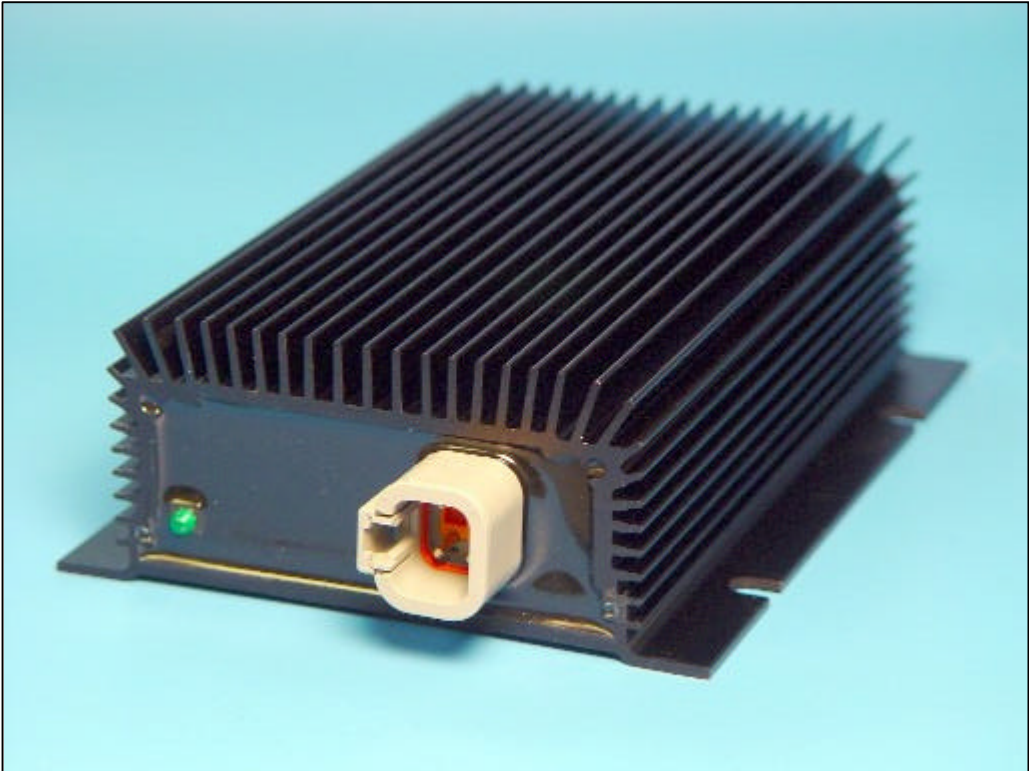


| REVISIONS |      |                    |         |    |
|-----------|------|--------------------|---------|----|
| REV       | ECO  | DESCRIPTION        | DATE    | BY |
| 001       | 4677 | Production Release | 3/27/06 | BF |

Specification Outline

21030E00 BATTERY EQUALIZER



|                                                                                                                                                                                                                                                                                                                       |  |                                                                                                                                                                                       |                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| <div>UNLESS OTHERWISE SPECIFIED<br/>DIMENSIONS ARE IN INCHES [MM]</div> <div>TOLERANCES ARE: <div><div>.XX ± .10 [X ± 2.5]</div><div>.XXX ± .030 [XX ± .76]</div></div></div> <div>INTERPRET GEOMETRIC DIMENSIONS AND<br/>TOLERANCING PER ASME Y14.5-1994</div> <div>DRAWINGS IN THIS DOCUMENT ARE NOT TO SCALE</div> |  | <div></div> <div>TITLE<br/>MODEL NO: 21030E00<br/>EQUALIZER, 30A<br/>SPECIFICATION OUTLINE</div> |                                                                          |
| <div>PROPRIETARY</div> <div>THIS DRAWING IS THE PROPERTY OF SURE POWER INC. and shall not be copied, reproduced, lent, or disposed of, nor used for any purpose other than that for which it is specifically provided without the written permission of<br/>SURE POWER INC.</div>                                     |  | <div>APPROVALS</div> <div>DRAWN JZD</div> <div>PRJCT ENGR</div> <div>ENGR MNGR</div> <div>SALES/MRKTG</div>                                                                           | <div>DATE</div> <div>9/7/05</div> <div></div> <div></div> <div></div>    |
|                                                                                                                                                                                                                                                                                                                       |  | <div>SIZE A</div> <div>CAGE CODE NO. 55156</div> <div>DWG NO. 21030E00</div> <div>SCALE: NONE</div>                                                                                   | <div>REV 001</div> <div>FILE: 21030E00-001</div> <div>SHEET 1 OF 9</div> |

