

# Handy Calibrators

## CA10 Series

**CA11** Voltage/Current Calibrator

**CA12** Temperature Calibrator

**CA13** Frequency Calibrator

- Both signal source and measurement functions
- Simple operation, easy to use
- Lightweight, compact body



Yokogawa M&C Corporation

# Compact, Low Cost, Versatile

Voltage/Current Calibrator

# CA11



## Features

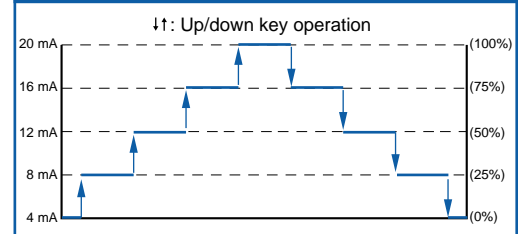
### Source and Measuring of Voltage and Current

Generates and measures voltages up to 30 V DC and currents up to 24 mA DC.

### 4-20 mA and 1-5 V DC Step-up/down Function

The output level can be changed between 4⇔8⇔12⇔16⇔20 mA signals by one touch for the 4-20 mA DC output, and between 1⇔2⇔3⇔4⇔5V signals for the 1-5 V DC output, for efficient calibration work.

#### 4-20 mA Step-up/down Output



### 20 mA SINK Function

Absorbs the voltage supplied from an external power supply to its H terminal and simulates a two-wire transmitter, ideal for loop checks.

### Sweep Function

Increases and decreases the output level to the preset level at a constant rate for the selected sweep time (16 or 32 seconds). The sweep function and sweep time are set by the internal dip switches.

## Panel Design Common to All Models

### Power Switch

### Up/Down Keys

Used to set the output signal level. A pair of up/down keys is conveniently located immediately below each digit in the LCD panel.

### Output On/Off Switch

(In case of CA12, set temperature clear switch)

### Range Selection Rotary Switch

The rotary switch simplifies range selection: just leave the switch set to the most frequently used range.

### Source/Measure Selection Switch

Temperature Calibrator  
**CA12**



Features

Simulator of Common Thermocouples and RTD Sensors

Outputs a signal equivalent to signals of six types of thermocouple K, E, J, T, N, and R as well as Pt100 resistance temperature detector. (The former Pt100 standard, JPt100, is also selectable by an internal dip switch.) Suitable for a broad range of applications such as maintenance of industrial process instruments and various thermometers.

Multi-range Thermometer

Can be used as a multi-range thermometer. Three-wire RTD connection for an RTD is possible.

Built-in Sensor for Reference Junction Compensation

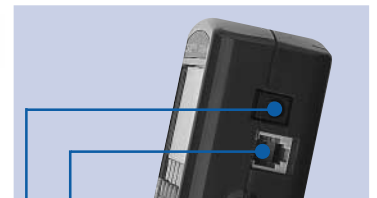
Reference junction compensation when generating a thermocouple signal can be performed by the built-in temperature sensor. For more precise compensation, use the external RJC sensor (model B9108WA, sold separately).

°C/°F Selection Key

Selects "°C" or "°F" unit.

Terminal Adapter

Provides screw terminals for connecting a temperature sensor such as a thermocouple and RTD when measuring temperature. When generating an RTD signal, a three-wire RTD signal can be output using the lead cables that come with the CA12 by short-circuiting the Lo-Lo terminals using the short-circuit bar that also comes with the CA12.



Plug for External RJC Sensor

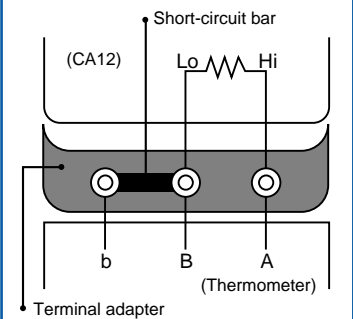
The RJC sensor is sold separately.

Plug for AC Adapter

Common for all CA11, CA12, and CA13

Example of Use of Terminal Adapter

(When outputting a three-wire RTD signal)



Frequency Calibrator  
**CA13**



Features

Pulse Generator and Meter

Wide setting range of 0.1 Hz to 11 kHz. A simple key action switches over the function between a pulse generator and pulse meter, suitable for checking flowmeters and receiver instruments.

Both Voltage Pulses and Contact Pulses are Available

The CA13 can generate and measure both voltage pulses (amplitude of +0.1 to +15 V, zero-based waveform) and contact pulses.

Duty Ratio Setting Key

The duty ratio of the generated pulses can be set in increments of 10% (within the range of 10 to 90% except for the two-phase output).

