FEED – Fused Electrical Disconnect

A Fully Integrated add-on product for adding Fused Protection and Manual Disconnects to your Alencon Converter.

Alencon Systems – Passionate About Power

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2 General Information

All efforts have been made to ensure the accuracy of material provided in this document at the time of release. Items are subject to continuous development and improvements. All specifications and descriptions are subject to change without notice.

2.1 Purpose

This manual provides information about installing, operating, maintaining, and troubleshooting the Alencon FEED device.

Who Should Read this Manual?

This manual should be read by anyone who needs to:

- Understand the product
- Plan the installation
- Install the product
- Commission the product
- Operate the product
- Maintain the product, as necessary

2.2 Product Warranty

Alencon Systems warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for three years from the date of delivery. Extended warrantees of an additional five (5), ten (10) and twenty (20) years are also available for purchase.

This warranty does not apply to any products which have been repaired or altered by persons other than repair personnel authorized by Alencon System, or which have been subject to misuse, abuse, accident, or improper installation. This warranty does not cover the repair or replacement of any goods which fail as a result of damage in transit, misuse, neglect, accident, Act of God, abuse, improper handling, misapplication, modification, improper storage, excessive stress, faulty or improper installation, testing or repair, negligent maintenance, or failure to comply with the written instructions for installation, testing, use or maintenance (if any) provided by Alencon Systems. Alencon Systems assumes no liability under the terms of this warranty as a consequence of such events.

Because of Alencon Systems' high quality-control standards and rigorous testing, most of our customers never need to use our warranty service. If an Alencon Systems product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Please consult Alencon Systems for more details. If you think you have a defective product, follow these steps:

- Collect all the information about the problem encountered. (For example, issues you are encountering in your PV array) Note anything abnormal when the problem occurs.
- Call Alencon Systems or your licensed Alencon Systems dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
- If your product is diagnosed as defective, obtain an RMA (return merchandise authorization) number from Alencon Systems. This allows us to process your return more quickly.
- Carefully pack the defective product (preferably in the original packaging material it was shipped in), a fully completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.

For more information on the Terms and Conditions request the Alencon Standard Warranty Document

2.3 Warnings, Cautions, and Notes

	***Warning!***	*Warnings indicate conditions, which if not observed, can cause personal injury!*
	***Caution!***	*Cautions are included to help you avoid damaging hardware or losing data.*
	***Note!***	*Notes provide optional additional information.*

3 Important Safety Instructions

WARNING! **SAVE THESE INSTRUCTIONS**– This manual contains important instructions for use with the FEED that shall be followed during installation and maintenance of these devices.

FIGURE 1: THE GRAPHIC ABOVE INDICATES THAT THE FEED IS A GROUNDING CONDUCTOR.

WARNING! Always ground the BOSS or SPOT chassis before energizing the unit. Use the Ground Lug shown in Figure 2 below to ground the unit safely.

FIGURE 2: GROUND LUG LOCATED ON THE BOSS OR SPOT UNIT WITH FEED

WARNING! A battery can present a risk of electrical shock, burn from high short-circuit current, fire or explosion from vented gases. Observe proper precautions.

FIGURE 3: THE GRAPHIC ABOVE INDICATES THAT THE CONVERTER ACTS AS A DIRECT CURRENT SUPPLY.

Installation of this equipment must be performed by an authorized electrician in accordance with the local and NEC ANSI/NFPA 70 and OSHA requirements. Follow CSA C22.1 when installed in Canada.

1. Before installing and using the FEED, read all instructions presented in this manual and the cautionary markings shown on the device enclosure.

2. During operation, hazardous voltages and currents may be present. Only authorized and qualified personnel should perform servicing/installation/maintenance.

3. The metallic enclosure surface may become hot during certain operation circumstances.

4. Test any wire or terminal for voltage before touching them. Disconnect all primary and secondary terminals before performing any work on the equipment.

5. Use only accessories recommended or approved by the manufacturer.

6. Ensure that wiring is in good conditions and that all wiring is sized accordingly. Ignoring to do so may result in a risk of fire.

7. PV modules produce electrical energy when exposed to light and thus can create an electrical shock hazard. Wiring of the PV modules should only be performed by qualified personnel.

