General Specifications

Model MA5D
Distributor
(2-output, Free Range Type)

GS 77J04A05-02E

■ General

The MA5D is a plug-in type distributor that is used in combination with a two-wire type transmitter to convert the transmitter's 4 to 20 mA DC signals into isolated DC current or DC voltage signals.

- Output range setting, selection of square root extractor and breakpoint linearization (breakpoint setting), I/O adjustment, I/O monitoring, and loop back test can be made using the optional Parameter Setting Tool (VJ77) or Handy Terminal (JHT200).
- The operation indicating lamp shows the operation status, abnormalities in a setting etc.
- I/O adjustment can be made using the switches on the front panel of the MA5D without a setting tool such as Handy Terminal.
- Supports BARD-800 and -810.

■ Model and Suffix Codes

MA5D - □2□ -A□□□ /□

Model

Type
- 0: General use
- 1: MA1W, MA6W type
  (same as the MA1W, MA6W terminal assignments)

Output
- 2: 2 outputs

Power supply
- 1: 15-40 V DC (Operating range: 12 to 48 V)
- 6: 100-240 V AC/DC (Operating range: 85 to 264 V)

Input signal
- A: 4 to 20 mA DC

Output-1 signal

A: 0 to 20 mA DC	Span is 5 mA or more
B: 0 to 5 mA DC	Span is 1 mA or more
1: –10 to +10V DC	Span is 0.1 V or more
2: –100 to +100 mV DC	Span is 10 mV or more

- Z: (Custom order)
  Customized current signals or voltage signals

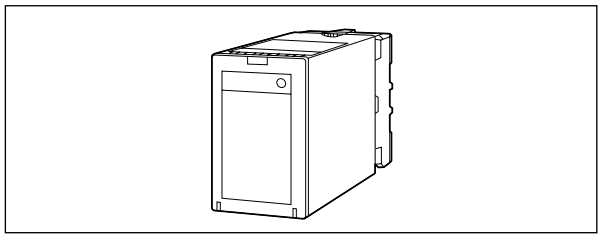
Output-2 signal

A: 4 to 20 mA DC	1: 0 to 10 mV DC
B: 2 to 10 mA DC	2: 0 to 100 mV DC
C: 1 to 5 mA DC	3: 0 to 1 V DC
D: 0 to 20 mA DC	4: 0 to 10 V DC
E: 0 to 16 mA DC	5: 0 to 5 V DC
F: 0 to 10 mA DC	6: 1 to 5 V DC
G: 0 to 1 mA DC	7: –10 to +10 V DC

- Z: (Custom order)
  Customized current signals or voltage signals
  * See " Customized Signal Specifications."

Breakpoint linearization
- 0: Not available
- 1: Available

Optional specification
- /SN: Without socket



■ Ordering Information

Specify the following when ordering.
- Model and suffix codes: e.g. MA5D-026-AAA0
- Output-1 range: e.g. 4 to 20 mA DC

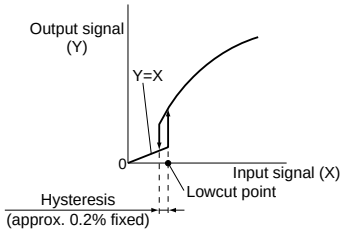
Specify a lowcut point when "with square root extractor" is required: e.g. Lowcut point 0.4%
The distributor will be shipped with a lowcut point of 0.6% if no specification of lowcut point.
Specify breakpoints in Work Sheet when linearization is required.

■ Input/Output Specifications

Input signal: 4 to 20 mA DC signal from transmitter
Input resistance: 250 Ω
Transmitter power supply: 25.25±0.25 V DC (provided with a current limiter to keep the current between 25 and 35 mA)
Allowable conductor resistance (RL): Up to [(20 – transmitter's minimum operating voltage) V/0.02 A] Ω
Maximum allowable input: 40 mA DC
Square root extractor: Outputted against the result of extracting square root of input.

$$Y=\left(\sqrt{\frac{X-(\text{input 0 \% value})}{\text{input span}}}\right)\times(\text{output span})+(\text{output 0 \% value})$$

Lowcut point setting range: 0.3 to 100% of input, setting available by 0.1% notch
Output characteristic: Output for lowcut point or less is cramped with straight line proportional to input.



