

**Lightning Surge Protectors for Electronics Equipment *M-RESTER***

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

MODEL **MAKF**

**MODEL & SUFFIX CODE SELECTION**

MODEL \_\_\_\_\_ **MAKF**-□□

OPERATIONAL VOLTAGE \_\_\_\_\_

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

OPTIONS \_\_\_\_\_

/AN: Without alarm output  
 /BN: Head element for replacement

**ORDERING INFORMATION**

Specify code number. (e.g. MAKF-120/AN)

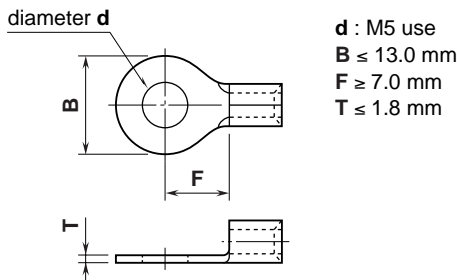
**RELATED PRODUCTS**

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

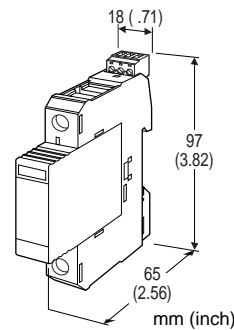
**GENERAL SPECIFICATIONS**

**Construction:** Plug-in  
**Surge protection type:** Voltage limiting type one-port SPD  
**Line connection**  
**Connection:** M5 screw terminal (spring loaded screw)  
**Applicable wire size:** See the drawing below.  
**Torque:** ≤2.5 N·m

• Applicable Solderless Terminal Size



**Alarm output connection**  
**Connection:** Terminal block  
**Applicable wire size:** 0.14 to 1.5 mm<sup>2</sup> (7 mm exposed)  
**Torque:** ≤0.25 N·m  
**Housing material:** Flame-resistant resin (black)  
**Enclosure protection:** IP20 if the solderless terminals are covered with marking tubes.  
**Line voltage identification key:** The connection of the head element and the base is keyed for exact matching.  
**Safety function:** Thermal breaker incorporated



**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 an installation for large load current

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

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

**Rated load:** 250V AC @0.5A (resistive load)  
 125V AC @0.2A (resistive load)

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

**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.  
**Dimensions:** W18×H90×D65 mm (0.71"×3.44"×2.56")  
 W18×H97×D65.5 mm (0.71"×3.82"×2.58") with alarm output  
**Weight:** 100 g (3.53 oz)

**PERFORMANCE**

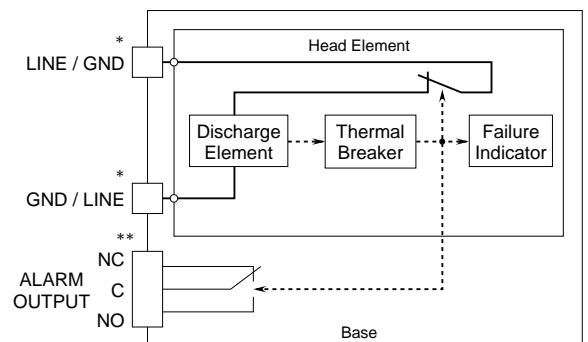
**Response time:** ≤20 nanoseconds  
**Maximum discharge current:** 20kA × twice (8/20 μsec.)  
**Nominal discharge current:** 1.5kA (8/20 μsec.)  
**Leakage current:** ≤1mA at the discharge voltages listed in the table below.

MODEL	Uc (AC) (V)	DISCHARGE VOLTAGE (Vmin)	Up	
			@1.0kA (8/20 μs) (Vmax)	@1.5kA (8/20 μs) (Vmax)
MAKF-120	150	250	600	650
MAKF-240	275	420	1000	1100
MAKF-280	320	460	1100	1200
MAKF-400	440	670	1500	1700
MAKF-480	530	820	1800	2100

Uc = Maximum continuous operational voltage  
 Up = Voltage protection level

**Insulation resistance:** ≥100MΩ with 500V DC  
 (line to alarm output)  
**Dielectric strength:** 2000V AC @1 minute  
 (line to alarm output)

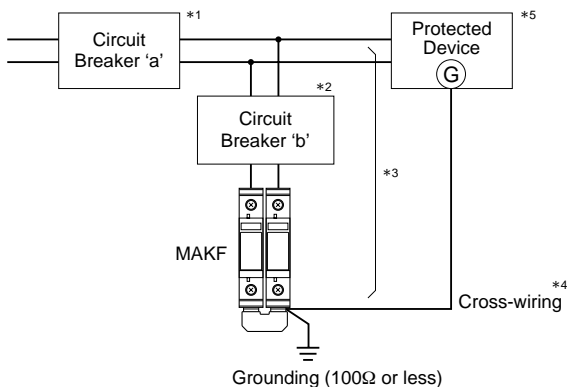
**SCHEMATIC CIRCUITRY**



\* M5 screw terminal  
 \*\* Terminal block provided for the alarm output option.

