



# eSure™ +27 VDC Bullet Converter

## Installation and User Manual

Specification Number: 1C4827375B

Model Number: C48/27-375B

Note: P/N 60147273 includes Vertiv™ eSure™ +27 VDC Bullet Converter Spec. No. 1C4827375B and associated components.

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## **Technical Support Site**

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit <https://www.vertiv.com/en-us/support/> for additional assistance.

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# Admonishments Used in this Document



**DANGER!** Warns of a hazard the reader **will** be exposed to that will **likely** result in death or serious injury if not avoided. (ANSI, OSHA)



**WARNING!** Warns of a potential hazard the reader **may** be exposed to that **could** result in death or serious injury if not avoided. This admonition is not used for situations that pose a risk only to equipment, software, data, or service. (ANSI)



**CAUTION!** Warns of a potential hazard the reader **may** be exposed to that **could** result in minor or moderate injury if not avoided. (ANSI, OSHA) This admonition is not used for situations that pose a risk only to equipment, data, or service, even if such use appears to be permitted in some of the applicable standards. (OSHA)



**ALERT!** Alerts the reader to an action that **must be avoided** in order to protect equipment, software, data, or service. (ISO)



**ALERT!** Alerts the reader to an action that **must be performed** in order to prevent equipment damage, software corruption, data loss, or service interruption. (ISO)



**FIRE SAFETY!** Informs the reader of fire safety information, reminders, precautions, or policies, or of the locations of fire-fighting and fire-safety equipment. (ISO)



**SAFETY!** Informs the reader of general safety information, reminders, precautions, or policies not related to a particular source of hazard or to fire safety. (ISO, ANSI, OSHA)

# Important Safety Instructions

## Safety Admonishments Definitions

Definitions of the safety admonishments used in this document are listed under “Admonishments Used in this Document” on page v.

## General Safety



**DANGER!** YOU MUST FOLLOW APPROVED SAFETY PROCEDURES.

Performing the following procedures may expose you to hazards. These procedures should be performed by qualified technicians familiar with the hazards associated with this type of equipment. These hazards may include shock, energy, and/or burns. To avoid these hazards:

- a) The tasks should be performed in the order indicated.
- b) Remove watches, rings, and other metal objects.
- c) Prior to contacting any uninsulated surface or termination, use a voltmeter to verify that no voltage or the expected voltage is present. Check for voltage with both AC and DC voltmeters prior to making contact.
- d) Wear eye protection.
- e) Use certified and well maintained insulated tools. Use double insulated tools appropriately rated for the work to be performed.

## Voltages

### AC Input Voltages



**DANGER!** The system the +27 VDC Bullet converter is installed in operates from AC input voltage capable of producing fatal electrical shock.

### DC Input Voltages



**DANGER!** The +27 VDC Bullet Converter operates from DC input voltage. Although the DC voltage is not hazardously high, the input power can deliver large amounts of current.

## DC Output and Battery Voltages



**DANGER!** The system the +27 VDC Bullet converter is installed in produces DC power and may have a battery source connected to it. Although the DC voltage is not hazardously high, the rectifiers and/or battery can deliver large amounts of current.

## Personal Protective Equipment (PPE)



**DANGER!** ARC FLASH AND SHOCK HAZARD.

Appropriate PPE and tools required when working on this equipment. An appropriate flash protection boundary analysis should be done to determine the “hazard/risk” category, and to select proper PPE.



Only authorized and properly trained personnel should be allowed to install, inspect, operate, or maintain the equipment.

Do not work on LIVE parts. If required to work or operate live parts, obtain appropriate Energized Work Permits as required by the local authority, per NFPA 70E “Standard for Electrical Safety in the Workplace”.

## Hazardous Voltage



**DANGER!** HAZARD OF ELECTRICAL SHOCK.

More than one disconnect may be required to de-energize the system before servicing.

## Handling Equipment Containing Static Sensitive Components



**ALERT!** Installation or removal of equipment containing static sensitive components requires careful handling. Before handling any equipment containing static sensitive components, read and follow the instructions contained on the Static Warning Page.

# Static Warning



This equipment contains static sensitive components. The warnings listed below must be observed to prevent damage to these components. Disregarding any of these warnings may result in personal injury or damage to the equipment.

1. Strictly adhere to the procedures provided in this document.
2. Before touching any equipment containing static sensitive components, discharge all static electricity from yourself by wearing a wrist strap grounded through a one megohm resistor. Some wrist straps have a built-in one megohm resistor; no external resistor is necessary. Read and follow wrist strap manufacturer's instructions outlining use of a specific wrist strap.
3. Do not touch traces or components on equipment containing static sensitive components. Handle equipment containing static sensitive components only by the edges that do not have connector pads.
4. After removing equipment containing static sensitive components, place the equipment only on static dissipative surfaces such as conductive foam or ESD bag. Do not use ordinary Styrofoam or ordinary plastic.
5. Store and ship equipment containing static sensitive components only in static shielding containers.
6. If necessary to repair equipment containing static sensitive components, wear an appropriately grounded wrist strap, work on a conductive surface, use a grounded soldering iron, and use grounded test equipment.



# Avertissements utilisés dans ce document



**DANGER!** Signale au lecteur un risque auquel il sera exposé et qui, s'il n'est pas évité, pourrait entraîner des blessures graves, voire mortelles. (ANSI, OSHA)



**AVERTISSEMENT!** Signale au lecteur un risque potentiel auquel il pourrait être exposé et qui, s'il n'est pas évité, pourrait entraîner des blessures graves, voire mortelles. Cet avertissement n'est pas applicable aux situations dans lesquelles seuls l'équipement, les logiciels, les données ou le service sont à risqué. (ANSI)



**ATTENTION!** Signale au lecteur un risque potentiel auquel il pourrait être exposé et qui, s'il n'est pas évité, pourrait entraîner des blessures mineures à modérées (ANSI, OSHA). Cet avertissement n'est pas applicable aux situations dans lesquelles seuls l'équipement, les données ou le service sont à risque, même si une telle utilisation semble autorisée dans l'une des normes applicables. (OSHA)



**ALERTE!** Informe le lecteur d'une action devant impérativement être évitée pour protéger l'équipement, les logiciels, les données ou le service. (ISO)



**ALERTE!** Informe le lecteur d'une action devant impérativement être effectuée afin d'empêcher tout endommagement de l'équipement, toute corruption des logiciels, toute perte de données ou toute interruption de service. (ISO)



**SÉCURITÉ INCENDIE!** Communique au lecteur des informations, des rappels, des consignes ou des politiques en matière de sécurité, ou l'informe de l'emplacement des équipements de sécurité incendie ou de lutte contre les Incendies. (ISO)



**SÉCURITÉ!** Communique au lecteur des informations, des rappels, des consignes ou des politiques en matière de sécurité générale, sans aucun lien avec une source de danger particulière ou avec la sécurité incendie. (ISO, ANSI, OSHA)

# Consignes de sécurité importantes

## Définition des avertissements de sécurité

Pour consulter les définitions des avertissements de sécurité utilisés dans ce document, reportez-vous à la section « Avertissements utilisés dans ce document » à la page v.

