General Specifications

Model MXS
Universal Computing Unit
(1-input, Isolated 2-output Type)

JUXTA

GS 77J04X11-01E

■ 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.

- The optional Parameter Setting Tool (VJ77) or Handy Terminal (JHT200) can be used for the setting changes of various parameters such as computing functions or input/output ranges, the setting changes of programs, and the test outputs.
- The operation indicating lamp shows the operation status, abnormalities in a setting etc.
- Without a setting tool such as Handy Terminal etc., outputs can be adjusted using the switches on the front panel.

■ Model and Suffix Codes

MXS-□□□□-□ *B/□

Model
Function
A: Free program G: Limiter
B: Moving average H: Velocity computation
C: Dead time J: Linearizer
D: 1st-order lag K: Ratio setter
E: 1st-order lead
F: Uniform-speed response (velocity limiter)

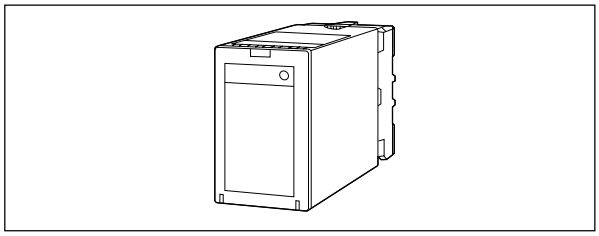
Input signal
A: 0 to 50 mA DC Span is 1 mA or more
B: 0 to 10 mA DC Span is 0.1 mA or more
1: –10 to +10 V DC Span is 0.1 V or more
2: –2 to +2 V DC Span is 10 mV or more

Output-1 signal
A: 0 to 20 mA DC Span is 2 mA or more
B: 0 to 5 mA DC Span is 1 mA or more
1: 0 to 10 V DC Span is 0.1 V or more
2: 0 to 100 mV DC Span is 10 mV or more
3: –10 to +10 V DC Span is 0.2 V or more
4: –100 to +100 mV DC Span is 20 mV or more

Output-2 signal
A: 4 to 20 mA DC
6: 1 to 5 V DC

Power supply
1: 15-40 V DC (Operating range: 12 to 48 V DC)
2: 100-240 V AC (Operating range: 85 to 264 V AC)

Optional specification
/R250: With 250 Ω receiving resistor



■ Ordering Information

Specify the following when ordering.
Model and suffix codes: e.g. MXS-AAA6-2*B
Input range: e.g. 4 to 20 mA DC
Output-1 range: e.g. 4 to 20 mA DC
If the constants for each computing function are specified with the order, the specified values will be assigned before shipment. (Refer to “Functions.”)

■ Input/Output Specifications

Input signal: 1 point of DC current or DC voltage signal
Input setting range:

Input signal suffix code	Setting range
A	0 to 50 mA DC Span is 1 mA or more*
B	0 to 10 mA DC Span is 0.1 mA or more
1	±10 V DC Span is 0.1 V or more
2	±2 V DC Span is 10 mV or more

*: Setting range is 0 to 35 mA DC for the optional specification “/R250.”

Input resistance:
Current signal: 100 Ω (external receiving resistor)
250 Ω for the optional specification “/R250”
Voltage signal:
1 MΩ for the suffix code “1”
(800 kΩ during power off)
1 MΩ for the suffix code “2”
(10 kΩ during power off)
Permissible applicable input:
Current input:
70 mA DC or less for input resistance of 100 Ω
40 mA DC or less for input resistance of 250 Ω
Voltage input: ±15 V DC or less

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Output signal: 2 points of DC current or DC voltage signals
Output-1 setting range:

Output signal suffix code	Setting range
A	0 to 20 mA DC Span is 2 mA or more
B	0 to 5 mA DC Span is 1 mA or more
1	0 to 10 V DC Span is 0.1 V or more
2	0 to 100 mV DC Span is 10 mV or more
3	±10 V DC Span is 0.2 V or more
4	±100 mV DC Span is 20 mV or more

Output-1 permissible load resistance:

