General Specifications

Model CCX7
Universal Computing Unit

SMPSC

◆General

This plug-in type universal computing unit receives DC current or DC voltage signals, applies various computing functions to them, and then converts them into isolated DC current or DC voltage signals.

- DC voltage signal, communication output (RS485), or alarm output (2 relay contacts) is selectable as output-2.
- Various parameters such as input range and computation programs can be set and modified using the Setup Utility.

◆Model and Suffix Codes

CCX7-□□□-□□□0/□

Model

Function
A: Direct Mapping
B: Moving average computation
C: Dead time computation
D: First-order lag computation
E: First-order lead computation
F: Uniform-speed response (Velocity limiter)
G: Limiter
H: Velocity computation
J: Linearizer
K: Ratio setting

Output
1: 1output
2: 2 outputs

Power supply
6: 100-240 V AC/DC (Operating range: 85-264 V)
7: 15-30 V DC (Operating range: 12-36 V)

Input signal
A: 0 to 50 mA DC, span is 5 mA or more
1: -10 to +10 V DC, span is 0.1 V or more

Output-1 signal
A: 4 to 20 mA DC
6: 1 to 5 V DC
Z (Custom Order): DC current / voltage signal

Output-2 signal
A: 4 to 20 mA DC
6: 1 to 5 V DC
P: Communication function (RS-485)
T: Contact output (2 relay contacts)
N: No Output-2

Options
/SN : Without socket
Blank : With socket

◆Input/Output Specifications

■ Input

Input Range:
Code A: 0 to +50 mA DC, span is 5 mA or more
Code 1: -10 to +10 V DC, span is 0.1 V or more

Input Resistance:
DC current signal: 100 Ω (with internal shunt resistor)
DC voltage signal: 1 MΩ (100 kΩ when power off)

■ Output-1

Output-1 Range	Allowable Load Resistance	Output-1 Range	Allowable Load Resistance
4 to 20 mA DC	750Ω max.	0 to 10 mV DC	250KΩ min.
2 to 10 mA DC	1500Ω max.	0 to 100 mVDC	250KΩ min.
1 to 5 mA DC	3000Ω max.	0 to 1 V DC	2KΩ min.
0 to 20 mA DC	750Ω max.	0 to 10 V DC	10KΩ min.
0 to 16 mA DC	900Ω max.	0 to 5 V DC	2KΩ min.
0 to 10 mA DC	1500Ω max.	1 to 5 V DC	2KΩ min.
0 to 1 mA DC	15KΩ max.	-10 to +10V DC	10KΩ min.

■ Output-2

- **Analog Output**

Output Signal	Output Resistance	Permissible Load Resistance
1 to 5 V DC	1 Ω or less	2 kΩ or more
4 to 20 mA DC	500 kΩ or more	350Ω or less

- **Communication Function**

This isolator can be connected to a personal computer, or programmable controllers.

Standards: EIA RS485
Maximum number of connectable controllers: 31 controllers
Maximum communication distance: 1200 m
Communication method: 2-wire half duplex, start-stop synchronization, non-procedural
Communication rate: 1200, 2400, 4800, 9600, 19200 bps
Data length: 8 bit
Stop bit: 1, 2 bit
Parity: Even parity, odd parity, or none
Communication protocol: MODBUS RTU

- **Alarm Output**

Signal type: Relay contact
Output signal: N.O. contact output (contact ON at excitation) 2 points, COM common
Contact capacity: 30 V DC, 1 A