## Consignes de sécurité générales



**AVERTISSEMENT!** LES PROCÉDURES DE SÉCURITÉ APPROUVÉES DOIVENT ÊTRE OBSERVÉES.

Les procédures suivantes peuvent vous exposer à certains risques. Ces procédures doivent être réalisées par des techniciens qualifiés connaissant les risques associés à ce type d'équipement. Ces risques peuvent inclure des chocs, des décharges électriques et/ou des brûlures. Afin d'éviter de tels risques:

- a) Les tâches doivent être effectuées dans l'ordre indiqué.
- b) Retirez montres, bagues et autres objets métalliques.
- c) Avant tout contact avec une surface ou une borne/cosse non isolée, vérifiez à l'aide d'un voltmètre qu'aucune tension quelle qu'elle soit, ni même la tension attendue, n'est présente. Vérifiez les tensions avec des voltmètres c.a. et c.c. avant d'établir tout contact.
- d) Portez des lunettes de sécurité. Portez des gants pour manipuler les batteries.
- e) Utilisez des outils isolés, certifiés et bien entretenus. Utilisez des outils doublement isolés et de puissance adaptée aux travaux à réaliser.

## Tensions

### Tensions c.a. en entrée



**DANGER!** Le système dans lequel le convertisseur Bullet +27 VDC est installé fonctionne à partir d'une tension d'entrée CA capable de produire un choc électrique mortel.

## Tensions d'alimentation en entrée c.c.



**DANGER!** Le convertisseur Bullet +27 VDC fonctionne à partir d'une tension d'entrée CC. Bien que la tension continue ne soit pas dangereusement élevée, la puissance d'entrée peut fournir de grandes quantités de courant.

## Tensions de sortie CC et de batterie



**DANGER!** Le système dans lequel le convertisseur Bullet +27 VDC est installé produit une alimentation CC et peut être connecté à une source de batterie. Bien que la tension continue ne soit pas dangereusement élevée, les redresseurs et/ou la batterie peuvent fournir de grandes quantités de courant.

## Équipement de protection individuelle (EPI)



**DANGER!** RISQUE D'ARC ET DE CHOC ÉLECTRIQUE.

Un EPI et des outils adéquats sont nécessaires pour travailler sur cet équipement.



Une analyse des limites de protection contre les arcs électriques doit être menée afin de déterminer la catégorie de « risque », ainsi que pour sélectionner l'EPI adéquat.

Seul un personnel autorisé et dûment formé doit être autorisé à installer, à inspecter, à utiliser ou à entretenir l'équipement.

Ne travaillez pas sur les pièces SOUS TENSION. Si vous devez travailler sur des pièces sous tension ou utiliser de telles pièces, obtenez des permis de travail adéquats, tels qu'exigés par les autorités locales, conformément à la norme NFPA 70E « Norme de sécurité électrique sur le lieu de travail ».

## Tension dangereuse



**DANGER!** RISQUE DE CHOC ÉLECTRIQUE.

Plusieurs sectionneurs peuvent être nécessaires pour mettre le système hors tension avant de procéder à l'entretien.

## Manipulation d'équipements contenant des composants sensibles à l'électricité statique



**ALERTE!** L'installation ou le retrait d'équipements contenant des composants sensibles à l'électricité statique exigent une manipulation délicate. Avant de manipuler tout équipement contenant des composants sensibles à l'électricité statique, veuillez à bien lire et à suivre les instructions fournies à la section « Mise en garde concernant l'électricité statique ».

# Mise en garde concernant l'électricité statique



Cet équipement contient des composants sensibles à l'électricité statique. Les mises en garde ci-dessous doivent être observées afin d'empêcher tout endommagement de ces composants. Le non-respect de ces mises en garde pourrait entraîner des blessures corporelles ou endommager l'équipement.

1. Respectez rigoureusement les procédures indiquées dans ce document.
2. Avant de toucher tout équipement contenant des composants sensibles à l'électricité statique, dotez-vous un bracelet relié à la terre via une résistance d'un mégaohm afin de décharger toute l'électricité statique présente sur votre corps. Certains bracelets disposent d'une résistance d'un mégaohm intégrée. Aucune résistance externe n'est nécessaire dans ce cas. Veuillez lire et observer les instructions d'utilisation du fabricant du bracelet pour en connaître les spécificités.
3. Ne touchez pas de piste ou de composant de l'équipement contenant lui-même des composants sensibles à l'électricité statique. Manipulez les composants sensibles à l'électricité statique en les tenant uniquement par les bords ne contenant aucun plot de connexion.
4. Après avoir retiré les composants sensibles à l'électricité statique, posez l'équipement sur des surfaces à dissipation statique, telles que de la mousse conductrice ou un sachet antistatique. N'utilisez pas de mousse de polystyrene (styromousse) ou de plastique ordinaire.
5. Entreposez et expédiez les équipements contenant des composants sensibles à l'électricité statique dans des conteneurs dotés d'une protection antistatique.
6. En cas de nécessité de réparation d'un équipement contenant des composants sensibles à l'électricité statique, dotez-vous d'un bracelet correctement relié à la terre, travaillez sur une surface conductrice, utilisez un fer à souder relié à la terre, ainsi qu'un équipement de test de terre.

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# 1 Introduction

## 1.1 Overview

The Vertiv™ eSure™ +27 VDC Bullet Converter (Model C48/27-375B, Spec. No. 1C4827375B) is a compact DC/DC converter unit which offers efficient power conversion. It operates from -48 VDC source to provide regulated +27 VDC to the load for continuous operation to -41V.

The C48/27-375B simply plugs into a load position on the system's distribution panel which accepts a bullet device. The bullet terminals provide connections for DC input and the regulated DC output. The supplied return lead is installed from the device to the panel's return bar.

The +27 VDC Bullet converter provides several functions.

1. Converts the input voltage to provide a regulated +27 VDC to the load.
2. Provides overload protection with a resettable electronic over-current switch.
3. Contains a mechanical switch to enable and disable the output. This switch also resets the electronic over-current protection switch.
4. Internal fuse for fail-safe output circuit overload protection. This fuse will blow only in the event of a failure of the device.

## 1.2 What is in the Box

Kit P/N 60147273 includes the items listed in **Table 1**.

**Table 1: Items in Kit P/N 60147273**

Part Number	Description	Qty
1C4827375B	+27 VDC Bullet Converter	1
565990	Return Wire Faston Tab	1
564330	Return Wire (6-inch long)	1
565752 (See Note 1)	Return Wire Jumper Extension (4-inch long)	1
566207 (See Note 1)	Return Wire Jumper Extension (8-inch long)	1
UM60147273	These Instructions	1

Note 1: The return wire jumper extension may or may not be required for each mounting bracket kit. Refer to the instructions furnished with the mounting bracket kits.

## 1.3 Support Mounting Bracket Kits

Support mounting bracket kits have been designed to easily install the C48/27-375B +27 VDC Bullet Converter into the power systems listed in **Table 2**. A support mounting bracket kit must be used for grounding and mechanical support. The various support mounting bracket kits available are listed in **Table 3**. Each kit comes with specific installation instructions.

Refer to **Figure 1** for an illustration of the C48/27-375B.

## 1.4 Application

Applications of this product include, but are not limited to the following:

- This product could be used in applications where the primary power system provides -48 VDC and +24 VDC is needed for site equipment.
- The +27 VDC Bullet converter regulates the output voltage to +27 VDC while operating from -48 VDC rectifiers or battery.



