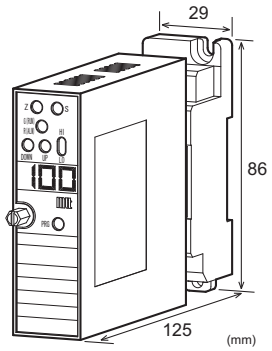
Slim Plug-In Temperature/Pressure Compensator with Isolated Single Output

DESCRIPTION

The MS3767 is a slim, plug-in temperature/pressure compensator that compensates for variations in temperature, pressure, or differential pressure for accurate flow rate calculation and provides an isolated single output.



ORDERING CODE

MS3767 □ - □ - □ □

Model

Equation

- **A**: Temperature/Pressure compensation
- **B**: Temperature compensation
- **D**: Temperature/Pressure compensation (w/o square-root extraction of IN1)
- **E**: Temperature compensation (w/o square-root extraction of IN1)
- **F**: Temperature/Pressure compensation (w/o square-root extraction)
- **G**: Temperature compensation (w/o square-root extraction)

Power Supply

- **A**: 100 to 240V AC (50 to 60Hz)
- **D**: 24V DC
- **P**: 100 to 240V DC

Input

- **A**: 4 to 20mA DC
- **B**: 2 to 10mA DC
- **C**: 1 to 5mA DC
- **D**: 0 to 20mA DC
- **E**: 4 to 20mA DC *1
- **H**: 10 to 50mA DC
- **Z**: Other DC current signals
- **3**: 0 to 1V DC
- **4**: 0 to 10V DC
- **5**: 0 to 5V DC
- **6**: 1 to 5V DC
- **4W**: ±10V DC
- **5W**: ±5V DC
- **0**: Other DC voltage signals

*1: Shunt resistor 50Ω

Output

- **A**: 4 to 20mA DC
- **D**: 0 to 20mA DC
- **Z**: Other DC current signals
- **1**: 0 to 10mV DC
- **2**: 0 to 100mV DC
- **3**: 0 to 1V DC
- **4**: 0 to 10V DC
- **5**: 0 to 5V DC
- **6**: 1 to 5V DC
- **3W**: ±1V DC
- **4W**: ±10V DC
- **5W**: ±5V DC
- **0**: Other DC voltage signals

Options

- **No code**: None
- **/H**: Polyurethane conformal coating
- **/X**: Others (Special order)

* For non-standard options, ask MTT for availability.

ORDERING INFORMATION

To place an order, please use the ordering code format as shown on the left, and also our Specification Order Form.

(e.g.) MS3767A-A-66 (Specification Order Form)

* For details, refer to page 4.

Other Ordering Examples:
For an input code of "Z": MS3767A-A-ZA (Input: 8 to 20mA)
For an output code of "0": MS3767A-A-A0 (Output:2 to 5V)

SPECIFICATIONS

●POWER SECTION

Power Requirements	100 to 240V AC: 85 to 264V AC (47 to 63Hz) 24V DC: 24V DC±10% 100 to 240V DC: 85 to 264V DC
Power Sensitivity	Better than ±0.1% of span for each power supply range.
Power Line Fuse	160mA fuse is installed (standard).

Power Consumption

Power	100-240V AC	24V DC	100-240V DC
	5.5VA max	1.6W max	6.0W max

●INPUT SECTION

Input Resistance

Voltage Input (DC)	With or without power: 1MΩ min.	
Current Input (DC)	4 to 20mA (std.)	250Ω
	2 to 10mA	250Ω
	1 to 5mA	100Ω
	0 to 20mA	250Ω
	10 to 50mA	10Ω

Allowable Input Voltage

Voltage Input Model	30V DC max., continuous (Standard for a span up to 10V)
Current Input Model	40mA DC max., continuous (Standard for 4 to 20mA)

Input Range	0 to 120% Note: Any input signal under 0% is assumed to be 0%, while any input signal over 120% is assumed to be 120%.