8. Always have this manual as well as the relevant converter (SPOT or BOSS) manual in hand.

4 FEED – General Information

The Alencon Fused Electrical Disconnect (FEED) is the ideal companion to your deployment of Alencon's SPOT or BOSS products. The FEED provides a convenient, load break DC-disconnect for the input of the SPOT and BOSS. It can also come pre-installed with appropriately rated fusing for your needs.

Based on your application and needs, the FEED can be provided with a fuse to ground. The FEED comes pre-wired and mounted on-top of the BOSS or SPOT. It is available either with individual string connections, parallel combined connectors, lug landings with conduit knockout, or a combination based on your project requirements. Please see the configuration matrix for specific options.

The FEED configuration matrix below shows how the FEED can be accessorized for use with the SPOT or BOSS (Version 6 or newer), depending on your requirements.

Please consult your Alencon technical sales representative for assistance in determining which FEED configuration is right for your needs.

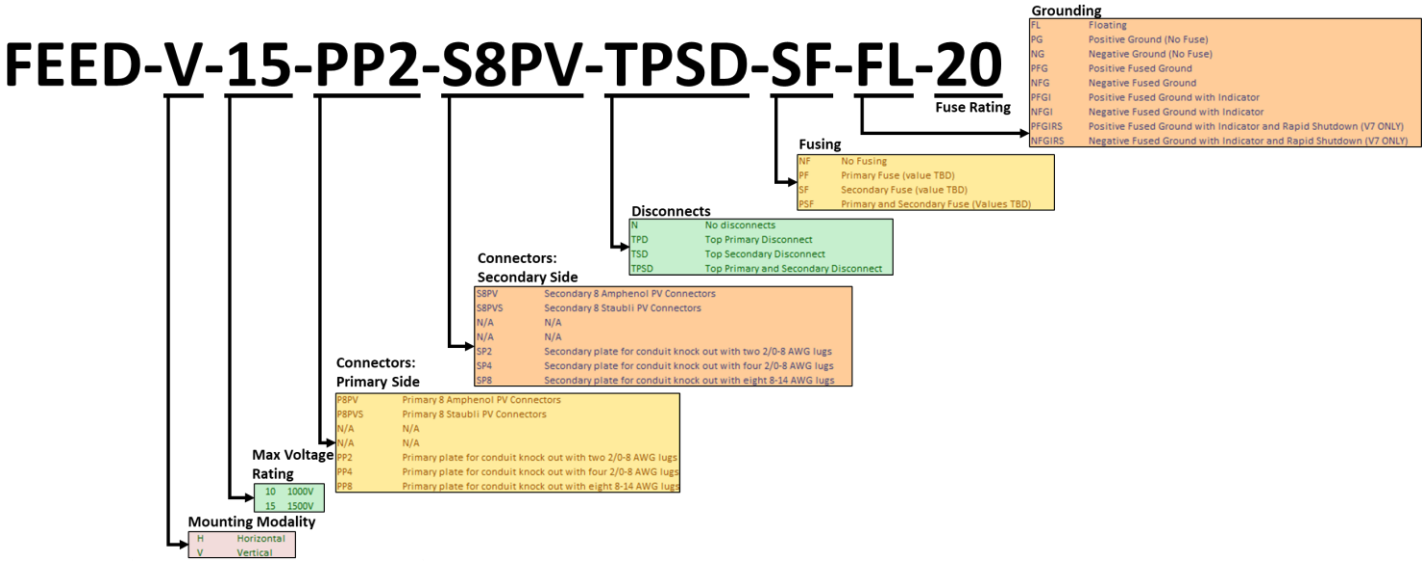

FIGURE 4: FEED CONFIGURATION MATRIX

5 FEED Specifications

Device	FEED 1000	FEED 1500	
Max Operating Voltage	1000 VDC	1250 VDC	1500 VDC
Max Number of Inputs*	4	4	
Max Number of Outputs*	4	4	
Max Load Break Current at Operating Voltage	120 A	84 A	52 A
Rating	IP65 (vertical configuration only)		
Fusing	10A, 15A, 20A, 30A – as required by application		
Dimensions (H*W*D)	130 mm * 440mm * 530mm (5" * 17" * 21")		
Weight	14 Kg		
Storage Temp	-40C to 80C		
Operating Temp	-40C to 70C		
Closure Type	Latch openable, field serviceable		

**When four inputs and/or outputs are specified, unit will use Amphenol H4 connectors. When single input and/or output is specified, an appropriately rated Amphenol SurLok connector will be used as default.*

5.1 Mechanical Specification

See Figure 5 below for the dimensions of a horizontal FEED with SPOT or BOSS.