**Table 2: Associated Power Systems**

Spec. No.	Description
548066	-48 VDC Stand-Alone Distribution Panel, 19-inch wide
548067	-48 VDC Stand-Alone Distribution Panel, 23-inch wide
10009822	-48 VDC Stand-Alone Distribution Panel, 23-inch wide,w/adapters
545277 and 520276	-48 VDC Stand-Alone Distribution Panel, 20-position
10012729	-48 VDC Stand-Alone Distribution Panel, 19-inch wide,w/adapters
582126000	NetSure™ 701 -48 VDC Power System
582127000	NetSure™ 7100 -48 VDC Power System
582137000	NetSure™ 512 -48 VDC Power System (List 27)
582137100	NetSure™ 5100 -48 VDC Power System

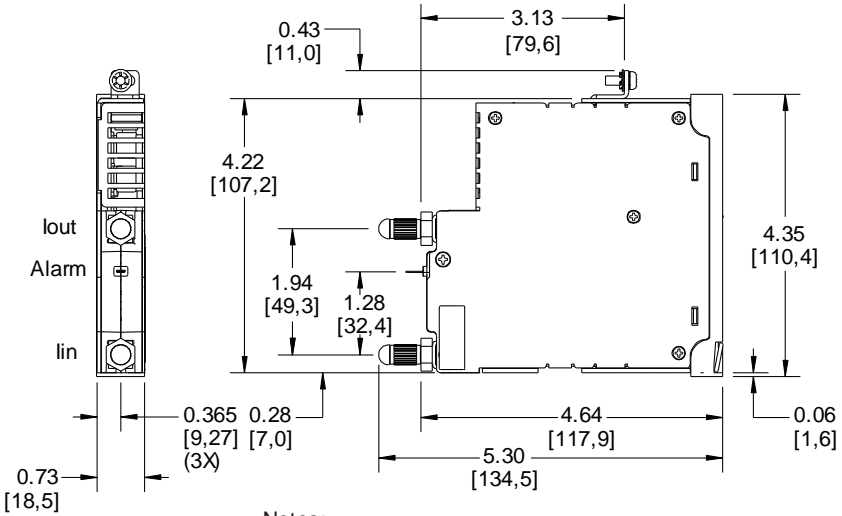
**Table 3: Power System Mounting Bracket Kits (cont'd on next page)**

Mounting Bracket Kit P/N	Description
565391	<p>For use with a List AA (24-position bullet) distribution panel installed in a Spec. No. 582127000 power system.</p> <p>For use with a List DA, DB, DC, DD (21-position bullet dual voltage) distribution panel installed in a Spec. No. 582127000 power system.</p> <p>(Kit Instructions, see IM565391.)</p>
565459	<p>For use with a List AL (26-position bullet) distribution panel installed in a Spec. No. 582127000, 582127000100, 582127000101, 582127000102, 582127000103, 582127000203 power system.</p> <p>For use with a List DE, DF, DG, DH, DJ, DK (26-position bullet dual voltage) distribution panel installed in a Spec. No. 582127000 power system.</p> <p>(Kit Instructions, see IM565391.)</p>
565601	<p>For use with a List AA, AM, AN (24-position bullet) distribution panel installed in a Spec. No. 582126000 power system.</p> <p>For use with a List JA, JB, JC (20-position bullet dual voltage) or List JD (22-position bullet dual voltage) distribution panel installed in a Spec. No. 582126000, power system.</p> <p>(Kit Instructions, see IM565391.)</p>
10010670	<p>For use with a P/N 548067 stand-alone distribution panel. Includes mounting bracket and door kits. (Kit Instructions, see IM565649.)</p>
60018725	<p>For use with a P/N 548066 stand-alone distribution panel. Includes mounting bracket and door kits.</p> <p>(Kit Instructions, see IM565649.)</p>
565460	<p>For use with a Spec. No. 582137000 List 27, 500, 501 power system.</p> <p>(Kit Instructions, see IM565460.)</p>
565939	<p>For use with a Spec. No. 582137100 List 20 power system.</p> <p>(Kit Instructions, see IM565939.)</p>
60011929	<p>For use with a Spec. No. 582137100 List 21 power system.</p> <p>(Kit Instructions, see IM565939.)</p>
565997	<p>For use with a Spec. No. 582137100 List 25 power system.</p> <p>(Kit Instructions, see IM565939.)</p>
60011928	<p>For use with a Spec. No. 582137100 List 26, 500, 501 power system and Spec. No. 582127000 List 600, 601, 900, 901 power systems.</p> <p>(Kit Instructions, see IM565939.)</p>
60011930	<p>For use with a Spec. No. 582137100 List 27 power system.</p> <p>(Kit Instructions, see IM565939.)</p>
60017372	<p>For use with a P/N 545277 and 520276 stand-alone distribution panel. Includes mounting bracket and door kits.</p> <p>(Kit Instructions, see IM60017372.)</p>

**Table 4: Additional Material for Systems to be Equipped with +27 VDC Bullet Converter**

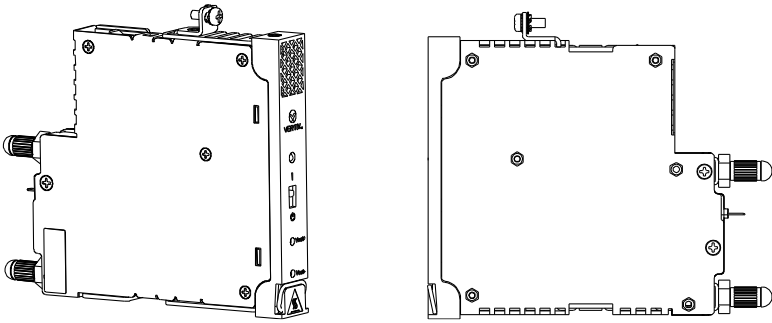
P/N	Description
565788	21-position return bus bar for use with Spec. No. 582137100 List 20 installed prior to January, 2020.
565789	26-position return bus bar for use with Spec. No. 582137100 List 25 installed prior to January, 2020.
60016097	2-position load bus bar adapter for use with two +27 VDC Bullet converters in parallel.
545346	3-position load bus bar adapter for use with three +27 VDC Bullet converters in parallel.
566026	Toggle breaker guard kit (included with each +27 VDC Bullet Converter bracket kit)

**Figure 1: C48/27-375B Illustration**



Notes:

1. All dimensions are in inches [mm].

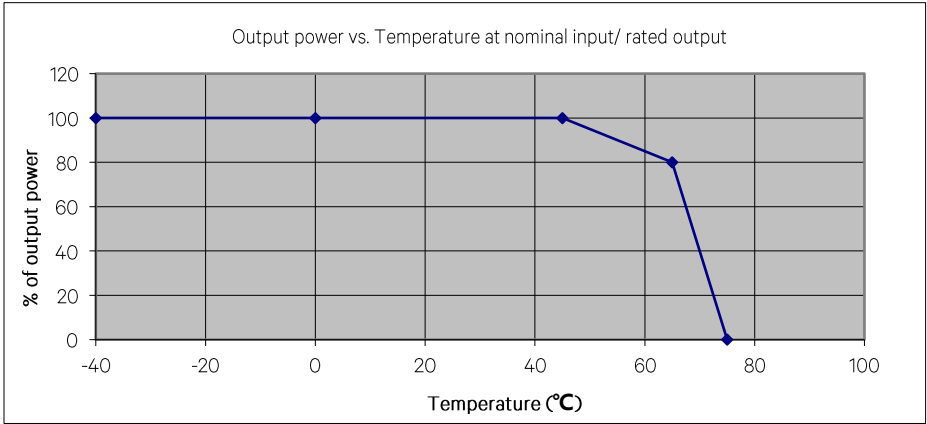


# 2 Specifications

## 2.1 DC Output Ratings

1. Nameplate Rating: +27 VDC/13.9A, 375W maximum.
2. Output Voltage: Nominal +27 VDC. Output voltage is non-adjustable.
3. Output Current: 13.9 amps maximum.
4. Output Power: See **Figure 2**.
5. Regulation:
  - a) Output Voltage Tolerance:  $\pm 0.35$  VDC.
  - b) Dynamic Response: Step changes in load, from 10% to 90% or 90% to 10% at 1A/usec shall not cause the voltage measured at the module output to overshoot or undershoot more than 5% of the regulated output level. The output voltage must return and stay within the regulation band within 4ms (Telcordia GR-947-CORE.)
  - c) Overshoot/Undershoot: 5.0% maximum output voltage overshoot at turn-on (high voltage shutdown does not activate). No voltage undershoots at turn-off.
  - d) Output Voltage Accuracy:  $\pm 0.10$ V (at +27 VDC and 50% load and nominal input voltage [41V to 58V]).

**Figure 2: Output Power Ratings V.S. Temperature**



Power Derating Based on Temperature:

- a)  $-40^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$ ) to  $+45^{\circ}\text{C}$  ( $113^{\circ}\text{F}$ ) with 375W output,
- b)  $+45^{\circ}\text{C}$  ( $113^{\circ}\text{F}$ ) to  $+65^{\circ}\text{C}$  ( $149^{\circ}\text{F}$ ) with linear derating to 300W,
- c)  $+65^{\circ}\text{C}$  ( $149^{\circ}\text{F}$ ) to  $+75^{\circ}\text{C}$  ( $167^{\circ}\text{F}$ ) with linear derating to 0 W.

6. Filtering:
  - a) Peak to Peak Noise: 250 mV up to 100 MHz.
  - b) Psophometric Noise: Less than 2 mv at load(5% to 100%) conditions (16.66 Hz to 6000 Hz).
  - c) Wideband Noise:

<20 mV between 25 Hz to 20 kHz according to ETS EN 300 132-2.

<25 mV rms in any 3 kHz band 10 KHz to 20 MHz for all line, load and environmental conditions according to GR-947-Core section 3.24.
  - d) Narrow Band Noise: -21 dBm (20 mV) at 25 Hz to 200 Hz, -40 dBm (2.24 mV) at 500 Hz to 3000 Hz and linear in between; -35 dBm (4 mV) at 3 kHz to 20 kHz according to ETSI EN 300 132-2 V2\_1\_2 2003-09 4.9.1
  - e) Voice Frequency Output Noise (System Noise): Output noise less than 38 dBnc at nominal input and load (5% to 100%) conditions (16.66 Hz to 6000 Hz).

## 2.2 DC Input Ratings

1. Nameplate Rating: -41 VDC / 10 A; -58 VDC / 7 A.
2. Input Voltage:

-41.0 VDC to -58 VDC with 100% maximum output.
3. Maximum Input Current: 10 A at 41 Vin.
4. Inrush Current: The peak value of the input inrush current shall not exceed 2.0 times the peak value of the maximum steady-state input current at 25 °C and shall not trigger the +27 VDC Bullet converter's internal input fault protection device(s). No damage to connection points when inserted into a live bus.
5. Typical Input Data: See **Table 5**.

**Table 5: Typical Input Data**

	Vin (VDC)	% load	Iin (ADC)	Vo (VDC)	Io (ADC)	Eff	Wloss (W)	BTU/hour
42	42.32	0.00%	0.07	27.88	0	0	2.96	10.10
	42.27	20.50%	1.99	27.26	2.82	0.914	7.25	24.74
	42.16	50.34%	4.71	27.12	6.96	0.951	9.8	33.44
	42.13	60.50%	5.65	27.08	8.38	0.957	10.33	35.25
	42.09	79.96%	7.43	26.99	11.11	0.959	12.89	43.98
	42.06	89.87%	8.35	26.94	12.51	0.960	14.18	48.38
	42.04	99.62%	9.26	26.90	13.89	0.960	15.7	53.57
48	48.24	0.00%	0.07	27.88	0	0	3.38	11.53
	48.15	20.50%	1.75	27.26	2.82	0.912	7.39	25.22
	48.07	40.50%	3.36	27.17	5.59	0.940	9.64	32.89
	48.05	50.34%	4.14	27.13	6.96	0.949	10.14	34.60
	48.01	60.73%	4.97	27.08	8.41	0.954	10.88	37.12
	47.96	79.96%	6.53	26.99	11.11	0.958	13.32	45.45
	48.03	89.96%	7.33	26.95	12.52	0.958	14.91	50.88
48.1	99.64%	8.11	26.90	13.89	0.958	16.44	56.10	
54.5	54.71	0.00%	0.07	27.88	0	0	3.83	13.07
	54.69	20.50%	1.53	27.26	2.82	0.919	6.8	23.202
	54.64	40.57%	2.96	27.17	5.6	0.941	9.59	32.722
	54.61	50.34%	3.66	27.13	6.96	0.945	11.08	37.81
	54.58	60.73%	4.39	27.08	8.41	0.950	11.88	40.54
	54.51	79.97%	5.75	26.99	11.11	0.957	13.56	46.27
	54.51	89.96%	6.46	26.95	12.52	0.958	14.77	50.40
54.49	99.65%	7.16	26.90	13.89	0.958	16.48	56.23	
58	58.19	0.00%	0.06	27.88	0	0	3.49	11.91
	58.19	20.45%	1.43	27.26	2.82	0.924	6.34	21.631
	58.14	40.57%	2.8	27.17	5.6	0.935	10.65	36.34
	58.11	50.34%	3.44	27.13	6.96	0.944	11.11	37.91
	58.09	60.73%	4.13	27.08	8.41	0.949	12.19	41.59
	58.04	79.97%	5.41	26.99	11.11	0.955	14.12	48.18
	58.02	89.96%	6.08	26.95	12.52	0.956	15.4	52.55
57.99	99.65%	6.73	26.90	13.89	0.958	16.6	56.64	



## 2.3 Environmental Ratings

1. Operation Temperature Range: -40 °C to +75 °C (-40 °F to +167 °F).
2. Storage Ambient Temperature Range: -40 °C to +70 °C (-40 °F to +158 °F).
3. Temperature Coefficient: 0.02% of output regulation per degree Celsius at full performance temperature range.
4. Relative Humidity: Capable of operating in an ambient relative humidity range of 0% to 93%, non-condensing.
5. Altitude:
  - a) 2000 m (6562 ft) at full power (power limited for heights above 2000 m).
  - b) The maximum operating ambient temperature is to be derated by 2 °C per 305 meters (1000 feet) above 2000 meters (6562) feet.
  - c) Operating: -60 meters (-200 feet) to 3050 meters (10000 feet) (per Telcordia GR-63).
6. Seismic: Designed to meet GR-63-CORE Zone 4.