Display Switching Key

Switches over the display between the frequency setting, amplitude setting, and number-of-pulse setting (when using a PULSE CYCLES range).

Plug for Input and Two-phase Output

The leftmost input plug can be used as an additional output terminal only by setting an internal dip switch for two-phase output.

Generation of DC Voltage and Current

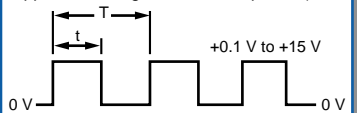
A DC voltage (0.1 to 15 V) and current (step setting of 4 ⇔ 8 ⇔ 12 ⇔ 16 ⇔ 20 mA) can be generated. (Note that the accuracy is ±0.5% of full scale. Use this function only for simplified checks. For precise measurement, use the CA11.)

Pulse Cycle Output

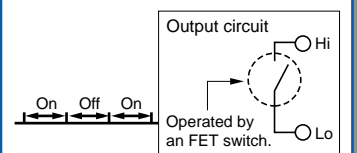
A set number of pulses (of a desired frequency and amplitude) can be output, ideal for checking totalizer counters.

Pulse Waveform Generated

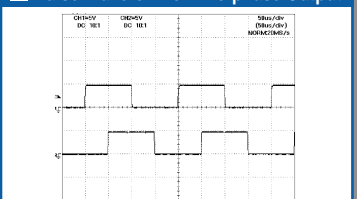
(When selecting voltage pulses)  
Duty ratio =  $t/T \times 100\%$  (The same equation applied to voltage-free contact pulses.)



(When selecting voltage-free pulses)

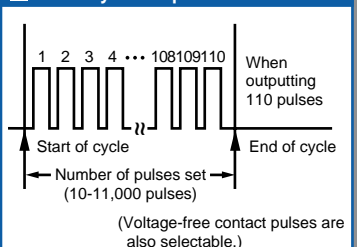


Pulse Waveform of Two-phase Output



Settings:  
Frequency = 5 kHz (duty ratio is fixed to 50%);  
Amplitude = 5 V (voltage-free contact pulses are also selectable.)

Pulse Cycle Output



(Voltage-free contact pulses are also selectable.)

CPM Function

The CA13 can count the number of pulses per minute when using the measurement function, suitable for totalizing the flow rate based on discontinuous pulses from a flowmeter. When using the generation function, the pulse train signal to be output can be set by a number of pulses per minute (60 CPM = 1 Hz).



## Additional Features

### Automatic Power-off

The power is turned off automatically if the calibrator is not touched for 10 minutes, prolonging battery life.

### Simple and Easy Calibration

For the CA11 and CA12, there is no need to open the case when performing calibrations during periodic maintenance as they can be simply calibrated by the up/down keys. (A separate reference instrument is needed. This feature does not apply to the CA13.)

### Complete Protection (CA11)

The complete protector protects the circuit against short-circuiting of the voltage output terminals and application of a voltage (of up to 30 V) to the output terminals, etc. due to misconnection.

### Runs on 1.5 V AA-size Batteries or AC Adapter

The handy calibrators can run on the built-in 1.5-V ANSI batteries or an AC power supply using the AC adapter (sold separately).

### Longer Lead Cables

The slightly longer than usual lead cables of 1.7 m (approximately 0.1  $\Omega$  for both cables) allow easy cable connection even if the handy calibrator is put on the floor.

### Compact and Lightweight

Almost the same size and weight as a hand-held digital multimeter, this calibrator is designed for use in the field.

### Handy Carrying Case — A Standard Accessory

The roomy case easily holds the calibrator without having to disconnect the lead cables.

#### ● Dip Switches (inside battery compartment)

	CA11	CA12	CA13
Switch Number	ON		
1	When generating a signal: the sweep function takes 16 seconds.	When generating a signal, the built-in RJC is on.	When generating a signal, a two-phase signal is output.
2	When generating a signal: the sweep function takes 32 seconds.	Unused	When measuring a signal, a voltage-free contact pulse signal is selected for the input.
3	Unused	Unused	Unused
4	Automatic power-off is disabled.	Automatic power-off is disabled.	Automatic power-off is disabled.



## Related Product

# Portable Calibrator Model 2422

- Simultaneous displays for output generation and input measurement
- Output dividing function
- Auto stepping output function
- Set-value memory function
- Runs on Ni-Cd batteries or AC power supply



**Examples of Applications**

**An Application of CA11**

Two-wire transmitter

Power supply (Distributor)

4-20 mA

CA11

Lo Hi

This is an example of connecting the CA11 to a distributor for two-wire transmitters. The CA11 can absorb up to 28 V DC supplied from the distributor and generates a 4-20 mA output (using the 20-mA SINK range), allowing loop check.

