



FC400-ECT-FA

OPERATION MANUAL

04FEB2025REV.1.06E

UNIPULSE

Operation overview for FC400



Basic operation procedures

Please read "Setting/operation" on page **6**.

Calibration

Please read "Calibration procedures" on page **7**.

Measurement to fit the purpose

Please read "Setting and Operation Related to Comparison " on page **13**.

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1 Before getting started

Be sure to read for safety.

Make sure that installation, maintenance, and inspection of the FC400 are performed by personnel with electrical knowledge. In this manual, precautions for safe use of the FC400 are described separately as and in the following text. The precautions described in this text are important content regarding safety. Use this product having understood the content accurately.

WARNING

Events that may cause death or severe injury to persons in cases of misuse.

Design warning

- Prepare a safety circuit outside the FC400 so that the entire system functions safely.
- Be sure to contact our sales representative before use if the FC400 will be used in the following situations:
 - If the product is used in an environment not described in the operation manual;
 - If the product is used in a way that may have a substantial effect on human life and/or property, such as in medical devices, transportation equipment, entertainment devices, safety devices, etc..

Mounting precautions

- Do not disassemble, repair or alter the FC400.
- Do not install the product in the following environments:
 - Locations with corrosive gases or combustible gases;
 - Locations over which water, oil, or chemicals splash.

Wiring warning

- Do not connect commercial power supply directly to the signal I/O terminal.
- Be sure to perform class D grounding when installing the product.
- Be sure to check that the power is off before the following actions:
 - Wiring and connection of cables to a terminal block;
 - Connection to functional grounding terminals.
- Be sure to check signal names and pin assignment numbers before connecting to the signal I/O terminal in order to wire cables properly.
- No connection is necessary for unused terminals.
- Be sure to check the wiring and so on carefully before turning the power on.

Startup/maintenance warning

- Use power supply voltage and load within the specified range and rating.
- Do not touch the terminal while power is on. This may cause electric shock and malfunction.
- Do not open the main unit cover. Contact us for inspection and/or repair of internal parts.
- Turn power off immediately if smoke, abnormal smell, or abnormal noise is detected.

CAUTION

Events that may cause injury to persons or material damage in cases of misuse.

Mounting precautions

- The FC400 must be incorporated into the control panel and so forth.
- Do not install the product in the following environments:
 - Locations where temperature or humidity exceeds specifications;
 - Locations subject to drastic temperature fluctuations or icing and condensation;
 - Outdoors or locations above 2,000m;
 - Locations exposed to direct sunlight;
 - Locations subject to dust accumulation;
 - Locations with poor ventilation;
 - Locations with a lot of salt and metal powder;
 - Locations where the main unit is subject to direct vibration and/or shock.
- Perform adequate shielding if the product is used in the following locations:
 - Near power lines;
 - Locations subject to strong electric and/or magnetic field;
 - Locations subject to noise such as static electricity and relays.
- Install the product as far away as possible from equipment generating high frequency, high voltage, large current, surge, etc. Moreover, perform wiring of cables separately from these power lines. Do not perform parallel wiring and identical wiring.
- Do not use the product if it is damaged.

Wiring precautions

- Use shielded cables for cables (load cell, external I/O).
- Be sure to ground the frame ground terminal.
- Tighten terminal screws to the specified torque.
Tightening torque: 0.31 to 0.37 N·m

Startup/maintenance precautions

- Be sure to allow an interval of five seconds or longer between turning power ON and OFF.
- Use after warming up for 30 minutes or longer following the startup of power supply.
- Protective performance of the FC400 may be lost if it is not used as specified.
- Cleaning
 - Unplug the power supply when cleaning.
 - Please use a dry cloth. When dirty, clean using a well squeezed cloth soaked in diluted neutral detergent. Afterwards wipe with a soft, dry cloth. Do not wipe with benzine, thinner, alcohol, etc. This may lead to discoloration and/or warping of the FC400.

Transportation precautions

- When sending the FC400 to us for repair and so on, pack it with sufficiently shock-absorbing materials.

Disposal precautions

- Handle this product as industrial waste when disposing.

— Trademark —

EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

1-1. Product supporting RoHS2 Directive

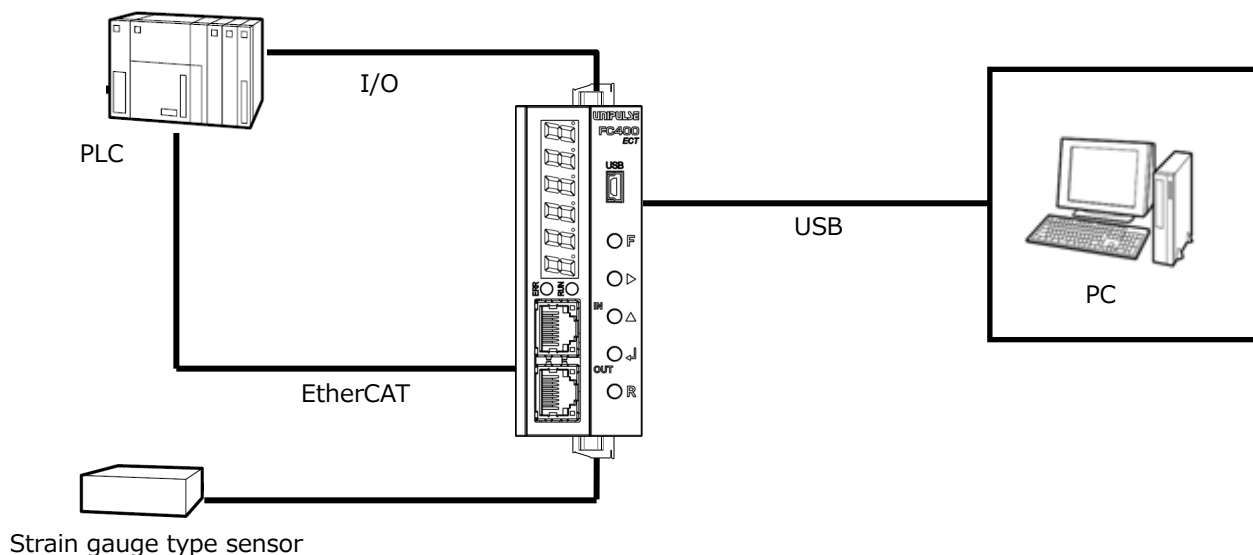
The parts and accessories used in this device (including the operation manual, package box and so on) correspond to the RoHS2 Directive which regulates the use of toxic substances that may have adverse effects on the environment as well as the human body.

1-2. Package contents

The following items are included in the package box. Be sure to check the contents before use.

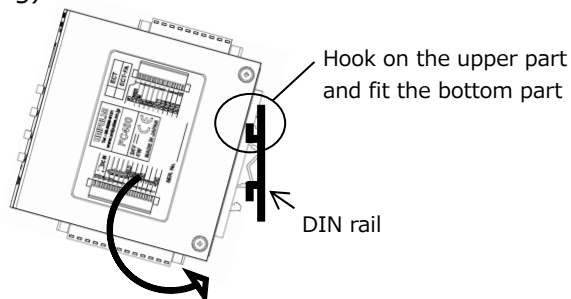
- | | | |
|--|-----|------------|
| - FC400 main unit | --- | One unit |
| - Terminal block (10 pin) [Model: CN87] | --- | One piece |
| - Terminal block (13 pin) [Model: CN85] | --- | One piece |
| - Small screwdriver for connection of terminal block | --- | One piece |
| - Jumper wire | --- | Two pieces |
| - FC400 quick reference | --- | Two copies |

1-3. Connection with other devices

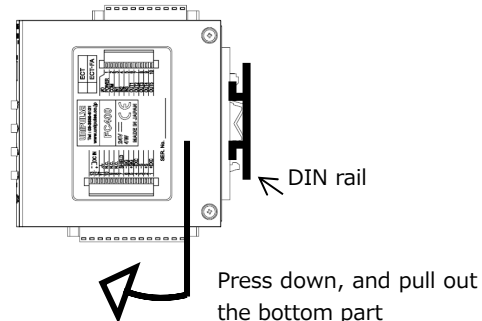


1-4. Attaching/detaching the DIN rail

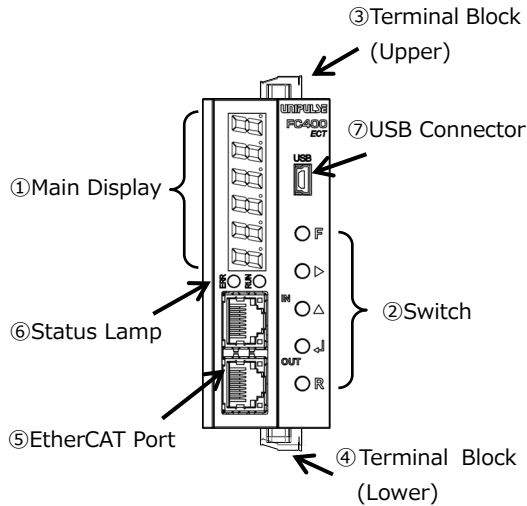
(Attaching)



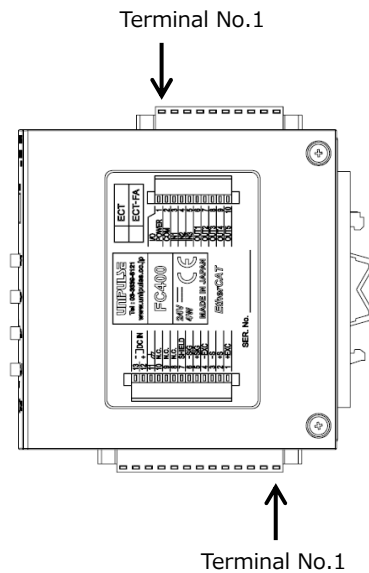
(Detaching)



1-5. Front panel / Terminal block



Name	Details	
① Main Display	1) Indicated value display 2) Over scale / error display 3) Setting value display	Display indicated value Over scale and other errors are displayed Each setting value is displayed
② Switch	F FNC ▶ HOLD △ ZERO ↺ ENT(P/B) R RESET	Go into setting mode Hold operation/Setting operation Digital Zero/Setting operation Peak⇔bottom switching/setting operation EtherCAT reset
③ Terminal Block (Upper)	For external I/O signal.	
④ Terminal Block (Lower)	For power supply/sensor	
⑤ EtherCAT Port	For LAN cable	
⑥ Status Lamp	Indicates communication state of EtherCAT	
⑦ USB Connector	For USB cable	



Terminal Block(Upper)

Uses	Terminal No.	Terminal Name	Details
Power supply for I/O signals	1	I/O POWER	For DC24V power supply which is used for I/O signals
	2	COM	Common terminal of I/O signals.
Input terminal	3	IN1	Input signal terminals (Functions are defined by setting)
	4	IN2	
	5	IN3	
Output terminal	6	OUT1	Output signal terminals (Functions are defined by setting)
	7	OUT2	
	8	OUT3	
	9	OUT4	
	10	OUT5	

Terminal Block(Lower)

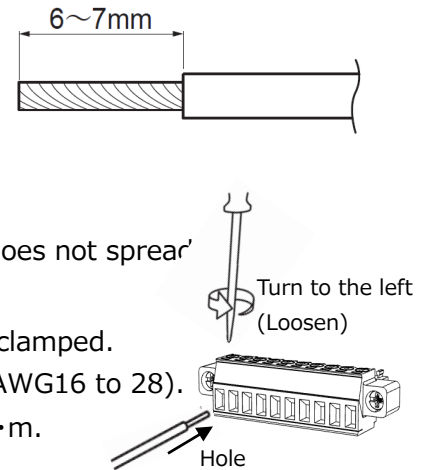
Uses	Terminal No.	Terminal Name	Details
Load input	1	+EXC	Terminals for connecting a strain gauge type sensor.
	2	+S	
	3	-S	
	4	-EXC	
	5	+SIG	
	6	-SIG	
	7	SHIELD	
	8	N.C.	
	9	N.C.	
	10	N.C.	
Power supply input	11	⏏	For DC24V power supply which is used as power source of FC400.
	12	DC IN+	
	13	DC IN-	

1-6. Connection to the terminal blocks

1. Peel off 6 to 7 mm of coating of the electric wire to be connected, and twist the tip enough so it does not spread.
2. Loosen the screw with a screwdriver and open the hole. A flathead screwdriver with a shaft diameter of 2.0mm is recommended. (Precision screwdrivers etc.)
3. Insert the electric wire into the hole, making sure that the tip does not spread.
4. Tighten the screw with a screwdriver.
5. Pull the electric wire slightly to check that it has been securely clamped.

* Electric wires between 0.08 to 1.31mm² can be connected (AWG16 to 28).

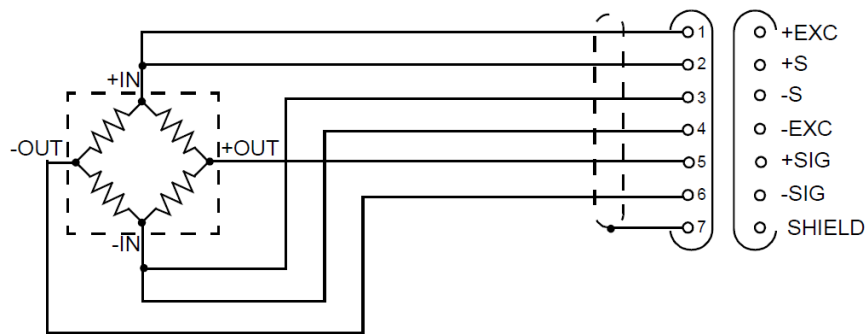
The recommended tightening torque value is 0.31 to 0.37 N·m.



