ETS·LINDGREN®
An ESCO Technologies Company

EMI-EMP Filter
Signal / Control / Data

Installation and Maintenance Manual

December 2019

1703315 Rev C

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Revision Record
MANUAL,EMI-EMP Filter | Part # 1703315 Rev C

Revision	Description	Date
A	Initial Release	April, 2019
B	Updated	September, 2019
C	Note added to Maintenance section	December, 2019

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NOTES, CAUTIONS AND WARNINGS

	**Note:** Denotes helpful information intended to provide tips for better use of the product.
CAUTION	**Caution:** Denotes a hazard. Failure to follow instructions could result in minor personal injury and/or property damage. Included text gives proper procedures.
WARNING	**Warning:** Denotes a hazard. Failure to follow instructions could result in **SEVERE** personal injury and/or property damage. Included text gives proper procedures.

SAFETY INFORMATION

	**Refer to Manual:** When product is marked with this symbol, see the instruction manual for additional information. If the instruction manual has been misplaced, download it from www.ets-lindgren.com, or contact ETS-Lindgren Customer Service.
	**High Voltage:** Indicates presence of hazardous voltage. Unsafe practice could result in severe personal injury or death.
	**High Voltage:** Indicates presence of hazardous voltage. Unsafe practice could result in severe personal injury or death.
	**Protective Earth Ground (Safety Ground):** Indicates protective earth terminal. You should provide uninterruptible safety earth ground from the main power source to the product input wiring terminals, power cord, or supplied power cord set.

See the ETS-Lindgren **Product Information Bulletin** for safety, regulatory, and other product marking information.

GENERAL SAFETY CONSIDERATIONS

	Before power is applied to this instrument, ground it properly through the protective conductor of the AC power cable to a power source provided with the protective earth contact. Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal could result in personal injury.
 	Before servicing: contact ETS-Lindgren – servicing (or modifying) the unit by yourself may void your warranty. If you attempt to service the unit by yourself, disconnect all electrical power before starting. There are voltages at many points in the instrument which could, if contacted, cause personal injury. Only trained service personnel should perform adjustments and/or service procedures upon this instrument. Capacitors inside this instrument may still be CHARGED even when instrument is disconnected from its power source.
	Only qualified personnel should operate (or service) this equipment.

INTRODUCTION

ETS-Lindgren Filters are electromagnetically isolated Electromagnetic Interference (EMI) Filter enclosures with EMI isolated filter components. Filters designated as -TS are equipped with transient protection devices (MOVs). The filter is designed to filter internally and externally generated EMI conducted emissions and arrest high transient currents when equipped with MOVs.

ETS-Lindgren Product Information Bulletin

See the ETS-Lindgren Product Information Bulletin included with your shipment for the following:

- Warranty information
- Safety, regulatory, and other product marking information
- Steps to receive your shipment
- Steps to return a component for service
- ETS-Lindgren calibration service
- ETS-Lindgren contact information

PRECAUTIONS

WARNING

LETHAL VOLTAGES PRESENT. THIS UNIT SHOULD BE INSTALLED AND MAINTAINED BY A QUALIFIED ELECTRICIAN.

AUTOMATIC BLEEDER RESISTORS DISCHARGE THE CAPACITORS TO 50 V FIVE (5) SECONDS AFTER POWER IS REMOVED.

USE A SHORTING STICK (NOT INCLUDED) TO TOUCH ALL EXPOSED METAL SURFACES PRIOR TO TOUCHING THE FILTER.

FILTER COMPONENTS

Filter Elements

The filter consists of filter components enclosed in a filter can and termination connections. If the filter is equipped with Transient Protection, there will also be MOVs in the filter.

There are **NO USER SERVICEABLE PARTS** inside the Filter.

Should a filter be determined to be defective, contact ETS-Lindgren to order a replacement or to schedule its return or replacement.

Terminations

Input

Only qualified personnel should operate or service this equipment.

The source conductors are brought through an opening made in the field on the dirty side wiring compartment of the filter. The opening should be of sufficient diameter to allow the free passage of conductors. The conductors should then be directly terminated to the filter terminals or lugs (if provided), or equivalent.

Output

The output conductors are brought into the clean side wiring compartment of the filter through a conduit penetration (if provided) or a circular opening in the back of the filter panel. The conductors should then be directly terminated to the filter terminals or lugs (if provided), or equivalent.

The output terminals of the filter are EMI isolated from the inputs.

Filter Penetrations

All filter penetrations include attached conductive elastomeric gaskets to maintain shielding effectiveness and environmental seal.

MOV Failure and Protective Devices (If Provided)

The prime power circuit breaker upstream from the filter and MOV protector should provide overcurrent protection. This minimizes the possibility of undetected loss of transient protection (if provided).

Automatic Discharge

Some signal filters contain bleeder resistors that will automatically reduce the voltage on any component after the removal of input power. Contact ETS-Lindgren for details. Always discharge filters as described in the SHORTING STICK section of this manual.

Shorting Stick (Not Provided)

Only qualified personnel should operate or service this equipment.

