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# ChoiceConnect

## CCU 100 and Repeater 100 Installation Guide

## Identification

CCU 100 and Repeater 100 Installation Guide  
29 July 2011 TDC-0971-xxx

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## Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference that may cause undesirable operation.

This device must be permanently mounted such that it retains a distance of 20 centimeters (7.9 inches) from all persons in order to comply with FCC RF exposure levels.

USA, FCC Class B - Part 15

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 or TV technician for help.

## Compliance Statement Canada

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

## Déclaration de Conformité

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

This device complies with Industry Canada licence-exempt RSS standard(s). 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.

Le présent appareil est conforme aux CNR d'Industrie 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, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.



## **Caution ELECTROMAGNETIC COMPATIBILITY**

**Use only approved accessories with this equipment. In general all cables must be high quality, shielded, and correctly terminated. Unapproved modifications or operation beyond or in conflict with these instructions for use, may void authorization by the authorities to operate the equipment.**

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## Before You Begin





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-  **Important** Proper installation of the CCU/Repeater ensures trouble-free operation of the Itron Fixed Network system. The installation of both the collector and repeater must be done by professional installers.

## Documentation Conventions

This document uses the following conventions.

Convention	Example
Key presses are in <b>bold</b> .	Click <b>OK</b> to finish.
Menu paths are in bold.	Select <b>Start &gt; File &gt; Save As</b> .
Computer commands to be typed by the user are in a monospace font.	At the C: prompt, type <code>cd itron/bin</code>
File names are in a monospace font.	The data is uploaded to the <code>upload.dat</code> file
Hypertext links are <a href="#">blue</a> .	See the <a href="#">Copyright</a> page for the contact information.

-  **Note** A note indicates neutral or positive information that stresses or supplements important points of the main text. A note supplies information that may apply only in special cases.
-  **Caution** A caution advises users that failure to take or avoid a specified action could result in a loss of data.
-  **Warning** A warning advises users that failure to take or avoid a specified action could result in physical harm to the user or the hardware.
-  **Tip** A tip helps users apply the techniques and procedures described in the text to their specific needs. A tip is not essential to the basic understanding of the text.

## Related Documents

For more information about CCUs/Repeaters and the Fixed Network, see the following:

- Network Collection Engine v4.x User Guide*
- Motorola R56 Manual- Standards and Guidelines for Communication Sites*  
Available from Motorola. This manual illustrates industry best practices for mounting and grounding antenna systems, and routing antenna cables into buildings. Use this guide as a reference when remotely mounting the 900 MHz antenna.



## CHAPTER 1

# CCU/Repeater Basics

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The CCU 100 (also known as a cell control unit or collector) and the Repeater 100 are configurable for different installation locations, including:

- On a water or communications tower.
- On a pole (such as an electricity or light pole).
- On a wall (indoor or outdoor).
- On a pipe (between 2 and 3.5 inches in diameter).
- On a roof.

Integrated mounting and coupling brackets secure the device in high winds and under heavy ice loads.

The CCU 100 also supports an optional solar power kit. Kits are sized by peak sun hour calculations which vary regionally across the country. The kit includes solar panels and a large battery backup unit. Size and weights vary by package type (based on peak sun hours).

A CCU/Repeater consists of a number of components in a single weatherproof device. Electrical components are encased in a plastic enclosure that provides double insulation and a high level of safety for the installer.



**Caution** Only authorized Itron personnel may open this device. Unauthorized access or modifications to this device voids the warranty.

Per FCC rules, unapproved modifications or operation beyond or in conflict with these instructions for use could void the user's authority to operate the equipment.

## CCU Configuration

A Fixed Network system administrator must configure each CCU 100 before it can be installed in the field. Verify with your supervisor or the system administrator that all CCUs are configured before you attempt to install them.

Please see the *Collector Configuration Application v4.x User Guide* for more information.

## CCU/Repeater Components

The CCU 100 and Repeater 100 come in two basic configurations; they may have either internal GPS/WAN antennas or external GPS/WAN antennas. The external CCU/Repeater configuration replaces the internal GPS/WAN antennas with external antenna connectors that allow both GPS and WAN antennas to be mounted externally. In the case of the Repeater 100, only an external GPS connection is provided; a WAN modem is not present in a repeater. Both internal antenna and external antenna configurations allow for remotely mounting the 900 MHz antenna by removing the antenna from the unit and attaching it to a remote antenna mounting plate.

Since the CCU/Repeater may be installed in an outdoor environment, each component of the CCU/Repeater is weather-tight and can withstand wind requirements in excess of 100 MPH.



**Note** When determining the configuration of the CCU/Repeater, be sure to review the *Fixed Network 100 Ordering Guide* for specific part numbers, cable lengths, and various options for the components.

## CCU/Repeater Module

The CCU/Repeater case houses the backup battery, GPS receiver, optional WAN radio, processing board and 900 MHz radio. The antennas for the radios can be either internally or externally connected, depending on the CCU/Repeater configuration.

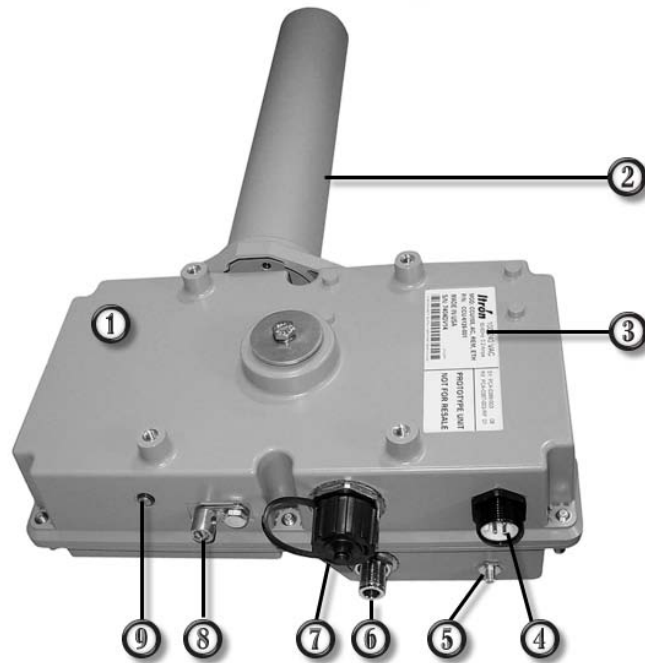


**Caution** Only authorized Itron personnel may open this device. Unauthorized access or modifications to this device voids the warranty.

Per FCC rules, unapproved modifications or operation beyond or in conflict with these instructions for use could void the user's authority to operate the equipment.



The CCU shown below has connectors for the external GPS/WAN antennas. The component connections are described in the following table.



Item	Description
1	<b>CCU/Repeater module</b> Processes data from the antennas and relays it on to the Fixed Network Application Software. Only authorized Itron personnel may open this module.
2	<b>900 MHz antenna</b> This 900MHz antenna receives messages from and sends messages to endpoints and repeaters in the network. The connection for this antenna is a Type N female.
3	<b>CCU/Repeater label</b> Displays the collector identification number, model number, and other associated information.
4	<b>Power connector</b> Supplies power to the CCU/Repeater module. AC mains, DC, or solar power options are available. A three pin cable connects the CCU/Repeater to the mains supply. A two pin cable connects the CCU/Repeater to a DC supply. A five pin cable connects the CCU/Repeater to the solar system.
5	<b>External GPS antenna connector</b> This female SMA connector is only on the external antenna CCU/Repeater. Use this connector when mounting the GPS antenna externally.
6	<b>External WAN antenna connector</b> This female N connector is only on the external antenna CCU. Use this connector when mounting the WAN antenna externally.

<b>Item</b>	<b>Description</b>
<b>7</b>	<b>Ethernet</b> Connects the CCU/Repeater to the Ethernet backhaul. Also used to connect the CCU/Repeater to a router for initial collector setup. Mating weatherproof cables are available from Itron. These cables are sealed industrial ethernet circular IP67 connectors (CONEC) <b>Note</b> A waterproof cap seals the Ethernet port from the elements in the field. Be sure to securely attach the cap once the collector is installed.
<b>8</b>	<b>Ground lug</b> The ground lug is provided on both the CCU and the Repeater and should be attached to earth ground if no ground is available in the three conductor power cable or when using a photocell adapter. This ground helps protect the internal circuitry from high voltage transient events. The ground lug accepts AWG minimum wire size 14, and maximum wire size 4.
<b>9</b>	<b>Status indicator</b> This indicator displays the current operational status of the CCU/Repeater. See <a href="#">Status Indicator</a> on page 63 for more information.
*	<b>(Not shown) Battery door</b> Removal of this door allows access to the replaceable battery pack.

## External GPS/WAN Antenna System

The external antenna CCU/Repeater configuration uses a GPS/WAN antenna kit that is connected to the CCU/Repeater by one or two separate pieces of coaxial cable. Cables are not included in the kit.

- The WAN antenna is only connected in CCU installations that use a wide area network backhaul system.
- The GPS antenna is used in all deployments of this system.

The antennas must be installed in a location that allows reception of GPS and WAN signals.

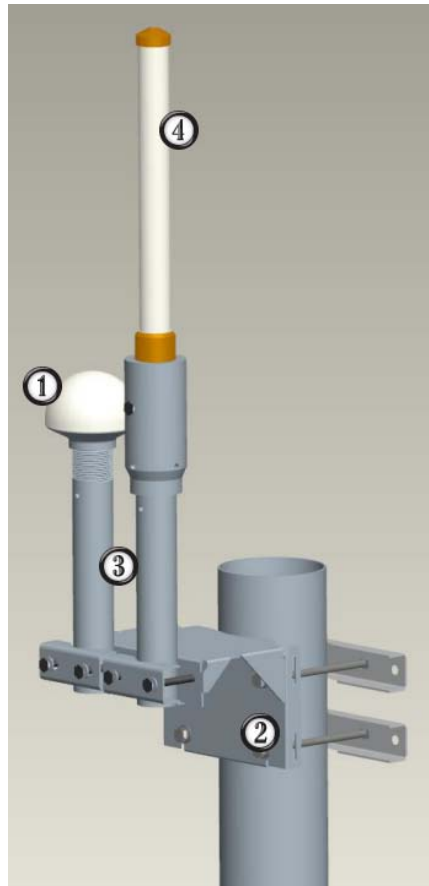
Itron recommends using a handheld GPS unit to verify that your GPS antenna mounting location can receive a signal from at least three satellites.

For more information, see [GPS and WAN Coverage](#) on page 8.



**Caution** The external GPS antenna must be oriented vertically when installed, and it must have an unobstructed view of the sky to properly receive a GPS signal.

The external GPS/WAN antenna system is shown below.



Item	Description
1	<b>External GPS antenna</b> Receives GPS data from orbiting satellites. The cable connection on the bottom of this antenna is TNC Female.
2	<b>Mounting bracket</b> Attaches the antenna to your desired mounting location.
3	<b>Antenna masts</b> Provide support for the GPS and WAN antennas. Cables for each antenna are routed through the masts. Clamps on the front of the mounting bracket secure the masts.
4	<b>External WAN antenna (CCU only)</b> Provides the wide-area network (WAN) signal for the CCU. The Repeater does not use this antenna. The cable connection on the bottom of this antenna is N Female.

## 900 MHz Antenna

The 900 MHz antenna transmits and receives data messages from endpoints and repeaters in the network.

There are three antennas that may be used for the 900 MHz radio link.

- A standard vertically polarized antenna that is directly attached to the CCU/Repeater.
- A standard vertically polarized antenna (5 dBi) that can be connected remotely.
- A high-gain vertically polarized remote antenna (8.15 dBi) that is mounted remotely in place of the direct attached solution.

Remote antennas must be properly grounded during installation. When a remote antenna is used, a lightning arrestor is supplied for this purpose.

Coaxial cable used to connect the 900 MHz antenna to the CCU/Receiver must be properly grounded. See [Lightning Arrestor](#) on page 12 for more information. All coaxial cable connections must be properly weather-proofed per industry standards, unless otherwise specified. If the CCU/Repeater is installed indoors, only the connections located outside need to be weather-proofed. When the CCU/Repeater is ordered with a remote 900 MHz antenna kit, some associated mounting hardware is included. Coaxial cables for the remote 900 MHz antennas are not included in the kit. These cables must be provided by the installer. Please see [Coaxial Cable](#) on page 13 for coaxial cable specifications.

For more information, see:

- [Antenna Specifications](#) on page 58
- [Remote 900 MHz Antenna Placement](#) on page 10
- [Grounding the Remote/External Antenna Systems](#) on page 11

## Planning a CCU/Repeater Installation

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This chapter describes how to prepare for a CCU/repeater installation.

