

## Lightning Surge Protectors for Electronics Equipment M-RESTER

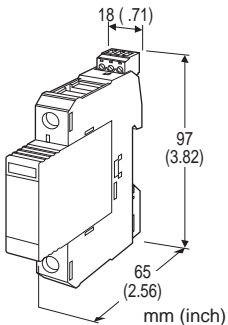
### ONE-PORT SURGE PROTECTOR FOR POWER SUPPLY USE

#### Functions & Features

- Designed to protect electronics equipment from induced lightning surges entering through power supply cables
- Connected in parallel between the power and ground lines regardless of load current
- Varistor discharge element has a high speed response without follow current
- No interruption of power supply even when the head element is removed: easy maintenance and replacing
- Degraded head element is automatically separated from the power lines to prevent overheating, with a relay contact output to alert the failure status
- Head-base connection is keyed so that only a head element of correct line voltage can be mounted

#### Typical Applications

- Low-voltage distribution board
- Combination with installation for large load current



## MODEL: MAKF-[1][2]

### ORDERING INFORMATION

- Code number: MAKF-[1][2]

Specify a code from below for each of [1] and [2].  
(e.g. MAKF-120/AN)

### [1] OPERATIONAL VOLTAGE

120: 120 V AC  
240: 240 V AC  
280: 280 V AC  
400: 400 V AC  
480: 480 V AC

### [2] OPTIONS

#### Configuration

/AN: Without alarm output

/BN: Head element for replacement

### RELATED PRODUCTS

- Single mount adaptor (model: MBS)
- Wiring bridge (model: CNB)

### GENERAL SPECIFICATIONS

**Construction:** Plug-in

**Degree of protection:** IP20 (If the solderless terminals are covered with insulation tubes.)

**Surge protection type:** Voltage limiting type one-port SPD  
**Connection**

**Line:** M5 screw terminal (spring up-screw type)  
(torque: 2.5 N·m)

**Alarm output:** Euro type connector terminal  
(torque: 0.25 N·m)

#### Applicable wire size

**Line connection:** See the solderless terminal drawing.

**Alarm output:** 0.14 to 1.5 mm<sup>2</sup>, stripped length 7 mm

**Housing material:** Flame-resistant resin (black)

**Alarm output:** The SPDT relay trips when the thermal breaker operates and/or the head element is removed.

**Rated load:** 250 V AC @0.5 A (resistive load)

125 V DC @0.2 A (resistive load)

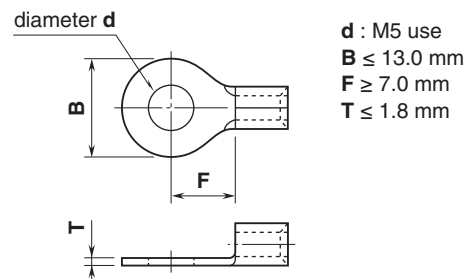
**Minimum switching load:** 5 V DC, 1 mA

**Line voltage identification key:** The connection of the head element and the base is keyed for exact matching.

**Safety function:** Thermal breaker incorporated

**Failure indicator:** The check window color changes from green (normal) to black (failed and the thermal breaker separated the M-ester from the circuit).

