## Introduction

The Inrush Current Reduction Module (ICRM) prevents damage to a protected voltage regulator during power-up by limiting inrush current to a safe level. Without inrush protection, the inrush current is limited only by the level of the power source impedance. The lower the impedance, the greater the risk of damaging the regulator from excessive inrush current. Devices with a pulse-width modulated (PWM) power stage are especially vulnerable to high inrush current due to a large amount of capacitance inherent to the design. However, voltage regulators that use SCR-type power stages do not require the protection of an ICRM since these regulators do not have a large amount of capacitance in the power stage.

When a voltage regulator with a PWM power stage is energized, the ICRM limits the inrush current by adding a high level of resistance in series with the voltage regulator power input. Once the inrush current subsides, the series resistance diminishes quickly to allow nominal, steady-state current flow.

## Application

Applications where a voltage regulator is powered by a permanent magnet generator (PMG), auxiliary winding, or generator output (shunt fed), usually do not require the protection of an ICRM. These sources usually have a higher source impedance which inherently minimizes inrush current. Also, these sources are typically connected directly to the voltage regulator with no interposing relays, contactors, or switches. If this is the case, then no inrush occurs since the source voltage ramps up to its rated value.

However, if rated or near rated voltage is applied to the voltage regulator, then some amount of inrush current is expected and an ICRM should be considered. Typically, voltage regulators in these applications receive power from a station service bus that is switched by a relay or contactor. Applications where a PWM type voltage regulator is powered by a low-impedance source need an ICRM to minimize the amount of inrush current.

To summarize, if the voltage that powers the voltage regulator ramps up to nominal as the generator comes up to rated speed, then an ICRM is not needed. If this is not the case, an ICRM should be used. If you are unsure whether your application requires an ICRM, contact Basler Electric Technical Support Services for assistance.

### ICRM Versions

Two versions of the ICRM are available. Each version is uniquely suited to protect a specific family of Basler Electric products. Table 1 lists each ICRM model, its part number, and the compatible products.

**Table 1. ICRM Cross-Reference**

| Model | P/N | Compatible Products |
|---|---|---|
| ICRM-7 | 9387900103 | DECS-100, DECS-150 |
| ICRM-15 | 9387900104 | AVC63-12, AVC125-10, DECS-200, DECS-250, SR Retrofit, SSR Retrofit |

**Caution**

If operating power is removed from an energized ICRM, a minimum interval of five minutes should elapse before operating power is restored. This cool-down interval allows the ICRM to regain its ability to limit inrush current.



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## Specifications

The following electrical and physical specifications, type tests, and certifications apply to the ICRM.

### Electrical Specifications

| | |
|---|---|
| Input Voltage: | 90 to 277 Vac, 90 to 300 Vdc |
| Input Frequency: | dc, 50 to 420 Hz |
| Input Current | |
| ICRM-7: | 9 Aac |
| ICRM-15: | 18 Aac |
| Power Dissipation: | 25 W |

### Physical Specifications

| | |
|---|---|
| Temperature | |
| Operating: | –25 to 70°C (–13 to 158°F) |
| Storage: | –40 to 70°C (–40 to 158°F) |
| Dimensions: | Refer to Figure 1 |
| Weight: | 227 g (8 oz) |

### Type Tests

*Dielectric Strength*

Withstands 2,000 Vac for one minute in accordance with IEC 60255-5

*Shock*

Withstands 15 G in three perpendicular planes in accordance with IEC 60255-21-1

*Vibration*

Tested in accordance with IEC 60255-21-2. Withstands 2 G in each of three mutually perpendicular axes, swept over the range of 10 to 500 Hz for a total of six sweeps, 15 minutes each sweep.

*Humidity*

Qualified to IEC 68-1, IEC 68-2-28

### Certifications

*UL Recognition*

cURus recognition per UL Standard 6200:2019 and CSA Standard C22.2 No. 14-13

*CE and UKCA Compliance*

This product has been evaluated and complies with the relevant essential requirements set forth by the EU legislation and UK Parliament.

