CommScope ERA®
CAP MX Medium Power Carrier Access Point
Installation Guide

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ERA is an extension of the hardware and software architecture that CommScope originally introduced as ION-E. Going forward, all new systems are ERA. Since ION-E and ERA share the same hardware modules, system software and management systems, existing ION-E systems can be updated and expanded using ERA components.

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Andrew Wireless Systems GmbH, November 2020

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Document Overview

This installation guide provides a product overview of and installation instructions for the Medium Power Carrier Access Point (CAP MX), which allows transmission between CommScope ERA® equipment, antennas, and Ethernet devices (such as WiFi and IP cameras).

Table 1 lists the CAP MX models that this installation guide supports.

Table 1. *Supported CAP MX Models*

Part Number [1]	Model Name
7830127-0001	CAP MX F-AC-APE 6/7E/80-85/17E/19/23/25T
7830127-0002	CAP MX F-DC-APE 6/7E/80-85/17E/19/23/25T
1 Contact your local sales representative for further information.	

For information on other ERA system components, refer to the ERA software and hardware user documentation, which can be accessed on the CommScope DCCS Customer Portal (see "Accessing ERA User Documentation" on page 65.)

For information on how to find the minimum software requirements for ERA hardware, refer to "Hardware to Software Mapping Information" on page 64.

Document Revision History

This is the first release of the *CommScope ERA® CAP MX Medium Power Carrier Access Point Installation Guide*.

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Document Cautions and Notes

This document may contain any of the following notes, cautions, and warning icons.

The icon to the left is used to indicate a caution or warning. Cautions and warnings indicate operations or steps that could cause personal injury, induce a safety problem in a managed device, destroy or corrupt information, or interrupt or stop services.

The icon to the left indicates a caution or warning that pertains to laser equipment.

The icon to the left indicates a caution or warning that pertains to Radio Frequency (RF).

The icon to the left indicates that the hardware is susceptible to Electro-Static Discharge (ESD) damage.

The icon to the left indicates a caution or warning that pertains to an electrical hazard.

The icon to the left indicates a caution or warning that pertains to a fire hazard.

The icon to the left indicates a Note. Notes provide information about special circumstances.

Abbreviations Used in this Guide

AC	Alternating Current	GUI	Graphical User Interface
AP	Access Point	ISDE	Innovation, Sciences et Développement économique Canada
AUX	Auxiliary	ISED	Innovation, Science and Economic Development Canada
C	Celsius	kg	Kilogram
CAN	Central Area Node	LED	Light Emitting Diode
CAP H	Carrier Access Point, High Power	MHz	Megahertz
CAP L	Carrier Access Point, Low Power	mm	Millimeter
CAP M	Carrier Access Point, Medium Power	MMF	Multi-Mode Fiber
CAP MX	MX Carrier Access Point, Medium Power	OPT	Optical Transport
Cat	Category	PoE	Power over Ethernet
CAT	Copper Transport	PN	Part Number
CMS	CommScope Mobility Solutions	RAN	Regional-Area Network

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dB	Decibel
dBm	Decibel-milliwatts
DC	Direct Current
EFTA	European Free Trade Association
EMC	Electromagnetic Compatibility
EMEA	Europe, Middle East, Africa
EU	European Union
F	Fahrenheit
FCC	Federal Communications Commission
Gb	Gigabyte
GHz	Gigahertz
RF	Radio Frequency
RU	Rack Unit
SFP	Small Form-Factor Pluggable
SMF	Single-Mode Fiber
TEN	Transport Expansion Node
UAP	Universal Access Point
Vac	Voltage in Alternating Current
Vdc	Voltage in Direct Current
W	Watts
WCS	Wireless Communications Switch

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ERA System Overview

CommScope ERA® coordinates wireless capacity throughout the entire coverage area via a single centralized head-end location or from an operator's existing C-RAN hub. ERA systems bring together licensed wireless and power, plus Gigabit Ethernet for WiFi into one wireless system that can scale to building size and is technology and spectrum agnostic and adaptive. An ERA system comprises the components listed below.

- **Central Area Node (CAN)**—provides server-level control and primary signal distribution. It combines the signals from multiple operators and distributes those signals within a venue or multiple venues. There are two configuration modes available for the CAN: **Classic** and **Switching**.
  - The **Classic CAN** configuration is appropriate for when all the BTS and Baseband sources are located in a centralized space in the same venue as the Classic CAN. You install RF Donor (RFD) Cards and CPRI Digital Donor (CDD) Cards in a Classic CAN, which digitizes the analog BTS signals from the RFD Cards and combines those with the BBU CPRI digital signals from the CDD Cards, and then distributes the RF signals to the TENs. The TENs then provide the RF signals to the Access Points (APs). The Classic CAN also supports APs that are directly connected to CAT or OPT Cards installed in the Classic CAN chassis. Wide-area Integration Nodes (WINs) are not supported by a Classic CAN. Users have full and flexible control of all signal routing via the ERA GUI.
  - The **Switching CAN** configuration is appropriate for when WINs are required to allow operators to bring in baseband signals from multiple remote locations to fully leverage the C-RAN architecture in their hubs. All operator Baseband signals (analog BTS and BBU CPRI) are supplied to the Switching CAN by the WINs, so no RFD or CDD Cards can be installed in the Switching CAN. The Switching CAN then combines the signals from all WINs and distributes those signals to the TENs, and the TENs provide the signals to the APs. APs are not directly connected to a Switching CAN. Users have full and flexible control of all signal routing via the ERA GUI.

This guide uses "CAN" to collectively refer to Central Area Nodes. When information pertains to a specific CAN mode, "Classic CAN" and "Switching CAN" will be used.

- **Wide-Area Integration Node (WIN)**—interfaces between a Switching CAN and RF sources, which makes C-RAN possible in ERA by allowing operators to bring in signals from multiple remote locations kilometers away. You install RFD and CDD Cards in the WIN, which takes the analog BTS signals from the RFD Cards and combines those with the BBU CPRI digital signals from the CDD Cards, and distributes the RF sources to a Switching CAN.
- **Transport Expansion Node (TEN)**—is an expansion node connected to the CAN via fiber and can be located throughout the venue coverage area. A single TEN can support, dependent on the AP type and powering method, 12 to 32 Access Points (APs), which greatly reduces the number of fiber runs between the head-end and each AP.
- **Access Point (AP)**—connects a Classic CAN or TEN to antennas or other wireless devices. On the downlink, an AP converts data arriving at the AP to analog signals and sends them to an antenna. On the uplink, received signals are digitized and serialized into data streams which are sent back to the Classic CAN or TEN. APs provide pass-through support for WiFi, IP cameras, or other devices over a common cable. An AP can be any of the Universal Access Points or Carrier Access Points.

This guide uses "Access Point (AP)" to collectively refer to all versions of the Universal Access Point (UAP) and the Carrier Access Point (CAP). "Fiber APs" collectively refers to the CAP H, CAP M, CAP MX, and the Fiber CAP L. When information pertains to a specific AP type, that AP will be identified.

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CAP MX Overview

This installation guide describes the Medium Power Carrier Access Point (CAP MX), which interfaces via an optical link with a Classic CAN, or with a TEN. This allows the CAP MX to provide data over Single-Mode Fiber (SMF), or Multi-Mode Fiber (MMF). Power for CAP MXs is provided over embedded AC/DC (AC version) or remotely through hybrid fiber (DC version).

On the downlink, the CAP MX converts data arriving at the CAP MX to analog signals and sends them to the Antenna port. On the uplink, received signals are digitized and serialized into data streams, which are sent back to the Classic CAN or TEN. Each CAP MX can provide RF coverage for up to seven specific frequency bands. Figure 1 shows how a double CAP MX configuration can be deployed in an ERA system.

The CAP MX RF bandwidth, with only a primary fiber connection to a CAN or TEN, is 320 MHz. Connecting a secondary fiber cable, in parallel to the primary fiber connection, increases the RF bandwidth to 480 MHz. The secondary fiber connection must be sourced from the same CAN or TEN as the primary fiber connection.

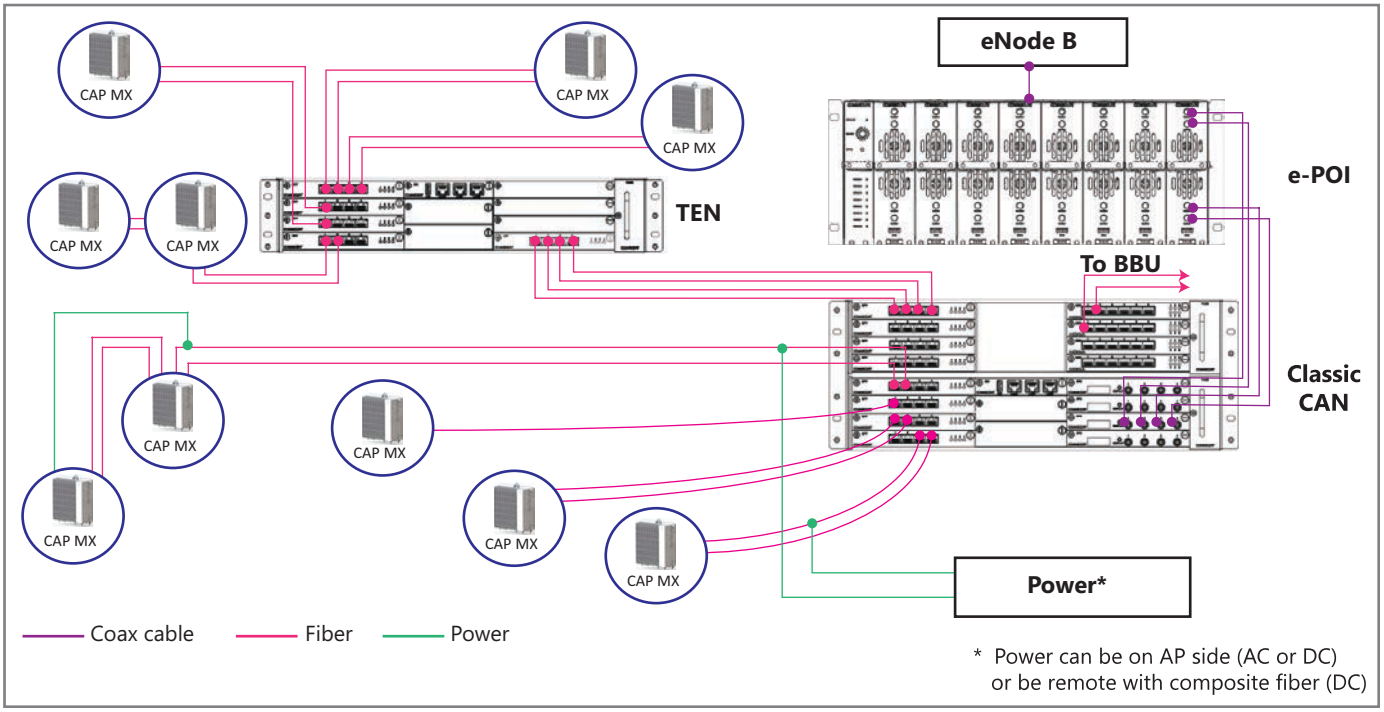

Figure 1. CAP MX in an ERA System using a Classic CAN

	All APs can only connect to a TEN or a Classic CAN. APs cannot connect to a Switching CAN or to a WIN.

The CAP MX

- is passively cooled and operates within the following temperature ranges:
  -33°C to +55°C (-27.4°F to 131°F)
- is rated for indoor and outdoor (IP66) installations; see also "Determine the Mounting Site" on page 23
- has a typical power consumption of 300W; see also "Determine the Power Consumption of the CAP MX" on page 22.

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CAP MX Connectors and Power LED

- Figure 2 shows the connectors and Power LED on a CAP MX that has one antenna connector.
- Table 2 on page 7 maps the callouts in Figure 2 and describes the connectors and Power LED.

Do not remove caps from any of the connectors until instructed to do so.

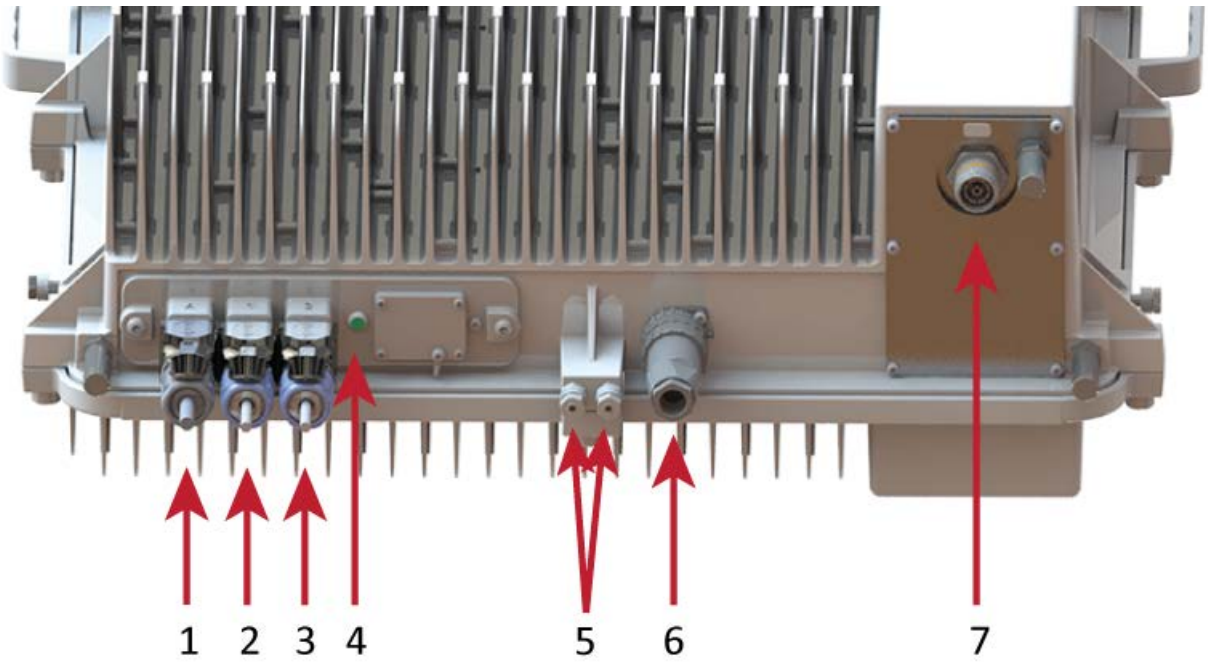

Figure 2. Location of Connectors and Power LED on a CAP MX with One Antenna Connector

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Table 2. *Function of the CAP MX Connectors and LED*

REF #	Label	Description	Function
1	A	RJ45 Auxiliary Port	Connects to external Ethernet devices such as WiFi and IP cameras. Cabling is via the appropriate CAT cable for the protocol; this model supports a 1000 BASE-T and 802.3at Class 3 Power over Cat6A Ethernet connection. Maximum attached cable length is 3 meters (9.8 feet). For information on the Auxiliary port in cascades, see "CAP MX Installation and Cascade Rules" on page 20. Port A ships with factory-installed EMI/weatherproof plug and must remain plugged if not in use. (Graphic shows the port populated with an OCTIS Ethernet connector PN 7760652 which must be ordered separately—see "OCTIS™ Kits" on page 8.)
2	2	Optical Port 2	If the CAP MX is functioning as a Primary CAP MX in a cascade, Optical Port 2 connects to Optical Port 1 of the Secondary CAP MX via the Optical OCTIS Kit (PN 7770612), which ships with the unit, to provide the main signal interface. Optical transport occurs over Single Mode Fiber (SMF) or Multi Mode Fiber (MMF). To transport up to 480 MHz of RF bandwidth, install two optical fiber cables in parallel (see Figure 1 on page 5). Port 2 ships with factory-installed EMI/weatherproof plug and must remain plugged if not in use. Graphic shows the OCTIS connector in blue; one Optical OCTIS Kit ships with each Fiber CAP MX (see "OCTIS™ Kits" on page 8).
3	1	Optical Port 1	Connects to a Classic CAN or TEN (possibly through a local Hybrid Fiber Junction Box) and provides the main signal interface; if Secondary CAP MX in a cascade, Optical Port 1 connects to Optical Port 2 of the Primary CAP MX. Optical transport occurs over Single Mode Fiber (SMF) or Multi Mode Fiber (MMF). Uses the Optical OCTIS Kit (PN 7770612), which ships with the unit. Port 1 ships with a dust cap that can be discarded upon unit installation. Graphic shows the OCTIS connector in blue.
4	Unlabeled	Power LED	See "Power the CAP MX" on page 62.
5	Unlabeled	Grounding bolts	Connects the CAP MX to an approved earth-ground source.
6	MAINS	Power connector (Vac or Vdc)	Connects to any of the following (graphic shows the port populated): • Vac—Main power • Vdc—Remote DC power supply or a Hybrid Fiber Junction Box.
7	ANT	4.3-10 RF connector	Transmits and receives signals to and from distributed antennas. For models with two antennas, connects to two separate external antennas or to two ports on a cross-polarized dual antenna via 50Ω coaxial cable. Each connector supports two RF bands; see "Connect the CAP MX to an RF Antenna" on page 54. This RF port can be connected directly to an antenna (using RF jumper cables) or through splitters, allowing additional antennas to be fed by the CAP MX.

CAP MX Hardware Options

The following sections describe hardware options for the CAP MX.

Single Mounting Bracket

The Single Mounting Bracket (CommScope PN 7841793-xx) provides the mounting brackets required to mount an CAP MX to a wall or other vertical, flat surface. See "Mount a CAP MX Using a Single Mounting Bracket" on page 32.

Dual Mounting Bracket

The Dual Mounting Bracket (CommScope PN 7839331-xx) provides the mounting brackets required to mount two CAP MXs back-to-back in a single bracket, which is then mounted to a wall or other vertical, flat surface. See "Mount Two CAP MXs Using a Dual Mounting Bracket" on page 38.

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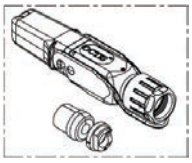
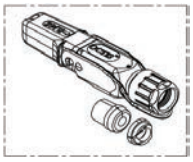
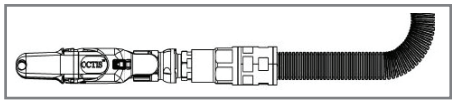
Hybrid Fiber Splice Box

The Hybrid Fiber Splice Box (CommScope PN 7693816-xx) separates the power from the fiber signals on a hybrid fiber feed from the Classic CAN or TEN. It feeds power to the CAP MX through a composite cable that includes both fiber and copper power wires. Fiber and copper terminate at the Splice Box, which allows you to separate the DC wires and fiber at the remote end. For CAP MXs, you will typically use composite cable to transport signal and power, and then use the Hybrid Fiber Splice Box to terminate the fiber at the CAP MX. See "Wire an Optional Hybrid Fiber Splice Box" on page 26.

OCTIS™ Kits

All CAP MXs include one OCTIS Kit for the primary interface to the Classic CAN or TEN that CAP MX plugs into the CAP MX Optical Port 1. You can order an additional OCTIS Kit, which would allow you to cascade two CAP MXs via Optical Port 2, or to attach an auxiliary Ethernet device via the AUX Port. Table 3 identifies the two OCTIS Kit options.

Table 3. *CAP MX OCTIS Kits*

	Kit Name	CommScope PN	Description
	Optical (SFP+) OCTIS Kit	7770612	This is the SFP+ connector that you use to cascade a Secondary Fiber CAP MX one Optical OCTIS Kit ships with each Fiber CAP MX. Use as follows: • Optical Port 1—to connect the CAP MX to a Classic CAN or TEN. • Optical Port 2—to cascade a second CAP MX. • SFP+ Module must be ordered separately, it is not included as part of the Optical OCTIS Kit.
	Ethernet (RJ-45) OCTIS Kit	7760652	This is the RJ-45 connector that you use to attach an auxiliary Ethernet device. The Ethernet OCTIS Kit must be ordered separately.
	Fiber/Cable Protective Kit f. OCTIS	7823597	Use to protect fibers or cables; is 2m (78.7”) long.

OCTIS Kit Instructions

Octis™ is a trademark of Radiall. The following connector drawings and instructions were provided by Radiall.

The following instructions are for the OCTIS SFP+ reverse level kit (CommScope PN: 7770612) and OCTIS RJ-45 reverse lever kit (CommScope PN: 7760652) kits. For information, please contact Radiall.

OCTIS SFP+ Reverse Lever Assembly Instructions

Scan the QR code to the right to watch the OCTIS SFP+ connector assembly video.