### Installation Profiles

The CCU/Repeater can be installed in a variety of configurations and locations.

Depending on the installation location, the CCU or Repeater components may be installed all in the same place (as an integrated solution), or the GPS/WAN antennas may be installed externally from the CCU/Repeater and the 900 MHz antenna can be installed remotely (as a distributed solution).

For example, the CCU/Repeater can be installed at the base of a water tower, the external GPS/WAN antenna system can be mounted further away for optimum reception, and the 900 MHz antenna can be placed at the top of the water tower.

The following profiles have been identified for CCU installation.

<b>Location</b>	<b>Description</b>
Utility pole	The CCU/Repeater is installed on a utility pole. The CCU/Repeater should be mounted as high as possible on the pole for optimum reception.
Light pole	The CCU/Repeater is installed on either a light pole or the davit arm that extends from the light pole. The CCU/Repeater should be mounted as high as possible on the pole for optimum reception.
Outdoor wall or pipe with remote 900 MHz antenna	The CCU/Repeater is installed on an outside wall or pipe with the 900 MHz antenna remotely mounted to achieve the maximum elevation and reception.
Indoor wall or pipe with remote 900 MHz antenna and external GPS/WAN antennas	The CCU/Repeater is installed inside an equipment room with the 900 MHz antenna remotely mounted to achieve maximum elevation and reception. The WAN (or other digital cellular) and GPS antenna are externally mounted to provide acceptable coverage.
Pipe	The CCU/Repeater is secured to a pipe or fence railing (from 2 to 3.5 inches in diameter). This type of installation typically occurs on the tops of water towers.

For more information on these various profiles, as well as the Itron-recommended profile, see [Chapter 3, Installing the CCU/Repeater](#) on page 17.

## Siting CCUs/Repeaters

CCUs/Repeaters are installed in the field on a variety of surfaces, such as wooden or metal walls, metal pipes, fence railing, and utility poles.

When determining where to place the CCU/Repeater, there are four primary considerations:

- Siting for optimum RF reception.
- Siting for optimum GPS and/or WAN reception.
- Availability of Ethernet connection (if required).
- Availability of power connection.
- Availability of a structure or location that can physically support the CCU/Repeater and its mounting hardware.



**Caution** Always ensure that you have permission to install a CCU/Repeater at your chosen site prior to beginning installation.

## Propagation Study and CCU/Repeater Site Selection

Prior to installing a CCU/Repeater in the field, consult with Itron to perform a propagation study. This study:

- Evaluates the quantity and types of endpoints in the network.
- Assesses environmental and geographical considerations related to CCU/Repeater installation.
- Optimizes CCU/Repeater placement in the network for the best possible reception.
- Helps influence the physical and structural implications of mounting a CCU/Repeater to a given surface.

Once the propagation study is complete, you can determine exactly where to install CCUs/Repeaters and what they will be mounted to.

## GPS and WAN Coverage

CCUs/Repeaters must be installed in locations where a GPS signal is strong and consistent. If WAN is being used as the communications backhaul for the network, a strong and consistent WAN signal is required as well (for CCUs only). If the signal is too weak, or its availability fluctuates, the CCU/Repeater can not gather accurate date/time information or communicate with the Fixed Network software.

Itron recommends using a handheld GPS unit to verify that your CCU/Repeater or external GPS antenna mounting location can receive a signal from at least three satellites.

To ensure the best possible signal, avoid installing the CCU/Repeater or the external antennas in the following ways:

- Adjacent to or between tall buildings, signs, towers, or bridges.
- Near swaying limbs, branches, or cables that could strike and damage the antenna.
- Between, beneath, or near highway overpasses, elevated train platforms, or tunnels.
- Near objects or devices attached to the same pole.
- Within 500 feet of high power radio frequency (RF) transmitters (such as paging transmitters, cellular transmitters, and municipal communications transmitters).
- Near potential broadband sources of radiated RF energy (such as power line transformers, RADAR transmitters, cellular antennas, and neon or fluorescent signs).
- Inside metal enclosures (the antennas will not communicate if surrounded by metal) or inside a building. The CCU/Repeater can be installed in a building or other metal enclosure, but the antennas must be installed externally.



**Warning** Before installing a CCU/Repeater near or on the same pole as a transformer, consult the National Electrical Safety Code (NESC), local utilities, municipalities, and cable and telephone companies for recommended distances from transformers and power lines.

## AC Service Requirements

A 90 to 265 VAC 10A power source is required at the installation site for the CCU/Repeater, unless you are using the DC CCU/Repeater or the solar CCU/Repeater. For more information on these options, see [Mains Power Installation Profiles](#) on page 13 or [Solar Power Installation Profiles](#) on page 44.

## External Ethernet Connections

If the Ethernet is used as the communications backhaul, the CCU installation site must have Ethernet access. Also, be sure to use weatherproof cables in this type of installation.



**Caution** When using Ethernet as the communications backhaul, the CCU must be identified as Ethernet-based when performing Initial Collector Setup (ICS). Failure to do so prohibits the CCU from communicating with the Network Collection Engine.

## Remote 900 MHz Antenna Placement

Antenna placement is one of the most important factors in determining your overall system performance. Careful consideration must be given to proper antenna placement. Follow the general guidelines below when determining the ideal location for a remote-mounted 900 MHz antenna.

- The antenna must be mounted vertically.
- The antenna needs to be mounted in a location where it has a clear unobstructed 360 degree view of the horizon. The antenna receives and transmits in all directions. Any objects such as building walls, nearby metal surfaces or other obstructions will interfere with the proper operation of the antenna. Mounting on a rooftop, where nearby buildings are higher than the installation location, is not an ideal location for the antenna.
- Do not mount the antenna near existing RF radiating antennas. If existing RF radiators are nearby, the horizontal separation distance to the radiator must be a minimum of 100 feet and/or 10 feet of vertical separation. In instances where nearby RF radiators are present, conduct an intermodulation interference study to evaluate the potential for interference and any effects it may have on system performance. Consult with your Itron systems engineer for more information.
- Height is preferred for optimal performance. Mount the antenna as high as possible, but Itron recommends that you install the antenna no higher than 100 feet. If the antenna is going to be more than 100 feet above the CCU, Itron recommends using a Tower CCU 100.

A side arm antenna installation must be done if the 900 MHz antenna is mounted where it does not have an unobstructed 360-degree view. Refer to the following guidelines for a side arm antenna installation.

- For the 900 MHz antenna, the minimum standoff distance is 24 inches, where the interfering structural members are four inches or less in diameter and spaced more than eight feet apart.
- For structural members between 4 and 10 inches in diameter, a sliding scale of 2 to 5 feet is to be used. (For example, a 24 inch standoff at 4 inch diameter to a 60 inch standoff at 10 inch member diameter.)

Provide Itron with any conditions that may impact the CCU/Repeater's performance.



## Grounding the Antenna System

To minimize the potential for a lightning event, it is essential that remote/external antenna systems be properly grounded. Proper grounding prevents the accumulation of static charges on the antenna system and also provides a direct discharge to ground for any acquired charges.

All grounding materials and procedures must meet or exceed local codes. Use coaxial grounding kits recommended by the coaxial cable manufacturer.



**Warning** Under no circumstances should the antenna grounding wires be run inside a building. Always install ground bars and grounding material on the exterior of buildings.

The recommended procedure for grounding an antenna system is as follows:

- Mount a copper ground bar near the antenna. This is the top ground bar.
- Mount a second copper ground bar near the CCU/Repeater. This is the bottom ground bar.
- Connect the two ground bars with a #6 gauge green jacketed stranded wire or a #2 solid copper wire.
- Ground the antenna mount and the top coaxial ground kit to the top ground bar.
- Ground the bottom coaxial ground kit and the lightning arrestor to the bottom ground bar.
- Connect the bottom ground bar to one or more earth ground rods.
- All ground wires should be connected straight to ground, with no right angle turns or sharp bends in the wires.
- Install ground leads on coaxial grounding kits without loops or bends and install grounding kits in the proper orientation per the manufacturer's specifications.

## Lightning Arrestor


A lightning arrestor (or surge protector) capable of withstanding multiple lightning strikes should be installed when using a remote/external antenna. This helps protect the CCU/Repeater in the event of a lightning strike.

The lightning arrestor is fitted to the coaxial antenna cable at the SURGE end and the RF jumper cable that connects to the CCU/Repeater module at the PROTECTED end. It includes a bulkhead connector interface that mounts to a ground plate with a washer and nut. The arrestor is also furnished with a ground lug, if your installation does not have provisions for a ground plate. The ground lug on the arrestor is designed for #2AWG solid or stranded wire. The ground wire must be crimped to this lug, never soldered.

 **Caution** The lightning arrestor must be connected to an earth-ground.



The top and bottom ends of the coaxial cable attached to the tower should be electrically grounded with kits for lightning protection. The antenna input connection cannot serve as the top ground point. For cable lengths in excess of 200 feet, ground the vertical cable run every 100 feet.

 **Note** The installer must supply any mounting brackets and cable-management clips to secure the coaxial cable to the tower or structure, when using a remote/external antenna. Consult your cable manufacturer for specifications on proper clips and grounding kits. Conduit clamps and tie wraps are not satisfactory methods for securing coaxial cables.

For a remote 900 MHz installation with a high gain antenna, a lightning arrestor is supplied by Itron in the CCU 100/Repeater 100 kit materials.

## AC Mains Power

The AC mains wiring to the CCU/Repeater utilizes a three conductor cable. This cable can be terminated with either a NEMA L5-15 (125V, 15A) or a NEMA L6-15 (250V, 15A) locking plug in order to meet local electrical codes. The CCU should be powered by a dedicated 10A circuit. The CCU/Repeater should *not* be connected to a circuit protected by a GFCI breaker. Power wiring on the Itron supplied power cable follows conventional color coding for AC wiring: Green/Ground, White/Neutral, Black/Hot.



**Warning** The CCU/Repeater must be grounded by using either the ground wire in the three conductor cable or the grounding lug on the bottom of the CCU/Repeater. For installations that use the photocell adapter the grounding lug must be used to ground the CCU.

## DC Mains Power

The DC wiring to the CCU/Repeater utilizes a two conductor cable. The CCU should be connected to a 10A DC circuit breaker or fuse. Wiring of the Itron supplied two conductor cable is accomplished by attaching the red wire to a +12V source and attaching the black wire to ground.

## Materials Not Provided by Itron

The following materials are not provided by Itron in the CCU/Repeater kit, but are required for installation.

Please acquire these items prior to beginning an installation.

- [Coaxial cable](#) on page 13 (for remote/external antennas)
- [Connectors](#) on page 15
- [Mounting hardware](#) on page 15

### Coaxial Cable

When mounting the remote/external antennas, coaxial cable must be supplied to connect the antenna to the CCU/Repeater. The proper size of cable is dependent on total cable length and frequency. Coaxial cable also requires proper hoisting grips, ground kits, connectors, jumpers, hangers, and weather proofing material. Coaxial cable and accessories are not provided by Itron. Coaxial cable systems must be installed according to the manufacturer's specifications. Itron recommends using qualified radio installation contractors to install the remote/external antenna system.

### Remote Mount 900 MHz Antenna on a Standard CCU/Repeater

When selecting cable for the remote mount 900 MHz antenna on the standard (non-tower) CCU/Repeater, total cable loss cannot exceed 1.5 dB to maintain system performance. Allow 0.1 dB loss for each connector.

## Remote Mount High Gain (8.15 dBi) 900 MHz Antenna on a Tower CCU

The table below lists several options for coaxial cable that can be used with the remote mount high gain 900 MHz antenna. When installing the high gain antenna on a Tower CCU the FCC has set limits to the maximum transmit power of the CCU. In order to meet these limits, Tower CCUs with FCC ID number EO9CCU100T must have a minimum of 2.2 dB worth of loss (but not more than 3.5 dB) between the tower cabinet and the antenna. All other tower CCUs should be installed with minimum cable loss.

Allow 0.1 dB loss for each connector. If required, a 1 dB attenuator (similar to the Pasternack PE7002-1) may be used to attain the desired power at the antenna.

Coax specification	Total Coaxial length		
	0-120 ft.	121-200 ft. (high-gain antenna only)	201-250 ft. (high-gain antenna only)
Standard black jacket cable	AVA5-50	AVA6-50	AVA7-50
Optional fire retardant cable	AVA5RK-50	AVA6RK-50	AVA7RK-50
Cable diameter (nominal)	7/8 in.	1-1/4 in.	1-5/8 in.
Cable weight (lb./ft.)	0.33	0.46	0.70
Minimum bend radius	10 in.	8 in.	15 in.
Cable attenuation @ 915 MHz	~ 1.2 dB/100 ft.	~ 0.84 dB/100 ft.	~0.70 dB/100 ft.