A shorting stick (grounding rod) should be used by qualified service personnel to ensure all capacitors and other energy storage elements are discharged and in a safe state. All terminals accessible to service personnel and capable of retaining stored energy in the event of automatic discharge circuit failure are accessible and should be shorted to ground with a shorting stick or equivalent.

ELECTRICAL PERFORMANCE CHARACTERISTICS

Voltage (RMS)

According to filter label, as applicable to each individual filter type.

Voltage Drop

The total AC voltage drop from input to output is designed to be no more than 2% of the rated voltage when measured into a unity power factor.

Overload Current

The filter can withstand an overload current of 1.4 times the rated current in amperes for a period of fifteen (15) minutes and maintain filtering during this period per MIL-F15733.

Insertion Loss (Stop Band)

As applicable to each individual filter type per MIL-STD-220.

Current

According to filter label, as applicable to each individual filter type.

Frequency of Operation (Pass Band)

According to filter label, as applicable to each individual filter type.

ENVIRONMENTAL SPECIFICATIONS

Attribute	Operating	Non-Operating
Temperature	-45° C to + 65° C	-55° C to +85° C
Altitude	Sea Level to 8,000 ft	Sea level to 40,000 ft
Humidity	Relative humidity between 10% and 90% at air temperatures between +25° C and +32° C	Relative humidity as low as 14% at an air temperature of +71° C and as high as 100% at temperatures from -33° C to +33° C with condensation at all temperatures lower than +30° C

INSTALLATION

Uncrate all parts. Check all parts for any shipping damage. Ensure adequate space is available for installing the filter.

Do not discard any packaging material until the unit is installed.

CAUTION Electrical connection should only be performed by a qualified electrician and in compliance with all applicable regulatory agencies.

Connection to the filter should be made by qualified electricians. Refer to the TERMINATIONS section for further details.

Wiring should be done in accordance to the wiring schematic provided in the ILLUSTRATIONS section of this manual and applicable local and national electrical codes and guidelines.

Installation of the conduit penetration and EMI gasket should be done in accordance with the drawing provided in the ILLUSTRATIONS section of this manual.

POWER ON

Prior to applying power to the filter, verify wiring is correct. Use an ohmmeter to verify there are no shorts from any line to ground or neutral.

CAUTION Electrical wiring verification should only be performed by a qualified electrician and in compliance with all applicable regulatory agencies.

MAINTENANCE

LETHAL VOLTAGES PRESENT. RISK OF ELECTRIC SHOCK.
AFTER REMOVING POWER FROM THE UNIT, THE AUTOMATIC BLEEDER RESISTORS WILL DISCHARGE THE UNIT TO 50 V IN FIVE (5) SECONDS.

WARNING

USE A SHORTING STICK (NOT INCLUDED) TO TOUCH ALL METALLIC SURFACES EXPOSED BEFORE TOUCHING THE FILTER.

Only qualified personnel should operate or service this equipment.

Periodically power down the filter and remove the wiring compartment lids to check inside for dirt, debris and corrosion. Oil, dirt, debris and corrosion inside the filter compartments should be removed according to appropriate procedures. User's own procedures for the removal of spills, dirt, debris and corrosion should suffice. Should EMI gasket become torn or unusable, contact ETS-Lindgren to order replacement part E-903-008 or E-903-016, depending on the size of filter.

The MOV arrestor (if provided) should be replaced annually, when it is estimated that a high incidence of over voltages have occurred during that year.

Once a filter is properly installed it typically does not require maintenance under normal operating conditions. However, if there is an extraordinary event affecting the filters (such as a severe voltage overload or water entering the wiring compartments), then the following procedures should be followed depending on the nature of the event. Follow the INSPECTION AND CLEANING OF WIRING COMPARTMENTS procedure after an event that causes abnormal contamination of filter wiring compartments with liquid or debris. Follow the CAPACITANCE MEASUREMENT AND MOV INSPECTION PROCEDURE following an event that causes abnormal voltage overloads or spikes beyond that which the filters are designed to accommodate.

Frequency of maintenance is at the discretion of the user and may be included in a routine maintenance schedule for the connected equipment. However, filters in clean, industrial environments typically do not require maintenance.

Inspection and Cleaning of Wiring Compartments

1. Remove power from the filter(s).
2. Wait at least sixty (60) seconds, then remove the wiring compartment covers.
3. Short the filter terminals to the filter case using a conductive shorting stick (not included) to ensure that the filter capacitors are fully discharged.
4. Inspect the filter terminals and insulators for contamination and/or damage.
5. If the terminals or insulators are cracked or damaged replacement in the field is not possible. Call ETS-Lindgren for instructions.
6. Clean the terminals and insulators as necessary, and remove any loose debris from the wiring compartments.
7. Re-install the wiring compartment covers. Ensure even compression of the RF gasket around the RF tight wiring compartment. Begin by torquing all of the cover screws to 1 N-m, starting in the center of each flange and working out towards the corners. Then, using the same pattern torque all screws to 5 N-m.
8. Re-apply power to the filter(s).