Alarm operating direction: High limit alarm or low limit alarm

Relay operating direction setting: Excitation or non-excitation at normal status
Alarm setting range: 0 to 100 % of input range
Setting resolution: 0.1 %, 4 significant digits
Hysteresis setting range: Set the value added to alarm setting point at alarm release, 0 to 100 % of input range
Setting resolution: 0.1 %, 4 significant digits
Alarm on-delay setting: Delay time from alarm condition completion to output
(Ex. Outputted when alarm status continues for 1 second or more after input value is over alarm point in case of set value "1 second.")
Setting range: 0 to 999 seconds
Setting resolution: 1 second (however, add about 0.2 seconds to setting time to prevent wrong operation)
Alarm off-delay setting: Delay time from alarm normal condition completion to output
(Ex. Released when normal status continues for 2 seconds or more after input value becomes normal status from alarm status in case of set value "2 seconds.")
Setting range: 0 to 999 seconds
Setting resolution: 1 second (however, add about 0.2 seconds to setting time to prevent wrong operation)
Alarm operation display: Front LED lights at excitation, 2 LEDs

◆Items Available to Be Set

The following items can be set through Setup Utility:
Input range, function code, computation program, address number, communication rate, parity, data length, stop bit, alarm operating direction, relay operating direction, alarm setting, hysteresis, alarm on-delay, alarm off-delay

◆Standard Performance

Accuracy rating: ±0.1 % of span
However accuracy is limited in the following case according to the input ranges:
Input range is -10 to +10 V (H range), span is under 5 V; accuracy (%) = ±0.1%×5 V / input span [V]
Input range is -5 to +5 V (M range), span is under 2.5 V; accuracy (%) = ±0.1%×2.5 V / input span [V]
Input range is -1 to +1 V (L range), span is under 0.5 V; accuracy (%) = ±0.1%×0.5 V / input span [V]
When current input, apply [input rangexinput resistance] to the above, and add 0.1 % of resistance error.
Response speed: 200 ms, 63 % response (10 to 90 %)
Alarm output: 350 ms (input change 10 to 90 %, alarm setting point 50 %, time till alarm output, when alarm delay setting and hysteresis are min.)
Effect of power supply voltage fluctuation: ±0.1 % or less of span for power supply voltage fluctuation of 15 to 30 V DC (±20 %), 100 to 240 V AC/DC
Effect of ambient temperature change: ±0.2 % or less of span for change of 10℃

◆Safety and EMC Standards

The followings will be acquired.
Safety:
Conforms to IEC1010-1: 1990 and EN61010-11: 1993.
Certified for CSA1010
CSA1010 category: CAT II (IEC1010-1)
Certified for UL508
Non-Incendive Explosion-Proof:
CSA C22.2 No. 213 Class I, Division 2, Groups A, B, C & D
FM No. 3611 Class I, Division 2, Groups A, B, C & D
The above certified/approved instrument is only for voltage of 15 to 30 V DC.
EMC Standards:
Conforms to the following EMC standards.
EN55011: 1991 Class A Group1 for EMI (emissions)
EN50082-2: 1995 for EMS (immunity)
The above conformed instrument is only for voltage of 15 to 30 V DC.

◆Power Supply and Isolation

Supply rated voltage range: 100-240 V AC/DC 50/60Hz or 15-30 V DC
Supply input voltage range: 100-240 V AC/DC (-15, +10%) 50/60Hz or 15-30 V DC (±20%)
Power consumption: 2.2W at 24V DC; 2.1W at 110 V DC; 4.2 VA at 100V AC; 6.1VA at 200 V AC
Insulation resistance: 100 MΩ minimum at 500V DC between input, output-1,output-2, power supply and grounding terminals mutually
Withstanding voltage: 2000 V AC for one minute between input, (output-1 and output-2), power supply and grounding terminals mutually; 1000 V AC for one minute between output-1 and output-2 terminals

◆Environmental Conditions

Operating temperature range: 0 to 50℃
Operating humidity range: 5 to 90% RH (no condensation)
Operating conditions: Avoid installation in such environments as corrosive gas like sulfide hydrogen, dust, sea breeze and direct sunlight.
Installation altitude: 2000 m or less above sea level.

◆Mounting and Appearance

Construction: Compact plug-in type
Material: Modified polyphenylene oxide (case body)
Mounting method: Wall or DIN rail mounting
Connection method: M3 screw terminal
External dimension: 29.5×76×124.5mm (W×H×D)
Weight: Approx. 170 g

◆Instruction Required When Ordering

• Model and suffix code
The input range and fixed constants for each computation function are set as specified before shipment.