## External GPS and WAN Antennas

The primary requirement for any coaxial cable used with the external GPS or WAN antenna is to have less than 5 dB of attenuation at 1.5 to 1.8 GHz for the entire length of cable, including connector losses.

You may use any type of 50 ohm coaxial cable, as long as the total loss, including connectors is less than 5 dB at 1.5 to 1.8 GHz.

If you are using coaxial cable larger (or stiffer) than 1/2 inch superflex, add a short (less than 5 feet) piece of LMR 400 cable to each end before connecting the cable to the CCU and the antennas. Use the appropriate connectors between the LMR 400 and larger coaxial cable.

If the antennas are mounted in an exposed outdoor environment, you must provide lightning protection and proper grounding. For more information on lightning protection and grounding, see [Lightning Arrestor](#) on page 12, [Grounding the Remote/External Antenna Systems](#) on page 11 and the Motorola R-56 guidelines.

## Antenna Sweep Test

After remote antenna installation perform an antenna system sweep test and verify that VSWR (voltage standing wave ratio) does not exceed 1.5:1. For more information, see [Perform an Antenna Sweep Test](#) on page 64.



**Caution** All coaxial cable used to connect an antenna to the CCU/Repeater must be properly grounded at the top and bottom of the coaxial line. Additionally, any cable lengths of 200 feet or greater must be grounded each 100 feet. See [Lightning Arrestor](#) on page 12 for more information.

## Antenna Connectors

Connectors for the 900 MHz and WAN antenna cables need to be male Type N connectors and must be sized according to the type of coaxial cable used. The GPS cable requires TNC male and SMA male connectors. These connectors are available from a variety of manufacturers.



**Important** All coaxial cable connections must be properly weather-proofed per industry standards unless otherwise specified. If the CCU/Repeater is installed indoors, only the connections located outside need to be weather-proofed.

## Mounting Hardware

Depending on your installation location and configuration, the following mounting hardware must be supplied by the installer to properly attach the CCU/Repeater to the mounting surface.



**Caution** Since each installation is unique, you must ensure that the mounting hardware you supply can securely support the CCU/Repeater. The CCU/Repeater (minus attachment hardware) weighs 7 pounds. Itron recommends consulting with a qualified engineer to verify load requirements and safety issues. Also, be sure to check and comply with local codes when installing the CCU/Repeater.

Profile	Mounting surface	Suggested hardware/sizing
Utility pole	Wood or steel pole	High-strength stainless steel straps
Light pole	Steel light pole	High-strength stainless steel straps
Outdoor wall or pole with remote 900 MHz antenna	Concrete, wood, or steel wall	1/4 inch-20 lag screws or 1/4 inch-20 molly bolts
	Wood or steel pole	High-strength stainless steel straps
Indoor wall or pole with remote 900 MHz antenna and external GPS/WAN antennas	Concrete, wood, sheetrock, or steel wall	1/4 inch-20 lag screws or 1/4 inch-20 molly bolts
	Wood or steel pole	High-strength stainless steel straps
Pipe	2.5 inch to 3.5 inch galvanized steel pipe	Two pipe mount brackets for pipes up to 3.5 inches in diameter, supplied by Itron (part number FAB-0192-001, two brackets are required for each CCU/Repeater).



# Installing the CCU/Repeater

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This chapter shows you how to install a CCU/Repeater in the field, using the Itron-recommended installation method.

The CCU/Repeater can be installed in a variety of ways. Several different CCU/Repeater installation profiles are shown in this chapter, for both mains powered and solar powered CCU/Repeaters.



**Warning** Before installing a CCU/Repeater, ensure that the selected location can support the weight of the CCU/Repeater and mounting hardware. A thorough structural analysis should be performed by a qualified engineer at your desired location prior to installation. Itron is not responsible for improper installations or for installations at a site that cannot adequately support the CCU/Repeater.

## Installation Overview

The following section shows you how to install a CCU/Repeater using the Itron-recommended profile. This profile calls for the CCU/Repeater to be mounted to a 2 inch diameter vertical pipe. A 110V source supplies mains power to the CCU/Repeater.



**Caution** Prior to installing a CCU in the field, be sure to configure it as described in the *Collector Configuration Application v4.0 User Guide*. A CCU cannot be configured after it has been installed in the field. Repeaters do not require pre-installation configuration.

There are several main steps to perform. Each step is described in more detail in the following sections.

1. [Attach the external GPS/WAN antennas](#) (on page 18) (if necessary).
2. [Attach the direct mount 900 MHz antenna](#) (on page 19) (if necessary).
3. [Attach the CCU/Repeater to the mounting surface](#) on page 21.
4. [Connect the cables](#) on page 29.
5. [Install the battery](#) on page 34.

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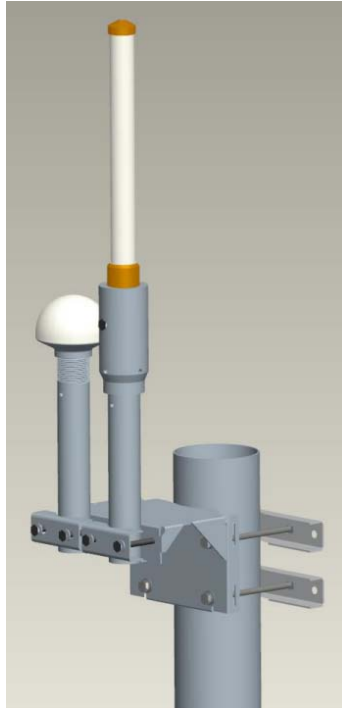
**Caution** Do not move or transport the CCU without first disconnecting power. Moving or tilting a CCU with power connected may cause the CCU to reset to the factory image.

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6. [Provide power](#) on page 37.
7. [Perform an antenna sweep test](#) on page 64.

## Attaching the External GPS/WAN Antennas

The external GPS and WAN antennas can be attached to pipes, poles, walls, and davit arms. A typical pole mount assembly is shown below.



### ***To attach the external GPS/WAN antennas***

1. Assemble the antenna unit as described in the *GPS/WAN Remote Antenna Mounting Kit Assembly Guide* included with the GPS/WAN External Antenna Mounting Kit.
2. Attach the GPS/WAN antenna unit coaxial cable as described in ["To connect cables"](#) on page 29.



## Attaching the Direct Mount 900 MHz Antenna

Attach the direct mount 900 MHz antenna before mounting the CCU/Repeater in its permanent location.

### ***To attach the direct mount 900 MHz antenna***

1. Slide the black rubber boot onto the base of the antenna as shown in the following illustration.



2. Screw the antenna onto the top of the CCU/Repeater. Be careful not to cross-thread the connectors. Do not over-tighten.



3. Push the rubber boot as close as possible to the top of the CCU as shown in the following illustration.



4. Slide the antenna sleeve over the antenna, ensuring that the front of the antenna sleeve is to the front of the CCU/Repeater.



5. Using the included screws and lock washers, screw the antenna sleeve to the top of the CCU/Repeater. Tighten the screws to 5 to 6 in/lbs.



## Attaching the CCU/Repeater

The CCU/Repeater may be attached to a variety of surfaces. See the following sections for diagrams showing some of the possible configurations.

- [Pipe mount](#) on page 22
- [Pole mount](#) on page 24
- [Wall mount](#) on page 26
- [Davit arm mount](#) on page 27

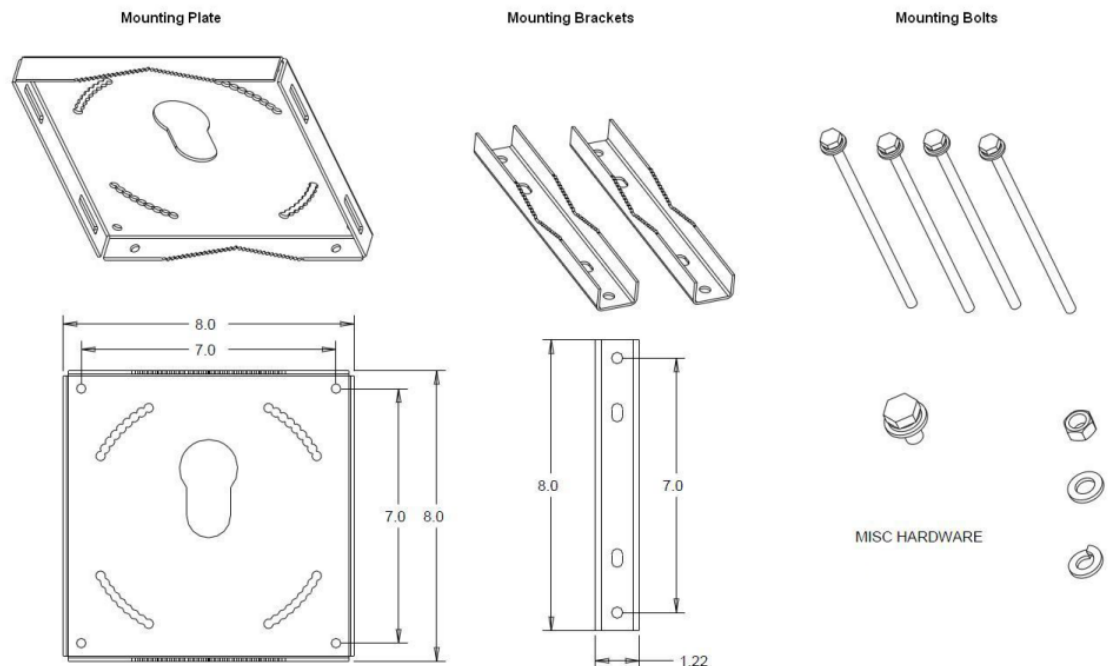
## Mounting Hardware

This set of hardware can be adapted to mount the CCU/Repeater in many different locations.

For pole or pipe mounts, the mounting hardware consists of a mounting plate, two brackets, four bolts, and a set screw.

For a wall mount, use two metal brackets (not shown below), four mounting bolts, nuts, and lock washers to prepare the CCU for mounting. Itron does not supply the hardware necessary to mount the CCU wall mounting brackets to the wall.

An integrated mounting support on the back of the CCU/Repeater enclosure slides into the slot in the center of the mounting bracket. A set screw locks the CCU/Repeater to the mounting bracket. Orientation of the enclosure may be adjusted  $\pm 16$  degrees horizontal to compensate for different angles.



## Pipe Mount

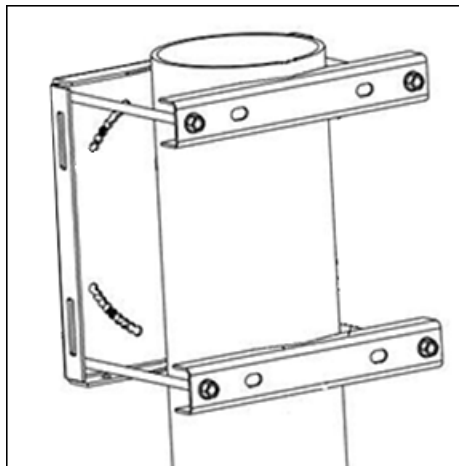
The image below illustrates a typical vertical pipe installation. The CCU/Repeater may also be attached to a horizontal pipe.

In this case the CCU/Repeater mounting plate is attached to the vertical pipe with the mounting brackets and the CCU/Repeater enclosure is secured to the mounting plate.

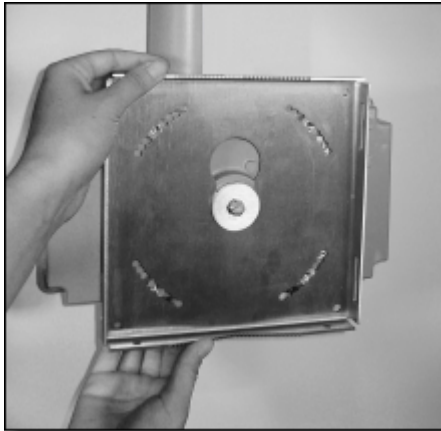


### ***To mount the CCU/Repeater on a pipe***

1. Using the two mounting brackets and four bolts, attach the mounting plate to the pipe.



2. Insert the mounting disc into the mounting plate keyhole.



3. Using the provided set screws, secure the CCU to the mounting plate with the antenna in the upright position.



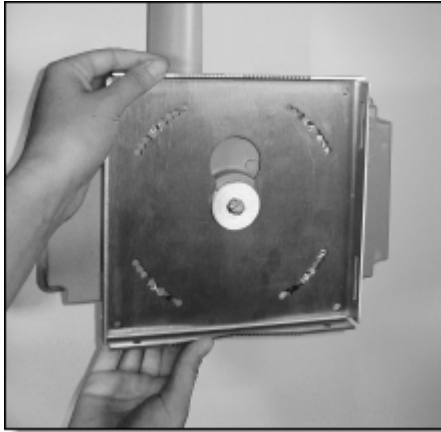
## Pole Mount

If the vertical pipe or pole exceeds 6.75 inches in diameter, metal bands may be used in place of the mounting brackets to secure the mounting plate to the pipe or pole. Two sets of slots (1.5 in. long) on the mounting plate are provided for the metal bands. It may be necessary to use the remote 900 MHz antenna kit to achieve optimum RF performance and GPS coverage if the pole obstructs the desired RF path.