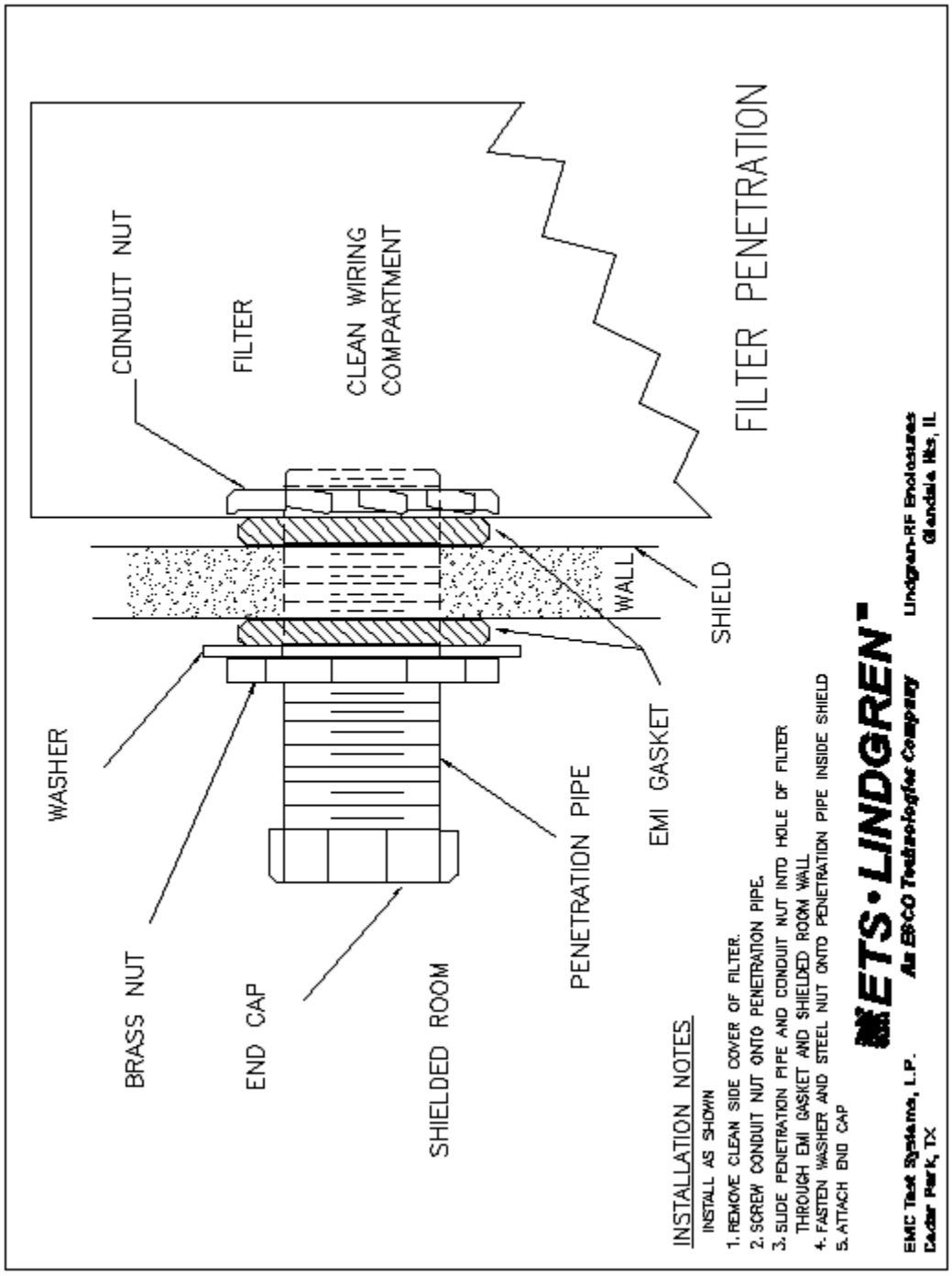
Capacitance Measurement and MOV Inspection Voltage

If no Transient Protection is provided the sections pertaining to MOVs do not apply.

1. Remove power from the filter(s).
2. Wait at least sixty (60) seconds, then remove the wiring compartment covers. Use a voltmeter to ensure no voltage is present.
3. Short the filter terminals to the filter case using a conductive shorting stick (not included) to ensure that filter capacitors are fully discharged.
4. Disconnect the phase and neutral electrical wiring from the electrical termination points.
5. Inspect the filter terminals and insulators for contamination and/or damage.
6. If any of the terminals or insulators are cracked or damaged replace the damaged component in accordance with the directions provided with the replacement parts.
7. Inspect the MOVs (when provided) for damage.
8. If any MOVs are damaged, replace the damaged component in accordance with the directions provided with the replacement parts.
9. Measure MOVs with a Bourns Model 4030-01 (or equivalent) to determine if they are operational. Replacement is required if they are not operational.
10. Measure the line to ground capacitance of each phase. Using an LCR bridge measure the capacitance of each phase at 120 Hz. Contact ETS-Lindgren for expected values (please provide model number of filter). The reading should be according to these values ±20%. A DF measurement should be done at the same time and recorded. DF readings above 0.08 should be noted and ETS-Lindgren should be called for advice before re-applying power to the filter.
11. Clean the terminals and insulators as necessary, and remove any loose debris from the wiring compartments.
12. Re-install the phase and neutral electrical wiring to the electrical termination points. Torque the bolts and/or nuts to the specified torque as noted next to the termination point.
13. Re-install the wiring compartment covers. Ensure even compression of the RF gasket around the RF tight wiring compartment. Begin by torquing all of the cover screws to 1 N-m, starting in the center of each flange and working out towards the corners. Then using the same pattern torque all screws to 5 N-m.
14. Re-apply power to the filter(s).