◆ Factory Setting

Factory settings are as follows:

- Input range: 0 to 10 V DC
- Fixed constants: See the functional specification.

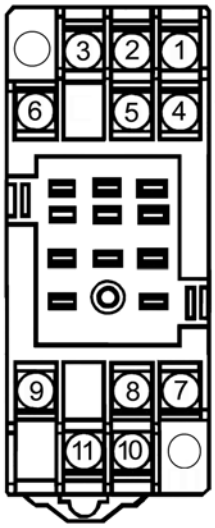
■ **When output-2 is specified as communication output**

- Address No.: 01
- Communication rate: 9600 bps
- Parity: None
- Data length: 8 bit
- Stop bit: 1 bit

■ **When output-2 is specified as alarm output**

- Alarm operating direction: High limit alarm (alarm-1),
  High limit alarm (alarm-2)
- Relay operating direction: De-energized at alarm (alarm-1 / 2)
- Alarm setting: 100 % (alarm-1), 100 % (alarm-2)
- Hysteresis: 3 % (alarm-1 / 2)
- Alarm on-delay: 0 second (alarm-1 / 2)
- Alarm off- delay: 0 second (alarm-1 / 2)

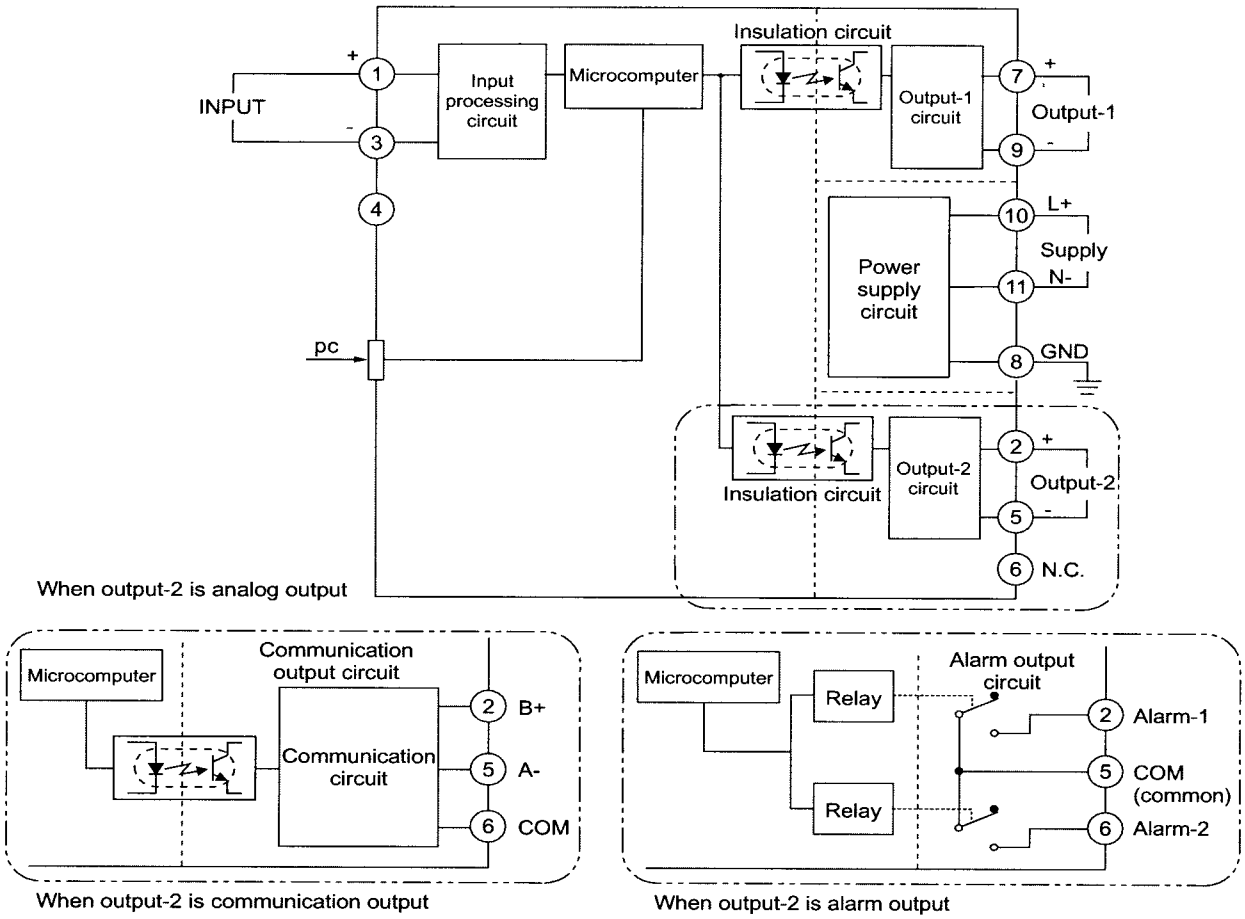
◆ Terminal Arrangement & Terminal Connection