Output signal: 2 points of DC current or DC voltage signals

Output-1 signal setting range:

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

Allowable load resistance:

Voltage output: (Common to output-1 and output-2)
2 kΩ or more for ±5 V DC
10 kΩ or more for ±10 V DC
250 kΩ or more for ±100 mV DC

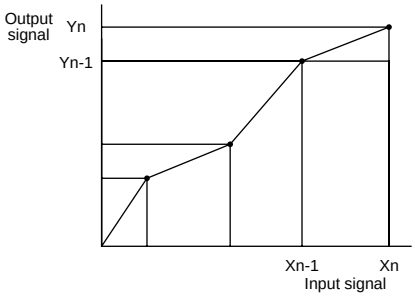
Current output:
Output-1: 15 (V)/max. output (A) (Ω) or less
Output-2: 7 (V)/max. output (A) (Ω) or less

Linearization:

Breakpoint: Up to 32 points (Set a relationship between input and output with % value over the span.)

Allowable setting range of breakpoint: –6 to +106% (both input and output)

- With 4 significant digits; can be set to the second place of a decimal point.
- Set breakpoints according to the following.
  For input: $-6.0\% \leqq X_0 < X_1 < X_2 \cdots X_{n-1} < X_n \leqq 106.0\%$
  For output: $-6.0\% \leqq Y_0$ to $Y_n < 106.0\%$



Adjustment range: (Common to output-1 and output-2)
Input adjustment: ±1% of span or more (Zero/Span)
Output adjustment: ±5% of span or more (Zero/Span)

■ 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.
For square root extractor input, ±1% of span when the input is 2% or less.

The accuracy is limited according to the output-1 range setting.

- Accuracy Calculation

Accuracy = Input accuracy + Output accuracy (%)
(Output accuracy for output-2 is ±0.05%.)
Input accuracy: ±0.05%
Compare the specified output-1 range with the output-1 range in the table below (narrower range) and choose accuracy calculation conditions.

Output-1 accuracy = ±0.05% × a/b

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

However, ±0.05% is applied if an output-1 accuracy obtained from the expression is less than ±0.05%.
If 1 or more is set for the line segment gain of linearization, multiply the input/output accuracy by the value of line segment gain.
Line segment gain (slope) is the maximum value calculated from the following expression.

$$\text{Line segment gain} = \frac{Y_n - Y_{n-1}}{X_n - X_{n-1}}$$

Response speed: 150 ms, 63% response (10 to 90%)

Effect of power supply voltage fluctuations:
±0.1% of span or less 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/DC ≂ 50/60 Hz
Power supply input voltage:
15-40 V DC ⎓ (±20%) or
100-240 V AC/DC ≂ (–15, +20%) 50/60 Hz
Power consumption:
24 V DC 3.5 W, 110 V DC 3.4 W
100 V AC 6.5 VA, 200 V AC 8.7 VA
Insulation resistance:
100 MΩ at 500 V DC between input, output, power supply, and grounding terminals mutually.
Withstand voltage:
2000 V AC for 1 minute between input, output, 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

Construction: Plug-in type
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
Connection: M3.5 screw terminals
External dimensions: 86.5 (H)×51 (W)×123 (D) mm (including a socket)
Weight: Main unit: approx. 200 g
Socket: approx. 80 g

■ Accessories

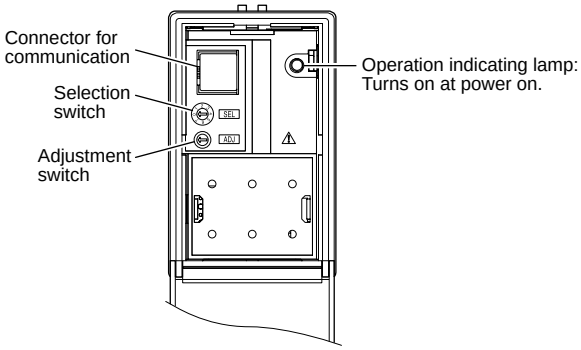
Spacer: One (for DIN rail mounting)
Range label: One

■ Customized Signal Specifications

Output-2	Current signal	Voltage signal
Output range (DC)	0 to 20 mA	–10 to +10 V
Span (DC)	1 to 20 mA	10 mV to 20 V

