

# Instruction Manual

## CA13 HANDY CAL Frequency Calibrator Model 710 30

Thank you for purchasing the CA13 HANDY CAL.

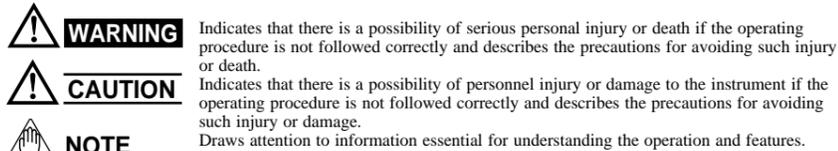
To fully utilize all of the features of this instrument, read this Instruction Manual carefully and use the instrument accordingly.

**YOKOGAWA**  
Yokogawa M&C Corporation

IM CA13-E  
1st Edition

### 1. Safety Use

- The following symbols are used on the instrument and in the Instruction Manual to ensure safe use.



- Damage to the instrument or personal injury or even death may result from electrical shock or other factors. To avoid this, follow the precautions below.

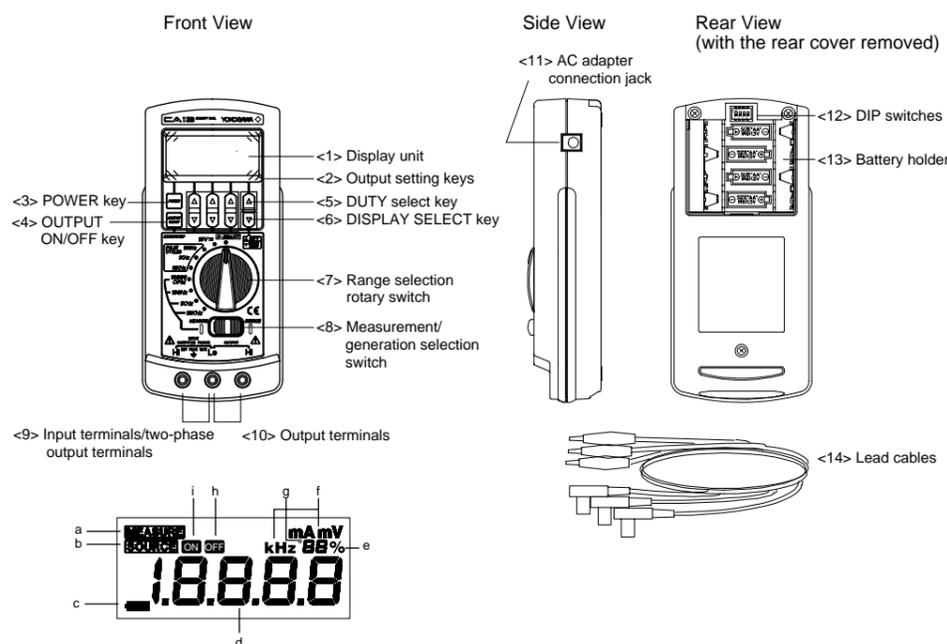
**WARNING**

- Use in gases**  
Do not operate this instrument in areas where inflammable or explosive gases or vapor exists. It is extremely hazardous to use the instrument under such environments.
- External connection**  
If you need to touch a circuit for external connection, cut off the power from that circuit and make sure that no voltage is being supplied. Then carry out the connection. When replacing the batteries, always disconnect lead cables.

**CAUTION**

- Disassembly**  
No person other than our service personnel should open the cover.