1-7. Strain gauge type sensor connection

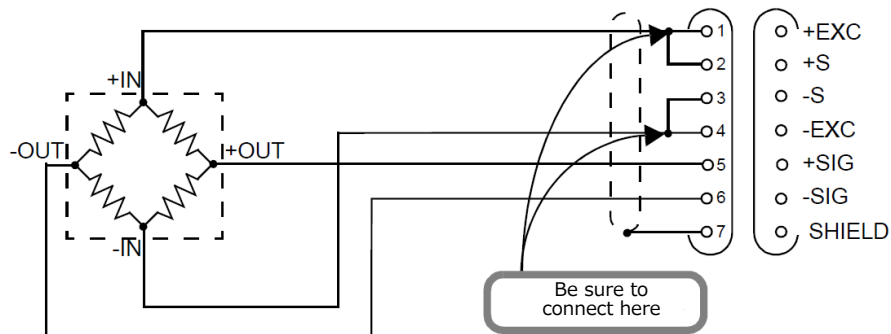
■ Six-line type connection

The load input terminal block for this device is of six-line type. Be sure to use a six-core shielded wire for connection with the Strain gauge type sensor and perform separate wiring for lines with a lot of noise (wiring for electrical power equipment, digital equipment etc.) and AC lines.



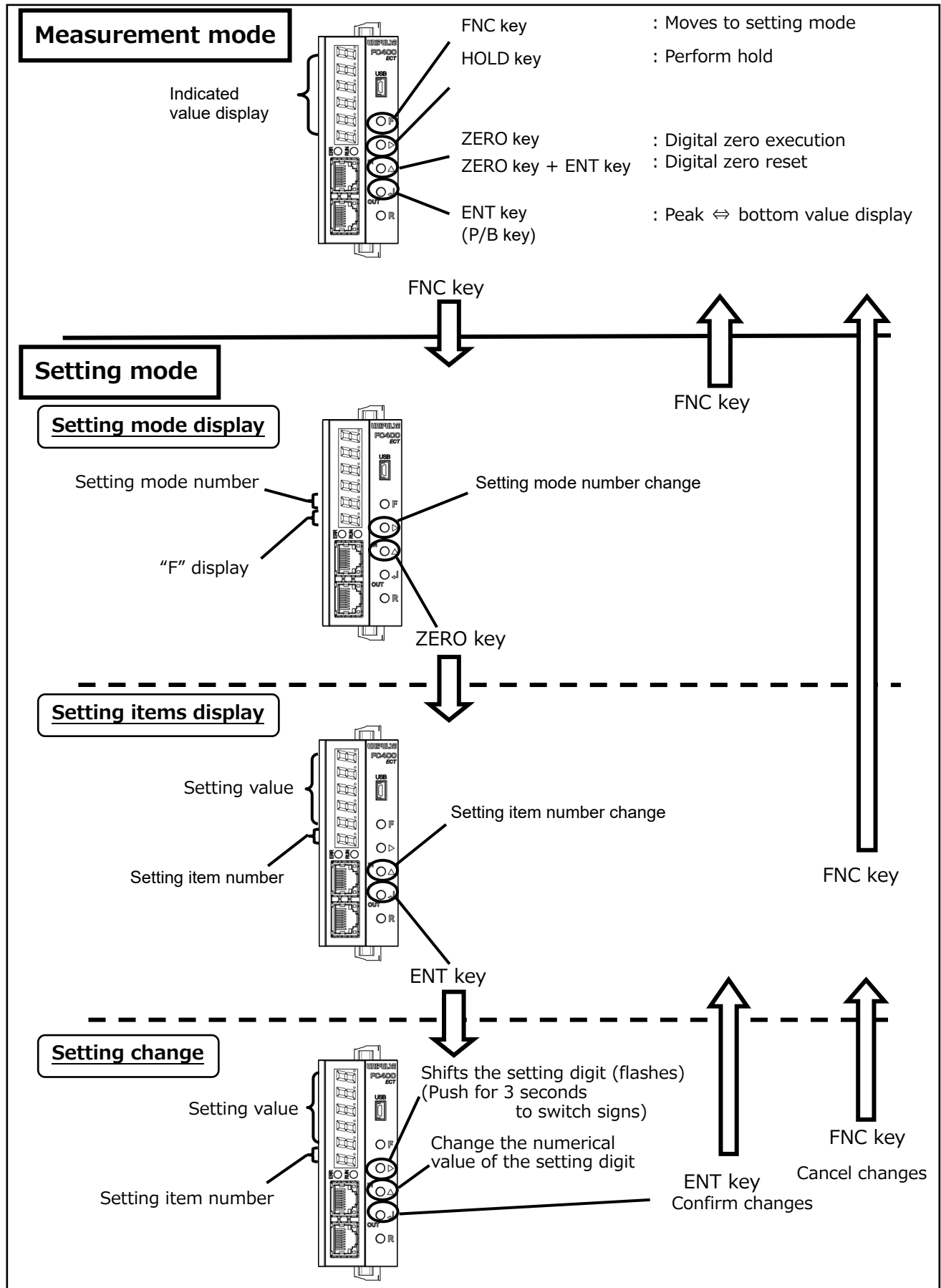
■ Four-line type connection

As outlined below, connect 1 with 2, and 3 with 4 respectively at the terminal block.



2 Settings/operations

Refer to the following and change the setting items for the required setting modes. (Refer to the "List of Setting Items" at the end of this document for setting mode configurations.)



3 Calibration procedures

3-1. Calibration

"Calibration" means matching the FC400 with the strain gauge type sensor. There are two methods of calibration, the "actual load calibration" and "equivalent input calibration".

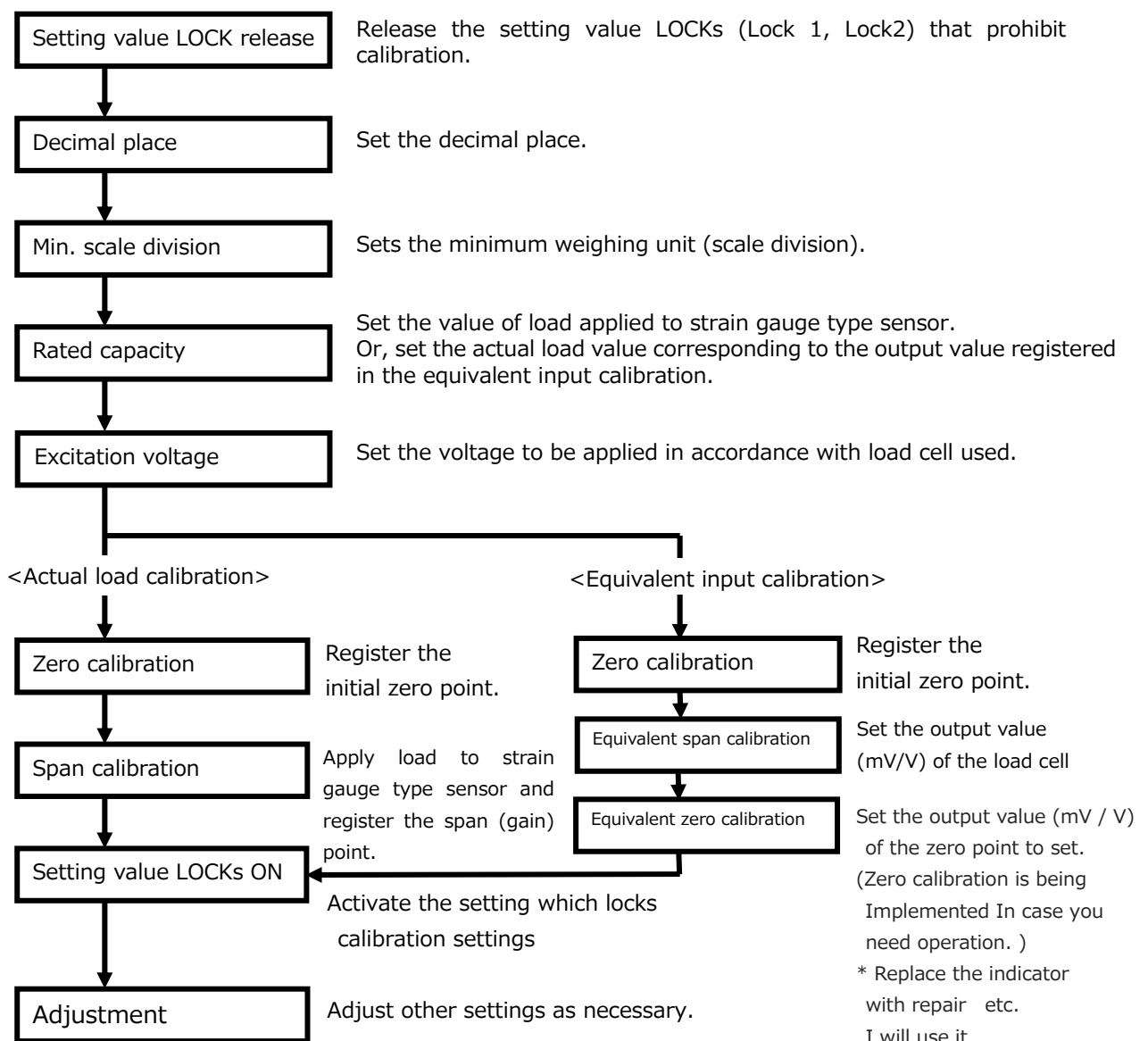
<Actual load calibration> ...

A method of calibration involving applying actual load or pressure to the sensor

< Equivalent input calibration > ...

A method of calibration involving directly inputting electrical signals equivalent to the electrical signal changes generated when actual load or pressure is applied to the sensor.

3-2. Calibration procedures



3-3. Settings/operations related to calibration

■ Setting value LOCK

LOCKS can be enabled to prevent calibration and setting values from being changed due to operational errors.

[Setting value LOCK]	(Setting item 3-1)
<div style="display: inline-block; width: 20px; height: 20px; background-color: white; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: white; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: white; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: gray; border: 1px solid black;"></div>	0: Lock1 OFF, Lock2 OFF 1: Lock1 ON, Lock2 OFF 2: Lock1 OFF, Lock2 ON 3: Lock1 ON, Lock2 ON

■ Decimal place

Set the common decimal place for displays, setting items etc. related to load.

[Decimal place]	(Setting item 5-4)
<div style="display: inline-block; width: 20px; height: 20px; background-color: white; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: gray; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: white; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: white; border: 1px solid black;"></div>	0:None 1:0.0 2:0.00 3:0.000 4:0.0000

■ Min. scale division

Set the minimum weighing unit (scale interval).
The input range is from 1 to 50.

[Min. scale division]	(Setting item 5-2)
<div style="display: inline-block; width: 20px; height: 20px; background-color: gray; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: gray; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: gray; border: 1px solid black;"></div>	(Input range: 1 to 50)

■ Rated capacity

Set the load applied to strain gauge type sensor during span calibration.
The input range is from 1 to 99999.

[Rated capacity]	(Setting item 5-1)
<div style="display: inline-block; width: 20px; height: 20px; background-color: gray; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: gray; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: gray; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: gray; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: gray; border: 1px solid black;"></div>	(Input range: 1 to 99999)

■ Excitation voltage selection

Set the voltage value applied to strain gauge type sensor.

[Excitation voltage selection]	(Setting item 5-5)
<div style="display: inline-block; width: 20px; height: 20px; background-color: gray; border: 1px solid black;"></div>	(0 : 5V, 1 : 2.5V)

* Please check the specifications of the strain gauge type sensor that you would like to use before changing the settings.

■ Zero calibration


Register the default zero point.

- (1) Select setting item 9-1
- (2) Make sure that unwanted load does not apply to the strain gauge type sensor.
- (3) Press the ENT key to start zero calibration
- (4) "CAL-ZE" is displayed while calibration is in progress
- (5) Returns to indicated value display, and zero calibration is complete

[Zero calibration]	(Setting item 9-1)
<div style="display: inline-block; width: 20px; height: 20px; background-color: white; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: white; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: white; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: white; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; width: 20px; height: 20px; background-color: white; border: 1px solid black; text-align: center;">0</div>	No setting value input ("0" is displayed)

■ Span calibration <Actual load calibration>


Apply load to strain gauge type sensor and register the span (gain) point.

[Span calibration] (Setting item 9-2)
 (Input range: 1 to 99999)

- (1) Select setting item 9-2
- (2) Enter the actual load value.
- (3) Hit ENT key to start the Actual load calibration.
- (4) "CAL-SP" is displayed while calibration is in progress
- (5) Returns to indicated value display, and span calibration is complete

■ Equivalent input span calibration <equivalent input calibration>

Perform calibration by inputting output of the sensor.


[Equivalent input span calibration] (Setting item 9-4)
 (Input range: 0.0100 to 3.8000)

- (1) Select setting item 9-4
- (2) Input the output value of the sensor
- (3) Execute equivalent input calibration by confirming the input value
- (4) Returns to indicated value display, and equivalent input calibration is complete

■ Equivalent input zero calibration <Equivalent input calibration>

Input the sensor output value and register the default zero point.

* Used when replacing indicators for repair and so on.

[Equivalent input zero calibration] (Setting item 9-3)
 (Input range: -3.0000 to 3.0000)


4 Settings/operations related to the fluctuation and stability of values

Here, the functions that have been built in for ease of use when actually weighing etc. after completing calibration are described.

Select the most appropriate value in accordance with the type of weighing and the setting environment.


■ Display update rate

Set the rate at which the indicated value is updated per second.
Reduce the display update rate if the indicated value flickers.

[Display update rate]	(Setting item 5-4)
	
	0: Once/sec
	1: 3 times/sec
	2: 6 times/sec
	3: 13 times/sec
	4: 25 times/sec

■ Sampling rate

This function changes a rate of referring to the sampled data.


[Sampling rate]	(Setting item 2-3)
	
	1: 2400 times/sec

■ Auto adjustment filter

This function recognizes fluctuation in the indicated value due to noise and vibration, and automatically sets the digital low-pass filter and moving average filter.