**To mount the CCU/Repeater on a pole**

1. Insert the mounting disc (on the back of the CCU) into the mounting plate keyhole.



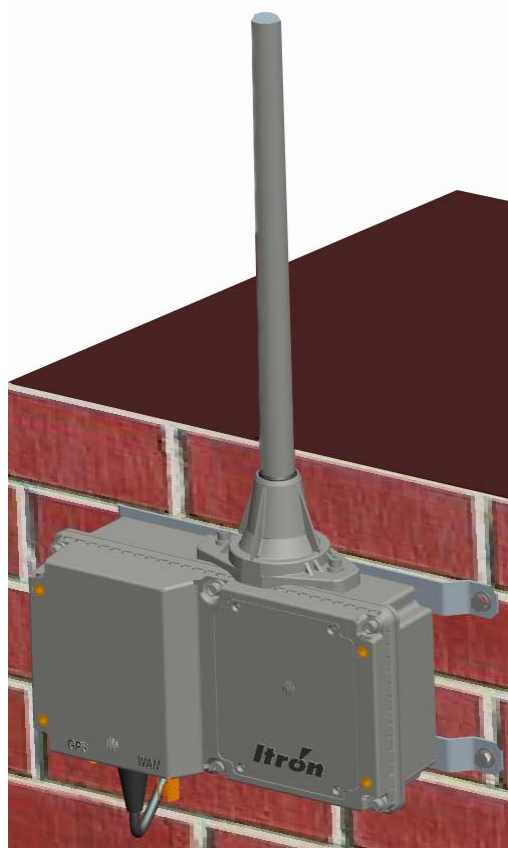
2. Using the provided set screws, secure the CCU to the mounting plate with the antenna in the upright position.



3. Using two steel straps, attach the mounting plate to the pole.

## Wall Mount

The following image illustrates a wall mount installation. In this scenario two brackets are secured to the flat wall surface and the CCU/Repeater is bolted to the brackets. It may be necessary to use the remote 900 MHz antenna kit to achieve optimum RF performance and GPS coverage if mounted indoors or if the wall obstructs the desired RF path.



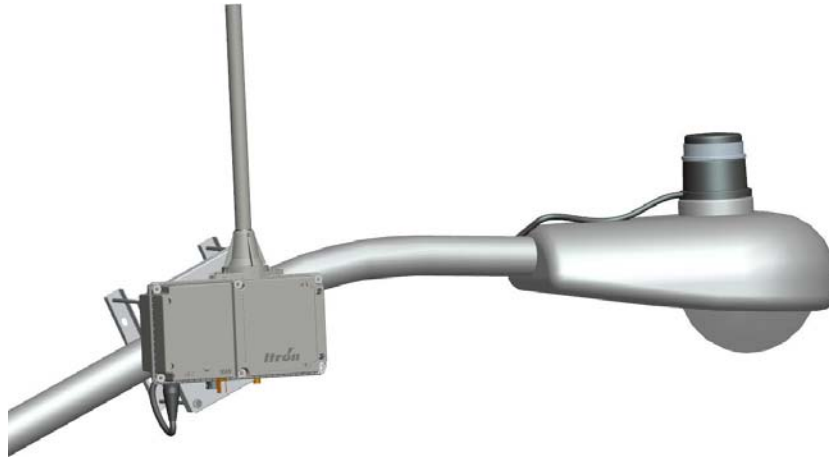
### ***To mount the CCU/Repeater on a wall***

1. Using four bolts, secure the CCU to the two wall mounting brackets with the antenna in the upright position.
2. Using four appropriate screws or bolts (not provided by Itron), attach the mounting brackets to the wall.



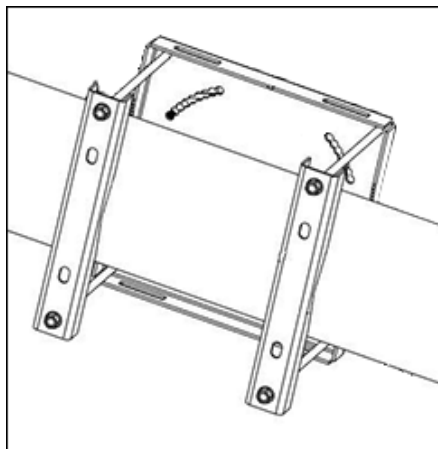
## Davit Arm Mount

The figure below illustrates a typical utility pole or street light pole installation. The CCU/Repeater is mounted on a davit arm or the street light arm. Two types of power connections are typical. A photocell adapter cable may be used when the CCU/Repeater is mounted on a street light arm. This cable plugs into the photocell sensor of the street light. Use of the photocell adapter requires that the CCU/Repeater be grounded using the grounding lug on the bottom of the CCU/Repeater. If the CCU/Repeater is mounted on a davit arm with no street light, the power cable must be connected according to local electrical codes.

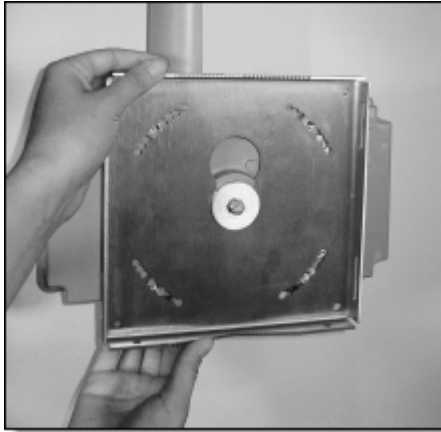


### ***To mount the CCU/Repeater on a davit arm***

1. Using the two mounting brackets and four bolts, attach the mounting plate to the davit arm.



2. Insert the mounting disc into the mounting plate keyhole. The following photos are shown off the davit arm for clarity.



3. Using the provided set screws, secure the CCU to the mounting plate with the antenna in the upright position.



## Connecting Cables

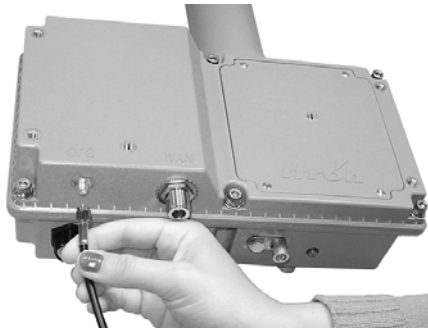
Connect the remote/external antenna cables (if needed), Ethernet cable (if needed), and grounding wire.

Because of the variable requirements for cable length, cables are not provided by Itron.

- ❗ **Important** All coaxial cable connections must be properly weather-proofed per industry standards unless otherwise specified. If the CCU/Repeater is installed indoors, only the connections located outside need to be weather-proofed.

### *To connect cables*

1. The GPS cable has an SMA connector on one end and a TNC connector on the other end. Connect the SMA connector end of the GPS antenna cable to the CCU/Repeater. Connect the TNC end of the GPS cable to the external GPS antenna.



2. The WAN cable has an N connector on each end. Connect one end of the WAN antenna cable to the CCU. Connect the other end of the cable to the external WAN antenna.

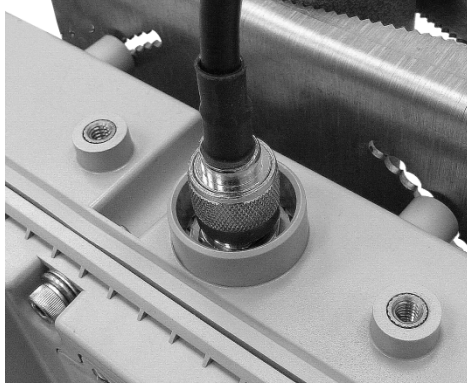
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**Note** Repeaters do not use WAN antennas.

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3. If you are using a remote 900 MHz antenna, attach the 900 MHz antenna cable to the connector on the top of the CCU/Repeater. This connection must be weatherproofed as described in the following steps.
  - a. Attach the coaxial cable to the top of the CCU.



- b. Wrap vinyl electrical tape around the connection starting at the CCU and wrapping up the cable as shown in the following illustration.

The vinyl electric tape provides a foundation for the butyl rubber sealant making it easier to disconnect the cable.



- c. Wrap the vinyl electric tape up the coaxial cable overlapping each wrap as shown in the following illustrations.

Ensure the tape fully covers the cable strain relief.



- d. Wrap a layer of butyl rubber sealant over the vinyl electric tape.

Ensure that the butyl rubber extends past the vinyl tape and onto the cable jacket.



- e. Overlap the butyl rubber so there is no gap. The butyl rubber will self-vulcanize over time and the seam will disappear.



- f. Wrap vinyl electric tape around the butyl rubber starting at the CCU and wrapping up as you did in step a.



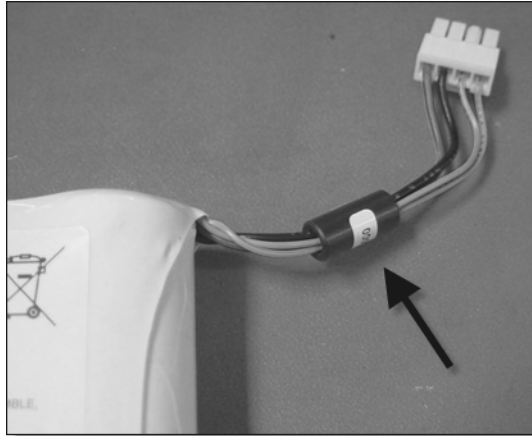
- g. Continue wrapping the vinyl tape in a spiral back down to the CCU. You now have two layers of vinyl tape covering the butyl rubber.



4. If you are using an Ethernet backhaul, attach the Ethernet cable ensuring the weather-tight connector is properly secured. If the Ethernet connection is not used, secure the weatherproof cap.
5. The grounding lug should be attached to earth ground according to local codes.

## Installing the Battery

If you are installing a newer battery that has a ferrite bead on the cables, as shown in the following illustration, follow the directions in "[To install a battery \(ferrite bead\)](#)" on page 35.



Otherwise, see "[To install a battery](#)" on page 34.

### ***To install the battery***

1. Remove the battery cover by loosening the four screws securing it.  
These are captive screws and do not need to be fully removed from the battery cover.
2. Plug in the four pin battery wiring harness. The harness should snap into place, providing a secure connection.





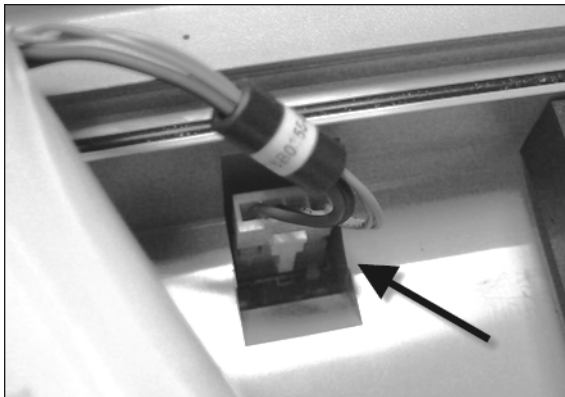
- Slide the battery into the battery compartment.



- Replace the battery compartment cover, and torque the screws to 6 inch-pounds.

#### ***To install a battery (ferrite bead)***

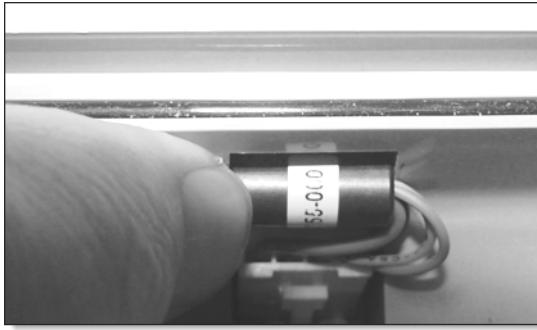
- Insert the battery connector into the connector on the CCU 100.



