly applied and check the cables for miswiring. Where the condition in 3) applies with too light a load, the load needs to be increased.

Although the F370 will not break down immediately even if the above messages are displayed, ADC+OVER or ADC-OVER indicates that an excessive voltage may be applied to the input circuit of the F370. It is therefore required to remove the cause immediately.
(Although the input is provided with a protection circuit, a long-time excessive voltage or an instantaneous but extremely high voltage may break the F370.)

# 16. SELF-CHECK AND INITIALIZATION

## 16-1. Self-Check

The self-check function includes a memory check to check the memory automatically for detecting problems, a visual check to check the display visually, a touch panel key input check and an external I/O check.

### 16-1-1. Self-Check DSP

The display is checked.

White → Black → Red → Green → Blue → "H" (half size) → "H" (full size)

**How to set**

Setting call → System → Page 1

### 16-1-2. Self-Check MEM

The memory is checked.

ROM check judgment checksum
ROM version

SRAM check judgment
NOVRAM check judgment

Judgment: OK or NG

**How to set**

Setting call → System → Page 1

## 16-1-3. Self-Check KEY

The touch panel keys are checked.

Black-bordered pseudo keys appear on the blue screen. These keys should change to white when pressed.
When all keys are pressed, the original screen is restored. If the color does not change with no reaction due to a problem, it is NG.
In the case of NG, the original screen is restored in 30 seconds after the last key operation.

**How to set**

Setting call → System → Page 1

## 16-1-4. Self-Check EXT

The external I/O is checked.

Pseudo LEDs for the input terminals and pseudo ON/OFF keys for the output terminals appear.
When each input terminal is shorted (turned on), the pseudo LED lights.
When each output terminal key is pressed, the output is turned on.
The original screen is restored by the ESC key.

**How to set**

Setting call → System → Page 1

## 16-2. Initialization (All setting value clearances)

The contents of the memory are rewritten to factory defaults.
In this operation, calibration values (zero calibration and span calibration) do not change but all other parameters are rewritten to factory defaults.
See the section on SETTING ITEM CHART page 113 for factory defaults.

**How to set**

Setting call → System → Page 1

## 16-3. Password

This setting is for maintenance and inspection. Do not operate.

# 17. ABOUT JAPANESE/ENGLISH DISPLAY SELECTION

The display language of the F370 is selectable between Japanese and English.