"CAL-FL" and indicated value are displayed alternately during adjustment.


Adjustment is complete once "CAL-FL" is no longer displayed.

[Auto adjustment filter]	(Setting item 4-3)
	
	0: Cancel
	1: Execute

■ Digital low-pass filter


This low-pass filter is used to screen the A/D converted data and cancel unnecessary noise content.

The cut-off frequency is set like the low-pass filter of an analog circuit.

[Digital low-pass filter]	(Setting item 4-)
	
	(Input range: 0.1 to 600.0)
Cut-off frequency	0.1 ⇔ 600.0
Response speed	Slow ⇔ Fast

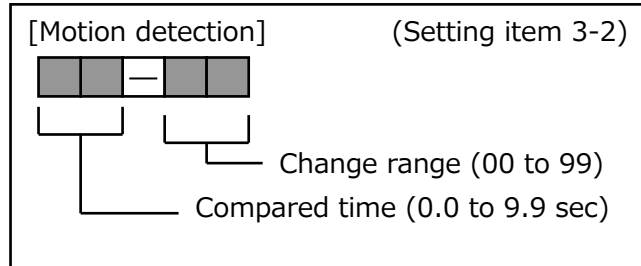
■ Moving average filter

This function takes the moving averages of the A/D converted data and reduces fluctuation in the indicated values.

[Moving average filter]	(Setting item 4-2)
	(Input range: 1 to 999)
Average rate	1 ⇔ 999
Response speed	Fast ⇔ Slow
Stability of indicated value	Unstable ⇔ Stable

■ Motion detection

Set the parameters to detect indicated value stability. If the indicated value change range is lower than the set range and this condition continues longer than the set time, indicated value is considered to be stable and the stable signal turns ON.



■ Zero tracking (Period)

■ Zero tracking (Range)

This function sets the indicated value to 0 (zero) automatically when the condition that the travel of the zero point is within the set tracking range continues for the set period of time or longer. The tracking range is set in increments of 1/4 of the indicated indicated value.

(E.g.: Setting value 0004 → Equivalent to 1 count on the display)

When the period is set to 0.0 sec and the range is set to 00, zero tracking does not work.

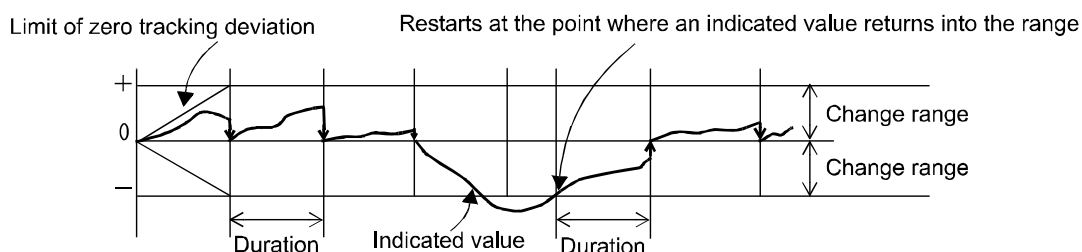
[Zero tracking (Period)] (Setting item 3-3)

(Input range: 0.0 to 9.9)

[Zero tracking (Range)] (Setting item 3-4)

(Input range: 0000 to 9999)

- Operation image



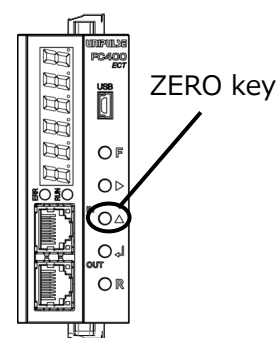
■ Digital zero (Designated key)

The indicated value is forcibly reset to zero when the ZERO key is pressed and digital zero is executed.

- If digital zero is executed with an indicated value exceeding the DZ regulation value, the DZ regulation value will be subtracted from the indicated value, and "ZE-AL" and display value displayed alternately.

Perform the following measures if this occurs.

- Change the setting value of DZ regulation value, and perform digital zero operation again.
(However, as this procedure is only meant as a temporary measure, perform zero calibration as soon as possible)
- Remove weighing residue attached to the tank and so forth.
- Check that there is no mechanical contact around the sensor.



■ DZ regulation value

Set the zero point correction (deviation from zero calibration point) range using digital zero or zero tracking.

[DZ regulation value] (Setting item 5-3)

(Input range: 00000 to 99999)

■ Peak ⇔ bottom value display (dedicated key)

If hold mode is set to "3:Peak & bottom", display of peak & bottom value can be switched alternately by pressing the ENT key (PEAK/BOTTOM key).

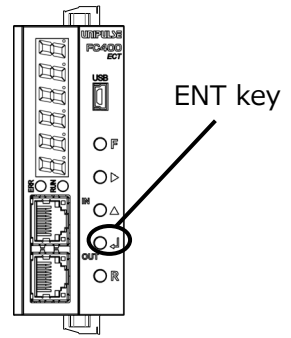
Switch to peak value display :

Peak value is displayed after indication of "P.HOLD".

Switch to bottom value display :

Bottom value is displayed after indication of "B.HOLD".

For hold mode other than "3: Peak & bottom", alternate switching is not possible.



■ Digital offset

This is a function to subtract a setting value from an indicated value. The value obtained by subtracting a setting value from an indicated value is displayed when digital offset is set.

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

[Digital offset] (Setting item 0-5)
 (Input range: -99999 to 99999)

■ 6 digit display

Set the number of 7-segment display digits.

* If it is set to 6 digit display, Min. scale division setting of setting item 5-2 will not be reflected.

Also, this setting will not be reflected to the comparison and the hold.


[6 digit display] (Setting item 5-4)
☐ ☐ ☐ ☐ ☐ ☐
 0: 5 digit display
 1: 6 digit display

5 Setting and Operation Related to Comparison

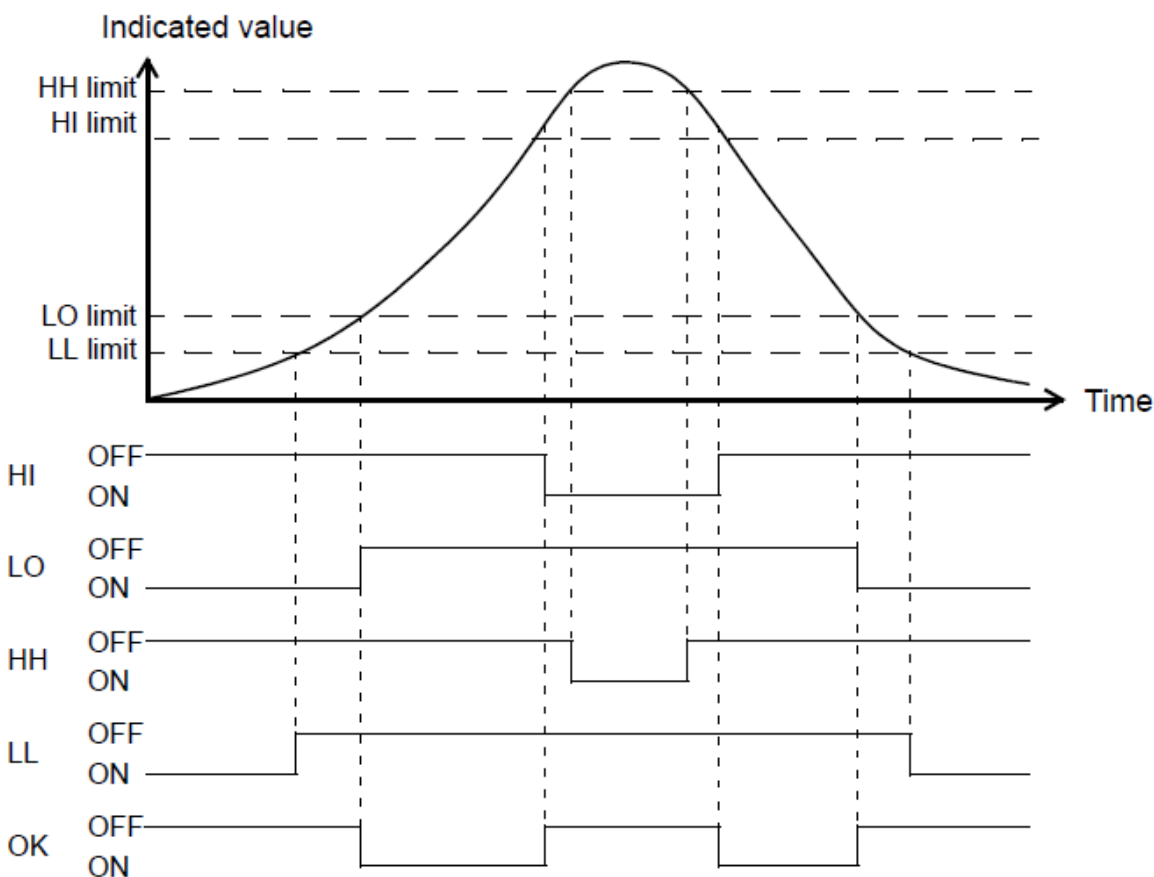
■ HI limit, LO limit, HH limit, LL limit

This function sets the HI limit and LO limit, turns the HI output ON when an indicated value exceeds the HI limit value, and turns LO output ON when an indicated value falls below the LO limit value. HH limit and

LL limit can also be set outside of these HI/LO limit comparisons. HH output is turned ON when an indicated value exceeds the HH limit value, and LL output is turned ON when the indicated value falls below the LL limit value. When HI, HH output, LO, and LL output are all OFF, OK output is turned ON.


[HI limit]	(Setting item 0-1)
[LO limit]	(Setting item 0-2)
[HH limit]	(Setting item 0-6)
[LL limit]	(Setting item 0-7)
	(Input range: -99999 to 99999)

● Output operations




■ HI/LO limit comparison mode

This function specifies the comparison timing.

[HI/LO limit comparison mode]	(Setting item 1-2)
	0: ALL
	1: MD
	2: NZ
	3: MD+NZ
	4: Hold

■ Hysteresis

This function provides off timing range of HI/LO limit comparison. This function is effective for chattering prevention when signals fluctuate (vibrate) subtly.

[Hysteresis]	(Setting item 0-4)
	(Input range: 0000 to 9999)

<Comparison conditions>

- HI limit

ON condition: Indicated value > HI limit setting value

OFF condition: Indicated value \leq (HI limit setting value - Hysteresis setting value)

- LO limit

ON condition: Indicated value < LO limit setting value

OFF condition: Indicated value \geq (LO limit setting value + Hysteresis setting value)

- HH limit

ON condition: Indicated value > HH limit setting value

OFF condition: Indicated value \leq (HH limit setting value - Hysteresis setting value)


- LL limit

ON condition: Indicated value < LL limit setting value

OFF condition: Indicated value \geq (LL limit setting value + Hysteresis setting value)

■ Alarm HI limit, Alarm LO limit

A sensor input value is always compared with the alarm HI limit and alarm LO limit. If the value exceeds alarm HI limit or falls below alarm LO limit, an OVERLOAD error will occur and the OVERLOAD output turns ON.

[Alarm HI limit]	(Setting item 2-1)
[Alarm LO limit]	(Setting item 2-2)
	(Input range: -99999 to 99999)

However, in the case when hold mode is set to "3:Peak & bottom", hold value comparison will be:

Peak value > Alarm HI limit

Bottom value < Alarm LO limit

■ Near zero

This function detects that an indicated value is a value near zero.

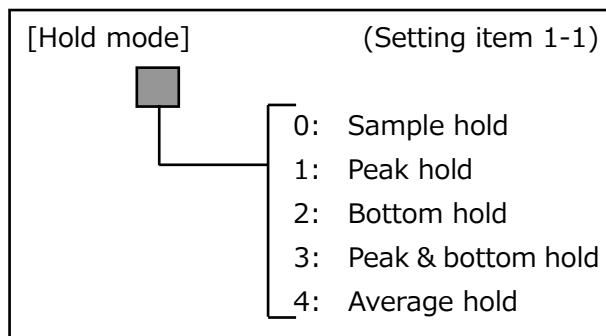
[Near zero]	(Setting item 0-3)
	(Input range: 00000 to 99999)

6 Settings and Operations Related to Hold

6-1. Setting of hold

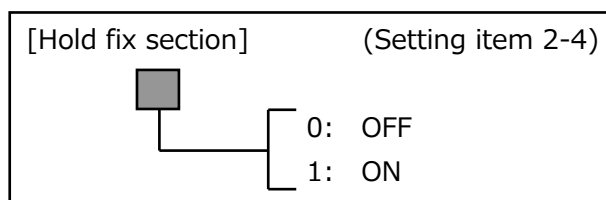
■ Hold mode

FC400 has a peak hold function that maintains and displays a peak value (maximum value) of input signals, a bottom hold function that maintains and displays a bottom value (minimum value) of input signals and a sample hold function that maintains and displays an arbitrary point. When hold fix section is set as 1: ON, detection section and fix section can be distinguished.



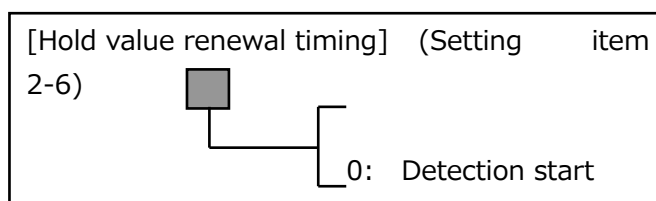
■ Hold fix section

Whether or not a fix section is inserted into hold motion can be selected.



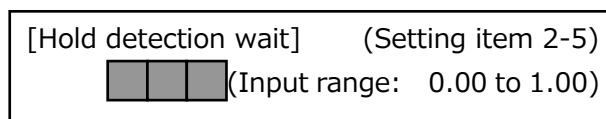
■ Hold value renewal timing

Renewal timing of hold value display can be changed. Normally, it is 0: detection start, but if only hold values are to be displayed or indicated values are to be held at high-speed measurement, 1: detection stop is set.



