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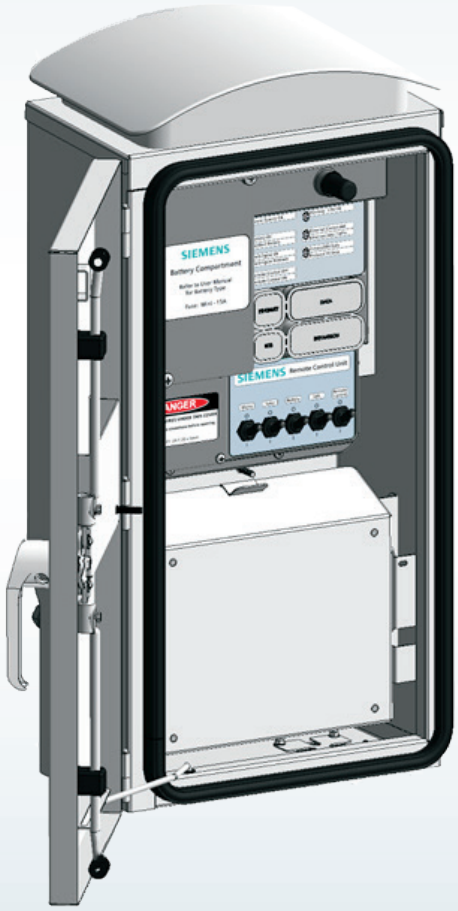


www.usa.siemens.com/fusesaver

Instruction manual

Type 3AD8 remote control unit (RCU) operating instructions

Installation operation maintenance IC1000-F320-A198-X-4A00

Answers for infrastructure and cities.

⚠ DANGER

Hazardous voltages.

Will cause death, serious injury or property damage.

Always de-energize and ground the equipment before maintenance. Read and understand this instruction manual before using equipment. Maintenance should be performed only by qualified personnel. The use of unauthorized parts in the repair of the equipment or tampering by unqualified personnel will result in dangerous conditions which will cause death, severe injury or equipment damage. Follow all safety instructions contained herein.

Important

The information contained herein is general in nature and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation and maintenance of the equipment purchased. Siemens reserves the right to make changes in the specifications shown herein or to make improvements at any time without notice or obligation. Should a conflict arise between the general information contained in this publication and the contents of drawings or supplementary material or both, the latter shall take precedence.

Qualified person

For the purpose of this manual a **qualified person** is one who is familiar with the installation, construction or operation of the equipment and the hazards involved. In addition, this person has the following qualifications:

- **Is trained and authorized** to de-energize, clear, ground and tag circuits and equipment in accordance with established safety procedures.
- **Is trained** in the proper care and use of protective equipment, such as: rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established safety practices.
- **Is trained** in rendering first aid.

Further, a qualified person shall also be familiar with the proper use of special precautionary techniques, personal protective equipment, insulation and shielding materials, and insulated tools and test equipment. Such persons are permitted to work within limited approach of exposed live parts operating at 50 volts or more, and shall, at a minimum, be additionally trained in all of the following:

- The skills and techniques necessary to distinguish exposed energized parts from other parts of electric equipment
- The skills and techniques necessary to determine the nominal voltage of exposed live parts
- The approach distances specified in NFPA 70E® and the corresponding voltages to which the qualified person will be exposed
- The decision-making process necessary to determine the degree and extent of the hazard and the personal protective equipment and job planning necessary to perform the task safely.

Note:

These instructions do not purport to cover all details or variations in equipment, or to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Siemens sales office.

The contents of this instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens Industry, Inc. The warranty contained in the contract between the parties is the sole warranty of Siemens Industry, Inc. Any statements contained herein do not create new warranties or modify the existing warranty.

Table of contents

Abbreviations

FS	**Fusesaver**
HV	**High voltage**
IEC	**International Elecrotechnical Commission**
LED	**Light-emiting diode**
LV	**Low voltage**
MLFB	**Order code**
MV	**Medium voltage**
PC	**Personal computer**
RCU	**Remote control unit**
SCADA	**Supervisory control and data acquisition**
USB	**Universal serial bus**
UTC	**Universal time coordinated**
VT	**Voltage transformer**

Introduction

Introduction

The remote control unit (RCU) is used to connect the Fusesaver (FS) pole-mounted or conductor-mounted circuit breaker into a utility SCADA system. The RCU is a pole-mounted enclosure containing a microprocessor, a short-range (approximately 20 m) radio used to communicate with the FS and a long-range radio (or modem). The long-range radio (or modem) is not supplied or fitted by Siemens unless specifically included to in the sales contract.

Successful application and operation of this equipment depends as much upon proper installation and maintenance by the user as it does upon the proper design and fabrication by Siemens.

Format and aim of the operating instructions

These operating instructions apply for the RCU.

The purpose of this instruction manual is to assist the user in developing safe and efficient procedures for the installation, maintenance and use of the equipment.

These instructions are intended to familiarize personnel with the mechanical and electrical design as well as the general functionality of the RCU. These instructions also include notes on operation and information concerning installation and maintenance.

It is required that operating and installation personnel familiarize themselves as early as possible with the instructions and other documents provided, in order to gather any relevant further information on the RCU and its features.

In written or verbal communications, please provide the complete description from the operating instructions, quote the serial number and use only the designations and key numbers for subparts used in these locations.

Contact the nearest Siemens representative if any additional information is desired.

Safety instructions

The RCU, together with the accessories and special tools also supplied, is in conformity with the statutory laws, rules, and standards applicable at the time of delivery, especially those regulations concerning health and safety.

Signal words

The signal words “danger,” “warning” and “caution” used in this manual indicate the degree of hazard that may be encountered by the user. These words are defined as:

Danger - Indicates an imminently hazardous situation that, if not avoided, **will** result in death or serious injury.

Warning - Indicates a potentially hazardous situation that, if not avoided, **could** result in death or serious injury.

Caution - Indicates a potentially hazardous situation that, if not avoided, **may** result in minor or moderate injury.

Notice - Indicates a potentially hazardous situation that, if not avoided, **may** result in property damage.

Field service operation and warranty issues

Siemens can provide competent, well-trained field service representatives to provide technical guidance and advisory assistance for the installation, overhaul, repair and maintenance of Siemens equipment, processes and systems. Contact regional service centers, sales offices or the factory for details, or telephone Siemens field service at +1 (800) 347-6659 or +1 (919) 365-2200 outside the U.S.

Designated usage

The RCU is used to connect the FS pole-mounted or conductor-mounted circuit breaker into a utility SCADA system. Any other use is forbidden, unless the consent of Siemens has been obtained.

NOTICE

Changes to any part of the RCU or its accessories, that are carried out by the user or others, and not previously agreed by Siemens, will void the warranty of the whole product.

Compatibility

This version of the RCU operating instructions is compatible with the following firmware and software versions:

Application	Applicable versions
RCU firmware	100
RCU Connect	V1.4.0.0

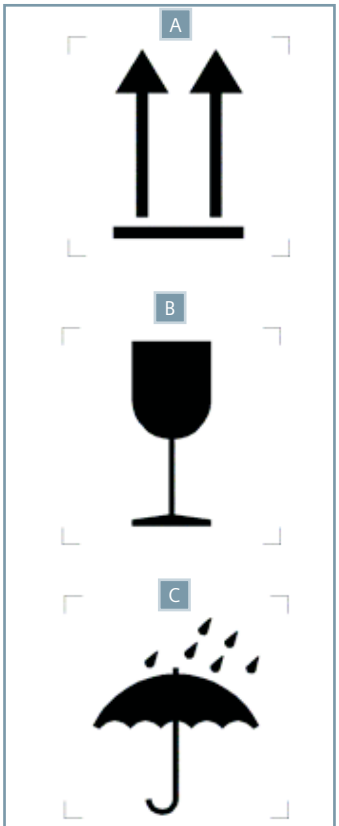
Table 1: Compatibility

Additional instructions

In addition to this manual, a protocol manual detailing the configuration options for each communications protocol is available. The utility may also be supplied with an RCU manual supplement which details the type of radio fitted, the radio cable and SCADA system protocol details which are specifically engineered for that utility (additional fees may be charged for this configuration service). Finally, if the RCU is fitted with a FS operator control panel (MLFB or order code 3AX1350-8C), the user will be supplied with a manual detailing the function and maintenance of the panel.

Receiving, handling and storage

Figure 1: Symbols on packages



Item	Description
A	This way up
B	Fragile
C	Keep dry

Packaging

Each RCU is packaged in its own cardboard box. Each box is labelled with a list of the contents of the box and the serial number of the RCU.

The cardboard box holds:

- RCU
- Pole-mounting bracket
- Battery
- Radio and/or antenna (if purchased from Siemens)
- Power supply isolation unit (if purchased from Siemens)
- RCU enclosure heater (if purchased from Siemens).

To open the box, use a box cutter to cut through the sealing tape and then fold open the top flap to access the contents. All items in the box can then be easily removed.

Other items as follows are packed separately (optional):

- Solar panel kit
- VT kit.

Marking

The packaging has symbols which give instructions for safe transport and proper storage. For the dispatch of non-hazardous goods, the following symbols apply. These symbols must be strictly observed.

Receipt and handling of shipment

On receipt, the contents of each RCU box should be checked for shipping damage and the manufacturer informed immediately if any damage is evident:

- Check the cardboard box for shipping damage.
- Major damage must be documented photographically.
- Ensure that any damage to the cardboard box is confirmed by the transport company.

Inspection and unpacking

Inspect the equipment as soon as possible after receipt for any damage that may have occurred in transit. Before unpacking, examine the package itself, as a damaged package may indicate damage to the contents of the package. Be careful when unpacking equipment. The use of sledge hammers and crowbars may damage the finish, or the equipment itself. After unpacking, examine equipment for any possible damage. Check the shipping manifest to be certain that all items have been received.

Note: If there is a shortage, make certain it is noted on the freight bill and contact the carrier immediately. Notify Siemens medium-voltage customer service at +1 (800) 347-6659 (+1 (919) 365-2200 outside the U.S.) of any shortage or damage.

If the RCU has been stored in a cold environment and is unpacked in a warm environment, it is recommended to wait a minimum of two hours before powering up the RCU to avoid damage resulting from condensation.

Storage

NOTICE

Avoid damage to any units during storage - damage can affect subsequent operation.

Do not overload any goods by over stacking. Do not place heavy goods on top of another.

The RCU box should be handled with care and protected from water exposure. It can be stored in its original transport packaging. The storage room should be well ventilated, as dust-free as possible and dry. It should have a temperature between -4 °F and +122 °F (-20 °C and +50 °C). The relative humidity should be kept below a level of 80 percent.

Shipping damage claims

NOTICE

If stored for long periods of time, the battery will require re-charging at least every six months. This should be done using a standard 12 V battery charger. Take care to not overcharge the battery.

Important: The manner in which visible shipping damage is identified by consignee prior to signing the delivery receipt can determine the outcome of any damage claim to be filed.

Notification to carrier within 15 days for concealed damage is essential if loss resulting from unsettled claims is to be eliminated or minimized.

1. When shipment arrives, note whether equipment is properly protected from the elements. Note trailer number on which the equipment arrived. Note blocking of equipment. During unloading, make sure to count the actual items unloaded to verify the contents as shown on the delivery receipt.
2. Make immediate inspection for visible damage upon arrival and prior to disturbing or removing packaging or wrapping material. This should be done prior to unloading when possible. When total inspection cannot be made on vehicle prior to unloading, close inspection during unloading must be performed and visible damage noted on the delivery receipt. Take pictures if possible.
3. Any visible damage must be noted on the delivery receipt and acknowledged with the driver's signature. The damage should be detailed as much as possible. It is essential that a notation "possible internal damage, subject to inspection" be included on delivery receipt. If the driver will not sign the delivery receipt with damage noted, the shipment should not be signed for by the consignee or their agent.
4. Notify Siemens immediately of any damage, at +1 (800) 347-6659 or +1 (919) 365-2200 outside the U.S.
5. Arrange for a carrier inspection of damage immediately.

Important: Do not move equipment from the place it was set when unloading. Also, do not remove or disturb packaging or wrapping material prior to carrier damage inspection. Equipment must be inspected by carrier prior to handling after receipt. This eliminates loss due to claims by carrier that equipment was damaged or further damaged on site after unloading.

6. **Be sure equipment is properly protected from any further damage by covering it properly after unloading.**
7. If practical, make further inspection for possible concealed damage while the carrier's inspector is on site. If inspection for concealed damage is not practical at the time the carrier's inspector is present, it must be done within 15 days of receipt of equipment. If concealed damage is found, the carrier must again be notified and inspection made prior to taking any corrective action to repair. Also notify Siemens immediately at +1 (800) 347-6659 or +1 (919) 365-2200 outside the U.S.

8. Obtain the original of the carrier inspection report and forward it along with a copy of the noted delivery receipt to Siemens at +1 (800) 347-6659 or +1 (919) 365-2200 outside the U.S. Approval must be obtained by Siemens from the carrier before any repair work can be performed. Before approval can be obtained, Siemens must have the above referenced documents. The carrier inspection report and/or driver's signature on the delivery receipt does not constitute approval to repair.

Note: Shipments are not released from the factory without a clear bill of lading. Approved methods are employed for preparation, loading, blocking and tarping of the equipment before it leaves the Siemens factory. Any determination as to whether the equipment was properly loaded or properly prepared by shipper for over-the-road travel cannot be made at the destination. If the equipment is received in a damaged condition, this damage to the equipment has to have occurred while en route due to conditions beyond Siemens control. If the procedure outlined above is not followed by the consignee, purchaser or their agent, Siemens cannot be held liable for repairs. Siemens will not be held liable for repairs in any case where repair work was performed prior to authorization from Siemens.

Description

RCU principle

The RCU is an outdoor device. The RCU works in partnership with a set of Fusesavers to increase network automation by allowing the utility control center to remotely monitor and control Fusesavers.

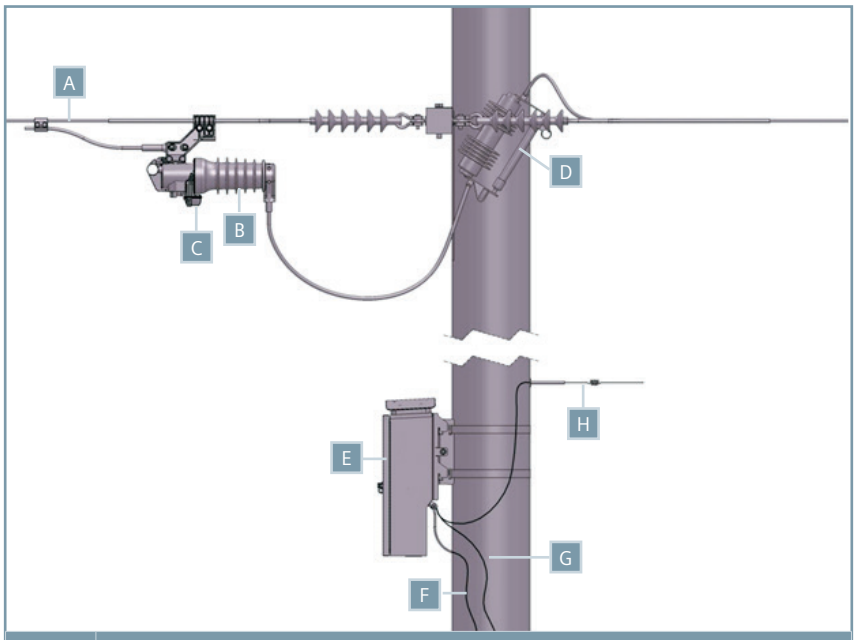
Additionally, the RCU can be equipped with a control panel to enable local operator control of the Fusesavers. FS control panel controls can include tripping and closing and changing protection mode of the Fusesavers.

The Siemens FS is equipped with a short-range radio (range approximately 65.6 ft (20 m)) to allow configuration and control. In order to connect the FS into a utility SCADA system, a RCU is required. For understanding of the FS operation, refer to the FS operating instructions (IC1000-F320-A170-XX-XXXX).

The RCU is a pole-mounted enclosure containing a microprocessor, a short-range radio and a long-range radio (or modem). The long-range radio (or modem) is not supplied or fitted by Siemens unless specifically included in the sales contract. The microprocessor retrieves data from the FS using the short-range radio and sends it to the SCADA system using the long-range radio. Incorporated into the RCU is a power supply system with a standby battery and provision for auxiliary power connection or solar power.

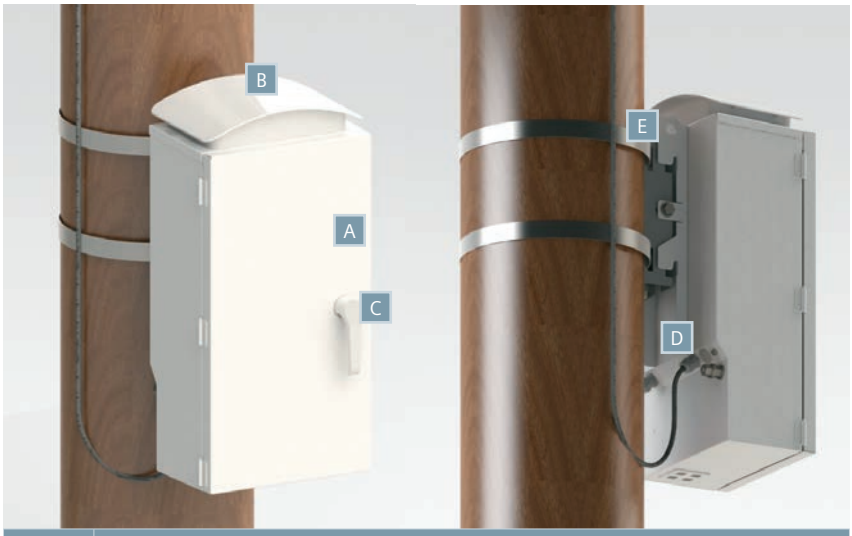
This manual describes in detail the functions, configuration and maintenance of the RCU. The intended users of this manual are the utility SCADA, operations and maintenance staff.

The design and testing of the RCU is according to the relevant parts of IEC 60950-1 Ed. 2.2 (2013) Information technology equipment – Safety – Part 1: General Requirements.



Item	Description
A	Conductor
B	Fusesaver
C	Communications module
D	Fuse
E	RCU
F	Ground (earth) connection
G	Auxiliary power connection
H	Antenna for long-range communications

Figure 2: Installation of RCU with Fusesavers



Item	Description
A	RCU enclosure
B	Shade hood
C	Padlockable handle
D	Cable-entry glands
E	Pole-mounting bracket

Figure 3: RCU mounted on pole

Item	Description
A	Electronics housing
B	Radio tray

Figure 4: Main internal elements

RCU external features

As shown in Figure 3, the RCU enclosure in mounted to the pole using the pole-mounting bracket. Various options for how the pole-mounting bracket connects to the pole and the installation methods are discussed in section RCU mounting on page 25. The RCU enclosure itself is manufactured from powder-coated stainless steel for long service life. Material options are available at time of ordering including 409- and 316-grade stainless steel.

The RCU enclosure has a handle with internal three-point locking mechanism. An external padlock can be fitted to restrict access. The locking mechanism will accept padlocks in the size range diameter .24-.39" (6-10 mm) shank.

On the top of the RCU enclosure is a high-grade UV stabilized plastic shade hood. This shade hood fulfills two functions:

1. Reduces the affect of enclosure heating from direct sunlight onto the top of the enclosure.
2. Provides an aperture for the short-range radio in the RCU to send and receive signals to and from the Fusesavers above.

At the rear of the RCU enclosure, there is a ground connection stud and a number of apertures fitted with cable glands to allow external wiring to access the internal of the RCU for items such as:

- An auxiliary power supply or VT supply
- Solar power supply
- External antennas.

Remote control internal features

The RCU enclosure provides a protective shell for the electronics housing and radio tray as shown in Figure 4.

Electronics housing

The electronics housing contains the microprocessor, battery, power connection terminals, data connection points and the user interface for the RCU. The RCU has a simple user interface for operations and maintenance purposes. The RCU front panel is shown in Figures 5 and 6. It has a number of LED indictors. The LEDs are normally off (to reduce power consumption) and turn on automatically while the door is open as controlled by the position of the door switch.

After connection of a power supply, the operator uses toggle switches to turn the RCU "ON". The LED indicator display panel provides feedback to the operator as to the function of the RCU and the connections among RCU, Fusesavers and the SCADA system.

Item	Description	Item	Description
A	Door switch	E	Battery
B	LED display	F	USB, Ethernet, lineman, operator panel and radio-interface connectors
C	Connector covers	G	Power supply and ground (earth) connection
D	Toggle switches	H	Battery fuse

Figure 5: Electronics housing

Item	Description
A	Green light ON - power source (solar or auxiliary power) providing power. Light OFF - no incoming power.
B	Green light ON - battery is OK. Light OFF - battery off or disconnected. Red light ON - battery needs replacing.
C	Green light ON - Fusesavers OK. Green light flashing - searching for Fusesavers. Red light ON - Fusesaver configuration or communication problem.
D	Green light ON - remote control OFF. Red light ON - remote control ON.
E	Green light ON or OFF - microprocessor problem. Green light flashing - microprocessor OK.
F	Green light ON - Ethernet connected. Red light flashing - network traffic.
G	Green light flashing - SCADA message received. Red light flashing - SCADA message sent.