- Align the edges of the ferrite bead with the edges of the recess in the battery well.



3. Press the ferrite bead into the recess in the battery well.




4. Place the battery in the battery well as shown in the following illustration.



## Providing Power

The final step of the CCU/Repeater installation is to provide power to the CCU. Depending on the CCU/Repeater model, either a two pin cable (DC), three pin cable (AC), or a five pin cable (solar) is required.

 **Caution** Do not move or tilt the CCU for one minute after connecting power. Moving or tilting a CCU too soon after connecting power may cause the current configuration to be lost.

### *To provide power*

1. Plug the appropriate cable in to the CCU/Repeater.

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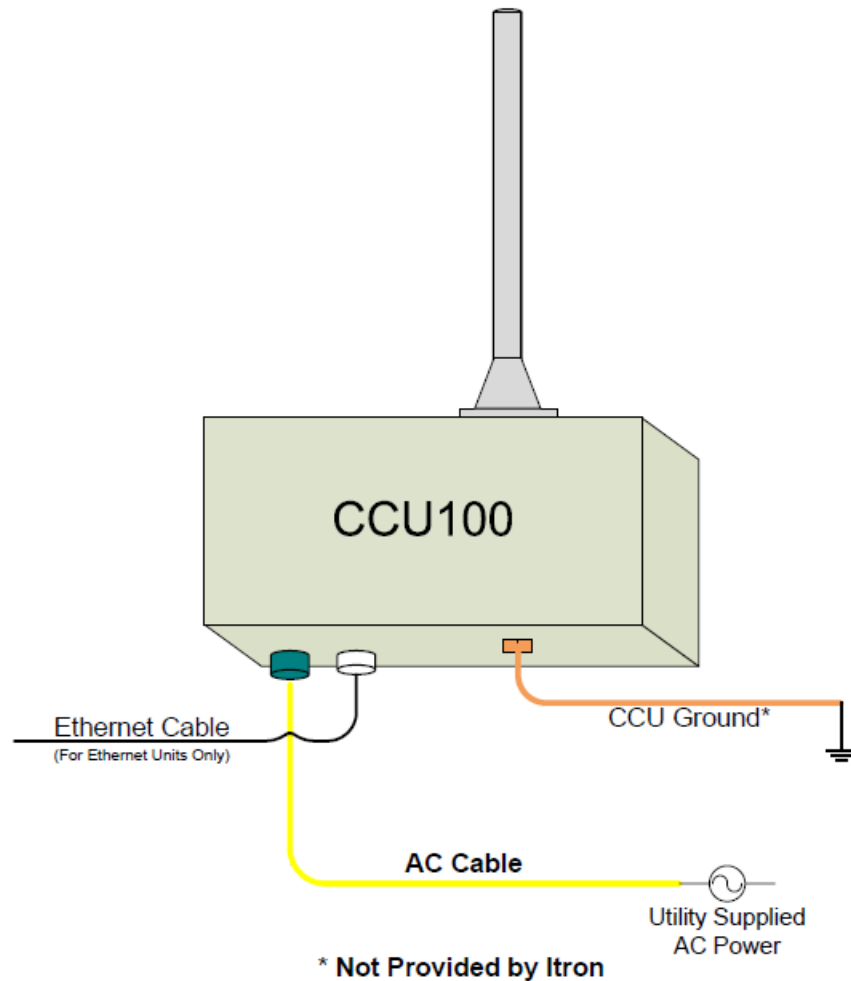
**Note** The connector is keyed so that the cable can connect in only one orientation.

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2. Securely fasten the power cable to the CCU/Repeater by tightening the retaining nut on the cable.


## AC Installation Diagram



## Tower Installation

 **Warning** Before installing a Tower CCU, ensure that the selected location can support the weight of the Tower CCU and mounting hardware. A thorough structural analysis should be performed by a qualified engineer at your desired location prior to installation. Itron is not responsible for improper installations or for installations at a site that cannot adequately support the Tower CCU.

All coaxial cable connections must be properly weather-proofed per industry standards unless otherwise specified. This includes any connections for the antennas and the Tower CCU. If the Tower CCU is installed indoors, only the connections located outside need to be weather-proofed.

 **Important** To prevent exceeding the maximum EIRP set by the FCC, there must be at least 2 dB of loss between the antenna connector at the base of the tower cabinet and the high gain 900 MHz antenna. Do not exceed 3.5 dB of loss to maintain system performance. Only use the Itron approved high gain antenna.

Because of the size and weight of the Tower CCU, Itron recommends that more than one person be present for the installation. See [Antenna Specifications](#) on page 55 for more information.

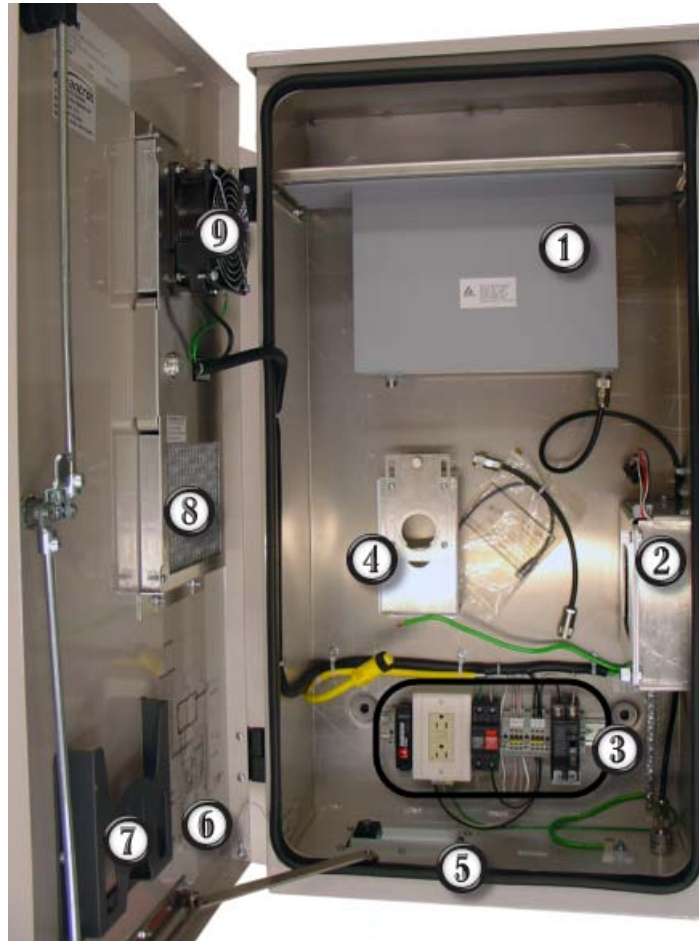
## Tower Installation Overview

The Tower CCU 100 (TCU) installation differs significantly from other CCU 100 installation profiles in that the CCU 100 is installed within a cabinet enclosure at the base of a radio tower and all of the antennas are mounted externally and remotely. The standard cabinet protects the hardware from adverse environmental conditions and provides easy access for servicing the CCU and its related components.

The TCU box comes preassembled except for the CCU. The CCU must have the ICS procedure performed prior to installing the CCU in the TCU box.



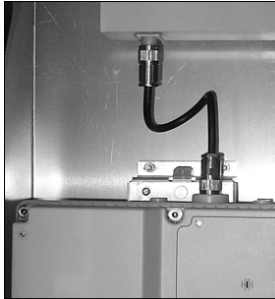
## TCU Components



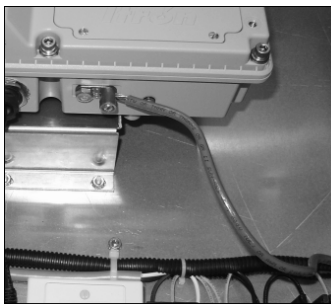
- 1 RF Filter
- 2 Battery
- 3 Surge protection devices (SPDs), receptacle, terminal blocks
- 4 CCU mounting plate
- 5 Roxtec™ block
- 6 Wiring diagram
- 7 Document holder
- 8 Air filters There are two air filters, one shown at (8) and another behind the fan (9).
- 9 Fan

**To assemble the Tower CCU 100**

1. Attach CCU to CCU mounting plate.
  - a. Insert the CCU mounting disc into the mounting plate keyhole.
  - b. Slide the CCU down until you feel it click into place.
2. Connect cable from CCU to RF filter.



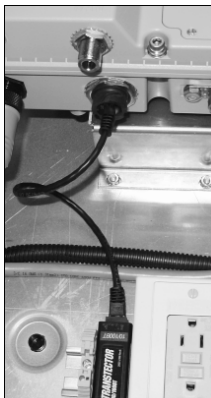
3. Connect ground wire to CCU.



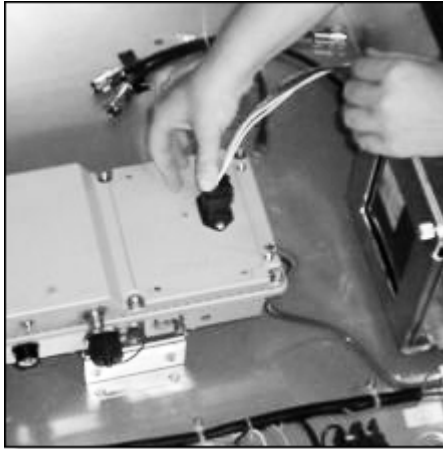
4. *(optional)* Connect the Ethernet cable to the CCU and the top of the 10/100 BT SPD.

Feed the external Ethernet cable through the Roxtec block and connect it to the bottom of the 10/100 BT SPD.

Instructions for using a Roxtec Block are supplied in the TCU cabinet.



5. Connect the battery to the connector on the battery door of the CCU.  
The battery door connection is only present on CCUs designed for TCU installations.



6. Feed the GPS and WAN (if required) antenna cables through the Rextec block and connect them to the CCU.



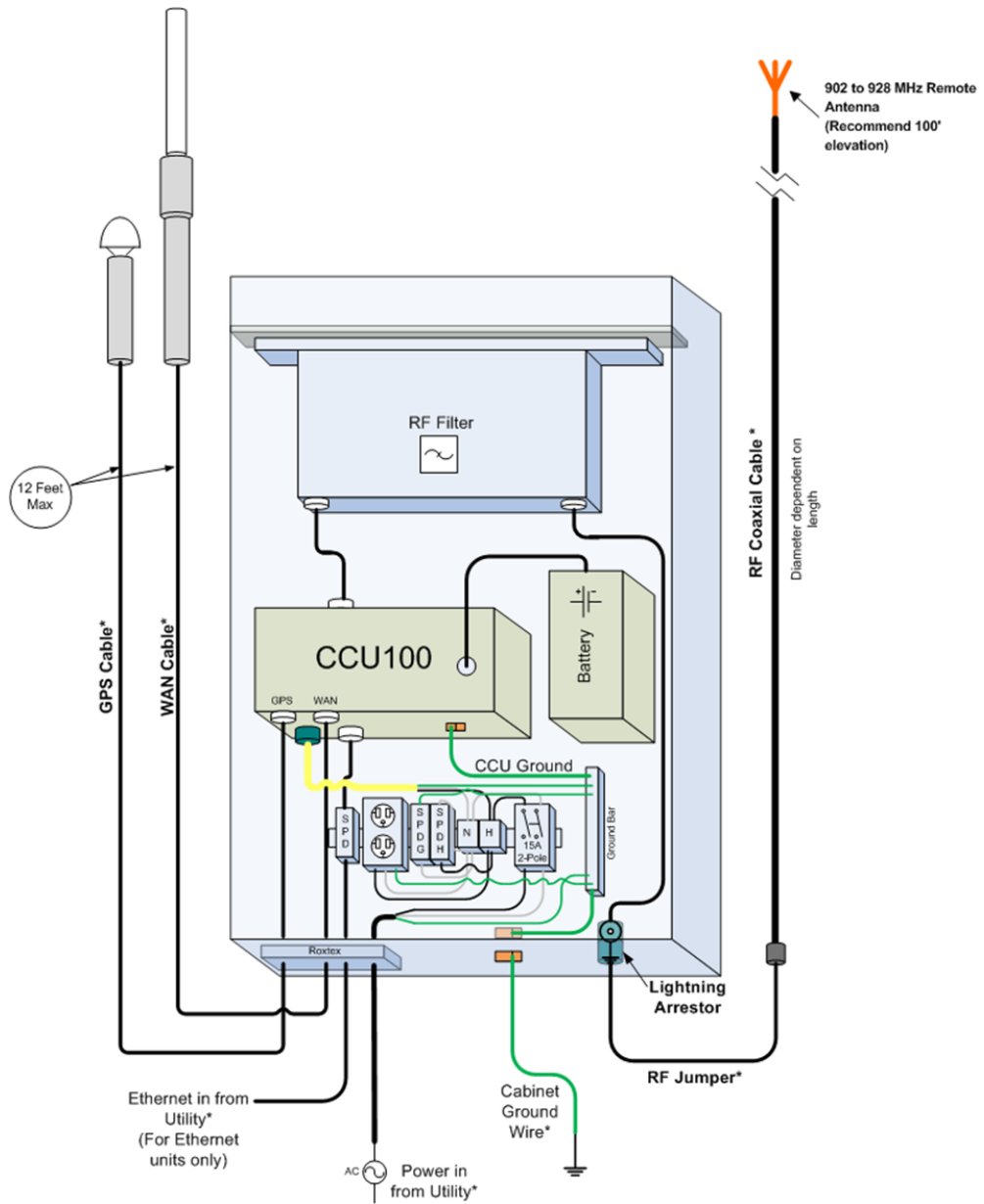
7. Connect the power cable to the CCU.