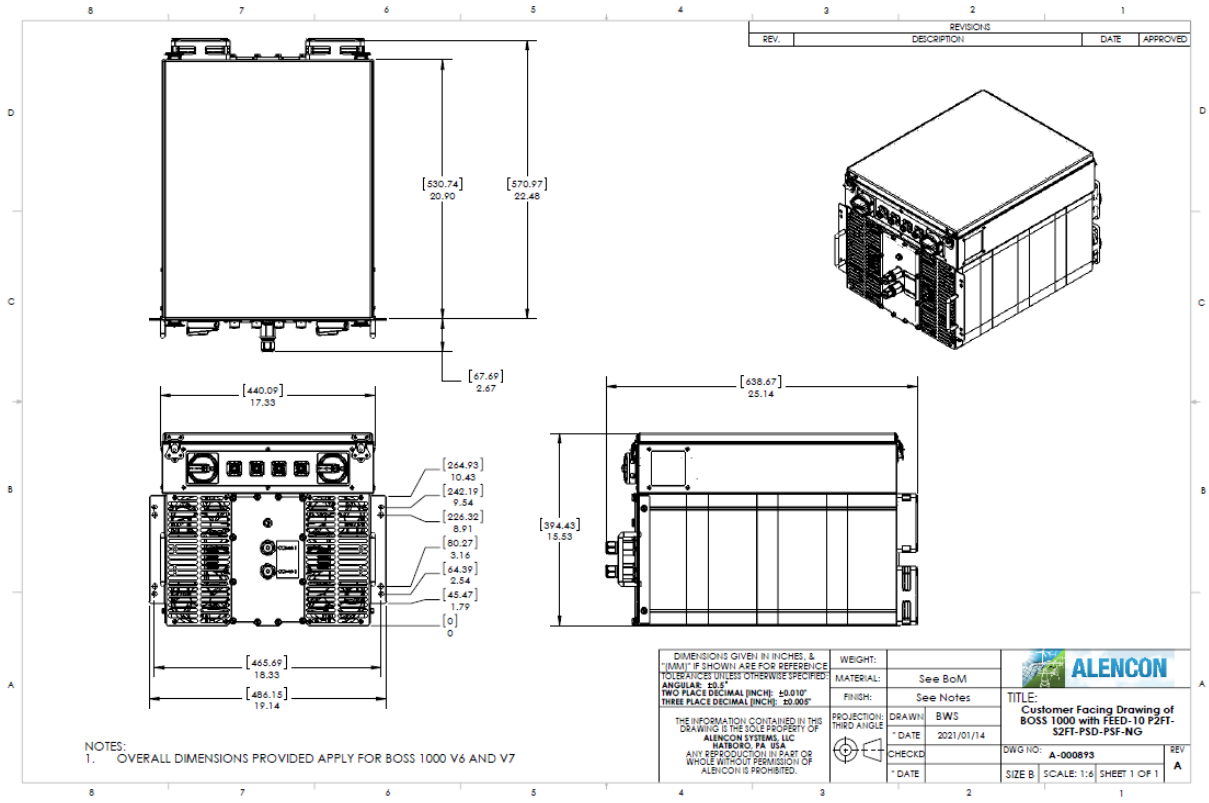

FIGURE 5: FEED-H DIMENSIONS WITH SPOT OR BOSS V7

See Figure 6 below for the dimensions of a vertical FEED with SPOT or BOSS.

