FibeAir® IP-20E
Installation Guide

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Information to User

Any changes or modifications of equipment not expressly approved by the manufacturer could void the user’s authority to operate the equipment and the warranty for such equipment.

Intended Use/Limitation

Fixed point-to-point radio links for private networks.

Authorized to Use

Only entities with individual authorization from the National Regulator to operate the mentioned radio equipment.

The equipment can be used in the following EU countries:

Austria (AT) - Belgium (BE) - Bulgaria (BG) - Switzerland/Liechtenstein (CH) - Cyprus (CY) - Czech Republic (CZ) - Germany (DE) - Denmark (DK) - Estonia (EE) - Finland (FI) - France (FR) - Greece (GR) - Hungary (HU) - Ireland (IE) - Iceland (IS) - Italy (IT) - Lithuania (LT) - Luxembourg (LU) - Latvia (LV) - Malta (MT) - Netherlands (NL) - Norway (NO) - Portugal (PT) - Romania (RO) - Sweden (SE) - Slovenia (SI) - Slovak Republic (SK) - United Kingdom (UK) - Spain (ES) - Poland (PL)
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About This Guide

This guide describes the FibeAir IP-20E installation procedures and provides additional information concerning system parts and frequency bands.

What You Should Know

For the warranty to be honored, install the unit in accordance with the instructions in this manual.

Target Audience

This guide contains technical information about IP-20E installation, and is intended for use by qualified Ceragon technical personnel at all levels.

Related Documents

- FibeAir IP-20E Technical Description
- FibeAir IP-20 Series MIB Reference
1. Before You Start

1.1 Important Notes

- For the warranty to be honored, install the unit in accordance with the instructions in this manual.
- Any changes or modifications of equipment not expressly approved by the manufacturer could void the user’s authority to operate the equipment and the warranty for such equipment.
- IP-20E is intended for installation in a restricted access location.
- IP-20E must be installed and permanently connected to protective earth by qualified service personnel in accordance with applicable national electrical codes.

1.2 Safety Precautions & Declared Material

1.2.1 General Equipment Precautions

⚠️ To avoid malfunctioning or personnel injuries, equipment or accessories/kits/plug-in unit installation, requires qualified and trained personnel. Changes or modifications not expressly approved by Ceragon Networks could void the user's authority to operate the equipment.

⚠️ Where special cables, shields, adapters and grounding kits are supplied or described in this manual, these items must be used, to comply with the FCC regulations.

⚠️ Use of controls, adjustments, or performing procedures other than those specified herein, may result in hazardous radiation exposure.

⚠️ When working with an IP-20E, note the following risk of electric shock and energy hazard: Disconnecting one power supply disconnects only one power supply module. To isolate the unit completely, disconnect all power supplies.

⚠️ Machine noise information order - 3. GPSGV, the highest sound pressure level amounts to 70 dB (A) or less, in accordance with ISO EN 7779.
Static electricity may cause body harm, as well as harm to electronic components inside the device. Anyone responsible for the installation or maintenance of the IP-20E must use an ESD Wrist Strap. ESD protection measures must be observed when touching the unit. To prevent damage, before touching components inside the device, all electrostatic must be discharged from both personnel and tools.

In Norway and Sweden:

Equipment connected to the protective earthing of the building installation through the mains connection or through other equipment with a connection to protective earthing – and to a cable distribution system using coaxial cable, may in some circumstances create a fire hazard. Connection to a cable distribution system has therefore to be provided through a device providing electrical isolation below a certain frequency range (galvanic isolator, see EN 60728-11).

Utstyr som er koplet til beskyttelsesjord via nettplugg og/eller via annet jordtilkoblede utstyr – og er tilkoblede til kabel-TV nettet, kan forårsake brannfare. For å unngå dette skal det ved tilkoping av utstyret til kabel-TV nettet installeres en galvanisk isolator mellom utstyret og kabel- TV nettet.

Utrustning som är kopplad till skyddsjord via jordat vägguttag och/eller via annan utrustning och samtidigt är kopplad till kabel-TV nät kan i vissa fall medföra risk för brand. För att undvika detta skall vid anslutning av utrustningen till kabel-TV nät galvanisk isolator finnas mellan utrustningen och kabel-TV nätet.

1.2.2 Précautions générales relatives à l’équipement

L’utilisation de commandes ou de réglages ou l’exécution de procédures autres que celles spécifiées dans les présentes peut engendrer une exposition dangereuse aux rayonnements.

L’usage de IP-20E s’accompagne du risque suivant d’électrocution et de danger électrique : le débranchement d’une alimentation électrique ne déconnecte qu’un module d’alimentation électrique. Pour isoler complètement l’unité, il faut débrancher toutes les alimentations électriques.

Bruit de machine d’ordre - 3. GPSGV, le plus haut niveau de pression sonore s’élève à 70 dB (A) au maximum, dans le respect de la norme ISO EN 7779.
1.2.3 Allgemeine Vorsichtsmaßnahmen für die Anlage

- Wenn andere Steuerelemente verwendet, Einstellungen vorgenommen oder Verfahren durchgeführt werden als die hier angegebenen, kann dies gefährliche Strahlung verursachen.

- Beachten Sie beim Arbeiten mit IP-20E das folgende Stromschlag- und Gefahrenrisiko: Durch Abtrennen einer Stromquelle wird nur ein Stromversorgungsmodul abgetrennt. Um die Einheit vollständig zu isolieren, trennen Sie alle Stromversorgungen ab.

  Maschinenlärminformations-Verordnung - 3. GPSGV, der höchste Schalldruckpegel beträgt 70 dB(A) oder weniger gemäß EN ISO 7779.
1.3  Pre-Installation Instructions

1.3.1  Packing

The equipment should be packed and sealed in moisture absorbing bags.

1.3.2  Transportation and Storage

The equipment cases are prepared for shipment by air, truck, railway and sea, suitable for handling by forklift trucks and slings. The cargo must be kept dry during transportation, in accordance with ETS 300 019-1-2, Class 2.3. For sea-transport, deck-side shipment is not permitted. Carrier-owned cargo containers should be used.

It is recommended that the equipment be transported to the installation site in its original packing case.

If intermediate storage is required, the packed equipment must be stored in a dry and cool environment, and out of direct sunlight, in accordance with ETS 300 019-1-1, Class 1.2.

1.3.3  Unpacking

The equipment is packed in sealed plastic bags and moisture absorbing bags are inserted. Any separate sensitive product, i.e. printed boards, are packed in anti-static handling bags. The equipment is further packed in special designed cases.

Marking is done according to standard practice unless otherwise specified by customers. The following details should be marked:

- Customers address
- Contract No
- Site name (if known)
- Case No

1.3.4  Inspection

Check the packing lists and ensure that correct parts numbers quantities of goods have arrived. Inspect for any damage on the cases and equipment. Report any damage or discrepancy to a Ceragon representative, by e-mail or fax.
2. Product Hardware Description

2.1 IP-20E Hardware Overview

FibeAir IP-20E features an all-outdoor architecture consisting of a single unit, which can be either directly mounted on the antenna or supplied with an integrated antenna.