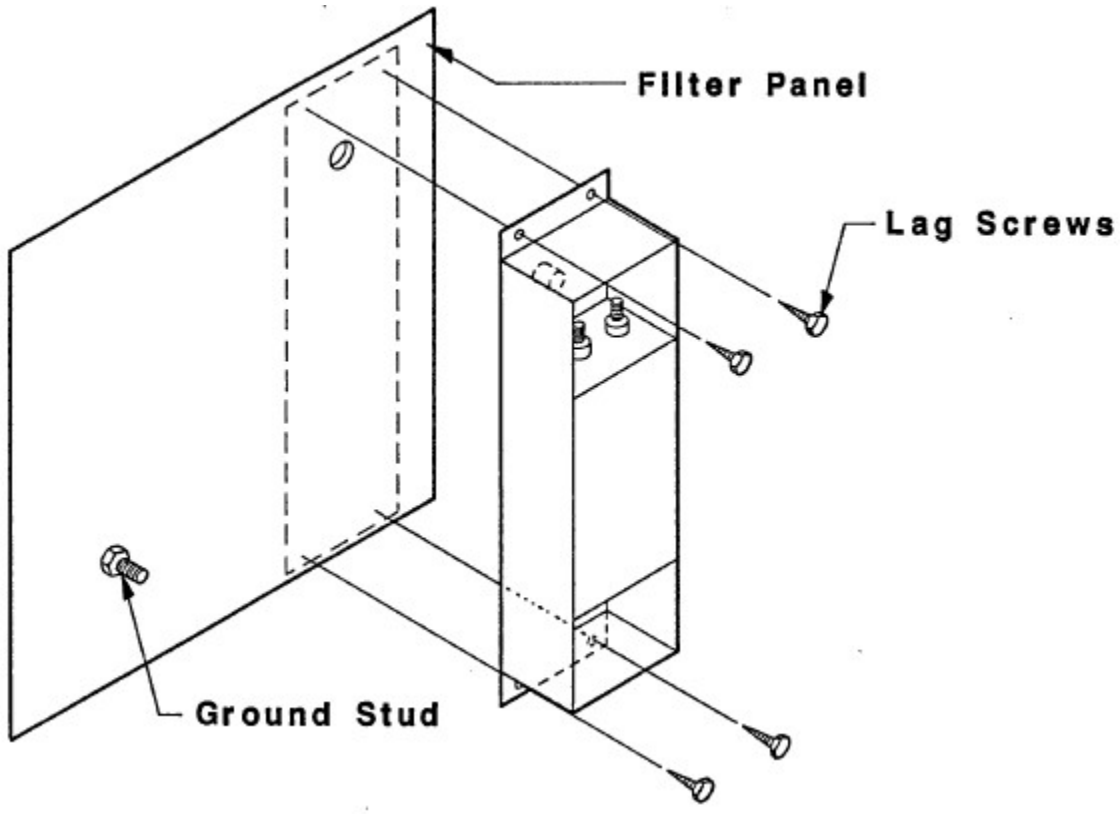
ILLUSTRATIONS

Filter Penetration



Filter penetrations should be installed as shown

Filter Installation on Shield



Installation on shield is straight forward as shown

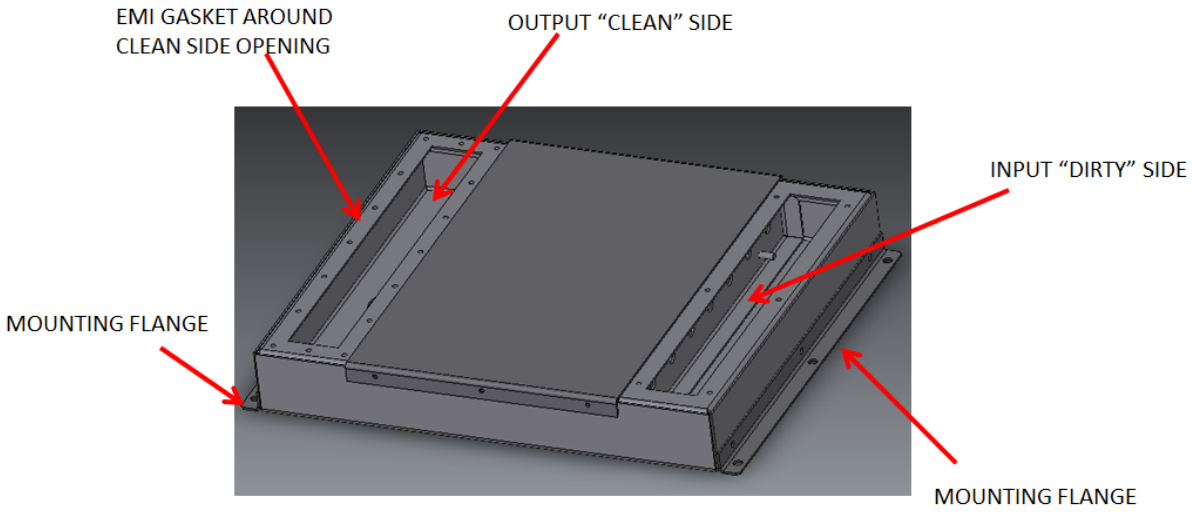
Filter Electrical Wiring

Individually Mounted Filters