8. See [Attaching the External GPS/WAN Antennas](#) on page 18 for instructions on installing the antennas.
9. Connect power to the cabinet. See the wiring diagram on the inside of the cabinet door.




# AC Tower Installation Diagram



**\*Not provided by Itron**

## Solar Powered Installation

All coaxial cable connections must be properly weather-proofed per industry standards unless otherwise specified. This includes any connections for the antennas and the CCU/Repeater. If the CCU/Repeater is installed indoors, only the connections located outside must be weather-proofed.

 **Warning** Before installing a CCU/Repeater, ensure that the selected location can support the weight of the CCU/Repeater, mounting hardware, solar panels, and batteries. A thorough structural analysis should be performed by a qualified engineer at your desired location prior to installation. Itron is not responsible for improper installations or for installations at a site that cannot adequately support the CCU/Repeater.

Because of the size and weight of the solar system, Itron recommends that more than one person be present for the installation.

## Solar Installation Overview

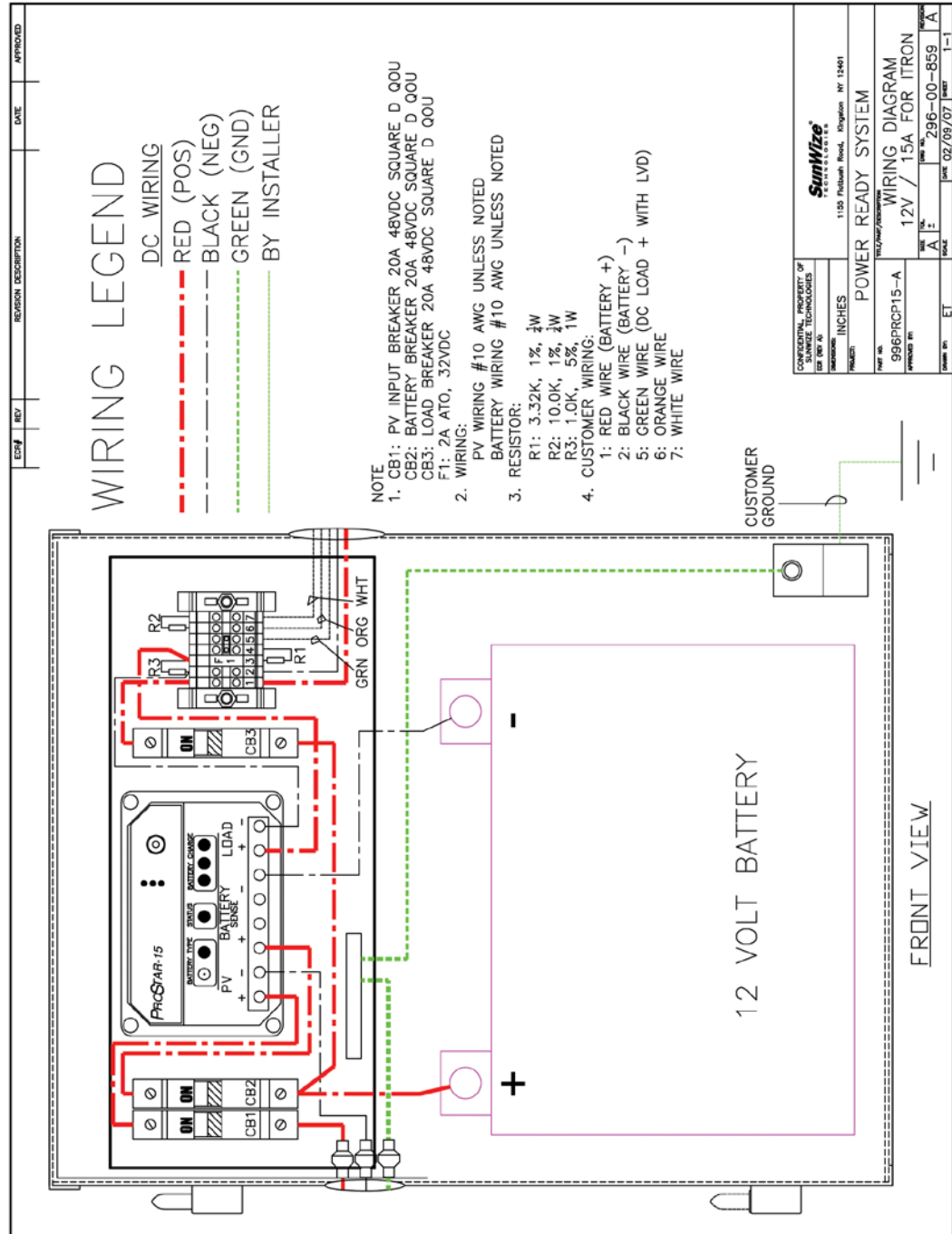
The Solar CCU/Repeater installation differs slightly from other CCU 100 installation profiles in that the power comes from a separate cabinet enclosure which houses the solar controller and batteries.

The Solar CCU/Repeater is mounted like other CCU/Repeaters, but the power comes from the solar cabinet which houses the solar controller and batteries. The picture below shows a solar tower installation.



## Solar Wiring Diagram

The diagram below illustrates how a solar panel system must be wired to connect to the CCU/Repeater. This enclosure is pre-wired. You are required to connect only the power and the ground.



**To assemble the Solar CCU 100**

1. Mount the solar panels and battery box as described in the *Installation, Operation, and Maintenance Manual* supplied with the solar system.
2. Wire the five conductor power cable to the solar cabinet, as shown in the [Solar Wiring Diagram](#) on page 45. Use the watertight grommet supplied with the solar cabinet.
3. Mount the CCU/Repeater in the desired location.

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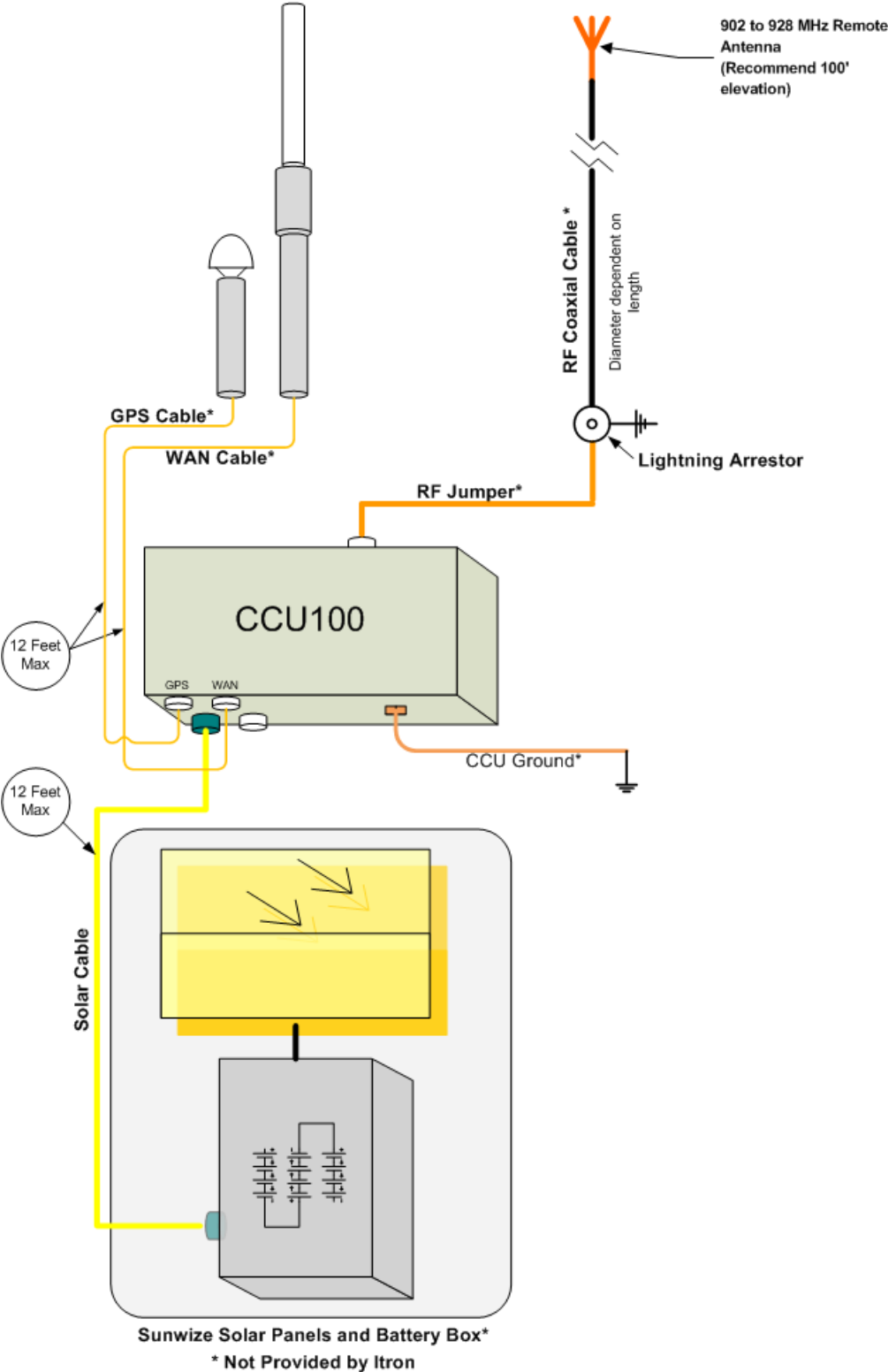
**Note** The supplied power cable from the solar battery box to the CCU/Repeater is only 12 feet long.

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4. Connect ground wire to CCU.
5. If required, connect the antenna and Ethernet cables to the CCU/Repeater.
6. Connect the battery to the CCU.
7. Connect the power cable to the CCU.
8. See [Attaching the Remote Antennas](#) on page 18 for instructions on installing the antennas.

# Solar Installation Diagram

The diagram below shows a typical solar powered installation.





## CHAPTER 4

# Battery Care and Replacement

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In this chapter, you will learn how to perform field maintenance on the CCU/Repeater battery. With some routine care, the batteries used by CCUs/Repeaters will perform at optimal levels for several years.

The following sections show you how to store and charge spare CCU/Repeater batteries, as well as how to replace a CCU/Repeater battery in the field.

## Shipping Requirements



**Warning!** Electrical fire hazard—protect against shorting.

Terminals can short circuit and cause a fire if not insulated during shipping.

Requirements for shipping batteries:

- Batteries must be labeled "NONSPILLABLE" during shipping. Follow all federal shipping regulations. See CFR 49 Parts 171 through 180, available online at [www.gpoaccess.gov](http://www.gpoaccess.gov)
- Batteries must have short circuit protection during shipping. Exposed terminals, connectors, or lead wires must be insulated with a durable inert material to prevent exposure during shipping.