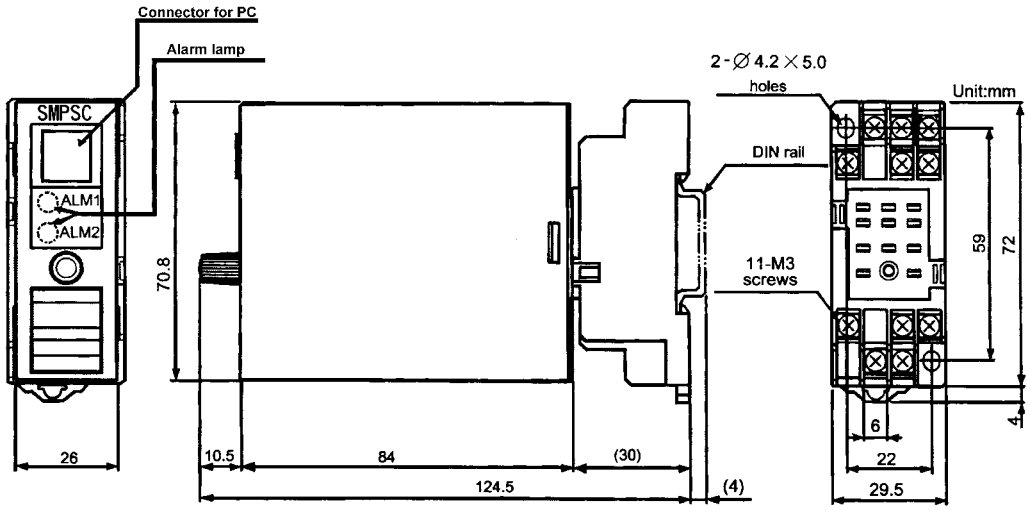
Terminal No.	Signal	Output-2 Analog output	Output-2 Communication output	Output-2 Alarm output
1	Input	(+)		
2	Output-2	(+)	B (+)	ALM1
3	Input	(-)		
4	Input	N.C.		
5	Output-2	(-)	A (-)	COM
6	Output-2	N.C.	COM	ALM2
7	Output-1	(+)		
8	GND	GND		
9	Output-1	(-)		
10	Supply	(L+)		
11	Supply	(N-)		

Note: In case of one output type, output-2 is N.C.

◆Block Diagram



◆External Dimension



◆Function Specifications

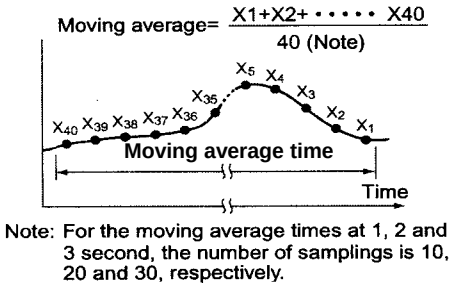
■ CCX7-A Direct Mapping

The output value is direct map into the input percentage value.