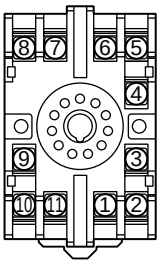
■ Front Panel

Input/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	Input zero adjustment
6	Input span adjustment

■ Terminal Assignments



MA5D - 02□-A□□□

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

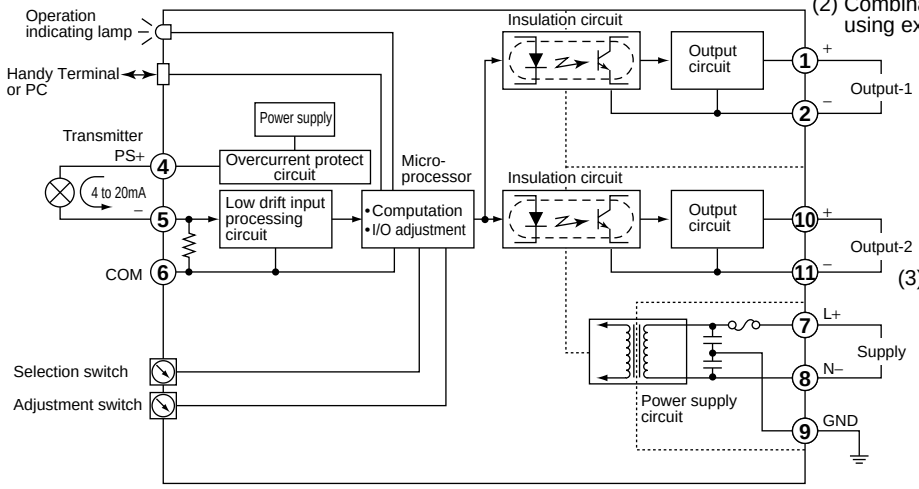
MA5D - 12□-A□□□

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

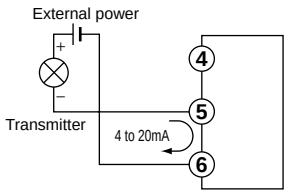
■ Block Diagrams

MA5D-02□-A□□□

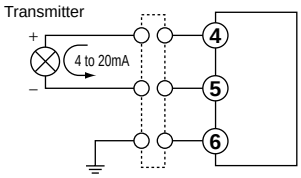
(1) Combination with two-wire type transmitter using internal power supply



