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1. General Information

1.1 Lumos LSX Module System Introduction

Lumos LSX Modules are frameless solar panels. They are mounted by through-bolting them via 4 holes in the module glass. There are two mounting methods—LSX Rail and LSX Direct Mount—both of which are covered in this document. Make sure you reference the correct sections!

This manual is applicable to the LSX250 series of solar modules, including the following models:

- LSX 245-60M-B/C*
- LSX 250-60M-B/C*
- LSX 255-60M-B/C*
- LSX 260-60M-B/C*

* LSX Modules are available with black or clear backsheets. In the model numbers, B = Black Backsheet, C = Clear Backsheet

Black Backsheet

Clear Backsheet
1.2 Warnings and Safety Guidelines

Installation, operation and maintenance of photovoltaic systems can be dangerous, and should be performed only by qualified persons. This manual should be read and understood fully before attempting to install any Lumos LSX Module System components.

Installations must conform to all applicable building and/or electrical codes and regulations, both national and local. It is the installer’s responsibility to determine and fulfill all necessary requirements, including obtaining permits and inspections, if necessary.

Installers should maintain a safe installation environment. All OSHA or equivalent guidelines should be followed. Protective headgear, eye protection, insulating gloves, protective footwear and insulated tools are recommended. Do not attempt to install modules in windy or wet conditions. Do not install any photovoltaic components where flammable gasses may be present.

Modules should be handled with care. Keep the modules in the original packaging as long as possible. Stack module boxes neatly and evenly. Do not drop the module. Do not drop any objects on the module. Avoid bending the module. Do not use sharp tools or chemicals to clean the front glass or backsheet, as this may damage the module. Do not attempt to drill any holes in any part of the module. Do not use the junction box as a handle.

Lumos LSX Modules should only be installed with Lumos approved racking. Lumos does not accept any responsibility for loss or damage as a result of attempting to install LSX Modules with other mounting systems.

Approved suction cups may be used to handle the modules. However, Lumos does not accept any responsibility for damages related to the use of suction cups, approved or otherwise. If utilizing suction cups to handle the modules, check that they are clean and free of dirt or debris. Do not adhere the suction cup to the back of the module. Ensure that the suction cup is fully adhered to the module before attempting to move the module.

Modules are to be installed only on approved structures. It is the installer’s responsibility to certify that the structure upon which the modules are to be mounted can handle the loads induced by the modules.

Photovoltaic modules generate DC power when they are exposed to sunlight. Contact with electrically active parts of the module can be hazardous. Avoid unnecessary handling of the module during installation. Do not disassemble any of the module components, or remove any affixed nameplates, labels or stickers. Do not disconnect any of the modules when they are under load.

Modules with broken glass prevent a serious shock hazard. Before handling broken modules, cover them with material that will block out all light, and wear insulating gloves. Dispose of broken modules safely and promptly (if making a warranty claim, store the module in a safe and secure location until the claim is resolved).
1.3 Electrical Ratings and Labels
The electrical characteristics are within ±10 percent of the indicated values of $I_{sc}$ and $V_{oc}$ under standard test conditions (irradiance of 100 mW/cm², AM 1.5 spectrum, and a cell temperature of 25°C (77°F)).

Refer to Section 690-8 of the National Electrical Code for an additional multiplying factor of 125 percent (80 percent derating) which may be applicable.

### WARNING!

Hazardous electricity can shock, burn or cause death. Do not touch terminals. Before installing, operating and servicing this unit thoroughly review the installation and operating manual. For field connections, use a minimum of 12 AWG CU wires insulated for a minimum of 90°C.

Glass is fragile. Stepping and/or standing on modules is ONLY permitted directly above supports.

Do not disassemble or alter the module. Do not open the junction box.

Do not carry a module by its cables or junction box. Do not leave modules unsupported or unsecured at any time.

