

**DESCRIPTION**

The MS3705HB is a slim, plug-in digital alarm setter (with high accuracy) that compares the levels of DC current or voltage signals with two set-points (upper and lower limits) and outputs two independent isolated relay contact closure signals.

**ORDERING CODE**

**MS3705HB -**  -

**Model** \_\_\_\_\_

**Power Supply** \_\_\_\_\_

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

**Input** \_\_\_\_\_

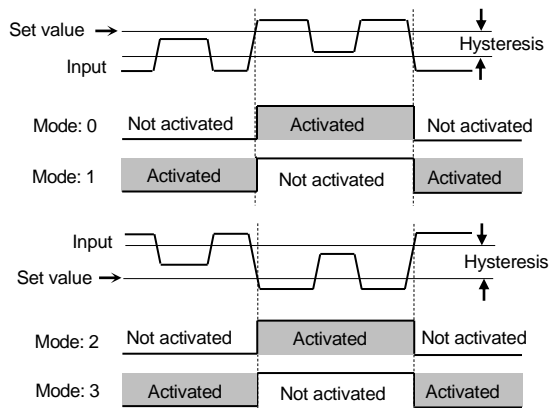
**A:** 4 to 20mA DC                      **3:** 0 to 1V DC  
**B:** 2 to 10mA DC                      **4:** 0 to 10V DC  
**C:** 1 to 5mA DC                        **5:** 0 to 5V DC  
**D:** 0 to 20mA DC                      **6:** 1 to 5V DC  
**E:** 4 to 20mA DC\*1                    **4W:** ±10V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

\*1: Shunt resistor 50Ω

**Relay Activation Modes for Output 1&2**

Mode of operation for each channel can be selected from the following:

<b>0:</b>	Input > Set value	Relay activated
	Input < (Set value – Hysteresis)	Relay not activated
<b>1:</b>	Input > Set value	Relay not activated
	Input < (Set value – Hysteresis)	Relay activated
<b>2:</b>	Input > (Set value + Hysteresis)	Relay not activated
	Input < Set value	Relay activated
<b>3:</b>	Input > (Set value + Hysteresis)	Relay activated
	Input < Set value	Relay not activated



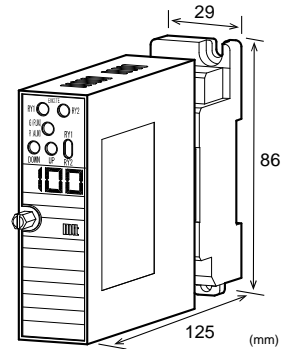
Note: The mode of operation can be changed by the switch on the front panel.

**Options**

**No code:** None

**/X:** 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.

(e.g.) MS3705HB-A-602

\* The factory default settings are as follows:

**Output 1:**  
 Relay activation mode: 0  
 Trip point: 50%  
 Hysteresis: 1.0%

**Output 2:**  
 Relay activation mode: 2  
 Trip point: 50%  
 Hysteresis: 1.0%

See also the default settings on page 5.

**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
	7.0VA max	2.2W max	8.4W 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 20mV)

Ranges Available		
	Current Signal	Voltage Signal
Input Range (DC)	-100 to 100mA	-300 to 300V
Input Span (DC)	100 $\mu$ A <sup>(*)</sup> to 200mA	200mV <sup>(*)</sup> 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 <sup>(\*)</sup>200 $\mu$ A to 200mA and <sup>(\*)</sup>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

Output Signal	Two independent form C relay contact closure signals
Trip Point Setting	Through the front-accessible rotary switch.
Range	0 to 105% of span (in steps of 0.1%; in steps of 1% for the range over 100%).
Accuracy	Better than $\pm 0.1\%$ of span.
Hysteresis	0.5 to 50.0% $\pm 0.1\%$ of span. (Adjustable by the front-accessible switch.)

Note: The upper and lower hysteresis limits are respectively 110% and -10% of span.

Relay Status Indicator LED	The red LED light up when the relay is activated.
Relay Activation without Power	COM and NC are closed for each output.
Relay Start-up Limitation	Standard: The relay gets ready for action about 2 seconds after power-up.

Note: Non-standard limitation is also available upon request when ordering. It should be between 1 and 60 seconds.