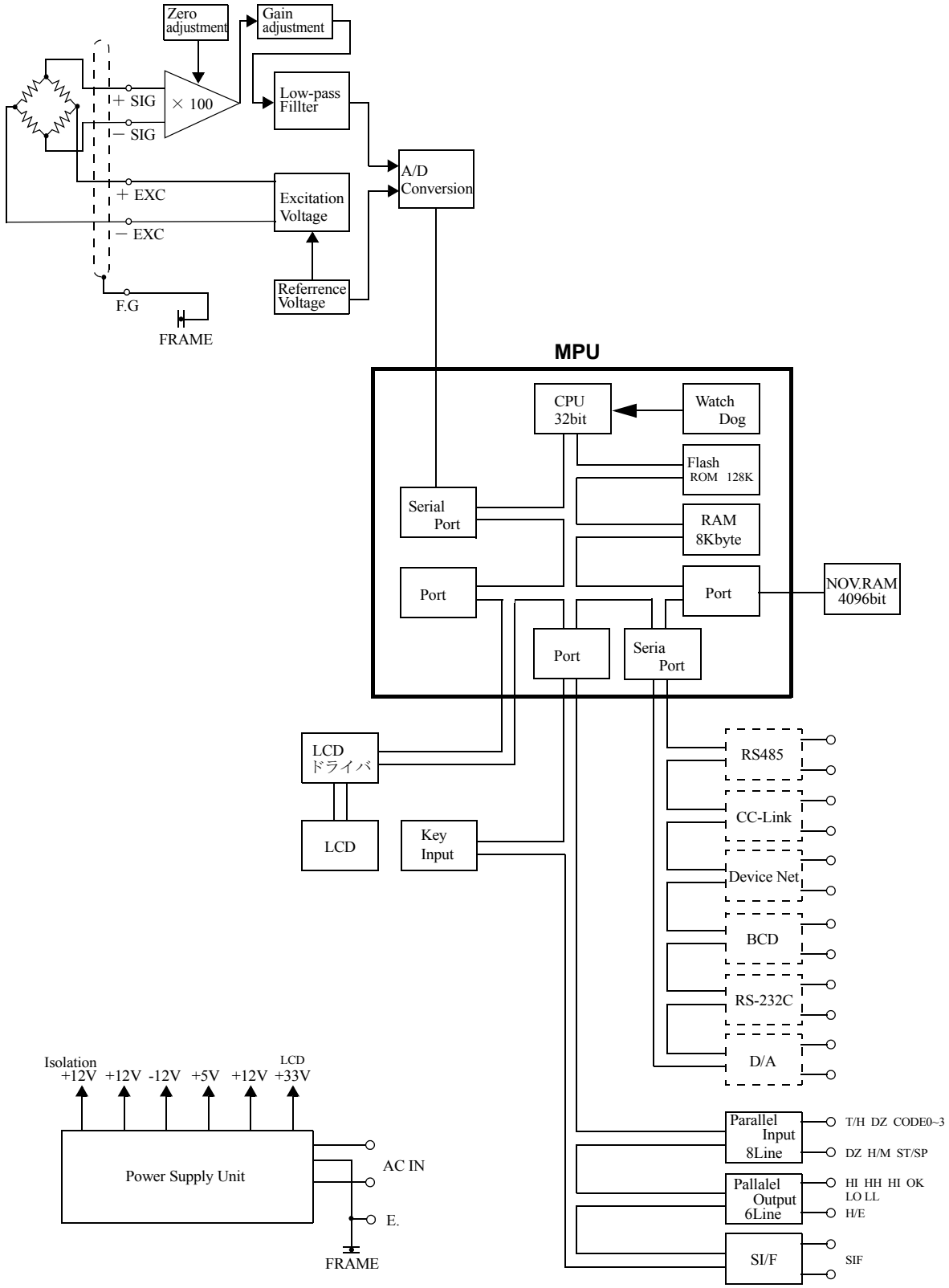
JPN: Japanese

ENG: English

**How to set**

Setting call → System → Page 2

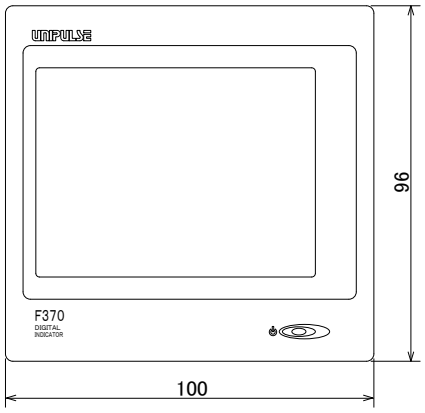
# 18. BLOCK DIAGRAM



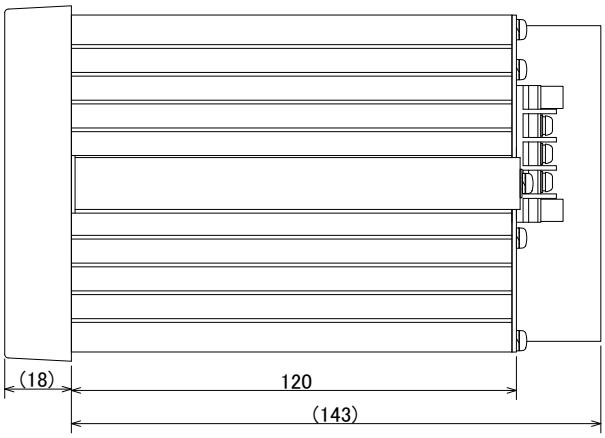
# 19. DIMENSIONS

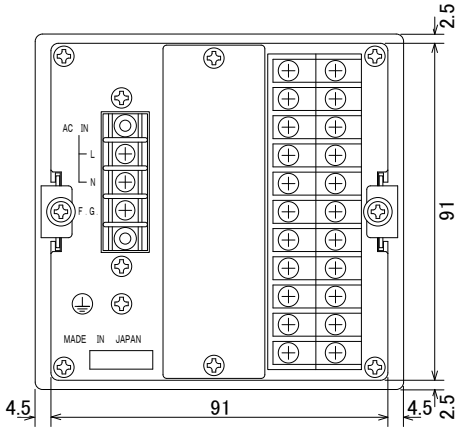
Unit : mm

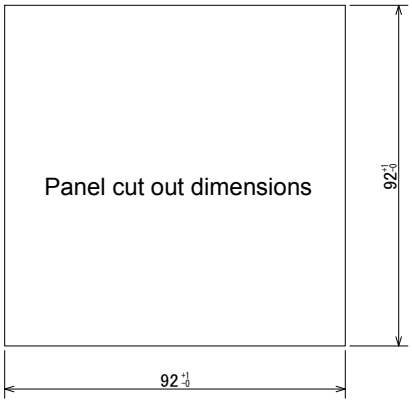
[ Front ]




[ Side ]



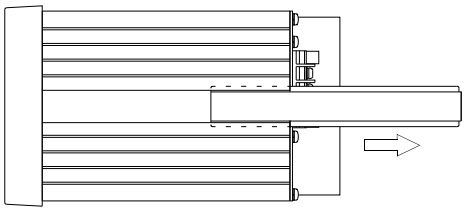