### 2. Names and Functions of Parts



- <1> Display unit**
- a MEASURE  
Lights when MEASURE (measurement) is selected using the selection switch <8>.
  - b SOURCE  
Lights when SOURCE (generation) is selected using the selection switch <8>.
  - c   
This mark informs the battery's status. When lit, it indicates that the batteries will soon need replacing and when blinking, it indicates that they must be replaced (see Section 3, "Replacing the Batteries").
  - d Displays a measured value or an output value.
  - e Displays the duty ratio (%) of a generated pulse when the frequency or the PULSE CYCLE range is selected during generation. When the two-phase output is set (see Section 7, Other Features), the "2P" indication blinks. Moreover, when the contact input is set during measurement (see Section 7, Other Features), the "Cn" indication lights up.
  - f Shows the unit of the range selected.
  - g Blinks when the calibrator detects an input pulse during measurement.
  - h OFF  
Lights when output is turned off in signal generation or the protective circuit is activated. The instrument automatically turns off when it finishes outputting the preset number of pulses in the PULSE CYCLE range. This indicator also comes on when the 10000 CPM range is selected in the measurement mode.
  - i ON  
Lights when output is turned on in signal generation. During measurement, this indication lights up for 1 minute from when counting of the 10000 CPM range starts.
- <2> Output setting keys**  
Set the output values for signal generation. The ▲ key and ▼ key are provided for each digit to increase or decrease their values one by one. One exception to this is the setting of the 4-20 mA range, where the two leftmost digit keys increment and decrement the value in 4 mA steps and the rightmost digit key increments and decrements the value by 0.1 mA. A carry-over function is applied when an attempt to decrement "0" and increment "9" is made.
- <3> POWER key**  
Turns on/off the power supply. For more information, see Section 4, "Turning the Power On/Off."
- <4> OUTPUT ON/OFF key**  
Turns on/off an output signal in signal generation. Also functions as "START/STOP" key at PULSE CYCLE generation and 10000 CPM range measurement.
- <5> DUTY select key**  
Each press of this key scrolls through the possible settings for the duty ratio of an output pulse, e.g., from 50%, 60%, ..., 90%, 10%, 20% ...and so on.
- <6> DISPLAY SELECT key**  
In the frequency generation range, whenever you press this key, the indications switch between the frequency and voltage amplitude settings. The value of the selected indication can be set using the output setting keys. In the PULSE CYCLE generation range, the pulse count, frequency, and voltage amplitude indications are switched and displayed in sequence. The value of a selected indication can be set using the output setting keys.
- <7> Range selection rotary switch**  
Selects the range of generation or measurement. Note that for measurement, the only valid range settings are the 10 kHz, 1 kHz, 100 Hz, and 10000 CPM range. The PULSE CYCLE range, 10-V range, and 4-20 mA range are not available (appearing as an "nC" indication) in measurement.

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#### <8> Measurement/generation selection switch

Selects SOURCE (generation) or MEASURE (measurement).

#### <9> Input terminals/two-phase output terminals

These terminals act as input terminals for frequency measurement when measurement is selected, and as the second pulse train output terminal when the two-phase output function is selected during generation.

#### <10> Output terminals

Act as the output terminals of pulse, DC voltage, or DC current. When the two-phase output function is selected, they function as the first pulse train output terminals.

#### <11> AC adapter connection jack

Used to connect an AC adapter (optional).

#### <12> DIP switches

See Section 7, "Other Features."

#### <13> Battery holder

Contains four AA-size batteries. See Section 3, "Replacing the Batteries."

#### <14> Lead cables for measurement or generation

Used to connect the instrument to the device under measurement/generation.

### 3. Replacing the Batteries

If the mark on the display unit starts blinking, the batteries have been used up. Follow the procedure below to replace the batteries.

- <1> Check that the power is off.
- <2> Slide the rear cover at the back of the instrument to remove it.
- <3> Replace all four batteries with new ones. Place them in their holder according to the polarity directions shown inside the holder.
- <4> After replacing the batteries, put the rear cover back on the instrument.

#### ■ Connecting the AC Power (optional)

Before connecting the AC power

Perform the following precautions to avoid electrical shock or damage to the instrument.

**CAUTION**

- Before connecting the power cord, check that the voltage of the supply side matches the rated voltage of the instrument.
- Before connecting the power cord, check that the power of the instrument is OFF.
- Do not use any AC adapter other than the dedicated AC adapter of Yokogawa.

Connecting procedure:

- <1> Check that the [POWER] key of the instrument is off.
- <2> Connect the AC adapter (optional) to the AC adapter connection jack in the instrument. (Note that unless the AC adapter is connected to the power outlet, the power cannot be turned on.)

### 4. Turning the Power On/Off

#### ■ Operating the POWER Key

When the instrument's power is off, pressing the [POWER] key for more than 1 second causes the power to be turned on. Pressing the key again causes it to be turned off.