- Use modules for their intended purpose ONLY.
- Artificially concentrated sunlight shall not be directed on the module or panel.
- Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly, the values of $I_{sc}$ and $V_{oc}$ marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor ampacities, fuse sizes, and size of controls connected to the PV output.

<table>
<thead>
<tr>
<th></th>
<th>LSX250-60M-C</th>
<th>LSX250-60M-B</th>
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<tr>
<td>Maximum Power ($P_{max}$)</td>
<td>250W</td>
<td>250W</td>
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<td>Open Circuit Voltage ($V_{oc}$)</td>
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<td>37.3V</td>
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<td>8.78A</td>
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<td>Operating Voltage ($V_{mp}$)</td>
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<tr>
<td>Operating Current ($I_{mp}$)</td>
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<tr>
<td>Tolerance of $P_{max}$</td>
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</tr>
<tr>
<td>Max Series Fuse Rating</td>
<td>15A</td>
<td>15A</td>
</tr>
</tbody>
</table>
1.4 Components and Tools
Here are the basic components and tools you will need to install LSX. You will definitely need additional tools, but these are the big ones you’ll need.

- **LSX Module**
- **LSX Rail 1.1** (LSXRail systems only)
- **LSX Splice 1.1** (LSXRail systems only)
- **LSX Tool** (LSXRail systems only)
- **Chalk Line or Laser Level**
- **Impact Drill**
- **Tape Measure**
- **Woods Power Grip (Optional)**
2. Installation

2.1 Mechanical Installation

2.1.1 Confirm Mounting Method
There are 2 methods of mounting LSX Modules--LSX Rail 1.1 and LSX Direct Mount. Before proceeding with your installation, identify which method you are using and find that section in this manual. **Always isolate dissimilar materials to avoid corrosion issues.** A simple layer of electrical tape between materials will suffice. LSX Rail is aluminum, so must be isolated when mounting to steel.

2.1.2 LSX Rail 1.1 Systems
Lumos LSX Rail 1.1 is sold in lengths corresponding to a specific number of modules. LSX Rail 1.1 can be cut, but cutting is rarely necessary (if absolutely needed, cut the rail 5" from the center of the last nut you will use). The LSX Splice 1.1 can be used to link any two pieces of rail together. Engineering letters to determine the maximum span, overhang, and splice-to-connection distance are available upon request.

There are 2 ways to lay out the rails--center out, or end to end. This decision is best left up to the installer, but feel free to contact Lumos if you’d like help deciding. There are tables at the end of this document that provide progressive rail locations for both methods. **Accurate placement of the rails is essential--they need to be spot on, +/- 1/16"!!** Spend the time to lay out the rails correctly and the module installation will be very fast. If the rails are off, the module installation will be difficult.

Use a string line or laser level to align the nuts, NOT the ends of the rails. The module glass will extend 7-7/16" beyond the last nut (or approximately 2-7/16" beyond the end of the rail).

!!! Do not use the ends of the rail as a reference!

Line up the nuts with a string or laser.
**LSX** Rail 1.1 can be connected by screwing or bolting through the bottom surface of the wireway, or by using a bracket on the non-wire way side. You might need to pre-drill holes, and there is a drill target in the wire way for this purpose. If using a bracket, be sure to attach the bracket to the non-wire way side, and use screws that do not penetrate the wire way. Use only 300 series stainless steel hardware. If you are using standoff, we recommend our XFlash or XTrack products. Allowable span will vary, and state-specific engineering letters are available upon request. It is the installer’s responsibility to verify with an engineer that the structure upon which the modules will be mounted can handle the loads.

Install the LSX Splice 1.1 as necessary. Be sure to maintain a 1/8” space on either side of the splice. These gaps allow for thermal expansion and will result in proper module spacing.

Once all the rail is in place and fastened, position the first module on the rail such that holes in the module align with nuts in the rail. You can place the PV wire into the wire way as you lay the modules down, or you can do it later (provided you’ll have access to the backside of the modules). Be sure to maintain a 1/4” gap between modules.