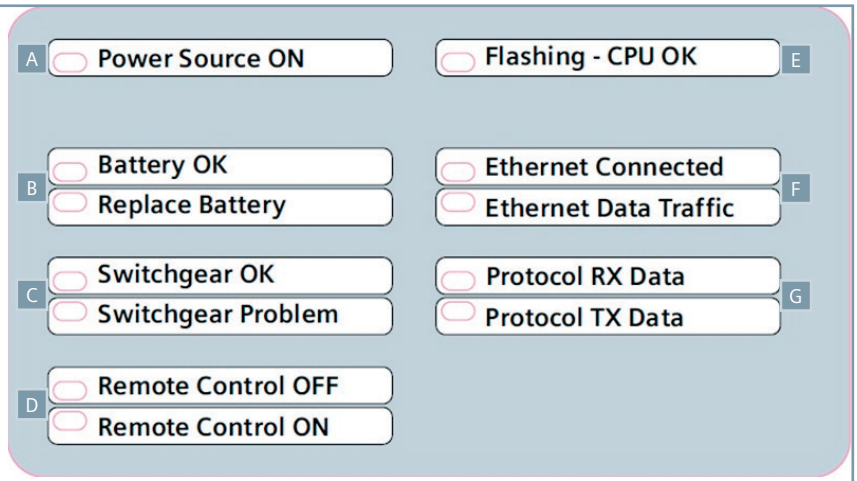
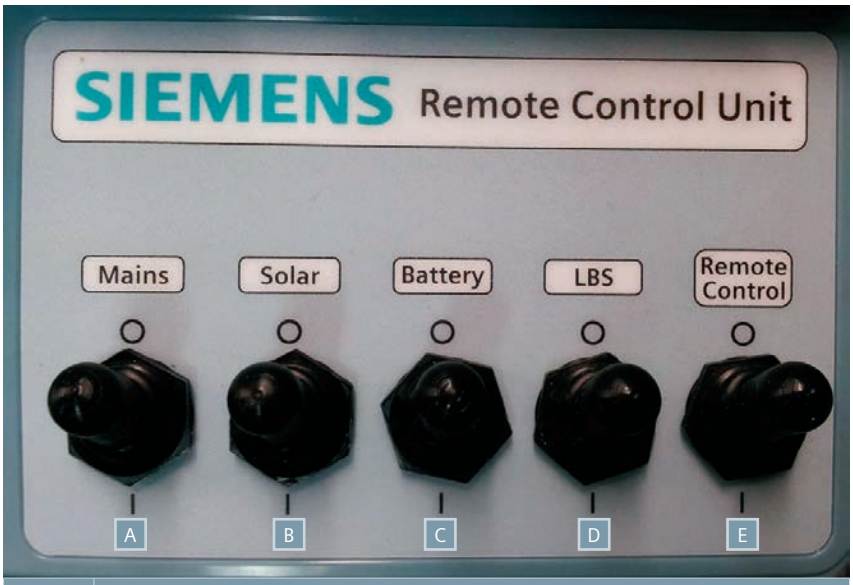


Figure 6: LED indicator display



Item	Description
A	Mains (auxiliary power) supply ON/OFF - no effect for solar installations
B	Solar panel supply ON/OFF - no effect for mains (auxiliary power) installation
C	Battery ON/OFF - used when replacing battery
D	LBS ON/OFF - for future use, leave OFF
E	Remote control ON - remote control is enabled so that remote SCADA operator can control Fusesavers Remote control OFF - remote control is disabled so that remote SCADA operator cannot control Fusesavers. This switch also affects control from an operator control panel if fitted (refer to Methods of asserting controls on page 20).

Figure 7: User toggle switches

Item	Description
A	Customer radio/modem
B	Radio tray
C	Radio/modem specific cable
D	Antenna cable

Figure 8: Radio tray

Radio tray and Fusesaver operator control panel

The radio tray is used to accommodate the long-range radio and the optional FS operator control panel. The radio tray hinges down and allows access to the radio behind. When in the hinged UP position, the tray provides a degree of protection from driving rain.

The maximum allowable dimensions for the radio are:

Enclosure heater	Width	Height	Depth
Without	7.9″ (200 mm)	6.3″ (160 mm)	4.1″ (105 mm)
With	7.9″ (200 mm)	6.3″ (160 mm)	2.8″ (70 mm)

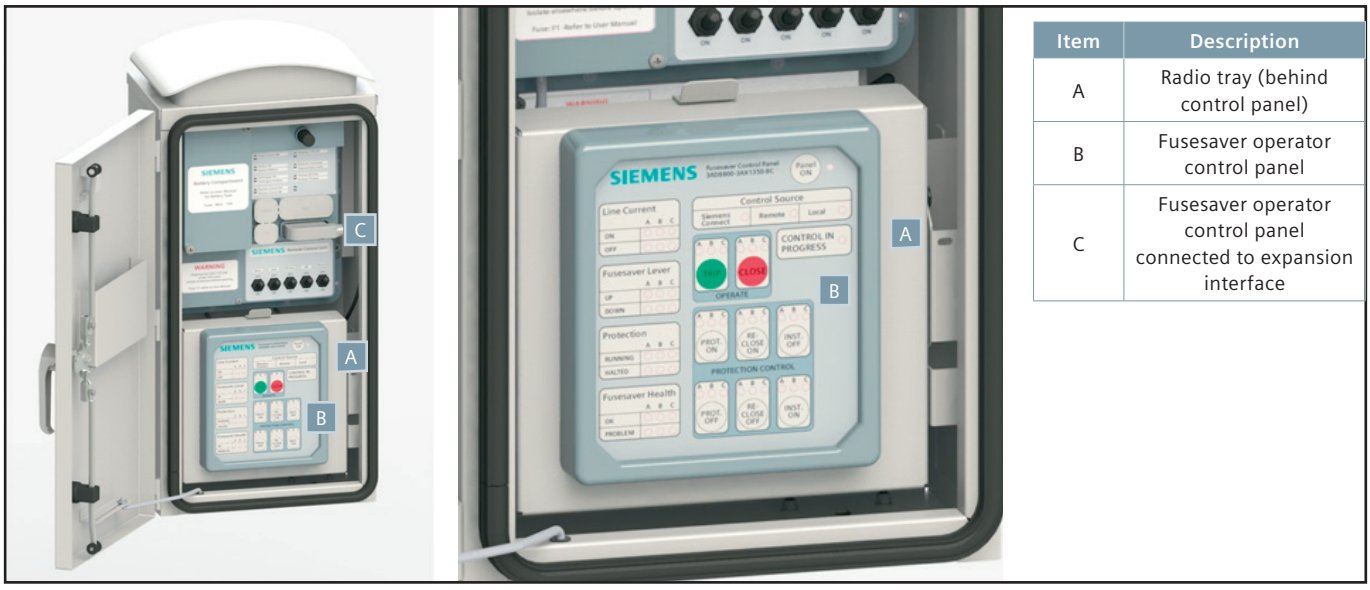
Table 2: Radio dimensions

The radio tray is available for fitting the user-specific radio, modem or other means to connect to the utility's SCADA system.

NOTICE

It is the responsibility of the user to correctly configure the RCU with the selected communications means and to verify the SCADA controls and events perform as expected.

On request, and subject to additional fees, Siemens may customize the radio tray to meet a specific communications device mounting. Further, Siemens may also provide a value-added service by fitting and testing the communications device in the factory prior to shipment. Please contact Siemens to discuss these services.



Item	Description
A	Radio tray (behind control panel)
B	Fusesaver operator control panel
C	Fusesaver operator control panel connected to expansion interface

Figure 9: Fusesaver operator control panel

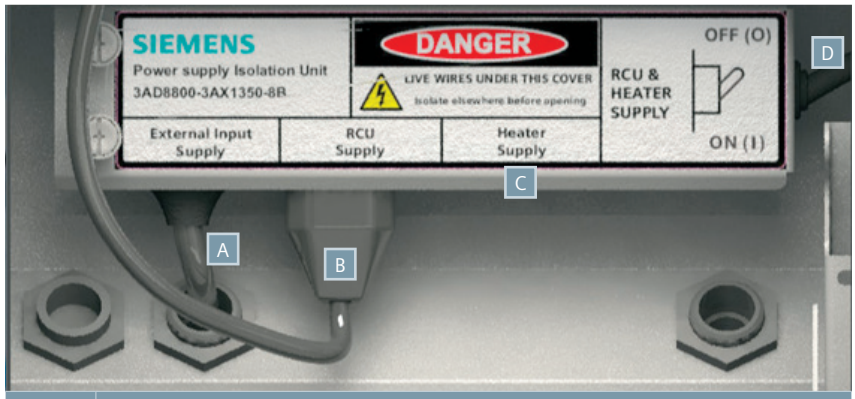
Optionally, the radio tray can be fitted with a FS operator control panel on the reverse side as shown in Figure 9: FS operator control panel. The FS control panel is an accessory to the RCU. A FS control panel fitted to a RCU provides a local operator with the ability to send trip, close and protection controls and view the current state of the Fusesavers connected to the RCU by short-range radio. The FS control panel is fitted inside the RCU and can be accessed by the operator when the RCU door is open.

Power supply isolation unit

Power supply isolation unit (MLFB part 3AD8800-3AX1350-8B) is an optional accessory that provides a double pole point of isolation for the electronics housing and the enclosure heater. Where an isolator is fitted, the incoming auxiliary power is connected to the isolator and the isolator provides sockets for the electronics assembly and for the heater.

The isolation unit is required if:

- The RCU is mains powered and if it is preferred to provide a point of isolation inside the enclosure for changing the electronic housing. Note that the user will still need to provide a point of isolation for the wiring to the RCU.
- An enclosure heater is fitted.



Item	Description
A	Incoming supply cable
B	Outgoing connection to RCU electronics housing (10 A IEC outlet)
C	Outgoing connection to enclosure heater (10 A IEC outlet)
D	Toggle switch

Figure 10: Power supply isolation unit

The isolation unit is not an applicable option for a solar powered RCU.

For discussion of connection of auxiliary power supply, refer to Auxiliary power supply on page 30.

Item	Description
A	Power supply isolation unit
B	Enclosure heater

Figure 11: Enclosure heater

Enclosure heater

The enclosure heater (MLFB part 3AX1350-8A) is an optional accessory that mounts behind the radio tray and plugs into the power supply isolator. It uses natural convection to heat the enclosure, i.e., there is no fan. It has a positive temperature coefficient element which acts as a thermostatic control keeping the battery and electronic compartment above 5 °F (-15 °C) for ambient temperatures as low as -22 °F (-30 °C).

The heater is required for climates:

- Where the temperature can fall below -4 °F (-20 °C) or
- Where the temperature will regularly fall below 14 °F (-10 °C) or
- Where condensing humidity is a recurrent problem.

The heater is suitable for continuous operation at 90-265 Vac.

Note that a power supply isolation unit is required if a heater is fitted.

The heater is not suitable for fitting to a solar powered RCU.

NOTICE

The space heater is covered by a guard. The surface temperature of the heater may be as much as 54 °F (30 °C) higher than the ambient air. Do not remove the guard or touch the surface of the heater when the heater is energized.

Function of the RCU

The RCU acts as an interface between a set of Fusesavers on the power line and a utility SCADA system. To do this, the RCU uses its configuration to find and access installed and running Fusesavers mounted on the power pole. It communicates with the Fusesavers using its built-in short-range radio.

The Fusesavers are installed on each of the phases of the power line and are organized to work as a set to control that line. One, two or three Fusesavers can be organized in this way for a single-phase, two-phase or three-phase line. A RCU provides access to the Fusesavers on a single power line so that if there are multiple lines at a site, then a separate RCU is required for each line.

On start up, the RCU turns on its short-range radio and scans for transmissions from the Fusesavers which match its configuration.

When it finds them, it will acquire data from the Fusesavers and put it into its database ready for re-transmission over a long-range radio (or modem) back to the utility SCADA system master station. The long-range radio is mounted in the radio tray and is provided with power by the RCU electronic system. A variety of data interfaces and power supplies are provided by the RCU (refer to RCU principle on page 9). The exact radio, interface, power supply and protocol used to interface to the SCADA system may be different for each user.

Data in the RCU database includes information about the Fusesavers and the RCU itself. Usually a subset of this data is mapped into the protocol used by the SCADA system.

The functional block diagram shown in Figure 12: RCU functional block diagram on page 16 identifies the main elements of the RCU.

- A short-range radio with built-in antenna that is used by the microprocessor to communicate to a PC to enable configuration of the RCU. The short-range radio is inside the electronics compartment.
- A short-range radio with built-in antenna that is used by the microprocessor to communicate to the FS mounted on the line above the RCU. The short-range radio is inside the electronics compartment.
- The microprocessor retrieves data from the FS for sending to the SCADA system. The microprocessor is inside the electronics compartment.
- The data interface between the microprocessor and the long-range radio (or modem). This has a variety of possible interfaces. The data interface is inside the electronics compartment.
- The long-range radio which connects to an external antenna to communicate with the SCADA system. The long-range radio is outside of the electronics compartment and is mounted on a removable radio tray.
- A power supply system which can take power from either a solar panel or from a 115 V or 230 Vac source and uses it to charge a standby battery. The power supply system provides power to all the parts of the RCU including the long-range radio or modem. The power supply is inside the electronics compartment. The standby battery is in a separate compartment.
- An operator control panel (optional) which connects to the microprocessor to provide additional status displays and controls for an operator.

RCU internal database and controls

The RCU maintains an internal database, which can be accessed by a SCADA protocol. The database consists of three parts:

- Points from the Fusesavers, such as open/closed or line current.
- Points from the RCU itself, such as door open or remote control active.
- Controls, such as FS trip/close or change to FS protection mode.

Refer to the relevant protocol manual for more detail on the database and controls.

RCU Connect utility

To interface to the Fusesavers and to the SCADA system, the RCU requires a configuration which is set up using a utility running on a PC called RCU Connect. RCU Connect is used to specify the information that the RCU needs to operate. RCU Connect is also used to commission and test the RCU. Instructions on how to use RCU Connect and the configuration parameters are in RCU commissioning beginning on page 41.

RCU Connect cannot change the FS policies or settings or operate the Fusesavers. This is carried out using the Siemens Connect utility running on a PC. Refer to the Siemens FS operating instructions IC1000-F320-A170-XX-XXXX.

RCU Connect uses wireless communication from the PC for which a USB antenna (the same one that is used for communication between a PC and a FS) is required. To enable communications, the RCU door must be opened as this allows RCU Connect to start communications at any time over the next 10 minutes. If communications are not started within 10 minutes, then the door must be closed and opened again.

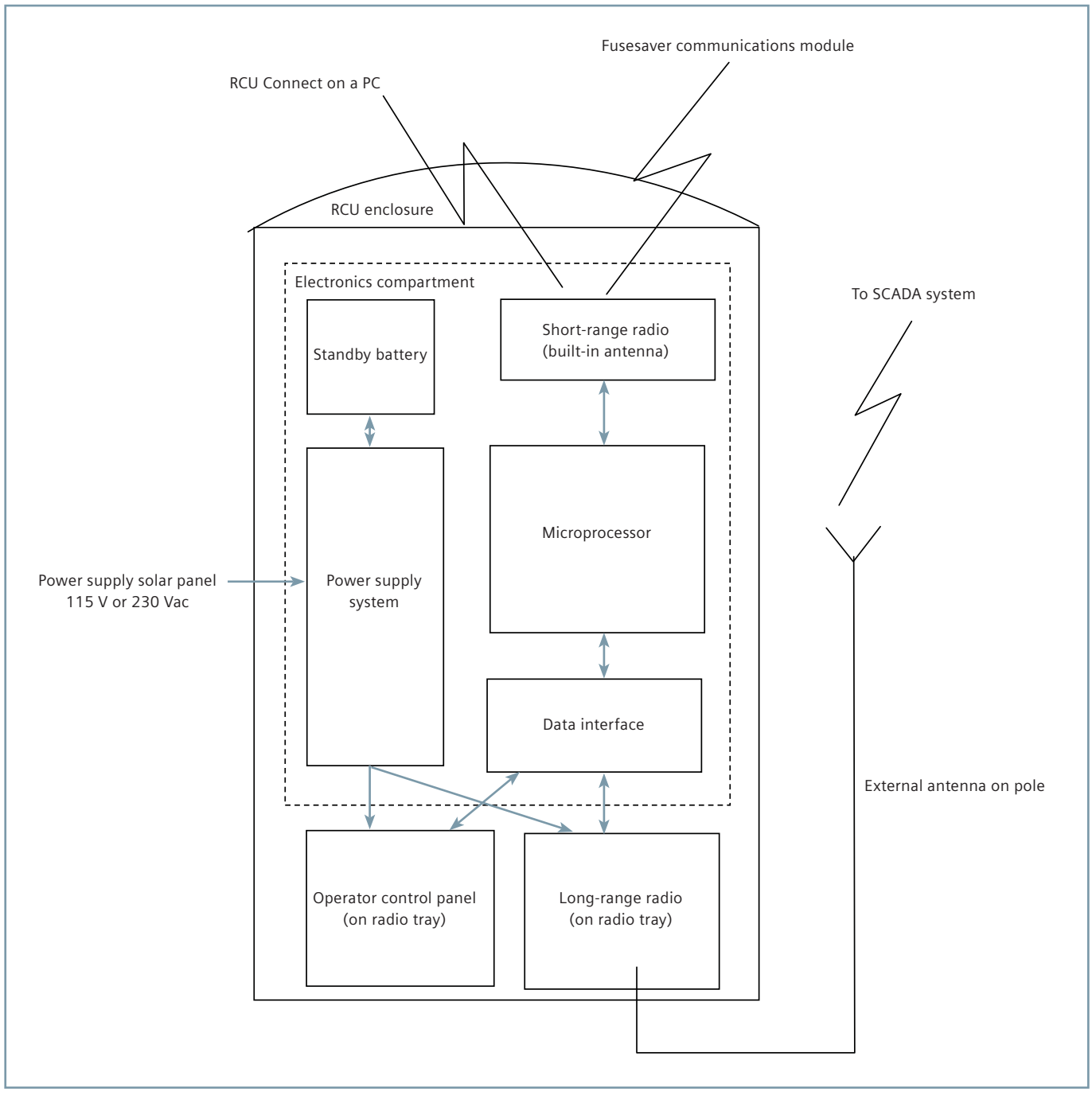
SCADA system protocols

The following SCADA system protocols are supported by the RCU:

1. DNP3 over serial port
2. Others in future.

It is important to understand that each protocol is different but that they all utilize the data in the RCU database and map it into the SCADA protocol in a different way. The mapping and other details needed to understand how to program the SCADA system master station are given in the relevant protocol manual. The details of the RCU database are given in the relevant protocol manual.

Figure 12: RCU functional block diagram



RCU power supply

The RCU can be powered from either an auxiliary power supply or a solar panel supply and incorporates a battery for standby backup purposes when the supply is absent. Refer to the Technical data on page 64 for specification of voltage ranges, power consumption, etc.

Auxiliary power supply

The auxiliary power supply should be connected into the terminal compartment (refer to Figure 26: Auxiliary power cable connection details on page 32) to a dedicated set of terminals. There is a voltage selector switch to select between 115 Vac and 230 Vac supplies. The terminal compartment also includes a fuse. Optionally, the incoming supply can be connected via a power supply isolation unit, see section on Power supply isolation unit on page 13.

Refer to section Auxiliary power supply beginning on page 30 for safe installation instructions.

Solar supply

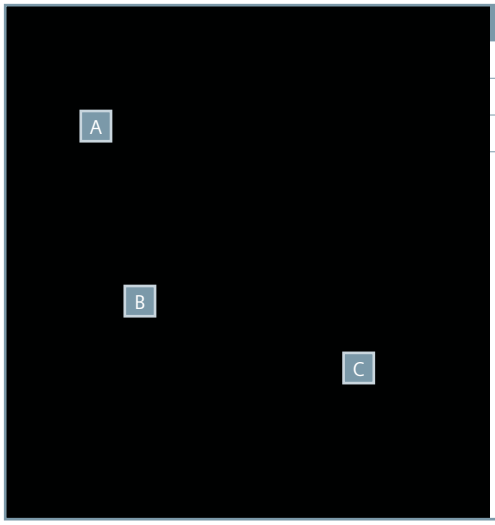
Where a low-voltage auxiliary power supply is not available, Siemens has a solar panel option to provide charge to the batteries. The solar panel is sized to provide adequate charge for energy efficient radios and modems in latitudes less than 45°. The panel angle can be adjusted between two settings to optimize performance for given latitudes. The solar panel must be mounted on the same power pole as the RCU, refer installation details in the Solar panel supply on page 33.

The solar panel is connected into the terminal compartment to a dedicated set of terminals as an alternative to the auxiliary power supply. Siemens can assist with determining the correct power rating of solar panels or a suitable solar panel can be supplied by Siemens.

The RCU monitors the solar supply in two ways:

1. The RCU checks that each day there is some voltage from the solar panel (even on the most overcast day the solar panel will have some output). This will detect a solar panel that has been disconnected or failed.
2. If there is insufficient sunlight during the day, the solar panel may not be able to fully recharge the battery on that day. This is not a problem since the battery will usually have sufficient power stored to operate during periods of low sunlight. However, over a period of days, it is expected that the panel will fully charge the battery. Accordingly, the RCU checks that the solar supply has been able to fully recharge the battery within a specified number of days. If not, this indicates that either the panel is degraded in some way (for example, covered in leaves or dust) or there has been an exceptional run of bad weather. The maximum time period for full recharge is set in the RCU configuration in RCU power supply settings starting on page 68.

If either of these conditions occurs, then a solar panel problem database point (DPID_4) is set and is available for transmission via the SCADA system.



Item	Description
A	Bird roost guard
B	Mounting bracket
C	Solar panel

Figure 13: Solar panel assembly

Battery backup

The battery provides backup power for the RCU. The battery is of the lead-acid type with a 12 V, 7.2 Ah rating. The battery is protected by a fuse in the cable. If the battery is accidentally reversed, the battery fuse will blow but no damage will be done to the RCU electronics. The battery cable is a replaceable item in case it is damaged in service.