When the power is turned on, the instrument starts a self-test and displays "CA13." The features selected by the range selection rotary switch and measurement/generation selection switch starts functioning.

- For battery-driven operations, disconnect the AC adapter from the instrument.

#### ■ Automatic Power off

In the factory-shipped setting, all indications start blinking if the instrument has not been operated for about 9.5 minutes. Then, if the instrument is not operated for another 30 seconds, it automatically turns off.

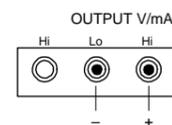
To disable this automatic power off feature, refer to Section 7, "Other Features."

If you wish to keep the instrument turned on after the indications start blinking, press the [POWER] key. This causes blinking to normal lighting, without changing the previous status.

### 5. Generation

#### 5.1 Connecting the Output Terminals

- <1> Insert the plugs of the lead cables supplied into the output terminals of the instrument.
- <2> Connect the clips on the other ends of the cables to the input terminals of the device under generation.



**CAUTION**

- Do not connect a voltage source to the output terminals directly. If voltage is applied to them inadvertently, the internal circuit may be damaged.

**NOTE**

- When using contact outputs, make sure the applied voltage passes through a current limiting resistor. (Maximum contact current: 50 mA)
- During generation, do not apply an input to the input terminals. Input voltage may affect the output waveform.

#### 5.2 Generating Pulses

##### ■ Frequency output ranges

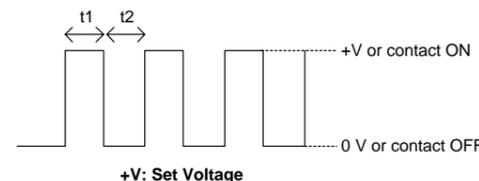
The instrument can generate a continuous signal of set frequency in the 10 kHz, 1 kHz, 100 Hz, or 10000 CPM\* range (other than the pulse cycle range, 10-V range, and 4-20 mA range)

\*Note: 60 CPM (count/minute) = 1 Hz

The output waveform is as shown on the right.

The default value of the duty ratio is 50% (t1=t2).

The operating procedures are as follows.



##### A Setting Operation



##### A-1. Frequency setting mode

- <1> Switch the MEASURE/SOURCE selection switch to SOURCE (generation).
- <2> Select any frequency range using the range switch. This causes the default value and unit of each range to appear. (Note that no unit is indicated for the 10000 CPM range.)
- <3> Use the output setting keys (▲ and ▼) to set the frequency.
- <4> Use the DUTY key to set the duty ratio (the details of which are described later).

##### A-2. Amplitude setting mode

- Use the output setting keys (▲ and ▼) to set the voltage amplitude level.
- The default value of 0.0 V allows you to select a contact output (the details of which are described later).
  - The set value is maintained for all ranges.

## B Turning on/off the frequency output

When the output is off, pressing the OUTPUT ON/OFF key generates a continuous signal of set pulses and lights up the ON indication. When the output is on, pressing the OUTPUT ON/OFF key opens the output terminals and lights up the OFF indication.

- The frequency setting can be changed even when the output is ON.

## PULSE CYCLE ranges

The desired number (count) of pulses to generate can be set in the PULSE CYCLE range. The output waveform is as shown on the right. The default value of the duty ratio is 50% ( $t_1 = t_2$ ).



The following describes the operating procedures.

## A Setting mode



- A-1. Pulse setting mode**  
 <1> Switch the MEASURE/SOURCE selection switch to SOURCE (generation).  
 <2> In the PULSE CYCLE range, select any frequency range from 10 kHz, 1 kHz, and 100 Hz. (This causes the minimum number of pulse counts, 10, to appear.)  
 <3> Use the output setting keys (▲ and ▼) to set the number of pulses.  
 <4> Use the DUTY key to set the duty ratio (the details of which are described later).
- A-2. Frequency setting mode**  
 Use the output setting keys (▲ and ▼) to set the frequency.
- A-3. Amplitude setting mode**  
 Use the output setting keys (▲ and ▼) to set the amplitude.  
 • The default value of 0.0 V allows you to select a contact output (the details of which are described later).  
 • The set value is maintained for all ranges.