| REVIEWS |     |             |      |    |
|---------|-----|-------------|------|----|
| REV     | ECO | DESCRIPTION | DATE | BY |
| -       | -   | -SEE SH 1-  |      |    |

## General Description

Sure Power equalizers are designed to provide 24V to 12V power conversion for heavy-duty applications.

The 21030E00 equalizer provides equalization for dual battery systems where high 12V loads are required, enhancing battery life and ensuring maximum performance for vehicle charging systems.

This product is designed to withstand the severe electrical environment of the heavy-duty trucks and off highway equipment:

## Features

- Under and Over Voltage Protection
- Reverse Voltage Protection
- Voltage Transient Protection
- Over load and Short Circuit Protection
- Thermal Overload Shutdown
- Equalization Status Indicator
- Sealed from Environmental Elements

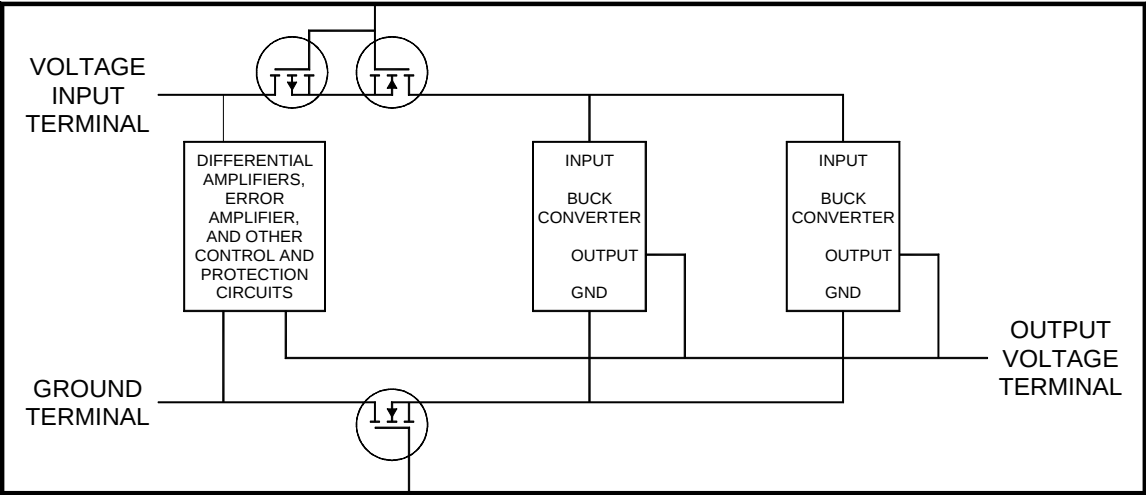
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| <div> <div>TITLE</div> <div> MODEL NO: 21030E00<br/> EQUALIZER, 30A<br/> SPECIFICATION OUTLINE </div> </div> |                    |          |      |     |
| SIZE                                                                                                         | CAGE CODE NO.      | DWG NO.  |      | REV |
| A                                                                                                            | 55156              | 21030E00 |      | 001 |
| SCALE:NONE                                                                                                   | FILE: 21030E00-001 | SHEET    | 2 OF | 9   |

| REVISIONS |     |             |      |    |
|-----------|-----|-------------|------|----|
| REV       | ECO | DESCRIPTION | DATE | BY |
| -         | -   | -SEE SH 1-  |      |    |

## Theory of Operation

The 21030E00 equalizer utilizes paralleled buck converters to step down the input voltage in order to achieve the appropriate output voltage.