● PERFORMANCE

Temperature Effect	Better than $\pm 0.15\%$ of span per 10°C change in ambient.
Response Time	150ms max. (0 to 90%) with a step input at 100%.
Relay Trip Point Indicator	Red LED, digit height 8.0mm, 3 digits.
Isolation	Isolation between input, output 1, output 2, power, and ground.
Insulation Resistance	100M $\Omega$ min. (@ 500V DC) between input, output 1, output 2, power, and ground.
Dielectric Strength	Input / Output 1 / Output 2 / [Power, Ground]: 2000V AC for 1 minute (Cutoff current: 0.5mA) Power / Ground: 2000V AC for 1 minute (Cutoff current: 5mA)
Relay Contact	
Rated Load	5A 125V AC, 5A 30V DC
Maximum Allowable Voltage	250V AC, 30V DC
Maximum Allowable Current	5A (NO) / 3A (NC)

Electrical Life	5A, 250V AC (NO): $50 \times 10^3$ cycles (Frequency: 1,800 cycles/h) 5A, 30V DC: $100 \times 10^3$ cycles (Frequency: 1,800 cycles/h)
Mechanical Life	$5 \times 10^6$ cycles (Frequency: 18,000 cycles/h)
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

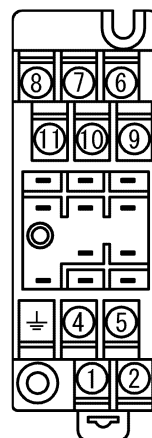
Installation	Wall/DIN rail mounting
Wiring	M3.5 screw terminal connection (with a power terminal block cover & drop-proof screws)
Screwing Torque	0.8 to 1.0 [Nm] * Recommended
External Dimensions	W29 x H86 x D125mm (including the mounting screw and socket)
Weight	Main unit: 130g max. Socket: 80g max.

● MATERIALS

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 0.2 $\mu$ m gold plating
Printed Circuit Board	Glass fabric epoxy resin (FR-4: UL 94V-0)
Conformal Coating	HumiSeal® 1A27NS (Polyurethane)

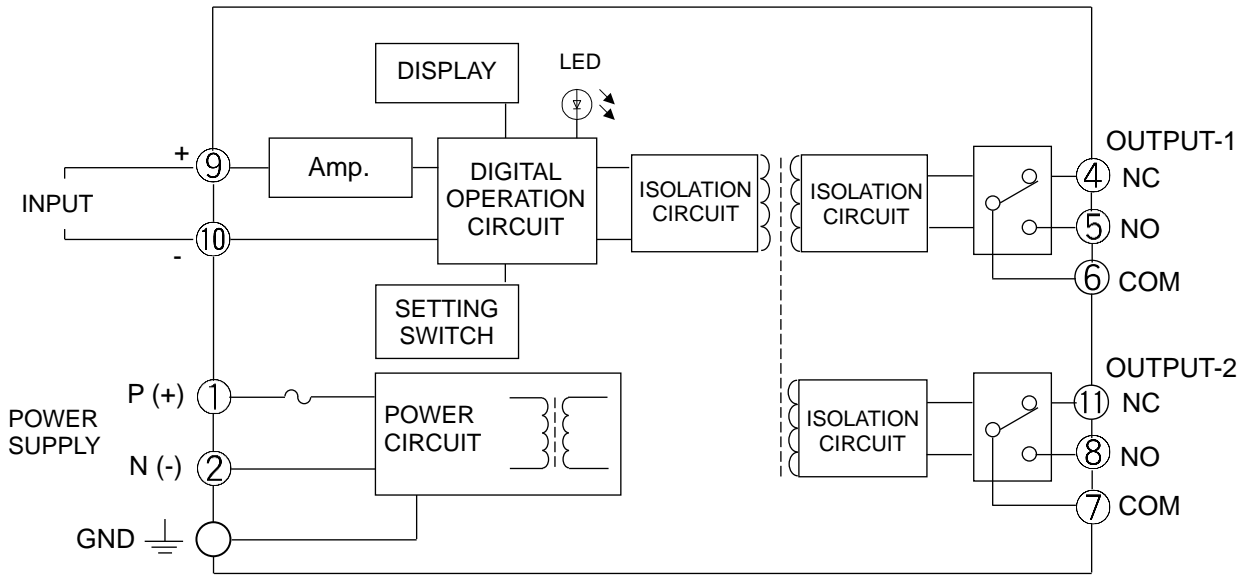
\* HumiSeal® is a registered trademark of Chase Corporation.