### China RoHS

The following table serves as the declaration of hazardous substances for China in accordance with PRC standard SJ/T 11364-2014. The EFUP (Environment Friendly Use Period) for this product is 40 years.

| **PRODUCT:** | ICRM-7, ICRM-15 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 有害物质<br>Hazardous Substances | | | | | | | | | |
| 零件名称<br>Part Name | 铅<br>Lead (Pb) | 汞<br>Mercury (Hg) | 镉<br>Cadmium (Cd) | 六价铬<br>Hexavalent Chromium ($Cr^{6+}$) | 多溴联苯<br>Polybrominated Biphenyls (PBB) | 多溴二苯醚<br>Polybrominated Diphenyl Ethers (PBDE) | 邻苯二甲酸二丁酯<br>Dibutyl Phthalate (DBP) | 邻苯二甲酸丁苄酯<br>Benzyl butyl phthalate (BBP) | 邻苯二甲酸二酯<br>Bis(2-ethylhexyl) phthalate (BEHP) | 邻苯二甲酸二异丁酯<br>Diisobutyl phthalate (DIBP) |
| 金属零件<br>Metal parts | O | O | O | O | O | O | O | O | O | O |
| 聚合物<br>Polymers | O | O | O | O | O | O | O | O | O | O |



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| PRODUCT: | ICRM-7, ICRM-15 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 零件名称 Part Name | 有害物质 Hazardous Substances | | | | | | | | | |
| | 铅 Lead (Pb) | 汞 Mercury (Hg) | 镉 Cadmium (Cd) | 六价铬 Hexavalent Chromium ($Cr^{6+}$) | 多溴联苯 Polybrominated Biphenyls (PBB) | 多溴二苯醚 Polybrominated Diphenyl Ethers (PBDE) | 邻苯二甲酸二丁酯 Dibutyl Phthalate (DBP) | 邻苯二甲酸丁苄酯 Benzyl butyl phthalate (BBP) | 邻苯二甲酸二酯 Bis(2-ethylhexyl) phthalate (BEHP) | 邻苯二甲酸二异丁酯 Diisobutyl phthalate (DIBP) |
| 电子产品 Electronics | X | O | O | O | O | O | O | O | O | O |
| 电缆和互连配件 Cables & interconnect accessories | O | O | O | O | O | O | O | O | O | O |
| 绝缘材料 Insulation material | O | O | O | O | O | O | O | O | O | O |

**本表格依据** SJ/T11364 **的**规定编制。

O: **表示**该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。

X: **表示**该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。

This form was prepared according to the provisions of standard SJ/T11364.

O: Indicates that the hazardous substance content in all homogenous materials of this part is below the limit specified in standard GB/T 26252.

X: Indicates that the hazardous substance content in at least one of the homogenous materials of this part exceeds the limit specified in standard GB/T 26572.

## Installation

The ICRM may be installed in any environment where the conditions do not exceed the capabilities listed in the *Specifications* section.

### Mounting

For maximum cooling, the ICRM should be mounted on a vertical surface and oriented so that the ventilation holes are located at the top and bottom of the unit.

**Caution**

Case may become hot during operation.



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Figure 1 shows the ICRM mounting dimensions. Mounting dimensions are identical for both ICRM models. Dimensions are shown in inches with millimeters in parenthesis.