- Applicable Solderless Terminal Size



d : M5 use  
B ≤ 13.0 mm  
F ≥ 7.0 mm  
T ≤ 1.8 mm

### INSTALLATION

**Operating temperature:** -5 to +55°C (23 to 131°F)

**Operating humidity:** 30 to 90 %RH (non-condensing)

**Mounting:** DIN rail; Surface mounting available with the Single Mount Adaptor model: MBS.

**Weight:** 100 g (3.53 oz)

## PERFORMANCE

**Response time:**  $\leq 20$  nsec.

**Maximum discharge current:**  $20\text{ kA} \times \text{twice}$  (8/20  $\mu\text{sec.}$ )

**Nominal discharge current:**  $5\text{ kA}$  (8/20  $\mu\text{sec.}$ )

**Insulation resistance:**  $\geq 100\text{ M}\Omega$  with  $500\text{ V DC}$  (line to alarm output)

**Dielectric strength:**  $2000\text{ V AC}$  @ 1 minute (line to alarm output)

**Leakage current:**  $\leq 1\text{ mA}$  at the discharge voltages listed in the table below.

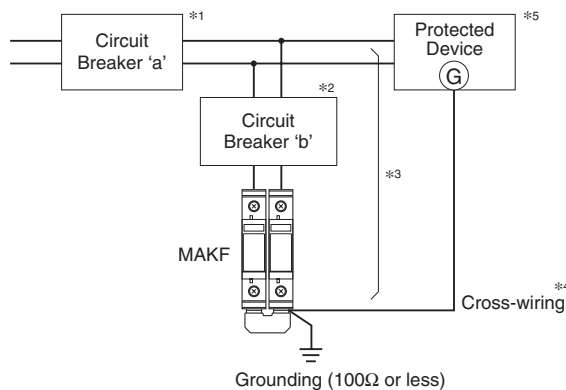
MODEL	Uc (AC) (V)	DISCHARGE VOLTAGE (Vmin)	Up	
			@1.0kA (8/20 $\mu\text{s}$ ) (Vmax)	@5kA (8/20 $\mu\text{s}$ ) (Vmax)
MAKF-120	150	250	600	800
MAKF-240	275	420	1000	1400
MAKF-280	320	460	1100	1500
MAKF-400	440	670	1500	2100
MAKF-480	530	820	1800	2500

Uc = Maximum continuous operational voltage

Up = Voltage protection level

## CONNECTION EXAMPLES

### ■CONFIGURATION EXAMPLE: Single-phase / 2-wire connection



- \*1. The circuit breaker must be installed.  
Molded-case circuit breakers (MCCB), earth leakage circuit breakers (ELCB) or current-limiting fuses (slow-blow type only) can be used.  
The rated interrupting capacity of the circuit breaker must be greater than the highest amount of current that could be available in the circuit.  
The MCCB or ELCB must have elements at both poles.  
Time-delay type over-current protection is recommended for an ELCB.  
Recommended sensitivity current rating: 30mA
- \*2. If the rated current of the circuit breaker 'a' exceeds 30A, or if the loss of power supply to the protected device should be prevented when the circuit breaker 'a' blows due to a surge protector failure, install the circuit breaker 'b' (rated current 20-30 A) at the branch circuit.
- \*3. Cable length between the branch point and the grounding:  
0.5 meters or less recommended.
- \*4. The protected device's metal housing must be cross-wired to the ground terminal of the MAKF. If the protected device has no ground terminal, ground only the MAKF.
- \*5. In order to protect an electronic circuit such as switching regulators, we recommend to use surge protectors which have serial impedance incorporated such as M-System's models MAX, MMA, MAH.

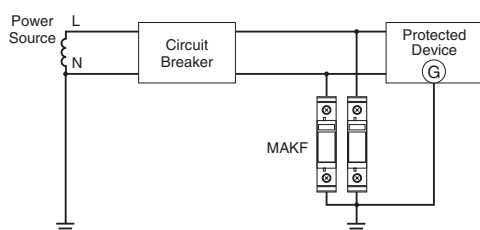
## ■CONNECTION EXAMPLES BY POWER SYSTEMS

Abnormal voltages appearing in case of a light load or a ground loop must be within the maximum continuous operational voltage when selecting the MAKF models.

For example, the IEC 60364-5-534 (Electrical installations of building; devices for protection against overvoltages) requires margins determined by the equations below:

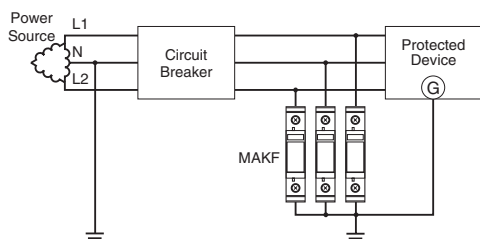
POWER SYSTEM	Uc (Max. Continuous Operational Voltage)
3ph/4w, Y connec, TT system	$U_c \geq 1.5 \times \text{Phase Voltage}$
3ph/4w, Y connec, TN system	$U_c \geq 1.1 \times \text{Phase Voltage}$
3ph/4w, Y connec, IT system	$U_c \geq \text{Line Voltage}$

### •Single-phase/2-wire connection



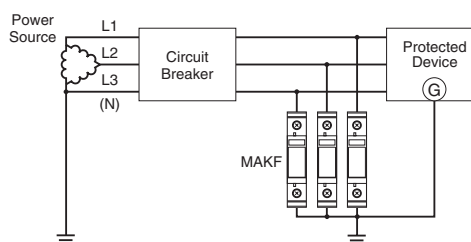
POWER SYSTEM	MODEL NO.
1-phase/2-wire, 100V AC	MAKF-120x
1-phase/2-wire, 200V AC	MAKF-240x
1-phase/2-wire, 250V AC	MAKF-240x