Ranges Available

	Current Signal	Voltage Signal
Input Range (DC)	-100 to 100mA	-300 to 300V
Input Span (DC)	100μA[*1] to 200mA	200mV[*2] to 600V
Input Bias	-100 to 100%	-100 to 100%

Note: For any input range including negative input signals, the input spans for current and voltage signals range from [*1]200μA to 200mA and [*2]400mV to 600V, respectively.

Input Spec. Ex. 1: For 3 to 8V input, the input span is 5V and the bias +60%.

Input Spec. Ex. 2: For -5 to 0V input, the input span is 5V and the bias -100%.

●OUTPUT SECTION

Allowable Output Load		
Voltage Output (DC)	1V span and up	2mA max.
	10mV	10kΩ min.
	100mV	100kΩ min.
Current Output (DC)	4 to 20mA	750Ω max.
Zero Adjustment	Approx. ±5% of span. (Adjustable by the front-accessible trimmer.)	
Span Adjustment	Approx. ±5% of span. (Adjustable by the front-accessible trimmer.)	
Accuracy for Setting Dropout Range	±0.5% of span (set value) Better than -0.4% of span (hysteresis)	
Accuracy for Output Clamping Level	Better than ±0.5% of span.	

Ranges Available

	Current Signal	Voltage Signal
Output Range (DC)	0 to 20mA	-10 to 10V
Output Span (DC)	4 to 20mA	10mV to 20V
Output Bias	0 to 100%	-100 to 100%

Note: For current output signals, the accuracy of any current output smaller than 0.1mA is not guaranteed.

Output Spec Ex. 1: For 4 to 20mA output, the output span is 16mA and the bias +25%.

Output Spec Ex. 2: For -1 to 4V output, the output span is 5V and the bias -20%.

●PERFORMANCE

Equations

Temperature/Pressure Compensation:

$$X_0=\sqrt{\frac{T_B+273.15}{((T_F-T_Z)\cdot X_2+T_Z)+273.15}\cdot\frac{((P_F-P_Z)\cdot X_3+P_Z)+101.32}{P_B+101.32}}\cdot X_1$$

Temperature/Pressure Compensation (without square-root extraction of IN1):

$$X_0=\sqrt{\frac{T_B+273.15}{((T_F-T_Z)\cdot X_2+T_Z)+273.15}\cdot\frac{((P_F-P_Z)\cdot X_3+P_Z)+101.32}{P_B+101.32}}\cdot X_1$$

Temperature/Pressure Compensation (without square-root extraction):

$$X_0=\frac{T_B+273.15}{((T_F-T_Z)\cdot X_2+T_Z)+273.15}\cdot\frac{((P_F-P_Z)\cdot X_3+P_Z)+101.32}{P_B+101.32}\cdot X_1$$

Temperature Compensation:

$$X_0=\sqrt{\frac{T_B+273.15}{((T_F-T_Z)\cdot X_2+T_Z)+273.15}}\cdot X_1$$

Temperature Compensation (without square-root extraction of IN1):

$$X_0=\sqrt{\frac{T_B+273.15}{((T_F-T_Z)\cdot X_2+T_Z)+273.15}}\cdot X_1$$

Temperature Compensation (without square-root extraction):

$$X_0=\frac{T_B+273.15}{((T_F-T_Z)\cdot X_2+T_Z)+273.15}\cdot X_1$$

X_0: Calculated output (%)
X_1: Differential pressure input (IN1) (%)
X_2: Temperature input (IN2) (%)
X_3: Pressure input (IN3) (%)
T_B: Reference temperature for compensation (°C)
T_Z: Temperature input 0% (°C)
T_F: Temperature input 100% (°C)
P_B: Reference pressure for compensation (kPa)
P_Z: Pressure input 0% (kPa)
P_F: Pressure input 100% (kPa)