**An Application of CA12**

Receiver instrument to be calibrated

(Generation)

CA12

Temperature controller or converter

This is an example of connecting the CA12 to a receiver instrument for a three-wire resistance temperature detector (RTD). Using the PT100 range, the RTD signal equivalent to the temperature set at the CA12 is output to the receiver instrument. To cancel the lead wire resistance, connection using three wires is necessary. The terminal adapter that comes with the CA12 simplifies this three-wire connection.

**An Application of CA13**

Flowmeter

Receiver instrument for flow pulse

Power supply (12 or 24 V)

Pulse signal

Flow totalizer counter, pulse converter, controller, etc.

(Measurement)

CA13

Hi Lo

(Generation)

CA13

Lo Hi

This is an example of inputting the pulse signal from the flowmeter, measuring the flow totalizer reading and generating a pulse signal to a receiver instrument such as a pulse converter and controller. Since the pulse signal from a flowmeter is discontinuous, use the CPM function to count the number of pulses per minute.

**An Application of CA13**

Rotary encoder

Phase A

Phase B

COM

(Generation)

CA13

Hi Lo Hi

This is an example of connecting the CA13 to an increment/decrement pulse counter. Use the two-phase pulse output and pulse cycle function to check the increment/decrement action of the pulse counter and indication of the pulse count.

**General Specifications of CA10 Series Calibrators**

- Power Supply:** Four 1.5-V alkaline batteries (ANSI AA-size) or dedicated AC adapter (sold separately)
- Life of Batteries (When generating a signal continuously)**
- CA11: Approximately 50 hours for 5 V DC output (with a load of 10 kΩ or greater)  
Approximately 25 hours for 20 mA DC output (with a load of 5 V)
  - CA12: Approximately 80 hours
  - CA13: Approximately 30 hours for 10 V<sub>P-P</sub> output (with a load of 10 kΩ or greater)  
Approximately 40 hours for voltage-free contact output
- Automatic Power-off:** After approximately 10 minutes
- Generation Signal Level Setting:** By four-digit up/down keys
- Response of Generator**
- CA11: Approximately 1 second (from when the output begins to change until when the output level falls within the specified accuracy)
  - CA12: Approximately 20 milliseconds for 400-Ω and RTD ranges (from when the specified current is applied until when the output level falls within the specified accuracy)
- Display:** LCD
- Maximum Allowable Applied Voltage**
- CA11: 30 V peak between each terminal to ground
  - CA12: 42 V peak between each terminal to ground
- Compliance to Standards**
- Safety: EN61010-1: 1993 (except for the A1020UP/1A1022UP optional AC adapter)
  - EMC: EN55011: 1991, group 1, class B  
EN50082-1: 1992
- Operating Temperature/Humidity Range:** 0 to 50°C and 20 to 80% RH (no condensation)
- Storage Temperature/Humidity Range:** -20 to 50°C and 90% RH or less (no condensation)
- Dimensions:** Approximately 192 (H) x 90 (W) x 42 (D) mm (excluding protrusions)
- Weight:** Approximately 440 g(f) (including batteries)
- Accessories**
- Lead cables (1 pair)
  - Carrying case (1)
  - Terminal adapter (1 for only CA12)

**Model Code**

Name	Model Code
CA11 voltage/current calibrator	71010
CA12 temperature calibrator	71021
CA13 frequency calibrator	71030

**Optional Accessories**

Name	Model Code
Dedicated AC adapter (100 V)	A1020UP
Dedicated AC adapter (120 V)	A1022UP
Dedicated AC adapter (220-240 V)	B9108WB
Reference junction sensor	B9108WA
Accessory case	B9108XA

**Spare Parts**

Name	Model Code
Lead cables (1 pair [1 red and 1 black cables] for CA11)	B9108MS
Lead cables (1 set [1 red and 2 black cables] for CA12)	B9108MT
Lead cables (1 set [2 red and 1 black cables] for CA13)	B9108MU
Carrying case	B9108NK
Terminal adapter (for CA12)	B9108KF

## Specifications of Each Model

### CA11 Voltage/Current Calibrator (Model Code 71010)

#### Source Functions

Accuracy =  $\pm$ (% of setting + value in mV,  $\mu$ V, or  $\mu$ A), at 23  $\pm$ 5°C for one year