■ CCX7-B Moving Average Computation

This computing unit outputs the average of 40 input data (X) sampled at intervals of one-fortieth of the moving-average time (L). At the next sampling, the unit discards the oldest data and outputs the average of the 40 data, repeating the same operation. The output between samplings is smoothed out by interpolation.

e.g.



Note: For the moving average times at 1, 2 and 3 second, the number of samplings is 10, 20 and 30, respectively.

Setting range of moving-average time:
0 to 320,000 seconds; minimum unit is 1 second (however, 0.1 second is possible for 4 seconds or shorter).

- To use a first-order lag filter for input (X), set the first-order lag time constant (T).
  Setting range of time constant:
  0 to 799.0 seconds; minimum unit is 0.1 second.
  Accuracy of moving average and time constant setting:
  ±1 second.

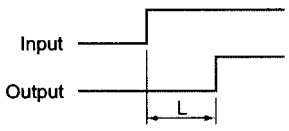
- **Ordering information and initial settings**
  Moving-average time: 10 sec
  First-order lag time constant: 0 sec

■ CCX7-C Dead Time Computation

This computing unit stores the input values (X) sampled at intervals of one-fortieth of the dead time (L) into 40 buffers and outputs data (output-1 = Y1, output-2 = Y2) by orderly shifting them after the dead time has elapsed. However, for the dead time of 3, 2, and 1 second, the numbers of samplings is 30, 20, and 10, respectively. The output between samplings is smoothed by interpolation.

$$Y1(s) = Y2(s) = \frac{e^{-Ls}}{1+Ts}X(s)$$

e.g. 0% → 100% step input



Setting range of dead time:
0 to 320,000 seconds; minimum unit is 1 second (however, 0.1 second is possible for 4 seconds or shorter.)

- To use a first-order lag filter for input (X), set the first-order lag time constant (T).
  Setting range of time constant:
  0 to 799.0 seconds; minimum unit is 0.1 second.
  Accuracy of dead time and time constant setting:
  ±1 second.

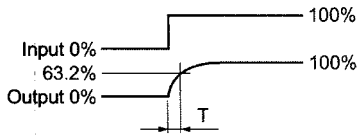
- **Ordering information and initial settings**
  Dead time: 10 sec
  First-order lag time constant: 0 sec

■ CCX7-D First-order Lag Computation

This computing unit provides a first-order lag computation on input (X) with a time constant (T) and outputs the result (output-1 = Y1, output-2 = Y2).

$$Y1(s) = Y2(s) = \frac{1}{1+Ts}X(s)$$

e.g. 0% → 100% step input



Setting range of time constant:
0 to 799.0 seconds; minimum unit is 0.1 second.
Accuracy of time constant setting:
±1 second.

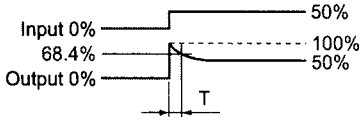
- **Ordering information and initial setting**
  First-order lag time constant: 10 sec

■ CCX7-E First-order Lead Computation

This computing unit provides a first-order lead computation on input (X) with a time constant (T) and outputs the result (output-1 = Y1, output-2 = Y2).

$$Y1(s) = Y2(s) = (1 + \frac{Ts}{1+Ts})X(s)$$

e.g. 0% → 50% step input



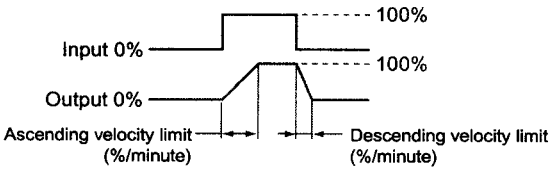
Setting range of time constant:
0 to 799.0 seconds; minimum unit is 0.1 second.
Accuracy of time constant setting:
±1 second.