Accuracy Rating	Input accuracy: ±0.1% of span Output accuracy: ±0.2% of span
Temperature Effect	Better than ±0.2% of span per 10°C change in ambient.
Response Time	1s max. (0 to 90%) with a step input at 100%.
CMRR	100dB min. (500V AC, 50/60Hz)
Isolation	3-way isolation between input, output, and power.
Insulation Resistance	100MΩ min. (@ 500V DC) between input, output, power, and ground.
Dielectric Strength	Input / Output / [Power, Ground]: 2000V AC for 1 minute (Cutoff current: 0.5mA) Power / Ground: 2000V AC for 1 minute (Cutoff current: 5mA)
Surge Withstand Capability	Tested as per ANSI/IEEE C37.90.1-1989
Operating Environment	Ambient temperature: -5 to 55°C Humidity: 5 to 90% RH (non-condensing)
Storage Temperature	-10 to 60°C

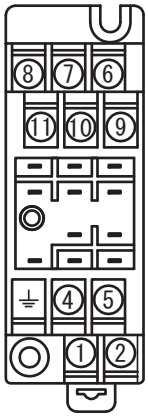
●PHYSICAL

Installation	Wall/DIN rail mounting
Wiring	M3.5 screw terminal connection (with a power terminal block cover & drop-proof screws)
Screwing Torque	0.8 to 1.0 [Nm] * Recommended
External Dimensions	W29 × H86 × D125 mm (including the mounting screw and socket)
Weight	Main unit: 130g max. Socket: 80g max.

●MATERIAL

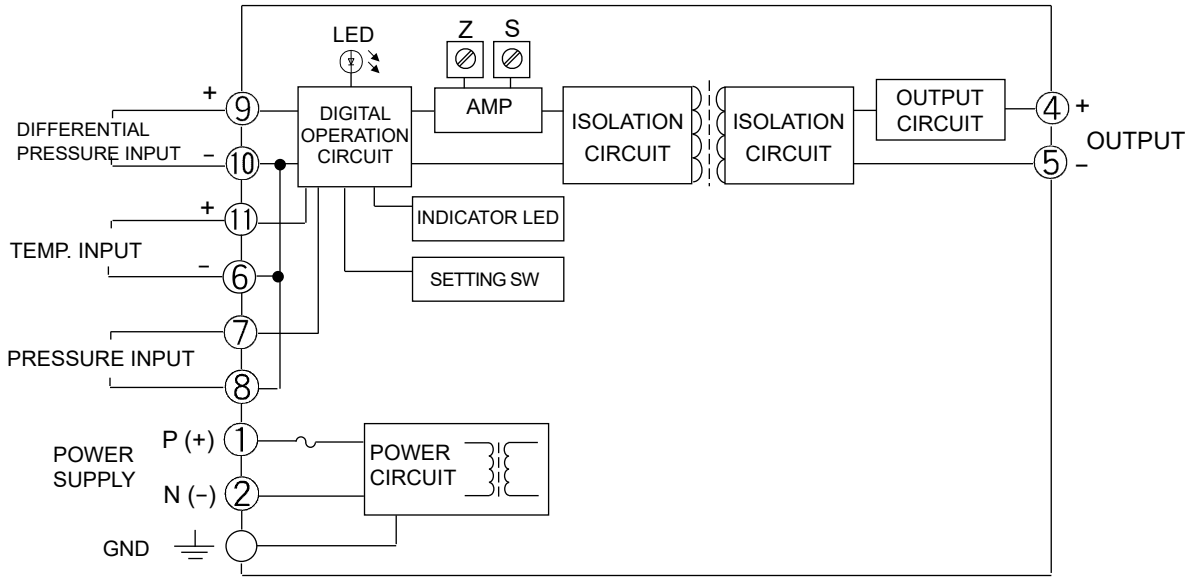
Housing	ABS resin (UL 94V-0)
Terminal Block	PBT resin (UL 94V-0)
Terminal Block Cover	PC resin (UL 94V-2)
DIN Rail Stopper	PP resin (UL 94HB)
Screw Terminal	Nickel-plated steel
Contacts Material and Finish	Brass with 0.2μm gold plating
Printed Circuit Board	Glass fabric, epoxy resin (FR-4: UL 94V-0)