Note that the battery negative terminal is connected to the ground of the enclosure and is also the 0 V signal for all the electronic interfaces in the RCU.

The RCU maintains a digital point "Battery Needs to be Replaced" (DPID 2), which indicates that the battery is at end-of-life. When this point is set, it lights the "Replace Battery" LED on the RCU front panel and is available for transmission via the SCADA system. When the battery is replaced, refer to Battery replacement section on page 57, the point is reset and the LED is turned off.

The "Battery Needs to be Replaced" point can be set in a number of ways:

- Charging: While recharging the battery after it has had a significant discharge (for example, when the source has been off for several hours), the total charge put into the battery is monitored. If it requires excessive charge (indicating the battery is at end-of-life), the battery replacement flag is set.
- Discharging: When the source supply is off, the battery is discharged to power the RCU, both the electronics and the SCADA radio. During discharging the battery, voltage is monitored and the time taken to drop to a level that indicates 50 percent of the battery charge has been consumed is measured. If this time is too short, then it indicates that the battery capacity is severely reduced and the battery is at end-of-life and the battery replacement flag is set. This requires the radio average current to be correctly configured, see the relevant protocol manual for more information.
- Time in service: After a battery has been replaced, the days it spends in service are counted. When they exceed the Battery Life configuration setting, refer to RCU power supply settings on page 68, the battery replacement flag is set.

Radio power supply

The long-range radio/modem requires a power supply to operate. The RCU provides the following options:

- A regulated supply which can be configured between 3 Vdc and 9 Vdc. This supply is internally protected by current limit from radio short circuits.
- Supply direct from battery. In this case, a 6 A fast fuse must be included in the radio cable to protect the RCU from radio short circuits.

The supply is available on the serial-port connector on the electronics compartment.

Refer to Radio/modem interface electrical on page 65 for more information on the radio-power interface.

Load-break switch power supply

The RCU incorporates a terminal to power other devices not part of the RCU. This capability is not normally used for FS installations. If this terminal is shorted to ground when the LBS switch is ON, the battery fuse will blow but no damage will be done to the RCU electronics.

NOTICE

The load-break switch has no use for Fusesaver installations and should be turned OFF.

The terminal can be used to supply power to other devices, refer to Siemens for engineering support if this is required.

Radio/modem interface

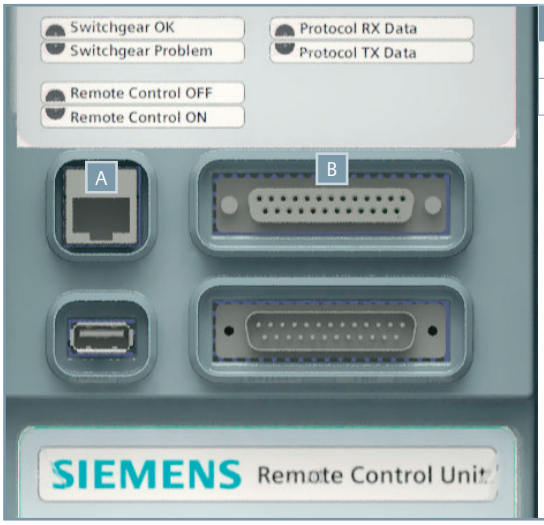
In order to communicate with the SCADA system, master station a long-haul radio or modem is required. The RCU electronics provides two digital interfaces for the radio:

- Serial asynchronous data (serial interface)
- 10/100BaseT (Ethernet interface).

NOTICE

The Ethernet interface is not activated for software versions covered in this instruction manual.

Only one interface can be used at a time. The use of the Ethernet interface increases the power consumption of the RCU. A custom cable is required to connect the radio/modem to the RCU interface. The design and construction of this cable must be performed by the customer referring to Radio/modem interface electrical section on page 65, or as a value-added service provided by Siemens.



Item	Description
A	Ethernet port
B	Serial port

Figure 14: Radio/modem interfaces

Control of Fusesaver

The FS has multiple sources of control for tripping, closing and changing protection mode as follows:

- Trip/close levers on the communications module (refer to FS operating instructions IC1000-F320-A170-XX-XXXX for more details).
- Siemens Connect utility running on a PC equipped with an USB antenna module (refer to FS operating instructions IC1000-F320-A170-XX-XXXX for more details).
- SCADA operator via the RCU.
- Operator control panel, if fitted to the RCU.
- Controls generated from the RCU itself based upon condition criteria.

This section provides details on the protection mode functionality that is possible via the RCU and the various means by which these controls can be asserted.

Methods of asserting controls

SCADA operator controls

The purpose of the RCU is to allow a remote operator to connect through the RCU to the Fusesavers to receive events and to apply controls. The availability of these events and controls is determined by the type and implementation to the utility SCADA system. Refer to the relevant protocol manual for information on the event types and controls supported by the RCU for your protocol. It is the user's responsibility to engineer the SCADA interface required to manage RCUs in the field.

The SCADA control center will be able to perform the following functions:

1. View RCU status and event information.
2. Issue trip and close commands to the Fusesavers via the RCU. The RCU must have remote control switch set to ON for this to be possible.
3. Change protection modes in the FS via the RCU. RCU must have remote control switch set to ON for this to be possible.
4. Issue a command to the FS to force the protection to be armed regardless of whether there is adequate line current to power the Fusesavers as in the normal operation. The protection will remain armed until a command to disable the forced arming is received or a time limit that is set by the FS policy file is set.

Control by the SCADA operator of Fusesaver trip, close, protection mode and forced protection arming is enabled when the remote control switch is ON and disabled when the remote control switch is OFF.

It is possible to configure the RCU so that SCADA trip is always accepted, refer to "Always Allow Trip" setting in the relevant protocol manual.

SCADA control of the Fusesaver dummy control is always allowed.

Fusesaver operator control panel controls

Control by the Fusesaver control panel (refer page 12) for Fusesaver trip, close and protection mode is enabled when the remote control switch is OFF and disabled when the remote control switch is ON; however it is possible to configure the RCU so that the operator control panel is always able to control the Fusesaver irrespective of the remote control switch. This is detailed in Fusesaver operator control panel settings on page 69.

Siemens Connect control

If a local operator is using the Siemens Connect PC application to operate the line Fusesavers (this is called being in-session), then the RCU will not send controls to the Fusesavers and will not retrieve events from the Fusesavers. This is because Siemens Connect is considered to be a local operator and takes charge of communications to the Fusesavers. Any controls received from the SCADA system or from a Fusesaver control panel fitted to the RCU will be rejected.

Once the Siemens Connect session is complete, all new events in the Fusesaver will be passed to the RCU for relay through the SCADA system.

While Siemens Connect is in-session with the Fusesavers, a digital point indicating that the Fusesavers are not in-session with the RCU is available for transmission to the SCADA system.

Fusesaver protection mode control

One of the core functions of the RCU is to allow remote control of the Fusesaver protection functionality. The Fusesaver has five possible protection modes as defined in the Fusesaver operating instructions (IC1000-F320-A170-XX-XXXX) as follows:

1. Normal mode: The Fusesaver utilizes the protection curve defined by the policy file and fuse settings at time of configuration. The Fusesaver will automatically close after the dead time.
2. Protection off mode: The Fusesaver will not trip when a fault occurs, protection functionality is disabled.
3. Normal single mode: The Fusesaver utilizes the protection curve defined by the policy file and fuse settings at time of configuration. The Fusesaver will not automatically close after the dead time, i.e., it will trip and stay in the open state.
4. Fast single: The Fusesaver protection is set to instantaneous. The Fusesaver will not automatically close after the dead time, i.e., it will trip and stay in the open state.
5. Fast mode: Fusesaver protection is set to instantaneous. The Fusesaver will automatically close after the dead time.

The Fusesaver can be put into any of these modes from the following inputs:

1. The external lever of the Fusesaver. When the lever is pulled down, the protection mode is forced to the mode defined in Fusesaver policy file. This always overrides the current mode setting in force. Important - when the external lever is returned to the UP position the protection mode will return to whichever mode was active prior to the lever being pulled down.
2. Commands from the RCU sent over the short-range radios that have originated from a SCADA operator.
3. Commands from the RCU sent over the short-range radios that have originated from an operator control panel in the RCU (if one is fitted).
4. Commands from the RCU sent over the short-range radios that have originated from the RCU itself when certain configurable conditions are met.

The interlocking of these sources of control is defined in Table 3 on page 22, the result of the interlocking can be summarized as follows:

- When a Fusesaver external lever is down, the protection mode is set to the mode predetermined in the Fusesaver policy file (for example, a Fast-Single mode to be used for live line working). When any Fusesaver external level is down, the RCU locks out all Fusesavers on the line from operations (including mode change) via RCU control panel or SCADA. Normally, all the Fusesavers on the line will have their levers pulled down at the same time so their mode is the same.
- When the Fusesaver external lever is up on all the Fusesavers, then the SCADA operator can control the protection mode or a local operator can control the protection mode depending on the position of the remote control on switch. However, if desired, the RCU can be configured so that the RCU operator control panel is always active to change mode control irrespective of the remote control switch.

Table 3: Controls interlocking logic

Fusesaver external lever	Siemens Connect	Remote control on/ off switch	Fusesaver operator control panel ignore remote switch parameter	Mode control by SCADA	Mode control by Fusesaver control panel	Comment
Down on any Fusesaver	Not relevant	Not relevant	Not relevant	Not allowed	Not allowed	Mode will be forced to the mode defined in the Fusesaver policy file for the Fusesavers which have levers down
Up on all Fusesavers	In session	Not relevant	Not relevant	Not allowed	Not allowed	When Siemens Connect is in-session (i.e., on the operate page), all other sources of control are locked out
Up on all Fusesavers	Not running	On	False	Allowed	Not allowed	
Up on all Fusesavers	Not running	On	True	Allowed	Allowed	
Up on all Fusesavers	Not running	Off	Not relevant	Not allowed	Allowed	

Condition-based controls

The RCU also has the capability to do post processing of events received from the Fusesavers to assess whether certain conditions have occurred from which the RCU may apply commands to the Fusesavers.

Excessive cleared faults

This section describes a system whereby the RCU monitors the number and time frame of cleared faults of Fusesavers under the RCU's control. The RCU changes the Fusesavers' protection mode to "Protection OFF" if the number of cleared faults is deemed excessive according to the excessive cleared fault parameters set in the RCU.

The RCU analyzes cleared fault events from Fusesavers and keeps a running tally of the number of cleared faults that occur on the line within a configurable time frame. An attempt to match cleared fault events from different phases is made by using a 30 s time-match window in order to count simultaneous multiple phase faults as one event for the line.

When the configured number of cleared faults is reached, the RCU will send a remote protection mode change control to the Fusesavers, as if it is another control such as a SCADA operator, setting the protection mode to "Protection OFF".

The event record of the Fusesaver will show the source of the control as "RCU". The RCU will also set the protocol database digital point for "Excessive Cleared Faults Flag" if the threshold is exceeded.

If the RCU is unable to control the Fusesaver remote protection mode, the control is lost, but will be attempted again if there is another cleared fault which exceeds the count/time constraint. Reasons for a control fail/rejected are:

1. The Fusesaver external lever is down,
2. Siemens Connect is in session,
3. Communications failure, or
4. Another control is in progress.

When the Fusesaver active protection mode bits change, the RCU will also reset the timing/counting of cleared fault events. This means that any change of active protection mode by the user (e.g., pulling down the external lever of the Fusesaver or by a SCADA control) resets the excessive cleared faults count and timing starts again.

The RCU configuration has parameters that allow configuration of the excessive cleared faults functionality. These are:

- The time window size specified in seconds (maximum of 65,535 seconds, 18.2 hours), and
- The number of cleared faults that occur within the time window (maximum of 16).

Setting either the number of cleared faults or the sliding window size fields to zero disables the feature.

Installation

⚠ DANGER

Hazardous voltages.

Will cause death or serious injury.

Do not work on energized equipment. Always de-energize and ground the lines before working on the equipment.

If live-line work must be performed, follow requirements of local occupational health and safety regulations and employ personal protective equipment (PPE) suitable for the voltages involved. It is the user's responsibility to develop safe and adequate working procedures complying with these requirements.

Always consider all parts as energized until they are de-energized, tested for absence of voltage, and grounded.

General

This section provides information about the installation and commissioning with regard to the following:

- Required documents
- Personnel requirements
- Tools, devices, and expendable materials to be used
- Accident prevention
- Recording and documentation.

NOTICE

To prevent damage to the RCU, operators should always use electrostatic discharge ground straps when operating the equipment if it is in a high-static environment.

Installation guidelines

The RCU should be installed on the lower portion of the pole. The RCU is not connected to high voltage. Subject to local utility regulations installation can be completed by personnel qualified to perform work on low-voltage installations.

Grounding of the RCU is required in accordance with the Grounding section on page 35.

Tools required for installing the RCU

- 1 x 24 mm box-end wrench
- 2 x 18 mm box-end wrench
- 2 x 19 mm box-end wrench
- Adjustable torque wrench in range 30 to 50 lb-ft (40 to 70 Nm) with 18 mm, 19 mm and 24 mm sockets
- Flat No. 2 screwdriver
- Flat No. 1 screwdriver
- Cable stripping and termination tools.

Additional parts:

- Ground cables and terminals.

Mechanical installation

A qualified person (or supervisor) must be assigned to oversee the installation and commissioning work, instructs personnel during installation and commissioning tasks, and checks for compliance with the applicable safety measures. Furthermore, this person is responsible for the organization, monitoring and signing off of the work.

The installation and commissioning work must be performed by authorized personnel with sufficient qualifications and experience. Suitable lifting gear in good working order must be used for installation.

Applicable accident prevention regulations must be observed.

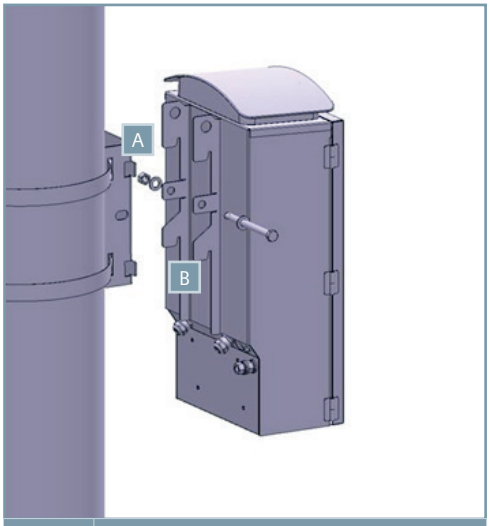
RCU mounting

The RCU is intended to be pole mounted onto timber, steel, concrete or similar poles. The standard RCU mounting bracket can accommodate all these options through the use of either bolting or strapping of the bracket to the pole. A combination of one bolt and a strap is also acceptable so long as the upper restraint is bolted.

The RCU weighs approximately 33 lbs (15 kg). The means of securing the RCU to the pole must be suitable for this weight. The battery should not be installed until after the RCU is secure to the pole.

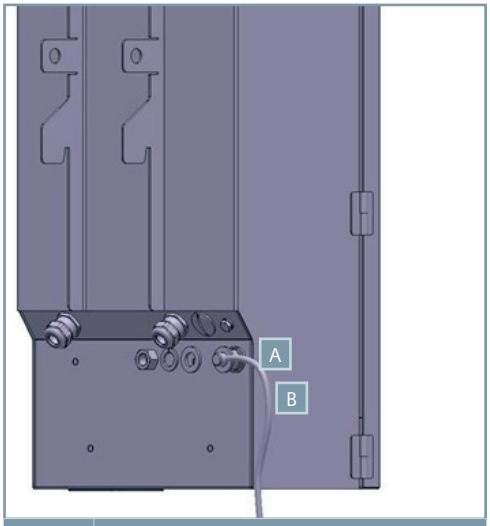
The recommended installation sequence is:

1. Mount the bracket to the pole using either M16 galvanized bolts of grade 4.6 or higher (torque 52 lb-ft (70 Nm)) or straps taking into account orientation guidelines described in RCU location and orientation section on page 28.
2. Hang the enclosure over the bracket using the locating ears as a guide.
3. Fit the M12 cross-bolt and secure the RCU to the pole bracket (torque 30 lb-ft (40 Nm)).
4. Connect grounding wire as required in Grounding section on page 35.



Item	Description
A	Pole-mounting bracket
B	Locating ear

Figure 15: RCU mounting



Item	Description
A	Ground stud
B	Ground wire

Figure 16: Connecting

Item	Description
A	Battery
B	Battery compartment cover
C	Negative terminal (black)
D	Positive terminal (red)
E	Battery fuse

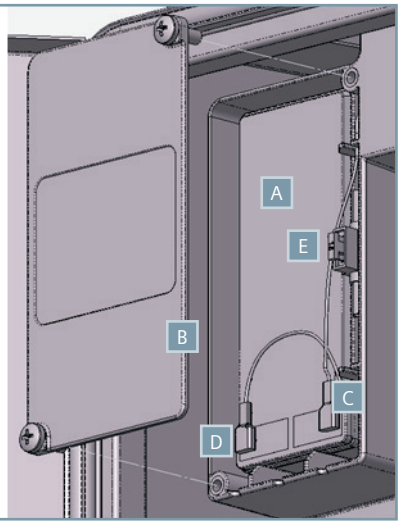


Figure 17: Battery connection details

Battery installation

After mounting the RCU, it is necessary to install the battery according to the following process:

1. Remove the battery from the packaging material.
2. Ensure the “Battery I/O“ toggle switch is set to the “O“ position.
3. Unscrew the battery compartment cover.
4. Fit the battery into the compartment in the orientation shown in Figure 17.
5. Connect the red wire to the positive (red) terminal of the battery and the black wire to the negative (black) terminal of the battery.
6. Fit the battery compartment cover and screw in place using flat-blade screwdriver to 9 lb-in (1.0 Nm) torque.

NOTICE

If the battery is connected with reversed polarity, the battery fuse will blow.

When installing the battery, do not pinch or damage the battery connection wires.

The battery should be removed prior to removing the RCU from a pole and for any transport. Refer to Battery replacement on page 57.

Solar panel mounting

The solar panel assembly is intended to be pole mounted onto timber, steel, concrete or similar poles. The standard solar panel mounting bracket can accommodate all these options through the use of either bolting or strapping of the bracket to the pole. A combination of one bolt and a strap is also acceptable so long as the upper restraint is bolted.

⚠ CAUTION

Falling objects with sharp points.

May cause serious injury.

When removing or installing solar panel with bird roost guard, use appropriate personnel protective equipment, including a hard hat and protective gloves. Do not stand directly under the solar panel during installation or removal.

The recommended installation sequence is:

1. Mount the bracket to the pole using either M16 bolts (torque 52 lb-ft (70 Nm)), 5/8" bolts (torque 50 lb-ft (68 Nm)) or straps taking into account orientation guidelines described in RCU location and orientation.
2. On the ground, assemble the bird roost guard and the U-channel to the bracket using the screws provided leaving the screws loose.
3. Mount the panel on the U-channel and orientate. Fit the M8 bolts and torque to 11 lb-ft (15 Nm). The solar panel can be installed at two different angles. The best angle of the panel depends upon the latitude of the site as follows:
   a. For latitudes <30°, install solar panel at 30° angle to the horizontal.
   b. For latitudes >30° and <45°, install the solar panel at 45° angle to the horizontal.

   Most of the U.S. is located between 30° and 45°. Southern areas (southern portions of Texas, Louisiana, Florida and all of Hawaii) are less than 30°. Northern states (e.g., Washington to Maine and Alaska) have latitudes of over 45°.
4. Tighten all bolts and screws.
5. Connect grounding wires as required in Grounding section on page 35.
6. Connect the panel output leads to the RCU.

Item	Description
A	Bird-roost guard
B	Solar-panel frame
C	Pole-mounting bracket

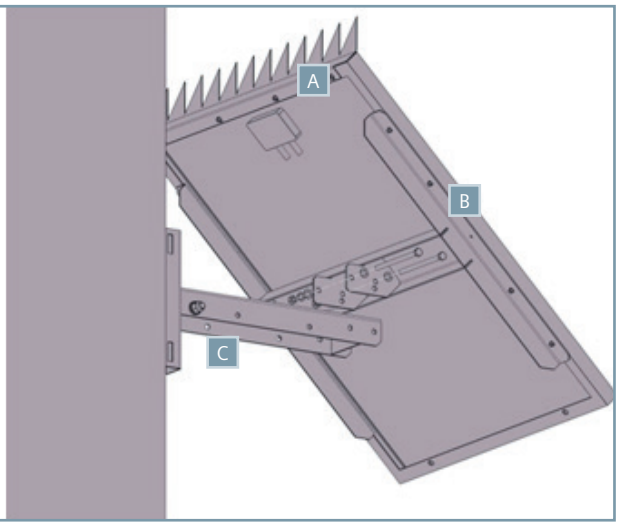


Figure 18: Solar panel mounting

Item	Description
A	Ground stud
B	Ground wire

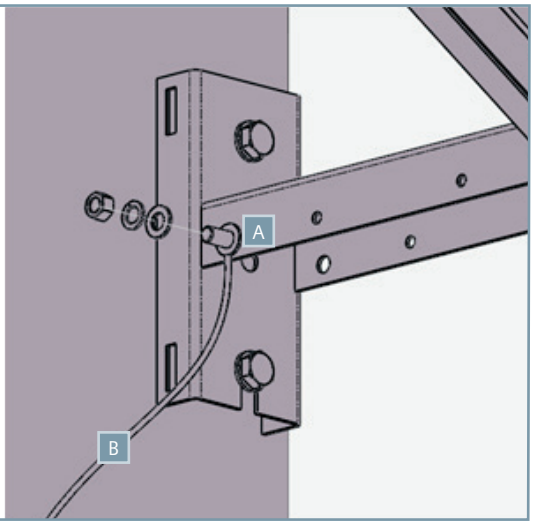


Figure 19: Connecting

RCU location and orientation

The following provides the preferred mounting orientation for the RCU and solar panel. For many real world installations, these ideal requirements will be contradictory and impossible to achieve. Therefore a hierarchy of constraints is provided.