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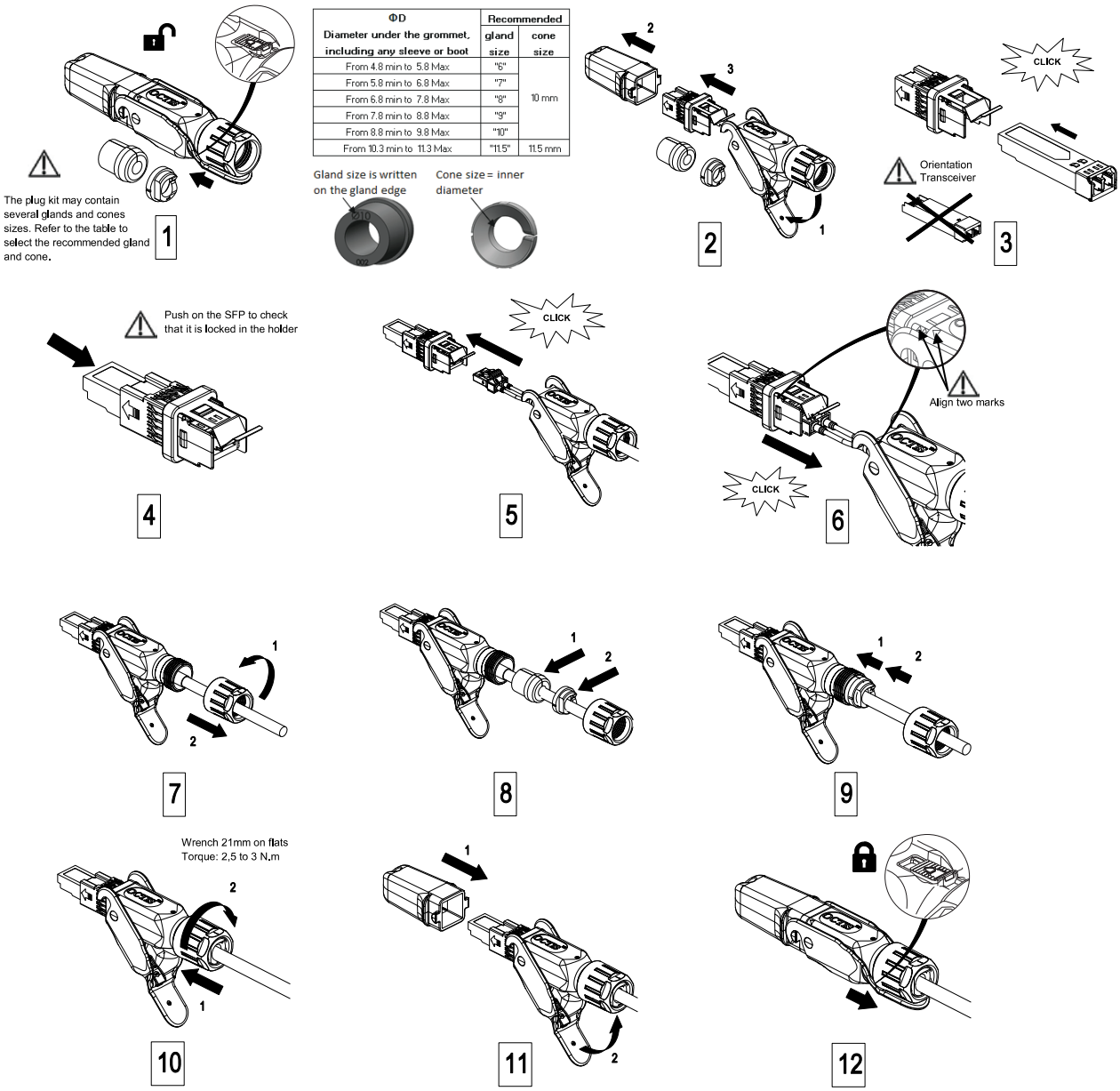

ΦD Diameter under the grommet, including any sleeve or boot	Recommended gland size	Recommended cone size
From 4.8 min to 5.8 Max	"6"	10 mm
From 5.8 min to 6.8 Max	"7"	
From 6.8 min to 7.8 Max	"8"	
From 7.8 min to 8.8 Max	"9"	
From 8.8 min to 9.8 Max	"10"	
From 10.3 min to 11.3 Max	"11.5"	11.5 mm

Figure 3. OCTIS SFP+ Reverse Lever Assembly Instructions (PN: 7770612)

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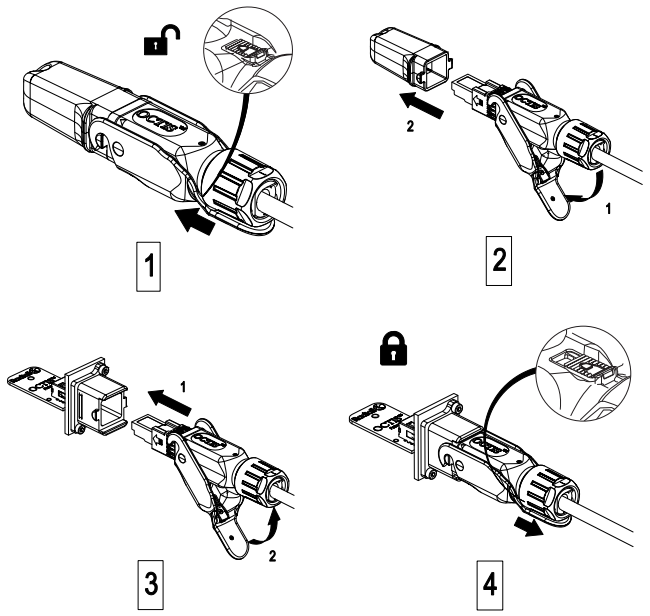

Figure 4. OCTIS SFP+ Reverse Lever Mating Instructions (PN: 7770612)

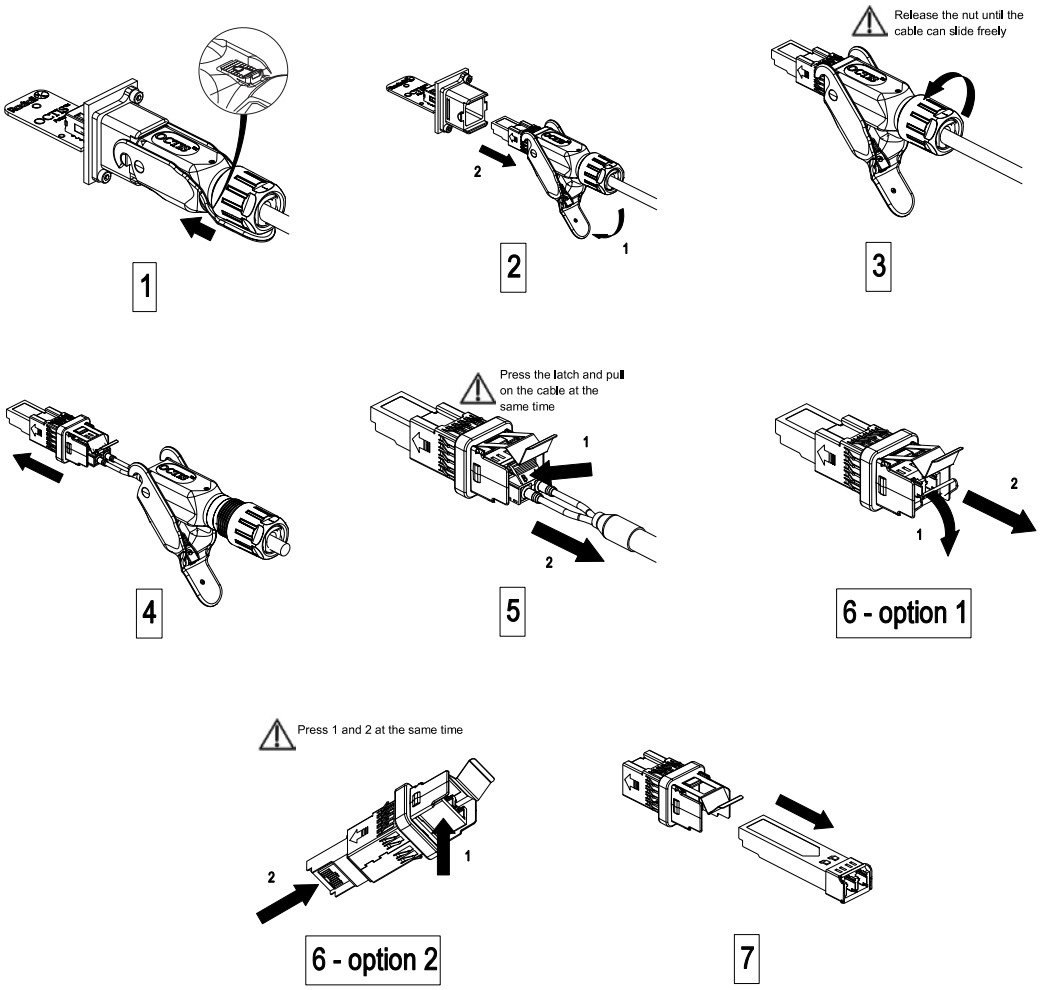

Figure 5. OCTIS SFP+ Reverse Lever Replacement Instructions (PN: 7770612)

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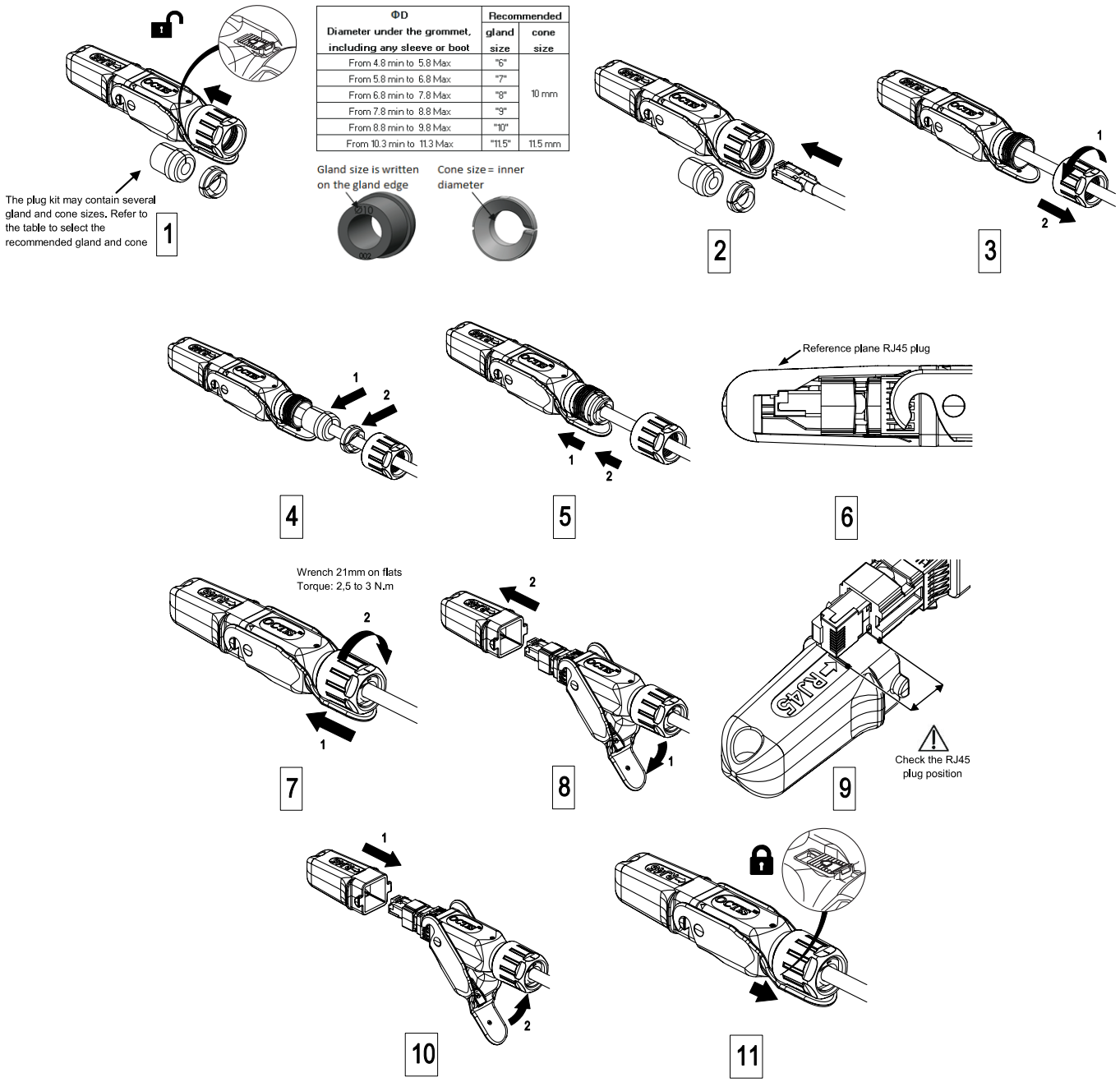
OCTIS RJ45 Reverse Lever Assembly Instructions

Scan the QR code to the right to watch the OCTIS RJ45 connector assembly video.

CommScope GigaSPEED X10D RJ-45 Connector tabs must be removed BEFORE inserting the them into the OCTIS connectors. For installation instructions, see "Special Instructions for GigaSPEED X10D Connectors" on page 12.



ΦD Diameter under the grommet, including any sleeve or boot	Recommended gland size	Recommended cone size
From 4.8 min to 5.8 Max	"6"	10 mm
From 5.8 min to 6.8 Max	"7"	
From 6.8 min to 7.8 Max	"8"	
From 7.8 min to 8.8 Max	"9"	
From 8.8 min to 9.8 Max	"10"	
From 10.3 min to 11.3 Max	"11.5"	11.5 mm

Figure 6. OCTIS RJ-45 Reverse Lever Assembly Instructions (PN: 7760652)

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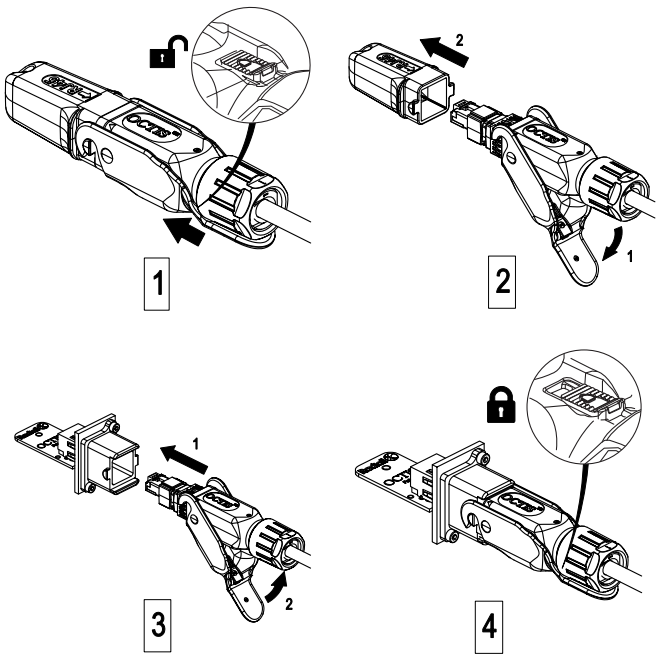

Figure 7. OCTIS RJ-45 Reverse Lever (PN: 7760652) Mating Instructions

Special Instructions for GigaSPEED X10D Connectors

The GigaSPEED X10D 3095B CAT6A cable has a primary and an additional secondary locking tab. If the RJ-45 connector is inserted in the OCTIS shell with the tabs intact, the connector will fit but it may get stuck inside the shell. To prevent this, both of these locking tabs must be removed before insertion into the OCTIS connector shell.

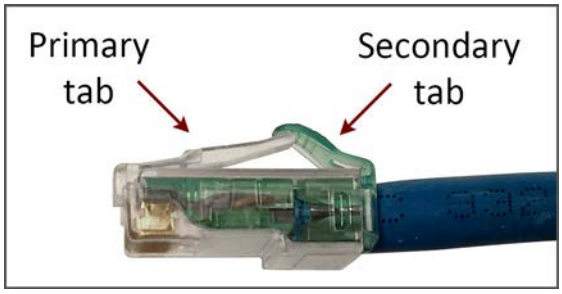

Figure 8. GigaSPEED X10D RJ-45 Connector Tabs to Remove

1 Remove the secondary tab of the RJ-45 connector using wire cutters.

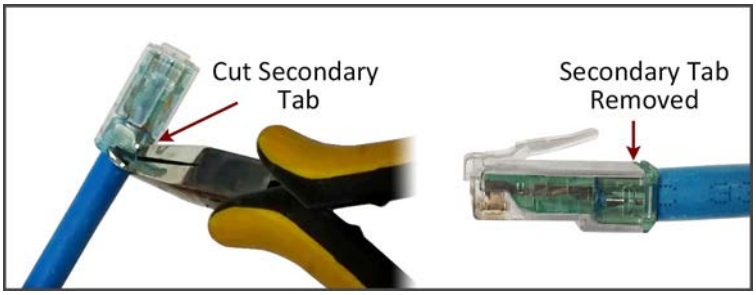

Figure 9. RJ-45 Primary Tab Removal

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2 Remove the primary tab of the RJ-45 connector using wire cutters.

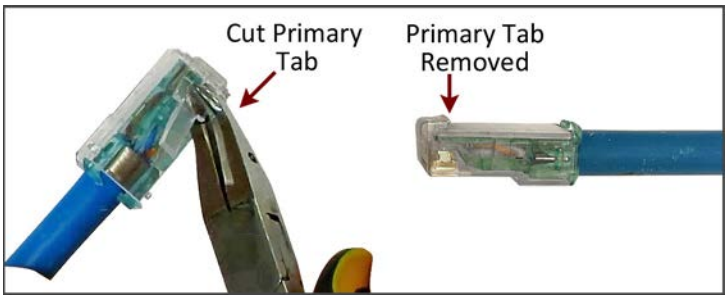

Figure 10. RJ-45 Primary Tab Removal

3 Insert the RJ-45 connector into the OCTIS connector shell as described in the"OCTIS RJ45 Reverse Lever Assembly Instructions" on page 11 or in the printout included with the connector.

4 Use the OCTIS dust cover to verify that the RJ-45 connector extends the correct distance beyond the shell using the indicator line on the dust cover.

Figure 11. RJ-45 Dust Cover Alignment

5 Complete the assembly of the OCTIS connector by following the OCTIS User Instructions printout included with the connector. The final assembly is shown in Figure 12 on page 13.

Figure 12. GigaSPEED X10D RJ-45 Correctly Installed in OCTIS Connector

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Safely Working with ERA Hardware

The following sections provide important information that you should read and know before working with any ERA hardware. Observe all cautions and warnings listed in this section.

RF Safety Cautions

This system is a RF Transmitter and continuously emits RF energy. Maintain a minimum clearance from the antenna as specified in Table 5 on page 19 while the system is operating. Whenever possible, power down the
CAP MX before servicing the antenna.

Only license holders for the respective frequency range are allowed to operate this unit.

Précautions de sécurité relatives aux radiofréquences

Ce système est un émetteur RF et émet en permanence de l'énergie RF. Maintenez un dégagement minimum par rapport à l'antenne comme spécifié dans Table 5 on page 19 pendant que le système fonctionne. Dans la mesure du possible, éteignez le CAP MX avant de réparer l'antenne.

Seuls les titulaires de licence pour la gamme de fréquences respective sont autorisés à utiliser cet appareil.

Health and Safety Precautions

A high leakage current ground (earth) connection to the Power Supply Unit (PSU) is essential before making any other connections to the PSU.

Laser radiation. Risk of eye injury in operation. Do not stare into the laser beam; do not view the laser beam directly or with optical instruments.

High frequency radiation in operation. Risk of health hazards associated with radiation from the antenna(s) connected to the unit. Implement prevention measures to avoid the possibility of close proximity to the antenna(s) while in operation.

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Property Damage Warnings

Keep operating instructions within easy reach and make them available to all users.

Only license holders for the respective frequency range are allowed to operate this unit.

Read and obey all the warning labels attached to the unit. Make sure that all warning labels are kept in a legible condition. Replace any missing or damaged labels.

Make sure the unit's settings are correct for the intended use (refer to the manufacturer product information) and regulatory requirements are met. Do not carry out any modifications or fit any spare parts, which are not sold or recommended by the manufacturer.

Due to power dissipation, the CAP MX may reach a very high temperature. Do not operate this equipment on or close to flammable materials. Use caution when servicing the CAP MX.

Only authorized and trained personnel are allowed to open the unit and get access to the inside.

Only suitably qualified personnel are allowed to work on this unit and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this installation guide.

Although the unit is internally protected against overvoltage, it is strongly recommended to ground (earth) the antenna cables close to the antenna connectors of the unit for protection against atmospheric discharge. In areas with strong lightning, it is strongly recommended to install additional lightning protection.

General Installation Safety Requirements

Wet conditions increase the potential for receiving an electrical shock when installing or using electrically powered equipment. To prevent electrical shock, never install or use electrical equipment in a wet location or during a lightning storm.

This system is a RF Transmitter and continuously emits RF energy. Maintain a minimum 8-inch (20 cm) clearance from the antenna while the system is operating. Whenever possible, shut down the RAN before servicing the antenna.

Do not remove caps from any of the connectors until instructed to do so.

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The CAP MX is to be used only with CommScope (NEC Class 2) or Limited Power Source ERA Subrack, or equivalent.

Read and observe all the warning labels attached to the unit. Make sure that all warning labels are kept in a legible condition. Replace any missing or damaged labels.

Guard Against Damage from Electro-Static Discharge

Electro-Static Discharge (ESD) can damage electronic components. To prevent ESD damage, always wear an ESD wrist strap when working with ERA hardware components. Not all ERA hardware requires grounding. For those hardware components for which grounding is required, connect the ground wire on the ESD wrist strap to an earth ground source before touching the component. Wear the wrist strap the entire time that you work with the hardware.

Compliance

1 **Notice:** For installations, which have to comply with FCC RF exposure requirements, the antenna selection and installation must be completed in a way to ensure compliance with those FCC requirements. Depending on the RF frequency, rated output power, antenna gain, and the loss between the repeater and antenna, the minimum distance D to be maintained between the antenna location and human beings is calculated according to this formula:

$$D_{[cm]} = \sqrt{\frac{P_{[mW]}}{4 * \pi * PD_{[mW/cm^2]}}}$$

where

- P (mW) is the radiated power at the antenna, i.e. the max. rated repeater output power in addition to the antenna gain minus the loss between the repeater and the antenna.
- PD (mW/cm^2) is the allowed Power Density limit acc. to 47 CFR 1.1310 (B) for general population / uncontrolled exposures which is
  - f (MHz) / 1500 for frequencies from 300MHz to 1500MHz
  - 1 for frequencies from 1500MHz to 100,000MHz

RF exposure compliance may need to be addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-location requirements of 1.1307(b)(3).

2 **Notice:** For installations which have to comply with European EN50385 exposure compliance requirements, the following Power Density limits/guidelines (mW/cm^2) according to ICNIRP are valid:

- 0.2 for frequencies from 10 MHz to 400 MHz
- F (MHz) / 2000 for frequencies from 400 MHz to 2 GHz
- 1 for frequencies from 2 GHz to 300 GHz

3 **Notice:** Installation of this equipment is in full responsibility of the installer, who has also the responsibility, that cables and couplers are calculated into the maximum gain of the antennas, so that this value, which is filed in the FCC Grant and can be requested from the FCC data base, is not exceeded. The industrial boosters are shipped only as a naked booster without any installation devices or antennas as it needs for professional installation.