- **Ordering information and initial setting**
  First-order lead time constant: 10 sec

■ CCX7-F Uniform-speed Response (Velocity Limiter)

This computing unit limits the input (X) velocity at the ascending velocity limit for a positive change and at the descending velocity limit for a negative change, and outputs the limited value (output-1 = Y1, output-2 = Y2). When the input velocity (slope) is no more that the limit value, the unit outputs the input as is.

e.g. 0% → 100% → 0% step input



Setting range of velocity limit value:

0.1% to 699.9%/minute; minimum unit is 0.1%/minute. Setting the limit at 700.0%/minute or above does not limit the input, so the unit simply outputs the input as is (i.e., works as an open limit function).

Accuracy of velocity limit setting:

±1% /minute.

- **Ordering information and initial settings**

Ascending velocity limit: 100%/minute

Descending velocity limit: 100%/minute

■ CCX7-G Limiter

This computing unit serves as an ordinary converter as long as long as the input (X) is within the upper and lower limits. When the input exceeds the limit, the unit outputs the signal that corresponds to the limit value (output-1 = Y1, output-2 = Y2).

Setting range of upper and lower limit values:

-6.0% to 106.0%; minimum unit is 0.01%. However, if the setting is made so that the upper limit < lower limit, the unit outputs the upper limit value

- **Ordering information and initial settings**

Upper limit value: 100%

Lower limit value: 0%

■ CCX7-H Velocity Computation

This computing unit calculates the input velocity by subtracting the input of the last velocity computation (X_L) form the present input (X). The unit then adds a 50% bias to one-half of the obtained velocity and outputs the result (output-1 = Y1, output-2 = Y2).

- The output obtained will be as follows:

When there is no change in input: 50%

When the input has increased: 50% or more

(100% when $X-X_L = 100\%$)

When the input has decreased: 50% or less

(0% when $X-X_L = 100\%$)

$$Y1=Y2=\frac{X-X_L}{2}+50\%$$

Setting range of velocity computation time:

0.1 to 320,000 seconds; minimum unit is 1 second (however, 0.1 second is possible for 4 seconds or shorter.)

- To use a first-order lag filter for input (X), set the first-order lag time constant (T).

Setting range of time constant:

0 to 799.0 seconds; minimum unit is 0.1 second.

Accuracy of velocity computation time and time constant setting: ±1 second.

- **Ordering information and initial settings**

Velocity computation time (L): 20 sec

First-order lag time constant (T): 0 sec

■ CCX7-J Linearizer

This computing unit gives an optional relationship between the input (X) and output (output-1 = Y1, output -2 = Y2) signals using an optional line-segment function. The line-segment function has 21 breakpoints, which each gives an input-output relationship as a percentage (%).

Breakpoint (21 points) setting conditions:

For input: -6.0%≦X0 to X20≦106.0%; minimum unit is 0.01%.

X0 < X1 < X2 < ⋯ < X20.

For output: -6.0%≦Y0 to Y20≦106.0%; minimum unit is 0.01%.

When input≦X0, Y0 is output.

When input≧X20, Y20 is output.

Computation accuracy:

±0.1% (when line-segment gain is 1 or less)

- **Ordering information and initial setting**

Breakpoint data (21 points at maximum):

Write down all the data of X0 to X20, Y0 to Y20. If not specified, the unit will be shipped with the breakpoint data set so that the input equals the output.

■ CCX7-K Ratio Setting

This computing unit sets the ratio by the following expression.

$Y1 = Y2 = K1 \times (X + A1) + A2$

Where Y1: Output-1 signal (%)

Y2: Otput-2 signal (%)

X: Input signal (%)

K1: Ratio (no unit)

A1, A2: Bias (%)

Setting range of ratio:

-320 to 320; minimum unit is 0.00001.

Setting range of bias:

-32,000% to 32,000%; minimum unit is 0.001%.

Computation accuracy:

±0.1%(when K1=1, A1=A2= 0%)

- **Ordering information and initial settings**

Ratio (K1): 1

Bias (A1): 0%

Bias (A2): 0%