## 2.4 Compliance Information

1. Safety: UL 62368-1; 3rd Ed, 2021-10-22 (Audio/video, information and communication technology equipment Part 1: Safety requirements) CAN/CSA C22.2 No. 62368-1:19, 3rd Ed, 2021-10-22 (Audio/video, information and communication technology equipment Part 1: Safety requirements).

UL recognized per UL / cUL Category QQJQ2 (UL) and QQJQ8 (cUL) as a power supply.

2. FCC: The +27 VDC Bullet converter operating in any of the approved power systems listed in **Table 2** conforms to the requirements of FCC rules Part 15, Subpart B, Class B for radiated and conducted emissions limits. Telcordia GR-1089-CORE class A. CISPR22, Class A conducted and radiated.
3. NEBS Compliance: Designed to meet GR-1089-CORE. GR-63-CORE to NEBS Level 3 and compliance to GR-3108 Class 2.

## 2.5 Standard Features

1. The +27 VDC Bullet converter plugs into a standard bullet breaker panel. The +27 VDC Bullet converter combines the functionality of a DC-to-DC converter, overcurrent protection device, and disconnect switch in a package that is in the form factor of a bullet DC breaker so that it can be used in DC power plants that utilize the bullet style breaker.
2. Input Protection:
  - a) Fusing: A non-user replaceable fuse is located in the negative input lead of the +27 VDC Bullet converter. The fuse rating is 20A.



- ALERT! For continued protection against risk of fire, replace only with fuse of the same type and rating.
- b) Low Input Voltage Protection: The +27 VDC Bullet converter shuts down at low input voltage. The low voltage disable point is  $-38\pm 1.8$  VDC. Hysteresis at least 1.5VDC for restart.
  - c) High Input Voltage Protection: High voltage disable point:  $61.5\pm 2.5$  VDC. Hysteresis at least 2VDC for restart. The +27 VDC Bullet converter withstands voltages to  $-64.0$  VDC without damage or hazard.
3. Output Protection:
    - a) High Voltage Shutdown (HVSD): If the output voltage exceeds  $29.5\pm 0.5$  VDC, at the +27 VDC Bullet converter output, the +27 VDC Bullet converter shuts down. Manual restart is required by turning the +27 VDC Bullet converter off and then back on.
    - b) Overcurrent Protection: The +27 VDC Bullet converter shuts down (opens the output) if output current exceeds 15.5 A. The +27 VDC Bullet converter goes into overcurrent protection. it is supposed to go into hiccup mode and restart after the overcurrent condition is removed.
    - c) Over Temperature Protection: The +27 VDC Bullet converter shuts down if the internal temperature of the +27 VDC Bullet converter exceeds an acceptable level. Boost conversion operation will automatically resume after the over-temperature condition is corrected.
  4. Hot Swappable: The +27 VDC Bullet converter is designed to be plug-and-play. The +27 VDC Bullet converter can be inserted or removed from a live DC

power system with no damage as long as the +27 VDC Bullet converter is inserted with the enable/disable switch in the disabled position. Plugging the +27 VDC Bullet converter into the system will not affect the system voltage.

5. Load Sharing: +27 VDC Bullet converters are capable of being operated in parallel and share the load, each converters output current shall be within 1A of the average current of all converters. See **Table 4** for load bus bar adapters for paralleling converters.
6. External Alarm Contact: A +27 VDC Bullet converter fail alarm contact is extended to the distribution device alarm termination strip on the distribution panel.
7. Local Controls: A switch is provided on the front of the +27 VDC Bullet converter to enable/disable operation.
8. Local Test Points: Test points are provided on the front of the +27 VDC Bullet converter to allow measurement of output current.
9. Local Status and Alarm Indicator: An LED indicator is provided on the front of the +27 VDC Bullet converter to provide visual operating status or failure condition of the +27 VDC Bullet converter. Refer to **Table 7** for LED indicator operation.

## 2.6 Mechanical Specifications

1. Weight: 0.45 kg (1.0 lb).
2. Dimensions (H x W x D) (body): 4.35" (110.49 mm) x 0.73" (18.54 mm) x 4.64" (117.87 mm).

# 3 Installation

## 3.1 General Requirements

- This product is intended only for installation in a restricted access location on or above a non-combustible surface.
- This product must be located in a controlled environment with access to Crafts persons only.

- This product is intended for installation in network telecommunication facilities (CO, vault, hut, or other environmentally controlled electronic equipment enclosure).

## 3.2 Installing the +27 VDC Bullet Converter



**NOTE!** *The +27 VDC Bullet converter can be inserted or removed with power applied (hot swappable) as long as the +27 VDC Bullet converter is inserted/removed with the enable/disable switch in the disabled position. See **Figure 8** on page 24.*



**WARNING!** The +27 VDC Bullet converter and front mounting bracket becomes very hot during +27 VDC Bullet converter operation at heavy load. Wear heat resistant gloves or allow the +27 VDC Bullet converter to cool down before removing.

Refer to the instructions furnished with the mounting bracket kits for complete installation instructions. The following is a typical installation procedure.

### Typical Installation Procedure



**DANGER!** Adhere to the “Important Safety Instructions” starting on page vi and those listed in the power system manual.



**ALERT!** Only install the +27 VDC Bullet converter into a -48 VDC distribution position. Non-repairable damage will occur if the +27 VDC Bullet converter is plugged into a +24 VDC distribution position.



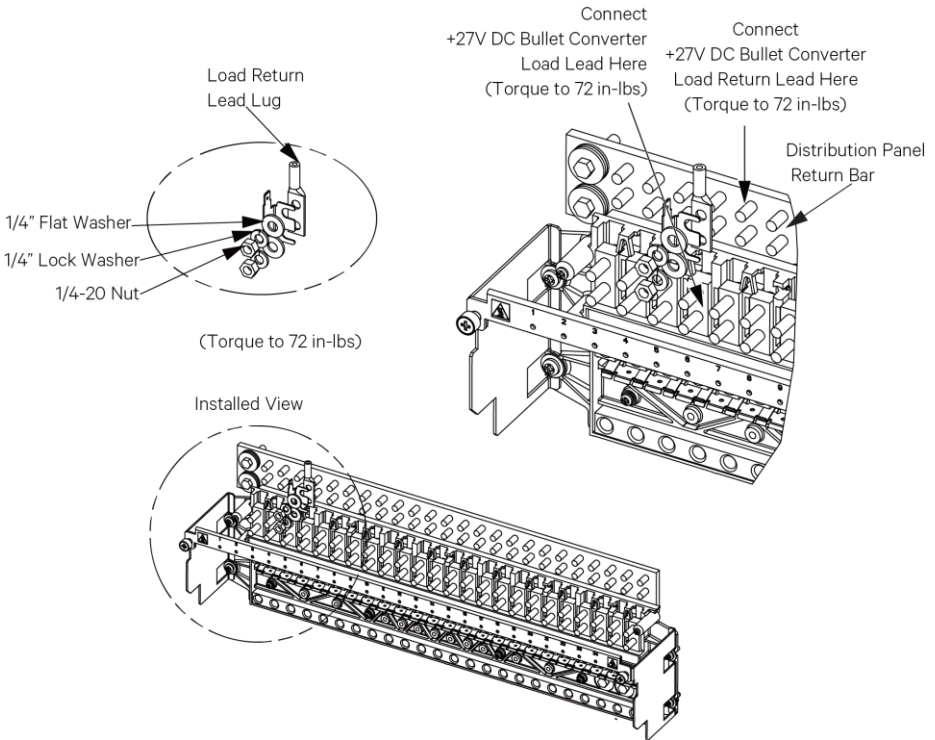
**NOTE!** *Mounting bracket kit P/N 565391 with distribution panel 582127000 List AA is used in the following procedure. Other kits and distribution panels similar. For complete installation instructions, refer to the instructions furnished with the mounting bracket kits.*

1. Performing this procedure may activate external alarms. Initial installation of the converter with the switch in the off position will actuate the CB/Fuse Alarm. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any future alarms associated with this system while the procedure is being performed.
2. Gain access to the distribution panel into which the +27 VDC Bullet converter is to be installed.