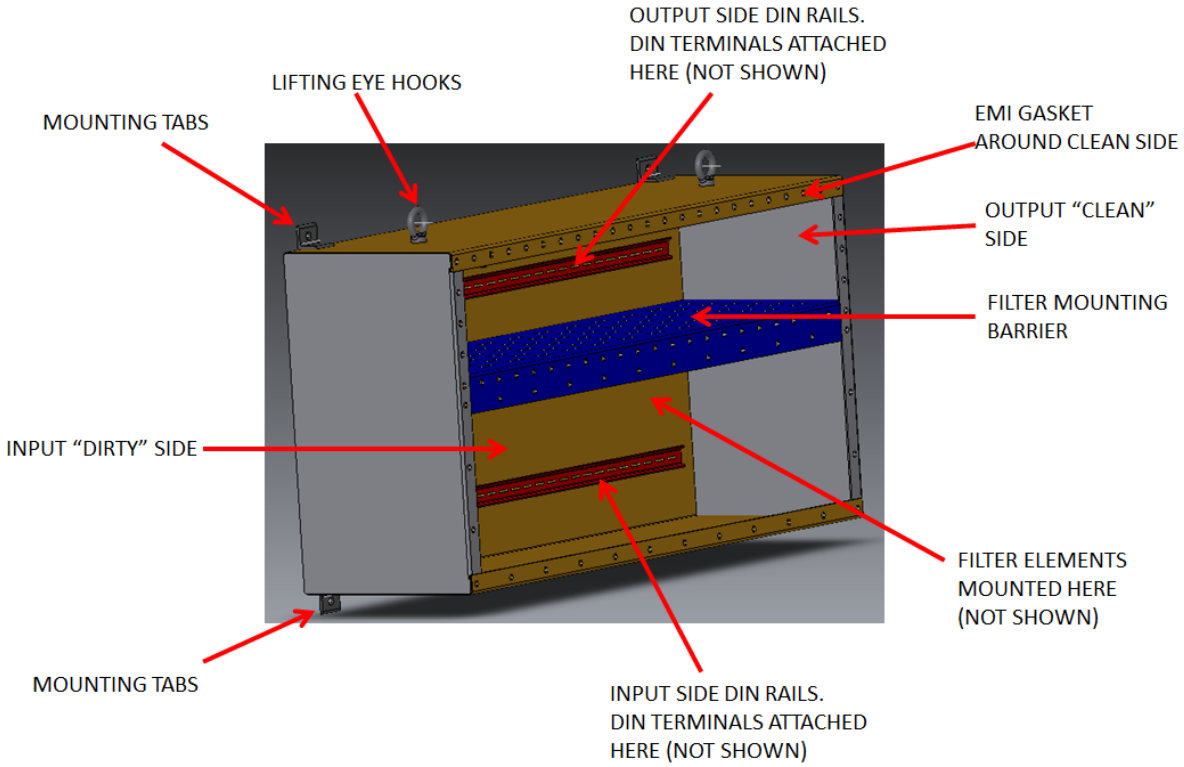
Most filters provided will have solder-on terminals. Connection should be made by soldering an appropriately sized conductor to the terminal. Soldering iron should not exceed 60W. An input terminal corresponds to an output terminal on the same line.