**Note:** The equipment is type approved and labeled according to EU Directive 1999/5/EC (R&TTE).

*IP-20E Rear View (Left) and Front View (Right)*

Cable Gland Construction

**Note:** The Extension port is smaller than the other ports and requires a special gland.
2.1.1 IP-20E Interfaces

There are two variants of the IP-20E interface layout:
- Variant A – Two electrical Ethernet interfaces (Data Port 1 and Data Port 3) and one optical SFP cage that supports regular and CSFP standards (Data Port 2).
- Variant B – One electrical Ethernet interface (Data Port 1), an optical SFP cage that supports the regular SFP standard (Data Port 2), and an optical SFP cage that supports regular and CSFP standards (Data Port 3).

Note: Variant B requires CeraOS 9.0 or higher.

The following table provides the marketing models for the IP-20E unit options.

### IP-20E Chassis Marketing Models

<table>
<thead>
<tr>
<th>Marketing Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP-20E-R2-DX0H-H-ESE</td>
<td>Two electrical Ethernet ports, one SFP Ethernet port (high power).</td>
</tr>
<tr>
<td>IP-20E-R2-DX0H-L-ESE</td>
<td>Two electrical Ethernet ports, one SFP Ethernet port (standard power).</td>
</tr>
<tr>
<td>IP-20E-R2-DX0H-H-ESS</td>
<td>Two SFP Ethernet ports, one electrical Ethernet port (high power).</td>
</tr>
<tr>
<td>IP-20E-R2-DX0H-L-ESS</td>
<td>Two SFP Ethernet ports, one electrical Ethernet port (standard power).</td>
</tr>
</tbody>
</table>

2.1.2 IP-20E Interfaces – Variant A

### IP-20E Interfaces – Variant A

- Port 1 (Eth1):
  - Electric: 10/100/1000Base-T RJ-45.
  - Proprietary PoE or external DC support (adapter)
- **Port 2**
  - **SFP cage which supports – Regular and CSFP standards**
    - Regular SFP provides Eth2
    - CSFP (Dual BiDi SFP) provides Eth2 and Eth3.

- **Port 3 (Eth4):**
  - Electric: 10/100/1000Base-T RJ-45.
  - Eth traffic
  - Default management port

### 2.1.3 IP-20E Interfaces – Variant B

*IP-20E Interfaces – Variant B*

- **Port 1(Eth4):**
  - Electric: 10/100/1000Base-T RJ-45.
  - Proprietary PoE or external DC support (adapter)
  - Default management port

- **Port 2 (Eth1)**
  - SFP cage which supports Regular SFP standard

- **Port 3:**
  - SFP cage which supports Regular and CSFP standards
    - Regular SFP provides Eth2
    - CSFP (Dual BiDir SFP) provides Eth2 and Eth3
2.1.4 Common IP-20E Interfaces

The following interfaces are common to Variant A and Variant B.

- Port 4:
  - Extension Port – Used for XPIC and HSB protection.

**Note:** XPIC and HSB are planned for future release.

- Antenna Port – Ceragon proprietary flange (flange compliant with UG385/U)

- RSL interface – IP-20E uses a two-pin connection to measure the RSL level using standard voltmeter test leads:

  **RSL Interface**

  ![RSL Interface Diagram]

  **Note:** The RSL interface includes a docking slot for a WiFi module plugin module. WiFi is hardware-ready and will be supported in future software releases.

- Grounding screw

  **Grounding Screw**

  ![Grounding Screw Diagram]
2.2 PoE Injector

The PoE injector is an outdoor unit which can be mounted on a wall, pole, or indoor rack.

Each PoE Injector kit includes the following items:

- PoE injector
- 2 DC power connectors

Two models of the PoE Injector are available:

- **PoE_Inj_AO_2DC_24V_48V** – Includes two DC power ports with power input ranges of ±(18-60)V each.
- **PoE_Inj_AO** – Includes one DC power port (DC Power Port #1), with a power input range of ±(40-60)V.
2.2.1 PoE Injector Interfaces

- Power-Over-Ethernet (PoE) Port
- GbE Data Port supporting 10/100/1000Base-T
- DC Power Port 1 ±(18-60)V or ±(40-60)V
- DC Power Port 2 ±(18-60)V (Optional)
- Grounding screw

PoE Injector Ports

![PoE Injector Ports Diagram]
2.3 Powering with External DC

For configurations in which power is not provided via PoE, a special adaptor (IP-20_Mini_Power_Adaptor) is available that enables users to connect a two-wire power connector to the PoE port. This adaptor is located inside of the gland. In such configurations, only one electrical GbE interface is available (MGT/ETH4).

*Two-Wire to PoE Port Power Adaptor*
2.4 System Components

The following figures show the main components used in the IP-20E installation procedures.

- **IP-20E**
- **Coupler/Splitter**
- **OMT**
- **PoE Injector**
- **Twist for Coupler/Splitter**
2.5 Adaptors and Installation Kits

**IP-20E Accessories**

<table>
<thead>
<tr>
<th>Marketing Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP-20E-CPLR-Kit</td>
<td>IP-20E Coupler Kit</td>
</tr>
<tr>
<td>IP-20E-SPLTR-Kit</td>
<td>IP-20E Splitter Kit</td>
</tr>
<tr>
<td>IP-20E-OMT-Kit</td>
<td>IP-20E OMT Kit</td>
</tr>
<tr>
<td>IP-20E_Flat_Ant_Mounting_Kit</td>
<td>IP-20E Mounting kit for the IP-20E</td>
</tr>
</tbody>
</table>

**PoE Injector**

<table>
<thead>
<tr>
<th>Marketing Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PoE_Inj_AO</td>
<td>Includes one DC power port (DC Power Port #1), with a power input range of ±(40-60)V (default offering).</td>
</tr>
<tr>
<td>PoE_Inj_AO_2DC_24V_48V</td>
<td>Includes two DC power ports with power input ranges of ±(18-60)V each.</td>
</tr>
<tr>
<td>PoE_Inj_19inch_Rack_Mnt_kit</td>
<td>PoE Injector 19” Rack Mount Kit</td>
</tr>
<tr>
<td>PoE_Inj_ETSI_Rack_Mnt_kit</td>
<td>PoE Injector ETSI Rack Mount Kit</td>
</tr>
</tbody>
</table>

**Two-Wire to PoE Port Power Adaptor**

<table>
<thead>
<tr>
<th>Marketing Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP-20_Mini_Power_Adaptor</td>
<td>RJ45 to TB Power Adaptor With Protection</td>
</tr>
</tbody>
</table>

2.6 Antenna Connection

Direct Mount:
MTI, Andrew (VHLP)

**Note:** Appropriate lubricant or grease can be applied to the screws that connect the IP-20E to the antenna interface.
2.7 **Power Specifications**

### 2.7.1 Power Input Specifications

<table>
<thead>
<tr>
<th>Standard Input</th>
<th>-48 VDC nominal</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Input range</td>
<td>-40.5 to -60 VDC</td>
</tr>
</tbody>
</table>

### 2.7.2 Power Consumption Specifications

<table>
<thead>
<tr>
<th>Unit Configuration</th>
<th>Maximum Power Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>43W</td>
</tr>
<tr>
<td>Standby</td>
<td>36W</td>
</tr>
</tbody>
</table>