When the module is aligned correctly, tighten all (4) LSX Bolts to securely fasten the module to the rail. **Hand-tighten with the LSX Tool (25 +/- 5 in-lbs, or 3.5 revolutions). Do not use a tool with a large mechanical advantage, such as a ratchet or a wrench. Do not use power tools. Use ONLY a screw driver with the LSX Tool tip, as shown in Section 1.4.**

Align the adjacent module. It is best to install the modules in a columnar fashion, starting from either the left or the right side of the array. This will ensure that the modules remain flush with each other.

After all modules are installed and all wiring is complete, install the end caps. Be sure to remove any and all protective covering before inserting end cap screws.

*Note: Never stand on the LSX Rail 1.1 adjacent to an installed module. Do not tie off to the LSX Rail 1.1 adjacent to an installed module as an anchor. Flexing the LSX Rail 1.1 adjacent to an installed module may break the glass. If a module does break, be sure to safely dispose of it by covering it from any sunlight and handling it with insulated gloves that will prevent electric shock or physical injury of any kind.*

### 2.1.3 LSX Direct Mount Systems

Direct mount systems use standard structural members, such as I-beams or hollow metal tubes. The LSX Modules are fastened to these members with self drilling, self tapping screws. The members will need to line up with the holes in the module glass, and the exact spacing will depend on the desired gap and member shape. Contact Lumos if you need assistance determining correct member placement.
Once the members are fastened in place, install the provided rubber strips. These strips are available in 27.5’ lengths with an adhesive backing—simply peel it off and center the strip over the connection location. The screws that will fasten the module should penetrate directly through the center of this rubber, so place it accordingly.

Position the first module. Use tape measures, string lines, laser levels, and general carpentry skills to ensure the module is placed as desired. Place the provided aluminum spacer into the module hole, and insert a module screw through the spacer. Drive the screw with a drill or impact driver and watch closely to ensure proper tightness. A well-fastened screw will have a slightly bulged rubber washer. Do not under or over tighten (see image at left). The provided screws may have a special Irius® head, as shown at left, or a hex head.

2.2 Electrical Installation

2.2.1 Grounding

LSX Modules are frameless and do not require grounding. However, the NEC dictates that the racking equipment must be grounded. If you are installing directly to a conductive structure, it is possible that the structure itself could be used as the equipment grounding conductor (EGC), so long as appropriate connections are made. If you are installing LSX on a non-conductive structure, such as a comp shingle or TPO roof, you will need a separate EGC. Verify the relevant local codes before beginning any installations.

If installing LSX Rail 1.1 and a separate EGC is required, install ground lugs onto each side of all splices. These lugs should penetrate the rail, but not the splice. If the Authority Having Jurisdiction (AHJ) requires it, also install a ground lug on the splice. It should be noted that the LSX Splice 1.1 is considered a “bracket” and thus should not need to be electrically bonded to the rail system. However, be sure to check with the AHJ requirements before omitting an additional ground lug on the splice. Also install a ground lug at the end of each rail section.
3. Weather Sealing

Lumos LSX modules are installed with 1/4” gaps between panels, which can be sealed off to create a weatherproof array. Lumos recommends EternaBond products for this purpose, and provides the following guidance for their use.

1. *Clean the Glass*

   Clean the surface with EternaClean and allow it to dry completely. Be sure to wipe down a 2” or wider border around each module (See Fig. 1). **Spray cleaner on a rag or towel and wipe the glass, rather than spraying directly on the glass.**

   ![Fig. 1: Thoroughly clean the green area.]

2. *Apply the Primer*

   Use a spray mask to apply an even coat of EternaPrime on all module edges (See Fig. 2). Move the mask as you go. Allow primer to dry until tacky, approximately 15 minutes.