Panelized Filters

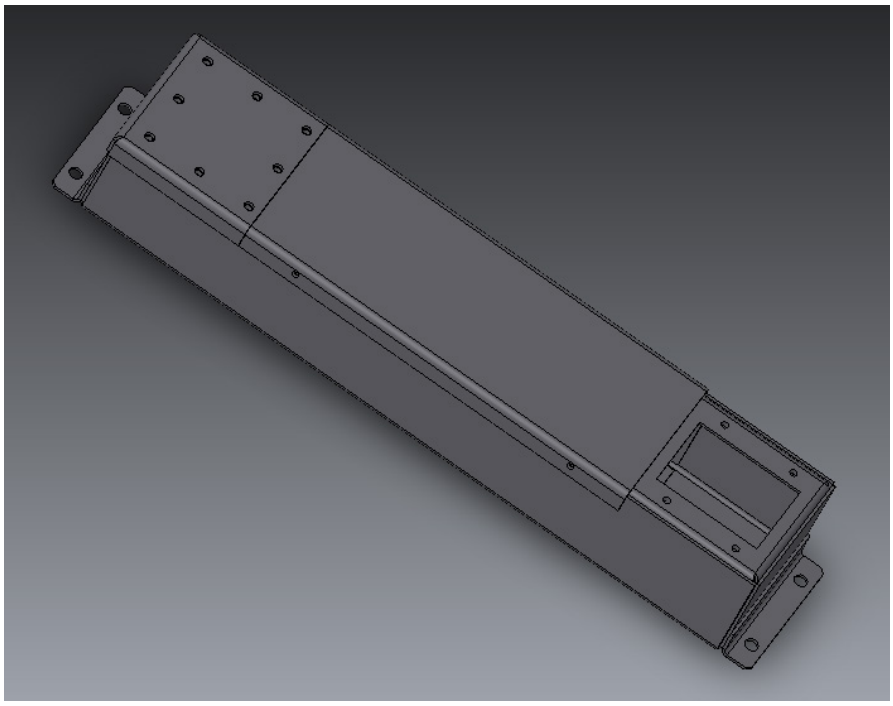
These filters will be pre-wired to a set of DIN terminals on rails at the bottom of the cabinet/panel. Connection is made to the DIN terminals by means of screwing a wire to them. Yellow/Green DIN terminals are grounded points.



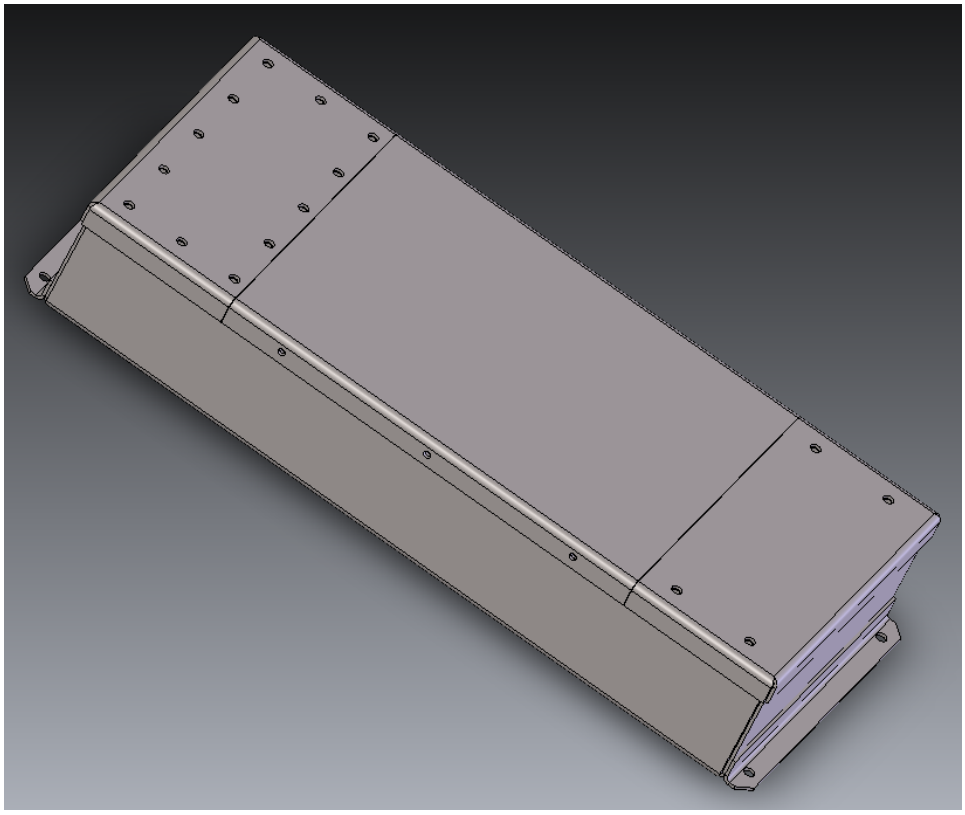
General illustration of an individually mounted signal filter