### 2.7.3 Power Connection Options

<table>
<thead>
<tr>
<th>Power Source and Range</th>
<th>Data Connection Type</th>
<th>Connection Length</th>
<th>DC Cable Type / Gage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ext DC (40.5 ÷ 60)VDC</td>
<td>Optical</td>
<td>≤ 150m</td>
<td>18AWG</td>
</tr>
<tr>
<td>(Using an RJ-45 to DC cable adaptor)</td>
<td>Electrical</td>
<td>150m ÷ 300m</td>
<td>14AWG</td>
</tr>
<tr>
<td>PoE Injector ±(18 ÷ 60)VDC</td>
<td>Electrical</td>
<td>≤ 100m (328ft)</td>
<td>CAT5e (24AWG)</td>
</tr>
</tbody>
</table>

### 2.7.4 PoE Injector Power Input

<table>
<thead>
<tr>
<th>Standard Input</th>
<th>-48 or +24VDC (Optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Input range</td>
<td>±(18÷40.5 to 60) VDC</td>
</tr>
</tbody>
</table>

### 2.7.5 Important Notes!

- The unit must only be installed by service personnel.
- The unit must have a permanent connection to protective grounding.
- Data port 2 (ETH2/ETH3) does not provide protection from over-voltages on telecommunication networks for host equipment users.
- The RSL interface connector is intended for technician use only.
- Disconnect device (circuit breaker) in the building installation:
  - Shall be readily accessible and incorporated external to the equipment.
  - The maximum rating of the overcurrent protection shall be up to 6 Amp.

---

1 Optional.
2 +18VDC extended range is supported as part of the nominal +24VDC support.
2.8 **Environmental Specifications**

Operating: ETSI EN 300 019-1-4 Class 4.1

Temperature range for continuous operating temperature with high reliability:
-33°C (-27°F) to +55°C (131°F)

Temperature range for exceptional temperatures; tested successfully, with limited margins:
-45°C (-49°F) to +60°C (140°F)

Humidity: 5%RH to 100%RH

IEC529 IP66

Storage: ETSI EN 300 019-1-1 Class 1.2

Transportation: ETSI EN 300 019-1-2 Class 2.3
3. Cable Installation and Grounding

3.1 Minimum and Maximum Cable Diameter

To fit the gland, the outer cable diameter should be between 6-10 mm. This applies to all glands on both the IP-20C unit and the PoE Injector.

3.2 Cable Grounding

Cables must be grounded as follows:

- For optical (SFP) cable (see Connecting an Optical Fiber Cable and SFP on page 39), no grounding is required.
- For Ethernet cables (see Connecting the Ethernet Cable on page 47), the external shielded CAT5E cable should be grounded to the antenna tower at the top (next to the IP-20 unit) and the bottom of the external run and every 50m using the kit CAT5E_gnd_kit.
3.2.1 Grounding Procedure

**Required Tools**

- Metric offset wrench key wrench #3
- Metric wrench 10mm

**Procedure**

1. On the front of each IP-20E unit, loosen the nut, plain washer, and serrated washer from the GND stud, using the metric offset hexagon key and the wrench.

2. Place the cable lug (supplied with the IP-20E grounding kit) in place on the screw.

3. Secure the cable lug.

4. The second side of the GND cable should be connected to the main ground bar or terminal ground bar of the site.

5. Perform a resistance test between the 2 lugs of the GND cable. Verify that the result is 0-2 ohms.

**Notes:**

The unit's earthing screw terminal shall be permanently connected to protective earth in a building installation in accordance with applicable national code and regulations by a service person.

A 2-pole circuit breaker, a branch circuit protector, suitably certified in accordance with applicable national code and regulations, rated maximum 20A, shall be installed for full power disconnection in a building installation.

Any outdoor antenna cable shield shall be permanently connected to protective earth in a building installation.
3.3 Power Source

When selecting a power source, the following must be considered:

**Recommended:** Availability of a UPS (Uninterrupted Power Source), battery backup, and emergency power generator.

Whether or not the power source provides constant power (i.e., power is secured on weekends or is shut off frequently and consistently).

The power supply must have grounding points on the AC and DC sides.

⚠️ **Caution!** The user power supply GND must be connected to the positive pole in the IP-20E power supply. Any other connection may cause damage to the system!

⚠️ **Note!** For the warranty to be honored, you must install the IP-20E in accordance with the instructions above.

3.4 Surge Protection

IP-20E includes built-in surge protection for its Ethernet and power interfaces. IP-20E’s surge protection implementation complies with surge immunity standard IEC 61000-4-5, level 4, provided the Ethernet cables were prepared according to the instructions in *Connecting the Ethernet Cable* on page 47.

In areas in which severe lighting conditions are likely to occur, it is strongly recommended to add additional protection by placing lightning protectors on all electrical Ethernet cables, near the connection points with the IP-20E unit.
### 3.5 Available Cable Options

#### 3.5.1 Fiber Optic Cables – Single Mode

<table>
<thead>
<tr>
<th>Marketing Model</th>
<th>Marketing Description</th>
<th>Item Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_90m</td>
<td>IP-20_FO_SM_LC2LC_ARM_90m</td>
<td>CABLE, FO, DUAL LC TO LC, 90M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_80m</td>
<td>IP-20_FO_SM_LC2LC_ARM_80m</td>
<td>CABLE, FO, DUAL LC TO LC, 80M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_7m</td>
<td>IP-20_FO_SM_LC2LC_ARM_7m</td>
<td>CABLE, FO, DUAL LC TO LC, 7M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_70m</td>
<td>IP-20_FO_SM_LC2LC_ARM_70m</td>
<td>CABLE, FO, DUAL LC TO LC, 70M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_60m</td>
<td>IP-20_FO_SM_LC2LC_ARM_60m</td>
<td>CABLE, FO, DUAL LC TO LC, 60M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_50m</td>
<td>IP-20_FO_SM_LC2LC_ARM_50m</td>
<td>CABLE, FO, DUAL LC TO LC, 50M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_40m</td>
<td>IP-20_FO_SM_LC2LC_ARM_40m</td>
<td>CABLE, FO, DUAL LC TO LC, 40M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_30m</td>
<td>IP-20_FO_SM_LC2LC_ARM_30m</td>
<td>CABLE, FO, DUAL LC TO LC, 30M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_300m</td>
<td>IP-20_FO_SM_LC2LC_ARM_300m</td>
<td>CABLE, FO, DUAL LC TO LC, 300M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_20m</td>
<td>IP-20_FO_SM_LC2LC_ARM_20m</td>
<td>CABLE, FO, DUAL LC TO LC, 20M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_200m</td>
<td>IP-20_FO_SM_LC2LC_ARM_200m</td>
<td>CABLE, FO, DUAL LC TO LC, 200M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_2.2m</td>
<td>IP-20_FO_SM_LC2LC_ARM_2.2m</td>
<td>CABLE, FO, DUAL LC TO LC, 2.2M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_15m</td>
<td>IP-20_FO_SM_LC2LC_ARM_15m</td>
<td>CABLE, FO, DUAL LC TO LC, 15M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_150m</td>
<td>IP-20_FO_SM_LC2LC_ARM_150m</td>
<td>CABLE, FO, DUAL LC TO LC, 150M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_120m</td>
<td>IP-20_FO_SM_LC2LC_ARM_120m</td>
<td>CABLE, FO, DUAL LC TO LC, 120M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_10m</td>
<td>IP-20_FO_SM_LC2LC_ARM_10m</td>
<td>CABLE, FO, DUAL LC TO LC, 10M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_SM_LC2LC_ARM_100m</td>
<td>IP-20_FO_SM_LC2LC_ARM_100m</td>
<td>CABLE, FO, DUAL LC TO LC, 100M, SM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
</tbody>
</table>
### 3.5.2 Fiber Optic Cables – Multi Mode