The equalizer monitors the input voltage at the terminals and provides an output that is one-half of the input.



Block Diagram

## Description of Features

Included are a number of protection and added features.

### PROTECTION FEATURES:

Reversal of the input polarity is protected with MOSFET devices in series with the input.

Reversal of the output polarity is protected with MOSFET devices in series with the ground connection.

A Metal Oxide Varistor (MOV) circuit is used to protect the input from load dump and inductive transients.

Input under-voltage and over-voltage conditions cause the unit to safely turn off. The output will operate down to lower voltages to keep power applied to loads during starting conditions.

Short circuit and current limiting protection is supplied by monitoring the output current. Detection of a short circuit or overload limits the output current to 1.2 to 1.4 times the maximum steady state output rating. Upon removal of this condition the output voltage will return to its normal state.

Monitoring the heat sink temperature provides thermal protection. Detection of extreme temperature shuts the unit off. When the heat sink cools approximately 15°C the unit will automatically turn back on.

Loss of ground protection ensures no damage occurs to the unit.

|                                                                                    |                        |                     |            |  |
|------------------------------------------------------------------------------------|------------------------|---------------------|------------|--|
|                                                                                    |                        |                     |            |  |
| <b>MODEL NO: 21030E00</b><br><b>EQUALIZER, 30A</b><br><b>SPECIFICATION OUTLINE</b> |                        |                     |            |  |
| SIZE<br>A                                                                          | CAGE CODE NO.<br>55156 | DWG NO.<br>21030E00 | REV<br>001 |  |
| SCALE:NONE                                                                         | FILE: 21030E00-001     | SHEET 3             | OF 9       |  |

| REVISIONS |     |             |      |    |
|-----------|-----|-------------|------|----|
| REV       | ECO | DESCRIPTION | DATE | BY |
| -         | -   | -SEE SH 1-  |      |    |

## Description of Features (cont.)

### STATUS INDICATOR:

An LED status indicator is provided to denote when the unit is producing current. As the batteries become equalized, the equalizer current will approach zero amps, and the LED indicator will diminish in intensity and eventually go dark.

## ELECTRICAL SPECIFICATIONS

### ABSOLUTE MAXIMUM RATINGS:

Maximum ratings establish the maximum electrical rating to which the unit may be subjected without damage.

| Parameter                   | Value         | Notes: |
|-----------------------------|---------------|--------|
| Standoff Voltage            | 80V           | Note 1 |
| Reverse Polarity            | -36V          | Note 2 |
| Output Current              | 30A           | Note 3 |
| Heat Sink Temperature       | 100°C         | Note 4 |
| Operating Temperature Range | -40°C - +85°C | Note 3 |
| Storage Temperature Range   | -55°C- 105°C  |        |

#### Notes:

1. This is maximum voltage applied between VBAT and GND that the unit will standoff without causing damage to the unit.
2. This is the maximum reverse voltage that may be applied between INPUT and GND, or between OUTPUT and GND.
3. Units can be operated up to 85°C at a reduced output current.
4. The unit generates a significant amount of heat (as shown in the ELECTRICAL CHARACTERISTICS section). When determining a mounting location it is important to account for this heat. Adequate ventilation should be provided.