RCU orientation

The RCU must be mounted on the power pole within 65.6 ft (20 m) of the Fusesavers it is to connect with. Best radio connection between RCU and Fusesavers is when the RCU is under the power lines with a line of sight to the Fusesavers. The worst orientation is when the RCU is on the power pole at right angles to the line. If there are communications problems between the RCU and the Fusesaver, then try moving the RCU through 90° on the pole.

Also, the RCU should be mounted on the shady side of the power pole to minimize solar heating which strongly affects battery life. In the Northern hemisphere, this means on the north side of the pole. In the Southern Hemisphere, this means on the south side of the pole. If this is impracticable, then the RCU should be mounted towards the Eastern side of the pole to minimize afternoon sun heating.

Solar panel orientation

The solar panel should be mounted as follows:

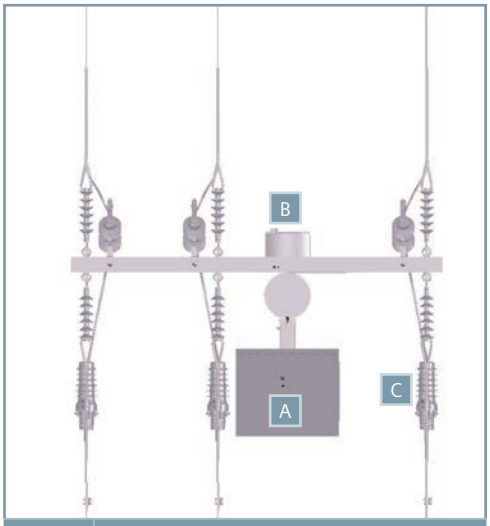
- On the same pole as the RCU within 6.6 ft (2 m) vertically of the RCU.
- Facing South in the Northern Hemisphere and North in the Southern Hemisphere.
- With no shading of the panel except within one hour of sunrise and sunset. This is vital to ensure correct operation of the solar panel. Any shadow that falls over any part of the panel significantly degrades the panel output. If this condition cannot be met, then the site is probably not suitable for solar operation.
- Where possible, avoid mounting the panel in the line of sight between the RCU and the Fusesavers to reduce interference with the RCU radio communications.

Hierarchy of constraints

When the orientation recommendations are not possible or incompatible, the following is the recommended hierarchy of constraints:

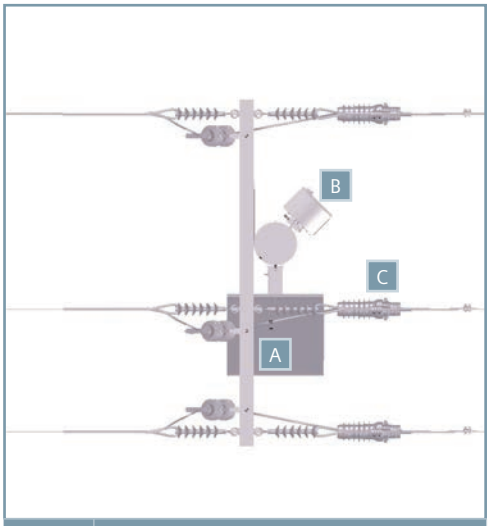
1. Achieve appropriate location of solar panel to generate acceptable charging. Suggested tolerance +/-30° from south facing (for Northern hemisphere installations).
2. Position the RCU to achieve reliable communications to Fusesavers. Ideally the RCU should be mounted on the same side of the pole as the Fusesavers being careful to avoid interference from the solar panel above.
3. Position RCU on shaded side of pole as much as possible maintaining point 2 to a tolerance of +/- 45° of colinear with the overhead line.

Figures 20-23 on page 29 demonstrate the preferred location of RCU and solar panel for various line orientations (Northern Hemisphere example).



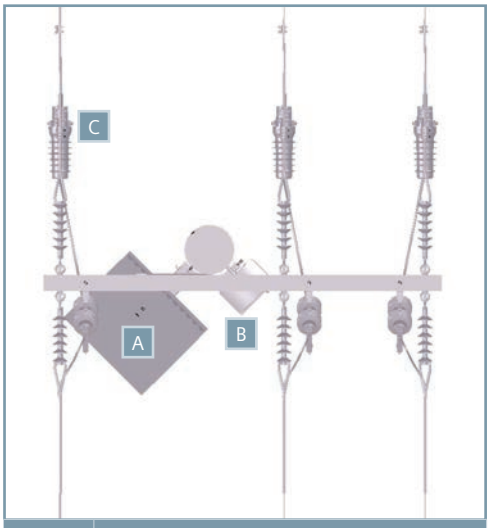
Item	Description
A	Solar panel facing south
B	RCU facing north
C	Fusesaver

Figure 20: North-south line – version 1



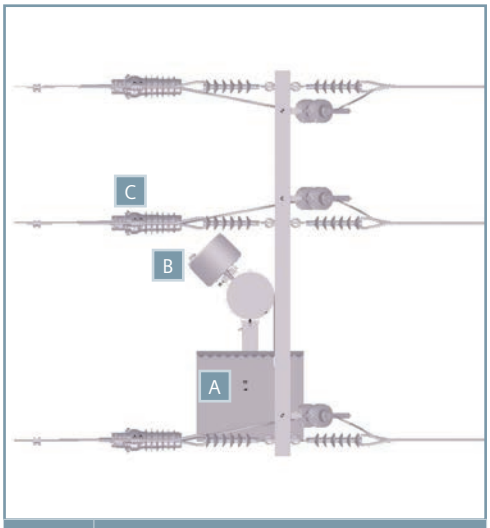
Item	Description
A	Solar panel facing south
B	RCU facing northeast
C	Fusesaver

Figure 21: East-west line – version 1



Item	Description
A	Solar panel facing southwest
B	RCU facing southeast
C	Fusesaver

Figure 22: North-south line – version 2



Item	Description
A	Solar panel facing south
B	RCU facing northwest
C	Fusesaver

Figure 23: East-west line – version 2

Auxiliary power supply

When a local low-voltage auxiliary power supply is available at the RCU pole, this may be connected directly to the RCU to provide power in accordance with the following guidelines. It is the user's responsibility to provide an appropriate ground cable and to conduct the installation.

⚠ DANGER

Hazardous voltages and high-speed moving parts.

Will cause death, serious injury and property damage.

Do not work on energized equipment. Always de-energize and ground the lines before working on the equipment.

De-energize and isolate auxiliary power supply at the source before removing power supply cover, and install power supply cover before energizing auxiliary power to the RCU.

NOTICE

The supply to the RCU must be protected at its source with fuses and an isolating means. Fuses must be sized to protect #16 AWG (1.5 mm^2) wire. Ground connection between the ground terminal of the power connection compartment and the RCU enclosure ground must be undamaged and intact.

Item	Description
A	Voltage selector switch

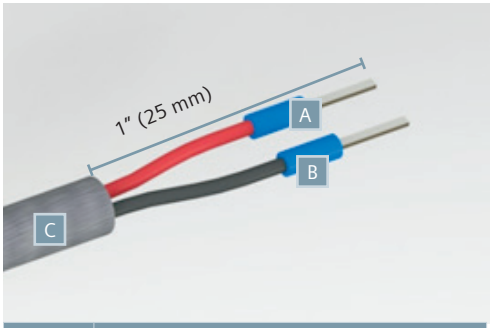
Figure 24: Auxiliary power voltage selector switch

Ensure that the voltage selector in the power supply compartment is selected to match the auxiliary power supply incoming voltage. If the voltage selector is set to 115 Vac and 230 Vac is applied, the fuse will blow. A spare fuse is supplied in the battery compartment. If the voltage selector is set to 230 Vac and 115 Vac is applied, the RCU will not sense source supply on. Short-term overvoltage of up to 120 percent nominal voltage to the input can be sustained for one hour without damage.

Auxiliary power cable specification

The auxiliary power cable shall be two conductor cable with external insulation suitably rated for the voltage and operating environment. It shall have the following additional specification:

- External insulation is be circular in cross-section
- External insulation diameter to be in range 0.31” to 0.50” (8 mm to 12.5 mm)
- The external insulation is be cut back as shown in Figure 25.
- The wire size of each core is to be in the range #16 AWG to #12 AWG (1.5 mm^2 to 4 mm^2). It is preferable to terminate the wires with crimps as shown.



Item	Description
A	Active wire
B	Neutral wire
C	Insulation

Figure 25: Auxiliary power cable details

⚠ DANGER

Hazardous voltages.

Will cause death or serious injury.

If IP 3x rating for terminal compartment is breached through incorrect auxiliary power wire installation, this creates a situation of possible electric shock risk that could lead to serious injury or death.

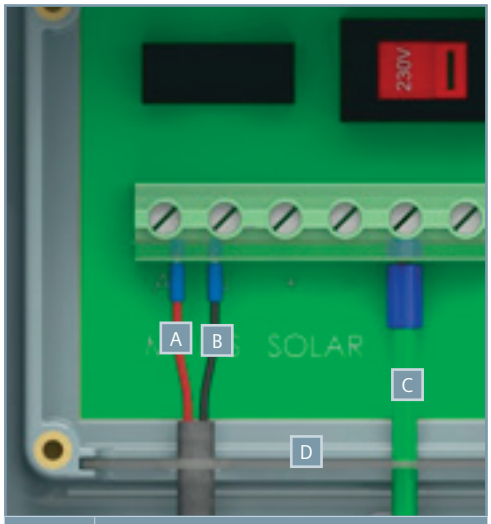
Installation process – incoming auxiliary power connected to electronics housing

The auxiliary power cable should be connected according to the following process using wire of the correct specification to ensure IP 3x rating is maintained for the terminal compartment.

1. The auxiliary power cable is fed through the cable gland on the RCU enclosure (item D in Figure 3 on page 10) a suitable amount to allow connection into the power supply compartment. The cable gland should be tightened to clamp the auxiliary power cable.
2. Active and neutral of the mains cable are connected into the power supply compartment terminal block and tightened in place. Ensure the correct wire is installed into the matching terminal block location. Connect the ground wire as shown.
3. Select the appropriate wire entry blanking plate from the various plates provided. Minimize the clearance between the slot in the blanking plate and the external diameter of the auxiliary power cable insulation.
4. The plastic cable barrier suitable for the auxiliary power cable (not the one for solar power supply) is installed in place over the auxiliary power cable outer insulation.
5. Fit the power compartment cover and screw in place (torque 13 in-lb (1.5 Nm)) using screwdriver.

Unless the RCU is operated from a dedicated power transformer mounted on the same pole, it is recommended to install surge arresters on both the incoming auxiliary power wires, with the arresters grounded to the RCU enclosure ground to the external enclosure ground (earth) stud.

Figure 26: Auxiliary power cable connection details



Item	Description
A	Active wire
B	Neutral wire
C	Ground wire
D	Wire entry blanking plate - auxiliary power

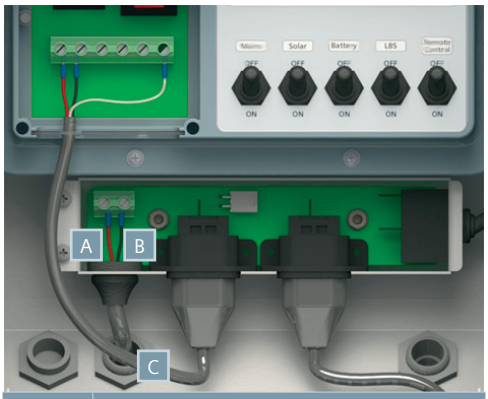
Installation process – incoming auxiliary power connected to power isolation unit

If the RCU is supplied with a power isolation unit, then the incoming auxiliary power supply active and neutral are connected to the terminal block in the isolator rather than the terminal block in the electronics housing. The specification for the auxiliary power supply wire is the same as above. When the power isolation unit is factory fitted to the RCU, the power cable to the electronics housing will be pre-fitted to the electronics housing.

1. The auxiliary power supply cable is fed through the cable gland on the RCU enclosure a suitable amount to allow connection into the power isolation unit. The cable gland (item D in Figure 3 on page 10) should be tightened to clamp the auxiliary power supply cable.
2. The cover of the power isolation unit is then removed by a suitably qualified person by undoing the screws on the front.

3. The auxiliary power supply cable is fed through the gland in the power isolation unit. Ensure the gland seals around the insulation of the auxiliary power supply cable.
4. The two power wires of the auxiliary power supply cable are connected into the power isolation unit terminal block and tightened in place. Connect the ground wire as shown.
   Ensure the correct wire is installed into the matching terminal block.
5. Fit the power isolation unit cover and screw in place (torque 13 in-lb (1.5 Nm)) using screwdriver.
6. Plug the cable from the RCU electronics compartment into the labelled socket on the power isolation unit.

Figure 27: Power isolation unit connection details



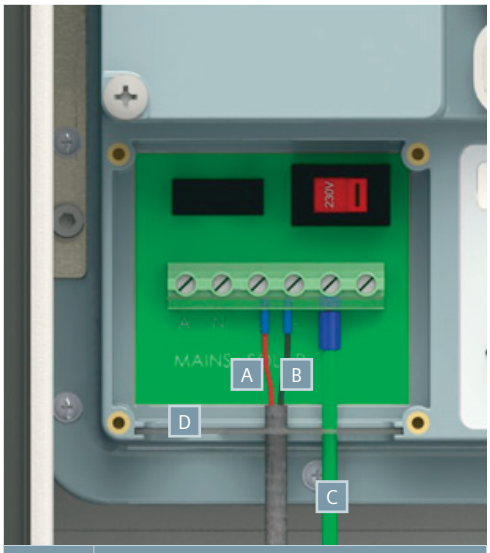
Item	Description
A	Line
B	Neutral
C	RCU electronics power cable

Solar power supply

The solar cable should be connected according to the following process:

1. The solar cable is fed through the cable gland on the RCU enclosure a suitable amount to allow connection into the power supply compartment. The cable gland (item D in Figure 3 on page 10) should be tightened to clamp the solar cable.
2. Positive (red) and negative (black) of the solar cable are connected into the power supply compartment terminal block and tightened in place. Ensure the correct wire is installed into the matching terminal block.
3. The plastic wire entry blanking plate suitable for the solar cable is selected from the various plates provided and is slid into place over the solar cable.
4. Fit the power compartment cover and screw in place (torque 13 in-lb (1.5 Nm)) using screwdriver.

Figure 28: Solar cable connection details



Item	Description
A	Positive wire (red)
B	Negative wire (black)
C	Ground wire
D	Wire-entry blanking plate - solar

NOTICE

Reversing the connections to the solar panel will not cause damage to the RCU electronics in the short term; however this should not be allowed to persist since at high-sunlight conditions for long periods the RCU electronics could be damaged by the current from the panel in high-sunlight conditions.

Shorting the solar supply terminals to ground will not damage the RCU.

Separate voltage transformer power supply

In some locations, a separate voltage transformer (VT) is installed to provide power to the RCU. This VT should be:

- Fused and rated on the high-voltage side to match the supply conditions.
- The secondary voltage should be 115 Vac or 230 Vac as preferred and rated at 150 VA.
- A fuse on the secondary adjacent to the VT is recommended to protect from wiring faults of the pole. The fuse should be rated for the VT and wiring. 2 A recommended.
- A method of isolating the RCU from the source supply is required for safe operation. The fuse and the isolating means must be located at the source end of the circuit.

For most primary voltage ratings Siemens can supply a suitable VT.

⚠ DANGER

Hazardous voltages and high-speed moving parts.

Will cause death, serious injury and property damage.

Do not work on energized equipment. Always de-energize and ground the lines before working on the equipment.

De-energize and isolate auxiliary power supply at the source before removing power supply cover, and install power supply cover before energizing auxiliary power to the RCU.

The VT secondary power supply cable specification and installation process is identical to the auxiliary power supply cable specification and installation in Auxiliary power supply section on page 30.

Grounding

Grounding of the RCU and connected accessories in the correct way is critical to ensuring operator safety.

⚠ WARNING

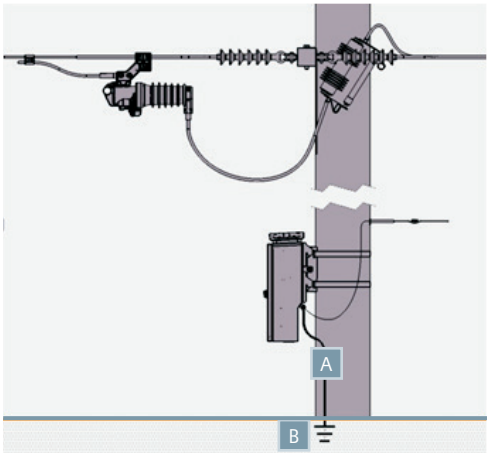
Hazardous voltages.

Can cause death or serious injury.

RCU enclosure must be solidly grounded. Follow ANSI C2 (NESC) practices for grounding the RCU enclosure. Improper grounding can expose operator to high voltage.

NOTICE

The RCU cubicle must be bonded to ground using the M12 enclosure ground (earth) stud provided to meet the safety requirements of the utility. The ground wire must be #6 AWG (16 mm²) in size or larger. It is the user's responsibility to provide the ground wire.

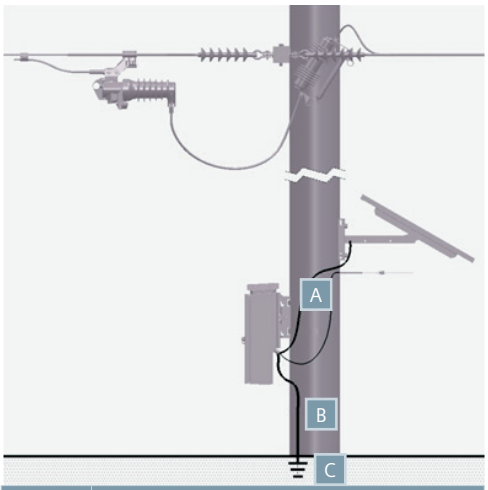


Item	Description
A	Ground wire
B	Ground grid or ground rod

Figure 29: RCU grounding diagram

RCU and solar panel grounding

When a solar panel is fitted, in addition to the RCU grounding described, the frame of the solar panel must be connected using the M12 stud provided to the M12 ground stud of the RCU using ground wire of #6 AWG (16 mm²) in size or larger. It is the user's responsibility to provide the ground wire and to fit in accordance with the applicable safety guidelines.



Item	Description
A	Ground wire from solar panel to RCU
B	Ground wire
C	Ground grid or ground rod

Figure 30: RCU and solar panel grounding diagram

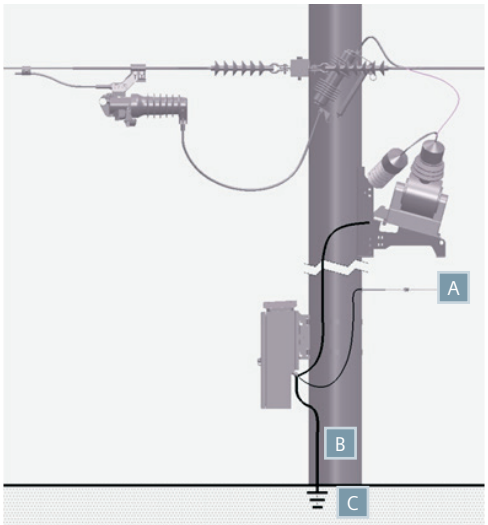
RCU and VT grounding

When a voltage transformer is fitted, in addition to the RCU grounding described above, the following additional grounding is required using ground wire of #6 AWG (16 mm²) in size or larger:

One side of the VT secondary must be grounded to the VT ground stud to create a defined neutral wire in the supply to the RCU. In the line wire, a service fuse and point of isolation should be fitted.

- The VT mounting frame must be connected to the RCU enclosure ground stud and to the ground grid or ground rod. If the VT has a ground screen, it must be grounded to the frame.
- If the primary of the VT is fitted with surge arresters, they must be grounded to the VT mounting frame and connected to the ground drive or ground rod.

It is the user's responsibility to provide the ground wire and to fit in accordance with ANSI C2 (NESC).



Item	Description
A	Ground wire from VT to RCU
B	Ground wire
C	Ground grid or ground rod

Figure 31: RCU and voltage transformer grounding diagram

Radio installation

Each different radio or modem will require slightly different installation methods to be developed. Refer to Table 2 on page 12 for allowable radio sizes. A generic approach is as follows:

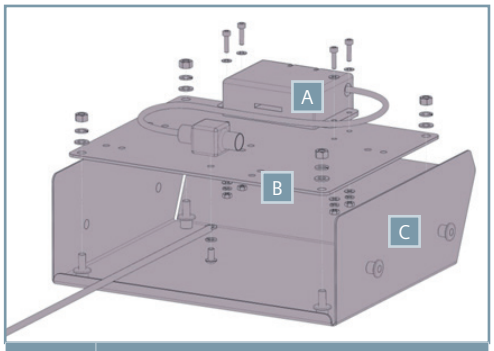
1. Remove the radio tray from the RCU.
2. Remove the radio mounting plate from the radio tray by unscrewing the M5 nuts using an 8 mm socket.
3. The user is to arrange the radio/modem items, including antenna and surge arrester in a appropriate way on the mounting plate. Mark all hole locations required.
4. Drill holes and deburr edges as required.
5. Assemble radio/modem items to mounting plate. User to provide fasteners.
6. Install the mounting plate back onto the radio tray and tighten in place with the M5 nuts using the 8 mm socket. Torque to 26 in-lb (3 Nm).
7. Fit the radio tray back into the RCU enclosure taking account of antenna connections and connection to electronics compartment.
8. If an antenna surge arrester is fitted (recommended), ground it to the M6 ground stud in the enclosure.
9. Connect the appropriate radio cable (user to supply or can purchase from Siemens) to the radio and the appropriate port on the RCU electronics enclosure.