<table>
<thead>
<tr>
<th>Marketing Model</th>
<th>Marketing Description</th>
<th>Item Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_90m</td>
<td>IP-20_FO_MM_LC2LC_ARM_90m</td>
<td>CABLE, FO, DUAL LC TO LC, 90M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_80m</td>
<td>IP-20_FO_MM_LC2LC_ARM_80m</td>
<td>CABLE, FO, DUAL LC TO LC, 80M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_7m</td>
<td>IP-20_FO_MM_LC2LC_ARM_7m</td>
<td>CABLE, FO, DUAL LC TO LC, 7M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_70m</td>
<td>IP-20_FO_MM_LC2LC_ARM_70m</td>
<td>CABLE, FO, DUAL LC TO LC, 70M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_60m</td>
<td>IP-20_FO_MM_LC2LC_ARM_60m</td>
<td>CABLE, FO, DUAL LC TO LC, 60M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_50m</td>
<td>IP-20_FO_MM_LC2LC_ARM_50m</td>
<td>CABLE, FO, DUAL LC TO LC, 50M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_40m</td>
<td>IP-20_FO_MM_LC2LC_ARM_40m</td>
<td>CABLE, FO, DUAL LC TO LC, 40M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_30m</td>
<td>IP-20_FO_MM_LC2LC_ARM_30m</td>
<td>CABLE, FO, DUAL LC TO LC, 30M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_300m</td>
<td>IP-20_FO_MM_LC2LC_ARM_300m</td>
<td>CABLE, FO, DUAL LC TO LC, 300M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_20m</td>
<td>IP-20_FO_MM_LC2LC_ARM_20m</td>
<td>CABLE, FO, DUAL LC TO LC, 20M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_200m</td>
<td>IP-20_FO_MM_LC2LC_ARM_200m</td>
<td>CABLE, FO, DUAL LC TO LC, 200M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_2.2m</td>
<td>IP-20_FO_MM_LC2LC_ARM_2.2m</td>
<td>CABLE, FO, DUAL LC TO LC, 2.2M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_15m</td>
<td>IP-20_FO_MM_LC2LC_ARM_15m</td>
<td>CABLE, FO, DUAL LC TO LC, 15M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_150m</td>
<td>IP-20_FO_MM_LC2LC_ARM_150m</td>
<td>CABLE, FO, DUAL LC TO LC, 150M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_120m</td>
<td>IP-20_FO_MM_LC2LC_ARM_120m</td>
<td>CABLE, FO, DUAL LC TO LC, 120M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_10m</td>
<td>IP-20_FO_MM_LC2LC_ARM_10m</td>
<td>CABLE, FO, DUAL LC TO LC, 10M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
<tr>
<td>IP-20_FO_MM_LC2LC_ARM_100m</td>
<td>IP-20_FO_MM_LC2LC_ARM_100m</td>
<td>CABLE, FO, DUAL LC TO LC, 100M, MM, 55mm OPEN END, WITH M28 GLAND, ARMORED, OUTDOOR</td>
</tr>
</tbody>
</table>
3.5.3 DC Cable and Connector

<table>
<thead>
<tr>
<th>Marketing P/N</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor_DC_cbl_2x18AWG_drum</td>
<td>CABLE, 305M, OUTDOOR_DC_CBL_2X18AWG_DRUM</td>
</tr>
<tr>
<td>IP-20_Mini_Power_Adaptor</td>
<td>IP-20 Mini Power Adaptor</td>
</tr>
</tbody>
</table>

3.5.4 Ethernet Cable and Specifications

<table>
<thead>
<tr>
<th>Marketing P/N</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAT5E_SFUTP_Outdoor_305m_drum</td>
<td>CABLE, MATERIAL, CAT-5E, SFUTP, 4X2X24AWG, UV RESISTANCE, 305M</td>
</tr>
</tbody>
</table>

This cable has the following specifications:

- Suitable for:
  - Fast Ethernet
  - Gigabit Ethernet
  - PoE

Cable Design – The numbers in the figure below refer to the items listed beneath the figure.

- [1] Conductor
- [2] Insulation
- [4] Tinned copper braid

### Color Code

<table>
<thead>
<tr>
<th>Pair</th>
<th>Wire A</th>
<th>Wire B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WHITE-blue</td>
<td>BLUE</td>
</tr>
<tr>
<td>2</td>
<td>WHITE-orange</td>
<td>ORANGE</td>
</tr>
<tr>
<td>Pair</td>
<td>Wire A</td>
<td>Wire B</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>3</td>
<td>WHITE-green</td>
<td>GREEN</td>
</tr>
<tr>
<td>4</td>
<td>WHITE-brown</td>
<td>BROWN</td>
</tr>
</tbody>
</table>
### 3.5.5 Outdoor Ethernet Cable Specifications

#### Electrical Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable type</td>
<td>CAT-5e SFUTP, 4 pairs, according to ANSI/TIA/EIA-568-B-2</td>
</tr>
<tr>
<td>Wire gage</td>
<td>24 AWG</td>
</tr>
<tr>
<td>Stranding</td>
<td>Solid</td>
</tr>
<tr>
<td>Voltage rating</td>
<td>70V</td>
</tr>
<tr>
<td>Shielding</td>
<td>Braid + Foil</td>
</tr>
</tbody>
</table>

#### Pinout

<table>
<thead>
<tr>
<th>RJ45,P1</th>
<th>RJ45,P2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WHITE/GREEN</td>
</tr>
<tr>
<td>2</td>
<td>GREEN</td>
</tr>
<tr>
<td>3</td>
<td>WHITE/ORANGE</td>
</tr>
<tr>
<td>6</td>
<td>ORANGE</td>
</tr>
<tr>
<td>4</td>
<td>BLUE</td>
</tr>
<tr>
<td>5</td>
<td>WHITE/BLUE</td>
</tr>
<tr>
<td>7</td>
<td>WHITE/BROWN</td>
</tr>
<tr>
<td>8</td>
<td>BROWN</td>
</tr>
<tr>
<td>SHELL</td>
<td>SHEEL</td>
</tr>
</tbody>
</table>

#### Mechanical/Environmental Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacket</td>
<td>PVC, double, UV resistant</td>
</tr>
<tr>
<td>Outer diameter</td>
<td>7-10 mm</td>
</tr>
<tr>
<td>Operating and Storage temperature range</td>
<td>-40°C - 85°C</td>
</tr>
<tr>
<td>Flammability rating</td>
<td>According to UL-1581 VW1, IEC 60332-1</td>
</tr>
<tr>
<td>RoHS</td>
<td>According to Directive/2002/95/EC</td>
</tr>
</tbody>
</table>
### 3.5.6 Outdoor DC Cable Specifications