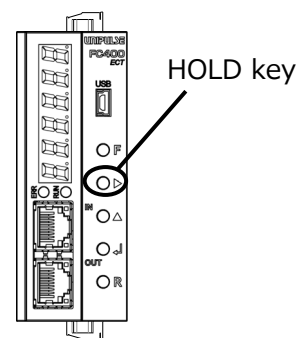
■ Hold detection wait

Detection wait of hold input is set. Changes of hold input will not be recognized within the time set as detection wait after capturing the changes.



■ Hold control (dedicated key)

This key is used for hold function operation. Operations change depending on setting values of hold fix section.



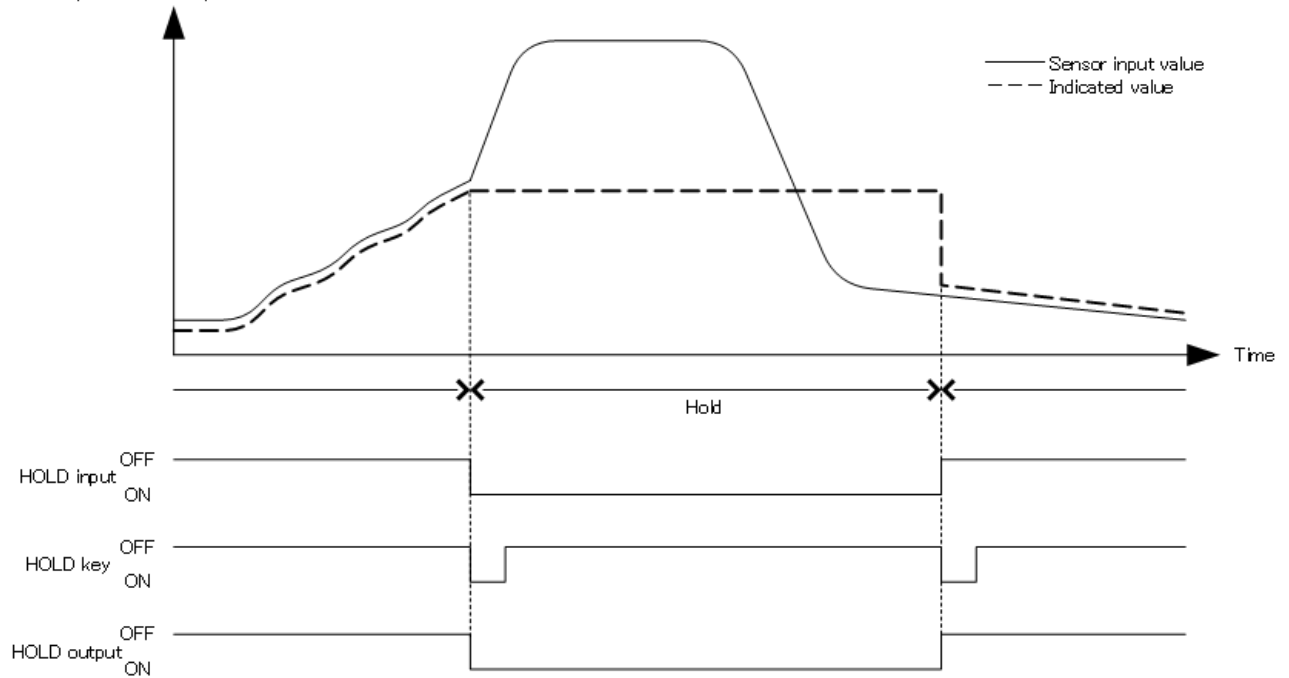
Key point

- When hold is turned ON with external signals, turn it OFF with external signals.
- When hold is turned ON with key inputs, turn it OFF with key inputs.

6-2. Sample hold (maintaining arbitrary points)

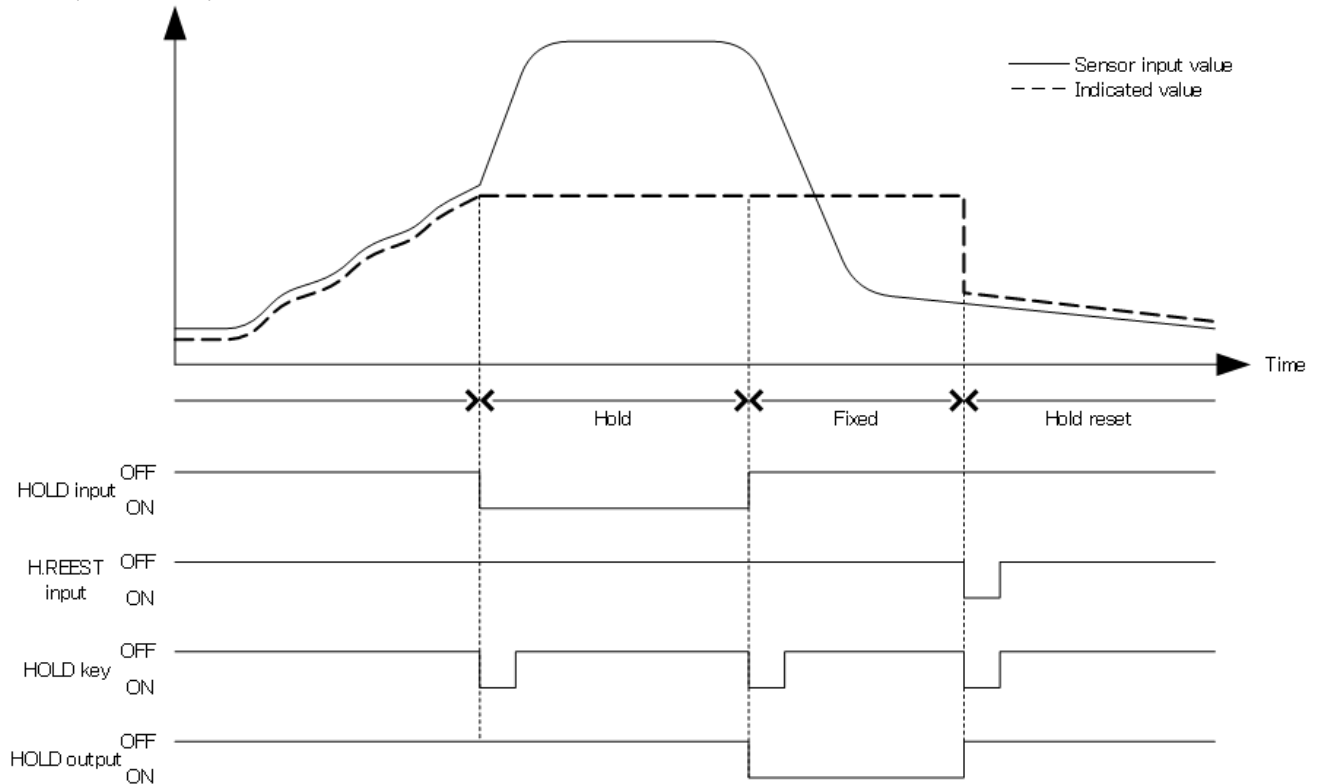
When hold fix section is 0: OFF

● Operation of sample hold



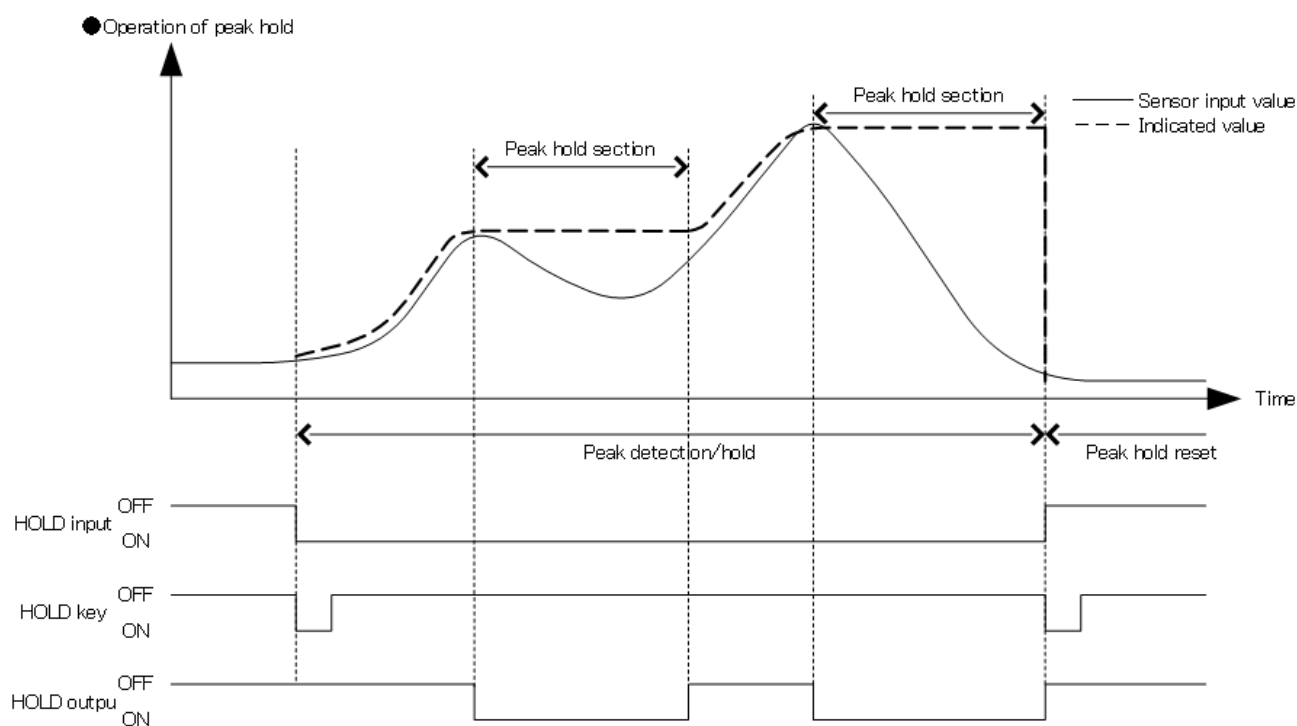
When hold fix section is 1: ON

● Operation of sample hold

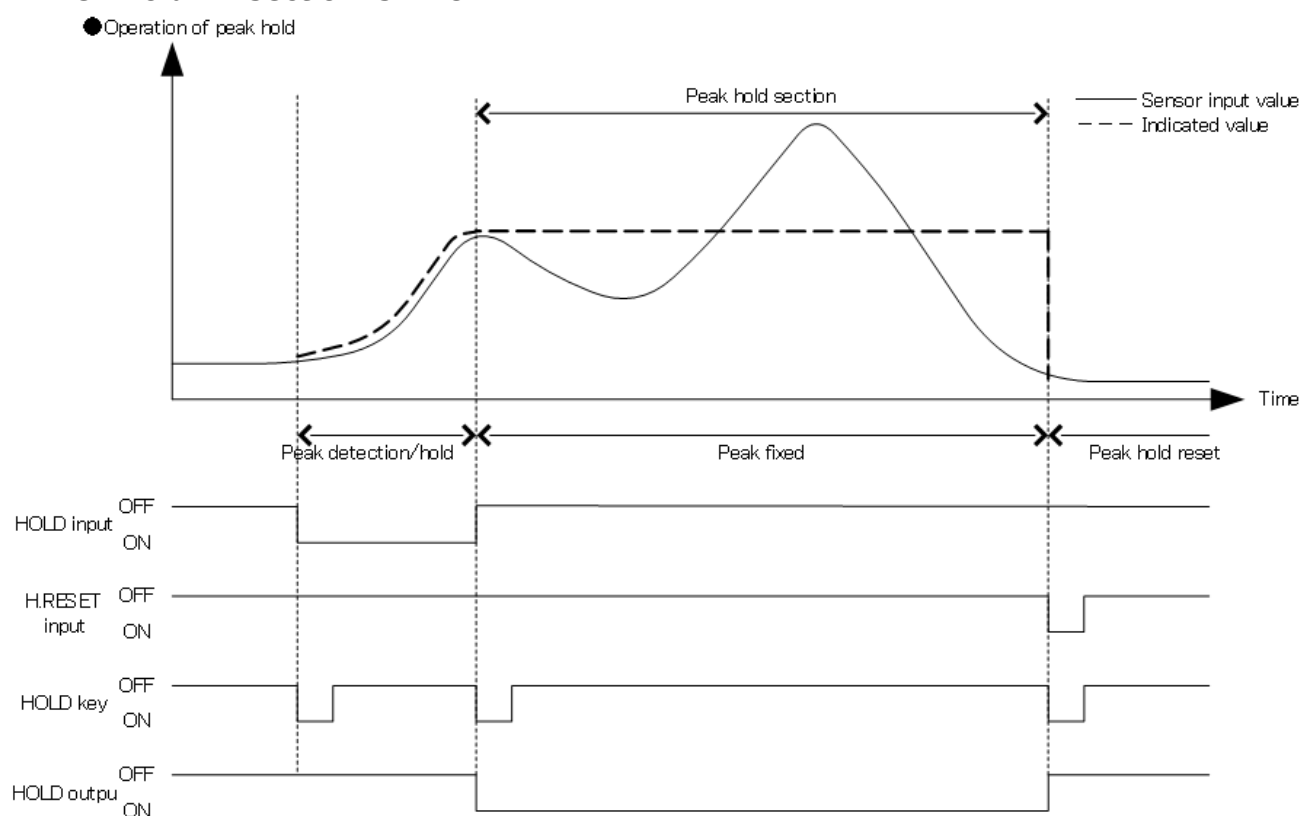


6-3. Peak hold (maintaining a maximum point)