Range Selection	Range of Generated Signal	Accuracy	Setting Resolution	Remarks
30V	0 to 30.00 V DC	0.05% + 20 mV	10 mV	Maximum output current: 1 mA
10V	0 to 11.000 V DC	0.05% + 2 mV	1 mV	Maximum output current: 10 mA
1-5V	1/2/3/4/5 V DC		1-V step	
1V	0 to 1.1000 V DC	0.05% + 0.2 mV <sup>*1</sup>	0.1 mV	*1: When the load is 1 k $\Omega$ or greater, and the error of the lead cables is excluded
100mV	0 to 110.00 mV DC	0.05% + 50 $\mu$ V <sup>*1</sup>	0.01 mV	
20mA	0 to 24.00 mA DC	0.05% + 4 $\mu$ A	0.01 mA	Maximum load: 12 V
4-20mA	4/8/12/16/20 mA DC		4-mA step	
20mA SINK	0.1 to 24.00 mA DC	0.1% + 4 $\mu$ A	0.01 mA	External power supply: 5 to 28 V

Temperature effect: 1/10 of accuracy/ $^{\circ}$ C; however, for 100-mV range, 0.005% + 10  $\mu$ V/ $^{\circ}$ C

#### Measurement Functions

Accuracy =  $\pm$ (% of reading + value in the least significant digit), at 23  $\pm$ 5°C for one year

Range Selection	Indication	Accuracy	Resolution	Remarks
30V	0 to $\pm$ 30.00 V DC	0.05% + 2 digits	10 mV	Input impedance: Approx. 1 M $\Omega$
10V	0 to $\pm$ 11.000 V DC	0.05% + 2 digits	1 mV	
1V	0 to $\pm$ 1.1000 V DC	0.05% + 2 digits	0.1 mV	
100mV	0 to $\pm$ 110.00 mV DC	0.05% + 7 digits	0.01 mV	Input impedance: Approx. 45 $\Omega$
20mA	0 to $\pm$ 24.00 mA DC	0.05% + 1 digit	0.01 mA	

### CA12 Temperature Calibrator (Model Code 71021)

#### Source and Measurement Functions

Accuracy =  $\pm$ (% of setting or reading + value in  $^{\circ}$ C), at 23  $\pm$ 5°C for one year

Range Selection	Range of Generated Signal/Indication	Accuracy		Resolution	Remarks
		Source <sup>*4</sup>	Measurement <sup>*5</sup>		
TC <sup>*1</sup>	K	-200.0 to 1370.0 $^{\circ}$ C	-328 to 2498 $^{\circ}$ F	0.05% + 1 $^{\circ}$ C (at -100 $^{\circ}$ C or greater)	0.07% + 1.5 $^{\circ}$ C (at -100 $^{\circ}$ C or greater)
	E	-200.0 to 1000.0 $^{\circ}$ C	-328 to 1832 $^{\circ}$ F		
	J	-200.0 to 1200.0 $^{\circ}$ C	-328 to 2192 $^{\circ}$ F		
	T	-200.0 to 400.0 $^{\circ}$ C	-328 to 752 $^{\circ}$ F	0.05% + 2 $^{\circ}$ C (at less than -100 $^{\circ}$ C)	0.07% + 2 $^{\circ}$ C (at less than -100 $^{\circ}$ C)
	N	-200.0 to 1300.0 $^{\circ}$ C	-328 to 2372 $^{\circ}$ F		
	R	0 to 100 $^{\circ}$ C	32 to 212 $^{\circ}$ F	0.05% + 3 $^{\circ}$ C	0.07% + 3 $^{\circ}$ C
100mV	-10.00 to 110.00mV	0.05% + 30 $\mu$ V	0.05% + 30 $\mu$ V	10 $\mu$ V	1 $^{\circ}$ C or 1 $^{\circ}$ F
RTD Pt100 <sup>*2,3</sup>	-200.0 to 850.0 $^{\circ}$ C	-328 to 1562 $^{\circ}$ F	0.05% + 0.6 $^{\circ}$ C <sup>*6</sup>	0.05% + 0.6 $^{\circ}$ C <sup>*7</sup>	0.1 $^{\circ}$ C or 1 $^{\circ}$ F
400 $\Omega$	0.0 to 400.0 $\Omega$	0.05% + 0.2 $\Omega$ <sup>*6</sup>	0.05% + 0.2 $\Omega$ <sup>*7</sup>	0.1 $\Omega$	

Temperature effect: 1/10 of accuracy/ $^{\circ}$ C

\*1 Based on the reference thermal EMF table of JIS C1602-1995

\*2 Based on the reference resistance table of JIS C1604-1997. The resistance values based on the former standard (JPT100) can also be selected.

\*3 Based on the international temperature standard 1990 (ITS-90). The scale based on the former standard, IPTS-68, can also be selected by setting an internal dip switch.