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4 **Notice:** For installations which have to comply with FCC/ISED requirements:

English:

This device complies with FCC Part 15. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

This device complies with Health Canada's Safety Code. The installer of this device should ensure that RF radiation is not emitted in excess of the Health Canada's requirement. Information can be obtained at http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct-eng.php.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

1 This device may not cause interference.

2 This device must accept any interference, including interference that may cause undesired operation of the device.

Antenna Stmt for ISED:

This device has been designed to operate with antennas that are selected for the location-specific use. The required antenna impedance is 50 ohms. The maximum Antenna Gain is specified in Table 5 on page 19. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least the minimum distance calculated in Table 5 from all persons and must not be co-located or operating in conjunction with any other antennas or transmitters. Users and Installers must be provided with antenna installation instructions and transmitter operating conditions to ensure RF exposure compliance.

French:

Cet appareil est conforme avec Santé Canada Code de sécurité 6. Le programme d'installation de cet appareil doit s'assurer que les rayonnements RF n'est pas émis au-delà de I'exigence de Santé Canada. Les informations peuvent être obtenues:
http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct-eng.php

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1 L'appareil ne doit pas produire de brouillage;

2 L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Antenne Stmt pour ISDE:

Cet appareil a été conçu pour fonctionner avec des antennes sélectionnées pour une utilisation spécifique à l'emplacement. L'impédance d'antenne requise est de 50 ohms. Le gain d'antenne maximum est spécifié dans le tableau 5. La ou les antennes utilisées pour cet émetteur doivent être installées de manière à fournir une distance de séparation d'au moins la distance minimale calculée dans le tableau 5 de toutes les personnes et ne doivent pas être colocalisées ou fonctionner dans en conjonction avec toute autre antenne ou émetteur. Les utilisateurs et les installateurs doivent recevoir les instructions d'installation de l'antenne et les conditions de fonctionnement de l'émetteur pour garantir la conformité à l'exposition RF.

5 **Notice:** The unit complies with Overvoltage Category II. It also complies with the surge requirement according to EN 61000-4-5 (fine protection); however, installation of an additional medium (via local supply connection) and/or coarse protection (external surge protection) is recommended depending on the individual application in order to avoid damage caused by overcurrent.

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For Canada and US, components used to reduce the Overvoltage Category shall comply with the requirements of IEC 61643-series. As an alternative, components used to reduce the Overvoltage Category may comply with ANSI/IEEE C62.11, CSA Certification Notice No. 516, CSA C22.2 No. 1, or UL 1449. Suitability of the component for the application shall be determined for the intended installation.

6 **Notice:** Corresponding local particularities and regulations must be observed. For national deviations, please refer to the respective documents, which are available from CommScope.

7 **Note:** For a Class B digital device or peripheral:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

8 **Notice:** For a Class A digital device or peripheral.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

9 **Note:** This unit complies with European standard EN60950-1 / EN62368-1.

Equipment Symbols Used / Compliance

Please observe the meanings of the following symbols used in our equipment and the compliance warnings listed in Table 4.

Table 4. *Compliance Labels*

Symbol	Compliance	Meaning
—	FCC	For industrial (Part 20) signal booster: WARNING: This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.
		For (Part 90) signal booster: WARNING: This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. You MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.

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Table 4. *Compliance Labels*

Symbol	Compliance	Meaning
—	ISED	WARNING: This is NOT a CONSUMER device. It is designed for installation by an installer approved by an ISED licensee. You MUST have an ISED LICENCE or the express consent of an ISED licensee to operate this device. AVERTISSEMENT: Ce produit N'EST PAS un appareil de CONSOMMATION. Il est conçu pour être installé par un installateur approuvé par un titulaire de licence d'ISDE. Pour utiliser cet appareil, vous DEVEZ détenir une LICENCE d'ISDE ou avoir obtenu le consentement exprès d'un titulaire de licence autorisé par ISDE.
CE	CE	To be sold exclusively to mobile operators or authorized installers - no harmonized frequency bands, operation requires license. Intended use: EU and EFTA countries.
		Indicates conformity with the RED directive 2014/53/EU and/or RoHS directive 2011/65/EU.
CE 0700	CE	Indicates conformity with the RED directive 2014/53/EU and RoHS directive 2011/65/EU certified by the notified body no. 0700.

Required Antenna Distances

Table 5. *Required Antenna Distances*

Model	Antenna gain without cable loss [dBi]	Minimum Distance DL			
		FCC		ISED	
		m	inches	m	inches
CAP MX	9	0.938	36.93	1.319	51.93

Maximum Output Power Levels

Table 6 lists the frequencies and maximum output power for bands supported in the CAP MX variants.

Table 6. *Maximum Power Output by Frequency*

Band	DL Frequency Range	Frequency	Power Output [dBm]
6	617-652 MHz	617	29
7E	728-746 MHz	728	29
	746-756 MHz	746	
	758-768 MHz	758	
80	862-869 MHz	862	29
85	869-894 MHz	869	
17E	2110-2180 MHz	2110	33
	2180-2200 MHz	2180	
19	1930-1995 MHz	1930	33
	1995-2020 MHz	1995	
23	2350-2360 MHz	2350	30
25TDD	2496-2690 MHz	2496	32

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INSTALLING CAP MXS

The following sections guide you through the installation of a CAP MX. Pay attention to all cautions and follow the steps in the order presented.

CAP MX APs require the use of RFD Card PN 7633229-01 or 7633229-02 or higher.

CAP MX Installation and Cascade Rules

When cascading a Secondary CAP MX or an external Ethernet device such as WiFi or an IP camera, you must observe the following rules.

- In a cascade, the CAP MX connected directly to the Classic CAN or TEN is the Primary CAP MX, and the CAP MX that connects to the Primary CAP MX is the Secondary CAP MX.
- You connect CAP MXs to an OPT Card in the Classic CAN or TEN.
  - Each OPT Card has four 10 Gbps ports (labeled 1 - 4) for fiber connections.
  - You can connect up to 4 CAP MXs per OPT Card for a total of 16 Primary CAP MXs, per Classic CAN or TEN.
  - You can connect one Secondary CAP MX to each Primary CAP MX for a total of eight CAP MXs per OPT Card, which 32 total CAP MXs per Classic CAN or TEN.
- The total 480 MHz RF bandwidth is shared between the two cascaded units, but can be shared unevenly; that is, with more bandwidth going to either the Primary or Secondary CAP MX—either CAP MX can transmit all the 480 MHz RF bandwidth or any subset of it.
- The Primary and Secondary CAP MXs power up as soon as power is applied to them. In a cascade, the GUI discovers and readies the Primary CAP MX for RF first, and then the Secondary CAP MX will be discovered and readied for RF. For information on the Power LED behavior, see "Power the CAP MX" on page 62.
- SMF or MMF connects the CAP MX via its Optical Port 1 to the OPT Card.
- When cascading a Secondary CAP MX or an external Ethernet device such as WiFi or an IP camera, you must observe the following rules.
  - To cascade two CAP MXs, use a fiber-optic cable.
  - SMF or MMF connects the Secondary CAP MX via its Optical Port 1 to the Primary CAP MX via its Optical Port 2.
  - You can connect the following to the Primary CAP MX
    - a Secondary CAP MX
    - an Ethernet device
    - both a Secondary CAP MX and an Ethernet device.
- To add a Secondary AP, you must add an Optical OCTIS kit to the Primary CAP MX, see "OCTIS™ Kits" on page 8.
- To add an Ethernet device, you must add an RJ45 OCTIS kit to the Primary CAP MX, see "OCTIS™ Kits" on page 8.

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Cat6A Cable Requirements for Ethernet Devices

If you connect an Ethernet device to a Fiber CAP MX, you must observe the following rules.

- Plenum rated cable must be used whenever it is required by local electrical codes.
- Shielded twisted pair is not required unless operating in a high RFI/EMI environment.
- CommScope strongly recommends using factory terminated and tested Cat6A Patch Cord.
- 24 AWG Cat6A cabling is sufficient for the cable run between the Fiber CAP MX and the Ethernet device.
- The maximum attached cable length at Port A is 3 meters (9.8 feet).

Prepare for Installation

Do the following before beginning installation.

- Review and know the cautions in "Safely Working with ERA Hardware" on page 14.
- Review the system design plan.
- Identify the equipment installation site, which must be able to support the weight of the CAP MX, see "Determine the Mounting Site" on page 23.
- Review the power requirements to make sure the site can support this installation.
- Map out all cable runs.
- Identify and obtain all tools and materials required to complete the installation; see "Recommended Tools and Material" on page 21

Recommended Tools and Material

The following tools and material is required for installation are not supplied by CommScope.

- Electrostatic Discharge (ESD) wrist strap
- Drill and bits that can penetrate the selected mounting surface
- SW10 wrench
- Single Mount
  - Single Mounting Bracket (CommScope PN 7841793-xx)
  - Four M6 screw anchors rated for the mounting surface
- Dual Mount
  - Dual Mounting Bracket (CommScope PN 7839331-xx)
  - Four M6 screw anchors rated for the mounting surface
- For installations using the optional Hybrid Fiber Splice Box
  - Hybrid Fiber Splice Box (CommScope PN 7693816-xx)
  - Torx T20H screwdriver
- Earth-bonding cable to ground the CAP MX chassis
- Fiber cleaning equipment.

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Determine the Power Consumption of the CAP MX

Use the power consumption matrix in Table 7 to calculate power consumption for a CAP MX, where

- the consumption numbers are at the CAP MX power inputs and do not account for feed losses
- the maximum consumption numbers in Table 7 do not include the power consumed by any attached auxiliary devices. Both CAP MX power consumption and auxiliary device power must be included when calculating feed losses.

Table 7. *CAP MX Power Consumption*

CAP M Model		Configuration	Voltage Range (V)	Typical Power (W) [1 2]	Maximum Power (W) [1 2]
Part Number	**Model Name**				
7830127-0001	CAP MX F-AC-APE	AC	90 to 264 Vac	300	350
7830127-0002	CAP MX F-DC-APE	DC	-36 to -60 Vdc	300	350

1 Does not include SFP+ Module consumption. Can support up to 3W (more with engineering consultation) maximum total SFP+ Module consumption. Typical installation (sufficient for SM up to 10km or MM) would be 0.8W typical, 1.0W max for each SFP+ Module.

2 Does not include power drawn by an external PoE device connected to the RJ45 Auxiliary port (Port A); in this configuration, the CAP MX will draw an additional 20W.

Mains power must be interruptible with an external delay-actions mains breaker. For the Mains breaker, observe the following recommendations.

- **CAP MX APs require a minimum 120 Volt / 15 Amp or 240 Volt / 13 Amp, single-phase, 50 / 60 Hz AC service. MAINS power must be interruptible with an external delay-actions mains breaker. CommScope recommends external AC breakers capable of at least 15 Amps maximum for 120-Volt service or at least 13 Amps for 240-Volt service. One type B breaker can support up to two CAP MX units, and a type C breaker can support up to four CAP MX units.**
- **For the DC power supply, observe the local regulations of the DC service provider.**

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Determine the Mounting Site

When deciding on a suitable mounting site, observe the following rules; refer also to "Mounting Orientation" on page 31.

- The CAP MX is suitable for installation indoors or outdoors.
- Use the weights listed in Table 8 to determine a site that can bear the weight of the CAP MX that is being installed, where:
  - The "Maximum Lift Weight" is the highest weight that must be lifted during installation. (An installer should lift the CAP MX components one at a time, not a wholly configured CAP MX.)
  - The "Total Hanging Weight" is the weight of the CAP MX, including the weight of the Mounting Bracket, minus the weight of the external cables and connectors, that the mounting site must be able to support.

Table 8. *Maximum CAP MX Installation Weights*

CAP MX installed with this option ...	Maximum Lift Weight		Total Hanging Weight	
	kg	lbs.	kg	lbs.
Single Mounting Bracket (PN 7841793-xx)	35.5	78.2	38.6	85.0
Dual Mounting Bracket (PN 7839331--xx)	35.5	78.2	79.4	175.1

- Use the dimensions shown in Figure 13 on page 24 for Single Mount and Figure 15 on page 31 for Dual Mount.

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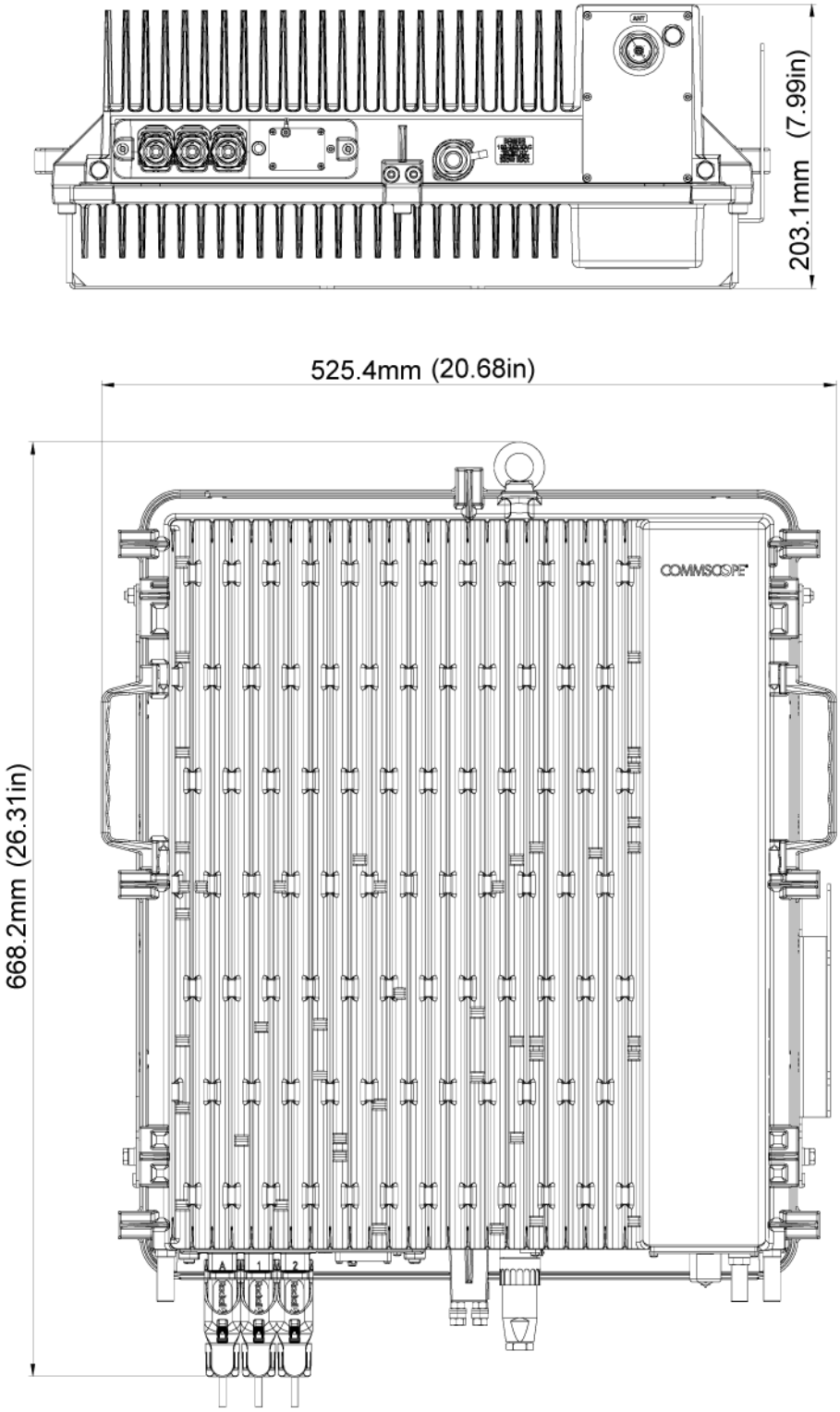

Figure 13. Mounting Dimensions for Single Mounting Bracket

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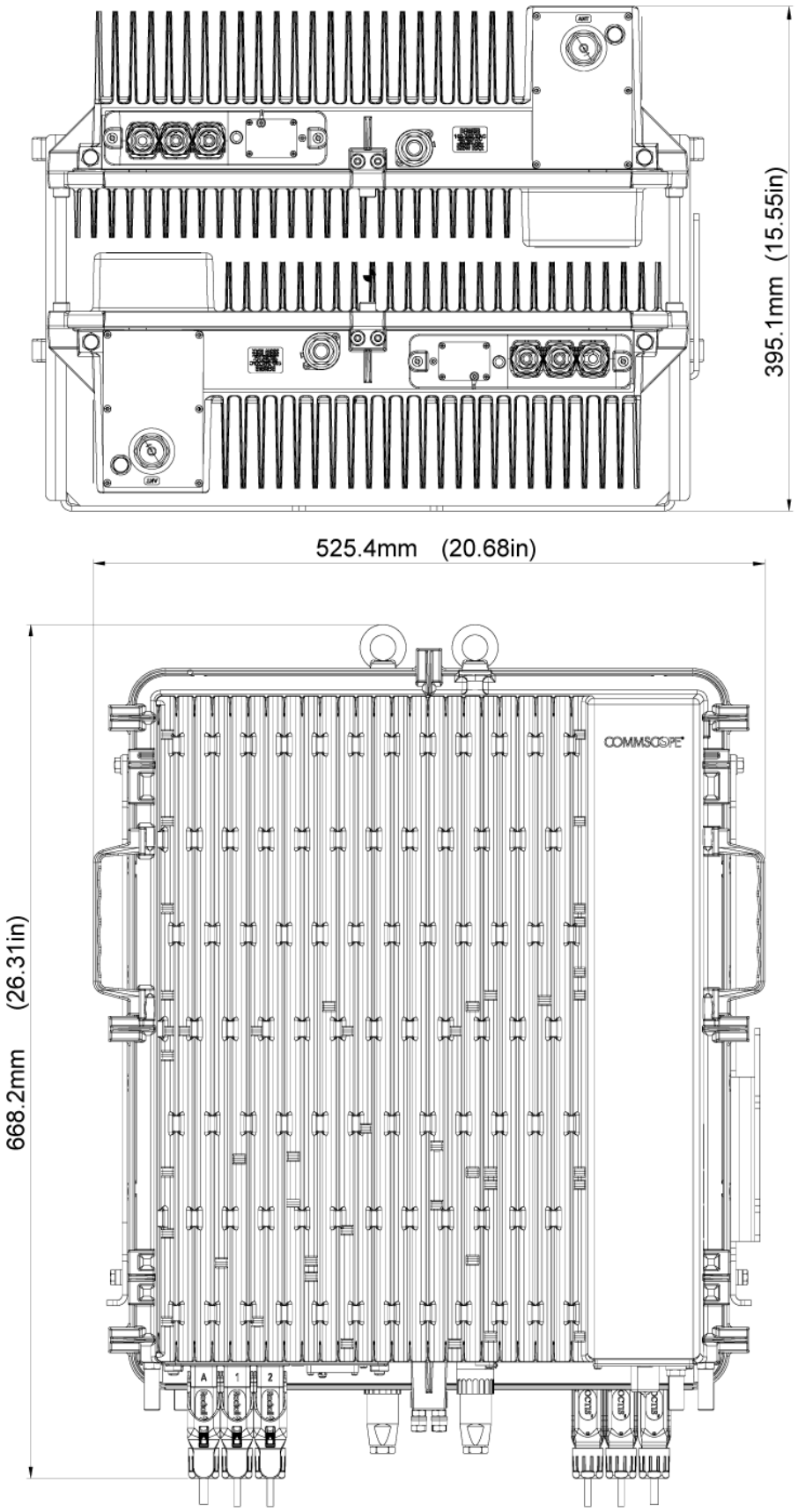


Figure 14. Mounting Dimensions for the Dual Mounting Bracket

Unpack and Inspect the CAP MX and Optional Accessories

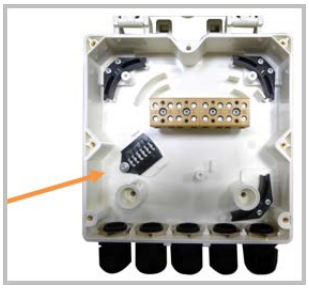
1. Inspect the exterior of the shipping container(s) for evidence of rough handling that may have damaged the components in the container.
2. Unpack each container while carefully checking the contents for damage and verify with the packing slip.
3. If damage is found or parts are missing, file a claim with the commercial carrier and notify CommScope Technical Support (see "CMS Global Technical Support" on page 63). Save the damaged cartons for inspection by the carrier.
4. Save all shipping containers for use if the equipment requires shipment at a future date.

Wire an Optional Hybrid Fiber Splice Box

The steps in this section pertain only to those installations that require the use of the optional Hybrid Fiber Splice Box to provide fiber and power to the CAP MX. If the optional Hybrid Fiber Splice Box is not required for this installation, skip to "Mount the CAP MX" on page 30.

1. Obtain the Hybrid Fiber Splice Box Kit (CommScope PN 7693816-xx).
2. Follow the steps in "Unpack and Inspect the CAP MX and Optional Accessories" on page 26.
3. Open the Hybrid Fiber Splice Box and remove the installation kit that is inside.

4. Using the parts from the Hybrid Fiber Splice Box, insert the Splice Holder and fasten it using a PTK 30x6 screw and one M4 washer.



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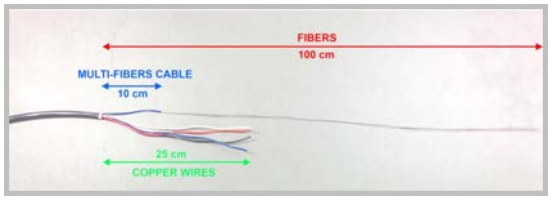
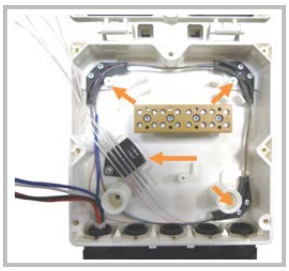
5 From the Hybrid Fiber Splice Box Kit, insert Fiber Patch Cord in one of the cable glands indicated in the graphic to the right.

6 Strip the insulation of the composite cable for 100 cm and the fibers for 90 cm, and then shorten the copper cables to 25 cm.

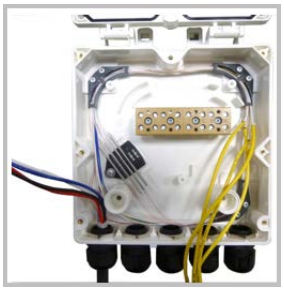


7 Insert the composite cable in the first cable gland and separate the multi-fibers cable from the copper wires. It is necessary to remove the nut to perform this action. The cable must be fed through the nut and it must be retightened once finished.