<table>
<thead>
<tr>
<th>Electrical Requirements</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable type</td>
<td>2 tinned copper wires</td>
</tr>
</tbody>
</table>
| Wire gage                             | 18 AWG (for ≤150m (492ft) installations, optical connections)  
                                           14 AWG (for 150m + 300m (492ft + 984ft) installations, electrical connections) |
| Stranding                             | stranded       |
| Voltage rating                        | 600V           |
| Spark test                            | 4KV            |
| Dielectric strength                   | 2KV AC min     |

<table>
<thead>
<tr>
<th>Mechanical/ Environmental Requirements</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacket</td>
<td>PVC, double, UV resistant</td>
</tr>
<tr>
<td>Outer diameter</td>
<td>7-10 mm</td>
</tr>
<tr>
<td>Operating &amp; Storage temperature range</td>
<td>-40°C - 85°C</td>
</tr>
<tr>
<td>Flammability rating</td>
<td>According to UL-1581 VW1, IEC 60332-1</td>
</tr>
<tr>
<td>RoHS</td>
<td>According to Directive/2002/95/EC</td>
</tr>
</tbody>
</table>
3.6 Securing the Cables

All cables should be secured at every meter on-site using either a T-Rups kit, P/N Outdoor Ties (SI-0027-0) or cable clamps. When using the T-Rups kit, take special care to apply the proper amount of force in order to avoid damage to the cable. This is especially important for optical (SFP) cables.

The following cable clamps are available:

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Marketing Model</th>
<th>Item Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SI-1229-0</td>
<td>Fiber_clamp_2cbl_4.0-7.0mm</td>
<td>DUAL FEADER CLAMP FOR 4.0-7.0mm CABLE 2 WAY.</td>
</tr>
<tr>
<td>SI-1230-0</td>
<td>Fiber_clamp_4cbl_4.0-7.0mm</td>
<td>DUAL FEADER CLAMP FOR 4.0-7.0mm CABLE 4 WAY.</td>
</tr>
<tr>
<td>SI-1231-0</td>
<td>Fiber_clamp_6cbl_4.0-7.0mm</td>
<td>DUAL FEADER CLAMP FOR 4.0-7.0mm CABLE 6 WAY.</td>
</tr>
</tbody>
</table>
### 3.7 Special Instructions for use of Glands

**Note:** Each IP-20E unit is supplied with two glands. If additional glands are required, they must be ordered separately, in kits of five glands each.

#### Glands Kit

<table>
<thead>
<tr>
<th>Marketing Model</th>
<th>Marketing Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP-20_Glands_kit</td>
<td>IP-20_Glands_x5 kit</td>
</tr>
</tbody>
</table>

In addition, gland caps can be ordered to protect the cable and connector from damage when elevating the cable and gland to the radio unit. See Step 5 in Section 3.7.1, *General Installation Procedure*. Gland caps are ordered separately, in kits of 10 caps each.

#### Gland Cap

<table>
<thead>
<tr>
<th>Marketing Model</th>
<th>Marketing Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable_Prot_10Caps_kit</td>
<td>Cable protective caps kit 10 pcs, IP-20C/S/E</td>
</tr>
</tbody>
</table>

In order to remove the plastic plugs for the unit, you can use the flange of supplied glands to disconnect them as shown in the figures below.
3.7.1 General Installation Procedure

This procedure applies to all cable types, and explains how to install the cables using long glands. The gland is supplied assembled.

When using the power adaptor (see section 2.1.1, IP-20E Interfaces), perform these steps to prepare the cable:

1. Strip off a maximum of 20 mm from the cable jacket.
2. Expose 10 mm at the edge of each of the two wires.

For all installations, perform the following steps:

1. Before inserting a cable, you must disassemble the gland cap and gland rubber from the gland body.
2. Slide the gland cap into the cable.

3. Slide the gland rubber into the cable.

4. Slide the cable into the body of the gland. If you are using a gland cap (see Step 5), make sure to leave enough space for the gland cap to fit into the gland without disturbing the cable.
5 Optionally, after securing the cable into the body of the gland, you can close the other side of the gland with an M28 gland cap. The gland cap protects the cable and connector from damage when elevating the cable and gland to the radio unit.
6 The M28 gland cap has hook on top. After attaching the gland cap to the gland, you can connect a rope to the hook and use this to lift the gland and cable up to the radio unit. Before screwing the gland into the radio unit, you must remove the gland cap.

7 If you used an M28 gland cap to close the gland when raising the gland and cable to the radio unit, remove the gland cap from the gland at this point by unscrewing the cap.

8 Connect the cable to the port.

9 Screw the gland into the radio unit until there is full contact between the gland and the radio unit.
Important Note! Before tightening the gland, make sure the gland is aligned with the tapped hole in the unit. Tightening the gland at an angle can ruin the thread on the gland and prevent proper sealing of the interface.

10 Insert the main part of the gland into the thread in the radio body and tighten until there is full contact and the gasket is fully contained between the gland and the radio and cannot be seen. Tighten the gland gently and make sure there is no resistance. If there is resistance, stop immediately, and thread out the gland. Verify that the gland thread is not damaged and tighten the gland again.

Important Note! Pay attention that the gland rubber is properly located and not damaged during the tightening of the gland cap.

If the gland thread is damaged do not use it!
11 Tighten the rear portion of the gland onto the main part of the gland and make sure that the main part of the gland does not have an additional swivel after the rear portion is secured.

**Note:** If the main portion of the gland is rotated while the rear portion is seizing the cable, this may ruin the cable connector.

---

**Tightening the Front Portion of the Gland**

**Tightening the Rear Portion of the Gland**
12 Secure the cable to the lip of the gland using a tie wrap.
3.8 Connecting an Optical Fiber Cable and SFP

3.8.1 Types of SFPs

The IP-20E includes an SFP cage that supports regular SFP and CSFP standards:

- Regular SFP provides a single Ethernet interface: ETH2. This interface uses two optical fiber cables (one for TX and one for RX).
- CSFP (Dual BiDi SFP) provides two Ethernet interfaces: ETH2 and ETH3. These interfaces use a single optical fiber cable per interface, multiplexing TX and RX on the same cable using different wavelengths for TX and RX.

When a Dual BiDi CSFP is used, a single-fiber BiDi CSFP must be used for the third party equipment connected to the CSFP ports, with opposite wavelengths for TX and RX. The following table provides an example of a valid CSFP-SFP pair in which TX=1310nm and RX=1490nm for the CSFP connected to the IP-20E, and TX=1490nm and RX=1310nm for the SFP connected to the third party equipment.

<table>
<thead>
<tr>
<th>CSFP – SFP Compatibility Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>P/N</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>IP-20E</td>
</tr>
<tr>
<td>Third Party Equipment</td>
</tr>
</tbody>
</table>

The following table lists recommended SFP modules that can be used with IP-20E.

<table>
<thead>
<tr>
<th>SFP Module Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part Number</td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td>AO-0098-0</td>
</tr>
<tr>
<td>AO-0097-0</td>
</tr>
<tr>
<td>AO-0228-0</td>
</tr>
</tbody>
</table>
The following table lists recommended CSFP modules that can be used with IP-20E.