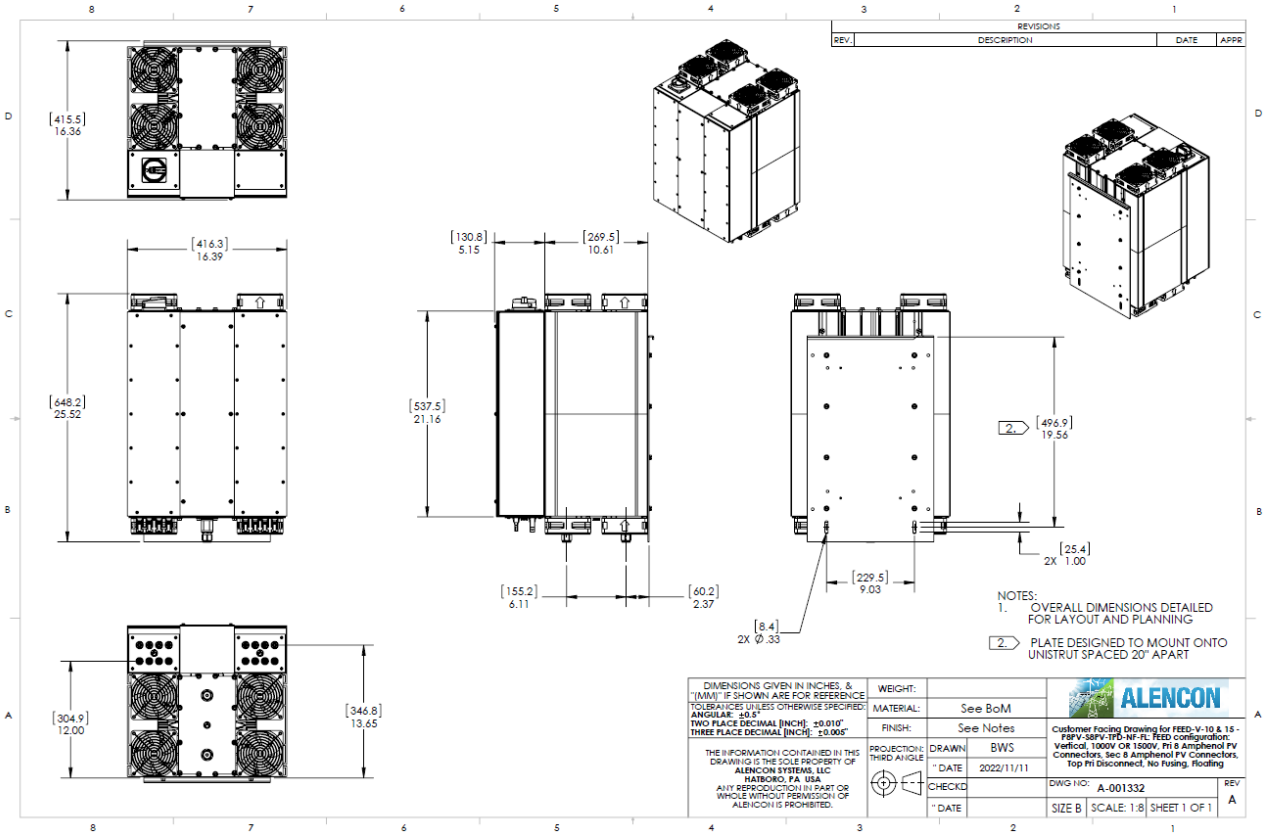

FIGURE 6: FEED-V DIMENSIONS WITH SPOT OR BOSS V7

6 FEED Features

There are 4 main features that can be incorporated into the FEED product, depending on the desired configuration:

- Horizontal vs Vertical Mounting
- Manual Disconnect Switches
- Protective Fuses
- Grounding / Ground Fault indication
- Connector Panel Variants

See two configuration possibilities in Figures 7 and 8.