### •Single-phase/2-wire (three-phase delta connection grounded in the middle of phases) or single-phase/3-wire connection



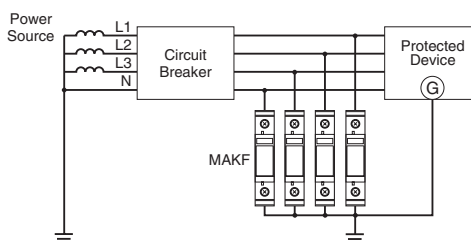
POWER SYSTEM	MODEL NO.
1-phase/2-wire, 100V AC	MAKF-240x
1-phase/2-wire, 200V AC	MAKF-400x
1-phase/3-wire, 200/100V AC	MAKF-240x
1-phase/3-wire, 400/200V AC	MAKF-400x

### •Three-phase/3-wire (delta connection)



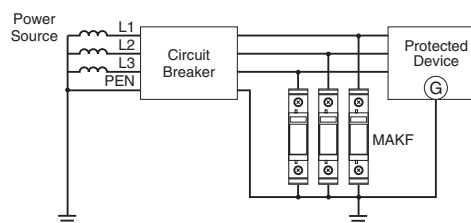
POWER SYSTEM	MODEL NO.
3-phase/3-wire, 200V AC	MAKF-240x
3-phase/3-wire, 220V AC	MAKF-240x
3-phase/3-wire, 400V AC	MAKF-400x
3-phase/3-wire, 440V AC	MAKF-480x

### •Three-phase/4-wire (star connection, TT system)



POWER SYSTEM	MODEL NO.
3-phase/4-wire, 200/115V AC	MAKF-240x
3-phase/4-wire, 220/127V AC	MAKF-240x
3-phase/4-wire, 380/220V AC	MAKF-400x
3-phase/4-wire, 415/240V AC	MAKF-480x

### •Three-phase/4-wire (star connection, TN system)



POWER SYSTEM	MODEL NO.
3-phase/4-wire, 200/115V AC	MAKF-120x
3-phase/4-wire, 400/230V AC	MAKF-240x
3-phase/4-wire, 480/277V AC	MAKF-280x
3-phase/4-wire, 690/400V AC	MAKF-400x