   ![Fig. 2: Applying the primer with a mask.]
3. **Apply the EternaBond RoofSeal Tape**
   a. Confirm the surface is clean and dry.
   
   b. Apply tape to all the horizontals before applying the verticals (see Fig. 3 and Fig. 4).
   
   c. Start at the edge of the array. Remove about 1” of release liner and lightly apply the tape to ensure proper alignment. The tape should be cut even with the edge of the glass at the ends of the array.
   
   d. Make your way along the gap, removing the release liner as you go (do not remove it all at once). Use your hand to press the tape firmly onto the glass as you work your way across the array.
   
   e. Use a tape roller to apply firm, even pressure to the entire length of tape. The firmer the pressure applied, the better the seal.

*Fig. 3: “Horizontals” run perpendicular to the slope and are sealed first.*

*Fig. 4: “Verticals” run parallel to the slope.*
4. Apply the RoofSeal Discs
   a. Center a 2" diameter circle of EternaCaulk at each intersection. Use a 1/8" bead.
   b. Remove the release liner from a disc, and center it over the intersection.
   c. Press the disc firmly in place, making sure the caulk does not squeeze out around the edges. See Fig. 5 and Fig. 6.

5. Optional: Apply Reinforcing Caulk
   (Recommended for slopes greater than 10° and areas with snow and ice)
   a. Ensure surfaces to be caulked are clean and dry. Mask with masking tape or similar.
   b. Run a 1/8" bead of Royal Seal 1000 caulk along the uphill side of the horizontal tape, including the uphill side of the disks (see Fig. 7). The bead should fill the corner where glass meets tape.
   c. Use a trowel, putty knife, or similar tool to shape the caulk bead into a ramp that will guide water up and over the horizontal tape (see Fig. 8). Remove masking material.
Notes and Tips

- Workers 200lbs and under can walk on the modules by stepping over the support rails (do not step on the centers or the edges of the modules).
- EternaBond RoofSeal tape and disks can be installed when the ambient temperature is between -20°F and 150°F.
- The standard roll size is 1.25" x 50'.
- EternaBond RoofSeal tape should only be installed on systems with tilts between 5° and 20°.
- If tape splicing is necessary:
  - Splice should be at least 1 ft from intersections
  - Overlap the tape by at least 3"
  - See Fig. 8 below
4. Disclaimer of Liability

This manual provides safe and proper methods to install the Lumos LSX Module System. This is for the safety of the installers as well as the protection of the equipment. It is the responsibility of the installer to read and understand the information presented in this document. Failure to adhere to the guidelines set forth in this document may invalidate any applicable warranties.

Due to the fact that installation methods and conditions are beyond Lumos’s control, Lumos does not accept responsibility and expressly disclaims liability for any loss, damage, or expenses that result during the installation, operation, or maintenance of the Lumos LSX Module System.

Lumos assumes no responsibility for any infringement of patents or other rights of third parties which may result from the use of Lumos LSX Module System products. No license is granted by implication or otherwise under any patent or patent rights.

Lumos reserves the right to modify this document, the LSX products and components, and any other product specifications and/or data sheets at any time. This document does not in any way constitute a warranty, express or implied. For warranty information on Lumos products, please contact Lumos directly.

5. Returns

Returns are only accepted with an approved RMA (Return Material Authorization) form. Returns must be packed appropriately, as the product was received, in the original packaging. Improperly packed returns will not be credited.

The pallet must be appropriately strapped and banded, including cross-wise, lengthwise, and side straps (as it was delivered). If you do not have strapping/banding equipment, use ratchet straps to replicate the strapping/banding method used at the factory.

For questions regarding RMA forms or to submit an RMA form, please contact Lumos directly.

6. Contact Lumos

For more information on the Lumos LSX Module System, LSX installation processes, maintenance, warranties, purchasing inquiries, finding an authorized dealer, or for more information on any other Lumos products and services, please contact:

Lumos Solar
929 Pearl St., Ste. 250
Boulder, CO 80302
Tel: (877) 301 - 3582
Fax: (303) 442 - 1829
info@lumossolar.com
7. Quick Reference Tables

This section contains Quick Reference Tables for determining array dimensions and locations of each rail using a common reference. Data from the tables can be combined to obtain the required design/layout information for LSX Arrays of any shape and/or size.