8 Bend the spliced fibers using the corner guides and fix the splices to the splice holder.



9 Bend the optical cables as shown in the graphic to the right.



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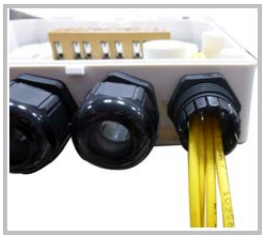
10 If a second splice holder is needed, it can be assembled using the M4 insulating washer and two M4 plain washers, as shown to the right. The required screw is a PTK30 x 12.

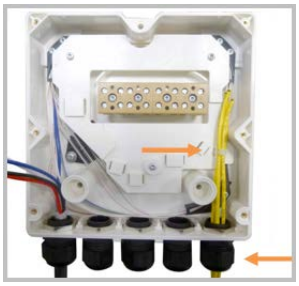
11 Remove the sealing nut and rubber of the cable gland and insert the optical cables.



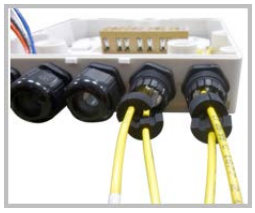
12 Place each cable into one of the grooves of the seal insert.

13 Press the seal insert into the clamp ring opening.

14 Fix the optical cables inside the box using one cable tie and tight the sealing nut.



15 It is possible to separate the optical cables and use two different cable glands. Remove the sealing nut and rubber on each cable gland.



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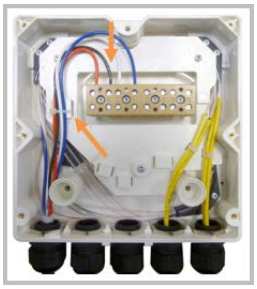
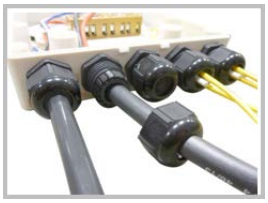
16 Close all unused grooves with the plastic cylinders, no matter if one or two cable glands are used.

17 Insert the copper wires in the first multiple terminal connectors. See markings on the internal support. Then fasten the copper cables inside the box using one cable tie.

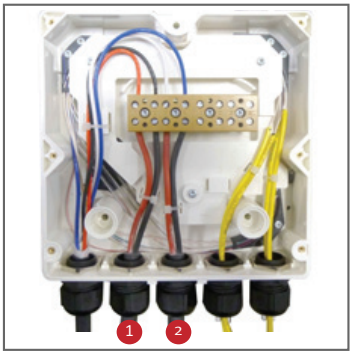


18 Remove the sealing nut and insert the CAP MX supply cable and tighten the sealing nut.



19 Connect the supply cable to the terminal strip and fix it inside the box using one cable tie.

In the instance when two CAP Ms are in a dual mount or a cascade, it is possible to connect a second power supply cable. In the figure to the right, **1** and **2** refers to two CAP Ms.



Mount the CAP MX

The CAP MX is suitable for indoor and outdoor installations.

General Mounting Cautions

The following cautions apply to all CAP MX installations; there may be other mounting cautions applicable to a specific mounting option, which will be defined in the applicable mounting procedure.

Attach all CAP MXs securely to a stationary object as described in this installation guide.

To maintain proper ventilation, keep at least 76 mm (3-inch) clearance around the CAP MX.

The installation site must be able to bear the weight of the CAP MX; see Table 8 on page 23.

Risk of injury by the weight of the unit falling. Ensure there is adequate manpower to handle the weight of the system.

The CAP MX must be mounted using the appropriate fastening system for the planned substrate and application location and be implemented according to all local codes and rules. The chosen fastening system must be corrosion resistant. The fastening system and substrate must provide maximal strength and provide resistance to failure due to tension, pull out/thru or shear. Substrate and total performance of the selected fastening system must provide no less than 5300 N (1200 lbs) resistance to tensile, pull out and shear forces.

Examples of fasteners for common substrates include the following:
Structural Wood - Lag Bolts (blind) / Machine Bolts, Nuts and Washers (thru)
Brick or Concrete - Masonry Screw Anchors / Lag Shield Anchors and Lag Bolts
Structural Steel - Machine Screws (blind threaded) / Machine Bolts, Nuts and Washers (thru)

Risk of serious personal injury by equipment falling due to improper installation. Installers must verify that the supporting surface will safely support the combined load of the electronic equipment and all attached hardware and components. For wall mounts, the screws and dowels (wall anchors) used should also be appropriate for the structure of the supporting wall.

If any different or additional mounting material is used, ensure that the mounting remains as safe as the mounting designed by the manufacturer. The specifications for stationary use of the CAP MX must not be exceeded. Ensure that the static and dynamic strengths are adequate for the environmental conditions of the site. The mounting itself must not vibrate, swing or move in any way that might cause damage to the CAP MX.

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Mounting Orientation

CAP MXs are passively cooled and must therefore always be mounted with its ANT port pointing down, as shown in Figure 15.

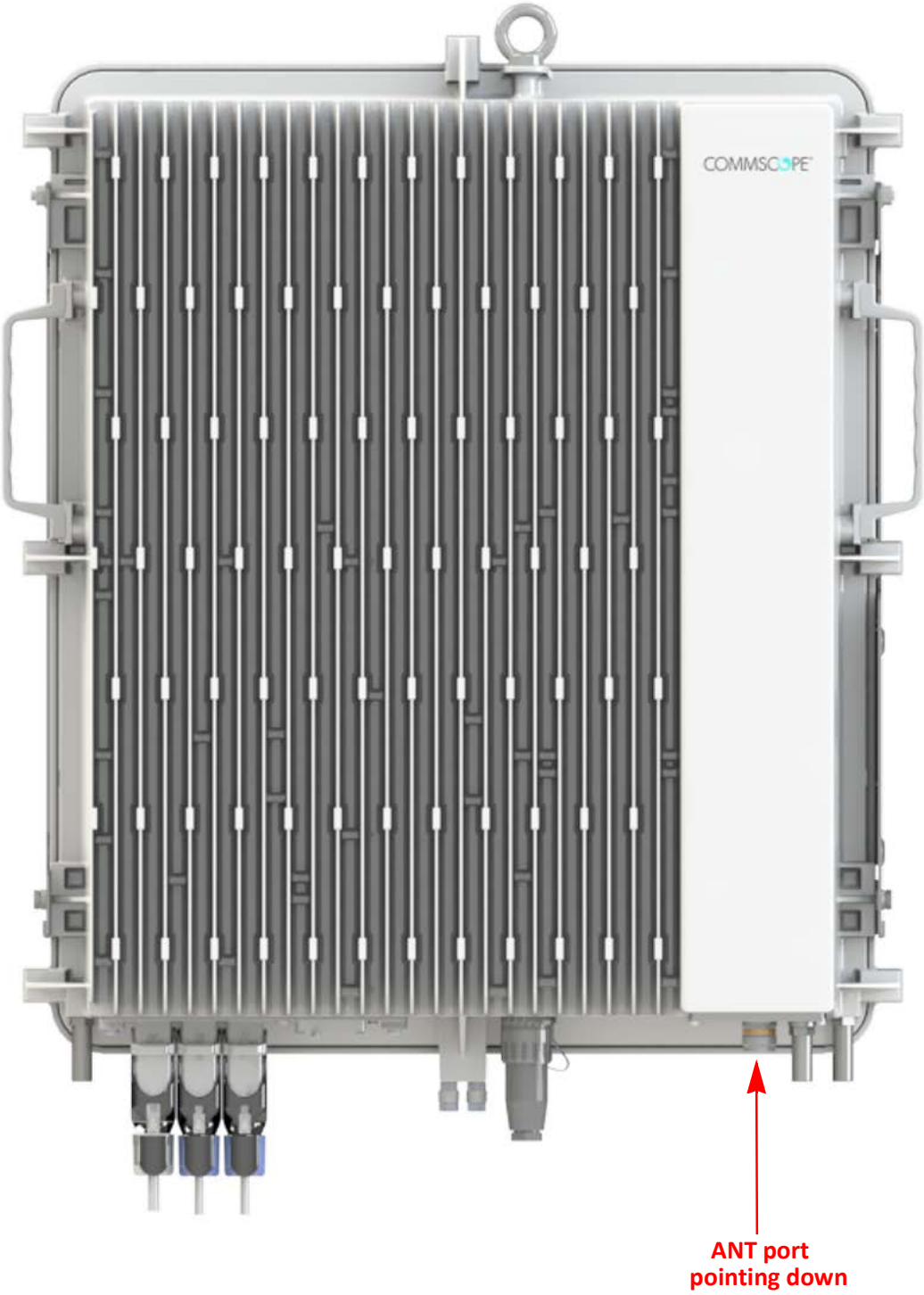

Figure 15. Mounting Orientation for a CAP MX

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Mount the CAP MX to a Wall or Vertical Surface

There are two mounting options for the CAP MX; follow the procedure that is appropriate for this installation:

- "Mount a CAP MX Using a Single Mounting Bracket" on page 32
- "Mount Two CAP MXs Using a Dual Mounting Bracket" on page 38.

If this installation requires the optional Hybrid Fiber Splice Box to provide fiber and power to the CAP MX, follow the steps in

Mount a CAP MX Using a Single Mounting Bracket

1 Obtain the CAP MX Single Mounting Bracket (CommScope PN 7841793-xx).

2 Follow the steps in "Unpack and Inspect the CAP MX and Optional Accessories" on page 26. Table 9 lists the parts that ship with the CAP MX Single Mounting Bracket.

Table 9. *Parts List for CommScope PN 7841793-XX*

Description	Quantity
Single Wall-Mounting Bracket	1

3 Refer to "Determine the Mounting Site" on page 23 to determine the mounting location, which must be able to support the weight and dimensions of the CAP MX.

Installer must verify that the mounting surface will safely support the combined load of the electronic equipment and all attached hardware and components.

4 Refer to "Mounting Orientation" on page 31 to determine the mounting orientation of the CAP MX.

5 Refer to and observe all cautions listed in "General Mounting Cautions" on page 30.

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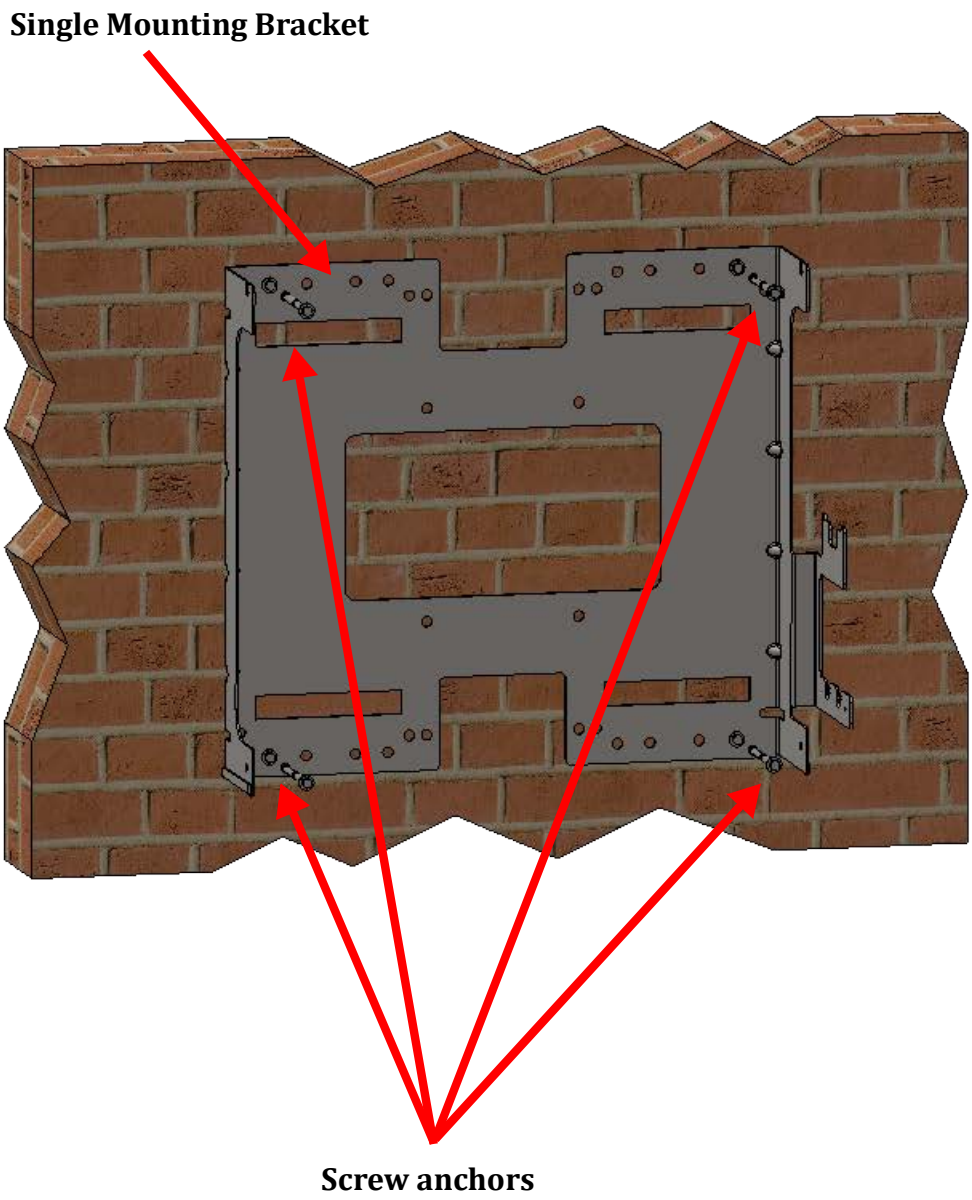
6 Secure the Mounting Bracket to the wall (or another suitable vertical surface) as shown below.

a Install the mounting bracket using 4 corrosion resistant M6 to M8 (1/4 to 5/16 inch) fasteners according to the drilling layout.

The M6 to M8 fastening system does not do not ship with the CAP MX as the anchor type is dependent on the on-site conditions (wall structure and materials). Use a corrosion resistant fastening system that is designed for the mounting substrate.

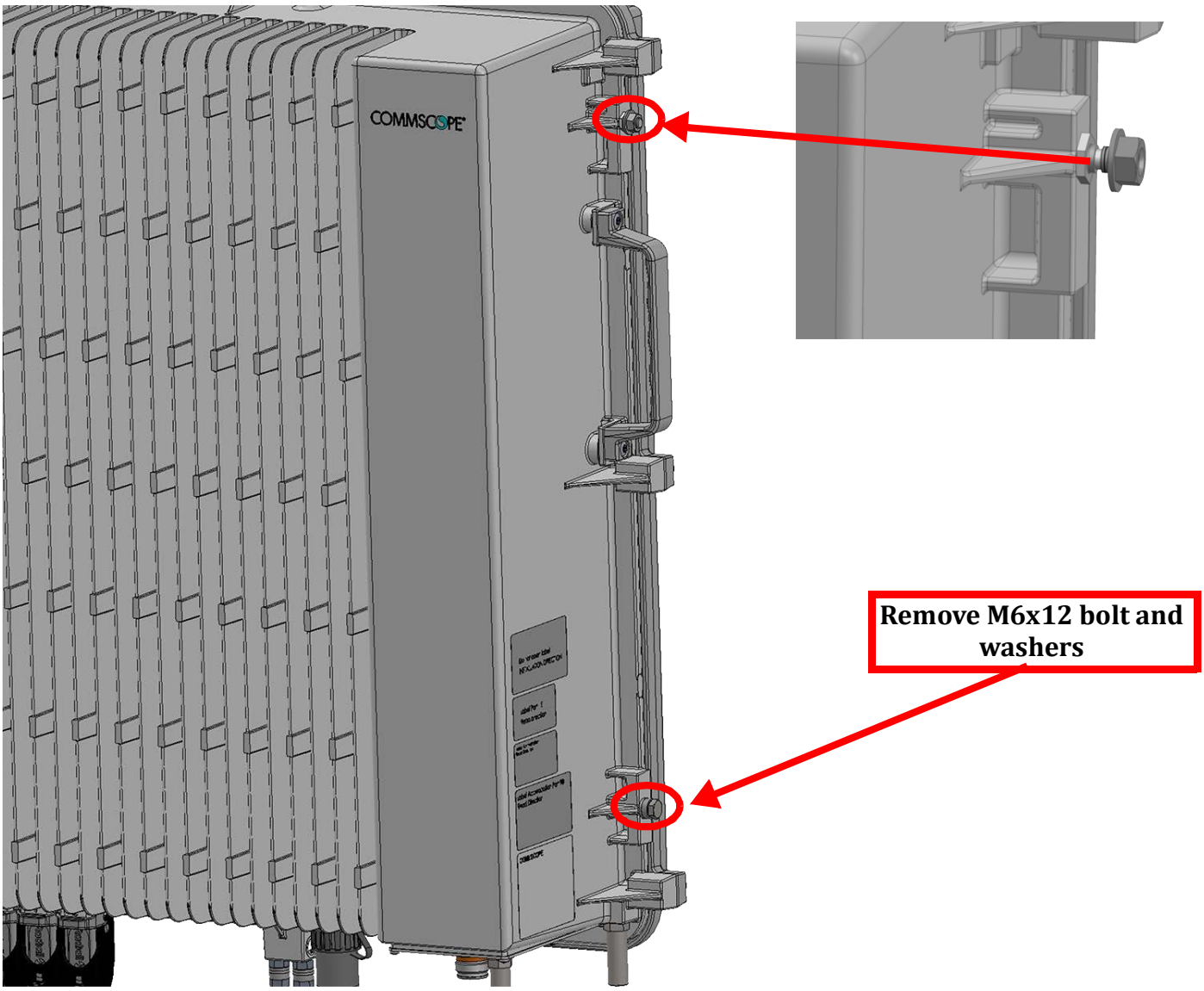
b Confirm that the Mounting Bracket is securely fastened to the wall.



7 From both sides of the CAP MX:

a Loosen the M6 lock nuts, as shown below, to provide adequate space for the mounting bracket.

b Remove the two M6 screws and their M6 plain and M6 split-lock washers; reserve the screws and washers as you will later reinstall them.



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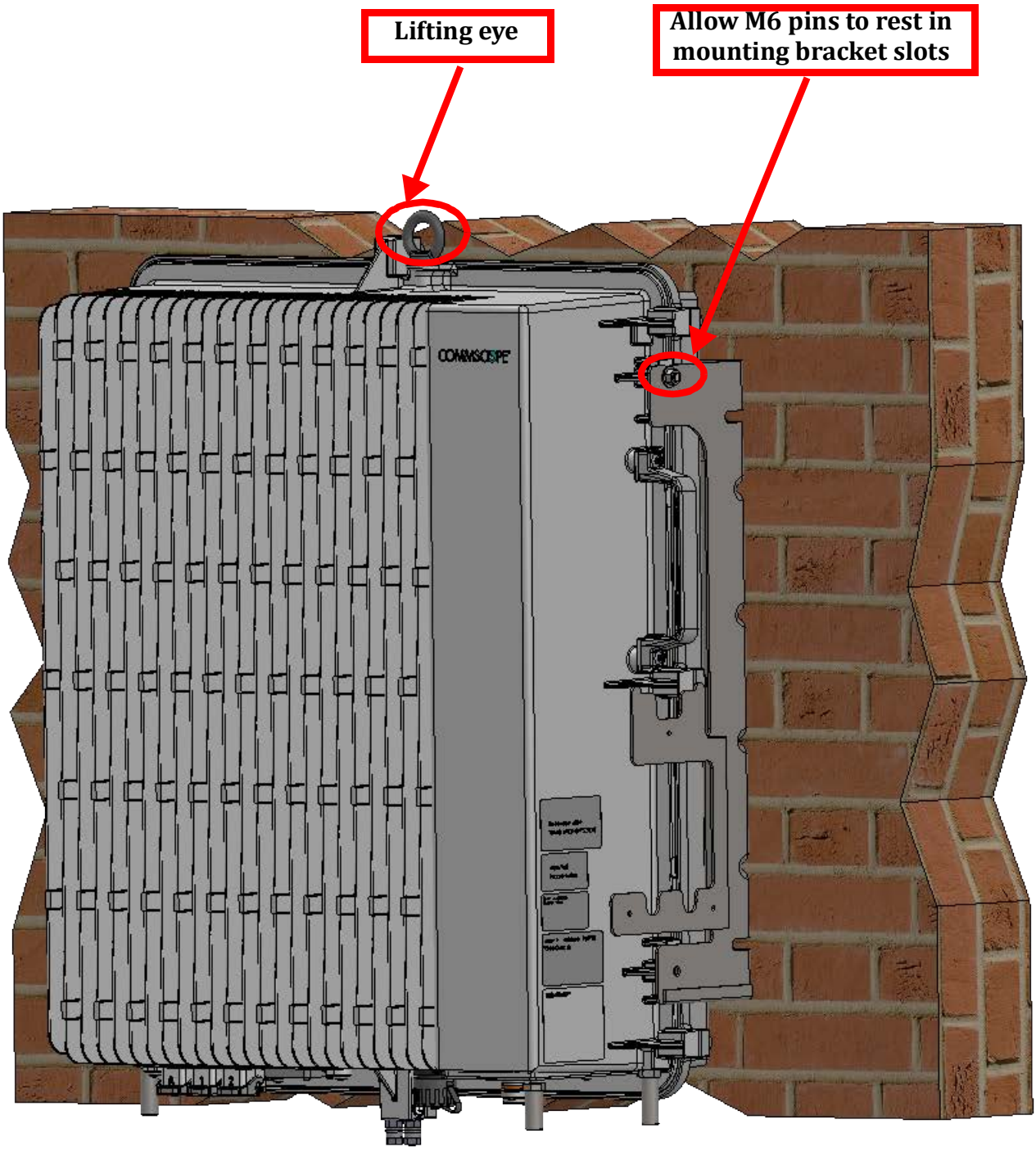
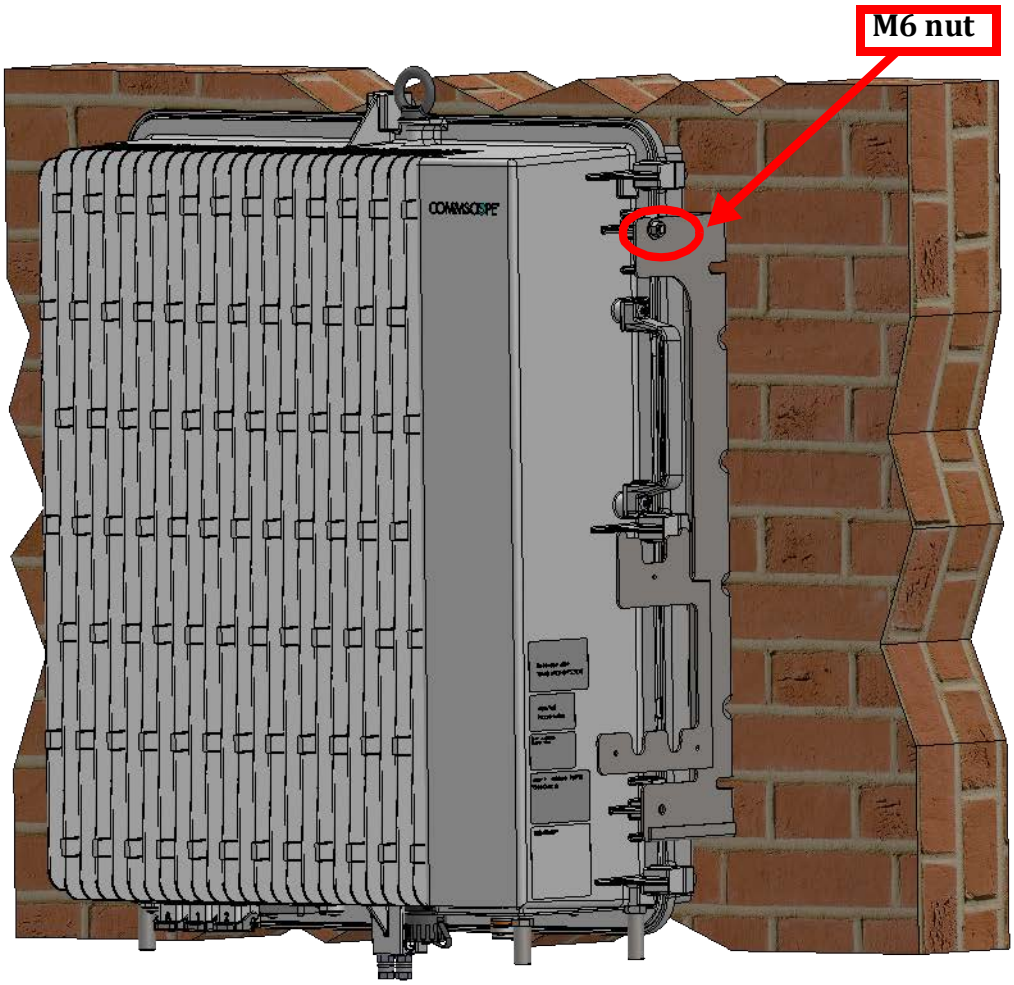
8 Use both handles and/or the provided lifting eye on the CAP MX to lift it above the Mounting Bracket and then lower it into place.