## B Starting/stopping the generation of pulses

- <1> When the OUTPUT ON/OFF (start/stop) key is pressed in the setting mode, the ON indication appears, and the instrument generates pulses equivalent to the number of counts set. It also displays the pulse count simultaneously. During this period, all keys other than the OUTPUT ON/OFF key are disabled. When pulse generation is complete, the OFF indication appears instead, and the instrument automatically returns to the pulse setting mode.  
 <2> If you press the OUTPUT ON/OFF (start/stop) key during generation, output can be interrupted. In this case, pressing the OUTPUT ON/OFF key again resumes output, while pressing any of the output setting keys returns the instrument to the pulse setting mode.

## Generating contact signals

A contact signal can be selected in any pulse generation range except for the 10 V and 4-20 mA ranges. One contact ON/OFF signal is an ON/OFF signal by field-effect transistor (FET). When "0.0 V" is set in the amplitude setting mode of pulse generation, the instrument enters the contact ON/OFF signal output mode, where the contacts at the output terminals switch ON and OFF when pulses are generated (i.e., when pulse generation is ON). Setting any item other than "0.0 V" activates the voltage pulse output.

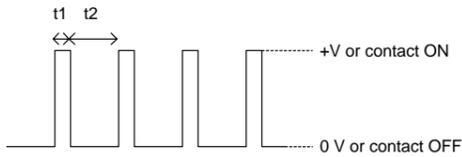


- The absorbing current when using contact signal output should be less than 50 mA.

## Setting the duty ratio

The duty ratio can be set in all pulse generation ranges, together with the voltage pulses or contact pulses. Note that it is set to 50% in two-phase output (described later) and cannot be changed.

- <1> The duty ratio can be set by scrolling through the available settings with each press of the DUTY select key, as follows: from 50% (initial value), 60%, ..., 90%, 10%, 20%, ..., and so on.  
 <2> The definition of the duty ratio is as shown here.



$$\text{Duty ratio} = \frac{t_1}{t_1 + t_2} \times 100 \text{ [ \% ] (equation)}$$

## Generating two-phase pulses

Selecting a DIP switch allows you to choose the generation of two-phase pulses with a 90-degree phase difference. See Section 7, Other Features for details.

## 6. Measurement

Measurement is available for four ranges only: 10 kHz, 1 kHz, 100 Hz, and 10000 CPM. It is not possible to carry out measurement in the PULSE CYCLE, 10 V, or 4-20 mA range.



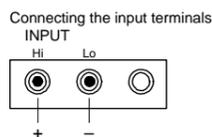
- The maximum allowable voltage is 30 V peak with respect to the grounding of all input and output terminals. Never attempt to apply a voltage exceeding this value; doing so may not only damage the instrument but could also cause personal injury.
- Always use the lead cables supplied with the product.



- Do not apply voltage exceeding the maximum allowable input voltage to the voltage input terminals. Doing so may damage the instrument. Maximum allowable input voltage: 30 V peak

### 6.1 Connection Method

- <1> Insert the plugs of the lead cables supplied to the Hi and Lo INPUT terminals.  
 <2> Connect the clips on each end of the cables to the output terminals of the equipment being calibrated.



### 6.2 Measuring Frequency

- <1> Switch the MEASURE/SOURCE selection switch to MEASURE (measurement).  
 <2> Select a measurement range from among 10 kHz, 1 kHz, and 100 Hz using the range selection switch.  
 <3> The instrument allows the voltage input and contact input to be switched between. Select either one using the DIP switch on the back of the instrument. For details, see Section 7, "Other Features." To measure normal voltage pulses, set the contact input of the DIP switches to OFF. (Note: It is set to OFF at factory shipment.)
- When the instrument detects an input pulse, the input-pulse detection indication blinks.
  - The result of measurement is displayed on the display unit, and the measured value is updated around every second.
  - The minimum frequency that can be measured in the 10 kHz, 1 kHz, 100 Hz range is 1 Hz. If the input frequency exceeds the measuring range or if no pulses can be detected in the input, the instrument displays "----".
  - If the range switch is set to an invalid range, the display reads "nC."