TERMINAL ASSIGNMENTS

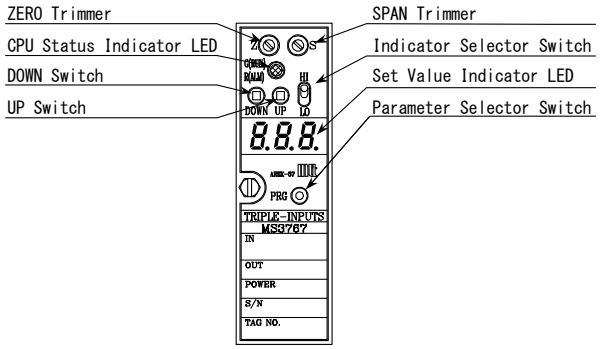


①	P (+) POWER
②	N (−)
⏚	GND
④	+ OUTPUT
⑤	− OUTPUT
⑥	− INPUT 2 (Temp. input)
⑦	+ INPUT 3 (Pressure input)
⑧	− INPUT 3 (Pressure input)
⑨	+ INPUT 1 (Differential pressure input)
⑩	− INPUT 1 (Differential pressure input)
⑪	+ INPUT 2 (Temp. input)

BLOCK DIAGRAM



FRONT VIEW



Reference temperature for compensation (Example: 100.00°C)
* Range available: -250.00 to 999.99°C; Default: 0.00°C
Reference pressure for compensation (Example: 101.32kPa)
* Range available: 0 to 9999.99kPa; Default: 0.00kPa
Input temperature range for compensation (Example: 0 to 250°C)
* Range available: -250.00 to 999.99°C, with a minimum span of 100.00°C; Default: 0 to 100.00°C
Input pressure range for compensation (Example: 0 to 1000.00kPa)
* Range available: 0 to 9999.99kPa, with a minimum span of 10.00kPa; Default: 0 to 101.32kPa
Dropout level (Example: 5%)
* Range available: 5 to 15%; Default: 10%
Note: Set values have a hysteresis of approx. -0.4%.
Output clamping level (Example: 2%)
* Range available: 0 to 10% (Below dropout setting); Default: 0%

ADDITIONAL ORDERING INFORMATION

Temperature/Pressure Compensation:

$$X_0=\sqrt{\frac{T_B+273.15}{((T_F-T_Z)\cdot X_2+T_Z)+273.15}\cdot\frac{((P_F-P_Z)\cdot X_3+P_Z)+101.32}{P_B+101.32}}\cdot X_1$$

Temperature/Pressure Compensation (without square-root extraction of IN1):

$$X_0=\sqrt{\frac{T_B+273.15}{((T_F-T_Z)\cdot X_2+T_Z)+273.15}\cdot\frac{((P_F-P_Z)\cdot X_3+P_Z)+101.32}{P_B+101.32}}$$

Temperature/Pressure Compensation (without square-root extraction):

$$X_0=\frac{T_B+273.15}{((T_F-T_Z)\cdot X_2+T_Z)+273.15}\cdot\frac{((P_F-P_Z)\cdot X_3+P_Z)+101.32}{P_B+101.32}\cdot X_1$$

X_0: Calculated output (%)
X_1: Differential pressure input (IN1) (%)
X_2: Temperature input (IN2) (%)
X_3: Pressure input (IN3) (%)
T_B: Reference temperature for compensation (°C)
T_Z: Temperature input 0% (°C)
T_F: Temperature input 100% (°C)
P_B: Reference pressure for compensation (kPa)
P_Z: Pressure input 0% (kPa)
P_F: Pressure input 100% (kPa)