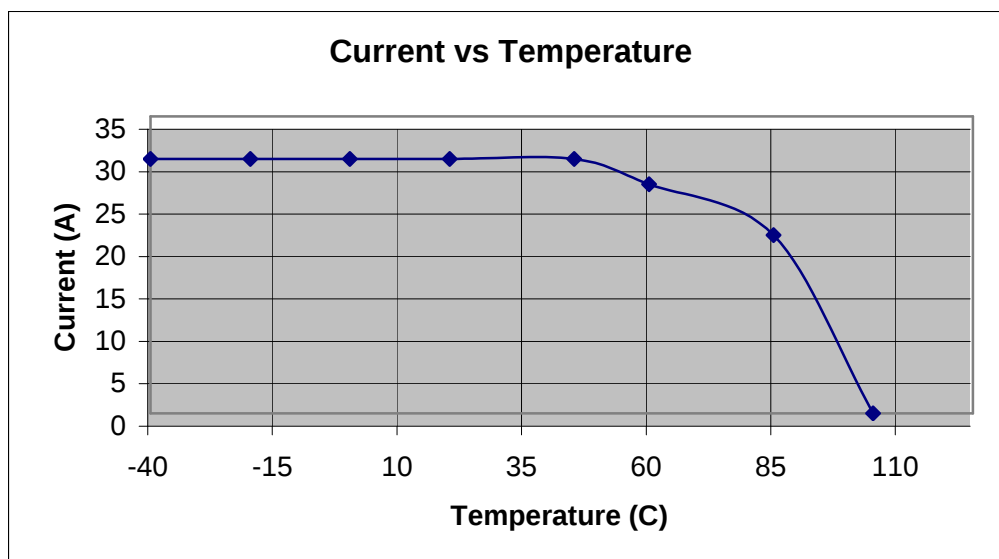
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| <b>MODEL NO: 21030E00</b><br><b>EQUALIZER, 30A</b><br><b>SPECIFICATION OUTLINE</b>    |                               |                            |                   |   |
| SIZE<br><b>A</b>                                                                      | CAGE CODE NO.<br><b>55156</b> | DWG NO.<br><b>21030E00</b> | REV<br><b>001</b> |   |
| SCALE: NONE                                                                           | FILE: 21030E00-001            | SHEET                      | 4 OF              | 9 |

| REVISIONS |     |             |      |    |
|-----------|-----|-------------|------|----|
| REV       | ECO | DESCRIPTION | DATE | BY |
| -         | -   | -SEE SH 1-  |      |    |

## ELECTRICAL CHARACTERISTICS

Unless otherwise stated, conditions apply to full temperature range and full input voltage range.

| Characteristic                 | Min              | Typ        | Max              | Unit | Notes:                                                                      |
|--------------------------------|------------------|------------|------------------|------|-----------------------------------------------------------------------------|
| Input Under Voltage Turn ON    | 17               | 17.8       | 18               | V    |                                                                             |
| Input Under Voltage Hysteresis |                  | 0.5        |                  | V    |                                                                             |
| Input Over Voltage Turn OFF    | 32               | 33         | 34               | V    |                                                                             |
| Input Over Voltage Hysteresis  |                  | 0.4        |                  | V    |                                                                             |
| Quiescent Current              |                  | 10         | 15               | mA   | Current draw from the INPUT with no load attached to OUTPUT. $V_{IN} = 24V$ |
| Output Voltage                 | $V_{IN}/2 - 1\%$ | $V_{IN}/2$ | $V_{IN}/2 + 1\%$ | V    |                                                                             |
| Input current                  |                  | 21         |                  | A    | Maximum input current                                                       |
| Current Limit                  | 30               | 32         |                  | A    |                                                                             |
| Over-Temp Limit                |                  | 105        |                  | °C   | The trip point for over-temp shutdown                                       |
| Over-Temp Hysteresis           |                  | 15         |                  | °C   |                                                                             |



|                                                                                    |                               |                            |                   |
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| <b>MODEL NO: 21030E00</b><br><b>EQUALIZER, 30A</b><br><b>SPECIFICATION OUTLINE</b> |                               |                            |                   |
| SIZE<br><b>A</b>                                                                   | CAGE CODE NO.<br><b>55156</b> | DWG NO.<br><b>21030E00</b> | REV<br><b>001</b> |
| SCALE: NONE                                                                        | FILE: 21030E00-001            | SHEET <b>5</b> OF <b>9</b> |                   |

| REVISIONS |     |             |      |    |
|-----------|-----|-------------|------|----|
| REV       | ECO | DESCRIPTION | DATE | BY |
| -         | -   | -SEE SH 1-  |      |    |