9 On the right side of the CAP MX secure the CAP MX to the Mounting Bracket by torquing the M6 nut to 11 N-m (100 in-lbs).



10 Repeat Step 9 on the left side of the CAP MX.

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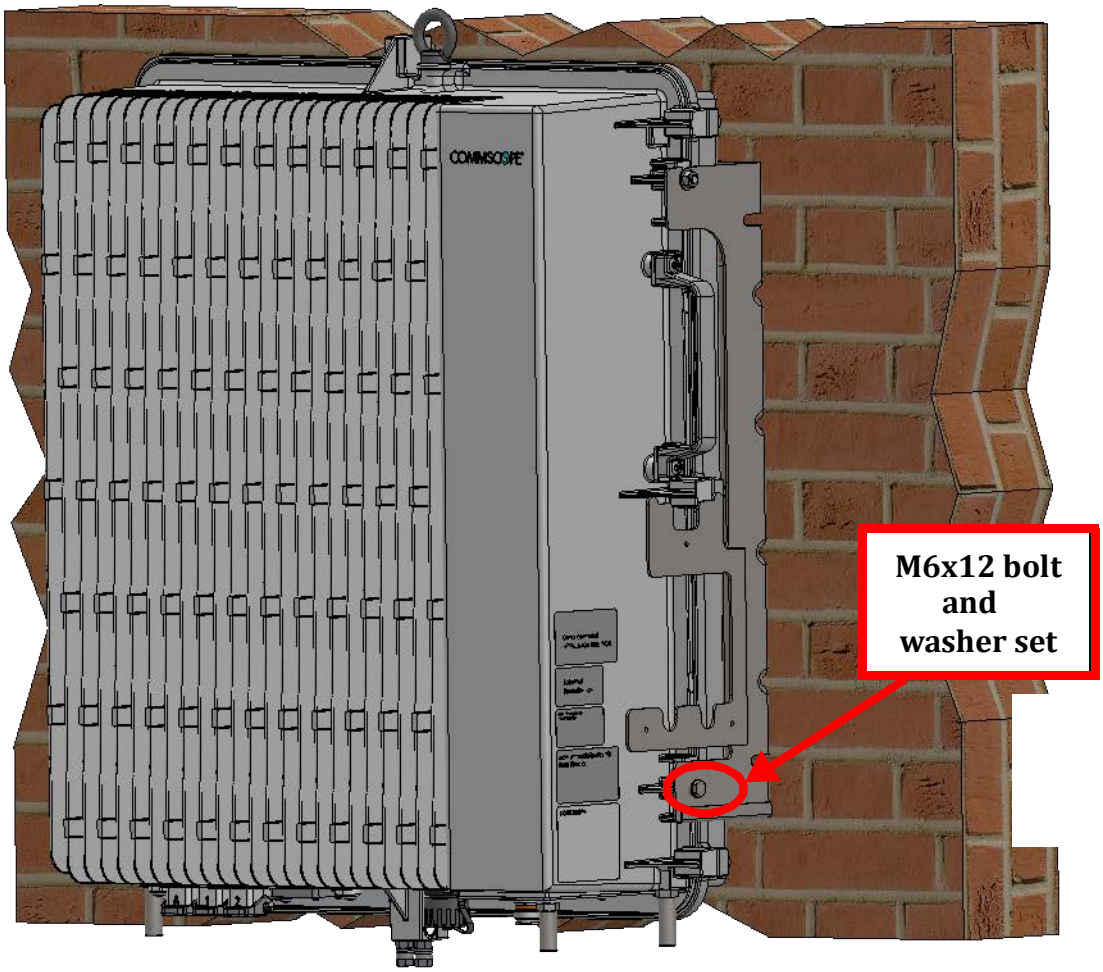
11 On lower right of the CAP MX, reinstall the M6x12 screw and its washers that you removed in Step 7 on page 34.

a Slide first the M6 plain washer and then the M6 split-lock washer over the M6x12 screw.

b Insert the M6x12 screw through the screw hole shown below, and screw it back into the CAP MX chassis; torque to 11 N-m (100 n-lbs).



12 Repeat Step 11 on the left side of the CAP MX.

13 Do one of the following:

- If this installation requires a Hybrid Fiber Splice Box, go to "Attach a Hybrid Fiber Splice Box to the CAP MX" on page 46.
- If this installation does **not** a Hybrid Fiber Splice Box, go to "Grounding the CAP MX" on page 51.

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Mount Two CAP MXs Using a Dual Mounting Bracket

In this procedure you will mount two CAP MXs back-to-back in one Dual Mounting Bracket. The steps in this procedure will identify the two CAP MXs as CAP MX-1 and CAP MX-2, as shown in Figure 16.

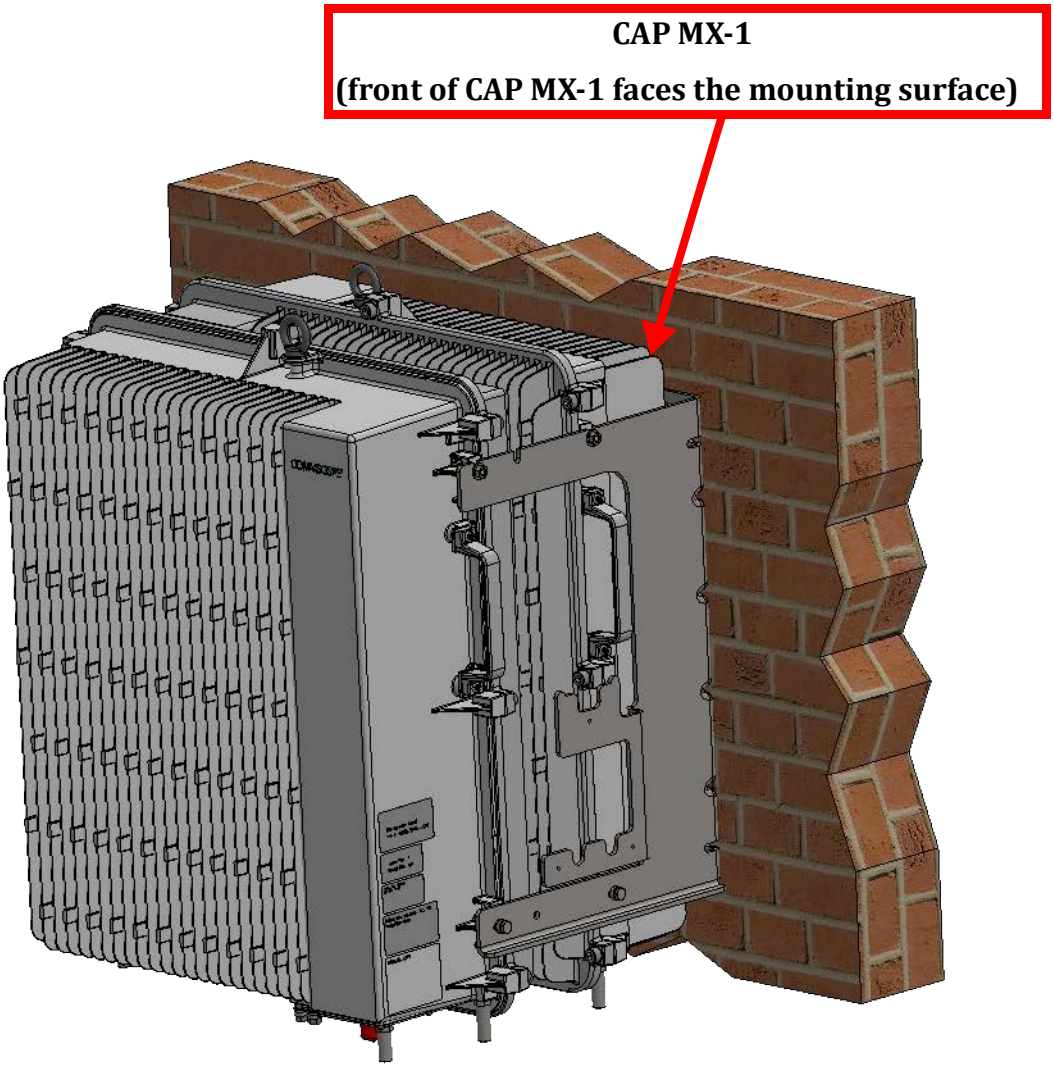

Figure 16. Two CAP MXs Back-to-Back in a Dual Mounting Bracket

Do the following to mount two CAP MXs in a Dual Mounting Bracket.

1 Obtain the Dual Mounting Bracket (CommScope PN 7839331-xx).

2 Follow the steps in "Unpack and Inspect the CAP MX and Optional Accessories" on page 26. Table 10 lists the parts that ship with the CAP MX Dual Mounting Bracket.

Table 10. *Parts List for CommScope PN 7839331-XX*

Description	Quantity
Dual Wall Mounting Bracket	1

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3 Refer to "Determine the Mounting Site" on page 23 to determine the mounting location, which must be able to support the weight and dimensions of the CAP MX.

Installer must verify that the mounting surface will safely support the combined load of the electronic equipment and all attached hardware and components.

4 Refer to "Mounting Orientation" on page 31 to determine the mounting orientation of the CAP MX.

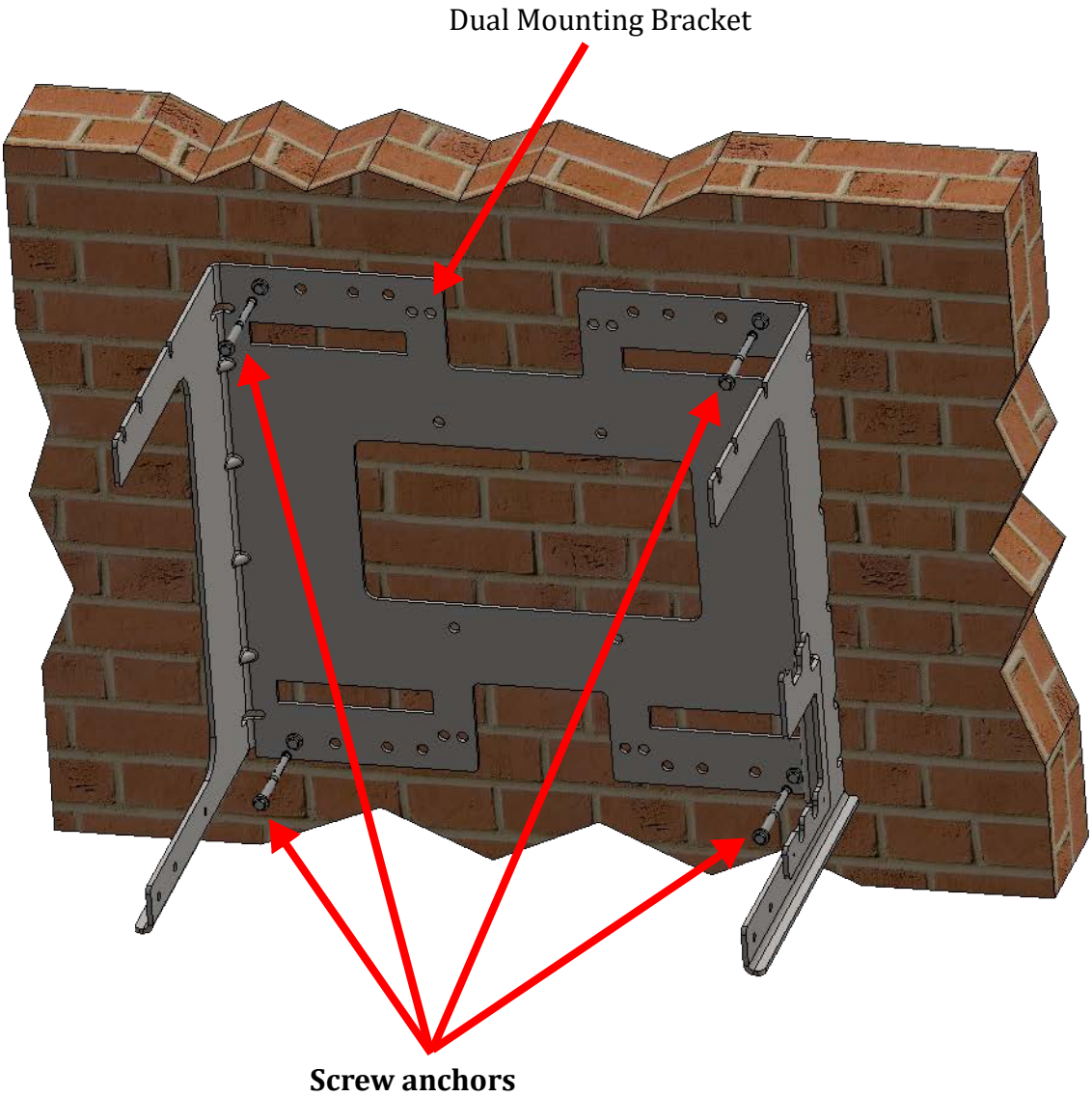
5 Refer to and observe all cautions listed in "General Mounting Cautions" on page 30.

6 Secure the Mounting Bracket to the wall (or another suitable vertical surface) as shown below.

a Install the mounting bracket using 4 corrosion resistant M6 to M8 (1/4 to 5/16 inch) fasteners according to the drilling layout.

The M6 to M8 fastening system does not ship with the CAP MX as the anchor type is dependent on the on-site conditions (wall structure and materials). Use a corrosion resistant fastening system that is designed for the mounting substrate.

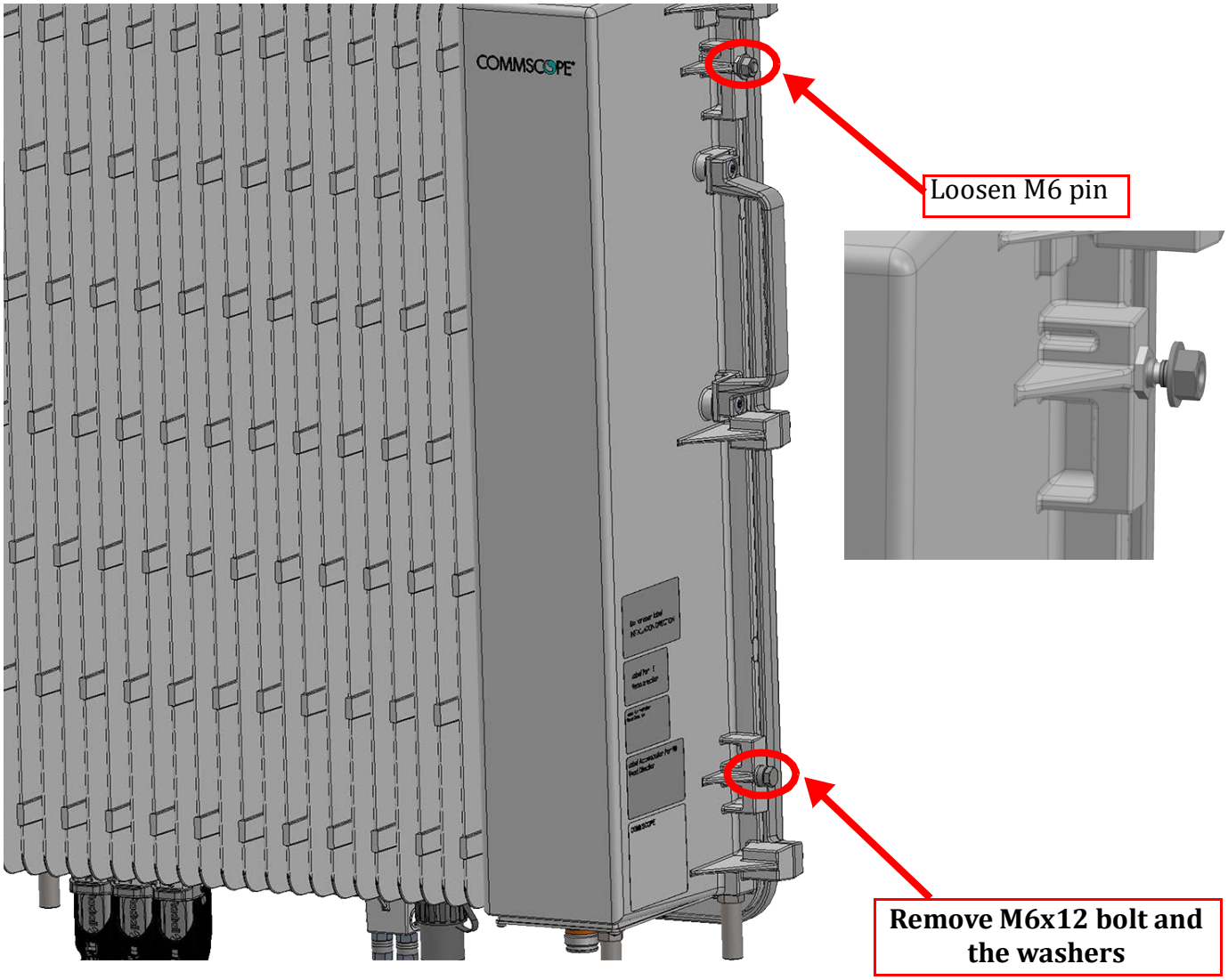
b Confirm that the bracket is securely fastened to the wall.



7 From both sides of CAP MX-1:

a Loosen the M6 lock nuts, as shown below, to provide adequate space for the mounting bracket.

b Remove the two M6 screws and their M6 plain and M6 split-lock washers; reserve the screws and washers as you will later reinstall them.