When hold fix section is 0: OFF

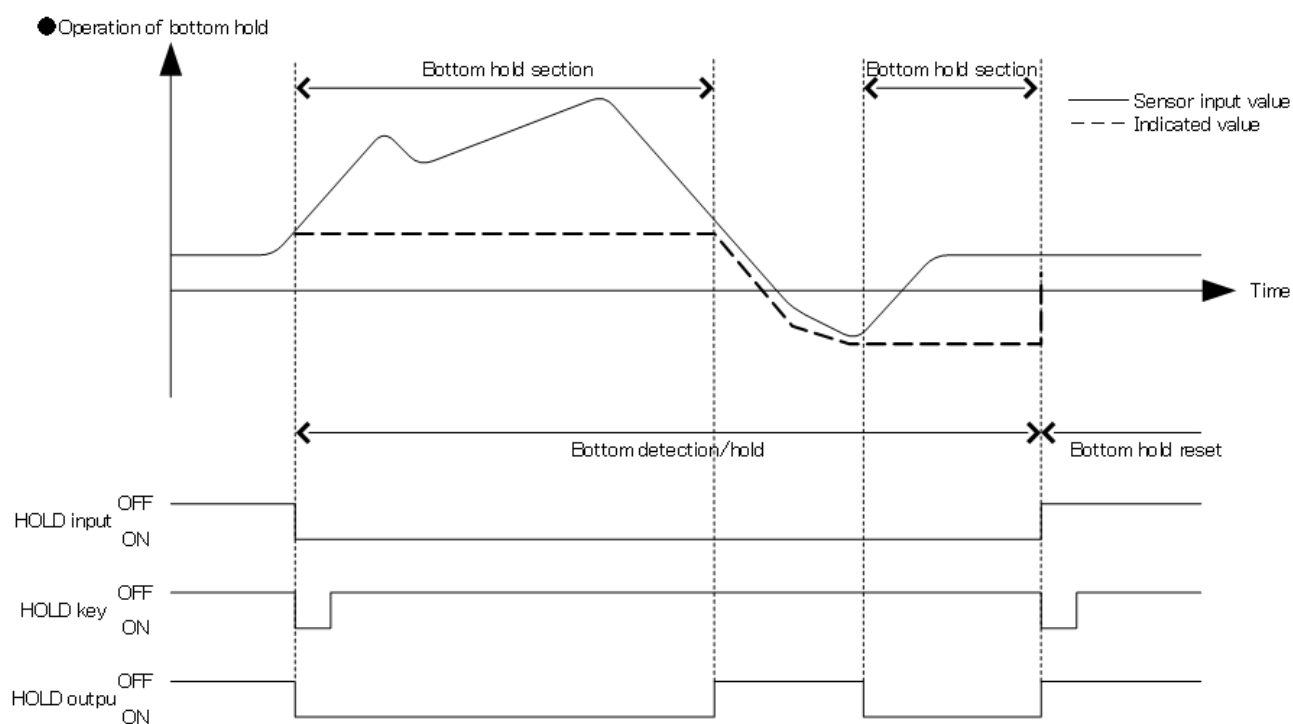


When hold fix section is 1: ON

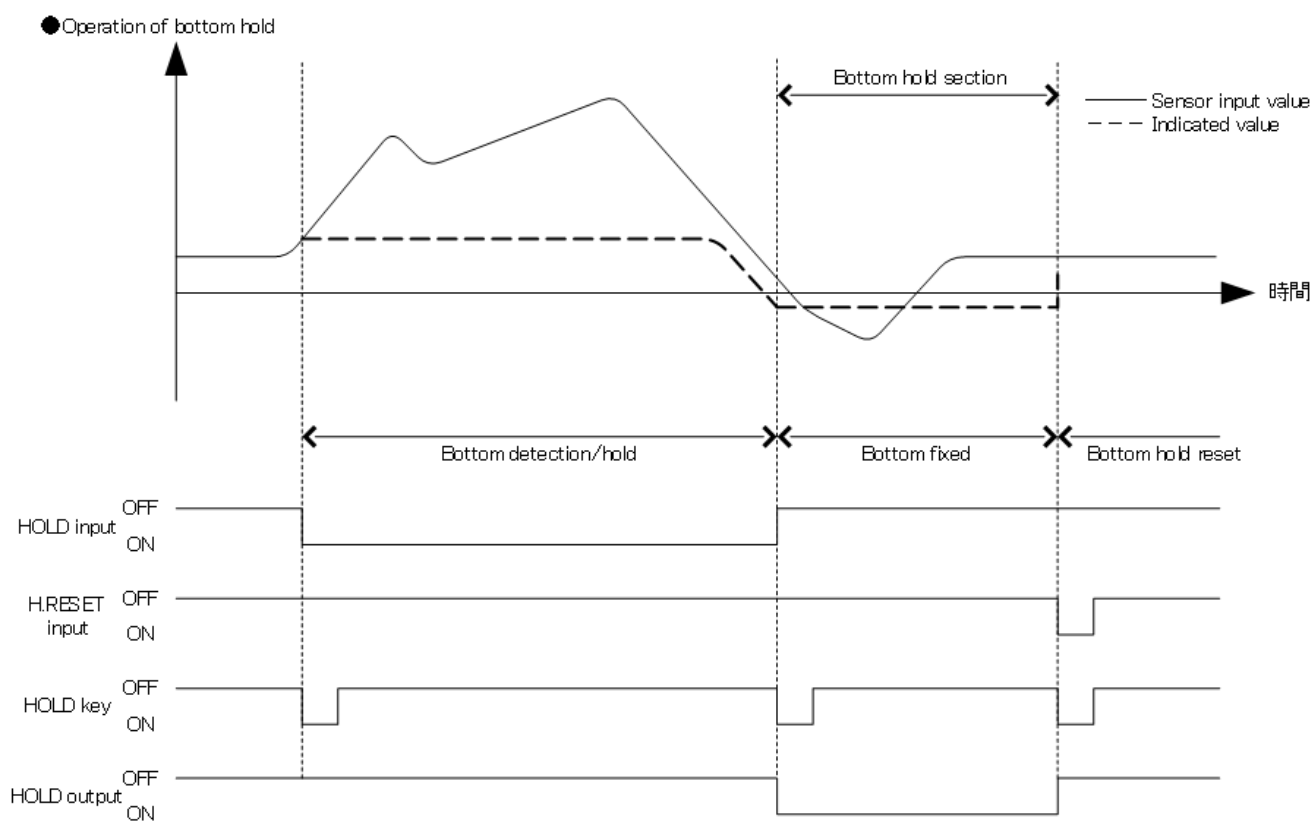


6-4. Bottom hold (maintaining a minimum point)

When hold fix section is 0: OFF

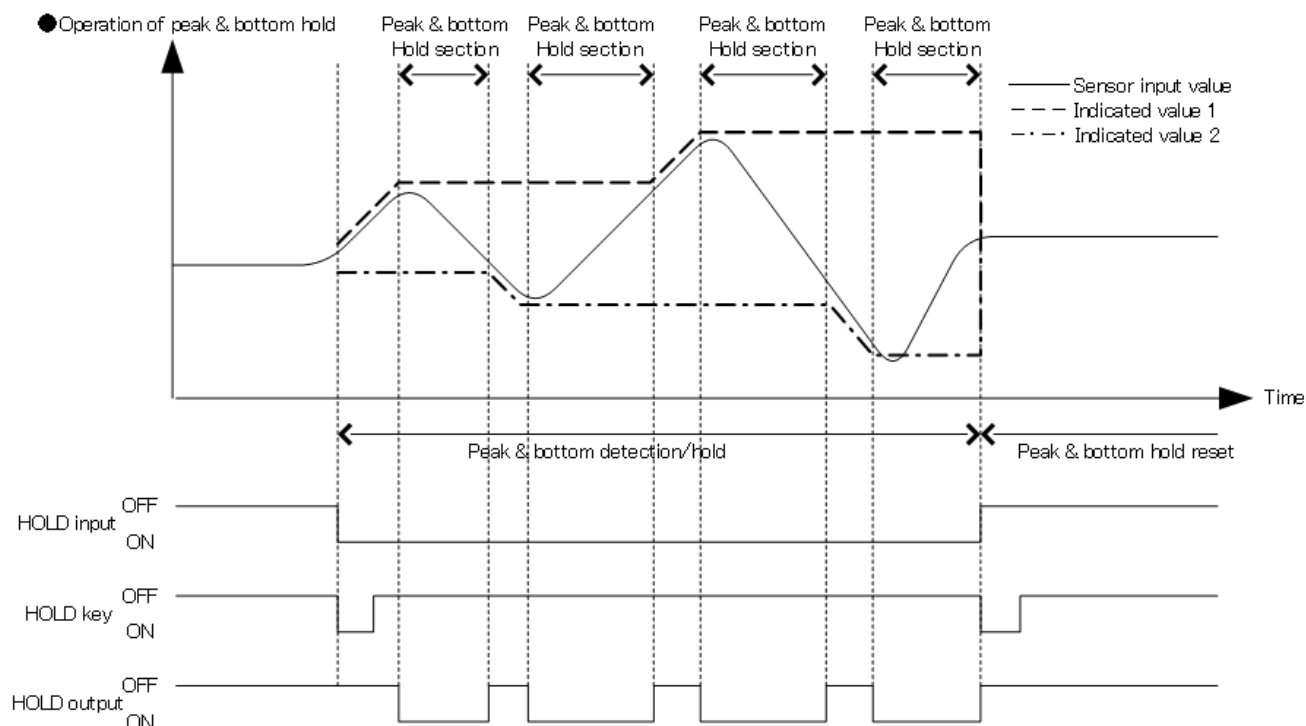


When hold fix section is 1: ON

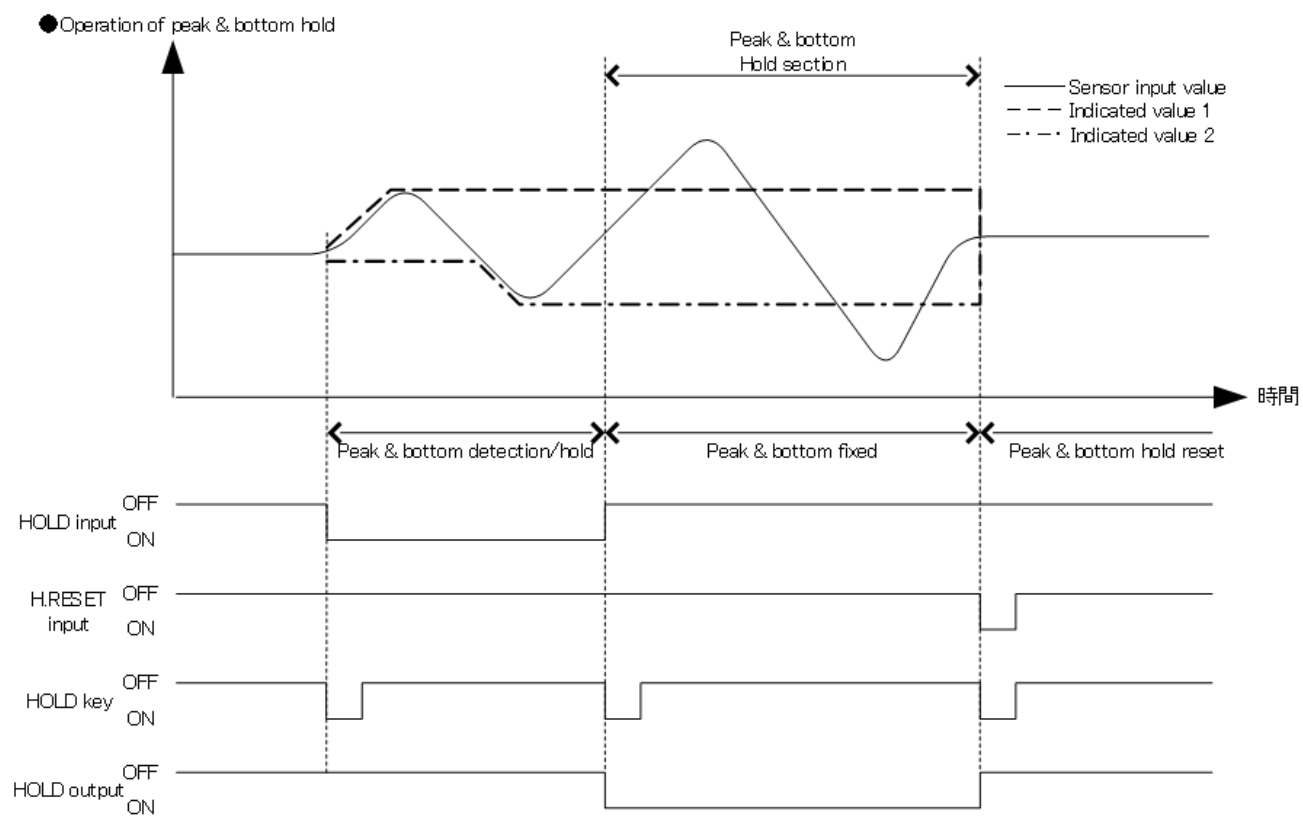


6-5. Peak & bottom hold (maintaining a maximum point and a minimum point)