## ELECTROMAGNETIC COMPATIBILITY:

| Transient Immunity Tests | Level                       | Notes:                                                                                               |
|--------------------------|-----------------------------|------------------------------------------------------------------------------------------------------|
| Load Dump                | $28 + 122e^{t/(0.4)}$       | IAW with SAE J1455 Rev 8/94 Section 4.11.2.2, Table 4a. Pulse applied to Vbat and ignition terminal. |
| Inductive Switching Kick | $28 \pm 600e^{t/(0.001)}$   | IAW with SAE J1455 Rev 8/94 Section 4.11.2.2, Table 4a. Pulse applied to all I/O.                    |
| Mutual Inductance        | $28 \pm 300e^{t/(0.00015)}$ | IAW with SAE J1455 Rev 8/94 Section 4.11.2.2, Table 4a. Pulse applied to all I/O.                    |

| Electrostatic Discharge Immunity | Level                                | Notes:                                           |
|----------------------------------|--------------------------------------|--------------------------------------------------|
| ESD – Handling                   | $\pm 15$ kV                          | IAW with SAE J1455 Rev 8/94 Section 4.11.2.2.5.1 |
| ESD – In Vehicle                 | $\pm 8$ kV direct<br>$\pm 15$ kV air | IAW with SAE J1113-13 Rev 2/95. Class C          |

| Radiated Immunity Test                   | Level  | Notes:                                        |
|------------------------------------------|--------|-----------------------------------------------|
| Absorber Lined Chamber<br>20MHz to 1GHz  | 100V/m | SAEJ1113/21. Units also pass ISO13766. Note 1 |
| Stripline Test Method<br>10kHz to 200MHz | 100V/m | SAEJ1113/23. Units also pass ISO13766. Note 1 |

| Emissions Test                                  | Level        | Notes:                                        |
|-------------------------------------------------|--------------|-----------------------------------------------|
| Radiated                                        | Class 2      | SAEJ1113/41. Units also pass ISO13766. Note 1 |
| Conducted                                       | Class 2      | SAEJ1113/41. Units also pass ISO13766. Note 1 |
| Radiated Emissions,<br>Broadband and Narrowband | Per Standard | ECE R 10.02. Note 1                           |

Note 1: Based on 21030C00CR test results. 21030E00 is part of the 21030C00 family.

|                                                                                       |                               |                            |                            |
|---------------------------------------------------------------------------------------|-------------------------------|----------------------------|----------------------------|
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| <b>MODEL NO: 21030E00</b><br><b>EQUALIZER, 30A</b><br><b>SPECIFICATION OUTLINE</b>    |                               |                            |                            |
| SIZE<br><b>A</b>                                                                      | CAGE CODE NO.<br><b>55156</b> | DWG NO.<br><b>21030E00</b> | REV<br><b>001</b>          |
| SCALE: NONE                                                                           |                               | FILE: 21030E00-001         | SHEET <b>6</b> OF <b>9</b> |

| REVISIONS |     |             |      |    |
|-----------|-----|-------------|------|----|
| REV       | ECO | DESCRIPTION | DATE | BY |
| -         | -   | -SEE SH 1-  |      |    |