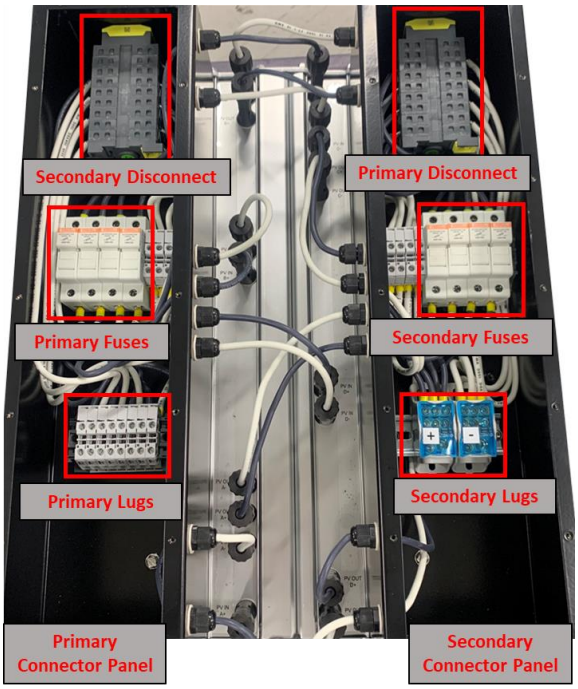

FIGURE 7: FEED-V INTERIOR LAYOUT

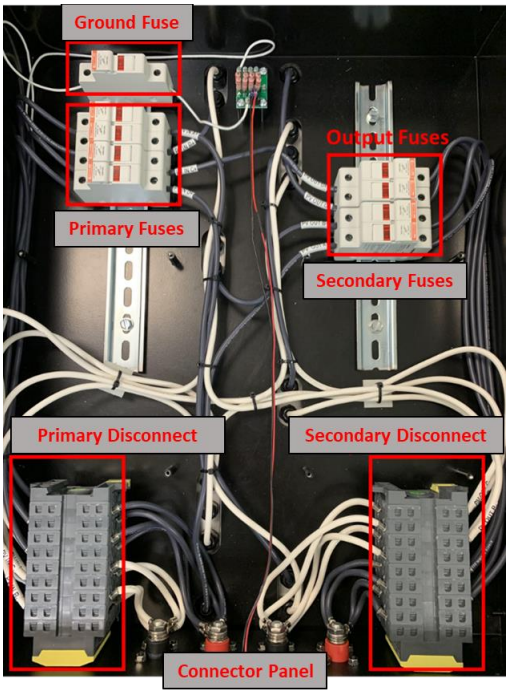

FIGURE 8: FEED-H INTERIOR LAYOUT

6.1 Horizontal vs Vertical Mounting

The FEED can be configured to hang vertically on Unistrut or mounted horizontally on a rack system. This option is specified as FEED-V or FEED-H.

6.1.1 FEED-H

Designed to be mounted in a 19" rack, connector panels, comms connectors and manual disconnect switches are oriented to the front of the device.

Note, the FEED-H is not weather rated as a standalone product and needs to be racked indoors or within a suitably weatherproof cabinet.

FIGURE 9: FEED-H

6.1.2 FEED-V

Designed to be hung on Unistrut, the FEED-V has 2 separate enclosures for the Primary and Secondary sides. Connector panels and comms connectors are oriented to the bottom of the unit, while manual disconnect switches will be on top of the unit.

FIGURE 10: FEED-V

6.2 Manual Disconnect Switches

Primary and Secondary switches are available on the FEED to isolate the SPOT or BOSS from a power source on either side.

6.3 Protective Fuses

Primary and Secondary fusing options are available for both the BOSS and SPOT converters. Fuse rating information can be found on the FEED product label. Fuses that are blown, can be replaced in the field following the instructions in Section 9. See FEED fuses as installed in Figures 7 and 8.

6.4 Grounding/Ground Fault Indication

A fused connection between main earth ground and voltage source will blow in the case of a ground fault. A bright red indicator LED will turn on to show the fault occurrence. This fused connection can be used to bond the Primary or Secondary to GND. Note that this feature is only available for grounded devices, a FEED with floating SPOT or BOSS will not have this feature.

FIGURE 11: FEED FRONT PANEL WITH GROUND FAULT INDICATOR LED

Ground fault fuse can be replaced in the field after ground leak has been located and repaired. Indicator LED will then turn back off.

6.5 Connector Panel Variants

There are multiple options for front panel connections that can be selected independently for both Primary and Secondary connection to the FEED. Those options are:

- **4 pairs Amphenol H4 PV Connectors (Figure 16-A and 17-A)**
  - Each channel will have separate connection to the FEED front panel, female receptacle for the negative line and male for the positive. Customer will be responsible to source the corresponding plugs (see Figure 12).