When hold fix section is 0: OFF



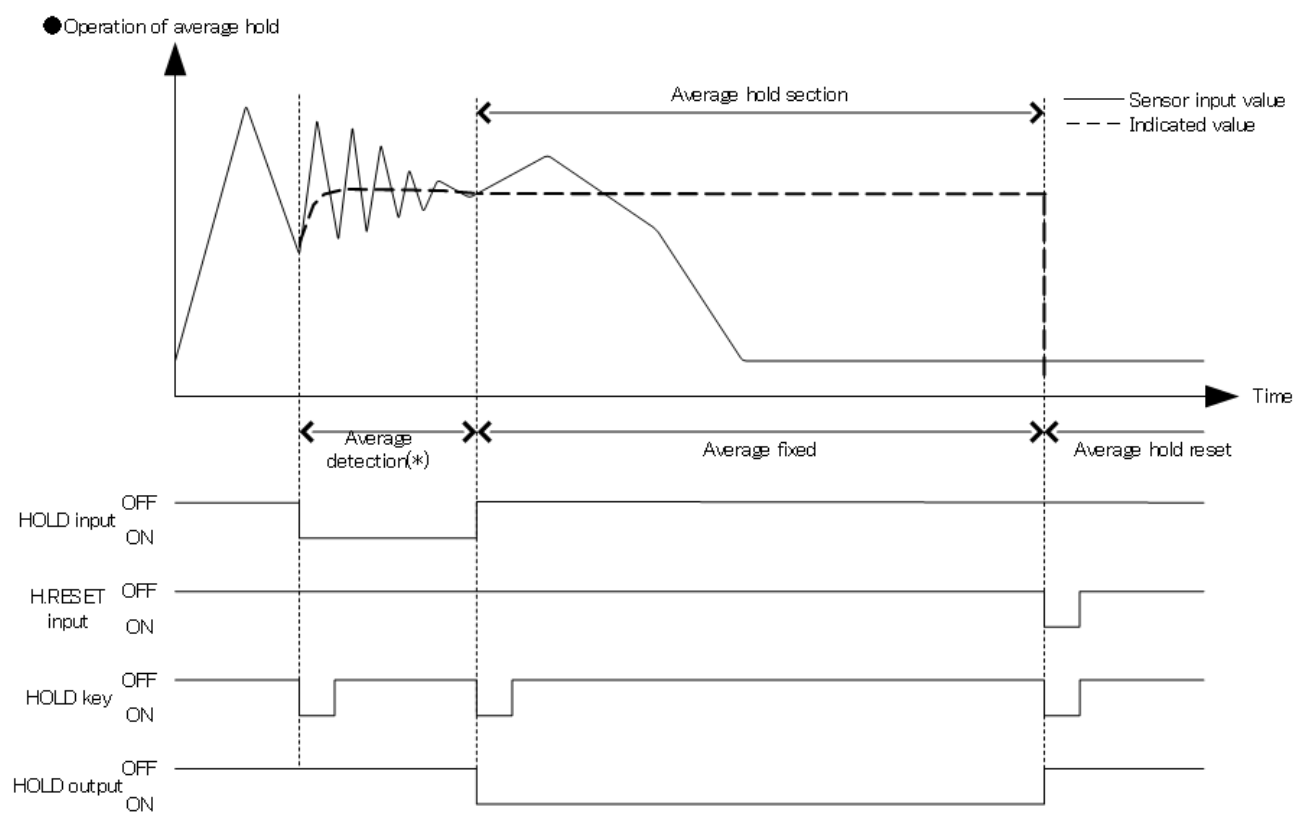
When hold fix section is 1: ON



6-6.Average hold (maintaining an average point)

Average hold only works if hold fix section is ON.

When hold fix section is 1: ON

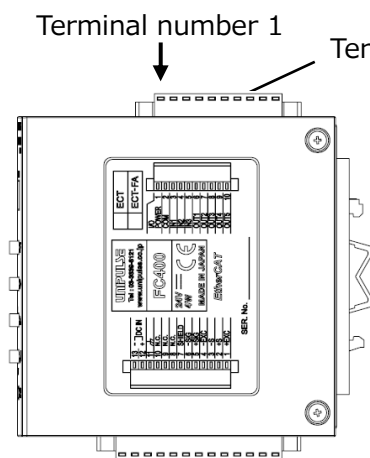


Key points

*Maximum detection section is 5 sec (fixed).
Detection more than 5 sec can not be made.

7 External I/O signals

7-1. Terminal block pin assignment



Use	Terminal number	Terminal name	Description
Power supply for I/O	1	I/O POWER	Connects with the DC24V power supply for I/O.
	2	COM	A common terminal for I/O signals.
Input terminal	3	IN1	Terminals for input signals. (Functions selected through settings.)
	4	IN2	
	5	IN3	
Output terminal	6	OUT1	Terminals for output signals. (Functions selected through settings.)
	7	OUT2	
	8	OUT3	
	9	OUT4	
	10	OUT5	

- An external DC24V (power supply for the external I/O signal circuit) must be prepared separately.
- I/O circuits and internal circuits are electrically insulated by a photo-coupler.

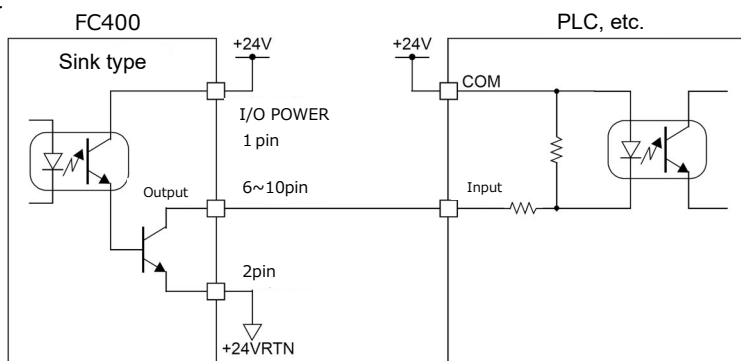
7-2. Connecting an external control device

Input terminals ... Switches, relays, transistors, photo-couplers etc. can be connected.

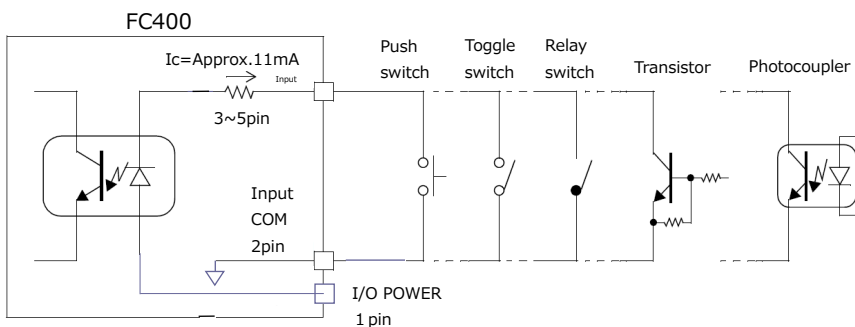
Connect a sink type unit for connecting transistors, photo-couplers etc.

Output terminals ... Open collector output for transistors.

- Output



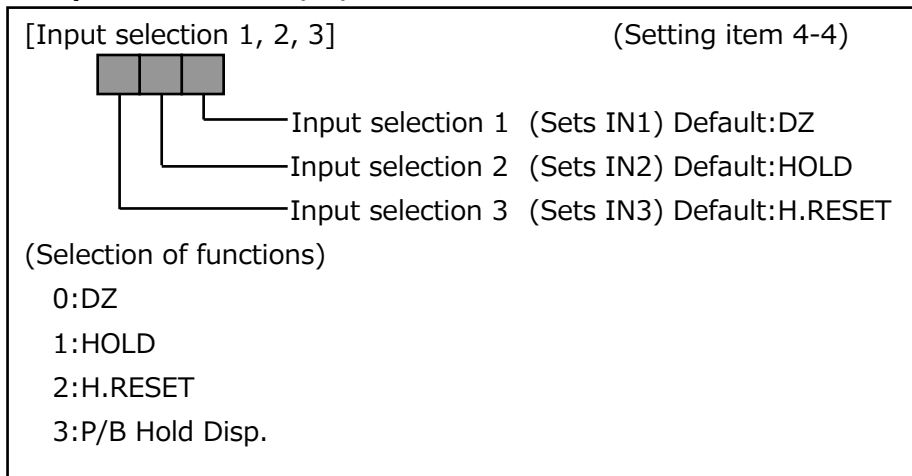
- Input



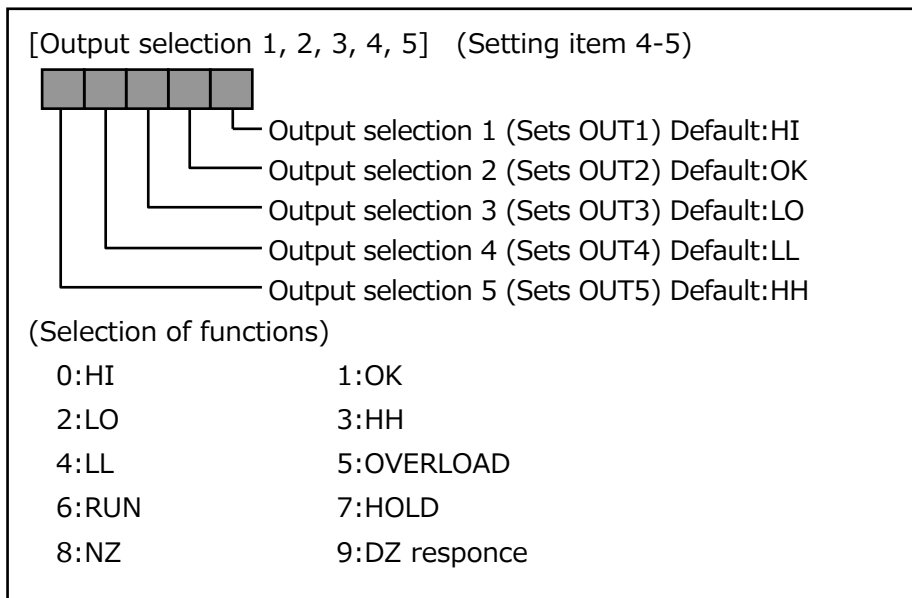
7-3. Selection of external I/O signal functions

Functions can be selected for each I/O terminal.

■ Input selection 1, 2, 3



■ Output selection 1, 2, 3, 4, 5



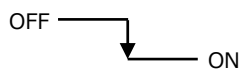
7-4. Description of external I/O signal functions

(Input signals)

Function	Input method	Description
DZ	Edge input	Digital zero is implemented at ON edge.
HOLD	Edge input	Hold control is performed. If hold fix section is set to 0:OFF, holding value is detected and fixed at the ON edge, and holding value is released at the OFF edge.
H.RESET	Edge input	Hold is released at ON edge. If hold fix section is set to 0:OFF, HOLD signals is also hold release at the same time.
P/B Hold Disp.	Edge input	If hold mode is set to 3: Peak & Bottom, the indication value display becomes bottom hold value at the ON edge, and becomes peak hold value at the OFF edge.

<Edge input>

- ON edge (OFF → ON)



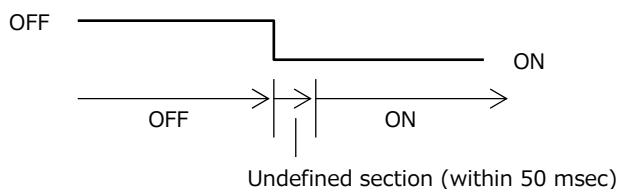
- OFF edge (ON → OFF)



* Pulse range of 50 msec or more

<Level input>

Switch processes when external input is ON and OFF.



(Output signals)

Function	Description
HI	This outputs HI signals.
OK	This outputs OK signals.
LO	This outputs LO signals.
HH	This outputs HH signals.
LL	This outputs LL signals.。
HOLD	Use this function to obtain synchronization of hold and decision.
NZ	Output turns ON when indicated value \leq near zero setting value.
OVERLOAD	This function outputs results of comparisons of Alarm HI limit and Alarm LO limit against indicated values.
DZ response	Use this function to check if digital zero is recognized.
RUN	The signal will switch between ON and OFF roughly once every 0.5 seconds.

8 EtherCAT interface

8-1. Introduction

Information needed for the setting of EtherCAT will be explained here. Basic knowledge about EtherCAT is necessary to read this manual. Please refer to specialized materials with regard to this.

FC400-ECT EtherCAT functions

The FC400-ECT EtherCAT I/F is equipped with the following functions.

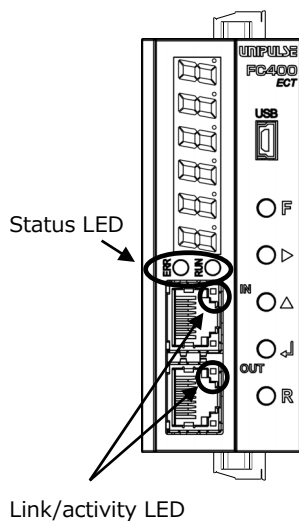
PDO communication Exchange data using Process Data Object

- Read load value
- Read status
- Input control signals (start, etc.)

SDO communication - Read/write setting values

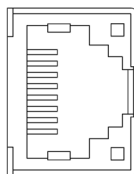
FC400-ECT is Free Run mode.

8-2. Names of components



	LED State	Indication
ERR	<ul style="list-style-type: none">- Off- Red blinking- Red single flash- Red double flash- Red	<ul style="list-style-type: none">No error (or Power OFF)Invalid configurationUnsolicited state changeSync Manager watchdog timeoutApplication controller failure
RUN	<ul style="list-style-type: none">- Off- Green- Green blinking- Green single flash- Red	<ul style="list-style-type: none">INIT (or Power OFF)OPERATIONALPRE-OPERATIONALSAFE-OPERATIONALFatal Event
Link/activity	<ul style="list-style-type: none">- Off- Green- Green flickering	<ul style="list-style-type: none">No link (or Power OFF)Link sensed, no activityLink sensed, activity

8-3.Connection



Compatible plug RJ-45

Name	Signal type
1	+TX
2	-TX
3	+RX
4	

Name	Signal type
5	
6	-RX
7	
8	

* For LAN cable, please use CAT5 or higher. and STP cable.