NOTICE

The user must ensure that radio/modem selected has appropriate fire safety ratings, and has no failure mode that could result in causing a fire.

NOTICE

If the radio uses a power supply from the battery, the radio cable must be fitted with 6 A fast-acting fuse in the cable.



Item	Description
A	Radio or modem
B	Mounting plate
C	Radio tray

Figure 32: Radio installation example

External antenna connection

To enable long-range wireless connection to the SCADA control center, it will be necessary for the user to fit an appropriate external antenna. The antenna cable is passed through a cable gland at the rear of the RCU enclosure (item D in Figure 3 on page 10) and connected to the user's radio equipment. The cable gland must be tightened to clamp the cable. It may be desirable to fit an antenna surge arrestor inside the RCU enclosure. The surge arrester must be grounded to the 6 mm ground stud inside the RCU enclosure.

Item	Description
A	Antenna radio cable gland
B	Antenna radio cable
C	Antenna surge arrester

Figure 33: Antenna cable connection

RCU Connect installation instructions

RCU Connect is supplied as a setup file which will self-install on the PC running the following Windows® operating systems:

1. Windows® 7
2. Windows® Vista
3. Windows® XP – service pack 3 or higher.

When first run, the user is guided to select the Windows® folder that will hold the utility's configuration files. The default folder is /Siemens/RCU Connect/ created under the user's application data folder in Windows®. It is recommended to use the default location.

File	Description
dotNetFx40_Client_ x86_x64.exe	An executable file for the installation on a PC
RCUConfigureSetup.exe	An executable file for the installation on a PC
USB2Drivers.zip	The zip file includes drivers for various systems
RCU Connect instructions.pdf	A separate manual with these installation instructions

Table 4: RCU Connect files

The installation sequence is as follows:

4. Install .NET
5. Install RCU Connect software.
6. Install drivers.
7. Check operation.

Install .NET

The .NET framework is normally already installed on Windows 7 operating systems. For Windows XP and Windows Vista, it may be necessary to do an installation. Launch the installation by clicking on the executable file (dotNetFx40_Client_x86_x64.exe) and following the Windows installation instructions.

Install RCU Connect application:

- Unzip the install folder to a suitable place on your PC, such as your desktop, and open the RCU Connect folder which has been created.
- Run the RCUConfigureSetup.exe self-extracting installation program (double-click it).
- If you have a previous version of RCU Connect installed, you do not have to uninstall it before installing the new version.
- The installation process offers to install RCU Connect to a standard location. Accept this default location unless you have a good reason not to (see Table 5: Location on page 40).
- Accept the licence agreement.

RCU Connect has now been installed. An icon is on the desktop and in the program menu.

Install drivers

When using Windows® 7, first plug in the USB antenna. Usually Windows® 7 finds and installs drivers automatically. If not, then act as for Windows Vista®.

To install drivers on Windows Vista® and Windows® XP, first plug in the USB antenna, and when prompted for drivers, direct the installer to the USB2 drivers folder.

1. Select the “Install from a list or specific location (Advanced)” checkbox.
2. Click “Next”.
3. Browse to the USB2 drivers folder that you installed.
4. Click “Next”.

The installation is now complete.

In some instances after plugging in the USB antenna, Windows® does not automatically prompt to search for drivers. In this case, the following steps are necessary:

1. Click on the Windows start menu.
2. Select the control panel option.
3. Select the device manager option.
4. Expand the LibUSB-Win32 Devices to show the ANT USB Stick 2 option.
5. Right click on the ANT USB Stick 2 option to show the menu. Click the “Update Driver Software...” option.
6. Select the Browse for driver files option and browse to the USB2 drivers folder that you installed.
7. Click “Next”.
8. The installation is now complete.

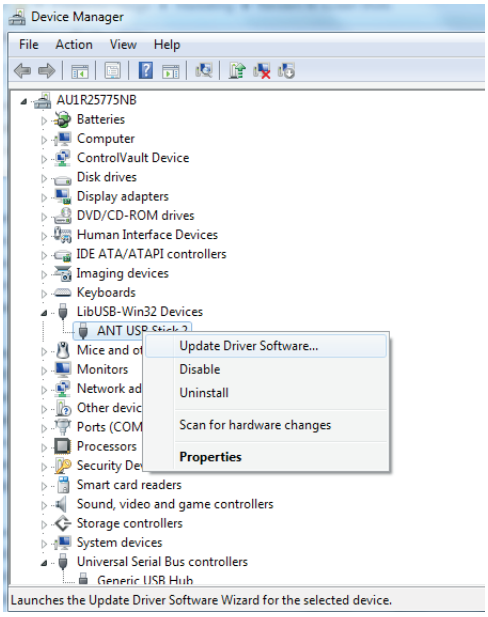


Figure 35: Manual USB driver update

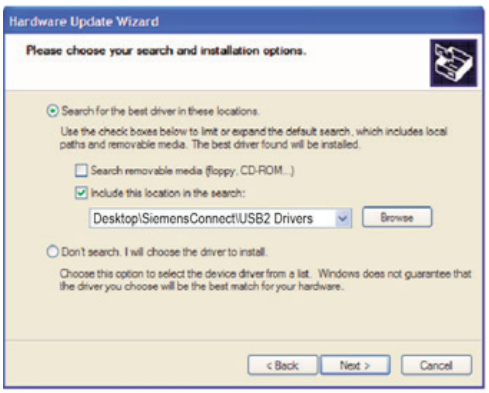


Figure 34: Install drivers

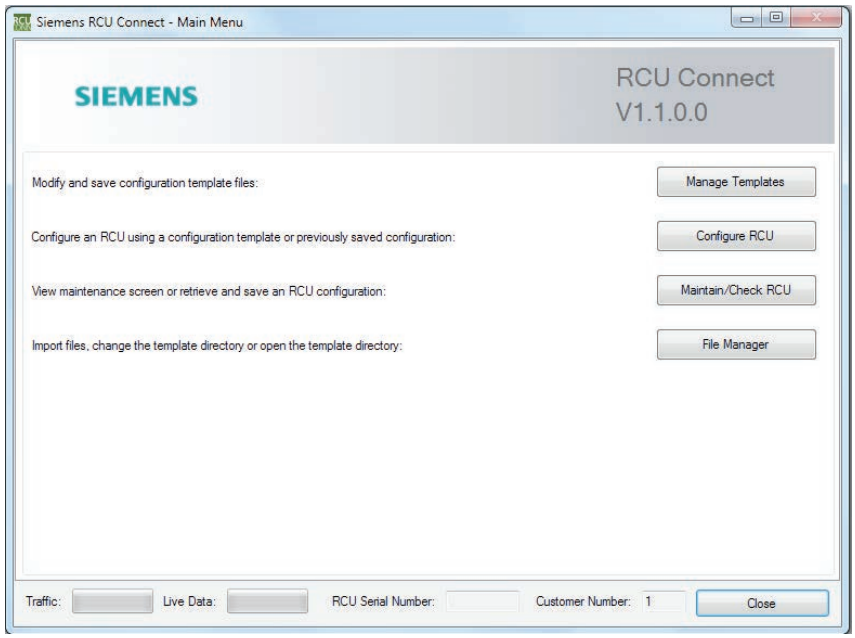


Figure 36: RCU Connect main menu

Check operation

When started for the first time, RCU Connect offers to locate the configuration files in the Windows® standard location.

To locate the event files in another location see also “Location of installed files”.

To locate the event files in the standard location:

- Double-click the RCU Connect Icon on the desktop.
- Accept this default location.

RCU Connect starts and locates the USB antenna. If the USB and its drivers are installed correctly, the USB antenna customer number is shown on the bottom of the screen.

More information on how to use RCU Connect can be found in section RCU commissioning on page 41.

Location of installed files

The installer will default to installing the program files in the standard Windows folders which depend on the operating system.

Windows® 7 and Windows Vista®	Default Location
Program	“[ProgramFilesFolder]\ Siemens\RCU Connect” which is usually “C:\Program Files (x86)\ Siemens\RCU Connect”
Configuration file folders	“[AppDataFolder]\ Siemens\RCU Connect\” which is usually C:\Users\user\AppData\ Roaming\ Siemens\RCU Configurations\...”
Windows® XP	**Default Location**
Program	“[ProgramFilesFolder]\Siemens\RCU Connect” which is usually “C:\Program Files\Siemens\RCU Connect”
Configuration file folders	“C:\Documents And Settings\user\Application Data\Siemens\RCU Configurations\....”

Table 5: Location

RCU commissioning

The process described in this section assumes the Fusesavers have already been correctly installed according to the Fusesaver operating instructions (IC1000-F320-A170-XX-XXXX). This section covers the on-site configuration of an RCU to couple with the available Fusesavers overhead using the RCU Connect PC application. The overall process consists of four steps:

1. The user completes the RCU configuration template form (KMS-3100) and sends this to Siemens.
2. Siemens creates two files and returns these to the user.
3. The user loads these files into the RCU Connect PC application.
4. The user chooses configuration settings for each site and loads these into the RCU using RCU Connect.

Configuration of an RCU is carried out wireless using the RCU Connect PC application and an USB antenna (the same one as used by Siemens Connect to communicate with Fusesavers). Before this wireless connection is possible, the operator must open the door of the RCU enclosure releasing the door switch. This enables a 10-minute window during which wireless short-range connection can be made to the RCU with RCU Connect

It is advised to connect the USB antenna to the PC using a short USB extension cable so the antenna can be placed away from the body of the notebook computer and pointed towards the RCU.

This section will explain how to do the following:

1. Use RCU Connect to create and maintain templates for various installation scenarios, including setting up the protocol mapping.
2. Use RCU Connect to enter the required information for deployment at a site, and send this information to the RCU.
3. Use RCU Connect to check the operation of a RCU once configured.

NOTICE

Radio communication between the RCU and RCU Connect running on a PC can be disrupted by metal objects adjacent to the USB antenna, such as the body of the notebook computer or an adjacent USB memory stick.

- Keep metal objects away from the RCU and USB antenna.
- Do not have the PC immediately below the RCU as the signals may be blocked by the metal cabinet.
- If the radio connection is lost during configuration, repeat the process.

NOTICE

To prevent damage to the RCU, operators should always use electrostatic discharge ground straps when operating the equipment if in a high-static environment.

Configuration and layout templates

RCU Connect is a PC application that allows a user to configure a RCU, check the operation of a RCU, and allow a user to maintain configuration templates to suit various installation scenarios.

Configuration templates

Each utility will have a set of configuration settings that are applicable to their entire population of RCUs (or at worst a few different configuration scenarios, such as solar powered and auxiliary power supply powered sites). They will also have a small number of settings that are unique for each site. RCU Connect allows the user to set-up a configuration file whereby all common settings are pre-set and only those site specific settings are available to the commissioning crew and require data entry. This saves time and reduces the chance for operator error during the commissioning process.

This is achieved with the aid of a configuration template. The customer completes the RCU configuration template specification form (KMS-3100) for each installation scenario, and returns the completed form to Siemens. Siemens will then create a configuration template file for each scenario tailored to the user's specified requirements.

Configuration templates have a ".rcu" file extension.

See the appendix for details of the RCU specific configuration settings.

Layout templates

The RCU configuration template specification form (KMS-3100) also allows the user to specify the visibility to each configuration item as displayed in RCU Connect.

Each configuration item can be set to be:

- Open – for the end user to enter data freely into the field,
- Read only – to display data in a field without being able to modify it,
- Challenge – requiring a response to a challenge, meaning that the user is restricted from entering data into the field until the user has clicked a button and entered a word to satisfy the challenge, or
- Hidden – the field is not visible to the user at all.

Read-only fields can be used to convey information without being able to change it. Challenge fields appear and behave like read-only fields until the challenge is satisfied. They will then appear and behave like open fields. Challenge fields can be used to prevent accidental data entry.

This allows the user to choose what specific set of configuration options the person responsible for the deployment of the RCU requires.

In addition to the configuration template file described above, using the visibility selections specified by the user in the RCU configuration template specification form (KMS-3100), Siemens will provide a second file called a "Layout File" back to the user. This layout file will also be loaded into RCU Connect to define how the settings display appears.

Layout files have a ".ucl" file extension.

Importing layout files and configuration templates into RCU Connect

The RCU Connect installer does not install any customer layout files or configuration templates. Layout files and configuration templates are supplied by Siemens separately, and are based on the RCU configuration template specification form (KMS-3100).

When the layout files and configuration templates have been received from Siemens, create a folder on the Windows® desktop called “RCU” and copy the layout files and configuration templates into this folder (or any other convenient folder).

If running RCU Connect for the first time, select “File Manager” from the main menu (refer to Figure 36: RCU Connect main menu on page 40) to bring up the file manager window as shown in Figure 37: RCU Connect - file manager window. Click the “Import file” button and browse to the RCU directory created previously and click “OK”. See Figure 38: Browse for folder dialog box. This will import the template files into the correct location for RCU Connect to use in future.

Template folder management

RCU Connect provides a shortcut to the configuration template folder by clicking the “Open Templates Folder” button. This will open Windows® Explorer starting at the configuration templates folder. From here, the user can rename, copy, delete and move files manually.

The default folder location for configuration templates and layout files may be changed to a new location by clicking the “Change Templates Folder “ button. In the “Browse For Folder” box that appears, the user can navigate to a new folder location, or create a new folder. Click “OK” to make the change from now on, or “Cancel” to leave the folder location as it was.

The user will need to re-import the required configuration templates and layout files after changing the Templates folder location.

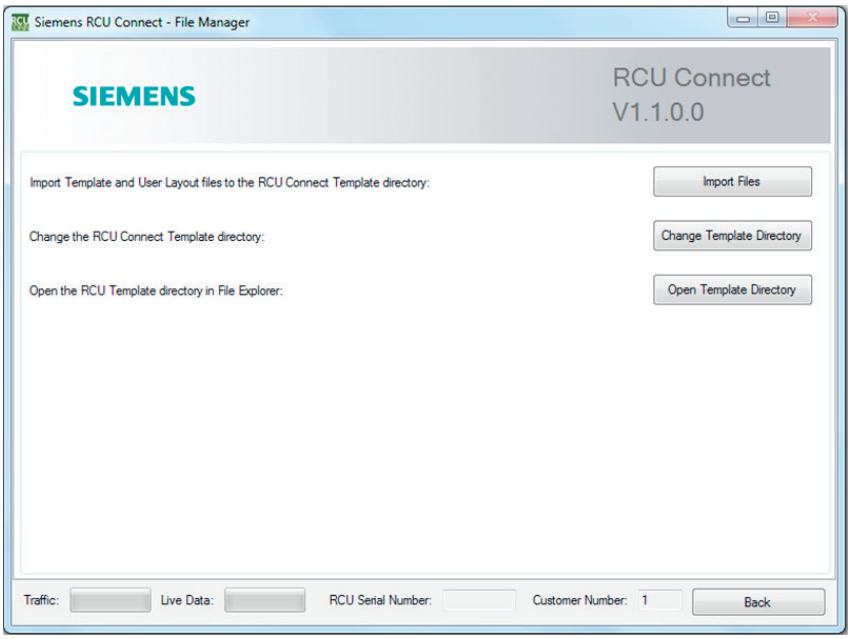


Figure 37: RCU Connect – file manager window

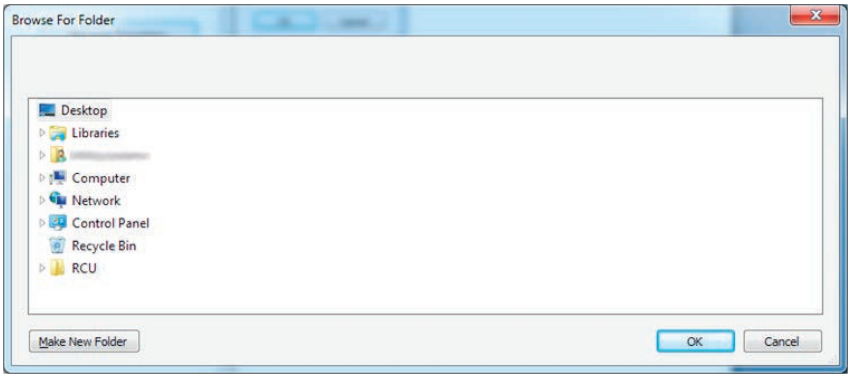


Figure 38: Browse for folder dialog box

Managing templates

The manage templates menu can perform the following tasks:

- Change a template's default values
- Create a new template based on an existing one
- Copy template files using Windows® Explorer.

The user can manage templates by clicking on the "Manage templates" button from the main menu of RCU Connect. The user must type "YES" into the challenge dialog box shown in Figure 39 before RCU Connect will allow further progress.

Figure 39: Challenge dialog box

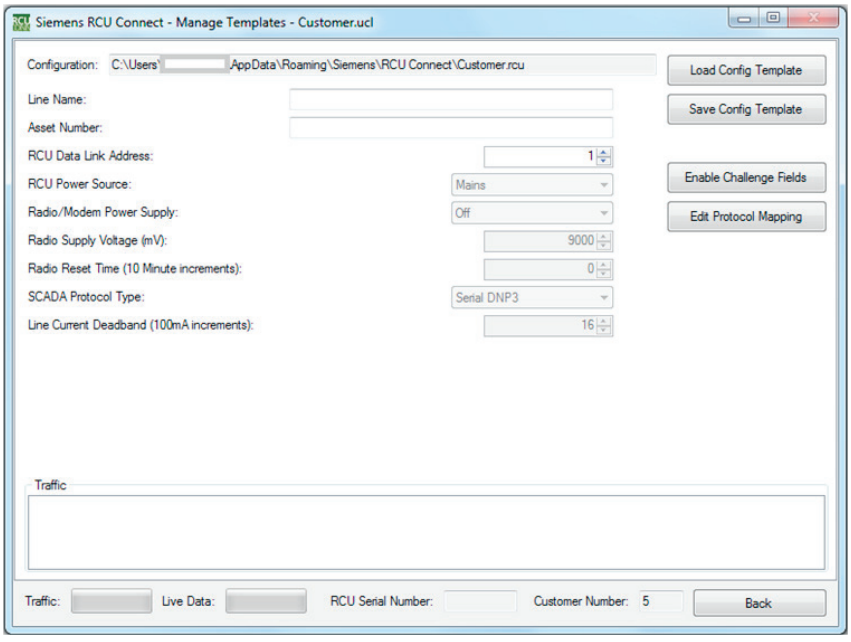


Figure 40: RCU Connect – manage templates window

If the user has no template files or no layout files, the RCU Connect will prompt the user to import the files. If RCU Connect cannot find any layout files, or the user has more than one layout file, RCU Connect will open a file selection box allowing the user to locate and select the desired layout file. A layout file must be selected, or the user will be returned to the main menu.

If RCU Connect cannot find any configuration templates, or the user has more than one configuration template, RCU Connect will open a file-selection box allowing the user to locate and select the desired configuration template. A configuration template must be selected, or the user will be returned to the main menu.

After passing the challenge screen, the user will see a screen similar to that shown in Figure 40.

The configuration template currently in use is shown in the box labelled "Configuration". The layout file is displayed in the title bar of the RCU Connect window.

Just below the "Configuration" box are the configuration settings to be addressed for each RCU site deployment.

On the right-hand side are a number of buttons. Whether the "Edit Protocol Mapping" button and the "Enable Challenge Fields" button are visible is subject to the users selections in the RCU configuration template specification form (KMS-3100).

Changing and creating templates

Changing a template's default values, or creating a new template based on another are both accomplished by loading a template, changing the data in the fields on the screen, and saving the template.

1. Load the template that you wish to change (or use as the base for the new template) by clicking the "Load Config Template" button and selecting the required starting configuration file.
2. Change the values in the fields to the desired values. If you have any "Challenge" fields, you can enable them for editing by clicking on the "Enable Challenge Fields" button and satisfying the challenge dialog box requirements.

3. Save the existing template by clicking “Save Config Template” and selecting the current template file then clicking “OK”. When asked if you wish to replace the existing file, click “Yes”. Create a new template by changing the template name to a name that is not already used by a configuration template in the Templates folder.

The user can only make changes to the default values in the fields with open or challenge access. They cannot change hidden fields.

Challenge fields

Challenge fields are configuration template fields that require the user to complete a challenge sequence to verify that they are in fact intending to change the values of these fields. It protects the user from accidentally changing values in those fields when managing templates or configuring an RCU. The challenge sequence simply requires the user to enter the text “YES” in the challenge box before clicking “OK”. Refer to Figure 39 on page 44.

Editing protocol mapping

If enabled, the user can maintain the protocol mapping for a specified configuration template by clicking the “Edit Protocol Mapping” button.

These items are usually very sensitive to change, and entering this screen requires the user to complete the challenge box. The user will then see a screen similar to Figure 41 (the actual screen shown will depend on the protocol used by the customer).

From this screen, the user can change the protocol database point mapping. Double clicking on a protocol database point will reveal the settings for that specific protocol database point, and right clicking on a protocol database point (or points if more than one is selected) will quickly allow the classification of those points to be changed. The example shown is for DNP3 points, and the user can change settings for both digital and analog DNP3 points.

The rows are color coded to distinguish between DNP3 classifications. In addition, rows that are shown in red indicate that the rows have a duplicate DNP3 index and need to be fixed before saving or sending to a RCU is allowed.