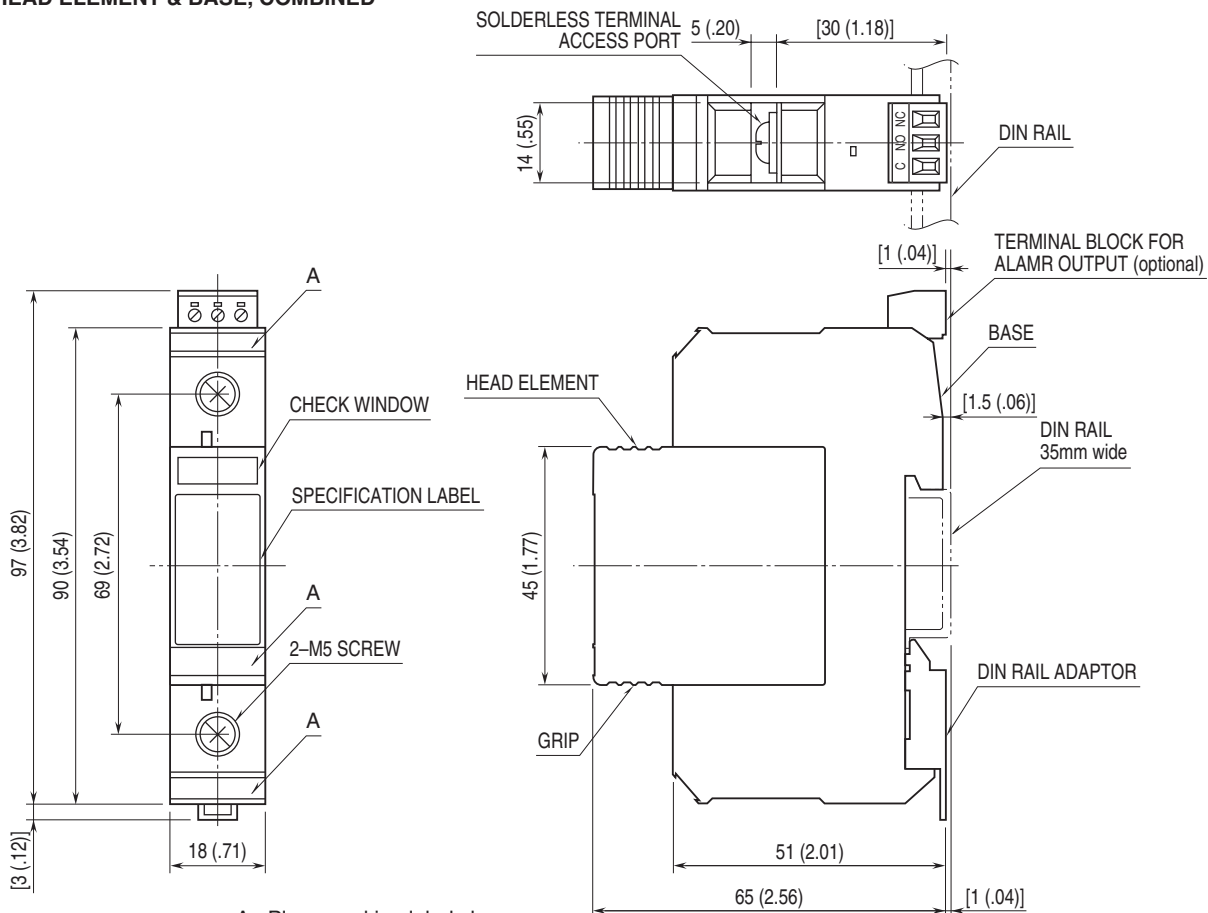
## ■ALARM OUTPUT

When the alarm output is to be transmitted remotely via outdoor cables, a surge protector for the signal line is required.

Choose a circuit breaker with alarm output. Configure a logical addition sequence so that the alarm trips when both or either of the MAKF or the breaker alarm trips.

## EXTERNAL DIMENSIONS & TERMINAL ASSIGNMENTS unit: mm (inch)

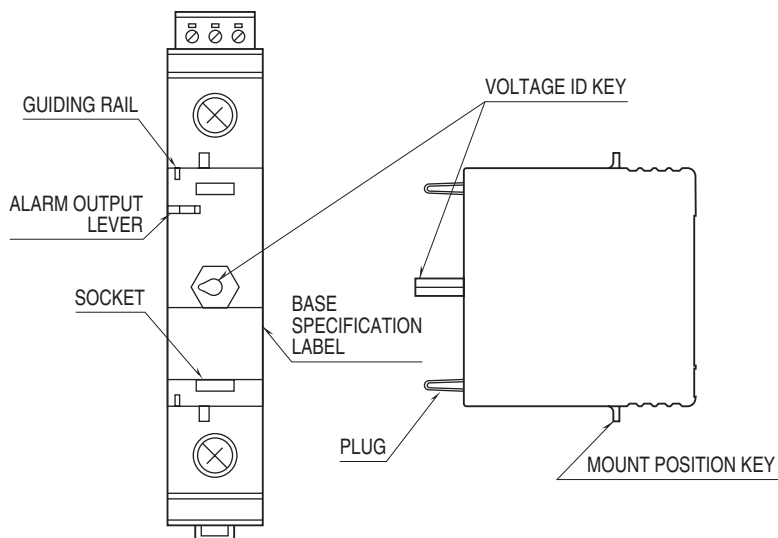
### ■ HEAD ELEMENT & BASE, COMBINED



A : Place marking labels here.

•When mounting, no extra space is needed between units.

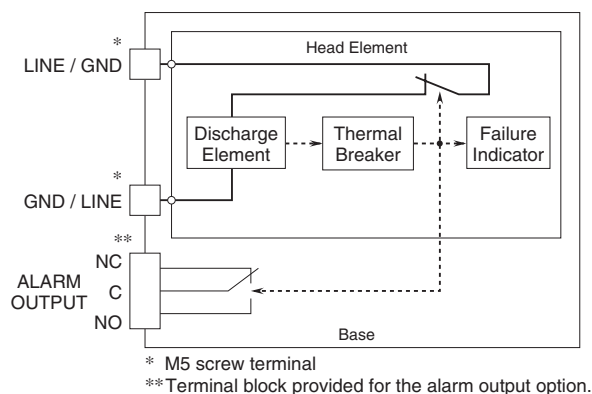
### ■ HEAD ELEMENT & BASE, SEPARATED



### ■ MARKING LABELS

(terminal identifiers, tag name labels)

L1	L2	L3
N	E	G

**SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM**

Specifications are subject to change without notice.