(2) Combination with two-wire type transmitter using external power supply

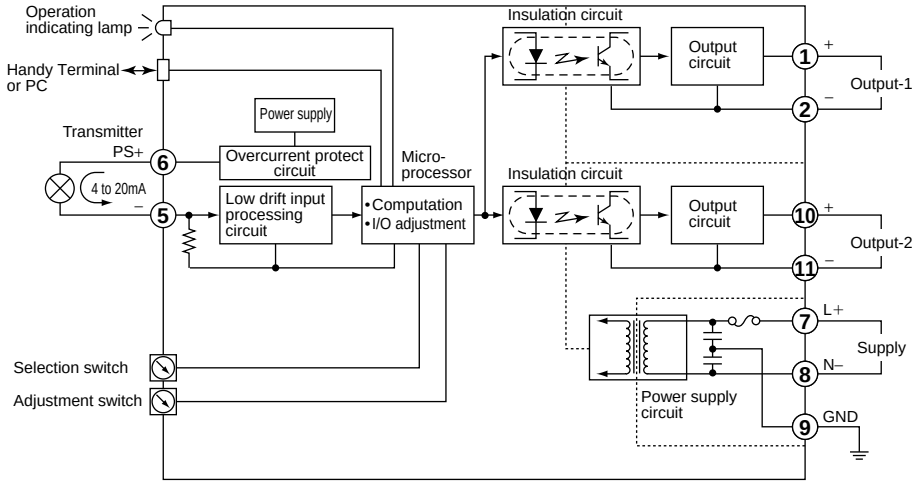


(3) Example to construct Intrinsically Safe System using Zener Barrier



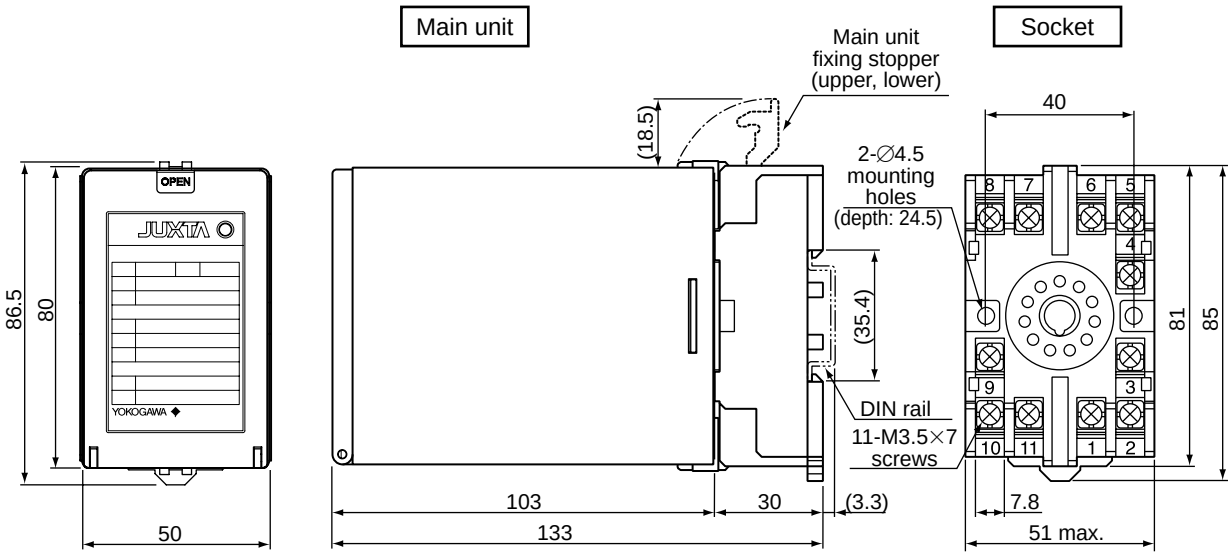
MA5D-12□-A□□□

(1) Combination with two-wire type transmitter using internal power supply

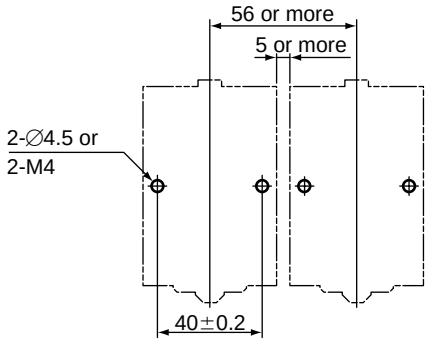


External Dimensions

Unit: mm



<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.

■ Work Sheet

Model and Suffix Codes

Number of breakpoints _____

Write at least 2 points for input and output breakpoints data.

Input (%)		Output (%)		Input (%)		Output (%)	
X_0		Y_0		X_{16}		Y_{16}	
X_1		Y_1		X_{17}		Y_{17}	
X_2		Y_2		X_{18}		Y_{18}	
X_3		Y_3		X_{19}		Y_{19}	
X_4		Y_4		X_{20}		Y_{20}	
X_5		Y_5		X_{21}		Y_{21}	
X_6		Y_6		X_{22}		Y_{22}	
X_7		Y_7		X_{23}		Y_{23}	
X_8		Y_8		X_{24}		Y_{24}	
X_9		Y_9		X_{25}		Y_{25}	
X_{10}		Y_{10}		X_{26}		Y_{26}	
X_{11}		Y_{11}		X_{27}		Y_{27}	
X_{12}		Y_{12}		X_{28}		Y_{28}	
X_{13}		Y_{13}		X_{29}		Y_{29}	
X_{14}		Y_{14}		X_{30}		Y_{30}	
X_{15}		Y_{15}		X_{31}		Y_{31}	

(Specification conditions)

Input conditions: $-6.0\% \leqq X_0 < X_1 < X_2 < \cdots\cdots X_{n-1} < X_n \leqq 106.0\%$

Output conditions: $-6.0\% \leqq (Y_0 \text{ to } Y_n) \leqq 106.0\%$