**CSFP Module Recommendations**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Marketing Model</th>
<th>Item Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AO-0232-0</td>
<td>CSFP_BiDi_1G_TXL_EXT_TEMP</td>
<td>XCVR, CSFP, 1310nm TX/1490nm RX, SM, 1.25Gbit/s, 10km, W.DDM, INDUSTRIAL GRADE, SINGLE PACK</td>
</tr>
<tr>
<td>AO-0231-0</td>
<td>CSFP_BiDi_1G_TXH_EXT_TEMP</td>
<td>XCVR, CSFP, 1490nm TX/1310nm RX, SM, 1.25Gbit/s, 10km, W.DDM, INDUSTRIAL GRADE, SINGLE PACK</td>
</tr>
</tbody>
</table>

The following table lists recommended SFP modules that can be used with third party equipment connected to a CSFP module on the IP-20E.

**SFP Module Recommendations for Third Party Equipment**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Marketing Model</th>
<th>Item Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AO-0194-0</td>
<td>SFP-BX-D-OPT</td>
<td>XCVR, SFP, SINGLE FIBER, 1490nm TX/1310nm RX, 1.25Gb, SM, 10km, W.DDM, COMMERCIAL, SINGLE PACK KIT</td>
</tr>
<tr>
<td>AO-0193-0</td>
<td>SFP-BX-U-OPT</td>
<td>XCVR, SFP, SINGLE FIBER, 1310nm TX/1490nm RX, 1.25Gb, SM, 10km, W.DDM, COMMERCIAL, SINGLE PACK KIT</td>
</tr>
</tbody>
</table>

### 3.8.2 Connecting Optical Fiber to SFPs

To connect an optical fiber cable and the SFP transceiver:

1. Use a pre-assembled cable.

2. Split the connector into two separate LC connectors (one for each fiber).
3 Remove the gland cap and rubber from the gland body.

4 Slide the gland cap into the cable.
5 Slide the rubber into the cable.
6 Insert the fibers with the connectors one by one into the cable gland.
7 Secure the cable to the lip of the gland using a tie wrap.

**Important Note:** If you are raising the cable to a radio unit on a tower, this step is crucial to prevent the cable from slipping from the gland, which could damage the connector.

8 Connect the wires to the SFP transceiver. Listen for the "click" to ensure that it is fully inserted.

9 Remove the tie wrap securing the cable to the gland.

**Note:** A new tie wrap must be used to secure the cable to the gland at the end of the procedure, as described in Step 13.
10 Connect the connector into the IP-20E connector.

11 Tighten the gland to the radio unit until there is full contact between the gland and the radio unit.
12 Tighten the gland cap.

**Important Note!** Before tightening the gland, make sure the gland is aligned with the tapped hole in the unit.

Tightening the gland at an angle can ruin the thread on the gland and prevent proper sealing of the interface. Tighten the gland gently and make sure there is no resistance. If there is resistance, stop immediately, thread out the gland, and verify that the gland threads are not damaged. Then, tighten the gland again.

*If the gland thread is damaged do not use it!*
13 Secure the cable to the gland using a tie wrap.
3.9 Connecting a DC Power Cable

Note: The DC power cable and connector must be ordered separately. See DC Cable and Connector on page 26.

To connect a DC power cable:

1. Strip off 45 mm from the cable jacket.
2. Expose 10 mm at the edge of each of the two wires.

3. Insert the power cable into the gland.

4. Insert the power cable wires into the power connector.
5. Insert the power cable wires into the power connector. Match “+” to the 0V wire and “-” to the -48V wire, and tighten the screws with a flat screwdriver.
6  Plug the power cable with connector into the IP-20E power connector.

7  Screw the gland into the radio unit

**Important Note!** Before tightening the gland, make sure the gland is even with the cover. Tighten the gland gently and make sure there is no resistance. If there is resistance, stop immediately and verify that the gland is not being inserted at an angle. Tightening the gland at an angle can ruin the thread on the gland and prevent proper sealing of the interface.

10  Tighten the gland cap.
11 Secure the cable to the gland with a tie wrap.

3.10 Connecting the Ethernet Cable

If you need to assemble the Ethernet cable, follow the instructions in section 3.10.1, Preparing the Ethernet Cable and Plug-in Field, then proceed to section 3.10.3, Connection of Ethernet Cable to IP-20E.

If you using a pre-assembled Ethernet cable, follow the instructions in section 3.10.2, Preparing the Ethernet Cable Already Assembled, then proceed to section 3.10.3, Connection of Ethernet Cable to IP-20E.

Note: To ensure proper grounding and connectivity, it is recommended to use pre-assembled Ethernet cables.

3.10.1 Preparing the Ethernet Cable and Plug-in Field

Important Note: To ensure proper grounding, the RJ-45 plug must be shielded, with a crimping tail.
To prepare the Ethernet cable and plug-in field:

1. Prepare the gland and insert the cable, as described in *General Installation Procedure* on page 32.
2. Strip off approximately 45 mm of the outer insulation jacket from the CAT5E cable.
3. Do not strip off the end of the cable shield, but rather, twist the shield to form a braid.

4. Roll back the foil shield insulation and wrap the drain wire around the foil. Do not remove any insulation from the conductors.
5. Align the colored wires.

**Note:** Cord colors should be matched to the same pins on both ends of the cable.

6. Trim all wires to the same length. About 12 mm on the left should be exposed from the inner sheath.
7. Separate the wires and place the twisted shield between the separated wires.
8 Insert the wires into the RJ45 plug. Verify that each wire is fully inserted into the front of the RJ45 plug and in the correct order, according to the pinouts shown in Section 3.5.5, *Outdoor Ethernet Cable Specifications*. The sheath of the Ethernet cable should extend into the plug by about 13 mm and held in place by the crimp.

9 Extend the cable jacket with the shield into the connector about 5 mm for strain relief and shielding connection.

10 Wrap the twisted braid firmly around the cable jacket and let the crimping tail of the RJ45 plug envelop it.

**Important Note!** To ensure proper grounding, it is essential that the twisted braid be firmly connected to the RJ45 plug.

Twisted Braid Enveloped by Crimping Tail

11 Crimp the RJ45 plug with the crimp tool. Make sure the twisted shield is crimped firmly to the RJ45 plug.

12 Verify that the wires ended up the correct order and that the wires extend to the front of the RJ45 plug and make good contact with the metal contacts in the RJ45 plug.