Output range	Permissible load resistance
0 to 20 mA DC	750 Ω or less
0 to 5 mA DC	3000 Ω or less
0 to 5 V DC	2 kΩ or more
0 to 10 V DC	10 kΩ or more (when 100% output exceeds 5 V)
0 to 100 mV DC	250 kΩ or more
–10 to +10 V DC	10 kΩ or more
–100 to +100 mV DC	250 kΩ or more

Output-2 signal: 4 to 20 mA DC or 1 to 5 V DC
Output-2 permissible load resistance:

Output range	Permissible load resistance
4 to 20 mA DC	350 Ω or less
1 to 5 V DC	2 kΩ or more

Input adjustment range:
±1% of span or more (zero/span adjustments)
Output adjustment range:
±5% of span or more (zero/span adjustments)

■ Standard Performance

Accuracy rating: ±0.1% of span
However, the accuracy is not guaranteed for output levels less than 0.5% of the span of a 0 to X mA output range type. The accuracy is limited according to the input/output range settings.

- Accuracy Calculation
  Accuracy = Input accuracy + Output accuracy (%)
  (For Output-2, output accuracy = ±0.05%.)

  Accuracy is obtained by totalizing the expression (1) for input accuracy and the expression (2) for output accuracy. However, ±0.05% is applied if a value obtained from the expression (1) or (2) is less than ±0.05%.
  For current input, add the error of receiving resistor ±0.1% to the input accuracy.

Input accuracy = ±0.05% × a/b ··· expression (1)

Input signal suffix code	Input range (Range converted into voltage)	Accuracy calculation condition a	Accuracy calculation condition b
A B*1 1	Outside of ±2.5 V DC and within ±10 V DC	4 (V)	Input span (Span converted into voltage)
	±2.5 V DC	1 (V)	
B*2 2	Outside of ±0.5 V DC and within ±2 V DC	0.8 (V)	
	Outside of ±100 mV DC and within ±0.5 V DC	0.2 (V)	
	Outside of ±20 mV DC and within ±100 mV DC	40 (mV)	
	±20 mV DC	10 (mV)	

Note: When input signal is current, the values converted into voltage by the receiving resistor are applied to the input range and input span.
*1: For B ("/250Ω").
*2: For B (receiving resistor 100Ω).

Output-1 accuracy = ±0.05% × a/b ··· expression (2)

Output-1 signal suffix code	Output range	Accuracy calculation condition a	Accuracy calculation condition b
A	0 to 20 mA DC	10 (mA)	Output span
B	0 to 5 mA DC	2.5 (mA)	
1	0 to 2.5 V DC	1 (V)	
	Outside of 0 to 2.5 V DC and within 0 to 10 V DC	4 (V)	
2	0 to 25 mV DC	10 (mV)	
	Outside of 0 to 25 mV DC and within 0 to100 mV DC	40 (mV)	
3	±2.5 V DC	1 (V)	
	Outside of ±2.5 V DC and within ±10 V DC	4 (V)	
4	±25 mV DC	20(mV)	
	Outside of ±25 mV DC and within ±100 mV DC	40 (mV)	

[Example of accuracy calculation]

Input range: 0 to 20 mA DC

Receiving resistor: 250 Ω

(0 to 5 V DC when converted into voltage)

Output range: 20 to 40 mV DC

Input accuracy =

$$\pm 0.05\% \times \frac{4}{5} = \pm 0.04\% \longrightarrow \pm 0.05\%$$

(since it is less than ±0.05%)

Add ±0.1% (error of receiving resistor) to the above.

Then, Input accuracy = ±0.15%

Output accuracy = $\pm 0.05\% \times \frac{40}{20} = \pm 0.1\%$

Therefore, Accuracy = ±0.25%

Computation cycle: 100 ms (For the function suffix code "A", selectable from 50 ms, 100 ms and 200 ms.)
Response speed: 500 ms, 63% response (10 to 90%)
Effect of power supply voltage fluctuations:
Equal to or less than whichever is greater, ±0.1% of span or accuracy for the fluctuation within the operating range of each power supply voltage specification.
Effect of ambient temperature change:
±0.15% of span or less for a temperature change of 10°C.