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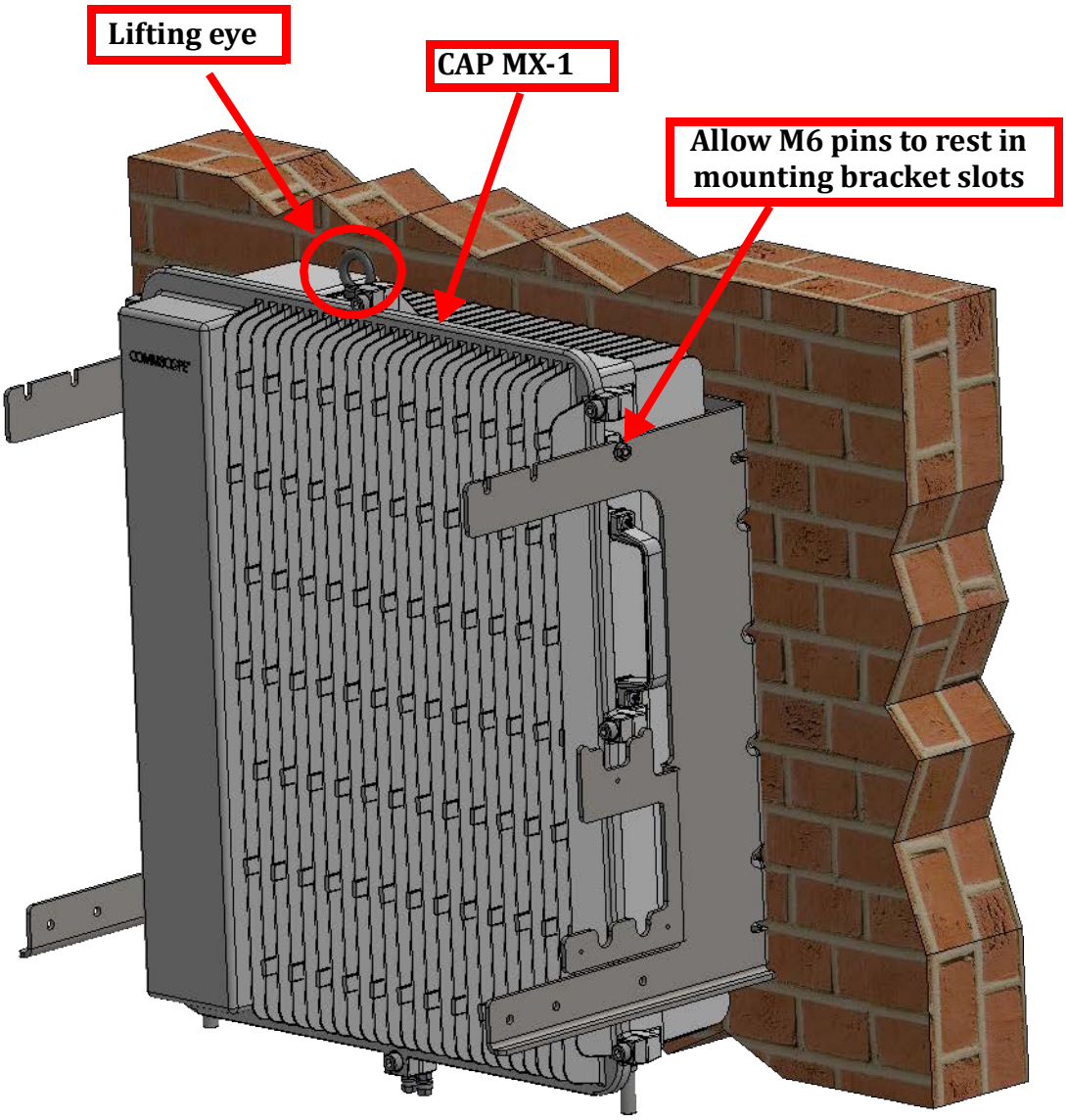
8 Use both handles, and/or the provided lifting eye, on the CAP MX-1 chassis to lift it above the Mounting Bracket, and with the front of the chassis facing the mounting surface, lower it into place, allowing the M6 pins to rest in the slots of the mounting bracket as shown below.



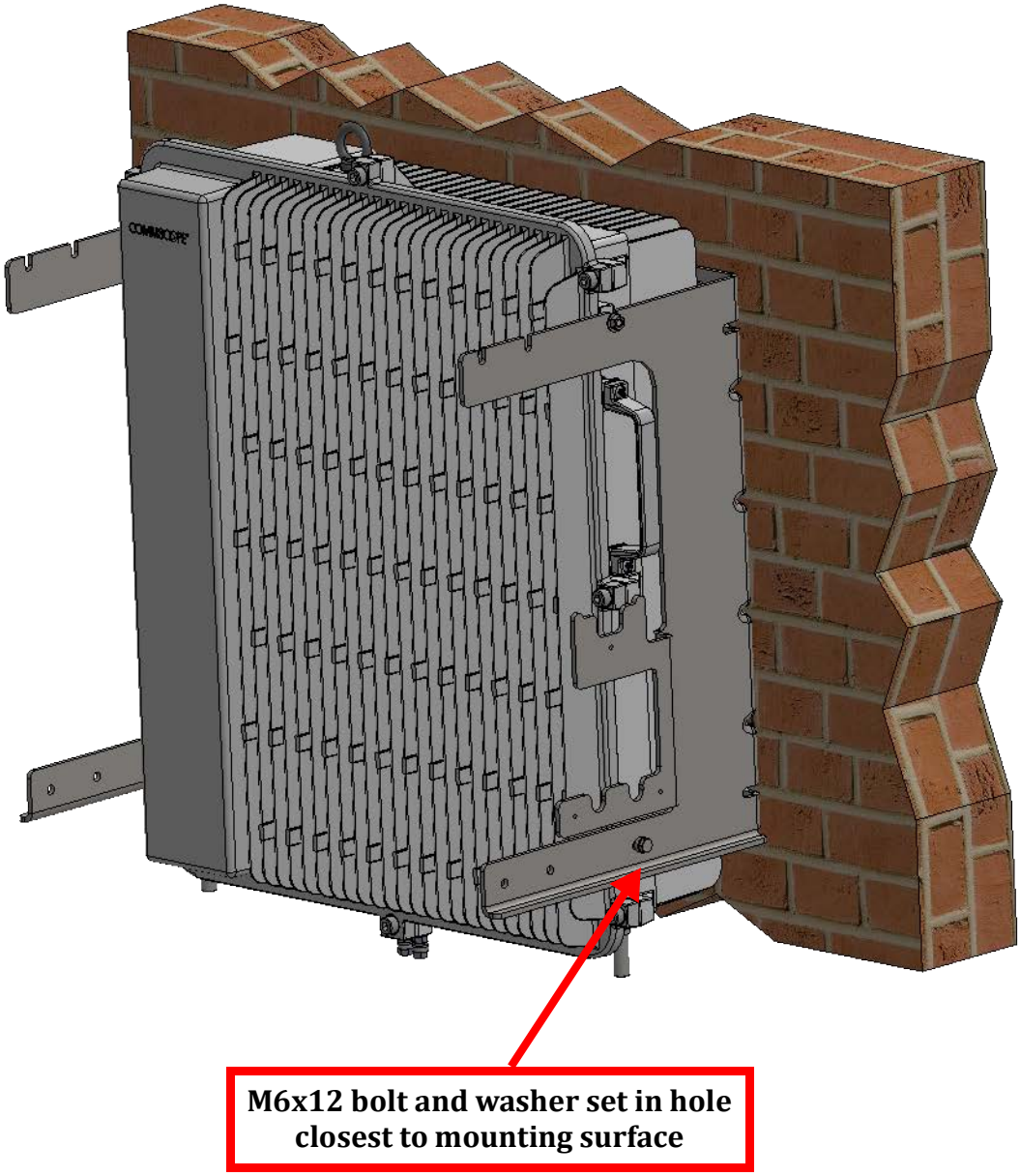
9 On the right side of the CAP MX-1, torque the M6 pin to 11 N-m (100 in-lbs).

10 Repeat Step 9 on the left side of the CAP MX.

11 On lower right of the CAP MX-1, reinstall the M6x12 screw and its washers that you removed in Step 7 on page 40.

a Slide first the M6 split-lock washer and then the M6 plain washer over the M6x12 screw.

b Insert the M6x12 screw through the screw hole shown below, and screw it back into the CAP MX-1 chassis; torque to 11 N-m (100 in-lbs).



12 Repeat Step 11 on the left side of the CAP MX-1.

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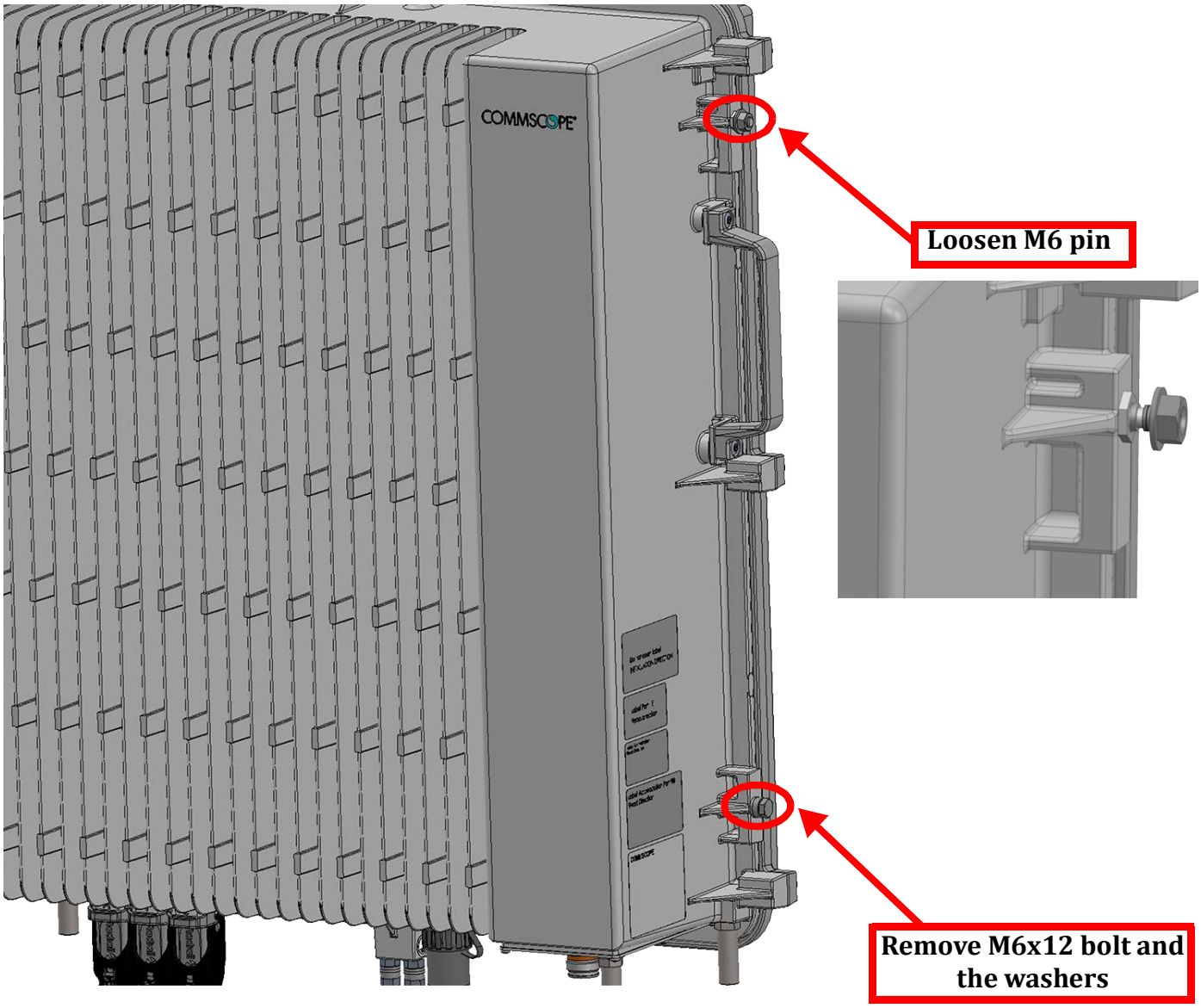
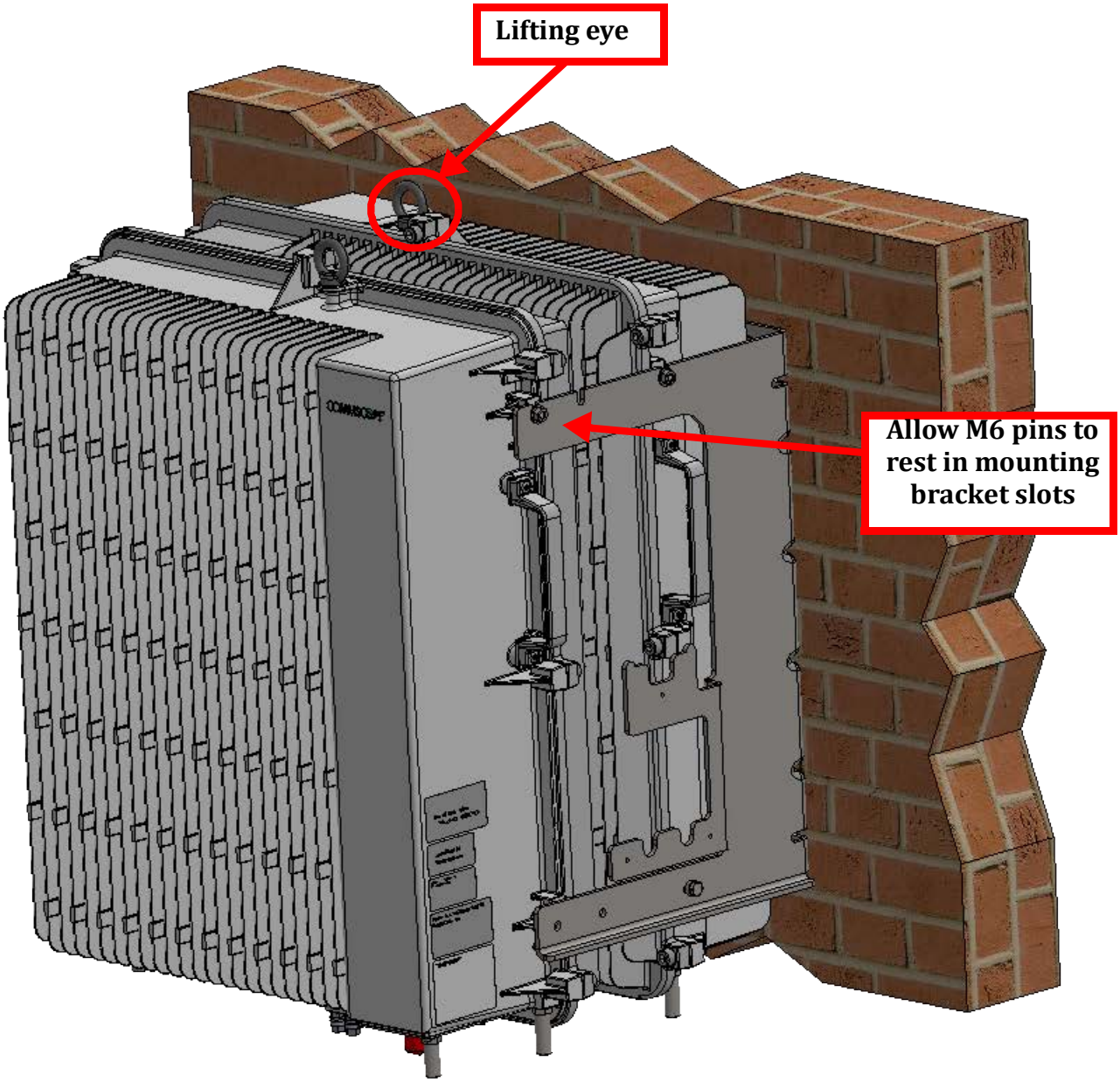
13 From both sides of CAP MX-2:

a Loosen the M6 lock nuts, as shown below, to provide adequate space for the mounting bracket.

b Remove the two M6 screws and their washers; reserve the screws and washers as you will later reinstall them.



14 Use both handles, and/or the provided lifting eye, on the CAP MX-2 chassis to lift it above the Mounting Bracket with the back of its chassis facing the back of CAP MX-1, and lower it into place, allowing the M6 pins to rest in the slots of the mounting bracket as shown below.



15 On the right side of the CAP MX-2, secure the CAP MX to the Mounting Bracket by torquing the M6 nut to 11 N-m (100 in-lbs).

16 Repeat Step 15 on the left side of the CAP MX.

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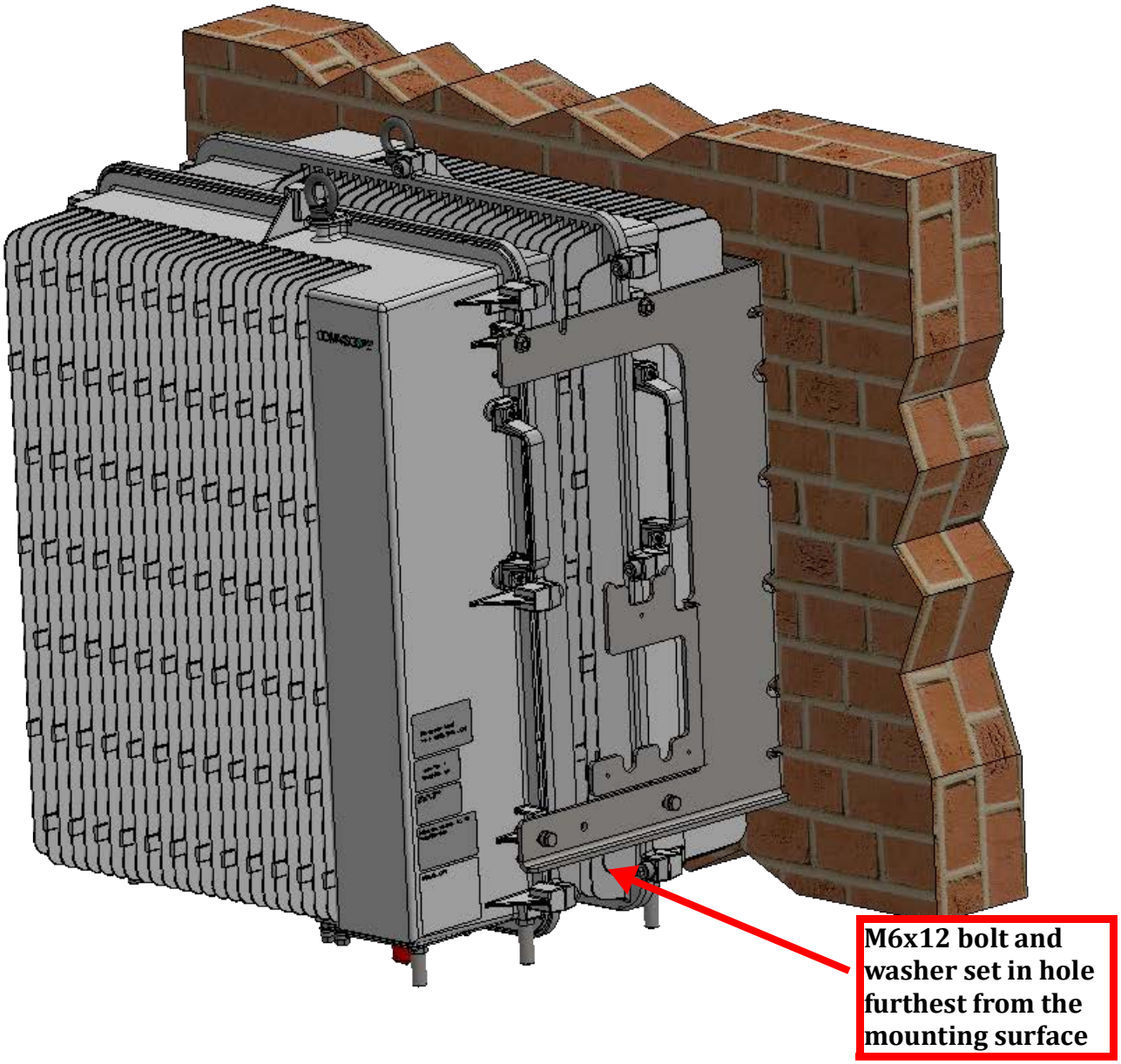
17 On lower right of the CAP MX-2, reinstall the M6x12 screw and its washers that you removed in Step 13 on page 43.

a Slide first the M6 split-lock washer and then the M6 plain washer over the M6x12 screw.

b Insert the M6x12 screw through the screw hole shown below, and screw it back into the CAP MX chassis; torque to 11 N-m (100 in-lbs).



18 Repeat Step 11 on the left side of CAP MX-2.

19 Do one of the following:

- If this installation requires a Hybrid Fiber Splice Box, go to "Attach a Hybrid Fiber Splice Box to the CAP MX" on page 46.
- If this installation does **not** a Hybrid Fiber Splice Box, go to "Grounding the CAP MX" on page 51.

Attach a Hybrid Fiber Splice Box to the CAP MX

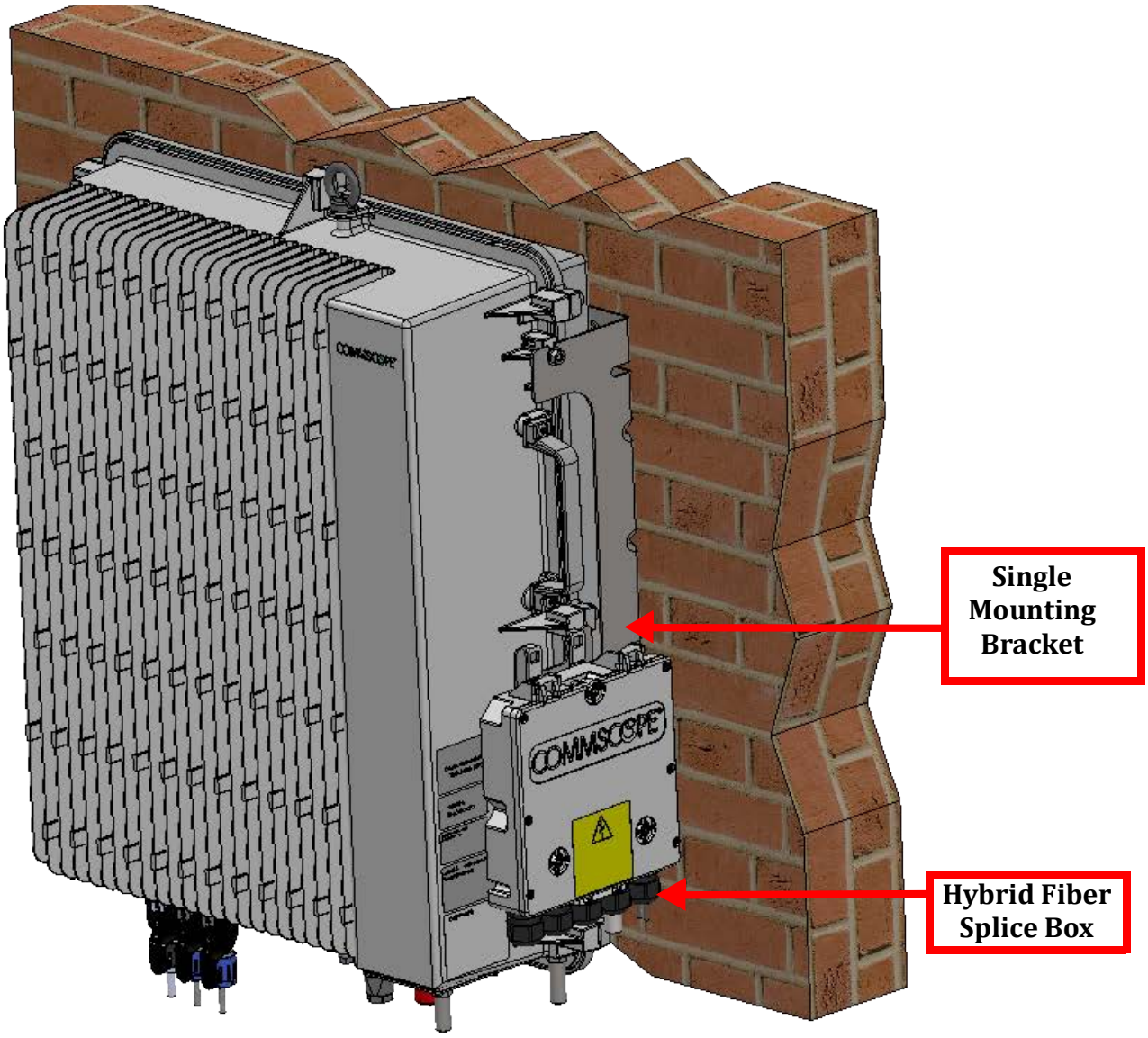
The steps in this section pertain only to those installations that require the use of the optional Hybrid Fiber Splice Box to provide fiber and power to the CAP MX. If the optional Hybrid Fiber Splice Box is not required for this installation, skip to "Grounding the CAP MX" on page 51.