TERMINAL ASSIGNMENT



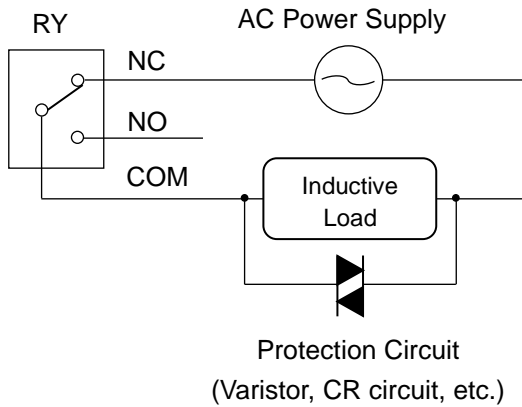
①	P (+)	POWER
②	N (-)	
⊥	GND	
④	NC OUT 1	
⑤	NO OUT 1	
⑥	COM OUT 1	
⑦	COM OUT 2	
⑧	NO OUT 2	
⑨	+ INPUT	
⑩	- INPUT	
⑪	NC OUT 2	

**BLOCK DIAGRAM**

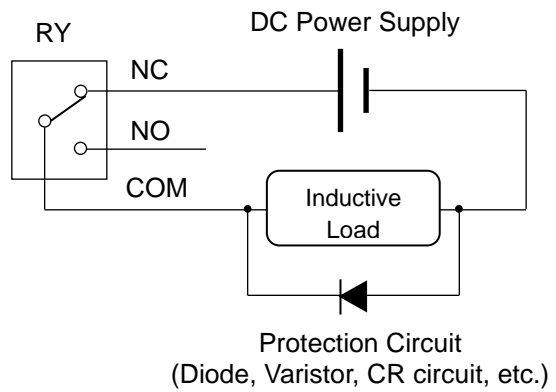


When an inductive load, such as an electric motor, is connected to the output, a relay contact protection circuit must be connected across the load.

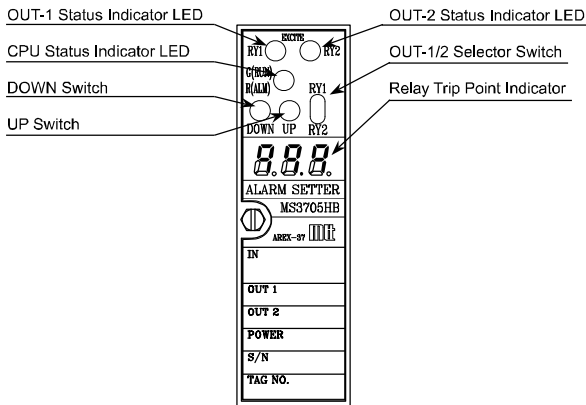
Example of AC Power Connection:



Example of DC Power Connection:



**FRONT VIEW**



**Checking and Setting the Hysteresis**

When the power is turned on with the UP Switch held down, the CPU Status Indicator LED blinks green and the Relay Trip Point Indicator shows a 3-digit hysteresis value for the output selected with the OUT-1/2 Selector Switch. This hysteresis value can be changed to a desired value by pressing the UP/DOWN Switch.

**Checking and Setting the Relay Activation Mode**

When the power is turned on with the DOWN Switch held down, the CPU Status Indicator LED blinks green and the Relay Trip Point Indicator shows a single-digit relay activation mode for the output selected with the OUT-1/2 Selector Switch. The mode can be toggled between 1 and 0 using either the UP or DOWN Switch (1 for the mode “H”, 0 for the mode “L”).

**Note:**

After making any setting change, the OUT-1/2 Selector Switch must be set to the opposite position to where it is located. This switching procedure enables the instrument to save the updated setting information.

To resume normal operation, the unit must be powered off and on.