FIGURE 12: AMPHENOL H4 CONNECTORS

- **1 pair Amphenol SurLok Connectors (Figure 16-B and 17-B)**
  - All 4 converters will have bonded Primary or Secondary, red receptacle for the positive line and black receptacle for the negative. Customer will be responsible to source the corresponding plugs (See Figure 13).

FIGURE 13: AMPHENOL SURLOK CONNECTORS

- **1 pair of Rebling 500A MFT-Style Battery Terminals (Figure 16-C and 17-C)**
  - All 4 converters will have bonded Primary or Secondary, red terminal for the positive line and black terminal for the negative (Figure 14). Cables can be attached directly with ring terminals.

FIGURE 14: REBLING 500A MFT-STYLE BATTERY TERMINAL

- **Conduit Knock Out with DIN mounted Lugs (Figure 16-D and 17-D)**
  - Lugs will be mounted internal to the FEED; cables can be brought in through conduit and bonded to the lugs (see Figure 15)

FIGURE 15: MARATHON EPBAD45 LUG

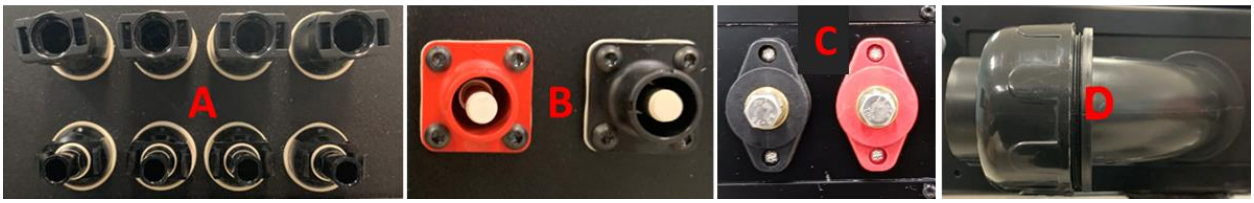

FIGURE 16: FRONT PANEL PLATE OPTIONS - ACTUAL

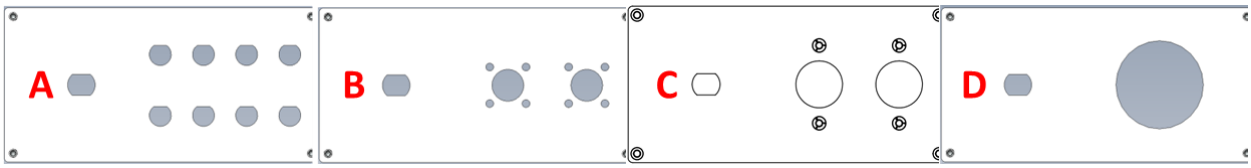

FIGURE 17: FRONT PANEL PLATE OPTIONS – DRAWN

7 Installation

The FEED comes pre-wired and mounted on-top of the BOSS or SPOT. The FEED can be installed in both vertical rail mounted as well as horizontal rack mounted applications. See the BOSS or SPOT manual for more information on mounting the full unit.

7.1 FEED Grounding

⚠ The FEED must be bonded to the main earth ground for safety. The FEED enclosure is bonded to the SPOT/BOSS chassis as part of manufacturing, so the SPOT/BOSS itself must be grounded as per the device manual, see an example in Figure 18 below.

FIGURE 18: SPOT/BOSS UNIT GROUNDING

8 System Commissioning

Once install is complete, energizing and commissioning of the power converters can begin, refer to the user manual of the relevant Alencon product (SPOT or BOSS) for full instructions.

9 Maintenance and Servicing

9.1 General Maintenance

The FEED is designed to require minimal maintenance. For any operating issues with the connected SPOT or BOSS, please refer to the User Manual of the relevant device.

If system still does not operate as expected, please contact Alencon Systems technical support for assistance with troubleshooting (see Appendix C).