13 Push back the CAT5E plug cover on the connector plug.

**Note:** It is recommended that the newly prepared cable be tested with a Cable Analyzer such as the FLUKE DTX-1800 (or the equivalent), to make sure the cable complies with ANSI/TIA/EIA-568-B-2. Make sure to verify both connectivity and grounding continuity at both ends of the cable.
### 3.10.2 Preparing the Ethernet Cable Already Assembled

To prepare the Ethernet cable already assembled:

1. Release the gland cap and the gland rubber slightly.

2. Insert the CAT5E cable into the gland cap and into the rubber gland.

3. Insert the CAT5e cable into the gland body.
3.10.3 Connection of Ethernet Cable to IP-20E

To connect the Ethernet cable to the IP-20E:

1. Remove the relevant cap from the IP-20E radio. You can use the side of the gland to unscrew the cap.

2. Connect the CAT5E cable to the IP-20E.
3  Screw the gland into the radio unit.

**Important Note!** Before tightening the gland, make sure the gland is even with the cover. Tighten the gland gently and make sure there is no resistance. If there is resistance, stop immediately and verify that the gland is not being inserted at an angle. Tightening the gland at an angle can ruin the thread on the gland and prevent proper sealing of the interface.
4   Tighten the gland cap.
5   Secure the cable to the gland using a tie wrap.
3.10.4 Connection of Extension Cable to IP-20E

This cable is supplied with the glands attached. It is used to connect two IP-20E radios in XPIC and HSB configurations. To connect the Extension cable to the IP-20E:

1. Remove the hexagon cap from the IP-20E radio. You can use a flat screwdriver or a wrench to open the cap.

2. Connect the CAT5e cable to the IP-20E.
3. Screw the gland into the radio unit.

**Important Note!** Before tightening the gland, make sure the gland is even with the cover. Tighten the gland gently and make sure there is no resistance. If there is resistance, stop immediately and verify that the gland is not being inserted at an angle. Tightening the gland at an angle can ruin the thread on the gland and prevent proper sealing of the interface.

4. Tighten the gland cap.

5. Connect the other side of the cable to the other IP-20E following steps 1-4.
4. PoE Injector Installation and Connection

4.1 PoE Injector Cable Connection

The PoE Injector cables are connected similar to the IP-20E.

- To connect an Ethernet (CAT5e) cable to the PoE port, refer to Connection of Ethernet Cable to IP-20E on page 51.
- To connect a DC power cable to the power port, refer to Connecting a DC Power Cable on page 45. This cable is not supplied with the PoE Injector.
- The total length of the cable between the IP-20E port and the Switch/Router the device is connected to should not exceed 100m/328ft. This length includes the connection between the IP-20E and the PoE Injector (X1 + X2 ≤ 100m/328ft in the figure below).

**Note:** The length of the cable connecting the customer equipment to the PoE injector should not be longer than 10m (according to ANSI/TIA-568 standard).

![Diagram of PoE Injector Connections](image)

**Note!** For the warranty to be honored, the connection must be through the glands only. Do not open the PoE injector box cover.

4.2 PoE Injector Grounding

To ground the PoE Injector:

1. On the right side of each PoE Injector, loosen the screw, plain washer, and serrated washer.
2. Place the cable lug (supplied with the PoE injector kit) between the plain and serrated washer.
3. Tighten the screw.
4.3 PoE Injector Wall Mount Installation

List of Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PoE Injector</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Glands Kit</td>
<td>1</td>
<td>For outdoor installations.</td>
</tr>
</tbody>
</table>

*Note:* Glands are required for outdoor installations. The glands kit (three or five glands) is not supplied with the PoE Injector, and must be ordered separately.

**Glands Kit**

<table>
<thead>
<tr>
<th>Marketing Model</th>
<th>Marketing Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP-20_3xGlands_kit</td>
<td>IP-20_3xGlands_kit</td>
</tr>
<tr>
<td>IP-20_Glands_kit</td>
<td>IP-20_Glands_x5_kit</td>
</tr>
</tbody>
</table>

**Required Tools**

- Metric offset wrench key wrench set
- Hammer
- Drilling Machine

**Procedure**

1. Mount and tighten the PoE Injector to a wall using two M6 bolts and anchors. The M6 bolts and anchors must be purchased separately.

   *Note:* Use Anchor Stainless Steel with flanged Hexagonal nut M6X70.

2. Drill two 6mm diameter holes with 100mm distance between the center of the holes.
3. Insert the anchors with the bolts.
4. Place the washers on the bolt.
5. Tighten the nuts.
4.4 PoE Injector Pole Mount Installation

List of Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PoE Injector</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Required Tools

- Slot Screwdriver

Procedure

To mount the PoE Injector on a pole:

1. Mount and tighten the PoE Injector to a pole with a diameter of 114 mm using a stainless steel hose clamp.
2. Pass the hose clamp through the pole mount slots.

**Note!** The Hose Clamp is not supplied with PoE injector kit.

3. Attach the PoE injector to the pole.
4. Connect the ends of the hose clamp.
5. Tighten the hose clamp using the captive screw.
4.5 PoE Injector 19” Rack Installation

List of Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PoE Injector</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>PoE Injector 19” Rack Mount Kit</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Required Tools

- Philips Screwdriver

To mount the PoE Injector on a rack:

1. Mount the PoE Injector to a 19” rack using a 19” rack adaptor.
2. Mount the PoE Injector on the 19” adaptor through the wall mounting holes, using M6 screws and washers.

3. Mount the 19” rack adaptor to a 19” rack using four M6 screws and cage nuts.
4.6 PoE Injector ETSI Rack Installation

List of Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PoE Injector</td>
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<td></td>
</tr>
<tr>
<td>2</td>
<td>PoE Injector ETSI Rack Mount Kit</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Required Tools

- Philips Screwdriver

To mount the PoE Injector to an ETSI rack:

1. Mount the PoE Injector to an ETSI rack using a 19" rack adaptor and ETSI adapting ears.
2. Connect the ETSI adapting ears to a 19" rack adaptor using four M6 screws.
3 Mount the PoE Injector on the adaptor through the wall mounting holes using M6 screws and washers.

4 Mount the 19” rack adaptor with the ETSI ears on the ETSI rack using four M6 screws and cage nuts.

**Note:** For this type of installation, a 2RU space is required.
5. Generic Installation Procedures and Notes

5.1 Pole Mount Assembly and Installation

The pole diameter range for pole mount installations is 8.89 cm – 11.43 cm (3.5 inches – 4.5 inches).

List of Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IP-20E Mounting kit for the IP-20E</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Required Tools

- Socket key wrench inch set
- Socket key wrench metric set
- Open metric wrench set

Procedure

1. Align the azimuth adjuster and the elevation adjuster.

![Azimuth Adjuster](image1.png) ![Elevation Adjuster](image2.png)
2 Connect the azimuth and elevation adjusters with two sets of M10x30 bolts, nuts, spring washers, and flat washers. Do not tighten the bolts at this point in the installation.

3 Insert two M10x130 bolts on the azimuth adjuster.
4. Remove the nuts, spring washers, flat washers, and square cushion block from the azimuth adjuster bolt.

5. Insert the azimuth adjuster bolt onto the azimuth adjuster.
6. Rotate the azimuth adjuster to connect the azimuth adjuster bolt with the elevation adjuster with an M10x55 bolt, spring washers, and flat washers, and install the nuts, washers, and square cushion block removed in Step 4 on the azimuth adjuster bolt.
7. Tighten all the bolts, as shown in the following figure.

8. Mount and tighten the pole mount to a pole with a diameter of 114 mm using the two washers and screws supplied with the IP-20E integrated antenna pole mount kit.

*Mount Pole Mount to Pole*
5.2 Performing Antenna Alignment Using the Integrated Antenna Pole Mount

You can perform adjustments to the azimuth and elevation of the antenna by turning bolts on the pole mount.

5.2.1 Adjusting the Antenna’s Azimuth

5.2.1.1 Large-Scale Azimuth Adjustment

To perform large-scale azimuth adjustment:

1. Loosen the two nuts (1 in the figure above) on the clamp (2 in the figure above) on the pole mount.
2. Push the pole mount softly, by hand. The pole mount is adjustable 360° around the pole.