**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.

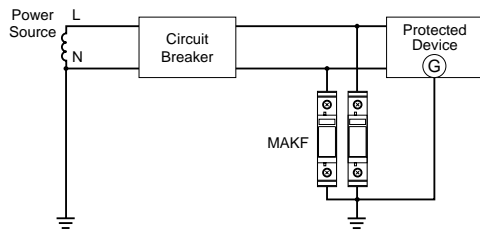
## ■ CONNECTION EXAMPLES BY POWER SYSTEMS

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	$Uc \geq 1.5 \times \text{Phase Voltage}$
3ph/4w, Y connec, TN system	$Uc \geq 1.1 \times \text{Phase Voltage}$
3ph/4w, Y connec, IT system	$Uc \geq \text{Line Voltage}$

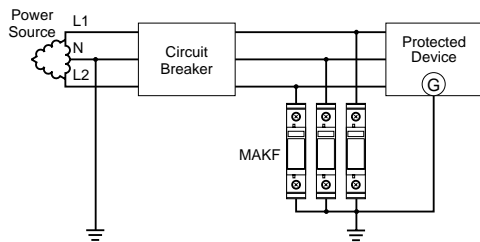
### • Single-phase/2-wire connection



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

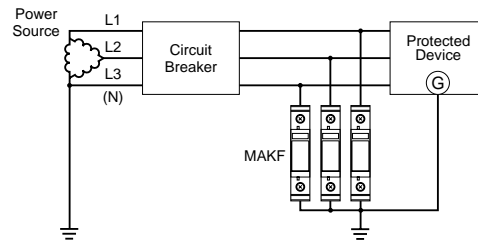
### • Single-phase/2-wire

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



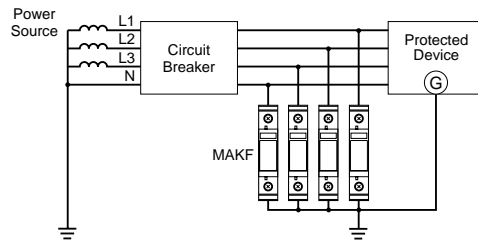
POWER SYSTEM	MODEL NO.
1-phase/2-wire, 100V AC	MAKF-240x
1-phase/2-wire, 200V AC	MAKF-400x
1-phase/3-wire, 200/100V AC	MAKF-240x
1-phase/3-wire, 400/200V AC	MAKF-400x

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



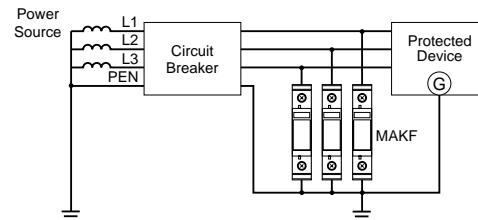
POWER SYSTEM	MODEL NO.
3-phase/3-wire, 200V AC	MAKF-240x
3-phase/3-wire, 220V AC	MAKF-240x
3-phase/3-wire, 400V AC	MAKF-400x
3-phase/3-wire, 440V AC	MAKF-480x