8-4.PDO communication

8-4-1.PDO communication format

■ Inputdata (FC400-ECT→Master): 16byte

ch	Details
n+0	Load value (32bit)
n+1	Hold value 1 (32bit) *2
n+2	Hold value 2 (32bit) *2
n+3	Status1 (32bit) *1

*1

B7	B6	B5	B4	B3	B2	B1	B0
	Load error	OFL2	OFL1	-LOAD	+LOAD	ZALM	Calibration processing state
B15	B14	B13	B12	B11	B10	B9	B8
				Calibration error No.			
				8	4	2	1
B23	B22	B21	B20	B19	B18	B17	B16
LOCK2	LOCK1	Alarm	LO	OK	HI	LL	HH
B31	B30	B29	B28	B27	B26	B25	B24
	Decimal place			ZT	NZ	RUN	HOLD
	4	2	1				

■ Output data (Master → FC400-ECT): 2byte

ch	B7	B6	B5	B4	B3	B2	B1	B0
m+0					P/B Disp.	H.RESET	HOLD	DZ
	B15	B14	B13	B12	B11	B10	B9	B8
					Span cal.	Zero cal.	Equi. span cal.	Equi. zero cal.

8-4-2.Input data

Load value

Indicates load value. (-99999~99999)

Hold value 1 (*2)

Indicates hold value. (-99999~99999)

Hold value 1 (*2)

Indicates hold value. (-99999~99999)

*2

Hold mode	Hold value1	Hold value 2
0:Sample hold	Sample value	0
1:Peak hold	Peak value	0
2:Bottom hold	Bottom value	0
3:Peak & bottom hold	Peak value	Bottom value
4:Average hold	Average value	

Calibration processing state

Turns ON during Equivalent calibration and Span calibration process.

ZALM, +LOAD, -LOAD, OFL1, OFL2

Turns ON during ZALM,+LOAD,-LOAD,OFL1 and OFL2.

Load error

Turns ON when a load error occurs. (ON when +LOAD, -LOAD, OFL1, OFL2 and ZALM.)

Calibration error No.

Displays calibration error codes.

HI

Turns ON when the indicator's HI limit signal is ON.

LO

Turns ON when the indicator's LO limit signal is ON.

HH

Turns ON when the indicator's HH limit signal is ON.

LL

Turns ON when the indicator's LL limit signal is ON.

OK

Turns ON when the indicator's OK limit signal is ON.

Alarm

Turns ON when the indicator's alarm limit signal is ON.

LOCK1, LOCK2

The respective output turns ON when setting value LOCK is ON.

HOLD

Turns ON when indicated value is being held.

RUN

The signal will switch between ON and OFF roughly once every 0.5 seconds.

NZ

Turns ON when the indicator's near zero signal is ON.

ZT

Turns ON during zero tracking.

*3

Decimal place

Indicates the decimal place. (*3)

Decimal place	Bit No.		
	4(B30)	2(B29)	1(B28)
None	0	0	0
0.0	0	0	1
0.00	0	1	0
0.000	0	1	1
0.0000	1	0	0

8-4-3.Output data

DZ

Indicated value is reset to zero at ON edge.

HOLD

Hold control is performed at ON and OFF edge.

H.RESET

Hold is released at ON edge.

P/B Disp.

If hold mode is set to 3: Peak & Bottom, the indication value display becomes bottom hold value at the ON edge, and becomes peak hold value at the OFF edge.

Equi. zero cal.

Equivalent input zero calibration is performed at the ON edge.

Equi. span cal.

Equivalent input span calibration is performed at the ON edge.

Zero cal.

Zero calibration is performed at the ON edge.

Span cal.

Span calibration is performed at the ON edge.

8-5. SDO communication

The following content can be read/written using SDO communication.

- * In order to perform SDO communication, you will need a combination of a scanner and a CPU unit which supports SDO communication.

- Setting values: Read/write

8-5-1. Object Index

Setting value		Index (Hex)	Input range
Mode 0	HI limit	2301	-99999~99999
	LO limit	2302	-99999~99999
	Near zero	2303	00000~99999
	Hysteresis	2304	0000~9999
	Digital offset	2305	-99999~99999
	HH limit	2306	-99999~99999
	LL limit	2307	-99999~99999
Mode 1	Hold mode	2311	0~4
	HI/LO limit comparison mode	2312	0~4
Mode 2	Alarm HI limit	2321	-99999~99999
	Alarm LO limit	2322	-99999~99999
	Sampling rate	2323	1
	Hold fix section	2324	0~1
	Hold detection wait	2325	000~100
	Hold value renewal timing	2326	0~1
Mode 3	Key invalid・LOCK	2331	0000~1113
	Motion detection (Period - Range)	2332	00000~99999
	Zero tracking(Period)	2333	00~99
	Zero tracking(Range)	2334	0000~9999
	Extended function selection 1	2335	00~11
Mode 4	Digital low pass filter	2341	0001~6000
	Moving average filter	2342	001~999
	Auto adjustment filter	2343	0~1
	Input selection	2344	000~333
	Output selection	2345	00000~99999
Mode 5	Rated capacity	2351	00001~99999
	Minimum scale division	2352	01~50
	DZ limitation value	2353	00000~99999
	Display selection	2354	0000~1404
	Excitation voltage selection	2355	0~1
Mode 9	Equivalent input zero calibration	2393	-30000~30000
	Equivalent input span calibration	2394	00100~38000
	Input conversion value display	2395	Read only
Command	Zero calibration	23C0	Read only 0 : Process normally 1 : Calibrating 2 : LOCK 3 : Calibration error
	Equivalent input zero calibration	23C1	
	Span calibration	23C2	
	Equivalent input span calibration	23C3	

8-6. Device ID

8-7. ESI File

I / O information, device parameters, device specific information, etc. are described in the configuration file. Please download from the unipulse website.

9 USB interface

The USB interface is used to read the indicated values of the FC400 and to write setting values into the FC400. Reading/writing setting values, recording, and graph display are possible using a dedicated PC application for the FC400.

9-1. USB interface

Communication specifications

Communication standard USB Ver.2.0 compliant, full speed (12Mbps)

Connector mini-B TYPE

9-2. PC preparation

For a PC that is being used for the first time, the USB driver and the dedicated PC application must be installed.

PC operating environment

OS	Windows 7/10 Home Premium/Professional/Ultimate 32/64bit Japanese edition, English edition, Chinese (Simplified) edition
Display	800 × 640 pixel or above
USB port	One free port (USB 2.0 or above)
USB driver	Virtual COM Port (VCP) Drivers (manufactured by FTDI Limited)
Memory	2GB or above
Hard disk	15GB free space or more

USB driver installation

A driver will be installed automatically when a USB is connected in a network environment.

Connect the PC to the network.

Automatic download/installation will start when the device is connected to the PC with the optional USB cable.

If automatic installation fails or the dedicated application does not start up, delete the drive and reconnect.

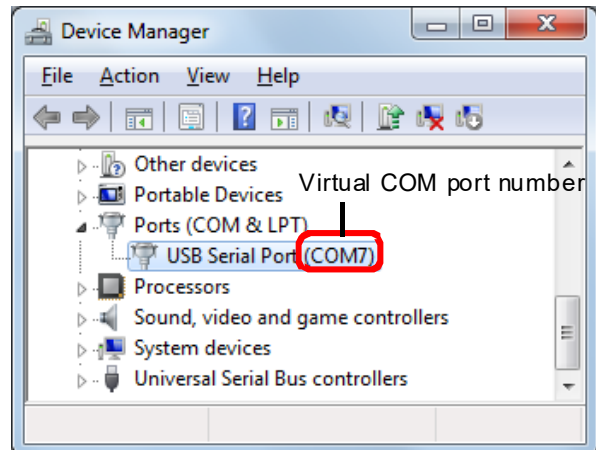
See the FTDI website if automatic installation does not work.

Guide (English) <http://www.ftdichip.com/Support/Documents/InstallGuides.htm>

Driver (English) <http://www.ftdichip.com/Drivers/VCP.htm>

Virtual COM port check

Check the virtual COM port number to which the device is connected from the PC device manager or when installing the driver.



Key point

If the COM port number of the FC400 cannot be identified due to multiple USB serial ports and so on, unplug the USB cable and confirm that one COM port is removed from the list of ports (COM and LPT). When the USB cable is reconnected to the previous connector, the number of COM ports displayed in the list will increase. This number represents the COM port number of the FC400.

Installation of the dedicated PC application

The dedicated application is used for setting the device, and is useful for managing and analyzing data.

Download and install the application from the UNIPULSE website. To download the application, user registration (free) is required.

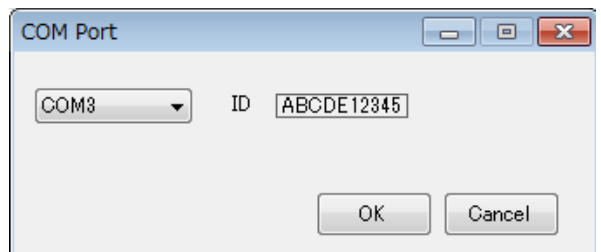
PC application startup

Double-click the FC400 shortcut on the desktop or click "UNIPULSE" → "FC400" → FC400 from the start menu.

Specifying the COM port

The COM port selection screen will appear when the PC application is activated for the first time after installation.

Once the COM port is selected and the "OK" button is clicked, it connects to the FC400 and the screen will appear.



10 Other functions

■ Operation when a zero error occurs

Select the display operation for when digital zero is performed in a state where the DZ regulation value has been exceeded.

[Operation when a zero error occurs]

(Setting item 3-5)



- 0: Execution (Indicated value - DZ regulation value)
- 1: Non-execution

■ Digital zero condition

Set the operating condition for digital zero.

[Digital zero condition] (Setting item 3-5)



- 0: Accept regularly
- 1: Only at stable time

■ Key invalid

Makes key operations for digital zero, hold subtraction and peak/bottom value switch invalid/valid.

[Key invalid] (Setting item 3-1)



- P/B switching key
 - ZERO key
 - HOLD key
- 0: Invalid
 - 1: Valid

■ Input conversion value display

Displays output values from the connected strain gauge type sensor in real time.

* Used when replacing indicators for repair and so on, or for confirming initial load etc.

[Input conversion value display]



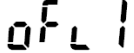
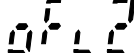
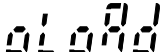
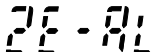
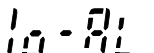
(Setting item 9-5)



(Display range: -3.9000 to 3.9000)

11 Troubleshooting

11-1. Over scale display

Display	Error name	Error content/countermeasures
	A/D converter input over	Signals that exceed the FC400 signal input range are input. Confirm that the sensor output does not exceed the span calibration range and that the cable connecting the FC400 to the sensor is not disconnected. This may also appear if nothing is connected to the load input on the terminal block.
	A/D converter minus over	Signals lower than the signal input range of the FC400 are input. Confirm that the sensor output is not below the span calibration range and that the cable connecting the FC400 to the sensor is not disconnected. This may also appear if nothing is connected to the load input on the terminal block.
	Display over	The indicated value is exceeding -99999. In order to return to normal display from this over scale display, increase the input signal of sensor until the over scale display disappears.
	Display over	The indicated value is exceeding 99999. In order to return to normal display from this over scale display, decrease the input signal of sensor until the over scale display disappears.
	OVERLOAD error	Sensor input is exceeding alarm HI limit or dropping below alarm LO limit. In order to return to normal display from this over scale display, change input signal of sensor closer to 0 until the over scale display disappears, or edit the settings of alarm HI limit or alarm LO limit.
	Digital zero over	Digital zero is executed with an indicated value exceeding the DZ regulation value. Change the DZ regulation value, and restart the digital zero operation.
	External output error	External output is overloaded.(Over current) Please check if the wires are properly connected.

11-2. Calibration error display

Display	Error name	Error content/countermeasures
c Err2	Calibration error 2	Zero calibration or span calibration cannot be performed because the electronic signal input on the positive side exceeds the input voltage range. Check for cable disconnection and mis-wiring.
c Err3	Calibration error 3	Zero calibration or span calibration cannot be performed because the electronic signal input on the negative side exceeds the input voltage range. Check for cable disconnection and mis-wiring.
c Err6	Calibration error 6	Load cell output value has not reached the span adjustment range of the FC400. Confirm that the load is applied to the load cell correctly and that the load cell output is capable of reaching the span adjustment range, and then re-perform span calibration.
c Err7	Calibration error 7	The load cell output is on the minus (negative) side. Confirm that load is applied to the load cell in the correct direction and that the wiring for load cell +SIG and -SIG are not reversed, and then re-perform span calibration.
c Err8	Calibration error 8	Load cell output exceeds the span adjustment range of the FC400. Confirm that the load is applied to the load cell correctly and that the rated output value of the load cell is within the span adjustment range, and then re-perform span calibration.