5.2.1.2 Fine Azimuth Adjustment

To perform fine azimuth adjustment:

1. Loosen the top and bottom fixed bolts on the azimuth axis (3 in the figure above).
2. Loosen the two nuts and bolts (4 and 6 in the figure above) on the fine adjusting bolt (1 in the figure above).
3 Move the adjusting nut (③ in the figure above) slowly backwards and forwards to adjust the antenna azimuth within ±15°.
4 Tighten the top and bottom fixed bolts and the nuts and bolts on the fine adjusting bolt.

5.2.1 Adjusting the Antenna’s Elevation

To adjust the elevation of the antenna:

1 Loosen the top and bottom bolts that connect the pole mount to the antenna adaptor (①, in the figure below).
2 Rotate the elevation adjusting bolt (② in the figure below) to adjust the antenna's elevation within ±15°.
3 Tighten the top and bottom bolts connecting the pole mount to the antenna adaptor. The recommended torque for these bolts is 25 Nm.

Fine Elevation Adjustment
6. IP-20E Detailed Configurations Description

6.1 1+0 Direct Mount Installation

List of Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IP-20E RADIO</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Required Tools

The following tools are required for the IP-20E installation:

- Metric offset hexagon key wrench #6
- Phillips #2 screwdriver

Procedure

To install the IP-20E in a direct mount 1+0 configuration:

**Important!** Do not remove the transparent pressure window located on the antenna interface.

Note: If necessary, change the antenna polarization by rotating the unit in accordance with the relevant antenna installation guide.
**Horizontal / Vertical Pole**

**VERTICALLY POLARISED**

- Note Alignment of transition with timing letters on mounting ring

**HORIZONTALLY POLARISED**

- Rotate transition to adjust polarisation
- Note Alignment of transition with timing letters on mounting ring

Torque M6 ODU/Coupler hardware to 12Nm.

Loosen the two clamping screws and remove to adjust polarisation. Make sure the screws seat correctly in the alignment notches on substraction. Tighten to a torque of 5Nm (3.59 lbf-ft)
Twist orientation:

- For horizontal polarization, locate the twist with the letter "H" vertical to the hook cover and fasten the two screws.
For vertical polarization, locate the twist with the letter "V" vertical to the hook cover and fasten the two screws.

1. Mount the IP-20E on the antenna using the four M8 captive screws and washers that are supplied, assembled, in the IP-20E, and tighten the screws.

**Note:** Make sure the polarization mounting direction of the IP-20E is correct.
6.2 1+0 with 43 dBi Flat Antenna

List of Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IP-20E RADIO with 43 dBi FLAT ANTENNA</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>IP-20E Mounting kit for the IP-20E</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Required Tools

The following tools are required for the IP-20E installation:

- Metric wrench #13 and #16

Procedure

When you order an IP-20E with a 43 dBi flat antenna, the radio and antenna are delivered together as a single unit. The polarization is determined by the placement of the radio-antenna unit. To comply with Class 2 RPE pattern, the unit must be installed in a diamond-shaped position, so that the vertical polarization is either 45° to the right (V+45) or 45° to the left (V-45). The letters "A" and "B" are placed on the upper corners of the radio to help the installer to position the unit with the correct polarization.
IP-20E Radio with 43 dBi Flat Antenna – Polarization Labels
In a V+45° installation, the letter A on the unit must be on top. In a V-45° installation, the letter B on the unit must be on top. The following figures show each type of installation.

V+45° Polarization

V-45° Polarization

The units in a link must be placed so that they are in a position that is a mirror image of the unit at the other side of the link. For example, if the unit at the local site is installed with a V+45° polarization, the unit at the remote site must be installed with a V-45° polarization, and vice versa.

To install an IP-20E with a 43 dBi flat antenna:

1. Attach the L-bracket provided with the IP-20E to the pole mount.
2. Attach the radio to the L-bracket according to the correct polarization, with the pole behind the radio, and tighten the two captive screws. The installation angle depends on whether you are installing the radio with a V+45° polarization, a V-45° polarization, or vertical polarization.

The following figures show the various polarization options. The first figure shows a V+45° polarization, with the letter A on top and the gland pointing down and to the left. The second figure shows a V-45° polarization, with the letter B on top and the gland pointing down and to the right. The third figure shows a vertical polarization.

*V+45° Polarization (A on Top)*
V-45° Polarization (B on Top)

Vertical Polarization
3. When looking at a complete link the radios should be aligned in the same direction. This means the radios face each other in a mirror image, as shown in the following figure.

Complete Link – $V^{-45°}$ Polarization at Local Site (Left), $V^{+45°}$ Polarization at Remote Site (Right)
6.3 2+0 Single Polarization

List of Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IP-20E Radio</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>IP-20E Coupler kit</td>
<td>1</td>
<td>For 2+0 SP configurations, use a splitter.</td>
</tr>
<tr>
<td>3</td>
<td>RFU-C Twist Kit</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Required Tools

The following tools are required for the installation:

- Metric offset hexagon key wrench #6
- Phillips #2 screwdriver
- Metric offset hexagon key wrench #2.5 and #3

Procedure

To install an IP-20E in a direct mount 1+1 or 2+0 SP configuration:

1. Mount the twist to the coupler or splitter using the O-Ring and four screws supplied in the Twist kit, and tighten the screws.

Important: Make sure the polarization mounting direction of the twist to the coupler or splitter is according to the antenna polarization.
2 Mount the coupler or splitter on the antenna using the four M8 screws and washers supplied with the coupler or splitter kit, and tighten the screws.
3 Mount the two O-Rings supplied with the coupler or splitter kit, as shown in the following figure.
4 Mount the IP-20E to the body of the coupler or splitter using the four M8 captive screws and washers that are supplied, assembled, with the IP-20E, and tighten the screws.
6.4 2+0 Dual Polarization

List of Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Remarks</th>
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</thead>
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<tr>
<td>1</td>
<td>IP-20E Radio</td>
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<td></td>
</tr>
<tr>
<td>2</td>
<td>IP-20E OMT Kit</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Required Tools

The following tools are required for the installation:
- Metric offset hexagon key wrench #6
- Phillips #2 screwdriver
- Metric offset hexagon key wrench #2.5 and #3

Procedure

1. Mount the OMT on the antenna using the four M8 screws and washers supplied with the OMT kit, and tighten the screws.
2. Mount the two O-Rings supplied with the OMT kit, as shown in the following figure.
3 Change the polarization of one of the IP-20E radios to 'H' polarization.
4 Mount an IP-20E radio to each side of the OMT. When mounting the radios, make sure that one side is polarized 'V' and the other side is polarized 'H'. Tighten the radios to the OMT kit using the four M8 captive screws and washers that are supplied, assembled, with the IP-20E radio.
## 7. Appendix A: Mediation Device Losses

<table>
<thead>
<tr>
<th>Mediation Device</th>
<th>Maximum Insertion Loss (Main/Secondary)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OMT</td>
<td>0.5dB (both on V and H)</td>
</tr>
<tr>
<td>Splitter 1:2</td>
<td>Splitter: 3.7:3.7dB</td>
</tr>
<tr>
<td>Coupler 1:4</td>
<td>Coupler: 2.7dB</td>
</tr>
</tbody>
</table>