[ Rear ]

# 20. INSTALLATION IN A PANEL

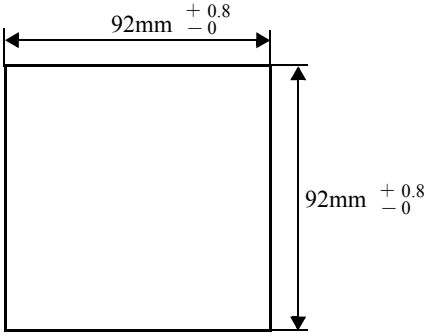
Follow the steps below to install the F370 in a panel.

1) Remove both side rails.

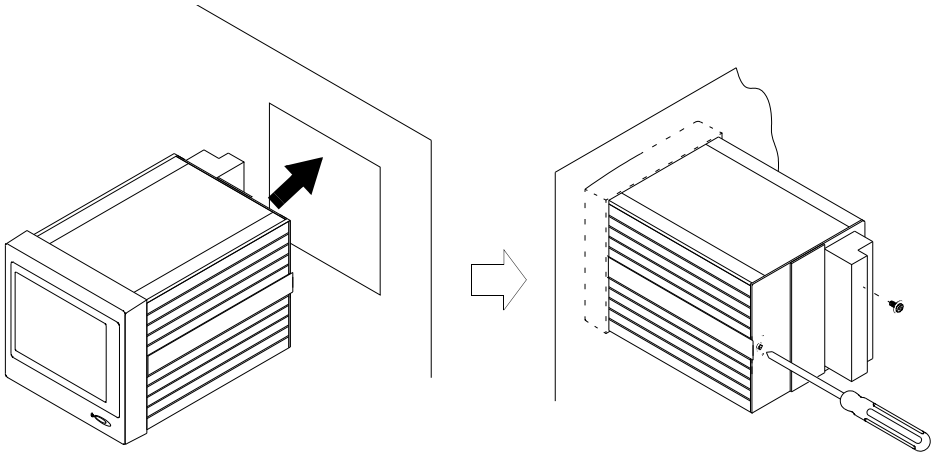


2) Make a hole in the panel in accordance with the panel cutout size.

Panel Cutout Size
92W × 92H (mm)




3) Install the F370 and attach it with side rails.