\*4 The accuracy for generation of thermocouple signals does not include the error of the reference junction compensation. When compensating the output using an RJC sensor, add the accuracy of the RJC sensor. The output compensation is performed every 4 seconds. RJC sensor specifications - measurement range: -10 to 50 $^{\circ}$ C; accuracy (in combination with the CA12):  $\pm$ 0.5 $^{\circ}$ C at 18 to 28 $^{\circ}$ C and  $\pm$ 1 $^{\circ}$ C at other temperatures.

\*5 The accuracy for measurement of thermocouple signals indicates the error against the reference EMF table and includes the error of the internal reference junction compensation when the temperature at the terminals is stable.

\*6 External excitation current: 0.5 to 2 mA; add 0.05% + 1 $^{\circ}$ C (or 0.4  $\Omega$ ) when it is 0.1 mA. Input capacitance of receiver instrument: 0.1  $\mu$ F or less.

\*7 When measuring a temperature using a three-wire RTD.

### CA13 Frequency Calibrator (Model Code 71030)

#### Pulse Generation

Accuracy: At 23  $\pm$ 5°C for one year

Range Selection	Range of Generated Signal	Accuracy	Setting Resolution	Remarks
10kHz	0.9 to 11.0 kHz	$\pm$ 0.1 kHz	0.1 kHz	Output voltage level: +0.1 to 15 V (zero-based waveform) Accuracy of output level: $\pm$ (5% + 0.1 V) Maximum load current: 10 mA (on voltage-free contact output) Maximum contact operating voltage: +28 V Maximum contact current: 50 mA Contact capacitance: Approx. 500 pF
1kHz	90 to 1,100 Hz	$\pm$ 1 Hz	1 Hz	
100Hz	1.0 to 110.0 Hz	$\pm$ 0.1 Hz	0.1 Hz	
10000CPM <sup>*1</sup>	10 to 11,000 CPM	$\pm$ 10 CPM	10 CPM	
PULSE CYCLES <sup>*2</sup>	10kHz	—	—	Duty ratio: 10 to 90% variable (in increments of 10%)
	1kHz			
	100Hz			

• Voltage-free contact output: Available by setting the voltage level to 0.0 V. The contact is operated by an FET switch.

• Two-phase output: A two-phase pulse signal having the phase difference of 90 $^{\circ}$  can be output by setting an internal dip switch. (The duty ratio is fixed to 50%.) The typical variation of the phase difference is approximately  $\pm$ 3  $\mu$ S (approximately  $\pm$ 10 $^{\circ}$  at 10 kHz,  $\pm$ 5 $^{\circ}$  at 5 kHz).

\*1 60 CPM = 60 count per minute = 1 Hz

\*2 Use the PULSE CYCLES ranges to generate a set number of pulses. Select the range suitable for the desired number of pulses per minute, from 10kHz, 1kHz, and 100Hz.

#### DC Voltage/Current Generation

Accuracy: At 23  $\pm$ 5°C for one year

Range Selection	Range of Generated Signal	Accuracy	Setting Resolution	Remarks
10V	0.0 to +15.0 V DC	$\pm$ 0.5% of full scale	0.1 V	Maximum output current: 10 mA (input impedance: approx. 2 $\Omega$ )
4-20mA	4/8/12/16/20 mA DC	$\pm$ 0.5% of full scale	4 mA	Maximum load: 12 V

#### Measurement Functions

Accuracy: At 23  $\pm$ 5°C for one year

Range Selection	Measurement Range	Accuracy	Resolution	Remarks
10kHz	0.001 to 11.000 kHz	$\pm$ 2 digits	0.001 kHz	Input sensitivity: 0.1 Vrms for sine wave; 0.14 Vpeak, duty ratio of 50% for pulse Maximum allowable input: 30 Vpeak Input impedance: 100 k $\Omega$ or greater
1kHz	1.0 to 1100.0 Hz	$\pm$ 2 digits	0.1 Hz	
100Hz	1.00 to 110.00 Hz	$\pm$ 2 digits	0.01 Hz	
10000CPM <sup>*1</sup>	0 to 11,000 CPM	—	1 CPM	

• Voltage-free contact output: Solid-state switching signal can be measured by setting an internal dip switch (however, no chattering is allowed in the input).

\*1 Indicates the number of pulses input per minute.

• Voltage applied for measuring the switching signal: +5 V at 0.1 mA or less.

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World Wide Web site at  
<http://www.yokogawa.com/MCC>

#### NOTICE

- Before using the product, read the instruction manual carefully to ensure proper and safe operation.

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