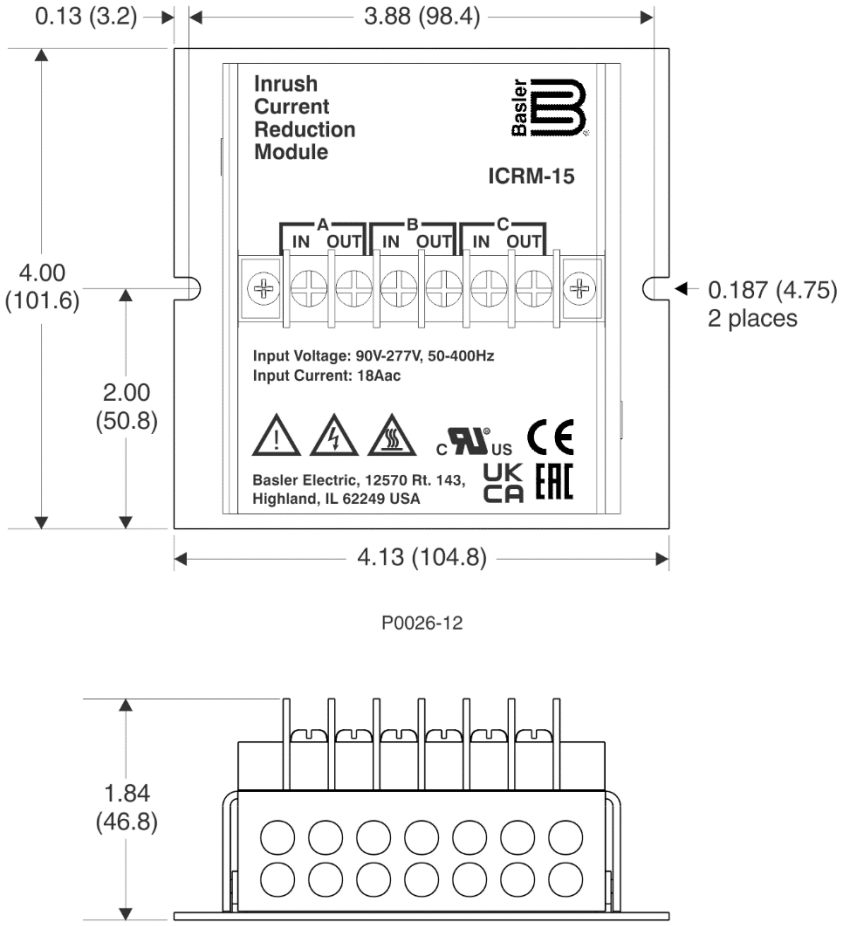



**Figure 1. ICRM Dimensions**

## Connections

Figure 2 illustrates typical connections for an application using single-phase operating power. The ICRM is not phase sensitive. Figure 3 illustrates typical connections for an application using three-phase operating power.

Table 2 lists the terminal connections for each voltage regulator that is compatible with the ICRM.

**Table 2. ICRM Terminals Cross-Reference**

| Voltage Regulator | ICRM Output Terminals | | |
|---|---|---|---|
| | A-OUT | B-OUT | C-OUT |
| AVC63-12, AVC125-10 | 26 | 28 | 30 |
| DECS-100 | 3 | 4 | 5 |
| DECS-150 | 3 | 4 | 5 |
| DECS-200 | C2 | C3 | C4 |
| DECS-250 | 88 | 89 | 90 |
| SR Retrofit, SSR Retrofit | | 4 | 3 |

Wiring requirements are subject to the specifications of the voltage regulator. Refer to the appropriate device instruction manual for wire sizing, fuse recommendations, and terminal designations.



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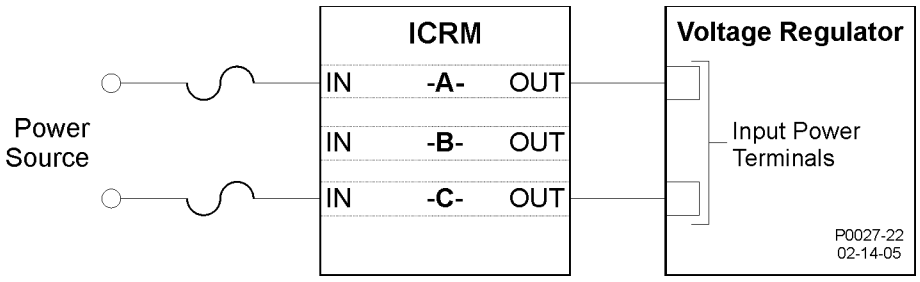



**Figure 2. Typical ICRM Connections, Single-Phase Operating Power**

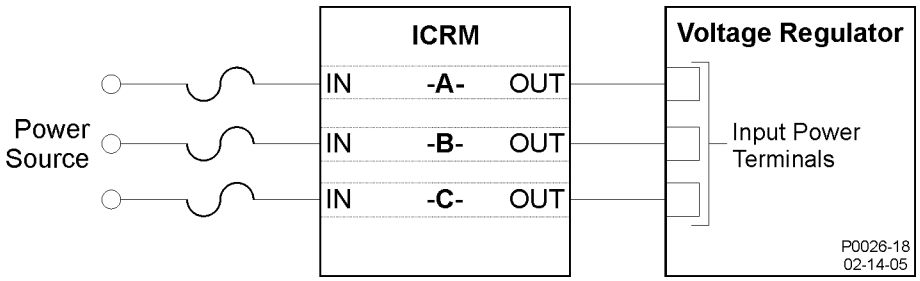



**Figure 3. Typical ICRM Connections, Three-Phase Operating Power**

## Troubleshooting

The ICRM contains no serviceable components. Replacement of the ICRM is recommended in the event of a failure.

If the protected device is not receiving operating power, check the following:

- Verify that the ICRM connections between the power source and voltage regulator are correct, and
- Confirm that the voltage supplied by the power source is sufficient to energize the voltage regulator.

If operating power is applied to the input terminals of the ICRM but voltage is not present at the output terminals, remove operating power, disconnect all ICRM wiring, and perform the following procedure.

1. Connect a suitable ohmmeter across the A-IN and the A-OUT terminals. The resistance measured across the IN and OUT terminals should be approximately 2 Ω for the ICRM-7 and 0.5 Ω for the ICRM-15. If an open-circuit or short-circuit is detected, the ICRM should be replaced.
2. Repeat step 1 for the B-IN and B-OUT pair of terminals and the C-IN and C-OUT pair of terminals.



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