# 21. SPECIFICATIONS

## 21-1. Analog Section

| | | |
|---|---|---|
| Sensor excitation | 10V, 5V, 2.5V DC (digital adjustment)<br>Output current: Within 120mA<br>4-wire (Up to four 350 Ω load cells can be connected.) | |
| Signal input range | -3.0 - +3.0mV/V | |
| Zero and gain adjustment | Performed by digital computation | |
| Accuracy | Non-linearity | : Within 0.02%FS ± 1 digit (at a 3.0mV/V input) |
| | Zero drift | : Within 0.5 μ V/ ℃ RTI |
| | Gain drift | : Within 0.01%/ ℃ |
| A/D converter | Rate | : 2000 times/sec. |
| | Resolution | : 16 bits (binary) |
| Analog filter | 10Hz, 30Hz, 100Hz, 300Hz (digital adjustment) | |

## 21-2. Digital Section

| | |
|---|---|
| Display | STN color LCD module (display area: 75mm × 56mm)<br>320 × 240 dots<br>Indicated value: ± 99999 (5-digit) |
| Equivalent input calibration | Range: 0.5 - 3.0mV/V Error: Within ± 0.1%FS |
| Hold functions | 1) Sample hold<br>2) Peak hold<br>3) Valley hold<br>4) Peak-to-peak hold<br>5) Relative maximum hold<br>6) Relative minimum hold<br>7) Inflection point hold<br>Period setting (all period, external signal, time, time with trigger) is available for 2) - 4).<br>Combinations allow selection from 16 hold types. |

Comparison functions

| | External output |
|---|---|
| HI-HI limit | HH |
| LO-LO limit | LL |
| | OK |
| HI limit | HI |
| LO limit | LO |

Calibration value selection　Four calibration values can be stored in memory and switched.

## 21-3. Options

BCD data output　Open-collector output

Output rate

Can be selected from 1 time/sec., 10 times/sec., 100 times/sec. and 1000 times/sec.

RS-232C communication interface

Start/stop system

Baud rate: 1200bps - 19200bps

RS-485 communication interface

Communication conditions are the same as RS-232C.

D/A converter　Voltage output　-10 - 10V

Current output　4 - 20mA

Zero output and full scale output can be digitally adjusted.

## 21-4. External Input and Output

Output

Output common - COM1

HI-LO limit comparison output (open-collector outputs)

- HH
- HI
- GO
- LO
- LL

Hold end output

- H/E

Serial data output SI/F start/stop system 600bps

Input

Input common - COM2

Parameter selection input

- CODE0
- CODE1
- CODE2
- CODE3

Hold control input

- T/H
- H/M

Digital zero input

- DZ

Graphic display start/stop input

- ST/SP

## 21-5. General

| | |
|---|---|
| Required power source | - AC spec: 100V to 240V AC (+10% -15%)<br>[free power source 50/60Hz]<br>- DC spec: 12V to 24V DC ( ± 15%)<br>(Depending on the request at the time of order) |
| Power consumption | - AC spec: 12W (28VA) max.<br>- DC spec: 20W max. |
| Rush current (Typ) | 15A, 5 msec.: 100V AC mean load state<br>(ordinary temperature, at cold-start time)<br>30A, 5 msec.: 200V AC mean load state<br>(ordinary temperature, at cold-start time) |
| Operating conditions | Temperature：-10 ℃ to +40 ℃<br>Humidity：80%RH or below (non-condensing) |
| Warmup time | 20 minutes |
| Dimensions | 100W × 96H × 143D（mm）(excluding projected parts) |
| Weight | About 1kg |

## 21-6. Accessories

- Operation Manual - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 1
- Acceptance proof - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 1
- The sticking-by-pressure terminal for external I/O terminal stand - - - 22
  (TMEV1.25-3S)
- AC cable* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 1
- Connector (57-30360, At the time of an BCD option addition) - - - - - - 1
- Mini driver (D/A, At the time of an RS-485 option addition) - - - - - - - - 1
- Ferrite core for sensor cable* (E04SR301334) - - - - - - - - - - - - - - - - - 1

* :It is attached only at the AC power source specification.