**Indicator**

The Relay Trip Point Indicator goes OFF if no switch is operated for one minute, while the CPU Status Indicator LED keeps illuminating green. This LED turns red and blinks if any CPU error is detected.

**UP/DOWN Setting Switch**

The switch is of a push button type. Pressing and holding the switch increases the speed at which the value changes.

**Factory Default Settings**

If not specified, the relay operation will be set to the factory defaults as shown in the table below.

Output	Mode	Trip Point	Hysteresis
OUT-1	0	50%	1.0%
OUT-2	2	50%	1.0%

**SETTING**

**TRIP POINT SETTING**

**Setting for OUT-1**

When the OUT-1/2 Selector Switch is set to the RY1 position with the power on, the Relay Trip Point Indicator shows the current trip point value for OUT-1. This value can be changed to a desired value by pressing the UP/DOWN Switch.

**Setting for OUT-2**

When the OUT-1/2 Selector Switch is set to the RY2 position with the power on, the Relay Trip Point Indicator shows the current trip point value for OUT-2. This value can be changed to a desired value by pressing the UP/DOWN Switch.

**HYSTERESIS / MODE SETTING**

The hysteresis and relay activation mode can be changed based on the conditions indicated below.

Input	Output	
	Mode 0	Mode 1
$\geq$ Set value	Relay activated	Relay not activated
$\leq$ (Set value – Hysteresis)	Relay not activated	Relay activated
(Set value – Hysteresis) to Set value	Unchanged	Unchanged

Input	Output	
	Mode 2	Mode 3
$\geq$ (Set value + Hysteresis)	Relay not activated	Relay activated
$\leq$ Set value	Relay activated	Relay not activated
Set value to (Set value + Hysteresis)	Unchanged	Unchanged



## LED STATUS INDICATOR

## ● INDICATOR PATTERNS

No.	Event	Relay Trip Point Indicator (7-segment LED)	CPU Status Indicator	Relay	Recovery Operation
1	Power ON or switch operation	Blinks 3 times (1 s ON - 0.5 s OFF cycle).	Green LED turns ON for 1 second, and then red LED turns ON for 0.5 second. This cycle is repeated 3 times.	Normal operation	—
2	Normal operation	OFF	Green LED is ON.	Normal operation	—
3	Trip Point setting	Set value	Green LED is ON.	Normal operation	—
4	Hysteresis / Mode setting	Set value	Green LED blinks at 1 second intervals.	Not activated.	—
5	Data error in Relay Trip Point setting	02 (Error code)	Red LED blinks at 1 second intervals.	Not activated.	Reconfiguration
6	Data error in Relay Start-up Limitation	04 (Error code)	Red LED blinks at 1 second intervals.	Not activated.	Reconfiguration
7	Data error of a compensated value	08 (Error code)	Red LED blinks at 1 second intervals.	Not activated.	None
8	Data error in Hysteresis Setting	16 (Error code)	Red LED blinks at 1 second intervals.	Not activated.	Reconfiguration
9	Data error in Relay Activation Mode Setting	32 (Error code)	Red LED blinks at 1 second intervals.	Not activated.	Reconfiguration
10	System error	Not defined.	Red LED is ON; Green LED is not defined.	Not activated.	None

## Notes:

No. 1: When the Relay Trip Point Indicator is ON, a 3-digit number “888” with dots is displayed.

No. 5 - 9: Only the last 2 digits are displayed in the event of an error.

No. 10: The red LED sometimes fails to light up. The relay operation may sometimes be unstable.

## DEFAULT SETTINGS

If you specify trip points and hysteresis at the time you place an order, the product will be set to your specified values before shipment.

The following is an example of how to specify these parameters.

(Example)

Trip Point for Output 1: 20%

Hysteresis for Output 1: 2%

Trip Point for Output 2: 30%

Hysteresis for Output 2: 4%

If nothing is specified, the product will be set to the following default values:

Trip Point for Output 1: 50.0%

Hysteresis for Output 1: 1.0%

Trip Point for Output 2: 50.0%

Hysteresis for Output 2: 1.0%

The relay start-up limitation (standard: 2 s) is available from 1 to 60 s as a special order.

The following is an example of how to specify this parameter.

(Example)

Relay start-up limitation: 10 s

Note that you cannot set the relay start-up limitation.