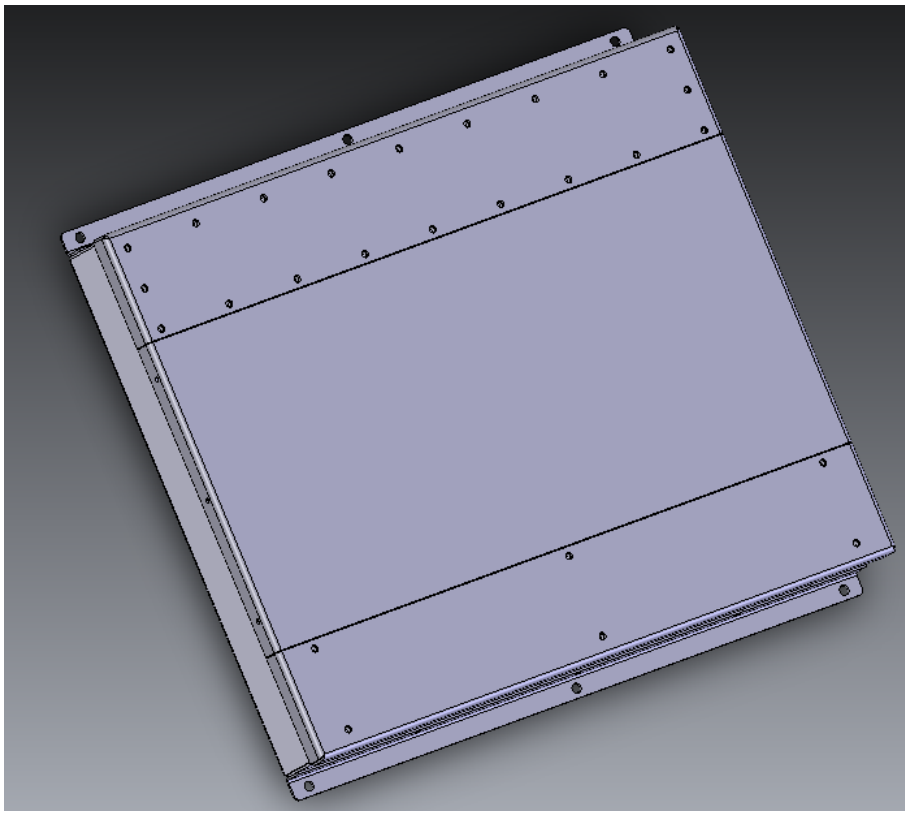
General illustration of a signal line panel filter



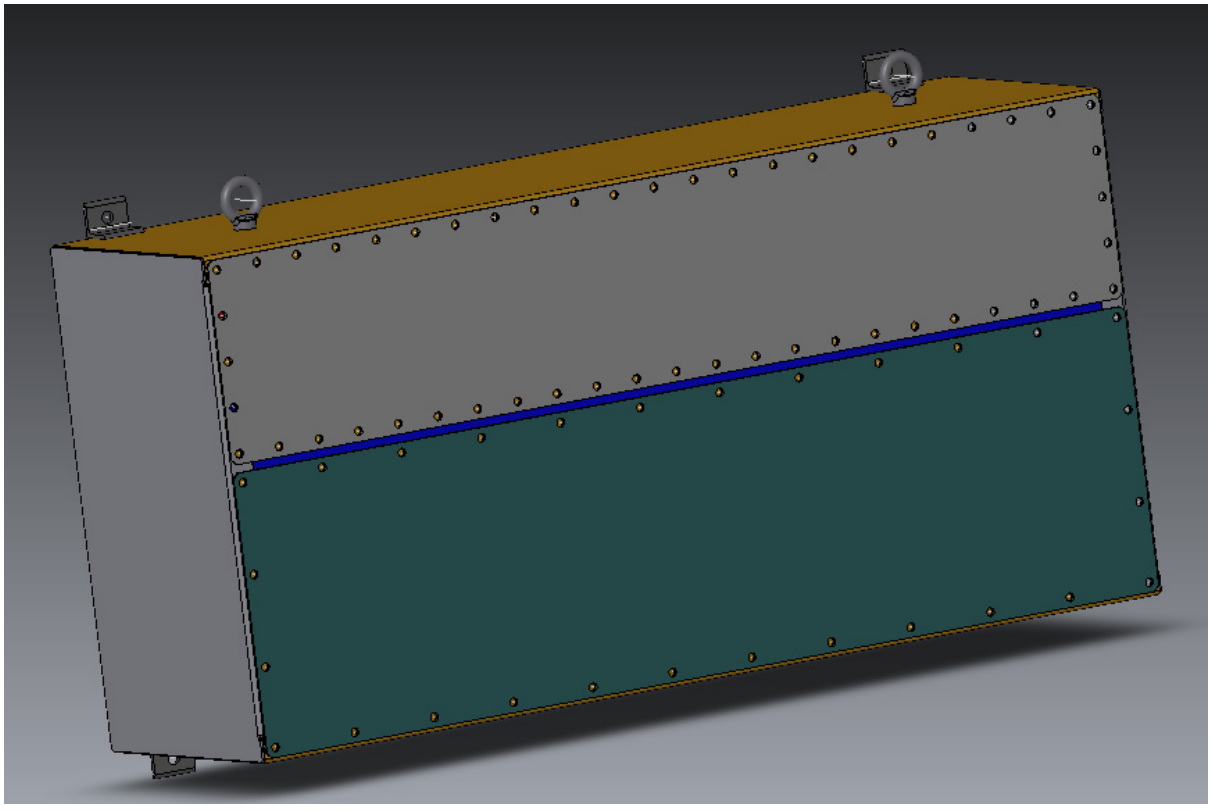
Individually mounted 2-line signal filter