	Item	User Specified	Unit	Example	Range Available	Default
1	Reference temperature for compensation		°C	100.00°C	-250.00 to 999.99°C	0.00°C
2	Reference pressure for compensation		kPa	101.32kPa	0 to 9999.99kPa	0.00kPa
3	Input temperature range for compensation		°C	0 to 250°C	-250.00 to 999.99°C	0 to 100.00°C
4	Input pressure range for compensation		kPa	0 to 1000.00kPa	0 to 9999.99kPa	0 to 101.32kPa
5	Dropout level		%	5%	5 to 15%	10%
6	Output clamping level		%	2%	0 to 10%	0%

Temperature Compensation:

$$X_0=\sqrt{\frac{T_B+273.15}{((T_F-T_Z)\cdot X_2+T_Z)+273.15}}\cdot X_1$$

Temperature Compensation (without square-root extraction of IN1):

$$X_0=\sqrt{\frac{T_B+273.15}{((T_F-T_Z)\cdot X_2+T_Z)+273.15}}\cdot X_1$$

Temperature Compensation (without square-root extraction):

$$X_0=\frac{T_B+273.15}{((T_F-T_Z)\cdot X_2+T_Z)+273.15}\cdot X_1$$

X_0: Calculated output (%)
X_1: Differential pressure input (IN1) (%)
X_2: Temperature input (IN2) (%)
T_B: Reference temperature for compensation (°C)
T_Z: Temperature input 0% (°C)
T_F: Temperature input 100% (°C)

	Item	User Specified	Unit	Example	Range Available	Default
1	Reference temperature for compensation		°C	100.00°C	-250.00 to 999.99°C	0.00°C
2	Input temperature range for compensation		°C	0 to 250°C	-250.00 to 999.99°C	0 to 100.00°C
3	Dropout level		%	5%	5 to 15%	10%
4	Output clamping level		%	2%	0 to 10%	0%

LED STATUS INDICATORS

●INDICATOR PATTERNS

No.	Event	Set Value Indicator (7-segment LED)	CPU Status Indicator LED	Output	Recovery Operation
1	Power ON or start of constant setting	Blinks 3 times (1 s ON - 0.5 s OFF cycle), then displays an equation code for 1 second.	Green LED turns ON for 1 second, and then red LED turns ON for 0.5 second. This cycle is repeated 3 times.	Normal	–
2	Normal operation	OFF	Green LED is ON.	Normal	–
3	Dropout operation	OFF	Red and green LEDs alternately blink at 1 second intervals.	Clamp value	–
4	Constant setting	Constant	Red LED blinks at 1 second intervals when the constant is positive; Green LED blinks at 1 second intervals when it is negative.	Value before setting	End of setting
5	DAC error	Error code: 1	Red LED is ON.	Typically 0%, but may vary.	None
6	Internal parameter error	Error code: 2	Red LED is ON.	Typically 0%, but may vary.	None
7	Equation parameter error	Error code: 4	Red LED is ON.	Typically 0%, but may vary.	Reconfiguration
8	Temperature constant parameter error	Error code: 8	Red LED is ON.	Typically 0%, but may vary.	Reconfiguration
9	Pressure constant parameter error	Error code: 16	Red LED is ON.	Typically 0%, but may vary.	Reconfiguration
10	Dropout/clamping parameter error	Error code: 32	Red LED is ON.	Typically 0%, but may vary.	Reconfiguration
11	System error	Not defined.	Red LED is ON; Green LED is not defined.	Typically 0%, but may vary.	None

Notes:
No. 1: When the Set Value Indicator is tuned ON, a 3-digit number “888” with dots is displayed.
No. 5 - 10: If multiple errors occur, the sum of error code numbers is displayed.
No. 11: The red LED may fail to light up.