Follow the procedure that is appropriate for this installation:

- "Attaching a Hybrid Fiber Splice Box for a Single Mount Installation" on page 46
- "Attaching a Hybrid Fiber Splice Box for a Dual Mount Installation" on page 49.

Attaching a Hybrid Fiber Splice Box for a Single Mount Installation

1 Hang the Splice Box onto the Single Mounting Bracket on the right-hand side of the CAP MX, as shown below.



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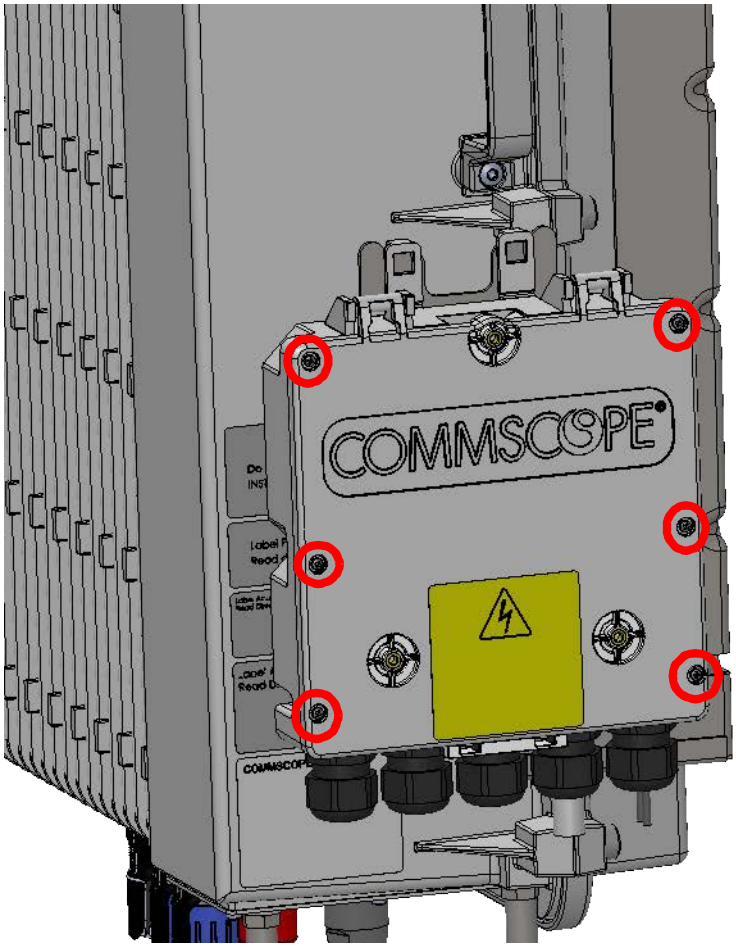
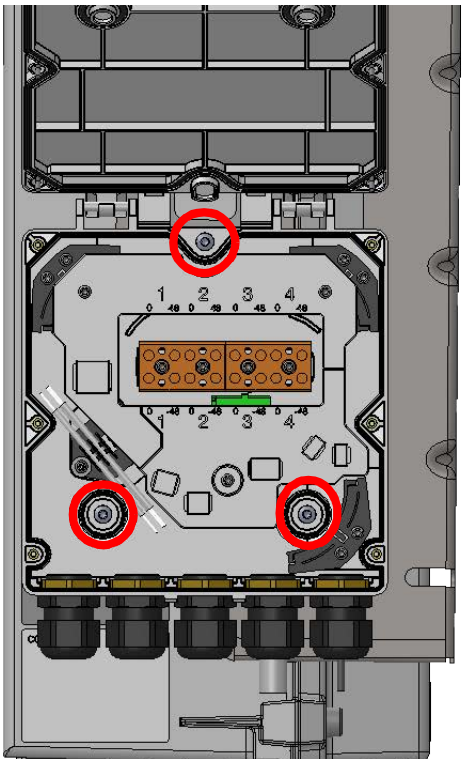
2 Remove the six neck screws (shown below) from the front cover of the Splice Box.



3 Open the Splice Box.

4 Attach an M4 x 25 pan-head screw to the upper hole, and two M4 x 25 pan-head screws to the holes in the lower corners of the Splice Box.



5 Close the Splice Box.

6 Replace the six neck screws that you removed from the front cover of the Splice Box in Step 2 on page 47.

7 Go to "Grounding the CAP MX" on page 51.

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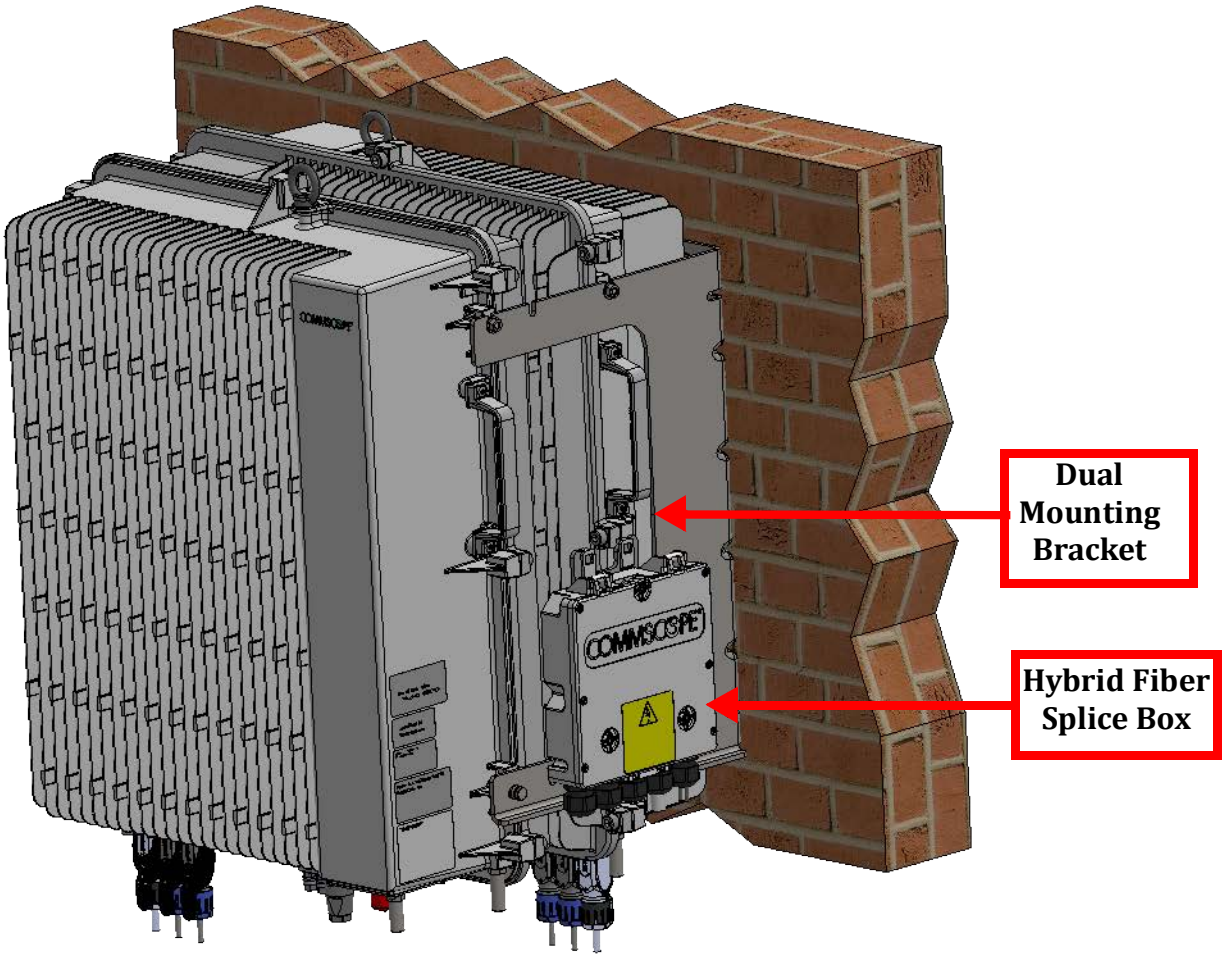
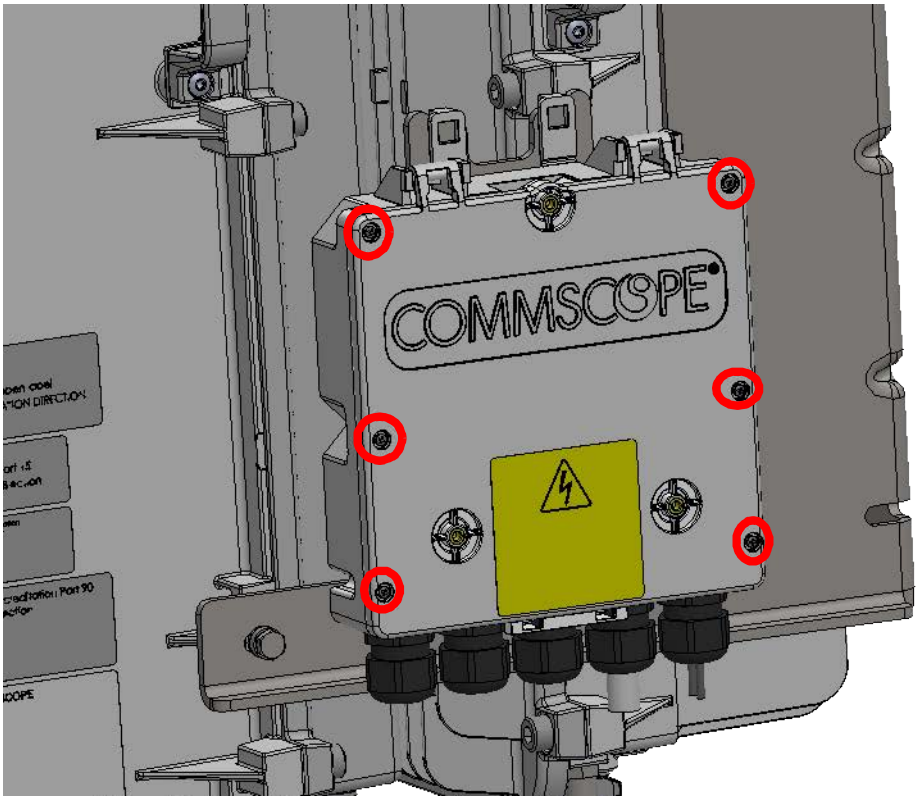
Attaching a Hybrid Fiber Splice Box for a Dual Mount Installation

1 Break the left-hand side hook of the Splice Box bracket. This is necessary for proper mounting.

2 Hang the Splice Box onto the Dual Mounting Bracket on the left-hand side of the CAP MX, as shown below.



3 Remove the six neck screws (shown below) from the front cover of the Splice Box.



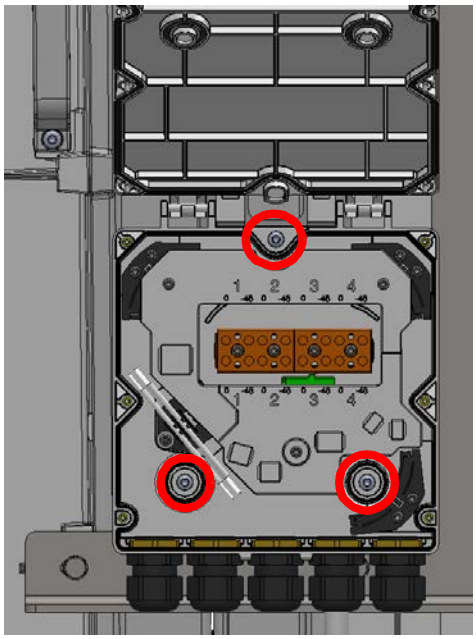
4 Open the Splice Box.

5 Attach an M4 x 25 pan-head screw to the upper hole, and two M4 x 25 pan-head screws to the holes in the lower corners of the Splice Box.

6 Close the Splice Box.

7 Replace the six neck screws that you removed from the front cover of the Splice Box in Step 3 on page 50.

8 Go to "Grounding the CAP MX" on page 51.



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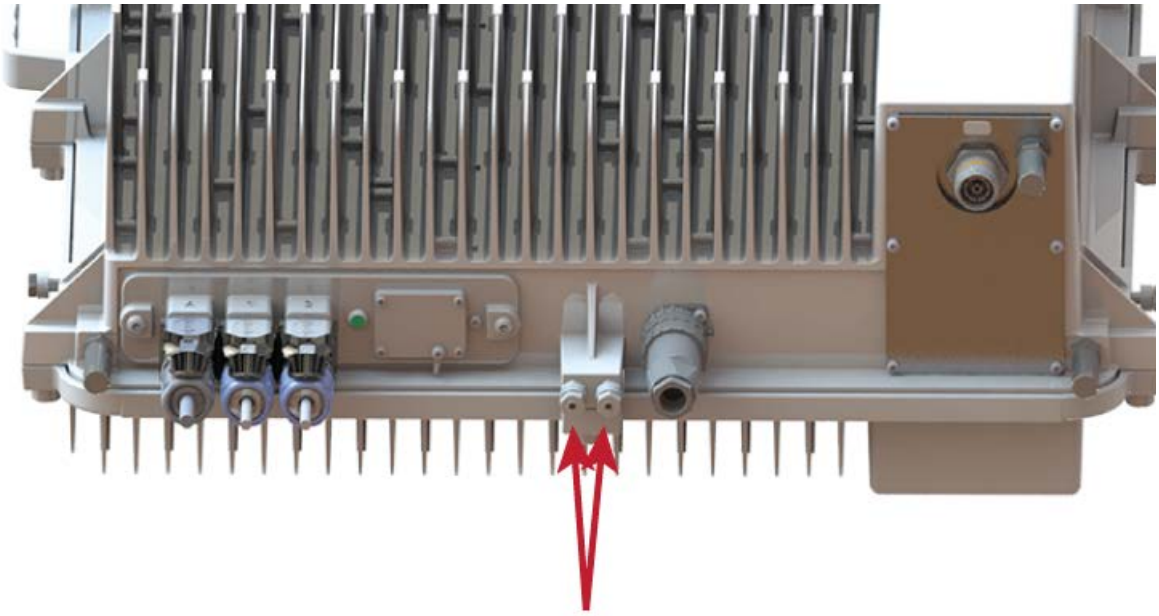
Grounding the CAP MX

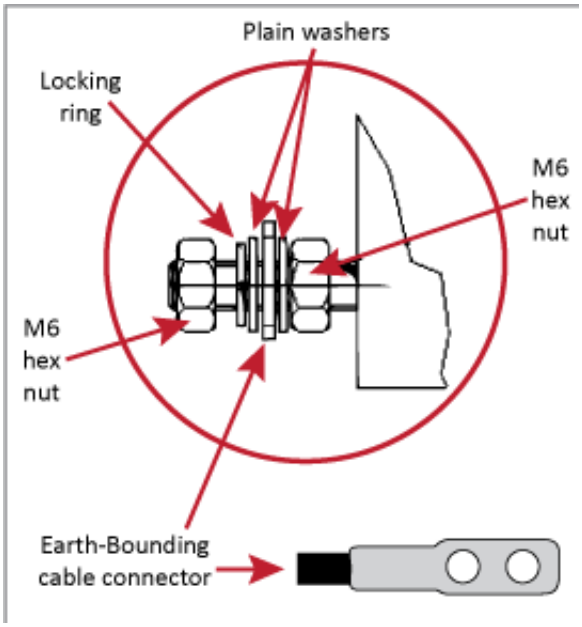
The CAP MX must be provided with a permanently connected protective earthing conductor. This conductor must be installed by a skilled person.

Do not use the grounding bolts to connect an external device.

1 Connect an earth-bonding cable to the grounding bolt connections on the outside of the CAP MX chassis, as shown below.



2 Loosen the M6 hex nut(s), and then connect the earth-bonding cable between the two washers as shown to the right.



The grounding conductor must be a dual-lug terminal.

3 Secure the earth-bonding cable by tightening the M6 hex nut(s) that you loosened in the preceding step. Torque the hex nuts to 11 N-m (100 in-lbs).

4 Connect the other end of the earth-bonding cable to a suitable permanent ground per local electrical code practices.

5 Follow the steps in "Connect the CAP MX Cables" on page 52.

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Connect the CAP MX Cables

Complete the following procedures in the order in which they are presented. Unless otherwise noted, each procedure is applicable to a singular CAP MX (not in a cascade), or to a Primary or Secondary CAP MX in a cascade.

- "Obtain the Required Cable Material" on page 53
- "Connect the CAP MX to an RF Antenna" on page 54
- "Connect the CAP MX to a Classic CAN or TEN" on page 58
- "Connect a Secondary CAP MX (Optional)" on page 58
- "Connect an External Ethernet Device (Optional)" on page 58.

Do not remove protective caps from any of the connectors until instructed to do so.

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Obtain the Required Cable Material

Contact your local CommScope sales representative to obtain the following components, as required, for this installation.

- Per the installation plan, obtain either Single Mode Fiber (SMF) or Multi Mode Fiber (MMF) that is of sufficient length to reach from the CAP MX to the Classic CAN or TEN.
- Obtain at least one Optical OCTIS Kit (PN 7770612). All installations require one Optical OCTIS Kit, which is included in the CAP MX shipment. If cascading a Secondary CAP MX, a second Optical OCTIS Kit is required.
- Obtain SFP+ Module pairs that are appropriate for this installation. Table 11 identifies the available SFP+ Modules and the maximum range for each.

Table 11. *Supported SFP+ Modules*

CommScope PN	Description	Maximum Range	
7660511	SFP+, 10GBase-SR, Multi Mode	**OM3** 300m	**OM4** 400m
7680813	SFP+, 10GBase-LR, Single Mode	10km	
7803247	SFP+, 10GBase CWDM-270	40km	
7803249	SFP+, 10GBase CWDM-290	40km	
7803291	SFP+, 10GBase CWDM-310	40km	
7803293	SFP+, 10GBase CWDM-330	40km	
7803295	SFP+, 10GBase CWDM-350	40km	
7803298	SFP+, 10GBase CWDM-370	40km	
7803900	SFP+, 10GBase CWDM-390	40km	
7803902	SFP+, 10GBase CWDM-410	40km	
7803904	SFP+, 10GBase CWDM-430	40km	
7803906	SFP+, 10GBase CWDM-450	40km	
7801330	SFP+, 10GBase CWDM-470	40km	
7801340	SFP+, 10GBase CWDM-490	40km	
7801342	SFP+, 10GBase CWDM-510	40km	
7801344	SFP+, 10GBase CWDM-530	40km	
7801360	SFP+, 10GBase CWDM-550	40km	
7801363	SFP+, 10GBase CWDM-570	40km	
7801365	SFP+, 10GBase CWDM-590	40km	
7801367	SFP+, 10GBase CWDM-610	40km	
7832204	SFP+, 10G BIDI TX1270/RX1330	40km	
7832206	SFP+, 10G BIDI TX1330/RX1270	40km	

- If connecting an external Ethernet device such as WiFi or IP camera, an Ethernet OCTIS Kit (PN 7760652) and appropriate CAT cable for the device.

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Connect the CAP MX to an RF Antenna

The following sections guide you through connecting the CAP MX; complete these procedures in the order in which they are presented.

- "Clean the RF Cable Connectors" on page 54
- "Connect the Antenna Cable(s)" on page 57.

Clean the RF Cable Connectors

This section tells you how to clean RF cable connectors. The graphics in this section illustrate the cleaning procedure and do not show the CAP MX.

This procedure requires the use of compressed air. Wear protective clothing—especially protective glasses—to protect against injury from flying particles.

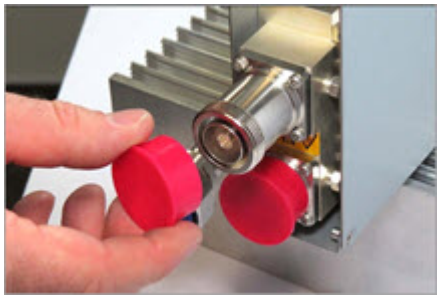
This procedure requires the use of flammable material. There is a risk of fire. Keep away from sources of ignition.

This procedure requires the use of eye irritant product. There is a risk of eye irritation. Avoid contact with eyes and skin. Wear protective clothing—especially protective glasses.

Do the following to clean the RF cable connectors.