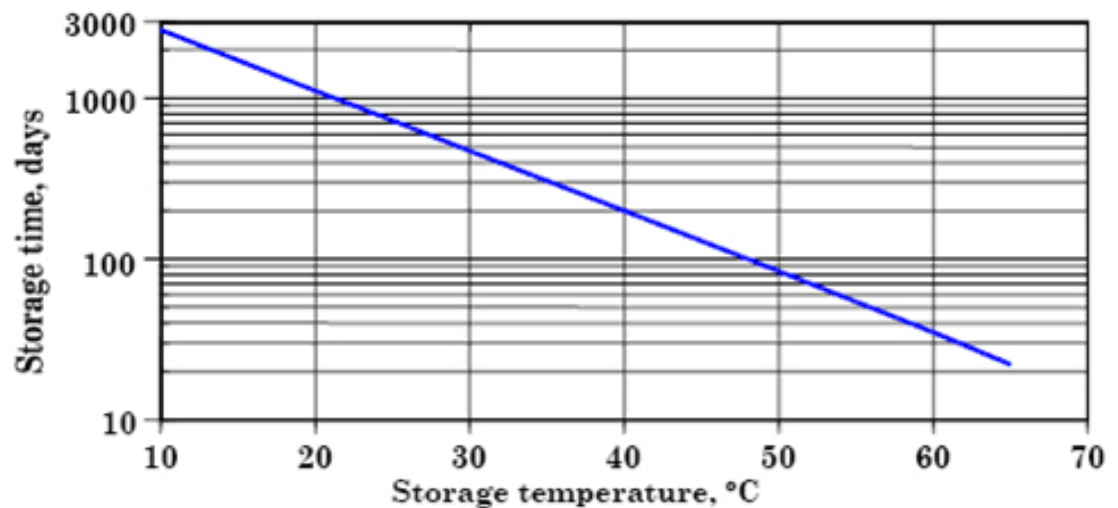
Failure to comply with these requirements can cause a fire during shipping and handling.

## Battery Storage and Charging

To ensure maximum lifespan and efficiency from your CCU/Repeater batteries, Itron recommends the following storage and maintenance procedures.

### Long-Term Storage

Batteries may be stored for up to two years at room temperature (25°C or 77°F), and then may be recharged with no loss in cell reliability or performance capabilities. The example storage time versus temperature chart below is a plot of maximum storage time as a function of storage temperature. This curve shows the maximum number of days at any given temperature, from 10°C (50°F) to 65°C (149°F), for the battery to discharge from a fully charged state of about 6.42 volts (2.14 volts per cell) down to a zero charge state of 5.79 volts or (1.93 volts per cell). The battery should not be allowed to discharge below 5.79 volts because of the danger of damaging the performance characteristics of the battery permanently.



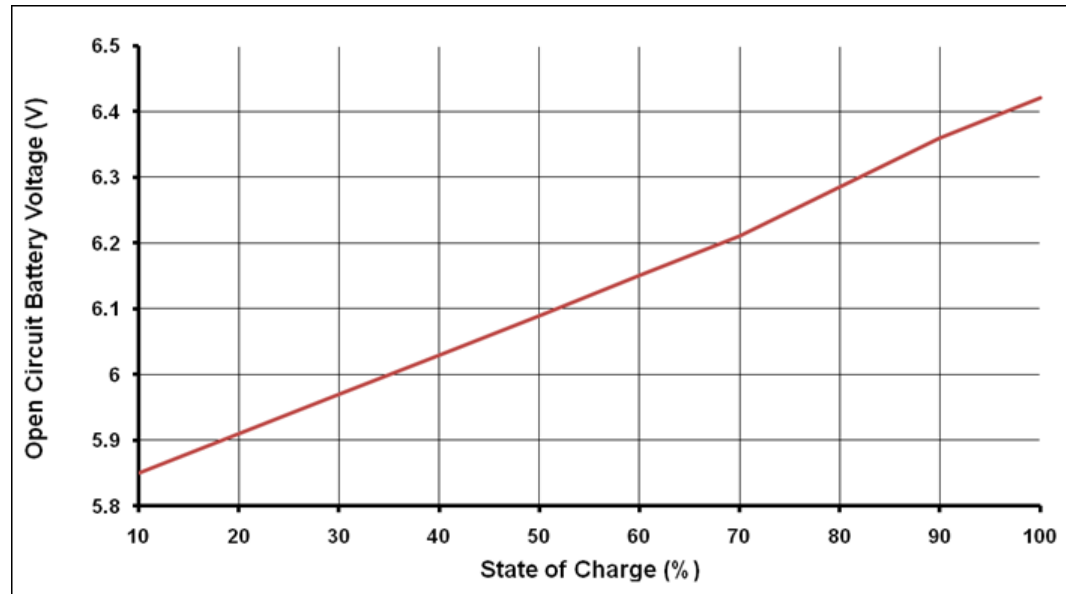
When batteries are stored at or near 25°C (77°F) it is recommended to conduct an open circuit voltage (OCV) audit every six months and recharge when OCV readings approach 6 volts (2.00 volts per cell). If storage temperatures are significantly higher than 25°C (77°F), even for short durations, the frequency of OCV audits must increase.

It is important to recognize that the self-discharge rate of the battery is non-linear. The rate of self-discharge changes as the state of charge (SOC) of the battery changes. The time taken for a battery to discharge from a 100% SOC to 90% SOC is different from the time it takes to self-discharge from a 20% SOC to a 10% SOC.



## State of Charge

The state of charge (SOC) of the battery can be approximated by using the curve shown in the chart below. This curve is accurate to within 20% of the true SOC of the cell under consideration, if it has not been charged or discharged within the past 24 hours. The curve is accurate to within 5% if the cell has not seen any activity, charge or discharge, for the past five days.



## Charge the Battery

You can charge spare CCU/Repeater batteries individually or in groups to save time.

When charging batteries, there are several items you need:

- Power Sonic PSC-61000A-C charger
- Molex 39-01-4046 connector
- CCU/Repeater batteries

The recommended method for charging the batteries is to utilize the Power Sonic PSC-61000A-C charger. The Power Sonic charger needs to be modified so that it can be plugged directly into the battery. This is done by retrofitting the output of the charger to a Molex 39-01-4046 connector with the red wire going to pin one and the black wire going to pin two of the connector. Follow the instructions that come with the charger for correct operation.

After charging, the battery should be removed from the charger for at least 24 hours. After this time the open circuit voltage should be measured to verify that it is at or above 6.4 volts.

- **Note** Batteries in storage need to be charged routinely for maximum shelf life. For more information, see [Long Term Storage](#) on page 50.

## Battery Service Life

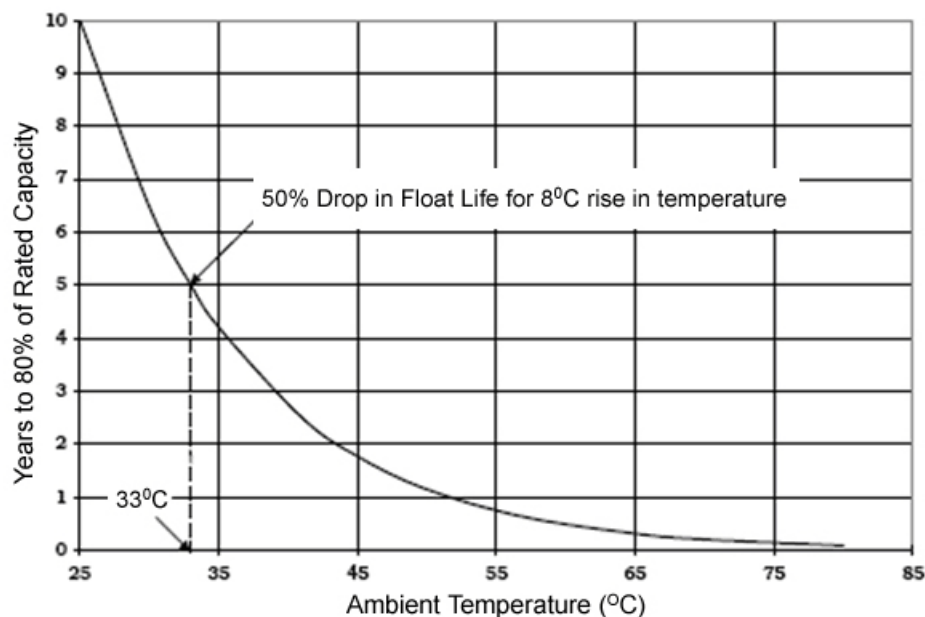
All batteries have extremely variable service life, depending upon the type of cycle, environment, and charge to which the cell or battery is subjected during its life. There are two basic types of service life: cycle life and calendar life. The battery in the CCU/Repeater is called in to service only during power outages, so in this case only calendar (or float) life is applicable.

### Calendar Life

The design calendar (or float) life of the battery is up to eight to ten years at room temperature (25°C/77°F) and under proper charging conditions.

This design life has been confirmed by the use of accelerated testing methods that are widely accepted by both manufacturers and users of sealed-lead batteries. High temperatures are used to accelerate the aging process of the battery under test.

The float life of a cell is cut in half for roughly every 8°C (14.4°F) rise in ambient temperature. The example below shows the relationship between ambient temperature and float life for batteries that have a float life of ten years at 25°C (77°F).



A ten year battery lasts for five years at 33°C (91.4°F) and only 2½ years at 41°C (105.8°F).

### Preventative Maintenance

Itron recommends a preventative maintenance cycle of a two-year replacement in extreme environments (average temperatures greater than 110°F/44°C), or five years in non-extreme environments (average temperatures less than 90°F/31°C).

## Replacing the Integrated Battery

The following procedure shows you how to replace the integrated battery once it has been installed in the field.



**Warning** Risk of explosion if battery is replaced by an incorrect type. Always replace with Itron part number BAT-0045-001.

For information on battery disposal or recycling, contact EnerSys at 1.800.363.7797 or recycling@enersys.com.

### ***To replace the battery***

1. Remove the battery compartment cover by loosening the four screws securing it.
2. Slide the battery out of the battery compartment.
3. Carefully, disconnect the four pin connector.
4. Connect the new battery's four pin connector.
5. Slide the new battery into the battery compartment.
6. Replace the battery compartment cover, and torque the screws to 6 inch-pounds.



## APPENDIX A

### Detailed CCU/Repeater Specifications

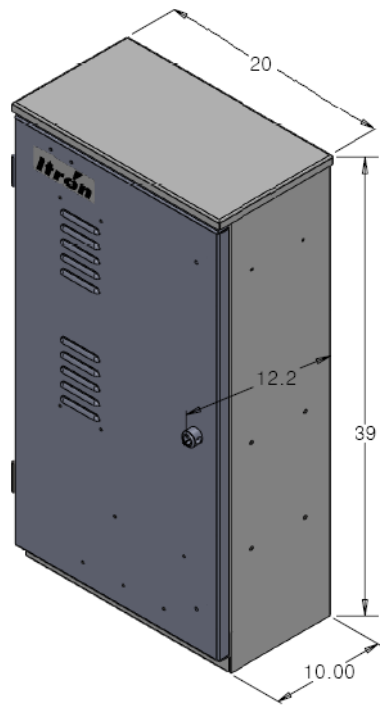
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#### CCU/Repeater Dimensions and Weight

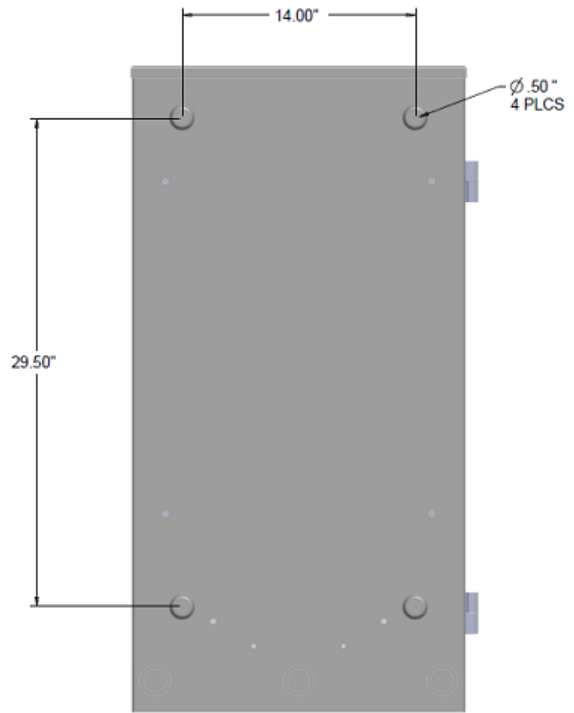
Weight is shown in pounds and dimensions are shown in inches.