## ENVIRONMENTAL SPECIFICATIONS

| Parameter            | Level                 | Conditions / Notes                                                                    |
|----------------------|-----------------------|---------------------------------------------------------------------------------------|
| Thermal Shock        |                       | per SAE J1455 Section 4.1 Rev 8/94.                                                   |
| Thermal Cycle        |                       |                                                                                       |
| Humidity             | 0 – 100 %RH           | per SAE J1455, Section 4.2.3 Rev 8/94.<br><b>See Note 1</b>                           |
| Splash               |                       | per SAE J1455 Section 4.4 Rev 8/94,<br>Splash only<br><b>See Note 1</b>               |
| Pressure Wash        |                       | per SAE J1455 Section 4.5 Rev 8/94.<br><b>See Note 1</b>                              |
| Dust Bombardment     | 0.88 g/m <sup>3</sup> | per SAE J1455 Section 4.7 Rev 8/94.<br><b>See Note 1</b>                              |
| Salt Spray           | 96 Hrs                | per SAE J1455 Section 4.3 Rev 8/94.<br><b>See Note 1</b>                              |
| Altitude             | 12000 ft              | per SAE J1455 Section 4.8 Rev 8/94.<br><b>See Note 1</b>                              |
| Mechanical Vibration |                       | per SAE J1455 Section 4.9 Rev 8/94<br>and Appendix A, Category 2<br><b>See Note 1</b> |
| Handling Shock       | Will Show Damage      | per SAE J1455 Section 4.10 Rev 8/94.                                                  |

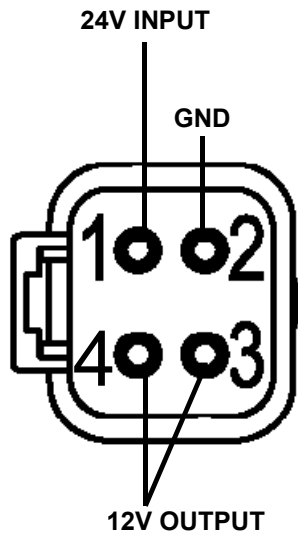
**Note 1:** Specifications not validated at this revision, SAE 1455 represents design intent.

|                                                                                       |               |                    |       |        |
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| <b>MODEL NO: 21030E00</b><br><b>EQUALIZER, 30A</b><br><b>SPECIFICATION OUTLINE</b>    |               |                    |       |        |
| SIZE                                                                                  | CAGE CODE NO. | DWG NO.            | REV   |        |
| A                                                                                     | 55156         | 21030E00           | 001   |        |
| SCALE: NONE                                                                           |               | FILE: 21030E00-001 | SHEET | 7 OF 9 |

| REVISIONS |     |             |      |    |
|-----------|-----|-------------|------|----|
| REV       | ECO | DESCRIPTION | DATE | BY |
| -         | -   | -SEE SH 1-  |      |    |

**FUNCTIONAL DESCRIPTION:**

**UNIT CONNECTIONS:**



**4-PIN MATING CONNECTOR**

(DEUTSCH)  
 HOUSING: DTP06-4S  
 SOCKET: 1062-12-0166  
 LOCK: WP4S

**Deutsch 4 Pin Connector**

**24V INPUT:** Pin 1

This terminal is connected to the +24V side of the battery stack.

**GND:** Pin 2

This is the terminal for grounding the unit. All internal operating currents are returned to this terminal.