1 Gather the following cleaning tools:
   - Isopropyl alcohol
   - Compressed air
   - Lint-free wipe
   - Cotton buds.

2 Remove the protective cap from the RF connector.



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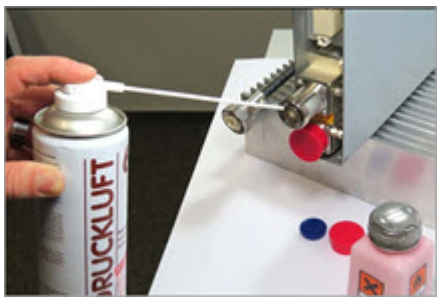
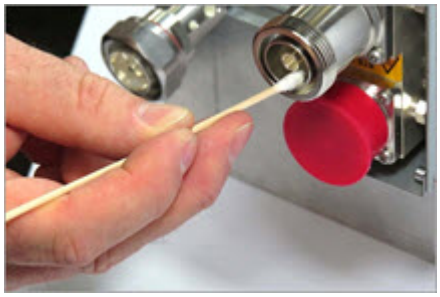
3 Use compressed air to remove metal chips and small particles from the mating and inner surfaces of the connector.



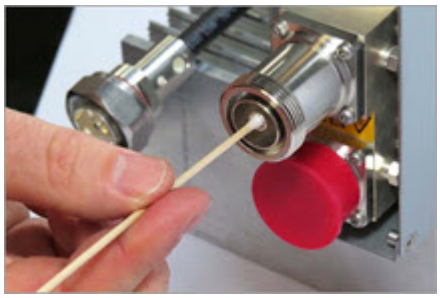
4 Use a lint-free wipe drenched with isopropyl alcohol to clean the connector winding.

5 Use a cotton bud drenched with isopropyl alcohol to clean the lip of the inner ring.

6 Use a cotton bud drenched with isopropyl alcohol to clean the inside surface of the inner ring.



7 Use a cotton bud drenched with isopropyl alcohol to clean the inside of the center conductor spring tines.



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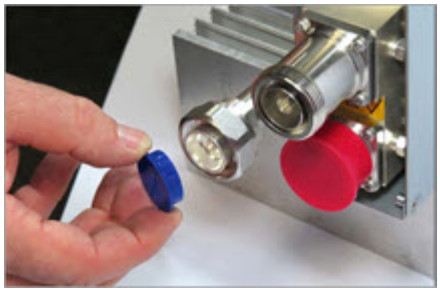
8 Remove the protective caps from the unit connector, and then clean it the same way that you cleaned the cable connector.



9 Use compressed air to remove metal chips and small particles from the mating and inner surfaces of the connector.

10 Use a lint-free wipe drenched with isopropyl alcohol to clean the winding area.

11 Use a cotton bud drenched with isopropyl alcohol to clean the inside mating surface of the inner ring.

12 Use a cotton bud drenched with isopropyl alcohol to clean the outside surface of the center pin.

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Connect the Antenna Cable(s)

The following information regarding antenna mapping and is relevant to all CAP MX variants.

- For Non-MIMO bands, there is no channel mapping option for the transceiver/antenna port. The transceiver/antenna port relationship is fixed in hardware.
- For MIMO bands, the ERA GUI maps MIMO channels according to their AP designation:
  - AP0 to antenna port ANT1
  - AP1 to antenna port ANT2.
- When using SISO channels on a CAP MX that supports MIMO, the system will automatically balance the number of channels between the two antenna ports, where the first SISO channel is mapped to ANT1, the second SISO channel is mapped to ANT2, and so on.

Do the following to connect the antenna cables:

1. Obtain 50Ω coaxial cables that are of sufficient length to reach from the CAP MX to the passive antenna. The end of the 50Ω coaxial cable that will connect to the ANT connector can be either a push-pull connector or a threaded connector.
2. Install the passive antennas per the manufacturer's installation instructions.
3. Remove the IP67/EMI blank plug from the ANT connector.
4. Connect the passive multi-band antenna to the ANT connector using coaxial cable with the least amount of loss possible.
   - If the 50Ω coaxial cable has a push-pull connector, make sure the cable is seated firmly in the ANT connector.
   - If the 50Ω coaxial cable has a threaded connector, torque the connector 5 N-m (3.69 ft-lb). Do not over-tighten the connector.
5. Connect the other end of the 50Ω coaxial cable to the passive antenna installed in Step 2.

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Connect the CAP MX to a Classic CAN or TEN

Connect the CAP MX Optical Port 1 as appropriate for this installation. Note the maximum range listed in Table 11.

1. Remove the dust cap from the CAP MX Optical Port 1 connector and the connectors on the SMF or MMF.
2. Follow the local cleaning technique to clean the optical port for each SFP+ Module.
3. Clean the connectors on the SMF or MMF following the fiber supplier's recommendations.
4. Install the SFP+ connector and Optical OCTIS Kit on the end of the SMF or MMF that will connect to the CAP MX, and then connect that end of the fiber to the CAP MX Optical Port 1 connector. (Refer to the technical data sheet that ships with the OCTIS Kit for further information.)
5. Use the other SFP+ Module to connect the other end of the SMF or MMF to an open port on the OPT Card.

If installing a CAP MX with a Hybrid Fiber Splice Box (PN 7693816-xx), the optical fiber will be hanging from the Splice Box.

Connect a Secondary CAP MX (Optional)

If appropriate for this installation, connect the Optical Port 2 connector. Note the maximum range listed in Table 11 on page 53.

1. Raise the lever on the EMI/IP67 cap on Optical Port 2 connector and remove the cap.
2. Remove the caps from the connectors on the SMF or MMF.
3. Follow the local cleaning technique to clean the optical port for each SFP+ Module.
4. Clean the connectors on the SMF or MMF following the fiber supplier's recommendations.
5. Install the SFP+ and Optical OCTIS Kit on the end of the fiber that will connect to the CAP MX and connect that end of the SMF or MMF to the CAP MX Optical Port 2 connector. (Refer to the technical data sheet that ships with the OCTIS Kit for further information.)
6. Use another OCTIS Kit and the other SFP+ Module to connect the other end of the SMF or MMF to Optical Port 1 on the cascaded CAP MX.

Connect an External Ethernet Device (Optional)

If you are not connecting an Ethernet device, do not remove the plug from Port A.

If connecting an Ethernet device to a cascaded pair, this must be the Primary Fiber CAP MX.

1. Read and follow the rules in "Cat6A Cable Requirements for Ethernet Devices" on page 21.
2. Raise the lever on the EMI/IP67 cap on the Port A connector, and then remove the connector's plug.
3. Follow the local cleaning technique to clean Port A.

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4 Install an Ethernet OCTIS Kit on the end of the CAT cable that will connect to the Fiber CAP MX, and then connect that end of the cable to Port A on the Fiber CAP MX. (Refer to the technical data sheet that ships with the OCTIS Kit for further information.)

Cat6A, including all Cat6A cables, Cat6A Patch Cords, and Patch Panels, between Port A on the Fiber CAP MX and an auxiliary Ethernet device cannot exceed 3 meters (9.8 feet).

5 Connect the other end of the CAT cable to the Ethernet port of the auxiliary device.

6 Go to "Power the CAP MX" on page 59.

Power the CAP MX

The CAP MX is powered on as soon as power is connected to it. The CAP MX must therefore be grounded before you connect any electrical power to it. If you have not completed the steps in "Grounding the CAP MX" on page 51, stop and do so before proceeding.

CAP MX APs require a minimum 120 Volt / 15 Amp or 240 Volt / 13 Amp, single-phase, 50 / 60 Hz AC service. MAINS power must be interruptible with an external delay-actions mains breaker. CommScope recommends external AC breakers capable of at least 15 Amps maximum for 120-Volt service or at least 13 Amps for 240-Volt service. One type B breaker can support up to two CAP MX units, and a type C breaker can support up to four CAP MX units.

For the AC power supply connection, a minimum cross section of 1.5 mm2 is required and for the DC power supply connection, a minimum cross section of 2.5 mm2 is required. Each wire must observe the applicable local regulations regarding loop impedance, voltage drop, and methods of installation. Make sure to connect the correct voltage to the CAP MX.

For the CAP MX to operate, the Mains power must be connected to the CAP MX Mains connector. Either an AC or a DC power cable is delivered with each CAP MX—the type of power cable delivered is dependent on the type of power supply in the CAP MX.

CAP MX AC Power Cable

The AC power cable is a 3.2 m (10.5 ft) 16 AWG cable with a 4-pin Amphenol C016 series plug on one end to connect to the CAP MX Mains connector. The other end of the cable is unterminated with 3 end splices to connect to the AC power source. A 10 m (33.7 ft) AC power cable is also available as an option. The AC power cable is shown in Figure 17.

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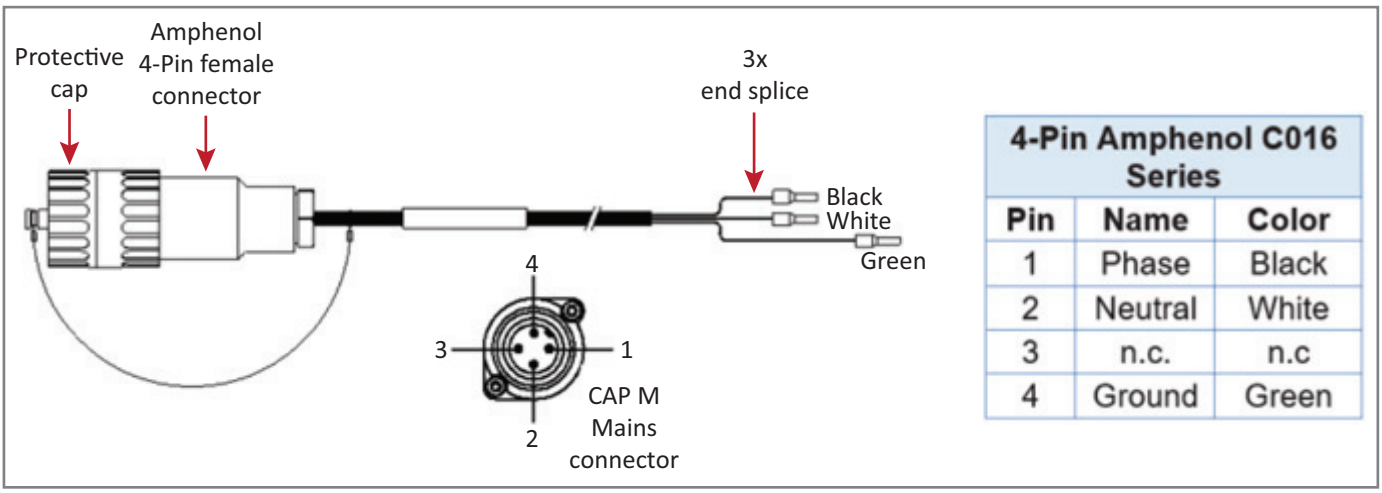
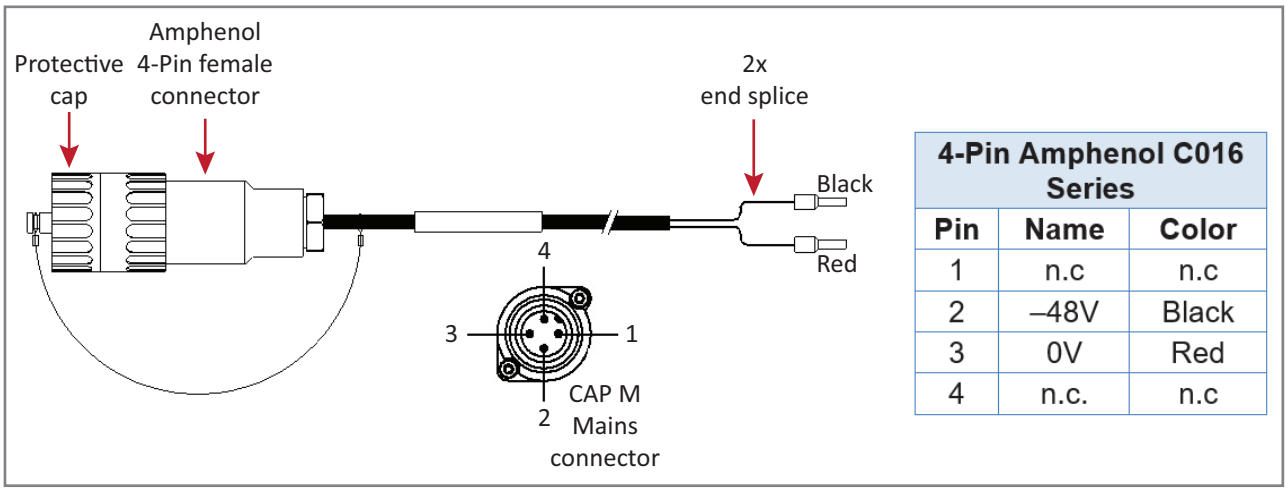


4-Pin Amphenol C016 Series		
Pin	Name	Color
1	Phase	Black
2	Neutral	White
3	n.c.	n.c
4	Ground	Green

Figure 17. CAP MX AC Power Cable

CAP MX DC Power Cable

The standard CAP MX DC power cable is a 3.2 m (10.5 ft) 13 AWG cable with a 4-pin Amphenol C016 series plug on one end to connect to the CAP MX Mains connector. The other end of the cable is unterminated with 2 end splices to connect to the -48 Vdc power source. The standard DC power cable is shown in Figure 18.



4-Pin Amphenol C016 Series		
Pin	Name	Color
1	n.c	n.c
2	–48V	Black
3	0V	Red
4	n.c.	n.c

Figure 18. CAP MX DC Power Cable

Connect the CAP MX Power

Do not connect or disconnect the power cable at the Mains connector while power is on. Turn off Mains power before connecting the power cable at the unit, then, engage mains power again.

Connect the Power connector as appropriate for this installation:

- "Connect the Mains Power to the CAP MX" on page 61
- "Connect a Hybrid Fiber Splice Box" on page 62.

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Connect the Mains Power to the CAP MX

1 Locate the Mains power cable that was delivered with the CAP MX.

2 Locate or install a suitable power junction box or receptacle near the unit and route the power cable from the power source to the CAP MX.

Do not connect the cable to the unit's Mains connector at this time. The power source must be interruptible.

The Mains cable must be properly secured observing local regulations and electrical codes. Be sure to allow enough slack in the cable at the CAP MX to plug or unplug the cable into the Mains connector.

3 Dependent on the type of power supply used by the unit, wire the power cable to the junction box or receptacle. Refer to the color code and pin numbers shown in:

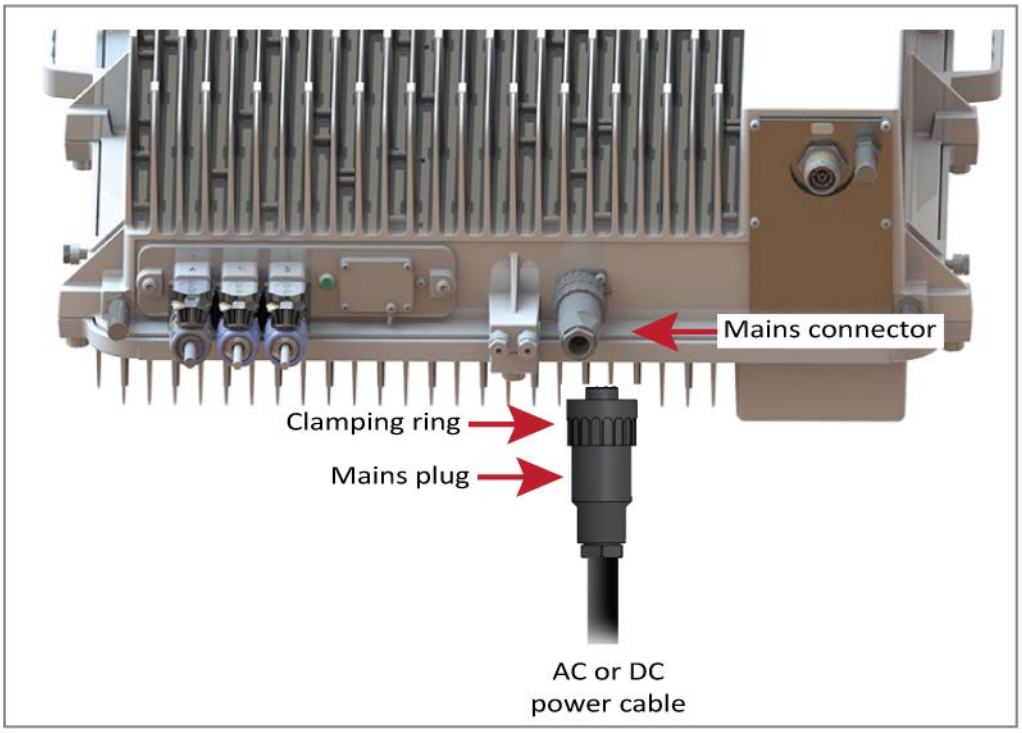
- Figure 17 on page 60 for the AC power cable
- Figure 18 on page 60 for the DC power cable.

4 With the cable's Mains plug disconnected from the CAP MX, turn the circuit breaker on, unscrew the plug's protective cover, and carefully test the plug with a voltmeter to ensure that the voltage and polarity are correct.

5 Once the testing has been completed, turn off the circuit breaker.

6 Unscrew the protective cover from the Mains connector of the unit.

7 Insert the AC or DC power cable into the Mains connector as shown below; tighten the clamping ring until it is hand tight. Do not over-tighten the clamping ring.



Connect a Hybrid Fiber Splice Box

For a CAP MX powered by the Hybrid Fiber Splice Box (PN 7693816-xx):

- connect the power cable to the proprietary 4-pin, 36 to 60 Vdc Power connector on the CAP MX, and terminate the other end to the CAP MX Hybrid Fiber Splice Box.
- Install an SFP+ module of the desired type (same as used at the OPT Card port) into the OCTIS connector before connecting the LC Fiber pigtail.
- connect the LC Fiber Pigtail to the supplied OCTIS connector and splice the other end of the fiber pigtail inside the locally-mounted CAP MX Hybrid Fiber Splice Box. The LC Fiber Pigtail, which is not included with the Fiber Splice Box for the CAP MX must be obtained separately.

Power the CAP MX

The CAP MX is powered on as soon as power is connected to it. Under normal operating conditions, the Power LED turns on briefly when the unit is first detected. It will then go out briefly, followed by an initialization period during which the Power LED flashes slowly while the CAP MX is configured. The Power LED remains a steady green (not flashing) once the unit reaches a fully operational state, which typically occurs within 45 seconds.

Table 12. *Status LED behavior*

LED Color	Description
OFF	CAP MX is not powered ON OR MAINS power failure
GREEN	Unit is powered ON and OPERATIONAL. The optical link is established, and the unit synchronized.
ORANGE	Indicates one of the following conditions: • unit booting • configuration failure • link failure • major or minor internal alarm or external alarm
RED	Critical HW alarm caused by internal modules.

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Contacting CommScope

The following sections tell you how to contact CommScope for additional information or for assistance.

CMS Global Technical Support

The following sections tell you how to contact the CommScope Mobility Solutions (CMS) Technical Support team. Support is available 7 days a week, 24 hours a day.

Telephone Helplines

Use the following Helpline telephone numbers to get live support, 24 hours a day:

24x7	+1 888-297-6433 (Toll free for U.S. and Canada)
EMEA 8:00-17:00 (UTC +1)	+ 800 73732837 (Toll free for parts of EMEA and Australia)
	+ 49 909969333 (Toll charge incurred)
	Calls to an EMEA Helpline outside of the 8:00 to 17:00 time frame will be forwarded to the 24x7 Helpline.

Online Support

To go to the CommScope Wireless Support Request web site from which you can initiate a Technical Support ticket, do one of the following:

- Scan the QR Code to the right.
- If viewing this document online as a PDF, click on the following URL link:

  http://www.commscope.com/wisupport
- Enter the preceding URL into your web browser, and then press **ENTER** on your keyboard.

Waste Electrical and Electronic Equipment Recycling

Country specific information about collection and recycling arrangements per the Waste Electrical and Electronic Equipment (WEEE) Directive and implementing regulations is available on CommScope's website.

To access information on the CommScope recycling program, do any of the following:

- Scan the QR Code to the right.
- If viewing this document online as a PDF, click on the following URL link:

  http://www.commscope.com/corporate-responsibility-and-sustainability/environment/weee-customer-recycling/
- Enter the preceding URL into your web browser, and then press **ENTER** on your keyboard.

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Hardware to Software Mapping Information

1. Scan the QR Code to the right to view or download the minimum software requirements for each of the DCCS hardware modules. Alternatively, you can go to the following web address to access the portal:

   http://www.commscope.com/resources/in-building-wireless

2. Click on a document link to open it, or right click on the link and select the **Save target as...** option from the contextual menu.

CMS Technical Training

1. To access training on the online CommScope Mobility Solutions Institute, do one of the following:
   - Scan the QR Code to the right.
   - If viewing this document online as a PDF, use the following URL link.

     www.commscopeuniversity.com
2. Once you have logged in, you can search for training by typing search words in the **Search** bar or by going to the **Catalog** page to view the available courses.
3. Click the course name or certification to open it.
   - If you have an account, enter your **Username** and **Password**, and then click **Login**. (Click on the **Reset Password** link if you do not have your login information.)
   - If you don't have an account, click on the **Create New User Account** link under the **Login** button, and follow the prompts.
4. Click the date you prefer and select the **Enroll** or **Register Now** button to enroll. Follow the prompts through the payment process.
5. Click either the **Available Training** or **Calendar** tab to view other training courses.

For training related questions, please contact the CommScope DAS and Small Cell Institute at one of the following emails, as appropriate for your location:

Americas: DASTrainingUS@CommScope.com

EMEA: DASTrainingEMEA@CommScope.com

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Accessing ERA User Documentation

1. Scan the QR Code to the right to go to the CommScope DCCS Customer Portal, where you can access the DCCS user documentation.

   Alternatively, you can go to the following web address to access the portal:

   http://www.commscope.com/membership

2. Access to the Customer Portal requires a user account and password. On the **Sign In** page, do one of the following:
   - If you have an account, enter your **Email** address and **Password**, and then click **Sign In**.
   - If you don't have an account, click the **Register** button, and follow the prompts.
   - After you've registered in My CommScope, click the **Request Additional Access** button and select the **DCCS Customer Portal** from the list of applications.
3. Once you have been granted access to the DCCS Customer Portal, you can use the link provided to access it directly or login to **My CommScope** and use the **DCCS** link there. You will be prompted to sign in using your Microsoft-enabled email account..
4. Select your site, and then click on a product link to open the product page.
5. Click on the title of any document to open it.

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