About the power cable

- The power cable attached to this product as standard equipment can be used in the AC100V power supply in Japan. (Official ratings voltage AC125V)
  Please use the power cable authorized in the country when you use this product outside Japan.

# 22. SETTING ITEM CHART

**Setting of OPERATION**

N : NOVRAM S : SRAM

| | page | Item | Default | Calibration LOCK | Set Value LOCK | N | S |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Digital Filter | OFF | | ◎ | ○ | |
| 2 | | Analog Filter | 300Hz | | ◎ | ○ | |
| 3 | | Display Rate | 10Times | | ◎ | ○ | |
| 4 | | Stability（Time） | 1.5Sec | | ◎ | ○ | |
| 5 | | Stability（Cnt） | 05CNT | | ◎ | ○ | |
| 6 | 2 | Zero Track（Time） | 0.0Sec | | ◎ | ○ | |
| 7 | | Zero Track（Cnt） | 00CNT | | ◎ | ○ | |
| 8 | | Contrast1 | | | | ○ | |
| 9 | | Contrast2 | 70 | | | ○ | |
| 10 | | Backlight | 10Min. | | | ○ | |
| 11 | 3 | Excitation Voltage | 2.5V | | ◎ | ○ | |
| 12 | | Auto Print | No | | ◎ | ○ | |
| 13 | | Hold Off Print | No | | ◎ | ○ | |
| 14 | | Cal.Protect | OFF | | | | |
| 15 | | Para.Protect | OFF | | | | |

**Setting of COMPARISON(CH00 ～ CH15)**

| | page | Item | Default | Calibration LOCK | Set Value LOCK | N | S |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Hi-Hi Limit | 12500* | | ◎ | | ○ |
| 2 | | HI Limit | 07500* | | ◎ | | ○ |
| 3 | | LO Limit | 00000* | | ◎ | | ○ |
| 4 | | LO-LO Limit | -02500* | | ◎ | | ○ |
| 5 | | Hysteresis | 00000* | | ◎ | | ○ |
| 6 | 2 | Near Zero | 00100* | | ◎ | | ○ |
| 7 | | HI-LO Limit Comparison Mode | ALL | | ◎ | | ○ |
| 8 | | HI-LO Limit Output Mode | MODE2 | | ◎ | | ○ |
| 9 | | Alarm Mode | No | | ◎ | | ○ |

* The display position of a decimal point changes by the decimal point position setup in the proofreading mode.

**Setting of HOLD MODE（CH00 ～ CH15）**

| | page | Item | Default | Calibration LOCK | Set Value LOCK | N | S |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Hold Function | Tracking | | ◎ | | ○ |
| 2 | | Hold Detect Time | 1.000Sec | | ◎ | | ○ |
| 3 | | Auto Start Level | 00100* | | ◎ | | ○ |
| 4 | | Minimum Count | 010 | | ◎ | | ○ |
| 5 | | Valley Detect Level | 1.0Times | | ◎ | | ○ |
| 6 | 2 | Minimum Slope | 00030* | | ◎ | | ○ |
| 7 | | Interval A | 200 | | ◎ | | ○ |
| 8 | | Interval B | 200 | | ◎ | | ○ |
| 9 | | Hold Point Shift | 000 | | ◎ | | ○ |
| 10 | | Mean Value Sampling Count | 001 | | ◎ | | ○ |

**Setting of GRAPH**

| | page | Item | Default | Calibration LOCK | Set Value LOCK | N | S |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Graph Function | CONTINUDE | | ◎ | | ○ |
| 2 | | Interval Time | 01.0Sec | | ◎ | | ○ |
| 3 | | Graph Start Level | 00100* | | ◎ | | ○ |
| 4 | | Level Detect Mode | Passed High | | ◎ | | ○ |
| 5 | | X Start Point | 10.0Sec | | ◎ | | ○ |
| 6 | 2 | Y Start Point | 00000* | | ◎ | | ○ |
| 7 | | Y End Point | 10000* | | ◎ | | ○ |

* The display position of a decimal point changes by the decimal point position setup in the proofreading mode.