■ Power Supply and Isolation

Power supply rated voltage: 15-40 V DC ⎓ or
100-240 V AC ~ 50/60 Hz
Power supply input voltage:
15-40 V DC ⎓ (±20%) or
100-240 V AC ~ (–15, +10%) 50/60 Hz
Power consumption:
24 V DC 2.3 W
100 V AC 4.6 VA, 200 V AC 6.4 VA
Insulation resistance:
100 MΩ or more at 500 V DC between input, output-1, output-2, power supply, and grounding terminals mutually.
Withstand voltage:
2000 V AC for 1 minute between input, (output-1, output-2), power supply and grounding terminals mutually.
1000 V AC for 1 minute between output-1 and output-2 terminals.

■ Environmental Conditions

Operating temperature range: 0 to 50°C
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 Dimensions

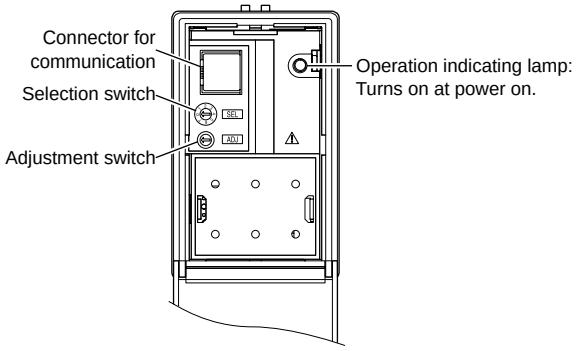
Material: Main unit : ABS resin (black), UL94 V-0
ABS resin + polycarbonate resin (black), UL94 V-0
PBT resin, including glass fiber (black), UL94 V-0
Socket: Modified polyphenylene oxide resin, including glass fiber (black), UL94 V-1
Mounting: Wall or DIN rail mounting (When mounting the units close together, leave a space of at least 5 mm between them.)
Connection: M3.5 screw terminals
External dimensions:
86.5 (H) × 51 (W) × 133 (D) mm (including a socket)
Weight: Main unit: approx. 200 g
Socket: approx. 80 g

■ Accessories

Spacer: One (for DIN rail mounting)
Range label: One
Receiving resistor: One (for current input)
* When the optional specification "/R250" is specified, the 250 Ω receiving resistor is attached. When the optional specification "/R250" is not specified, the 100 Ω receiving resistor is attached.

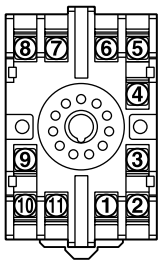
■ Front Panel

Output can be adjusted using the selection switch and adjustment switch.



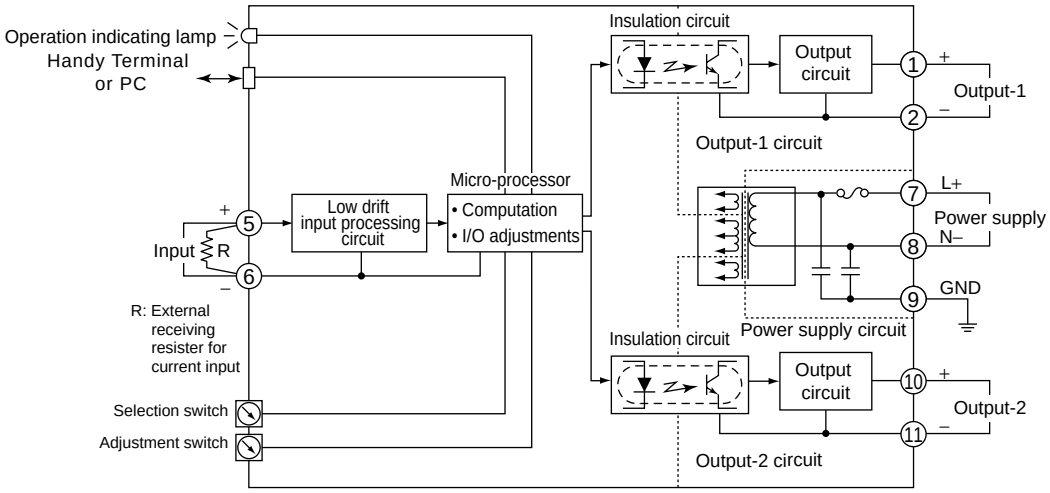
Position of selection switch	Item to be adjusted
0	No function
1	Output-1 zero adjustment
2	Output-1 span adjustment
3	Output-2 zero adjustment
4	Output-2 span adjustment
5	No function
6	No function
7	No function