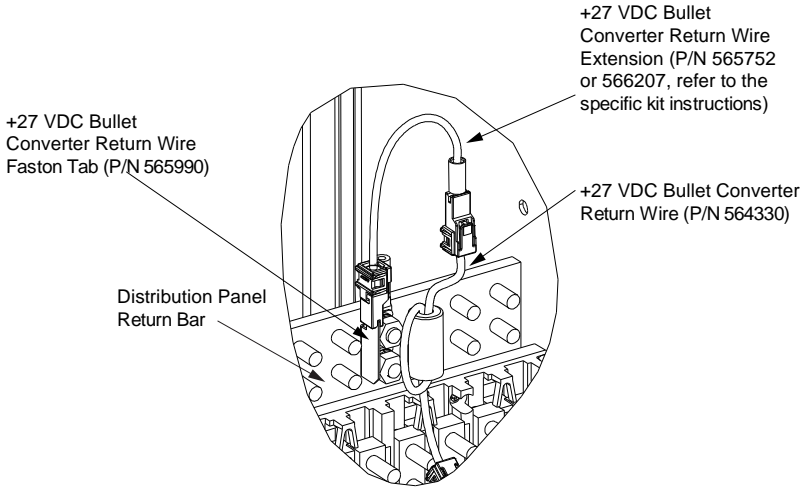
3. Install the +27 VDC Bullet converter mounting bracket kit per the installation instructions furnished with the kit. If two or three converters are to be connected in parallel or if a 6 position GMT fuse board kit (10062803) is used along with the converters, a two-position (60016097), or three-position (545346), or four-position (10078650), or five-position (10078651) lug adapter busbar plate should be installed first, as shown in the installation instructions.
4. It is recommended that +27 VDC Bullet converters should be installed at the end of the distribution panel opposite from the end where the input bus bar connects to the distribution panel. If the +27 VDC Bullet converter is to be installed for a newly connected load, connect the load and load return cables to the distribution panel for the position to be occupied by the +27 VDC Bullet converter. At the same time, connect the +27 VDC Bullet converter return wire faston tab (P/N 565990) provided with the +27 VDC Bullet converter to the distribution panel return busbar (use the same location and hardware used for the return lead to the load). See **Figure 3**. Torque as indicated in **Figure 3**.
5. If the +27 VDC Bullet converter is to replace an existing circuit breaker, remove the circuit breaker and verify the load and return cables for the position are wired and labeled correctly. It may be advantageous to loosen and temporarily move the load side cables for easier access to the hardware on the return landing position studs. Connect the +27 VDC Bullet converter return wire faston tab (P/N 565990) provided with the +27 VDC Bullet converter to the distribution panel return busbar (use the same location and hardware used for the return lead to the load). See **Figure 3**. Torque as indicated in **Figure 3**.
6. For return wire selection and installation routing, refer to the instructions furnished with each mounting bracket kit. Mounting bracket kit P/N 565391 with distribution panel 582127000 List AA is used in **Figure 4** and **Figure 5**. Refer to **Table 3** for other available kit P/Ns. General instructions are as follows:
  - a) **If required**, connect 4-inch long return wire extension P/N 565752 or 8-inch long return wire extension P/N 566207 provided with the +27 VDC Bullet converter to the return wire faston tab P/N 565990 previously installed on the distribution panel return bar.
  - a) Connect the return wire P/N 564330 provided with the +27 VDC Bullet converter to either the return wire extension installed in a) above or to the return wire faston tab P/N 565990 previously installed on the distribution panel return bar.

7. If the load side cables were disconnected in an above step, reinstall and tighten those cables in the appropriate positions.
8. Route the return wire (P/N 564330) down and behind the +27 VDC Bullet converter's front mounting bracket, then connect it to the +27 VDC Bullet converter. See **Figure 5**. Orient the white square on the return wire faston receptacle's locking tab as shown in **Figure 5**.

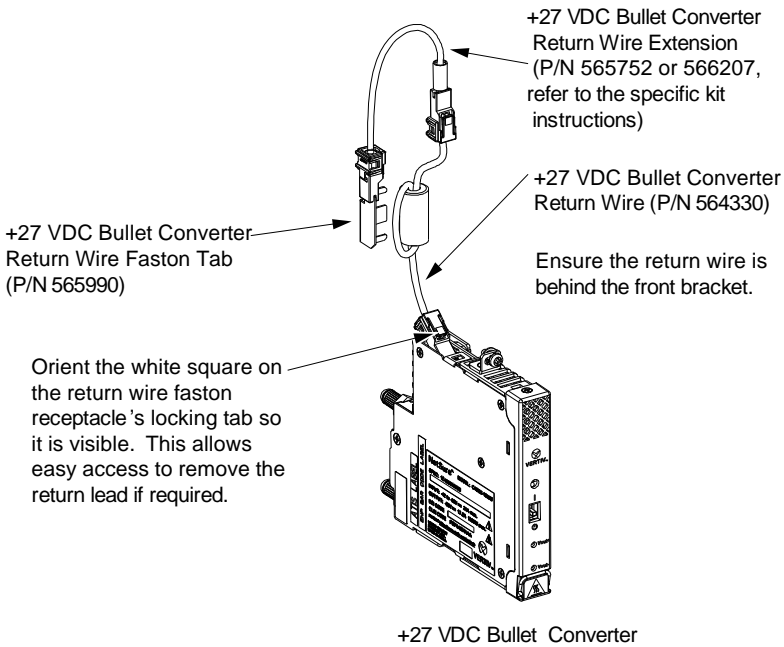
**Figure 3:** Connecting +27 VDC Bullet Converter Load and Load Return Cables to the Distribution Panel with the **+27 VDC Bullet Converter Return Wire Faston Tab (P/N 565990)**



**Figure 4:** Connecting +27 VDC Bullet Converter Return Wire (P/N 564330) and Return Wire Extension (P/N 565752) to the +27 VDC Bullet Converter Return Wire Faston Tab (P/N 565990)