<b>Component</b>	<b>Weight</b>
CCU/Repeater	7 lbs
AC tower unit	76 lbs
External GPS/WAN antenna system	6 lbs
Remote 900 MHz antenna system	3.5 lbs
900 MHz antenna (standard, unity gain)	1 lb
Pole mounting kit	3 lbs
Wall mounting kit	2 lbs

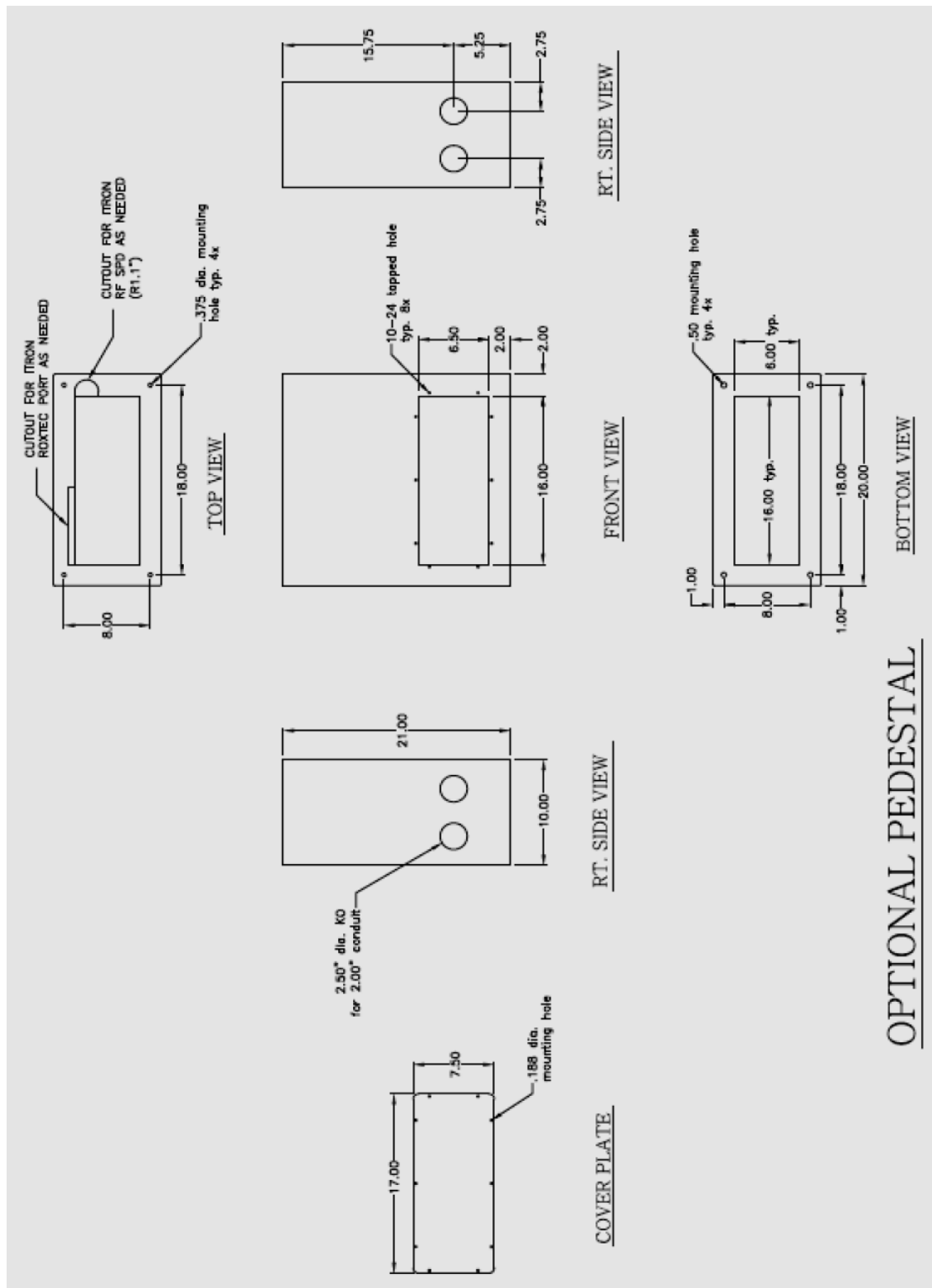




TCU MOUNTING HOLE DIMENSIONS




The illustration below shows the dimensions for the optional pedestal unit. This unit ships with a gasket and fasteners to attach the cabinet to the pedestal.



## Antenna Specifications

Specifications for the 900 MHz, GPS, and WAN antennas are shown in the following tables.

-  **Important** All coaxial cable connections must be properly weather-proofed per industry standards unless otherwise specified. This includes any connections for the antennas and the CCU/Repeater components. If the CCU/Repeater is installed indoors, only the connections located outside need to be weather-proofed.

This device has been designed to operate with the antennas listed below. Antennas not included in this list are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

<b>900 MHz antennas</b>		
<b>Specification</b>	<b>Standard 5 dBi</b>	<b>High gain (8.15 dBi)</b>
Part number	MSE-0330-001	MSE-0372-001
Gain	3 dBd (5.15 dBi)	6.0 dBd (8.15 dBi)
Horizontal beamwidth	Omnidirectional	Omnidirectional
Vertical beamwidth	-3dB minimum, +/- 16 degrees from horizontal	17 degrees
Electrical downtilt available	0 degrees	0 degrees
Power rating	50W	100W
Impedance	50 ohms	50 ohms
Termination	Type N male	Type N female
Lightning protection	Direct ground	Direct ground
Overall length	18 in.	65 in.
Radome diameter	1.00 in. OD	1.310 in. OD
Mounting area length	n/a	~8 in.
Weight (without clamps)	1 lb.	3 lbs.
Maximum wind speed	160 mph	125 mph
Wind load @ rated wind speed	n/a	57 lbs.



<b>GPS/WAN antennas</b>		
<b>Specification</b>	<b>GPS</b>	<b>WAN</b>
Part number	MSE-0260-001	MSE-259-001
Gain	30 dB	0 dBd (806-896) 3dBd (1850-1990)
Horizontal beamwidth	Omnidirectional	Omnidirectional
Power rating	N/A	100 W
Impedance	50 ohms	50 ohms
Termination	Type TNC female	Type N female
Frequency	1575.42 MHz	806-896 MHz 1850-1990 MHz
Polarization	RHCP	Vertical
Prime power	3.3 V DC	N/A
Overall length	2.61 in.	13.75 in.
Radome diameter	3.05 in.	1.310 in.
Weight	6 oz.	< 1.0 lb.

For the latest antenna part numbers, see the *Fixed Network 100 Ordering Guide* or contact your Itron representative.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

### **Industry Canada Conformity**

This radio transmitter (IC: 864A-CCU100 and IC:864A-CCU100A and IC:864A-CCU100TA and IC:864A-CCU100T) has been approved by Industry Canada to operate with the antenna types listed above with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (IC: 864A-CCU100 et IC:864A-CCU100A et IC:864A-CCU100TA et IC:864A-CCU100T) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessus et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

## Environmental Specifications

The following environmental specifications are associated with a CCU/Repeater.

Specification	Value
Operating temperature	Components GPS/WAN antenna system: -33° C to 60° C CCU/Repeater: -33° C to 60° C
Storage temperature	-40° C to 85° C  <b>Note</b> Batteries may be stored for up to two years at 25° C without periodic recharging. When batteries are stored at this temperature, an open circuit voltage audit should be conducted every six months.  If the storage temperature is significantly higher than 25° C, the frequency of the audits must be increased.
Humidity	0 to 90% non-condensing

## Transmitter

Detailed specifications for the CCU/Repeater transmitter are described in the following table.

Specification	Value
Maximum transmit power at antenna	29.5 dBm
Frequency	903.0 MHz to 926.8 MHz (USA)

## CCU/Repeater Power Operating Range

Specification	Value
Voltage (AC)	90 VAC to 265 VAC
Voltage (DC)	+12 VDC typical +11.7 VDC minimum +17.0 VDC maximum
Frequency	47 Hz to 63 Hz
Average power	10 Watts (battery trickle charge)
Peak power	50 Watts

## Battery Pack

The battery pack is contained in its own compartment. The battery pack is a three-cell, sealed, lead acid battery pack (6V, 4.5 amp-hours) that is field replaceable and designed to last five years under normal circumstances. To ensure minimal impact upon battery life, a preventative maintenance schedule of two year replacement is required in an extreme environment, such as a desert installation. Normal preventative maintenance is every five years for non-hot environment installations.



**Warning** Risk of explosion if battery is replaced by an incorrect type. Always replace with Itron part number BAT-0045-001.

The batteries can power the system for a duration of 90 minutes in the case of a power outage.

If	Then
AC power fails	The CCU/Repeater battery pack maintains system functions for approximately 90 minutes. A message indicating the AC failure is sent to the Network Software.
AC power is restored	A message is sent to the Network Software indicating that AC power has been restored.

The battery pack specifications are listed below.

Specification	Value
Type	Sealed-lead acid, rechargeable
Power	6V, 4.5 amp-hours
Life	Five years at 33° C. Battery life decreases by 50% for each 8° C rise in temperature above 25°C.
Charge time	10 hours at 25° C

The battery in the CCU/Repeater uses three EnerSys Cyclon lead-acid cells connected in series to provide a nominal voltage of 6 volts. The battery is terminated with a four position Molex connector (Molex P/N #39-01-4041) with the following pinout:

Pin #	Wire Color	Signal
1	Red	+V BATT
2	Black	Ground
3	White	Thermistor
4	White	Thermistor

For information on battery disposal/recycling contact EnerSys at 1.800.363.7797 or recycling@enersys.com.



## APPENDIX B

# Status and Diagnostics

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## Status Indicator

The LED Status Indicator is primarily intended to support installation personnel for immediate feedback. The following sequences define the Fixed Network solution's operational characteristics:

Sequence details: The *dot* time: 100 mSec

The *dash* time is 300 mSec

Off Time between *B* and *N*: 700 mSec

Off time between *dot* and *dash*: 100 mSec

CCU State	Description	LED Pattern
Off	The CCU is not running	Off
Powered (Host booting)	When power has been applied to the CCU and the CCU reset has been released allowing the boot operation to begin.	Solid continuous illumination
Time Acquisition	The CCU is attempting to synchronize its system time with an external time reference through NTP and / or GPS.  Note Repeaters do not support NTP. Instead, repeaters acquire time from either the CCU or from GPS. If time is received from the CCU, the repeater status indicator will not display the Morse T.	Morse code for the letter 'T' ( _ ). A single 660 ms flash repeated every 10 seconds.
Starting	The Linux kernel has been loaded and initialized and the CCU application begins execution	Morse code for the letter 'P' ( . _ . ) with the dits at 220 ms the dahs at 660 ms and 220 ms spacing between the dits and dah. Repeated every 10 seconds.
ERT Heard	The radio processor has booted and is reporting end-point messages to the host processor	Morse code for the letter 'N' ( _ . )
Headend Connected	The CCU has established an authenticated connection with the head-end over the configured WAN interface.	Morse code for the letter 'B' ( _ . . )
No Battery	The CCU has determined that it should have a backup battery but that battery does not appear to be present or is not functioning. The display of this state is a higher priority than states other than Low-visibility and will be displayed exclusively if the battery cannot be detected.	Morse code for the letter 'S' ( . . . )


CCU State	Description	LED Pattern
Ok	The radio processor has booted and is reporting end-point messages to the host processor and the CCU has established an authenticated connection to the head-end. This condition will be signaled for about 15 minutes before moving the "low-visibility" state.	Morse code for the letter sequence 'BN' ( _ . . . _ . ) The dit and dah timing described above with the space between the 'B' and the 'N' characters being 660 ms.
Token Received	If the radio reports decoding a "magic" token which would enable the WiFi diagnostic interface this pattern is presented for one 10 second interval. This condition is higher priority than the Lo-visibility and the missing battery indications.	Morse code for the number '5' ( . . . . . ).
Low-visibility	After 15 minutes in the "Ready" state the LED pattern changes to the "Low-visibility" mode which indicates that the CCU is running (does not imply that end-points are still being read or that head-end communications are still possible).	10 ms illumination every 30 seconds.

## Performing an Antenna Sweep Test

If the 900 MHz antenna is remotely mounted for your installation, an antenna sweep test must be performed to verify that the antenna functions within acceptable tolerances at your installation site.

This test should be performed under the following conditions:

- **Beginning Frequency:** 902
- **Ending Frequency:** 928
- **VSWR Expected Results:** Must be 1.5 or less for the specified frequency band.
- **Return Loss:** Must be -18dB or better for the specified frequency band. Any deviations from this return loss warrant further investigation.
- **Test Point:** Feed line connected to the antenna at the top; test from the lightning (or surge) arrestor to the antenna port.
- **Results:** Test results must be saved in .PDF format.
- **Test Gear:** Current and proper calibration; be sure that calibration is turned on during the test. A qualified operator of the test equipment must perform the test.

 **Note** If the system does not perform to the above test specifications, the reasons for system failure and possible remedies must be identified before leaving the installation site.

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