7.1 Terminology--Portrait v. Landscape

The terms “landscape” and “portrait” are used to describe array orientation and rail orientation. The problem is that any combination is possible (i.e., a portrait array with portrait rail, a portrait array with landscape rail, etc.). The best way to think of it is that portrait rail runs parallel to the short side of the modules, and landscape rail runs parallel to the long side of the modules. The array orientation is called “portrait” if the front edge of the array is parallel to the short edge of the modules, and “landscape” otherwise. The images below should clear things up.
EXAMPLE: HOW TO USE THE TABLES

A design layout dictates that 30 modules are to be installed on a car port, in three rows of ten modules. The modules are LSX 250 Series, all to be mounted on LSX Rail 1.1 in portrait orientation. The array itself will also be in portrait (see page 11 for clarification). First, make sure the array will fit in the space provided, using the tables in Appendix A:

**Height of Array: Go to Array Height: Portrait Orientation**

For **3 Rows**, we see that the array height is 197 1/16”.

**Width of Array: Go to Array Width: Portrait Orientation**

For **10 Modules per Row**, we see that the array width is 411 11/16”

Measure your space--will the above array fit?

Next, determine what length of rail is needed. LSX Rail 1.1 is sold in modular lengths, not by the foot. For our example, we need rail that will hold 10 modules in portrait. Since LSX Rail 1.1 is available for 3-6 modules in portrait, we will need at least 2 pieces of rail and at least one splice to meet the required length. It is best to select rail sizes such that the number of splices is minimized.

In our example, we could achieve this length of rail by any of these combinations:

- (1) 6-Module Span + (1) 4-Module Span + (1) splice (combining two rail spans)
- (2) 5-Module Spans + (1) splice (combining two rail spans)
- (2) 4-Module Spans + (1) 2-Module Span + (2) splices (combining three rail spans)

The spacing between rails can be determined quickly and easily using the tables in Appendix B. There are quite a few different tables, and which one to use will depend on your particular installation. For this sample installation, let’s assume we’ll start at one end and work our way across the array (the corresponding table is on page 20).

Our system has three rows of modules in portrait – therefore we will have 6 rail lines. Setting the first rail, Rail 1, as our reference, and using Datum B, we show the following locations for horizontal rail lines:

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<thead>
<tr>
<th>Rail</th>
<th>Reference Line</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Reference Line</td>
</tr>
<tr>
<td>2</td>
<td>36 13/16” above Rail 1</td>
</tr>
<tr>
<td>3</td>
<td>65 3/4” above Rail 1</td>
</tr>
<tr>
<td>4</td>
<td>102 9/16” above Rail 1</td>
</tr>
<tr>
<td>5</td>
<td>131 1/2” above Rail 1</td>
</tr>
<tr>
<td>6</td>
<td>168 5/16” above Rail 1</td>
</tr>
</tbody>
</table>

(See quick reference tables on the following pages)
### Appendix A - Critical Dimensions Tables

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<thead>
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<th># Rows</th>
<th>Array Height (mm)</th>
<th>Array Height (in)</th>
<th># Columns</th>
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<th>Array Width (in)</th>
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<td>1040</td>
<td>40 15/16</td>
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<td>8364.45</td>
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Appendix B - Critical Dimensions Drawings
LSX 250 MODULE DIMENSIONS

TO EDGE OF CELLS

EDGE OF SOLAR CELLS

41" [1040mm]

26 1/8" [663mm]

26 1/8" [663mm]

7 7/16" [188.5mm]

11 1/16" [17.5mm]

14" [355mm]

1 5/8" [41.5mm]

1 1/2" [381mm]