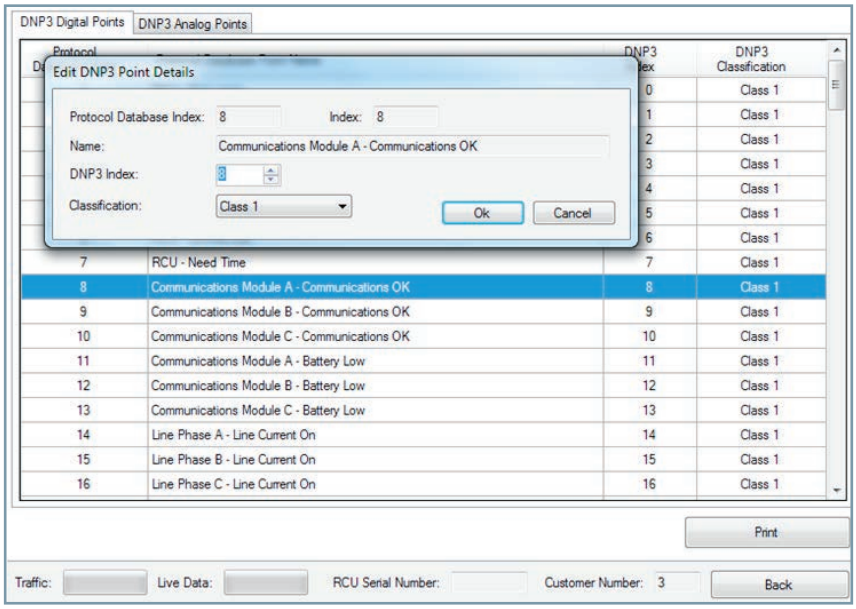


Figure 41: RCU Connect – edit protocol screen

Unmapped DNP3 points appear at the end of the list in dark grey.

The user can print the protocol database point mapping screens by clicking the “Print” button. For more information regarding the protocol database, refer to the relevant protocol manual supplied.

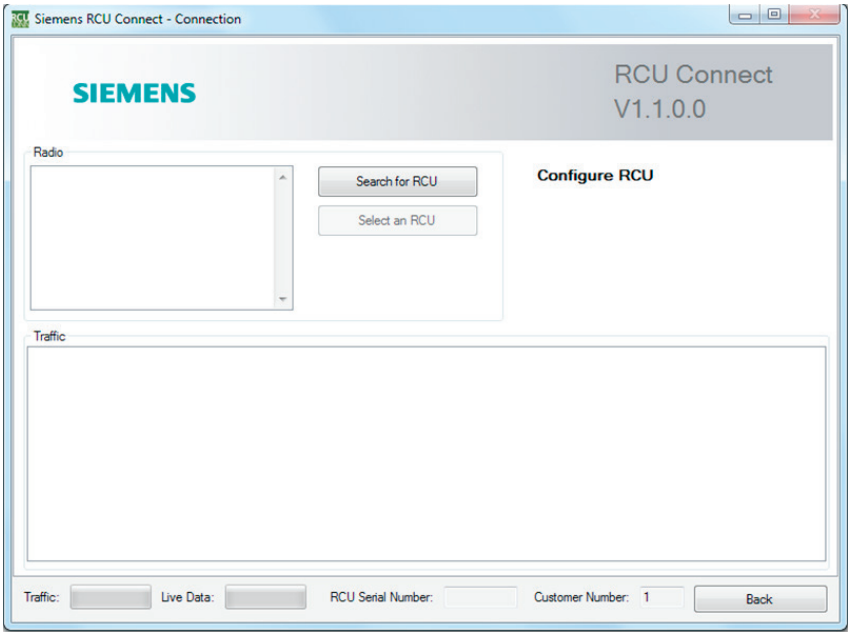


Figure 42: RCU Connect – connection window

Loading a configuration into an RCU

The process for configuring an RCU can occur on-site or be conducted in the workshop. The sequence for loading a configuration into the RCU is as follows:

1. Connect a USB antenna into a PC and start RCU Connect.
2. Open the door of the RCU and power up the RCU.
3. The user can load a configuration to a RCU by clicking the “Configure RCU” button from the main menu of RCU Connect. If the user has no template files or no layout files, RCU Connect will prompt the user to import the files (see Importing layout files and configuration templates into RCU Connect section on page 43). If RCU Connect cannot find any layout files, or the user has more than one layout file, RCU Connect will open a file selection box allowing the user to locate and select the desired layout file. A layout file must be selected, or the user will be returned to the main menu. If RCU Connect cannot find any configuration templates, or the user has more than one configuration template, RCU Connect will open a file selection box allowing the user to locate and select the desired configuration template. A configuration template must be selected, or the user will be returned to the main menu.
4. When suitable layout files and configuration templates have been selected, the “Connection” screen is displayed as shown in Figure 42.

NOTICE

It is recommended that only one RCU within the workshop be powered up while configuration occurs to simplify the process.

5. Click the “Search for RCU” button, RCU Connect will scan for available RCUs, and display each one in the box listed by serial number, as shown in Figure 43.
6. Select a RCU from the list, RCU Connect will attempt to connect to the RCU. After a few seconds, if successful, the “Select an RCU” button will become enabled. The user can now click the “Select an RCU” button and RCU Connect will display the “Configure RCU” screen shown in Figure 44.

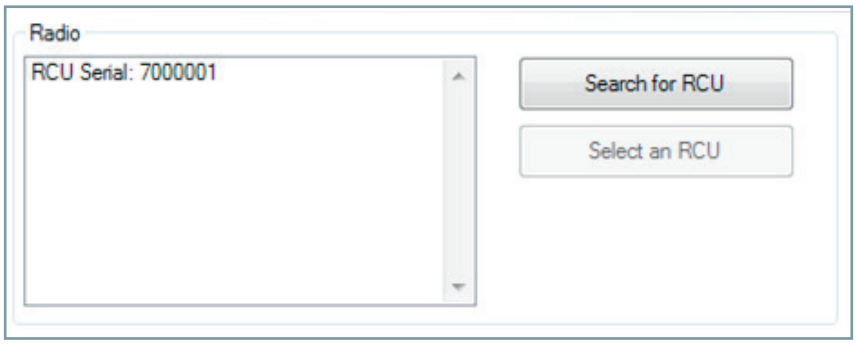


Figure 43: RCU Connect – selecting an RCU

NOTICE

Once RCU Connect and the RCU are communicating the “Traffic” and “Live Data” indicators shown at the bottom of Figure 43 will provide a visual indication that communications is in progress.

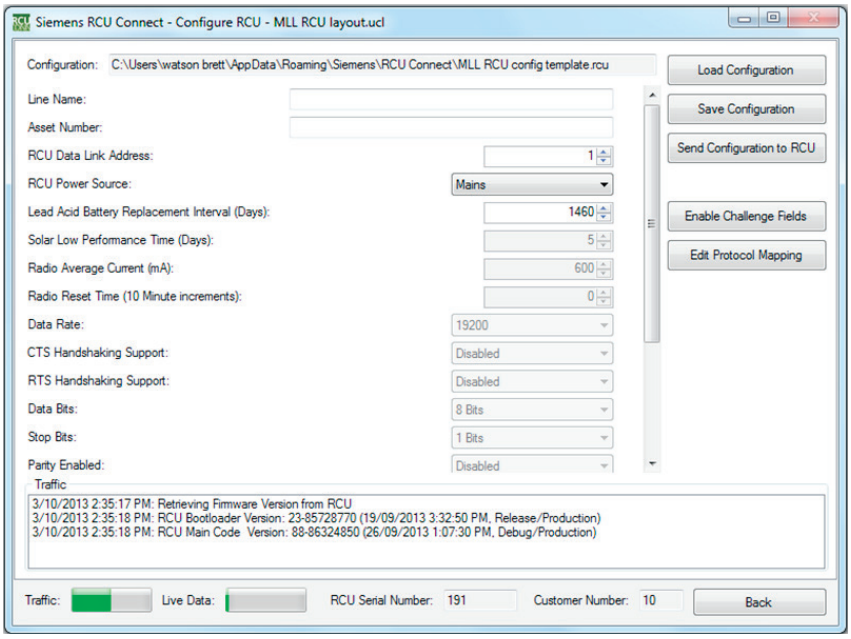


Figure 44: RCU Connect – configure RCU window

The Configure RCU menu allows the user to perform the following tasks:

- Fill in the configuration fields for a RCU
- Load a specific RCU configuration that was previously saved
- Save a specific RCU configuration for later use
- Send a configuration to a RCU.

7. When the “Configure RCU” menu is shown, the data in the fields has been retrieved from the configuration template selected, which is shown in the “Configuration” field at the top of the screen. The user should then modify each field to suit the specific RCU that is being configured for deployment. For example, if the RCU being configured has an asset number of “98/AB665”, and an RCU data link address of “223”, the user will enter the data as shown in Figure 44.

8. Alternatively, the user might want to load a previously saved configuration. This can be achieved by clicking the "Load Configuration" button and selecting the configuration to load from the file selection screen. Once a configuration has been loaded, the settings based on the configuration template have been replaced by the settings in the configuration that has been loaded. Once a configuration has been loaded or saved, the name of the configuration is shown in the "Configuration" field at the top of the screen, see Figure 45.

9. Once the user is satisfied with the field values on the screen, the user can save the configuration by clicking the "Save Configuration" button, and entering a file name for this RCU configuration file.

10. The user then sends the configuration to the RCU by clicking the "Send Configuration to RCU" button. This should be the last action that is performed for this RCU on the "RCU Configuration" screen, as once the user sends the configuration to the RCU, the RCU restarts, and the dialog box shown in Figure 46 will appear. The user can click "OK" to return to the main menu.

NOTICE

Files with an extension of ".rcuconfig" are saved configurations, not configuration templates. They contain the information entered at the time of deployment for a specific RCU. "rcuconfig" files can be reused as the starting point for a new configuration process.

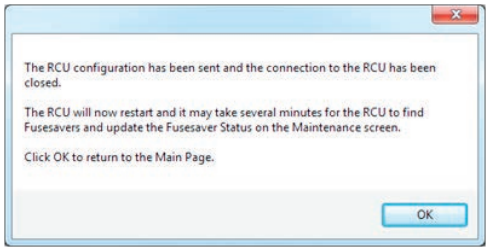


Figure 46: RCU Connect – the RCU restarts after the configuration has been sent

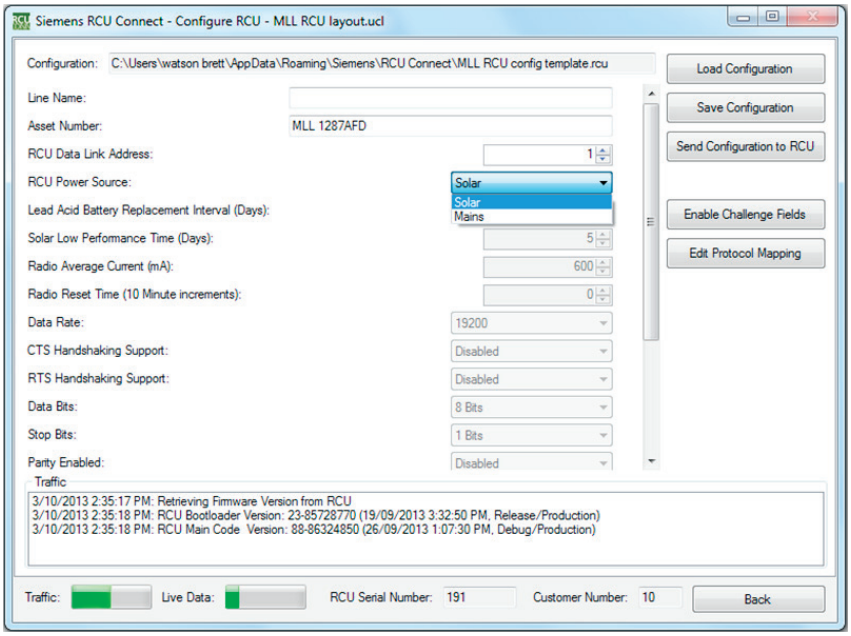


Figure 45: RCU Connect – enter site specific data

11. After the configuration is loaded, the RCU restarts and searches for the Fusesavers specified in the configuration. While searching, the RCU will flash the "Switchgear OK" LED. When it finds and establishes communications with all the Fusesavers in the line, the "Switchgear OK" LED will stop flashing and be on steady. This normally takes approximately five minutes.

12. If the RCU cannot find all the Fusesavers in the line the Switchgear Problem LED will be on steady. This may take up to 10 minutes to occur. If the RCU cannot successfully find Fusesavers its behavior depends upon the configuration.

    a. If, when configuring the RCU the user has entered a Fusesaver line name (this is the unique way that Fusesaver lines are identified), then the RCU will search indefinitely for the Fusesavers that make up the named Fusesaver line.

b. However, if no Fusesaver line name has been entered, then the RCU will search for Fusesavers within range of its short-range radio.

13. If the RCU finds at least one Fusesaver in a line, it will continue searching for the other Fusesavers on that line until the search times out after several minutes. However, if it can't find any working Fusesavers, it will restart itself and search for any Fusesaver over again. The RCU will do this three times and then stop. This prevents continual restarts generating nuisance alarms for the SCADA system. To get the RCU to search again, the RCU must be restarted either by remote control or by a local operator.

NOTICE

It is strongly advised that only one RCU and one set of Fusesavers be within range at the same time. For workshop testing, this means ensuring additional RCUs are turned off and additional Fusesavers do not have communications modules fitted.

If multiple Fusesaver lines coexist at a single site, please contact Siemens for advice on how to manage these sites.

Site checking

The user can check a RCU configuration by clicking on the "Maintain/Check RCU" button from the main menu of RCU Connect. This allows the user to view RCU data, and data about the connection the RCU has to the Fusesaver line.

From the "Maintain/Check RCU" screen (see Figure 47), the user can also save the configuration, restart the RCU and set the clock on the RCU (this can be useful if a connection to the SCADA network has not been made, for example, when testing in the workshop).

In the "RCU Status" section, the user can find information regarding the battery life remaining, communication statistics, and some diagnostic information on the power supply and configuration. If there is a problem with the connection between the RCU and the Fusesaver line, the "Fusesaver Config Error" box is checked (see Figure 47). If this occurs, there is a problem with the RCU configuration, the Fusesaver line configuration, or the radio connection between the two.

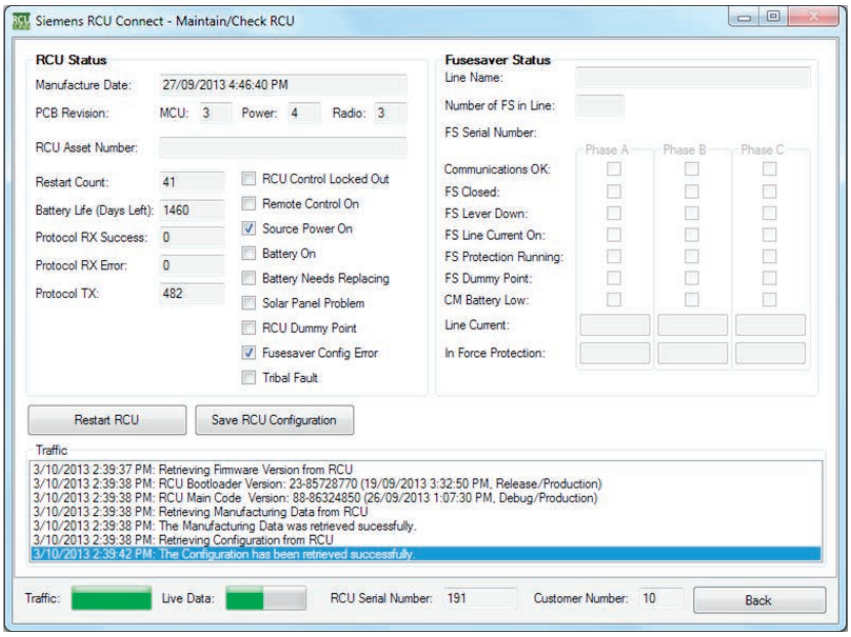


Figure 47: RCU Connect – maintain/check window

When the configuration and connection is working correctly, the user will see something similar to Figure 48: RCU Connect – RCU communicating correctly with Fusesavers on page 50. Under Fusesaver status, the line name, number of Fusesavers in the line and serial number of each Fusesaver can be seen, as well as the individual Fusesaver status for each device. In the example shown in Figure 48, the Fusesaver line has line current, the devices are all closed, communications is OK, protection is running, and the protection mode is normal.

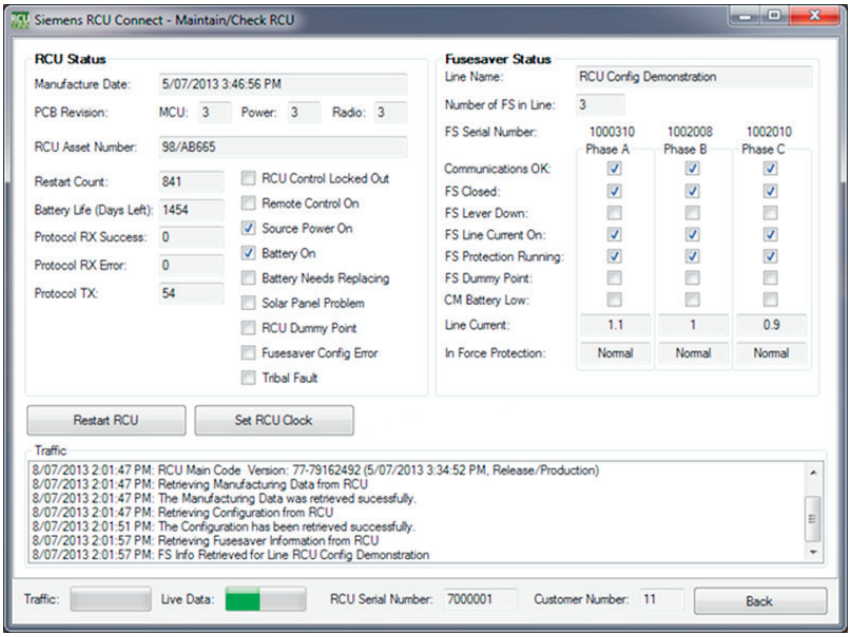


Figure 48: RCU Connect – RCU communicating correctly with Fusesavers

Using this data and the displays on the RCU, the user satisfies themselves that the site is working correctly.

A suggested checklist for confirming successful RCU commissioning at a site is:

1. "RCU Battery" LED on.
2. "Switchgear OK" LED on.
3. Switchgear line name correct.
4. RCU messages being received by SCADA and being responded to by the RCU. The "Protocol Tx" and "Protocol Rx" LEDs on the front of the RCU can be used for this or the protocol counters in RCU Connect.
5. RCU source supply on.
6. Dummy control of Fusesaver working from SCADA operator for all phases.
7. "Remote Control" LED on.
8. If a Fusesaver operator control panel is fitted, then the displays on the panel show the correct switchgear state, the correct protection mode and all phases are healthy.

Reset RCU configuration procedure

Under some circumstances, it may be desirable to reset the configuration in the RCU back to the default.

This is achieved by the following method:

1. Press and hold the door switch at the top of the electronics housing.
2. Turn the Remote Control OFF switch ON and OFF five times within 5 seconds.

This need might arise if, for example, a user has configured the RCU with an USB antenna with the wrong customer number in it. In this case, a user with the correct USB antenna will not be able to connect to the RCU to re-configure it because it has been configured with the wrong customer number. However, by following the above method, the configuration will be cleared from the RCU and it will then be available for configuration by the user.

SCADA protocol testing

It is usual for each utility to configure the SCADA protocol and exhaustively test every point and control. This can be very difficult and time consuming to achieve without the support of special test equipment.

Siemens provides such a utility called RCU Probe which gives visibility into the RCU database and allows hand overriding of database points. Using RCU Probe, the expert user can prove the protocol configuration and operation of the protocol prior to the configuration being distributed to the installation team.

RCU Probe has its own user manual (IC1000-F320-A201-XX-XXXX) and is intended for use by the appropriate technical expert. It is not suitable for use outside of the acceptance test workshop since it connects to the RCU using the Ethernet port on the RCU and provides unrestricted control of Fusesavers.

Contact Siemens for further information.

Customer number

Each end customer has a unique customer code and this code is embedded in the USB antenna. The code is sent as part of the configuration to both Fusesavers (with Siemens Connect utility) and to RCUs with the RCU Connect utility. When searching for Fusesavers, RCU will only find those Fusesavers that have a customer number that matches the RCU customer number. This ensures that different utilities will not be able to operate each other's Fusesavers or be able to connect to each other's RCUs.

Fusesaver operator control panel

As the Fusesaver control panel is an accessory to an RCU, the RCU must configured to work with the Fusesaver control panel. There are a number of RCU configuration settings that will affect the operation of the control panel. Settings for these are to be completed by the user in the RCU configuration specification form (KMS-3100).

If an RCU is unconfigured, the RCU will not attempt to connect to any Fusesavers and thus the FS control panel will not have anything useful to display or control. Under this circumstance, the control panel on/off LED will flash on and off to indicate that the FS control panel is working but the RCU is not configured.

Enable operator control panel

This setting must be set to "Enabled" so that the RCU will auto-detect and drive the FS control panel. If this setting is set to disabled, the RCU will not power up the control panel so no LEDs will be lit.

Operator control panel ignore remote switch

This setting allows FS control panel controls to the Fusesavers such as trip/close or change of protection mode to always be allowed irrespective of the position of the remote control on/off switch. Setting options are:

- True: The RCU will allow controls from the panel to be sent to the FS irrespective of the position of the remote control on/off switch.
- False: The RCU will disable all controls from the control panel if the remote control switch is on.

Note that when this setting is true, both the local and remote control source LEDs may be lit because both sources of control can be enabled.