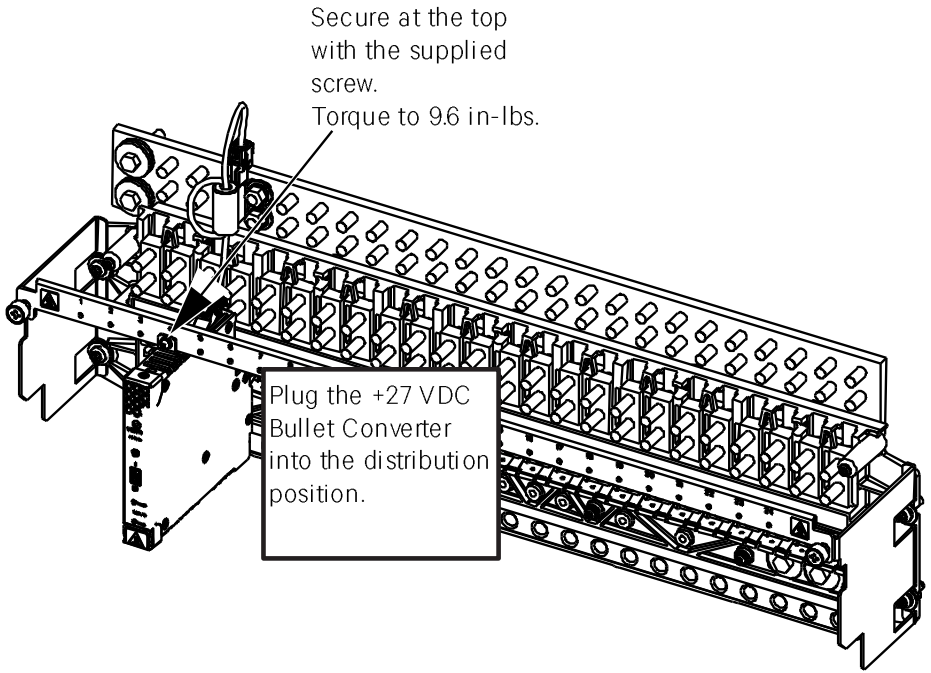
**Figure 5:** Connecting +27 VDC Bullet Converter Return Wire (P/N 564330) to the +27 VDC Bullet Converter



9. Ensure the enable/disable switch on the +27 VDC Bullet converter is in the disable (down) position. See **Figure 8** on page 24.
10. Plug the +27 VDC Bullet converter into the distribution panel. See **Figure 6**.
11. Secure the +27 VDC Bullet converter to the front mounting bracket with the screw provided with the +27 VDC Bullet converter. Torque as indicated in **Figure 6**.



**Figure 6:** Installing +27 VDC Bullet Converter



12. Place the enable/disable switch on the +27 VDC Bullet converter to the enable position. See **Figure 8** on page 24. If two or three +27 VDC Bullet converters are connected in parallel to a load that exceeds 375 watts peak, they should be switched on simultaneously.
13. Observe the status of the +27 VDC Bullet converter front panel local indicator. If operating normally, this indicator should be illuminated green. See **Figure 8** on page 24.
14. Enable the external alarms or notify appropriate personnel that this procedure is finished.
15. Ensure that there are no local or remote alarms active on the power system.

## 4 Making Electrical Connections

### 4.1 Important Safety Instructions



**DANGER!** Adhere to the “Important Safety Instructions” starting on page vi and those listed in the power system manual.

### 4.2 Wiring Considerations

All wiring and branch circuit protection should follow the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC), and applicable local codes. For operation in countries where the NEC is not recognized, follow applicable codes.

Refer to **Table 6** for recommended wire sizes.

**Table 6: Recommended Wire Sizes**

Modules in Parallel	Recommended Wire Size <sup>1</sup>	
	Ambient Temperature	
	40 °C	65 °C
1	12 AWG	12 AWG
2	8 AWG	8 AWG
3	8 AWG	8 AWG

<sup>1</sup> Wire sizes based on recommendations of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC). Table 310.15 (B) (16) for copper wire at 90 °C conductor temperature.



**NOTE!** (3) converters in parallel cannot exceed 750W total.

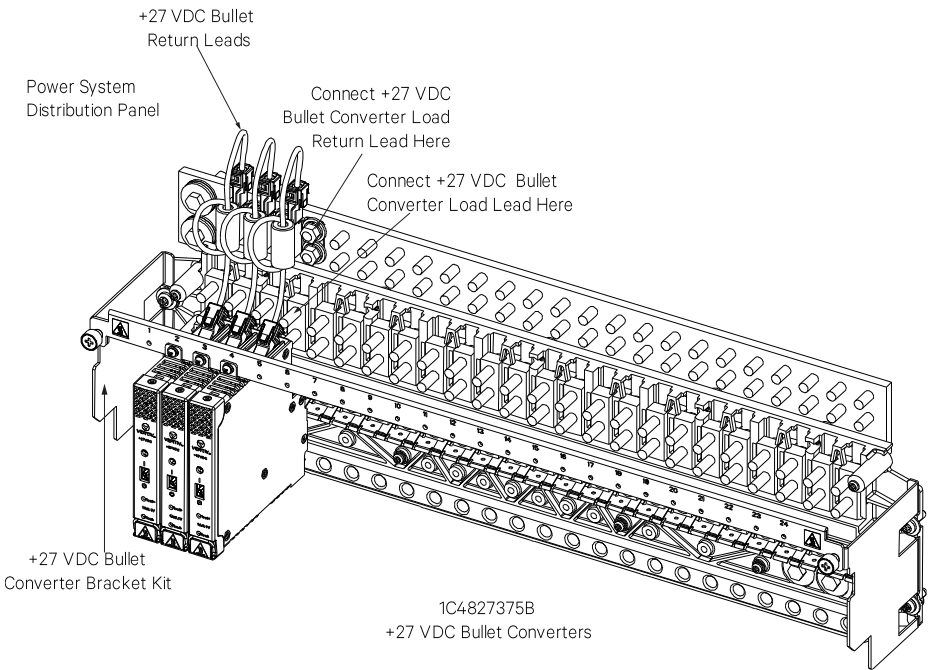
### 4.3 Electrical Connections

#### Procedure

1. Output leads from the +27 VDC Bullet converter are connected to the system's return bar and to the respective load position for the distribution position the device is installed in. Refer to the instructions furnished with the power system for wiring to a load position. See **Figure 7** for a typical wiring illustration. If the bullet converter output is to be connected to the GMT Fuse

Kit (10062803) refer to the instructions included with that kit for connection details.

**Figure 7: Typical Wiring Illustration**



## 5 Initially Starting and Checking +27 VDC Bullet Converter Operation

### 5.1 Initially Starting the +27 VDC Bullet Converter

#### Procedure

1. Place the enable/disable switch on the +27 VDC Bullet converter to the enable position. See **Figure 8**. If two or three +27 VDC Bullet converters are connected in parallel to a load that exceeds 375 watts peak, they should be switched on simultaneously.

## 5.2 Checking +27 VDC Bullet Converter Status

### Procedure

1. Observe the status of the +27 VDC Bullet converter front panel local indicator. If operating normally, this indicator should be illuminated green. See **Figure 8**.

# 6 Operation

## 6.1 Local Indicator, Test Points, and Switch

### Location and Identification

Refer to **Figure 8**.

### Indicator

There is one (1) indicator located on the +27 VDC Bullet converter's front panel. Refer to **Table 7** for the function of this indicator. Refer also to **Table 7** for the alarm contact state for each indicator function.

### Test Points

There are two (2) test points located on the +27 VDC Bullet converter's front panel (Iout- and Iout+) for measurement of output current. Use a voltmeter to measure the voltage across the two points. Refer to **Table 8** to convert the voltage reading from the test points to current.