5 5/16" [8mm]

43 5/16" [1100mm]
LSX RAIL 1.1 DATUMS AND OVERALL DIMENSIONS

THIS DRAWING SHOWS THE LOCATIONS OF DATUM A, DATUM B, AND THE RAIL CENTERLINE. ALL MEASUREMENTS ON THE FOLLOWING PAGES REFER TO ONE OF THESE 3 DATUMS. WHEN LAYING OUT LSX RAIL 1.1, YOU WILL ALWAYS MEASURE TO ONE OR MORE OF THESE LOCATIONS ON THE RAIL.

RAIL PROPERTIES:

AREA: 0.99 IN²
IX: 0.48 IN⁴
IY: 0.89 IN⁴
WEIGHT: 1.22 LB/FT (ASSEMBLED)

DATUM A IS A COMMON CONNECTION LOCATION. IT IS MARKED BY A DRILL TARGET ON THE RAIL.

DATUM B IS RECOMMENDED FOR LOCATING RAILS
NOTE:
RAIL POSITION ALTERNATES SUCH THAT WIREWAY ALWAYS FACES OUT.

PORTRAIT RAIL, DATUM A LOCATIONS

TYP GAP BETWEEN PANELS

PORTRAIT RAIL, DATUM B LOCATIONS

TYP GAP BETWEEN PANELS

PORTRAIT RAIL, CENTERLINE LOCATIONS

TYP GAP BETWEEN PANELS
NOTE:
RAIL POSITION ALTERNATES
SUCH THAT WIREWAY
ALWAYS FACES OUT.

DETAIL A
SCALE 1:2

LANDSCAPE RAIL, DATUM A LOCATIONS

LANDSCAPE RAIL, DATUM B LOCATIONS

LANDSCAPE RAIL, CENTERLINE LOCATIONS

NOTE:
RAIL POSITION ALTERNATES
SUCH THAT WIREWAY
ALWAYS FACES OUT.
**PORTRAIT RAIL LOCATION TABLES**

USE THESE TABLES IF YOU ARE LAYING OUT RAILS FROM ONE END OF THE ARRAY. (IF YOU ARE MEASURING FROM THE CENTER OUT, USE THE "CENTER OUT" TABLES.)

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**CRITICAL DIMS FOR LSX250 MODULES ON LSX RAIL 1.1**

9/1/2015

AS NOTED

DISCLAIMER

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## Centerline Out Rail Location Tables

Use these tables if you are installing rails from the center of the array out.

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**Date:**
9/1/2015

**File Name:**
20150901_Rev002_LSX Critical Dimensions with LSX Rail 1.1
**PORTRAIT CENTER OUT RAIL LOCATION TABLES**

USE THESE TABLES IF YOU ARE INSTALLING RAILS FROM THE CENTER OF THE ARRAY OUT.

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**TABLES FOR USE**

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**NOTES**

- Use these tables if you are installing rails from the center of the array out.
- Portrait center out rail location tables.
- Use these tables if the center lies between modules (# of columns is even).

---

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This drawing is the property of Lumos, LLC (Lumos). This information is confidential and is to be used only in connection with work described by Lumos. No part is to be disclosed to others without written permission from Lumos.
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**CRITICAL DIMS FOR LSX250 MODULES ON LSX RAIL 1.1**

**DATE**

9/1/2015

**APPROVED BY**

N/A

**DISCLAIMER**

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**LANDSCAPE CENTER OUT RAIL LOCATION TABLES**

Use these tables if you are installing rails from the center of the array out.

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### USE THESE TABLES IF THE CENTER LIES BETWEEN MODULES (# OF COLUMNS IS EVEN)

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### CRITICAL DIMS FOR LSX250 MODULES ON LSX RAIL 1.1

- **9/1/2015**
- **AS NOTED**

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**FILE NAME:** 20150901_Rev002_LSX Critical Dimensions with LSX Rail 1.1

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