### 6.3 Measurement in the 10000 CPM Range

- In the 10000 CPM range, the instrument counts up the input pulses for one minute.  
 <1> When this range is selected, the OFF indication appears on the display unit.  
 <2> When the OUTPUT ON/OFF (start/stop) key is pressed, the indication changes to ON. This starts the counter of input pulses.  
 <3> When one minute has elapsed since the start of counting, the indication automatically changes back to OFF, and the counting stops. The display unit shows the total count value (CPM value).  
 <4> When counting is restarted, the measured value is reset, and a new counting starts.  
 <5> If you press the start/stop key in the mid-course of counting, i.e., before the one minute elapses, the counting stops at that time.

## 7. Other Features

The following features are available depending on setting of the DIP switches, which are accessed by removing the rear cover from the back of the instrument.



- 1: Two-phase output  
 2: Contact input measurement  
 3: Not used  
 4: Disable automatic-power off

## 7.1 Two-phase Output

Setting the DIP switch 1 to ON enables the following two-phase output to be generated.

First pulse train between OUTPUT Hi-Lo



Second pulse train between OUTPUT/2PHASE Hi-Lo



### Operating procedure:

- <1> Switch the MEASURE/SOURCE selection switch to SOURCE (generation).  
 <2> Set the DIP switch 1 to ON. The indication "2P" will blink on the display, indicating that the two-phase output has been selected.  
 <3> When two-phase output is selected, the input terminals for measurement will function as two-phase output terminals.  
 <4> Switching the SOURCE/MEASURE selection switch to MEASURE makes the two-phase output terminals change back to input terminals even when the two-phase output has been selected. Doing this enables measurement.



When two-phase output is selected, the input terminals used for measurement also function as output terminals. Be sure not to apply external power to any terminal.

## 7.2 Contact Input

When DIP switch 2 is set to ON, a transistor contact ON/OFF signal can be measured instead of the voltage pulse during measurement. If contact input is selected, the "Cn" indication appears on the display unit. For the contact input, +5 V of power is applied to the input terminals via an internal 100 kΩ resistor.

## 7.3 Disabling Automatic Power off

At the factory shipment, the instrument is initialized so that it will turn off automatically if not operated for a period of 10 minutes or more. If you set DIP switch 4 to on, the instrument can be used continuously without automatic power off. However, when the instrument is battery-driven, it is recommended that this switch be generally set to off in order to prevent the batteries from being used up.

## 8. Maintenance

### Periodic calibration

It is recommended that the instrument be calibrated annually to ensure that the instrument works correctly. For calibration, contact to our service representatives.

## 9. Specifications

Generation of pulses, DC voltage, and DC current:  
 Accuracy at 23 ± 5°C for one year.

Range Selection	Range of Generated Signal	Accuracy	Setting Resolution	Remarks
10kHz	0.9k to 11.0kHz	±0.1kHz	0.1kHz	Output voltage level: +0.1 to +15 V Zero-base waveform Output level accuracy: ±(5% + 0.1 V) Max. load current: 10 mA <For contact output> Max. ON/OFF voltage: +28 V Max. contact current: 50 mA Capacitance between contact: Approx. 500 pF
1kHz	90 to 1100Hz	±1kHz	1kHz	
100Hz	1.0 to 110.0Hz	±0.1Hz	0.1Hz	
10000 CPM (See note 1)	10 to 11000CPM	±10CPM	±10CPM	
PULSE CYCLE (See note 2)	10kHz	10 to 11000cycles	10cycles	Duty ratio: Can be set between 10 to 90%
	1kHz			
	100kHz			
10V DC	0.0 to 15.0V	±0.5%FS	0.1V	Max. output: 10 mA (Internal resistance: approx. 2Ω)
4-20mA DC	4/8/12/16/20mA	±0.5%FS	4mA	Max. load: 12 V

- Contact output: Contact output is enabled by setting the voltage level to 0.0 V. The contact is turned ON/OFF by the FET switch.
- Output of two pulse trains: The DIP switch can be configured so that the instrument outputs two pulse trains having a 90° phase difference with 50% duty ratio fixed. Typical change in phase difference: Equivalent to approximately ±3 μs (i.e., approximately ±10° at 10 kHz or ±5° at 5 kHz)

Note 1: 60 CPM (counts/min) = 1 Hz

Note 2: PULSE CYCLE: Generates the number of pulses set, and allows the frequency for each generated signal range to be set for the 10 kHz, 1 kHz, and 100 Hz range.