9.2 Fuse Replacement

The replacement of fuses in the FEED can be done on-site of deployment to avoid returning the product to Alencon facilities. To replace a fuse within the FEED:

1. Safely shut down the SPOT or BOSS power converter (see relevant manual for full instructions)
2. Open disconnect switches to isolate the FEED unit
3. Remove power cables from the FEED connector panels (ensure there is no current or voltage on these lines before disconnecting)
4. For FEED-H:
    a. Open 4 corner clasps to remove FEED-H cover (see Figure 19)

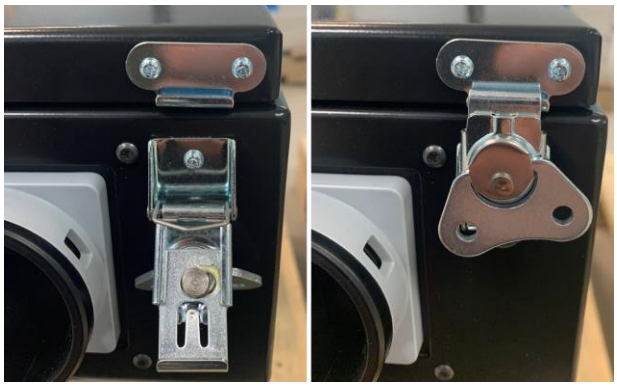

FIGURE 19: FEED-H CLASP – OPENED (LEFT) AND CLOSED (RIGHT)

b. Remove the FEED Cover and set it aside (see Figure 20)

FIGURE 20: REMOVING THE FEED-H COVER

5. For FEED-V:
   a. Unscrew 6 Phillips flat-head panel screws to remove the center cover (Figure 21)

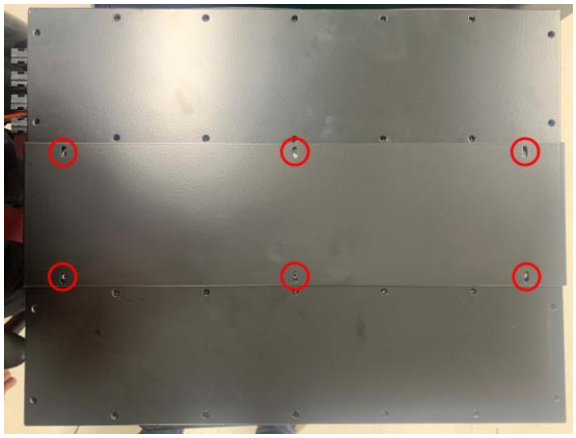

FIGURE 21: REMOVING THE FEED-H CENTER COVER

   b. Unscrew 14 T15 button-head panel screws to remove the Primary or Secondary side cover (Figure 22)

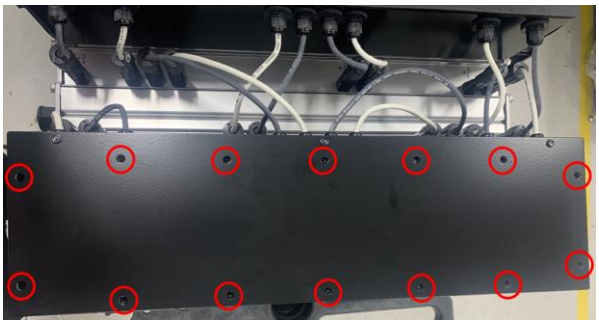

FIGURE 22: REMOVING THE FEED-H SIDE COVER

6. Open corresponding fuse holder (all will be labeled inside the FEED)
7. Remove the dead fuse (a continuity test can be conducted to ensure the fuse has blown)
8. Install new fuse and close the fuse-holder
9. Check continuity is present over the new fuse
10. Reattach FEED cover(s), replacing all screws or clasps
11. Reconnect power cables to the front panel

For any other required maintenance, the FEED and converter will need to be returned to Alencon facility for servicing and repair.

9.3 Further Service and Repair

If the FEED requires further servicing, contact Alencon Systems technical support to assist. A damaged FEED may need to be returned to Alencon Systems, to an authorized Alencon service agent, or have Alencon approved personnel make on-site repairs.