Always allow trip

This setting allows FS control panel trip commands to either be passed to the FS or rejected by the RCU depending upon the status of the external lever of the FS. Settings options are:

- True: The RCU will issue the trip command to the FS to trip regardless of external lever position. The FS will trip regardless of policy file setting for MANUAL INHIBIT (see FS operating instructions in IC1000-F320-A170-XX-XXX).
- False: If the external lever of the Fusesaver is down, then the RCU will reject the trip command.

Note: this setting only applies to FS trip commands. FS close commands will always be rejected if the external lever is down regardless of whether the FS policy for the external lever is to allow manual operations when the external lever is down.

RCU operation

The RCU has been designed with the intention that limited operator interaction is required with the RCU once installed and configured. The primary reason for interaction is to:

- Check the RCU panel LEDs for problems, refer to RCU maintenance on page 56.
- Disable remote control of the Fusesavers from the SCADA operator. This would normally occur to allow line crews to work downstream of the Fusesavers, refer below.
- Operate the Fusesaver with an operator control panel installed on the RCU, refer page 20.
- Observe the LED light status on the display to assist in SCADA communications debugging.
- Conduct maintenance on the RCU, such as changing batteries, as described on page 57.
- Open the door to allow RCU Connect to open communications with the RCU, refer page 15.
- Load newer versions for RCU firmware as described on page 5.

Remote control

To disable remote SCADA control of the Fusesavers the following process is followed:

1. Open the enclosure door.
2. Change the “Remote Control” toggle switch position from “I” to “O”.
3. Check that the red LED light next to the “Remote Control ON” text on the display has turned off.
4. Check that the green LED next to the “Remote Control OFF” text on the display has turned on.
5. Close the RCU enclosure door and lock.

The same process is applied to restore the Fusesavers to remote SCADA control, except the “Remote Control” toggle switch is set to “I”.

It is possible to permit Fusesaver trip controls from a SCADA system even though the remote control on switch is in the OFF position, refer to Configuration parameters on page 23.

Fusesaver operator control panel

If a Fusesaver operator control panel is fitted in the RCU, then the local user has a much greater range of local interaction with the RCU. The local user will be able to trip and close Fusesavers or to change their protection mode.

NOTICE

After pressing the operator panel “ON” button, ensure the LED for this button lights up. If the LED does not light up, then there is a problem with the panel and the user should contact Siemens customer service. In this case, the user should not press any other buttons on the operator panel as the user cannot confirm whether the control has been issued or the status of the Fusesavers.

After opening the RCU door the local operator must press the “Panel ON” button on the panel to make it active. The LED lights will come on showing the status of each Fusesaver on the line above.

If the panel is plugged in after the RCU has been powered up, please allow up to 30 s for the RCU to detect the panel.

When the RCU has completed searching for and has verified the Fusesavers it is connected to, the OK green LED will be lit. This normally takes around five minutes. When this stage is complete, the FS control panel should have valid data for each of the phases to which the RCU is connected.

Depending upon the configuration settings chosen by the utility, the operator may be required to switch the remote control ON/OFF toggle switch to the remote control OFF position prior to attempting to apply controls to the Fusesaver via the operator panel. If the operator does not do this and tries to apply a control by pressing a button on the panel, the control will be rejected.

The operator can send controls to the Fusesavers by pressing the appropriate button on the panel. On pressing a button, the following sequence of events will occur:

1. The LED lights on the button will begin to blink to indicate the RCU is attempting to apply the controls to the Fusesaver.
2. So long as the Fusesaver can accept controls from the RCU (i.e., the external lever is UP and is the Fusesavers are not in session with Siemens Connect), the controls will be passed to the Fusesaver. Typically this takes 15-20 s, however can take up to 70 s before the RCU will time-out.
3. Once the control is successfully applied, the LEDs on the panel will change to reflect the new state of the Fusesavers. There can be a delay of 5-10 s before the state update occurs.
4. If the control was not successfully applied, then the LEDs will stop blinking and the Fusesaver state will remain as previously indicated.

The operator panel can be turned off by pressing the "Panel ON" button again (the LED lights will go out), or by closing the RCU door.

Each of the buttons on the Fusesaver Operator Control Panel has the following functionality.

Panel on

The control panel will be off when the cubicle door is opened and is turned on by pressing the panel on button. When the control panel is on, the LED adjacent to the panel on button will be lit. The control panel can be turned off by pressing the panel on button while the panel is already on or by closing the RCU door. When the control panel is off, no LEDs will be lit.

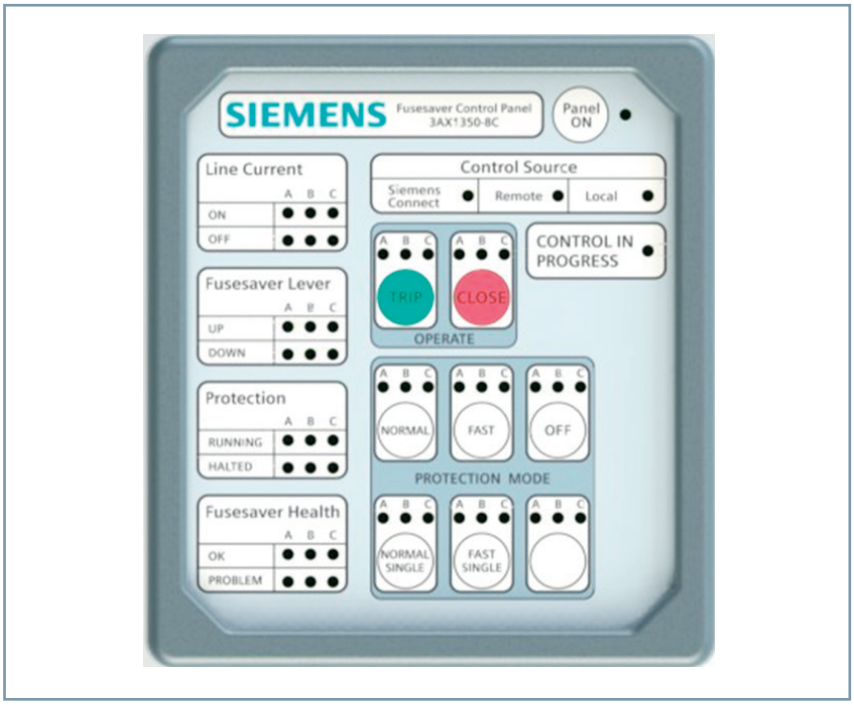


Figure 49: Fusesaver operator control panel

Fusesaver status

The FS status LEDs indicate the current status for each phase of the FS line. If no LED is lit for a phase, this means no data is available for that phase. These Fusesaver statuses are:

- Fusesaver line current is on or off
- Fusesaver external lever is up or down
- Fusesaver protection is running or halted.

Fusesaver control source

The control source LEDs indicate who has permission to send controls to the Fusesavers connected to the RCU. The possible control sources are:

- Local: This control panel is allowed to issue controls to the Fusesavers connected to the RCU. If the Local LED is not lit, then all FS controls from the control panel will be rejected. This includes both trip/close and protection controls.

- Remote: The remote operator, i.e., the SCADA operator, is allowed to issue controls to the Fusesavers connected to the RCU. If the remote LED is not lit, then all FS controls from the remote operator will be rejected.
- Siemens Connect: A Siemens Connect session is currently in progress with the Fusesavers and is allowed to send trip/close controls to the Fusesavers. All FS controls originating from the RCU, whether they are local or remote, will be rejected.

Control in progress

This LED will flash to indicate that a control issued by the FS control panel is in progress. The control-in-progress LED will stop flashing when one of the following conditions is met:

- The control has been sent to the Fusesavers and the control is successful, e.g., close control has been sent and all phases are now closed.
- The control has been sent to the Fusesavers but the control has timed out after 70 s without being successful, e.g., close control has been sent but not all phases are closed after 70 s.

No further panel controls are allowed while the control in progress LED is flashing. The typical time for a protection control to be applied is 10-20 s and for a trip or close control is 40-60 s.

Fusesaver operate

The FS trip/close LEDs indicate the current open/close state for each phase of the FS line.

If no LED is lit for a phase, this means there is no data available for that phase.

The trip button will issue ganged-trip control to all Fusesavers on the line. The close button will issue a ganged-close control to all Fusesavers on the line.

A ganged trip or ganged close will command all Fusesavers on the line to trip/close only if communications are normal to each and every FS. If communications have failed to any FS, then no trip/close command will be sent to any FS.

Once a trip or close control is issued to the Fusesavers, the corresponding status LEDs will begin to flash (i.e., a trip control in progress will flash trip LEDs). The trip/close status LEDs flash in conjunction with control-in-progress LED to indicate which control is currently in progress. The status LEDs will stop flashing when the control in progress has finished.

It is possible to issue controls to Fusesavers that are already in the required state, e.g., sending a trip control to Fusesavers that are already open. In this scenario, the RCU will still send the control to the Fusesavers. The control in progress LEDs will begin to flash but will stop soon after as the Fusesavers are already in the desired state. The benefit of this is, for example, if two phases are tripped and one is closed, pressing the trip control will open the closed FS and bring the phases to the same state. If independent trip/close control of Fusesavers is required, it is necessary to use the Siemens Connect PC application (refer to Fusesaver operating instructions IC1000-F320-A170-XX-XXXX).

Protection mode

The FS protection status indicates the currently active “protection modes” for each phase of the FS line.

If no LED is lit for a protection bit on a phase, this means there is no data available for that phase.

The FS control panel protection controls are ganged controls which will command all Fusesavers on the line to change a protection bit only if communications are normal to each and every FS. If communications have failed to any Fusesaver, then no protection bit change command will be sent to any Fusesaver.

Once a protection control is issued to the Fusesavers, the corresponding status LEDs will begin to flash, e.g., a PROT ON control in progress will flash PROT ON LEDs and the Control-In-Progress LED. The status LEDs will stop flashing when the control in progress has finished (see Control in progress).

It is possible to issue controls to Fusesavers that are already in the control state, e.g., sending a PROT ON control to Fusesavers that are already have protection on. In this scenario, the RCU will still send the control to the Fusesavers. The control in progress LEDs will begin to flash, but will stop soon after as the Fusesavers are already in the desired state.

Fusesaver health

The Fusesaver health LEDs indicate the operational health for each phase on the line. A Fusesaver's health can be "OK", "PROBLEM" or "No Data" if no data is available for that phase.

A FS is deemed to be "Health OK" if all of the following conditions are met:

- The phase is correctly configured.
- Communications to the FS is healthy.
- The FS communications module battery life is not low.
- The FS VI is not worn out.
- The FS does not have a mechanism fault.

A Fusesaver is deemed to have a "PROBLEM" if any of the following conditions are met:

- There is a communications problem to the FS.
- There is a problem with the FS configuration (RCU problem LED will also be red).
- The FS communications module battery life is low.
- The FS VI is worn out.
- The FS has a mechanism fault.

Both LEDs will be off under the following circumstances:

- There is no FS for that phase.
- The RCU is currently in the process of checking the FS configuration (RCU OK LED will be flashing)
- The state of the FS communications module, FS VI or FS mechanism is unknown as data for these points has not been updated recently.

Time management

The RCU has in internal real time clock, which runs on Coordinated Universal Time (UTC).

Time is set either by the RCU Connect utility to match the PC or by the SCADA protocol (if supported by the protocol and the master station). Time is maintained in the RCU during loss of supply by using the standby battery. If the battery is disconnected or turned off for more than one hour, time may be lost and must be reset when power is restored to the RCU, usually the SCADA protocol will do this.

On power up, the RCU acquires time from the following sources in this order:

- The battery backed up clock
- The SCADA system
- The Fusesaver time master if SCADA time not acquired.

The RCU sets time for the line Fusesavers every 24 hours and when time is set by the SCADA system.

Fusesaver availability monitoring

The Fusesaver protection is only armed when the line current is sufficient to power the Fusesaver (line power is needed for protection even if a communications module is fitted). At times of low demand, it is possible that the line current will fall low enough such that the Fusesaver protection is inactive. It can be difficult to ascertain if a particular line has enough current for some or all of the day for the Fusesaver protection to be armed. Fusesavers installed on sites with inadequate line current will not provide the improved network reliability and return on investment potentially forecast by the user.

To assist the user in assessing that Fusesavers have been installed on lines with adequate line current, the RCU monitors the line current ON flag in the Fusesaver and determines the Fusesaver protection availability over the previous 24 hours for which Fusesaver data is available. The RCU then provides this as an analog database point for the SCADA system (APID 23, 24, 25). This enables SCADA monitoring of the Fusesaver protection availability.

These points are updated every 2.4 hours and are initialized to 100.00% on restart.

Note that no line current due to the Fusesaver being open is included as an outage in the availability calculation.

RCU maintenance

The RCU has been designed for maintenance free operation except for the battery which is discussed in Battery replacement section on page 57.

NOTICE

Do not attempt to disassemble the RCU.

- Disassembly will void the warranty.
- Except for the battery and electronics compartment, serviceable parts are not inside the RCU.

If the RCU is suspected of having a fault, please contact Siemens customer service. When contacting Siemens, you will need to provide the following information:

- Manufacturing serial number. This is located on the label on the side of the battery compartment.
- Software version installed in the RCU. This is displayed in RCU Connect maintenance tab when connected to the RCU.
- Details of any customer specific equipment installed including radios, modems or RCU accessories fitted.

In case of a genuine electronic failure, the entire electronics compartment will need to be returned to Siemens for analysis, repair or replacement. The process to replace an electronics compartment is described in Electronics compartment replacement section on page 58.

To ensure that the RCU operates reliably, spare parts must be replaced only by trained and certified personnel. To order spare parts from Siemens an MLFB number is required. For more information see the MLFB-list or contact Siemens.

General

⚠ DANGER

Hazardous voltages and high-speed moving parts.

Will cause death, serious injury and property damage.

Do not work on energized equipment. Always de-energize and ground the lines before working on the equipment.

De-energize and isolate auxiliary power supply at the source before removing power supply cover, and install power supply cover before energizing auxiliary power to the RCU.

Site check

A site inspection allows a quick check of the operation of the RCU. After opening the door, the panel LEDs will come on. Normal operation will display:

- Power source on (unless it is dark and the power source is solar)
- Battery OK
- Switchgear OK
- Remote control on
- CPU OK flashing
- Protocol RX data and TX data flashing occasionally when the SCADA system polls the RCU. For some protocols, such as DNP3, which may not have frequent polling of the RCU, it may be possible to force unsolicited messages to the SCADA system by turning the remote control switch off and on again. The protocol LEDs can be observed and voice communication with the SCADA operator will confirm receipt of the data.

Spare parts

Spare parts must only be replaced by qualified personnel.

Accessory/spare part	Order number
Battery 12 V, 7.2 Ah lead acid	3AX1350-6A
Solar panel kit 65 W	3AX1350-6B
Fusesaver operator panel	3AX1350-8C

Table 6: Spare parts

Battery replacement

The RCU monitors the battery to determine when replacement is required as described on page 65. If the battery is detected as being near end of its life, the replace battery indicator on the front panel is lit and the replace battery database point will be set.

When the battery is replaced it must be of the same type. The battery is a sealed lead-acid battery preferably conforming to the battery standard JISC8702. Battery specification is in Battery life section on page 65, and the Siemens part number is listed above for re-ordering.

To replace a battery the action is:

1. Turn off the battery switch, check that the battery LED lights on the display panel go out. The auxiliary power supply or solar switches can be left on and the RCU will still be operating.

2. Remove the battery compartment cover (Phillips no. 2 screwdriver required).
3. Disconnect the battery and remove. Dispose of battery according to local environmental regulations.
4. Put in new battery and re-connect. Take care to connect with the correct polarity, red wire to battery positive terminal. If the battery is connected in reverse the battery fuse in the battery positive lead will blow. If this happens, reverse the connections and replace the fuse. Fuse type is Automotive MINI - 15 A.
5. Turn on the battery switch. Check the battery LED comes on. This may take several seconds.
6. Press and release the door switch four times within a 10 s period. Take care to ensure the LEDs go out before releasing the door switch. The replace battery LED will go out and the battery life has been reset.

Electronics compartment replacement

The following process describes how to replace an entire electronics compartment in the RCU.

Replacement process

The following process should be followed by suitably qualified technicians to replace an electronics enclosure in the RCU:

1. Turn the auxiliary power, solar power and battery toggle switches to the "O" position on the electronics enclosure.
2. If an auxiliary supply or VT supply is connected, then isolate the supply externally from the RCU. If an isolation module is fitted, then turn off the isolation switch and unplug the outgoing connection to the RCU electronics housing (refer to Figure 10: Power supply isolation unit on page 13).
3. Disconnect the radio cable from the electronics enclosure.
4. Remove the power compartment cover using the Phillips head screwdriver.
5. Disconnect the ground wire and the auxiliary power or solar cable wires in the terminal block in the power supply compartment.

⚠ DANGER

Hazardous voltages and high-speed moving parts.

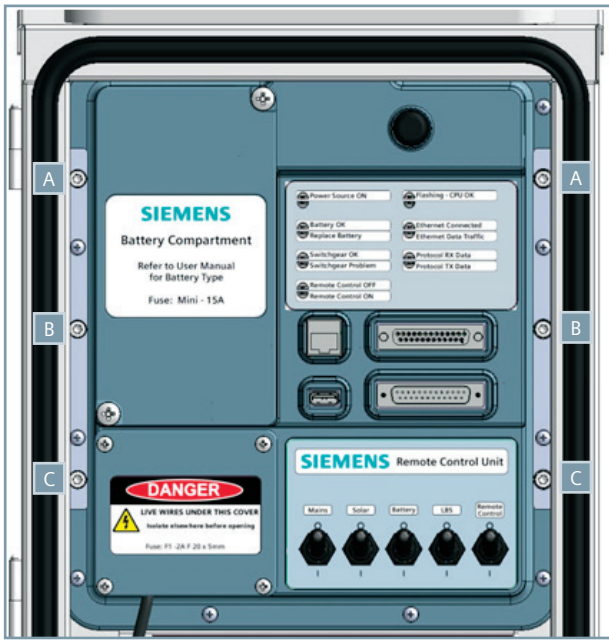
Will cause death, serious injury and property damage.

Do not work on energized equipment. Always de-energize and ground the lines before working on the equipment.

Tools required to replace electronics compartment:

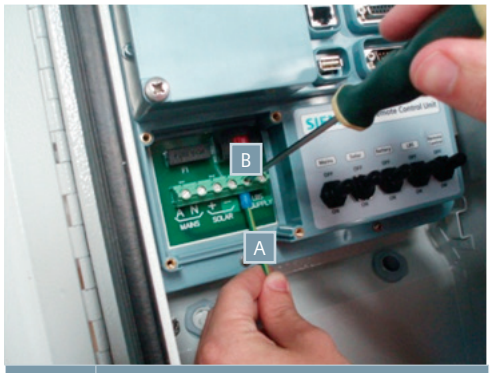
- 4 mm Allen key – recommend T-handle
- Torque driver (1.5 Nm)
- Phillips no. 2 screwdriver
- Small flat screwdriver.

6. Replace the power compartment cover and screw in place using the Phillips head screwdriver.
7. Unscrew the M5 cap head screws holding the electronics compartment into the RCU enclosure (see Figure 50) using the 4 mm Allen key being careful to support the compartment while doing so. Retain the screws and washers.
8. Remove the electronics compartment from the RCU enclosure.
9. Insert a replacement electronics compartment into the RCU enclosure.
10. Align the holes and screw the M5 x 20 cap screws with spring washers into the captive nuts in the RCU enclosure using the 4 mm Allen key. Torque to 13 in-lb (1.5 Nm).
11. Remove the power compartment cover using the Phillips head screwdriver.
12. Fit the ground wire connected to the internal RCU enclosure ground stud into the terminal block as shown in Figure 51. Tighten in place.
13. Complete remainder of installation as in Control of Fusesaver section of this user manual beginning on page 20.



Item	Description
A	Upper retaining screws
B	Middle retaining screws
C	Lower retaining screws

Figure 50: Screws holding electronics compartment in RCU enclosure



Item	Description
A	Ground wire
B	Ground terminal connection

Figure 51: Ground wire connection in terminal block

⚠ WARNING

Hazardous voltages.

Can cause death or serious injury.

The ground wire must be reconnected from the terminal block to the enclosure ground stud.

Firmware update

The following process is followed to conduct a firmware update:

1. Power off the RCU by ensuring both the battery and auxiliary power supply toggle switches are turned “O”.
2. Insert an USB memory stick with the self-extracting file provided by Siemens into the USB port on the electronics compartment.
3. Power on the RCU by turning on any of the auxiliary power, solar or battery supply toggle switches with a connected supply.
4. The CPU OK LED will start flickering quickly for between 5-15 s. This indicates the firmware update is in process. If this does not occur, restart sequence from step 1.
5. At end of the upload sequence, all LEDs on the display will synchronously blink red-green to signify upload successful.
6. Remove the USB memory stick from the USB port.
7. Power the RCU down and then, after 3 s, power the RCU up again. The RCU will now re-start and operate as normal.

Fusesaver operator panel mapping update

To update the RCU panel mapping,the following items will be needed:

- Siemens supplied or approved USB memory stick with panel mapping file present. Siemens can assist with providing the latest mapping files.

The following are instructions to update the panel mapping file on an RCU:

1. Power off the RCU by ensuring both solar/mains and battery supply toggle switches are turned “OFF”.
2. Operator inserts an USB memory stick with the self-extracting panel mapping file provided by Siemens into the USB port on the electronics compartment.
3. Power on the RCU by turning on any of the mains, solar or battery supply toggle switches with a connected supply.
4. The Ethernet-connected LED will start flickering quickly for between 2-3 s. This indicates the firmware update is in process. If this does not occur, restart sequence from step 1.
5. At end of the upload sequence all LEDS on the display will synchronously blink red-green to signify upload successful.
6. Power off the RCU again, and remove the USB memory stick.
7. To complete the process, power on the RCU again by turning “ON” the main/ solar supply and the battery switch. The RCU will now operate as normal with the Fusesavers and control panel.