### Switch

There is one (1) switch located on the +27 VDC Bullet converter's front panel. To place the +27 VDC Bullet converter into operation, place the switch in the "enable" position. To remove the +27 VDC Bullet converter from operation, place the switch in the "disable" position.

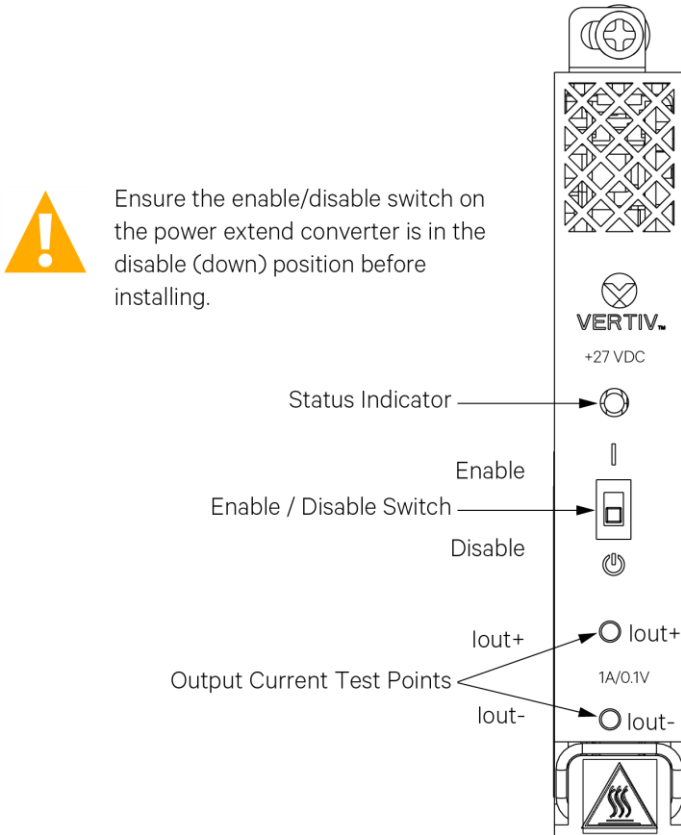
## 6.2 +27 VDC Bullet Converter High Voltage Shutdown and Lockout Restart and +27 VDC Bullet Converter Overcurrent Shutdown and Lockout Restart

If the +27 VDC Bullet converter experiences a high voltage or overcurrent condition on the output, the +27 VDC Bullet converter shuts down and locks out. The +27 VDC Bullet converter must be manually restarted. Refer to the following procedure to restart the +27 VDC Bullet converter.

## Procedure

1. Turn the +27 VDC Bullet converter off and then back on by placing the front panel enable/disable switch to the disable position and then to the enable position.

**Figure 8: Local Indicator, Test Points, and Switch Location and Identification**



**Table 7: Front Panel Indicator Function and Alarm Contact State**

Condition	LED Color	Alarm Contact State
+27 VDC Bullet converter is within correct input voltage range and operating properly.	Green	Open Circuit
Low output voltage.	Red	Closed to Source Input Bullet Terminal
+27 VDC Bullet Converter fail.		
Overcurrent Protection Mode.		
Enable/Disable switch set to off.		
Output protected (HVSD).		
Latched off due to overcurrent.		
No power to input.	Off	Closed to Source Input Bullet Terminal
Blown fuse.		

**Table 8: Test Point Conversion Table**

Test Point Voltage Measurement (VDC)	Actual Output Current (Amps)
0.00	0.00
0.10	1.00
0.20	2.00
0.30	3.00
0.40	4.00
0.50	5.00
0.60	6.00
0.70	7.00
0.80	8.00
0.90	9.00
1.00	10.00
1.10	11.00
1.20	12.00
1.30	13.00
1.40	14.00

## 7 Troubleshooting and Repair

### 7.1 Important Safety Instructions



**DANGER!** Adhere to the “Important Safety Instructions” starting on page vi and those listed in the power system manual.

### 7.2 Contact Information

Refer to Section 4154 (provided with your customer documentation) for support contact information.

### 7.3 Troubleshooting

#### 7.3.1 +27 VDC Bullet Converter Fault Symptoms and Troubleshooting

The fault indicators that can be displayed by the +27 VDC Bullet converter are as follows.



- Status Indicator (Red)
- Status Indicator (Off)

Refer to **Table 9** for a list of possible causes and corrective actions.

**Table 9: +27 VDC Bullet Converter Troubleshooting**

Symptom	Possible Cause(s)	Suggested Action(s)
Status Indicator Red	Low output voltage.	Replace the +27 VDC Bullet converter.
	Converter fail.	Replace the +27 VDC Bullet converter.
	Operating in Bypass Mode.	Lower output load to bring converter out of Bypass mode.
	Enable/Disable switch set to off.	Set switch to enable position.
	Output protected (HVSD).	Check for converter failure causing it to go into HVSD, replace converter.
	Latched off due to overcurrent.	Lower the load on the output or correct overload condition.
Status Indicator Off	No power to input.	Check rectifier system for proper operation to supply input voltage to the +27 VDC Bullet converter.
	Blown fuse.	Replace the +27 VDC Bullet converter.

## 7.4 Repair

When a trouble symptom is localized to a faulty +27 VDC Bullet converter, the +27 VDC Bullet converter is to be replaced in its entirety. No attempt should be made to troubleshoot or repair individual components inside the +27 VDC Bullet converter.

## 7.5 +27 VDC Bullet Converter Replacement

### 7.5.1 General

The +27 VDC Bullet converter can be inserted or removed with power applied (hot swappable) as long as the +27 VDC Bullet converter is inserted/removed with the enable/disable switch in the disabled position.

### 7.5.2 Important Safety Instructions



**DANGER!** Adhere to the “Important Safety Instructions” starting on page vi and those listed in the power system manual.



**WARNING!** The +27 VDC Bullet converter and front mounting bracket becomes very hot during +27 VDC Bullet converter operation at heavy loads. Wear heat resistant gloves or allow the +27 VDC Bullet converter to cool down before removing.

### **Procedure**

1. Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any alarms associated with this system while this procedure is performed.
2. Place the +27 VDC Bullet converter front panel switch to the disable position.
3. Carefully remove any brackets or panels to access the +27 VDC Bullet converter.
4. Loosen the screw retaining the converter to the mounting bracket.
5. Pull the +27 VDC Bullet converter out from the distribution position.
6. Carefully disconnect the return wire from the top of the +27 VDC Bullet converter.
7. Ensure the enable/disable switch on the replacement +27 VDC Bullet converter is in the disabled position.
8. Carefully reconnect the return wire to the top of the replacement +27 VDC Bullet converter.
9. Plug the replacement +27 VDC Bullet converter into the distribution position that the defective +27 VDC Bullet converter was removed from.
10. Tighten the screw to retain the converter to the mounting bracket
11. Carefully replace any brackets or panels that were previously removed.
12. Place the replacement +27 VDC Bullet converter front panel enable/disable switch to the enable position.
13. Observe the status of the replacement +27 VDC Bullet converter front panel local indicator. If operating normally, this indicator should be illuminated green.

14. Enable the external alarms or notify appropriate personnel that this procedure is finished.
15. Ensure that there are no local or remote alarms active on the system.

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