**Setting of Calibration**

| | page | Item | Default | Calibration LOCK | Set Value LOCK | N | S |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Zero Calibration | 0 | ◎ | | ○ | |
| 2 | | Actual Load Cal | 10000* | ◎ | | ○ | |
| 3 | | Egv.Input Cal | 3.000 | ◎ | | ○ | |
| 4 | | Cal. Select | CAL.0 | ◎ | | ○ | |
| 5 | | Increment | 001 | ◎ | | ○ | |
| 6 | 2 | Unit | kg | ◎ | | ○ | |
| 7 | | Decimal Place | 0.00 | ◎ | | ○ | |
| 8 | | Digital Offset | 00000* | ◎ | | ○ | |

* The display position of a decimal point changes by the decimal point position setup in the proofreading mode.

**Setting of Option**

In case of used RS-232C

| | page | Item | Default | Calibration LOCK | Set Value LOCK | N | S |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Comm.Mode | MODE0 | | ◎ | ○ | |
| 2 | | Speed | 9600bps | | ◎ | ○ | |
| 3 | | Character Length | 8bit | | ◎ | ○ | |
| 4 | | Stop | 1bit | | ◎ | ○ | |
| 5 | | Parity | No | | ◎ | ○ | |
| 6 | 2 | Terminator | CR | | ◎ | ○ | |

**Setting of Option**

In case of used BCDOUT

| | page | Item | Default | Calibration LOCK | Set Value LOCK | N | S |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Output Rate | 100Times | | ◎ | ○ | |
| 2 | 1 | Output Selection | Hold Value | | ◎ | ○ | |

**Setting of Option**

In case of used Output Mode

| | page | Item | Default | Calibration LOCK | Set Value LOCK | N | S |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Output Mode | Input Value | | ◎ | ○ | |
| 2 | | Voltage Zero Output | 00000 | | ◎ | ○ | |
| 3 | | Voltage Full Scale | 10000 | | ◎ | ○ | |
| 4 | | Current Zero Output | 00000 | | ◎ | ○ | |
| 5 | | Current Full Scale | 10000 | | ◎ | ○ | |
| 6 | 2 | Voltage Output Selection | Hold Value | | ◎ | ○ | |
| 7 | | Current Output Selection | Hold Value | | ◎ | ○ | |

**Setting of Option**

In case of used RS-485

| | page | Item | Default | Calibration LOCK | Set Value LOCK | N | S |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Comm.Mode | MODE0 | | ◎ | ○ | |
| 2 | | Speed | 9600bps | | ◎ | ○ | |
| 3 | | Character Length | 8bit | | ◎ | ○ | |
| 4 | | Stop | 1bit | | ◎ | ○ | |
| 5 | | Parity | No | | ◎ | ○ | |
| 6 | 2 | Terminator | CR | | ◎ | ○ | |
| 7 | | ID | 0000 | | ◎ | ○ | |
| 8 | | end.reg | No | | ◎ | ○ | |
| 9 | | wire-sel | 4wire | | ◎ | ○ | |

**Setting of SYSTEM**

| | page | Item | Default | Calibration LOCK | Set Value LOCK | CH | Note |
|---|---|---|---|---|---|---|---|
| 1 | 1 | All Para.Clear | | | | | |
| 2 | | Self Check DSP | | | | | |
| 3 | | Self Check MEM | | | | | |
| 4 | | Self Check KEY | | | | | |
| 5 | | Self Check EXT | | | | | |
| 6 | 2 | PASSWORD | * * * * | | | | |
| 7 | | LANGUAGE | ENG | | | | |

# 23. CONFORMITY TO EC DIRECTIVES

The F370 digital indicator conforms to EC directives (based on the EC council of ministers), carrying a CE mark.

- Low voltage directive: EN61010-1
- EMC directive: EN61326-1

(EN55011, EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-5, EN61000-4-6, EN61000-4-8, EN61000-4-11, EN61000-3-2, EN61000-3-3)

When installing, attention should be given to the following.