12 List of setting values

Setting mode 0

Setting item	Name	Initial value	Setting range	LOCK		Page
				1	2	
1	HI limit	000.00	-99999 to 99999	⊙		P13
2	LO limit	000.00	-99999 to 99999	⊙		P13
3	Near zero	000.00	00000 to 99999	⊙		P14
4	Hysteresis	00.00	0000 to 9999	⊙		P14
5	Digital offset	000.00	-99999 to 99999	⊙		P12
6	HH limit	999.99	-99999 to 99999	⊙		P13
7	LL limit	-999.99	-99999 to 99999	⊙		P13

Setting mode 1

Setting item	Name	Initial value	Setting range	LOCK		Page
				1	2	
1	Hold mode	0	0 : Sample hold 1 : Peak hold 2 : Bottom hold 3 : Peak & bottom hold 4 : Average hold		⊙	P15
2	HI/LO limit comparison mode	0	0 : ALL 1 : MD 2 : NZ 3 : MD+NZ 4 : Hold		⊙	P13

Setting mode 2

Setting item	Name	Initial value	Setting range	LOCK		Page
				1	2	
1	Alarm HI limit	999.99	-99999 to 99999	⊙		P14
2	Alarm LO limit	-999.99	-99999 to 99999	⊙		P14
3	Sampling rate	1	1 : 2400 times/sec		⊙	P10
4	Hold fix section	0	0 : OFF 1 : ON		⊙	P15
5	Hold detection wait	0.00	0.00~1.00 sec		⊙	P15
6	Hold value renewal timing	0	0 : Detection start 1 : Detection stop		⊙	P15

Setting mode 3

Setting item	Name	Initial value	Setting range	LOCK		Page
				1	2	
1	Key invalid/LOCK	1 1 1 0				P8
	Setting value LOCK		0: Lock1 OFF, Lock2 OFF 1: Lock1 ON, Lock2 OFF 2: Lock1 OFF, Lock2 ON 3: Lock1 ON, Lock2 ON			
	PEAK/BOTTOM key		0: Invalid 1: Valid			P32
	ZERO key		0: Invalid 1: Valid			
	HOLD key		0: Invalid 1: Valid			
2	Motion detection (period - range)	1.5-05	0.0 to 9.9 – 00 to 99		⊙	P11
3	Zero tracking (period)	0.0	0.0 to 9.9		⊙	P11
4	Zero tracking (range)	0000	0000 to 9999		⊙	P11
5	Extended function selection	0 0				P32
	Operation when a zero error occurs		0: Execution (indicated value - dz regulation value) 1: Non-execution			
	Digital zero condition		0: Accept regular 1: Only at stable time			P32

Setting mode 4

Setting item	Name	Initial value	Setting range	LOCK		Page
				1	2	
1	Digital low-pass filter	100.0	0.1 to 600.0		⊙	P10
2	Moving average filter	030	1 to 999		⊙	P10
3	Auto adjustment filter	0			⊙	P10
4	Input selection	2 1 0				P22
	Input selection 1 Input selection 2 Input selection 3		0: DZ 1: HOLD 2: H.RESET 3: P/B Hold Disp.			
5	Output selection	3 4 2 1 0				P22
	Output selection 1 Output selection 2 Output selection 3 Output selection 4 Output selection 5		0: HI 1: OK 2: LO 3: HH 4: LL 5: OVERLOAD 6: RUN 7: HOLD 8: NZ 9: DZ response			

Setting mode 5

Setting item	Name	Initial value	Setting range	LOCK		Page
				1	2	
1	Rated capacity	100.00	00001 to 99999	⊙	⊙	P8
2	Min. scale division	0.01	01 to 50	⊙	⊙	P8
3	DZ regulation value	999.99	00000 to 99999		⊙	P11
4	Display selection	0204		⊙	⊙	
	Display update rate		0: Once/sec 1: 3 times/sec 2: 6 times/sec 3: 13 times/sec 4: 25 times/sec			P10
	Undefined		0: Fixed			P16
	Decimal place		0: None 1: 0.0 2: 0.00 3: 0.000 4: 0.0000			P8
	6 digit display		0: 5 digit display 1: 6 digit display			P12
5	Excitation voltage selection	1	0: 5V 1: 2.5V	⊙	⊙	P8

Setting mode 7

Setting item	Name	Initial value	Setting range	LOCK		Page
				1	2	
1	Device ID	0	0~65535			P29

Setting mode 9

Setting item	Name	Initial value	Setting range	LOCK		Page
				1	2	
1	Zero calibration	0		⊙	⊙	P8
2	Span calibration	100.00	00001 to 99999	⊙	⊙	P9
3	Equivalent input zero calibration	0.0000	-3.0000 to 3.0000	⊙	⊙	P9
4	Equivalent input span calibration	3.0000	0.0100 to 3.8000	⊙	⊙	P9
5	Input conversion value display	---	-3.9000 to 3.9000			P32
7	Version display	***				
8	Checksum display	****				
9	Password	0000				

13 Specifications

13-1. Analog section

Load cell power supply	DC5V or 2.5V±5% Output current: 90 mA, ratiometric type (Up to six 350Ω series load cells can be connected in parallel)
Zero adjustment range	Automatically adjusted by digital computation -3.0 to 3.0 mV/V
Span adjustment range	Automatically adjusted by digital computation 0.01 to 3.8 mV/V
Minimum input sensitivity	0.15μV/count
Accuracy	Non-linearity 0.01%FS or less Zero drift 0.0002%FS/°C typ. Gain drift 1 ppm/°C typ.
Filter	Low-pass filter 0.1 to 600.0 Hz Moving average filter 1 to 999 times
A/D converter	Conversion rate 2400 times Conversion resolution 24bit (binary)
Minimum indicated resolution	1/10000

13-2. Display section

Display unit	Numbers are displayed by a 7-segment green LED with a character height of 8 mm (5 digit)
Display value	Max. 6 digits
Min. scale division	Can be set from 1 to 50
Decimal place	Selectable from 0, 0.0, 0.00, 0.000, and 0.0000 (zero blanking display based on decimal place)
Over scale display	A/D converter input over LOAD A/D converter input minus over -LOAD Display over OFL1 Display over OFL2 OVERLOAD OLOAD

13-3. Settings section

Setting procedure	Settings made using four tact switches Settings can also be made using an interface (EtherCAT, USB)
Saving of setting values	Initial setting values saved in NOVRAM (non-volatile memory) Other settings saved in F-RAM (non-volatile memory)
Setting value protection	Protection possible through locking software

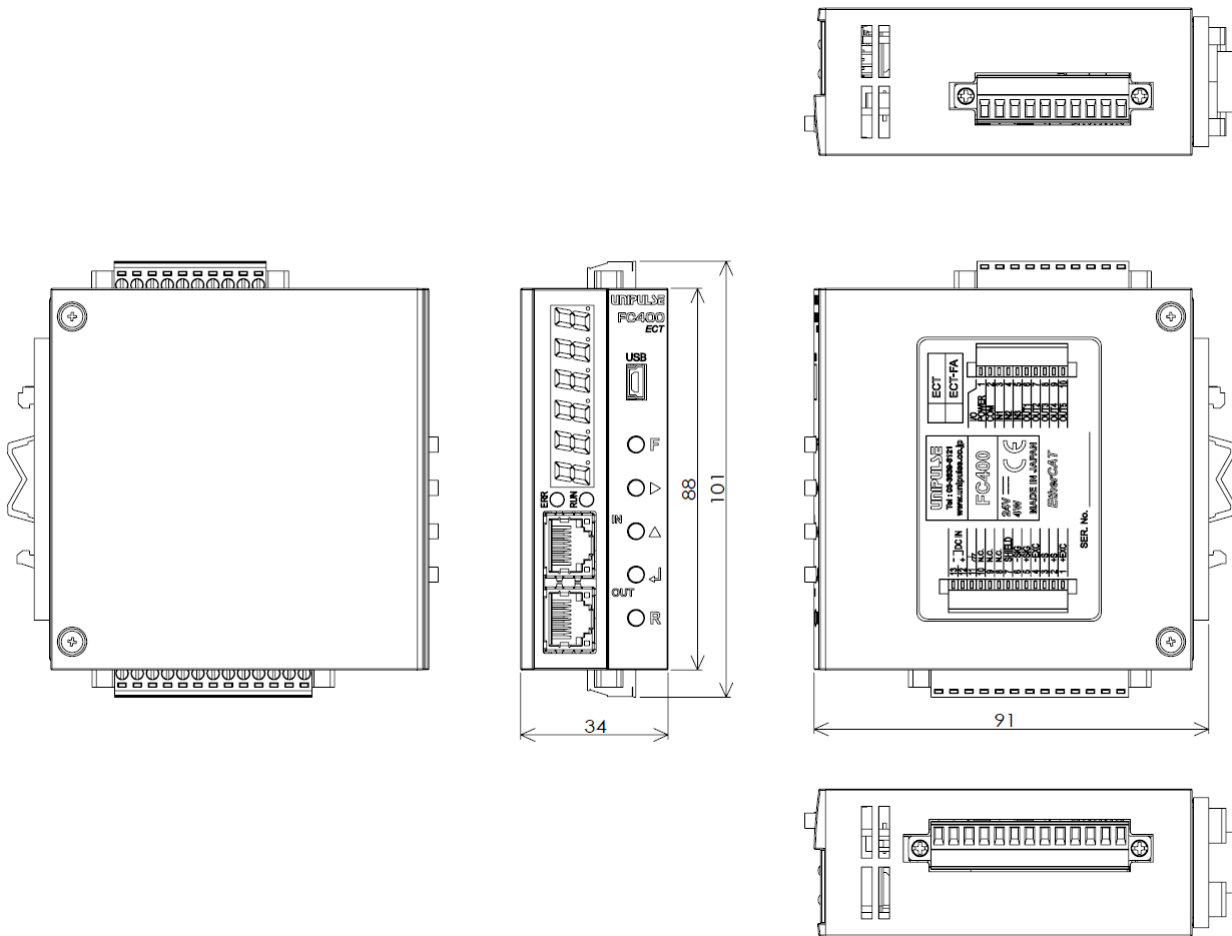
13-4. External signal input/output

Compatible plug	CN87 (10 pin), CN85 (13 pin)
Input signal (3 points)	Each control input can be selected through settings Contact (relays, switches etc.) or non-contact (transistors, photo-couplers etc.) Considered ON when short-circuited with COM terminal * Prepare a DC24V external power supply
Output signal (5 points)	Each control output can be selected through settings Open collector output for transistors ($V_{ceo} = 30\text{ V}$, $I_c = 50\text{ mA}$)

13-5. General performance

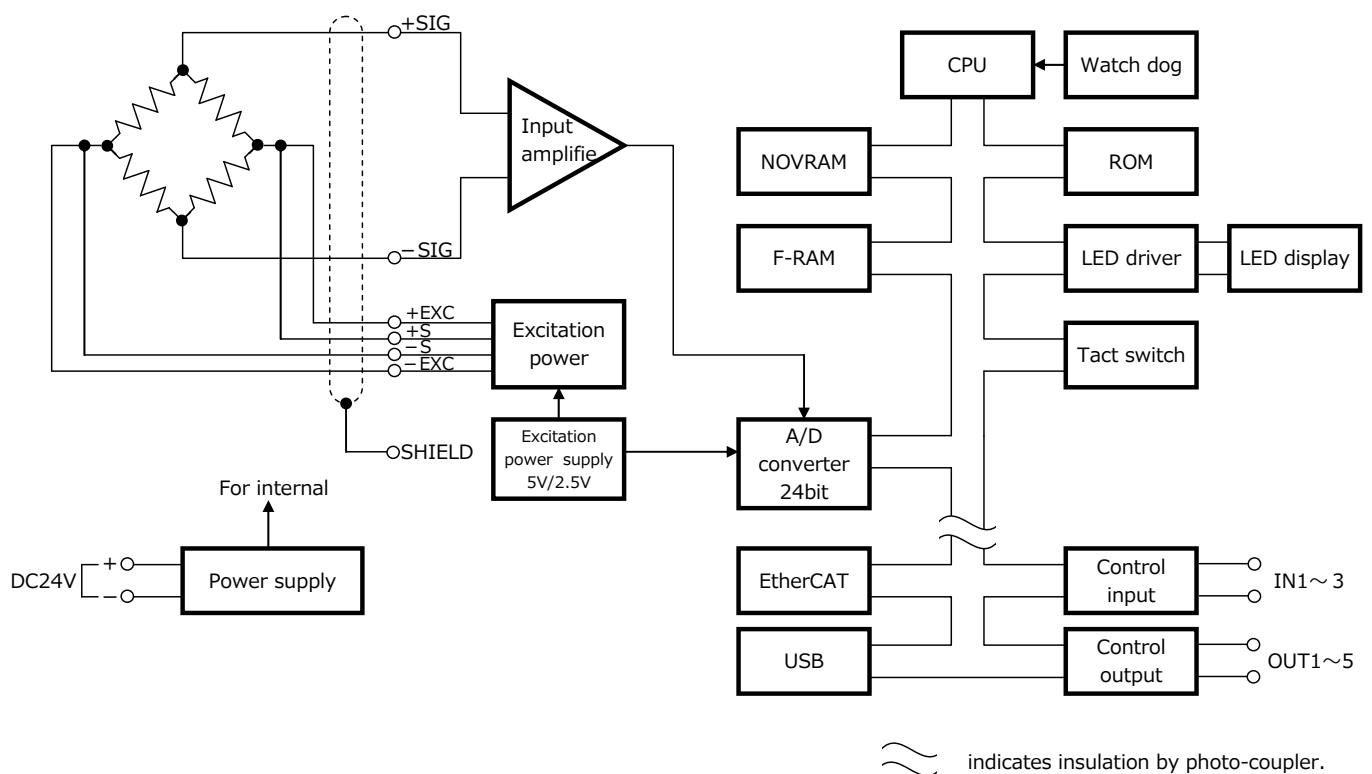
Power supply voltage	DC24V ($\pm 15\%$)
Power consumption	4W
Operating conditions	Temperatures temperature range -10 to $50\text{ }^{\circ}\text{C}$ Storage temperature range -20 to $85\text{ }^{\circ}\text{C}$ Humidity 85%RH or below (no condensation)
External dimensions	34 (W) \times 88 (H) \times 91 (D) (* not including protruding sections)
Weight	Approx. 230 g

13-6. External dimensions



Unit : mm

13-7. Block diagram



13-8. Compliance with EC directives

***The FC400 is CE-compliant. With using it, observe the following:**

The FC400 weighing indicator is compliant with EC Directives(based on Council of the European Union) and CE-marked.

-EMC Directive EN61326-1:2013
EN55011:2009,A1:2010 Group1, ClassA
EN61000-4-2:2009
EN61000-4-3:2006, A1:2008, A2:2010
EN61000-4-4:2012
EN61000-4-5:2006
EN61000-4-6:2009
EN61000-4-8:2010

The following precautions should be taken for installation.

- 1.Since FC400 is defined as an open type(built-in device), it should be used to install and fix to a panel,etc.
- 2.Use shielded cable for connections other than power supply (load cell, external input/output).
- 3.Use the designated EtherNet cable.
- 4.Be sure to ground the frame ground terminal(FG).

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