**12V OUTPUT:** Pins 3, 4

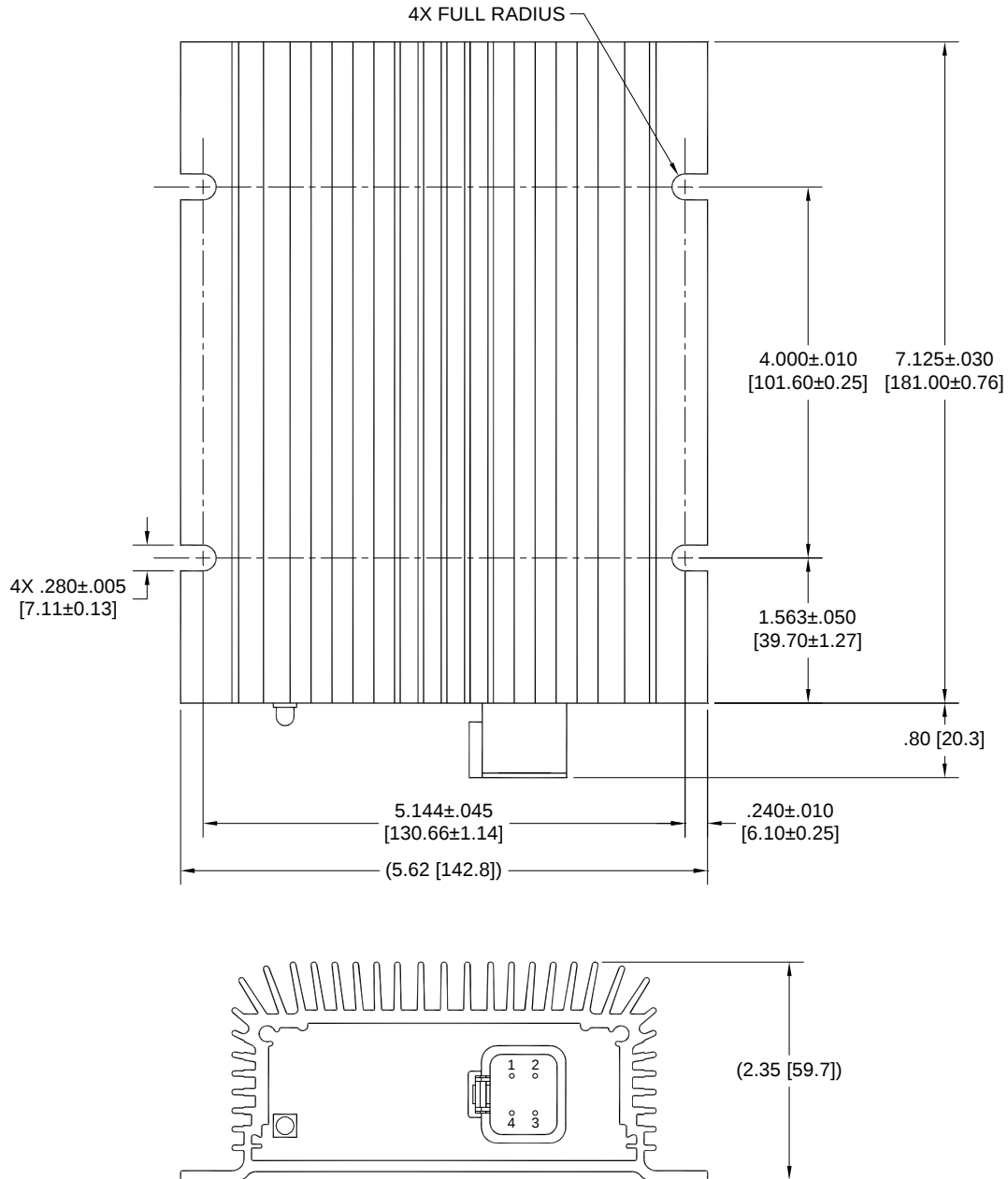
This is the 12V output. It can be connected to the desired 12V loads.

**MODEL NO: 21030E00**  
**EQUALIZER, 30A**  
**SPECIFICATION OUTLINE**

|                  |                               |                            |                            |
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| SIZE<br><b>A</b> | CAGE CODE NO.<br><b>55156</b> | DWG NO.<br><b>21030E00</b> | REV<br><b>001</b>          |
| SCALE: NONE      |                               | FILE: 21030E00-001         | SHEET <b>8</b> OF <b>9</b> |

# UNIT DIMENSIONS

| REVISIONS |     |             |      |    |
|-----------|-----|-------------|------|----|
| REV       | ECO | DESCRIPTION | DATE | BY |
| -         | -   | -SEE SH 1-  |      |    |



MODEL NO: 21030E00  
EQUALIZER, 30A  
SPECIFICATION OUTLINE

|             |                        |                     |              |
|-------------|------------------------|---------------------|--------------|
| SIZE<br>A   | CAGE CODE NO.<br>55156 | DWG NO.<br>21030E00 | REV<br>001   |
| SCALE: NONE |                        | FILE: 21030E00-001  | SHEET 9 OF 9 |