Fusesaver operator panel firmware update

To update the FS control panel firmware, the following items will be needed:

- Siemens supplied or approved USB memory stick with FS control panel firmware file present. Siemens can assist with providing the latest control panel firmware files.

The following are instructions to update the control panel firmware on a RCU:

1. Power off the RCU by ensuring both solar/mains and battery supply toggle switches are turned “OFF”.
2. Operator inserts an USB memory stick with the self-extracting control panel firmware file provided by Siemens into the USB port on the electronics compartment.
3. Power on the RCU by turning on any of the mains, solar or battery supply toggle switches with a connected supply.
4. The protocol Rx data LED will start flickering quickly for between 5-15 s. This indicates the firmware update is in process. If this does not occur, restart sequence from step 1.
5. At end of the upload sequence, all LEDs on the display will synchronously blink red-green to signify upload successful.
6. Power off the RCU again and remove the USB memory stick.

7. To complete the process, power on the RCU again by turning “ON” the main/ solar supply and the battery switch. The RCU will now operate as normal with the Fusesavers and control panel.

Troubleshooting the Fusesaver operator control panel

Fusesaver LEDs off - indicating no data

Some LED indications on the FS control panel have a third state of no data when both LEDs are off. There are a number of reasons why a panel indication would have no data:

- RCU power up: On power up, the RCU searches for Fusesavers, checks their configuration for correct match and synchronizes time to them. The RCU OK LED will be flashing during this time which may take up to 10 minutes to finish. During this time no data will be available.
- RCU failed to find Fusesavers line: If the RCU fails to find a correctly configured Fusesaver line, then all phases will remain in the no data state and the RCU problem LED will be red.
- Phase not present: If a FS line has less than three phases, then the phases that are not present will always have their LEDs in the no data state, e.g., FS line only has B and C phases, then A phase will have no data.
- Communications lost to a FS (e.g., communications module removed): When communications to the Fusesavers are restored, the RCU will verify the FS configuration is still OK, which can take up to five minutes for a single phase and during this time no data will be displayed for that FS.

No control source - local

In order to carry out FS controls via the control panel, the control source must indicate local control is allowed. There are a number of reasons why the control source local would not be lit.

- Control source Siemens Connect: Local control will not be allowed while Siemens Connect is in session with the Fusesavers.
- Control source – remote: Local control may not be allowed while the remote operator has control to the Fusesavers. This functionality depends on the configuration setting of the RCU, see Operator control panel ignore remote switch on page 51.
- RCU power up: On power up the RCU will search for and check the configurations of Fusesavers in the vicinity. During this time the RCU OK LED will be flashing and both local and remote control to Fusesavers is not available.
- FS external lever down: When the external lever of any FS on the line is down, then controls to all Fusesavers, remote or local, are disallowed. Depending on the RCU configuration, trip controls may still be allowed even though the control source is LED is not lit.
- RCU synchronizing new time: All RCU controls, remote or local, will be locked out for a short period (less than 30 seconds) when new time is being synchronized from the RCU to the Fusesavers; this avoids unreliable controls.

Fusesaver control – no control In progress

When an operator presses a FS control, the control-in-progress LED and the corresponding control status LED will begin to flash when the control has been accepted by the RCU and sent to the Fusesavers. If the control-in-progress LEDs do not start to flash, the control has been rejected. A control will be rejected for the following reasons.

- Control source – local: The control source local LED is not lit, therefore all FS controls from the control panel will be rejected. See No control source – local on page 61 to get the panel into local control.
- Control already active: The control has been rejected because the RCU is already in the process of sending a control to the Fusesavers. The previous control may have been from the remote operator, the RCU itself (if configured to do so) or from the control panel. If the previous control was from the control panel, the control-in-progress LEDs will already be flashing.
- Line not configured: If the RCU fails to find a correctly configured FS line on start-up, then all controls to Fusesavers will be rejected. RCU problem LED will be red in this case.
- RCU power up: On power up, the RCU searches for Fusesavers, checks their configuration for correct match and synchronizes time to them. The RCU OK LED will be flashing during this time, which may take up to 10 minutes to finish and there will be no data for some or all of the Fusesaver status LEDs. During this time, controls to Fusesavers will be rejected.
- Communications lost: If the RCU loses communications to a FS or is currently verifying the configuration of a FS that had lost communications, then all FS controls will be rejected. This is because all FS control panel controls are ganged controls that require communications to be good to all phases. Communications lost can be indicated by the FS health indicators, whereas the RCU verifying the FS configuration after having lost communications will result in the FS status data for that phase being no data.
- Button press rejected: If the operator presses the control button for more than 5 s or presses more than one button at the same time, the button press will be ignored.

Fusesaver control – does not complete

When an operator presses a FS control, the control-in-progress LED and the corresponding control status LED will begin to flash when the control has been accepted by the RCU and sent to the Fusesavers. If the control that was sent does not complete (e.g., close control sent but some/all phases still in open state), the most likely cause is communications failure during the control. Note that if the control in progress LED is flashing, then the RCU has determined the communications to the Fusesavers to be working at the start of the control, so the probability of this occurring is low.

Panel on indicator is the only LED that is lit

When the panel is turned on and panel on LED is the only LED that is lit, it is because the control panel has no data for any of the phases. The most likely cause in this case is the RCU has just been powered up.

Panel on indicator LED and control source are the only LEDs that are lit

When the panel is turned on and the panel on LED and control source are the only LEDs that are lit, it is because the control panel has no data for any of the phases. The most likely cause in this case is the RCU has just been powered up, is searching for Fusesavers and has not found a correctly configured FS line.

Panel does not turn on

There are a number of valid reasons for a FS control panel not turning on:

- The RCU is configured with the FS control panel disabled.
- The RCU firmware is an old version and cannot drive the FS control panel.
- The FS control panel connector is not plugged into the RCU. It is acceptable to plug the panel into a powered up RCU (hot connection). On re-connection, it may take up to 30 s for the RCU to detect the FS control panel.
- The RCU power is off.

Panel LEDs are all flashing on/off

The FS control panel type is unknown to the RCU. The RCU requires a panel map update. Siemens can assist with providing the correct panel mapping.

Panel LEDs turn on one-by-one across the panel

The FS control panel firmware version is not compatible with the firmware in the RCU. Siemens can assist with providing the latest panel firmware.

Fusesaver replacement

If a Fusesaver is replaced or any change made to the Fusesaver line name, then the RCU should be powered down and up again so that it will search again and find the changed installation.

Manufacturer's product liability

The manufacturer's product liability shall be excluded if at least one of the following criteria applies:

- Original Siemens spare parts are not used.
- Fitters carrying out replacements have not been trained and certified by Siemens.
- Parts have been incorrectly fitted or adjusted.
- Settings are not made in accordance with Siemens specifications.
- After installation and setting, no final test is performed by a qualified person including documentation of the test results.

To keep documentation complete, it is important that measurement results are submitted to the local competent Siemens office.

Disposal

The materials of the RCU should be recycled. Disposal of the RCU with minimum environmental impact is possible on the basis of existing legal regulations.

- The metal components can be recycled as mixed scrap, although wide-ranging dismantling into sorted scrap and mixed scrap residues is more environmentally sustainable.
- Electronic scrap must be disposed of in accordance with applicable regulations.

The RCU consists of the following materials:

- Steel
- Copper
- Plastics
- Rubber materials
- Batteries
- Electronic boards.

If the packaging is no longer needed, it can be fully recycled.

Service

Contact Siemens customer service if you require further information at +1 (800) 347-6659 or +1 (919) 365-2200 outside the U.S.

Technical data

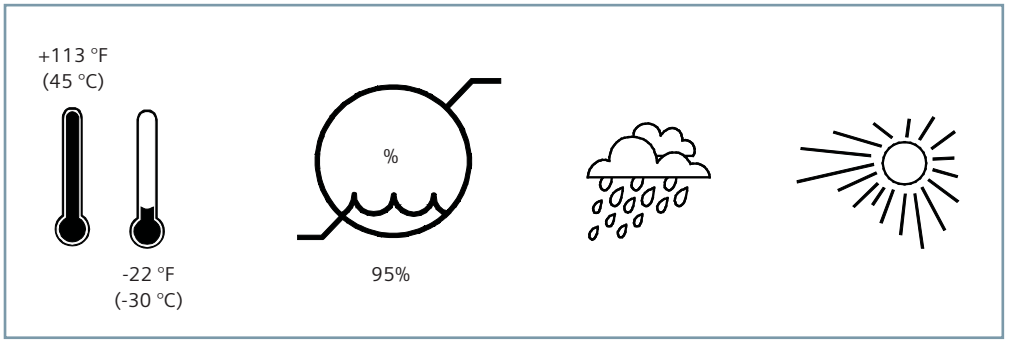
Auxiliary power supply voltage details

Table 7: Auxiliary power supply voltage details

Selection	Minimum continuous supply voltage	Maximum continuous supply voltage	Maximum power draw no heater/heater	Fuse F1 (located in terminal compartment)
230 Vac	184	265	50 W/150 W	20 mm x 5 mm cartridge 400 mA time delay 1,500 A interruption type Littlefuse 215.400MXP
115 Vac	92	133	50 W/150 W	

Ambient conditions and installation height

Figure 52: Ambient conditions



Rating plate

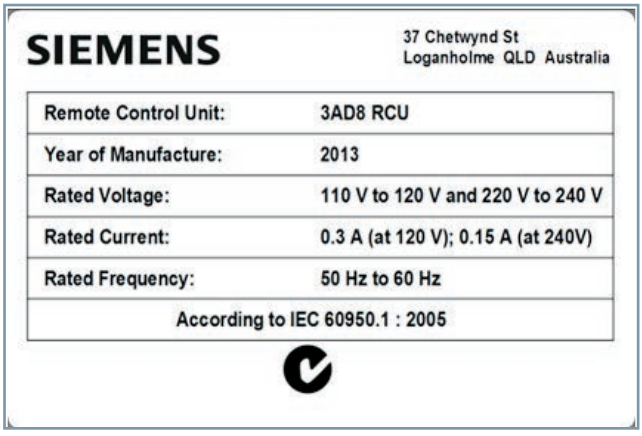


Figure 52: Example of RCU rating plate

The maximum installation height is 9,800′ (3,000 m) above sea level.

The minimum temperature listed requires installation of an enclosure heater. The minimum temperature limit for RCUs without a heater is 5 °F (-15 °C).

The RCU is designed for outdoor use and with the door closed has an IP 55 category 2, degree of protection rating.

Battery life

The RCU uses a standard sealed lead acid (SLA) 12 V battery conforming to standards JISC8702, 12 V, 7.2 Ah. This type of battery is readily available however battery quality varies greatly by manufacturer and this affects battery life significantly. It is recommended to purchase replacement batteries from Siemens.

In service, the battery life is affected by two factors:

- The first is temperature, the higher the temperature, the lower the battery life. This means that at time of installation care should be taken to ensure that the RCU is on the shady side of the power pole to reduce solar temperature rise.
- The second is discharge/charge cycles of the kind found in solar powered systems. Each charge/discharge cycle reduces battery life and the deeper the discharge the greater the effect. This means that a solar system should be engineered to keep worst case overnight discharge below 25 percent of the battery nominal capacity.

For typical installations, a battery life of four years or more would be expected.

The RCU battery management system maximizes battery life by a three-stage charging method, temperature compensation and system shutdown if the battery nears exhaustion. The period of backup available is related to:

- The state of charge and capacity of the battery. At end of life, the battery will have reduced capacity, typically 60 percent of its capacity when new.
- The power consumption of the radio in receive or idle mode.
- The power consumption of the radio in transmit mode and the transmit duty cycle.
- The power consumption of the RCU electronic system which is typically <20 mA when a serial data interface is employed and <120 mA when the Ethernet interface is employed.

Radio/modem interface electrical

A cable (or cables) is required between the radio/modem and the RCU electronics compartment to carry data signals and power. Siemens can design and assemble this cable as a value-added service, or the utility can design and make their own using the information provided in this section.

Power supply

Power for the radio/modem is available on the DB25 serial connector on the electronics compartment pin 6 (positive) and pins 1, 8, 9, 21 (negative/ground).

There are two options for power supply.

- A regulated supply which can be configured between 3 Vdc or 9 Vdc that can supply up to 2 A continuous. This supply is internally protected by current limit from radio short circuits.
- Supply direct from battery. In this case, a 6 A fast fuse must be included in the radio cable to protect the RCU from radio short circuits.

For details of how to set the power supply to the correct voltage refer to Auxiliary power supply on page 30.

Serial interface

This is via the DB25 serial connector on the electronics compartment. Use of these signals is protocol dependent. Refer to the relevant protocol manual for details. There are two options for electrical signal levels:

1. RS232
2. 3 Vdc or 9 Vdc logic level with respect to 0 V (battery negative). The voltage is configurable and applies to all signals. The sense of each signal can be configured separately (i.e., whether voltage high signals logic true or false).

When using the serial interface, there is a push-to-talk (PTT) clean contact for operation of some radios (maximum current 0.5 A, maximum voltage 20 V). When using the PTT output, there are configurable pre-transmit and post-transmit times (0 – 10 s, resolution 0.1 s).

10/100baseT data interface

Connection is though the Ethernet RJ45 connector on the electronics compartment. Interface is IP4 with fixed address which can be configured.

NOTICE

The Ethernet interface is not activated by software versions covered in this instruction manual.

Serial connector – DB25

The 25-pin serial connector on the electronics compartment is female. The radio cable should have a male connector to match. Table 8 lists the interface signals available on each pin of the connector.

3 Vdc or 9 Vdc configurable signals

Voltage range 3 Vdc or 9 Vdc configurable, only one voltage, called the signal supply is configured for all these signals.

These signals supply an alternative data interface to RS232 to operate with radio/ modems which have logic level types of serial interface.

The signal supply itself is also available on pin 22.

Maximum output current for all lines is 10 mA.

Table 8: Serial data connector

Serial data connector			
Pin	**Signal**	**Level**	**RCU electronics input/output**
1	GND		
2	DTR	RS232	Output
3	TXD	RS232	Output
4	RXD	RS232	Input
5	DCD	RS232	Input
6	Radio power supply positive	Configured 3 Vdc or 9 Vdc or battery	Output
7	PTT	Clean contact	Output
8	GND		
9	GND		
10	DTR	3 V-9 V configurable	Output
11	TXD	3 V-9 V configurable	Output
12	RXD	3 V-9 V configurable	Input
13	RI	3 V-9 V configurable	Input
14	RI	RS2323	Input
15	CTS	RS2323	Input
16	RTS	RS2323	Output
17	DSR	RS2323	Input
18	Radio power supply positive	Configured 3 Vdc or 9 Vdc or battery	Output
19	Radio power supply positive	Configured 3 Vdc or 9 Vdc or battery	Output
20	PTT	Clean contact	Output
21	GND		
22	Signal supply	3 Vdc or 9 Vdc, 5 mA	Output
23	CTS	Configurable 3 Vdc or 9 Vdc	Input
24	RTS	Configurable 3 Vdc or 9 Vdc	Output
25	DCD	Configurable 3 Vdc or 9 Vdc	Input

RS232 signals

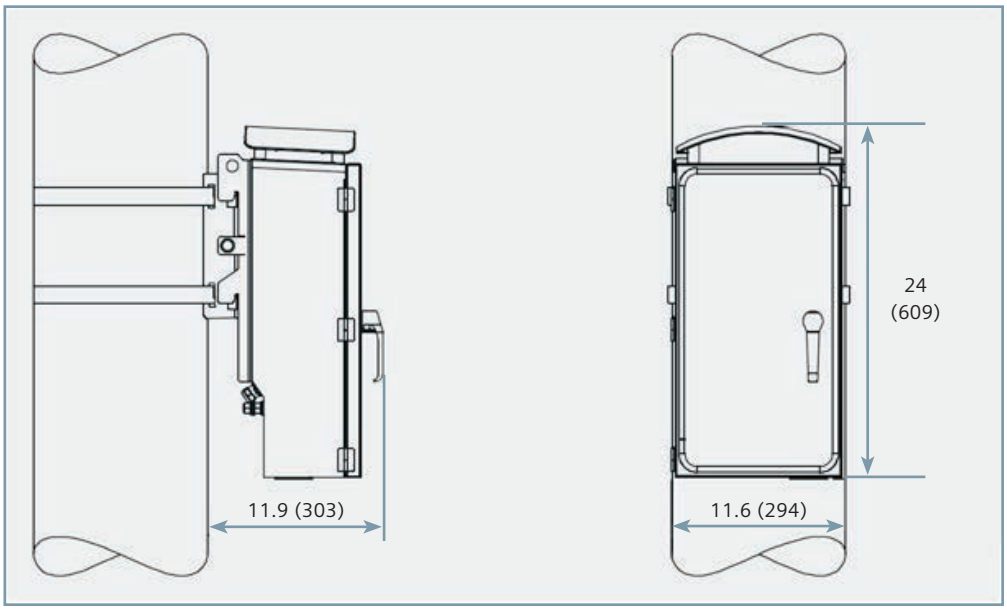
Conforms to RS232 standard.

Dimensions and weights

Table 9: Dimensions and weights in lbs (kg)

Mass	**Without battery**	33.1 (15)
	With battery	39.7 (18)

Figure 54: RCU dimensions in inches (mm)



Appendix

The following configuration settings relate to the RCU.

Site specific settings

These settings will have to be provided for each site. They are included in the RCU configuration specification form (KMS-3100) only for the purpose of selecting the visibility option for each setting. Otherwise, the specific site data is entered as part of the commissioning process.

Line name

This setting determines how an RCU will locate and couple with Fusesavers when turned on. Two options are available:

1. No line name - The line name field is left blank. This method is suitable for sites with only one set of Fusesavers within range of the RCU per site. Provided that there is a configured line at that site, the RCU will find it and connect to that line. This is very helpful in minimizing configuration problems, and also permits testing an RCU in a workshop with test Fusesavers and then taking it to site to work with the Fusesavers already installed at site without the need for re-configuration.
2. Named line – In this case, the user configures the RCU to search for a line of a particular name. This mode must be used when more than one Fusesaver line is within range of the RCU.

NOTICE

If "No Line Name" is suitable for all sites, then the line name can be hidden in the configuration template to avoid site errors.

Asset number

The user can use this optional setting to assign their own internal asset number to the RCU for this site. This asset number is available for transmission over the SCADA system as a string (SPID_2). Maximum of 32 characters available.

Protocol address

Most SCADA protocols require a unique site address, refer relevant protocol manual supplement.

RCU power supply settings

These settings would normally be applied to a population of RCUs.

RCU power source

The power source setting tells the RCU which terminal block it should expect to receive power from. Setting options are:

- Auxiliary power supply or VT power supply
- Solar.

Lead-acid battery replacement interval

The purpose of this setting is to alert the control center when RCU batteries require replacement due to being in service for a long time. The setting is the number of days of battery service that indicates end of useful battery life. If the battery has been in service for longer than the setting, DPID 2 (RCU - Battery Needs to be Replaced) database point is set which can be monitored by the SCADA system.

The range of values available are from 365 to 3,650 days.

Most utilities have experience with this type of battery in this type of application (for example automatic circuit reclosers typically use the same type battery) and have maintenance schedules which are appropriate. In this case, the battery replacement period should be set to match the field experience and maintenance schedule

In the absence of this field experience, Siemens recommends:

- For solar installations, the maximum battery life should be set to 1,460 days (four years) or less due to the day/night cycling of the battery.
- For cooler climates where daily peak temperatures very rarely go above 86 °F (30 °C) and usually stays below 77 °F (25 °C), battery life of 1,825 days (five years) is appropriate.
- For hotter climates where the daily temperature regularly goes above 86 °F (30 °C), battery life of 1,460 days (four years) is appropriate. Maximizing the shading effect of the power pole is essential to achieve this battery life.
- For very hot climates where most of the day is spent at high temperatures and night temperatures are also high, then battery life will be reduced further. Refer to Siemens for alternative battery options.

Solar low-performance time

This is a threshold setting that is the number of consecutive days of low solar-power input. If the threshold value is exceeded, an event is created in the RCU database and transmitted via the SCADA system. The purpose of this setting is to alert the control center of a damaged or dirty solar panel requiring maintenance. This setting is only applicable if the power source option is set as “Solar”. Values in the range of 2-10 days are available. Recommended value is 5 days.

Condition-based command settings

The RCU configuration has parameters that allow configuration of the excessive cleared faults functionality. These are:

- The time window size specified in seconds (maximum of 65,535 s, 18.2 hours)
- The number of cleared faults that occur within the time window (maximum of 16).

Fusesaver operator control panel settings

Enable Fusesaver operator control panel

If no RCUs have Fusesaver operator control panels fitted, then set this to “Disabled”. If one or more sites will have a Fusesaver operator control panel fitted, then set this to “Enabled” (the RCU will then auto-detect if a panel is fitted at a particular site).

Fusesaver operator control panel ignore remote switch

This setting allows the RCU to be configured so that Fusesaver operator control panel controls, such as trip/close or change of protection mode, will always be allowed irrespective of the position of the remote control on switch. Setting options are:

- TRUE: The RCU will allow controls from the Fusesaver operator control panel to be sent to the Fusesaver irrespective of the position off the remote control on switch.
- FALSE: The RCU will disable all controls from the Fusesaver operator control panel if the remote control switch is on.

Protocol settings

Refer to the relevant protocol manual for protocol setting option explanations. The protocol manual addresses:

- Radio power-supply settings
- Radio/modem serial-interface settings
- SCADA-operation settings
- Protocol-point configuration
- DNP3 configuration.

The information provided in this document contains merely general descriptions or characteristics of performance which in case of actual use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract.

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