■ Terminal Assignments



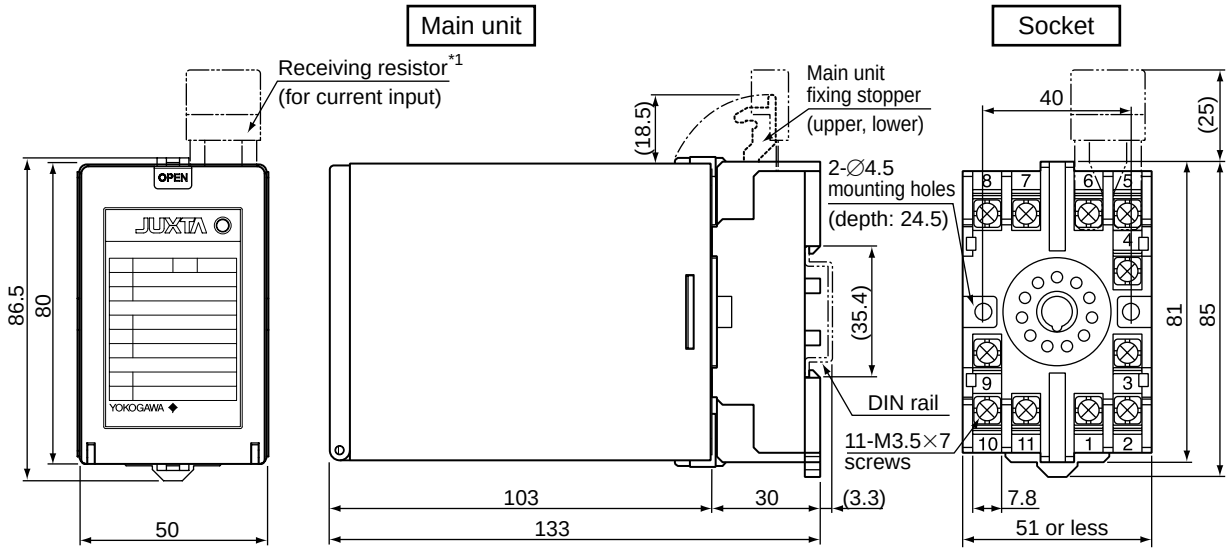
1	OUTPUT 1	(+)
2	OUTPUT 1	(−)
3	N.C.	
4	N.C.	
5	INPUT	(+)
6	INPUT	(−)
7	SUPPLY	(L+)
8	SUPPLY	(N−)
9	GND	(GND)
10	OUTPUT 2	(+)
11	OUTPUT 2	(−)

■ Block Diagram



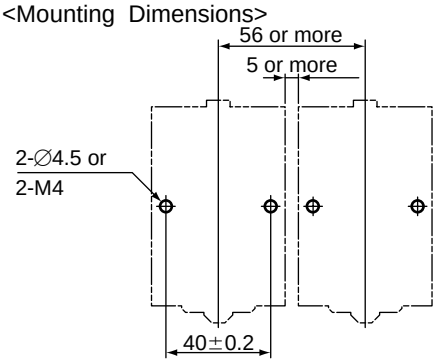
■ External Dimensions

Unit : mm



*1: The receiving resistor is supplied for the input signal suffix code "A" or "B."

<Mounting Dimensions>



Note:
- When mounting the units close together, leave a space of at least 5 mm between them.
- Use the supplied spacer to keep a space of 5 mm for DIN rail mounting.