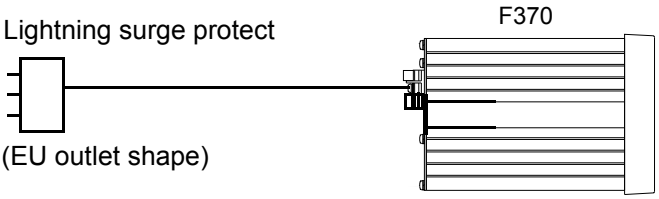
1. Since the F370 is defined as an open type (built-in equipment), be sure to install the F370 and fix to a panel or the like for use.

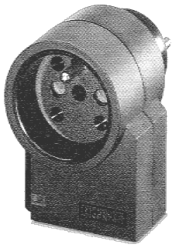
2. The power cable attached to this product as standard equipment can be used in the AC100V power supply in Japan. (Official ratings voltage AC125V)
   Please use the power cable authorized in the country when you use this product outside Japan.

3. Use shielded cables for others (load cell, external I/O, option).

### Connection of Lightning serge protect

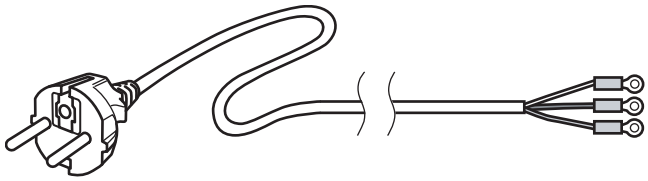
The F370 main body conforms to EMC directive EN61000-4-5 (lightning surge immunity) in combination with the lightning surge protect.



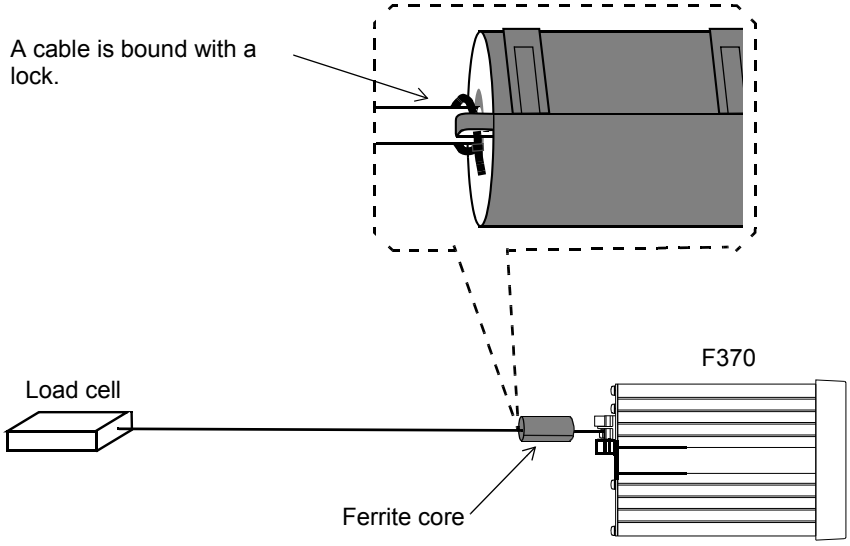
"MAINTRAB MNT-ID"
lightening surge protector
is trademark of
Phoenix Contact, Germany

No lightning surge protector [MAINTRAB MNT-1D] is included as a standard.It is optionally available (TSU01) in combination with a 250V AC high-voltage cable in EU outlet form (See below: Standard product in Europe). For details, contact our sales department.



### Attachment of ferrite core

It is necessary to attach a ferrite core to a sensor cable for a load cell or the like.




**Caution**

- The F370 main body conforms to EMC directive EN61000-4-5 (lightning surge immunity) in combination with the lightning surge protect.

- The F370 does not conform to EC directives with the CC-Link option or Device Net option, and on a DC power source.

UNIPULSE

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