Appendix A - Safety Precautions

A.1 Degree of Danger Symbols

	***Warning!***	*Warnings indicate conditions, which if not observed, can cause personal injury!*
	***Caution!***	*Cautions are included to help you avoid damaging hardware or losing data.*
	***Note!***	*Notes provide optional additional information.*

A.2 Electrical hazards

A.2.1 Electric shock from live voltage

 High voltages are present at the equipment and its components. Some maintenance work must be done when voltage is present. Failure to adhere to the safety messages may lead to severe or lethal injuries due to electric shock. To avoid electric shock from live voltage:

- Wear class 2 personal protective equipment.
- Always perform work in compliance with the regulations specified in 29 CFR, Chapter XVII, Part 1910 (OSHA), NEC, and NFPA 70E.
- Do not touch any live components of the equipment or the medium-voltage grid.
- Follow all instructions precisely.
- Observe safety messages.
- Before performing any work on the equipment, always disconnect the equipment if voltage is not
- absolutely necessary.
- After disconnecting the equipment, wait at least 10 minutes for the equipment's capacitors to discharge completely.
- Before performing work on the equipment, ensure that no voltage is present (with a Voltmeter or other measuring instrument).

A.2.2 Danger due to Battery Voltage

 BOSS may be connected to high voltage batteries on both primary and secondary sides of the equipment. Before beginning to work on the BOSS, disconnect the power sources on both primary and secondary sides.

A.2.3 Electric shock caused by ground fault

 If a ground fault occurs, plant sections that are supposedly grounded may in fact be live. Failure to adhere to the safety messages may lead to severe or lethal injuries due to electric shock. To avoid electric shock from ground faults:

- Ensure that no voltage is present before touching any components.
- Wear class 2 personal protective equipment.

A.2.4 Electric shock due to damaged equipment

 Operating damaged equipment can lead to hazardous situations that may result in serious or lethal injuries caused by electric shock. To avoid electric shock from damaged equipment:

- Only operate the equipment if it is in safe and technically faultless working order.
- Only operate the equipment if there is no visible damage.
- Regularly check the equipment for visible damage.
- Make sure that all external safety equipment is always freely accessible.
- Make sure that all safety equipment is in good working order.

A.3 Environmental hazards

A.3.1 Danger to life due to blocked escape routes

In hazardous situations, blocked escape routes can lead to serious injury or death. To avoid harm from blocked escape routes:

- An escape route of at least 3 ft. (915 mm) wide must always be available.
- Do not place any objects in the escape route area.
- Remove all tripping hazards from the escape routes.

A.3.2 Damage to the equipment caused by dust or moisture penetration

 Dust intrusion or moisture penetration can damage and impair the functionality of the equipment. To avoid damage from dust or moisture penetration:

- Do not open the equipment when it is raining or when humidity exceeds 95%.
- Perform maintenance on the BOX only when the environment is dry and free of dust
- Always cover electrical bus channel prior activating the equipment.

A.3.3 Danger to life due to electric shock when the equipment is unlocked

Unlocked equipment can be opened by unauthorized persons. This means that unauthorized persons have access to components on which lethal voltages are present. To avoid danger from unlocked equipment:

- Ensure that unauthorized persons have no access to the equipment.
- Always lock the equipment
- Keep the electrical bus channel covered

Appendix B – Glossary

Word(s)/Acronyms	Definition
ALS	ALENCON Systems, LLC
DC	Direct Current
ESD	Electrostatic Discharge
ESS	Energy Storage System
FEED	Fused Electrical Disconnect
GFDI	Ground-Fault Detection
GND	System Ground Potential
HV / LV	High Voltage / Low Voltage
IP	Internet Protocol
JBOX	Junction Box
LD	Leak Detector
PODD	Point of Data Distribution
RTU	Remote Terminal Unit. Microprocessor controlled electronic protocol to exchange data with other devices
SCADA	Supervisory Control and Data Acquisition system. Performed by transmitting telemetry data to a master system and by using messages from the master supervisory system to control connected objects
SPOT	String Power Optimizer and Transmitter
SPOT-BOX	Container with (1) to (4) SPOT units and Junction Box
BOSS	Bidirectional Optimizer for Storage Systems
BOSS-BOX	Container with (1) to (4) BOSS units and Junction Box
GARD	Ground and Arc fault Rapid Disconnect
UI	User Interface

Appendix C – Technical Support and Assistance

Visit the Alencon Systems web site at www.alenconsystems.com where you can find the latest information about the product. Contact your distributor, sales representative, or Alencon Systems' technical support if you need additional assistance. Please have the following information ready before you call:

- Product name, serial number, and LIN (all can be located on the product label)
- Description of your peripheral attachments including fusing and cables

For technical support please email: support@alenconsystems.com or call +1 (215) 816-3366