### • 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

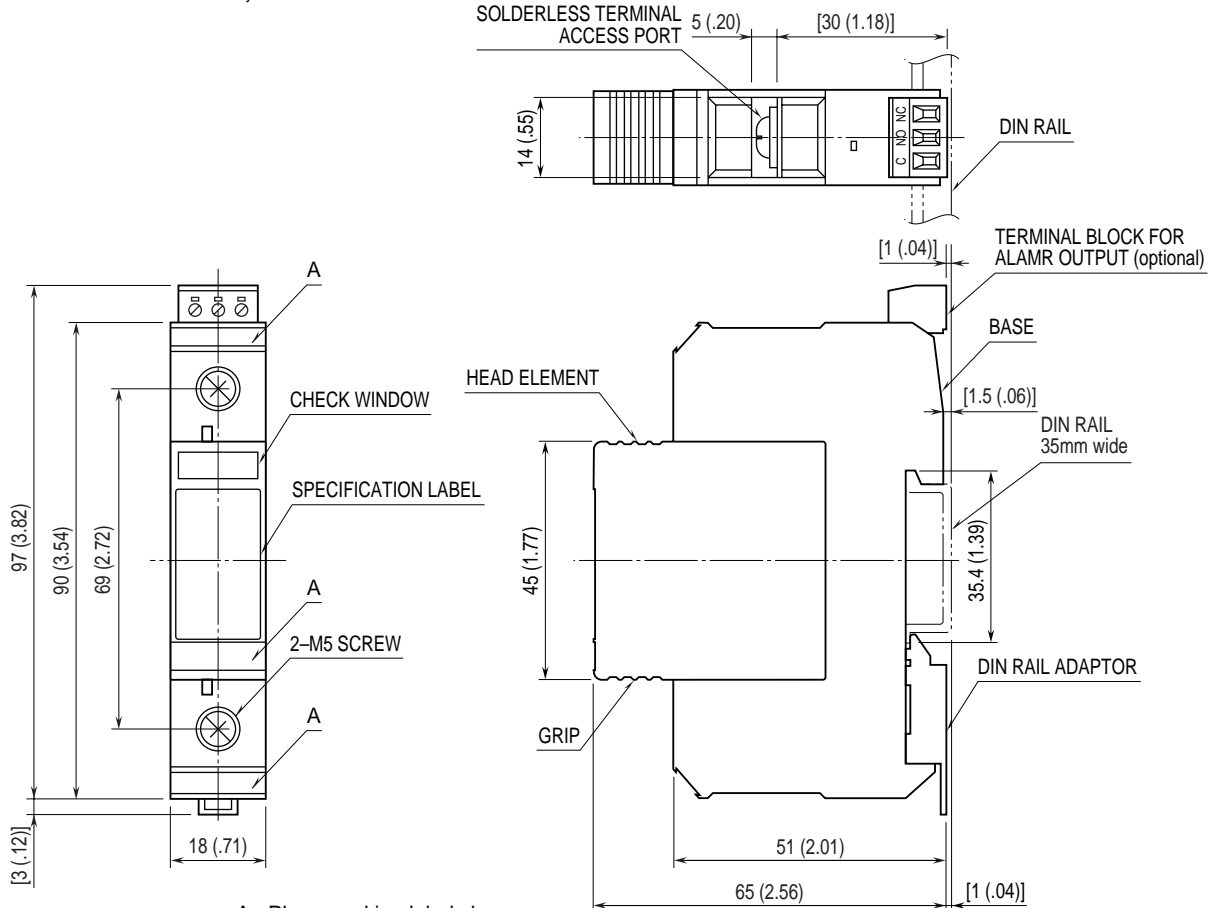
## ■ ALARM OUTPUT

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 & COMPONENT IDENTIFICATION (unit: mm)**

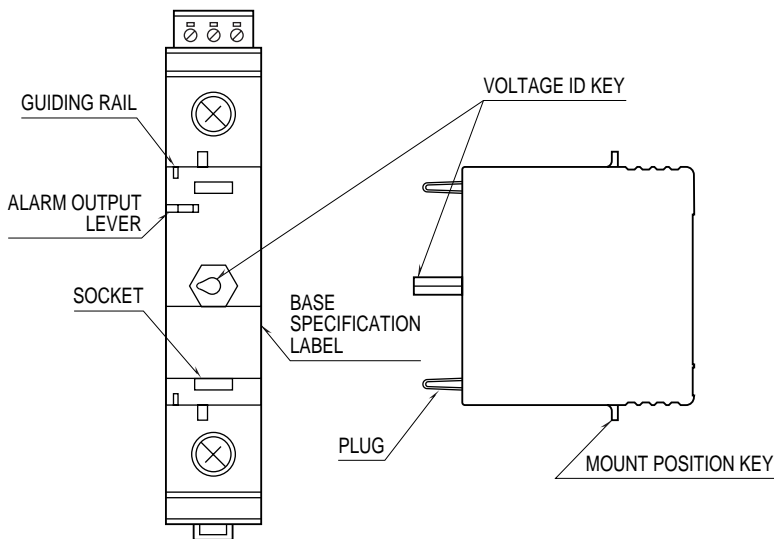
■ **HEAD ELEMENT & BASE, COMBINED**



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

Specifications subject to change without notice.