Functions

● MXS-A Free Program

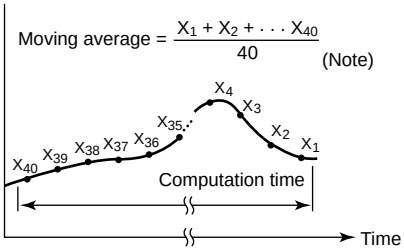
This computing unit is used to meet individual applications by programming the available commands.

Initial Setting

- Program: Outputs the value that corresponds to the input.

● MXS-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) (output 1 = Y1, output 2 = Y2). 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.



Note: For the moving-average times of 3, 2, and 1 second, the number of samplings is 30, 20, and 10, respectively (when the computation cycle is 100 ms).

Setting range of moving-average time:
0 to 320000 seconds
Number of significant digits: 4
Minimum unit: 1 second (however, 0.1 second for a setting of 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 first-order lag time constant: 1.0 to 799.0 seconds
Minimum unit: 0.1 second
However, when not using the first-order lag filter, set 0 second.

Setting accuracy of moving-average time and first-order lag time constant: (±5.0% of set value) ±1 second

Ordering Information

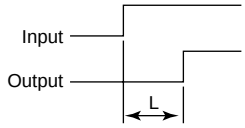
- Moving-average time: e.g. 10 seconds
  Number of significant digits: 4 (e.g. 123456 seconds unacceptable, 123400 seconds acceptable)
- First-order lag time constant: e.g. 20 second

● MXS-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 times of 3, 2, and 1 second, the number of samplings is 30, 20, and 10, respectively (when the computation cycle is 100 ms). The output between samplings is smoothed out by interpolation.

$$Y1=Y2=\frac{e^{-L[s]}}{1+T[s]}X$$

e.g. 0 → 100% step input



Setting range of dead time:
0 to 320000 seconds
Number of significant digits: 4
Minimum unit: 1 second (however, 0.1 second for a setting of 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 first-order lag time constant:
1.0 to 799.0 seconds
Minimum unit: 0.1 second
However, when not using the first-order lag filter, set 0 second.

Setting accuracy of dead time and first-order lag time constant:(±5.0% of set value) ±1 second

Ordering Information

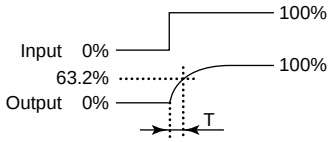
- Dead time: e.g. 10 seconds
  Number of significant digits: 4 (e.g. 123456 seconds unacceptable, 123400 seconds acceptable)
- First-order lag time constant: e.g. 20 second

● MXS-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).

$$Y1=Y2=\frac{1}{1+T[s]}X$$

e.g. 0 → 100% step input



Setting range of first-order lag time constant: 1.0 to 799.0 seconds
Minimum unit: 0.1 second

Setting accuracy of first-order lag time constant:
(±5.0% of set value) ±1 second

Ordering Information

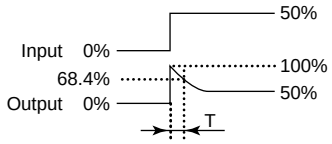
- First-order lag time constant: e.g. 10 seconds

● MXS-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).

$$Y1=Y2=(1+\frac{T[s]}{1+T[s]})X$$

e.g. 0 → 50% step input



Setting range of first-order lead time constant: 1.0 to 799.0 seconds
Minimum unit: 0.1 second
Setting accuracy of first-order lead time constant: (±5.0% of set value) ±1 second

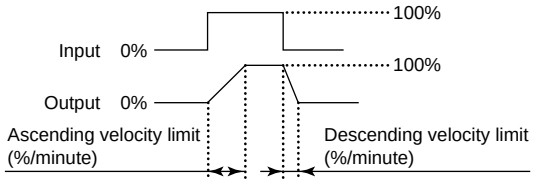
Ordering Information

• 1st-order lead time constant: e.g. 10 seconds

● MXS-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 than the limit, the unit outputs the input as is.

e.g. 0→ 100 → 0% step input



Setting range of velocity limit: 0.1 to 699.9%/minute
Minimum unit: 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).
Setting accuracy of velocity limit: (±5.0% of set value) ±0.1%/minute

Ordering Information

• Ascending velocity limit: e.g. 100%/minute
• Descending velocity limit: e.g. 100%/minute

● MXS-G Limiter

This computing unit serves as an ordinary computing unit 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 (output 1 = Y1, output 2 = Y2).