Individually mounted 4-line signal filter

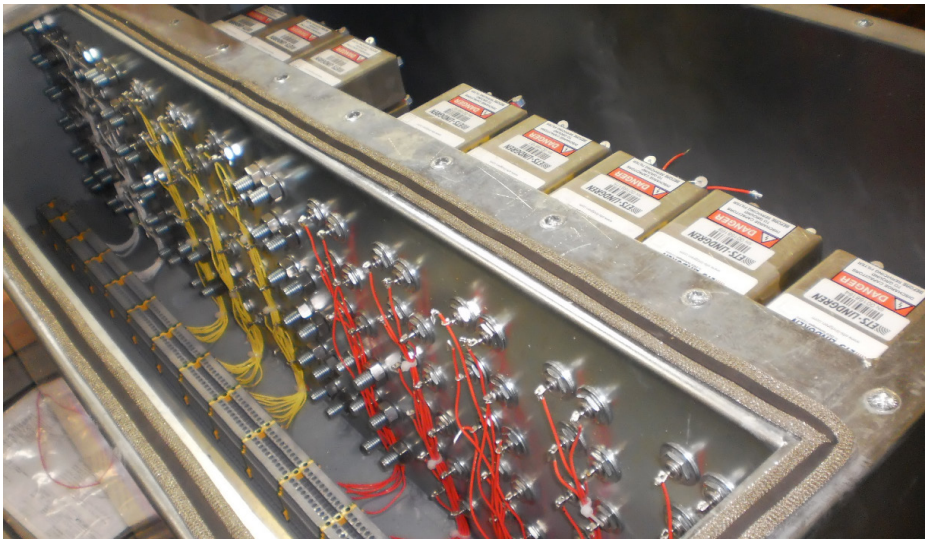


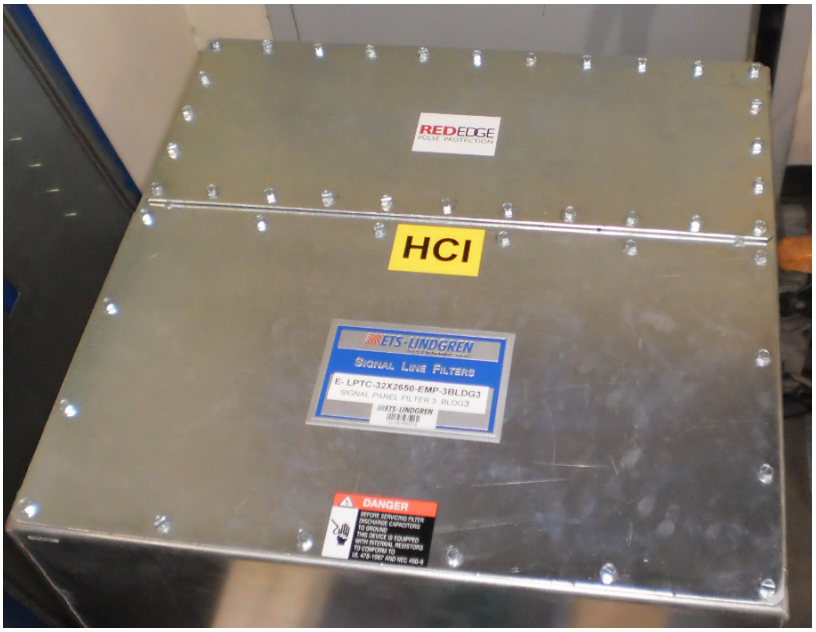
Individually mounted 10 to 12-line signal filter



Panel signal filter


REDEDGE
HCI




REDEDGE
HCI
ETS-LINDGREN
SIGNAL LINE FILTERS
DANGER

WARRANTY STATEMENT

ETS-Lindgren INC., hereinafter referred to as the Seller, warrants that the RF filters purchased under this contract will be free from defects in workmanship performed by the Seller, and will conform to the applicable specifications and/or drawings.

This warranty is limited to either giving credit, repairing or replacing with reasonable promptness after written notice from the buyer of such defect promptly after discovery of same and in no case later than the warranty period after shipment by Seller. The Buyer shall notify the Seller in writing of any defect and include a complete description of the defect within fourteen (14) days after discovery of same to allow the Seller to arrange for appropriate action to make good this warranty, should the Seller determine that the claim is valid.

This warranty does not extend to any portion of the material which has been subject to misuse, neglect, accident, installation or operations not in accordance with the Seller's installation Procedure, nor does it extend to any portion of the material which has been repaired or altered by other than the Seller. The Buyer, upon request shall furnish to the Seller reasonable evidence that the defect arose from causes other than those contained in the preceding sentence.

THIS WARRANTY IS EXCLUSIVE. NO OTHER WARRANTY, WRITTEN OR ORAL, IS EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE REMEDIES PROVIDED BY THIS WARRANTY ARE THE BUYER'S SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT IS THE SELLER LIABLE FOR ANY DAMAGES WHATSOEVER, INCLUDING BUT NOT LIMITED TO, DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

If the Seller is required to take corrective action under the terms of this warranty, it shall be done at no cost to the Buyer. If after proper determination it is found that any claim of defect is indeed the result of causes not covered by this warranty, the Buyer shall pay all costs including reasonable profit to the Seller for expenses incurred during investigation of the Seller of the unwarranted claim.