Measurement of frequency:  
 Accuracy at 23±5°C for one year.

Range selection	Indication	Accuracy	Resolution	Remarks
10kHz	0.001 to 11.000kHz	±2dgt	0.001kHz	Input sensitivity: Sine wave of 0.1 Vrms Pulse with a 0.14 V peak and a duty ratio of 50% Max. input: 30 V peak Input resistance: 100 kΩ or more
1kHz	1.0 to 1100.0Hz	±2dgt	0.1Hz	
100Hz	1.00 to 110.00Hz	±2dgt	0.01Hz	
10000 CPM (See note 1)	0 to 11000CPM		1CPM	

- Contact input: The transistor switch's ON/OFF signal can be measured by setting the DIP switch. (Note that there must be no chattering in the input signal.) Voltage for measurement of an ON/OFF signal: +5 V at 0.1 mA or less

Note 1: CPM: Displays the totalized input pulse count for a 1 min period

General/common specifications:

Power supply: Four 1.5 V alkaline dry batteries (ANSI AA-size) or a dedicated AC adapter (optional)

Battery life: Approx. 30 hours for 10 V<sub>P-P</sub> load of 10 kΩ

Approx. 40 hours for contact output

When running on alkaline batteries

Auto-power off: After about 10 minutes of no operation

Display: Segment LCD

Maximum voltage that can be applied: 30 V peak or less between each terminal and ground

Operating temperature and humidity ranges: 0 to 50°C at 20 to 80% R.H. (no condensation allowed)

Storage temperature and humidity ranges: -20 to 50°C at no more than 90% R.H. (no condensation allowed)

Dimensions: Approx. 192 (H) × 92 (W) × 42 (D) (mm) not including protruding parts

Weight: Approx. 440 g

Safety standards: EN61010-1: 1993

When using with AC adaptor (optional), only B9108WB conform to the safety regulation (A1020UP/A1022UP are excluded)

EMC standards: EN55011: 1991 Group 1 Class B

EN50082-1: 1992

Influence under RF electromagnetic field environment: ±10% change in pulse amplitude and DC generated values

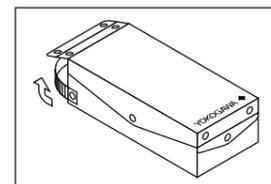
Accessories: Two red lead cables and one black lead cable for generation and measurement (B9108MU)

Carry case (B9108NK)

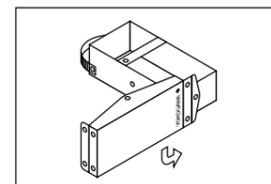
Optional accessories: Dedicated AC adapters (A1020UP for 100 V AC; A1022UP for 120 V AC; and B9108WB for 220-240 V AC)

## 10. How to Use the Carry Case

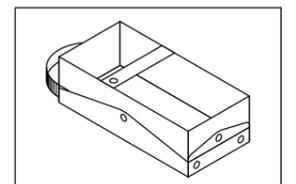
The carry case may be used as described below:



- (1) Release the strap-side snap fasteners and the other side snap fasteners of the case cover to open it.



- (2) Turn the case cover over by using the logo-side snap fastener as the center.



- (3) Re-fasten the strap-side snap fasteners and side snap fasteners of the cover.

### Other features and notes of the carry case

- The instrument can be placed inside the housing of the back side of the case cover, with the lead cables connected to the terminals of the instrument.
- The strap allows the instrument to be used or stored by suspending it on a hook, rod, and others.
- Note that the logo-side fastener of the case cover cannot be released.

## 11. Notice of the Instruction Manual

- <1> The information contained in this Instruction Manual is subject to change without notice.  
 <2> The information contained herein is assumed to be accurate. However, should any doubt, errors, omission, or comments come to your attention, please inform us.  
 <3> Yokogawa M&C assumes no responsibility or liability for damages resulting from the customer's misuse or inadvertent operations.  
 <4> This Instruction Manual describes the details of the functions of the product and does not warrant the product for any particular purposes.