Setting range of upper and lower limits:
Upper limit: –6.0 to 106.0%, minimum unit is 0.01%.
Lower limit: –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.

Ordering Information

• Upper limit: e.g. 100%
• Lower limit: e.g. 0%
Number of significant digits: 4 (e.g. 12.345% unacceptable; 12.34, 1.23, 101.1% acceptable)

● MXS-H Velocity Computation

This computing unit calculates the input velocity by subtracting the input of the last velocity computation (X_L) from 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 to 320000 seconds
Number of significant digits: 4
Minimum unit: 1 second (however, 0.1 second for a setting of 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 first-order lag time constant: 1.0 to 799.0 seconds
Minimum unit: 0.1 second
However, when not using the first-order lag filter, set 0 second.
Setting accuracy of velocity computation time and first-order lag time constant: (±5.0% of set value) ±1 second

Ordering Information

• Velocity computation time: e.g. 20 seconds
Number of significant digits: 4 (e.g. 123456 seconds unacceptable, 123400 seconds acceptable)
• First-order lag time constant: e.g. 20 seconds

● MXS-J Linearizer (Optionally-set Line-segment Function)

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

Set the number of line segments by 1 to 20.

Breakpoint setting conditions:

Number of breakpoints: 21

Input breakpoints: $-6.0 \leq X_0$ to $X_{20} \leq 106.0\%$

Number of significant digits: 4

Minimum unit: 0.01%

$X_0 < X_1 < X_2 < \ldots < X_{20}$

Output breakpoints: $-6.0 \leq Y_0$ to $Y_{20} \leq 106.0\%$

Number of significant digits: 4

Minimum unit: 0.01%

When input $\leq X_0$, Y_0 is output.

When input $\geq$ final set value, the final set value of output is output.

Computation accuracy:

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

Ordering Information and Initial Settings

- Breakpoint data:
  Input: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 ⋯ 100%
  Output: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 ⋯ 100%
  Number of significant digits: 4 (e.g. 1.23456% unacceptable; 12.34, 1.23, 101.1% acceptable)
- Number of line segments: 20

<Work Sheet>

Model and suffix code: MXS- J□□□ - □ *B

Input (%)		Output (%)	
X_0		Y_0	
X_1		Y_1	
X_2		Y_2	
X_3		Y_3	
X_4		Y_4	
X_5		Y_5	
X_6		Y_6	
X_7		Y_7	
X_8		Y_8	
X_9		Y_9	
X_{10}		Y_{10}	
X_{11}		Y_{11}	
X_{12}		Y_{12}	
X_{13}		Y_{13}	
X_{14}		Y_{14}	
X_{15}		Y_{15}	
X_{16}		Y_{16}	
X_{17}		Y_{17}	
X_{18}		Y_{18}	
X_{19}		Y_{19}	
X_{20}		Y_{20}	

Number of line segments	

● MXS-K Ratio Setter

This computing unit sets the ratio by the following expression.

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

where Y1: Output-1 signal (%)
Y2: Output-2 signal (%)
X: Input signal (%)
K1: Ratio (no unit)
A1, A2: Bias (%)

Setting range of ratio:

−320 to 320

Number of significant digits: 4

Minimum unit: 0.00001

Setting range of bias:

−32000 to 32000%

Number of significant digits: 4

Minimum unit: 0.001%

Computation accuracy:

±0.1% (However, when the ratio is 1 or less.)

Ordering Information and Initial Settings

- Ratio: K1 = 1
  Bias: A1 = 0%, A2 = 0%
  Number of significant digits: 4 (e.g. 1.23456 unacceptable; 12.34, 1.234, 0.01234 acceptable)

- The information covered in this document is subject to change without notice for reasons of improvements in quality and/or performance.