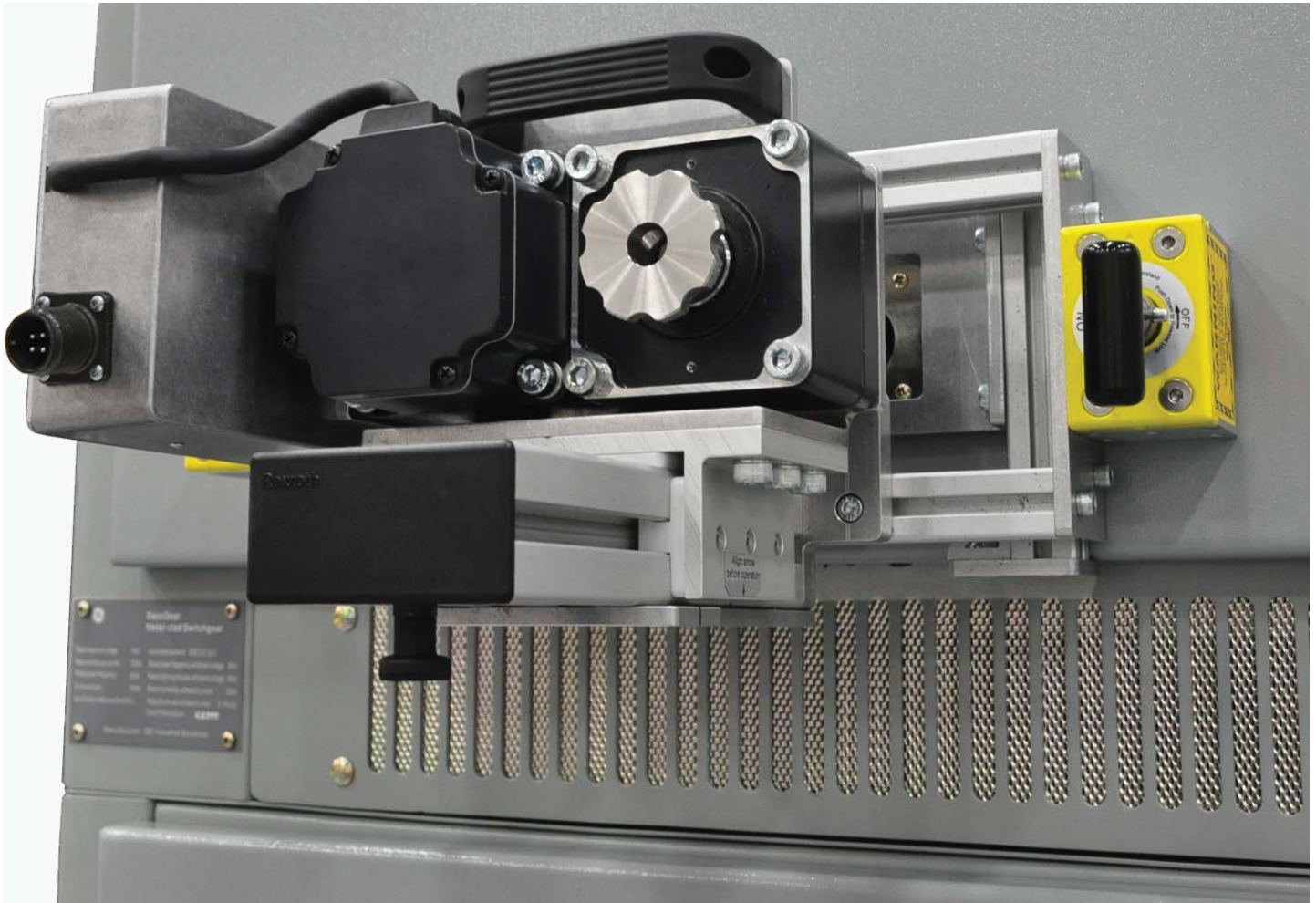


DEH-50008 Installation, Operation and Maintenance Manual

Remote Racking System

For Use with 5kv - 15kV IEEE Metal-clad Switchgear



HAZARD CLASSIFICATIONS

The following important highlighted information appears throughout this document to warn of potential hazards or to call attention to information that clarifies a procedure.

Carefully read all instructions and become familiar with the devices before trying to install, operate, service or maintain this equipment.

DANGER

Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

WARNING

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

CAUTION

Indicates that if the hazard is not avoided could result in minor or moderate injury.

NOTICE

Is used to notify of practices not related to personal injury.

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Seco Cube® SecoBloc®
SecoVac® VB2+ Multilin®

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Contact your local sales office if further information is required concerning any aspect of SecoGear switchgear and SecoVac VB2+ breaker operation or maintenance.

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SECTION 1. SECOVAC REMOTE RACKING SYSTEM INTRODUCTION

This manual describes the functions and features of the Remote Switch Operator (RSO). This technical document is intended to act as a simplified reference for users of the equipment; allowing for safe, quick, and efficient use of the RSO features.

DANGER

ENSURE THAT PERSONNEL USING THIS EQUIPMENT ARE ADEQUATELY TRAINED IN THE SWITCHGEAR OPERATION; THAT THEY ARE CORRECTLY STATIONED OUTSIDE THE ARC FLASH BOUNDARY; AND THAT THEY COMPLY WITH ALL APPLICABLE FEDERAL, STATE, LOCAL, AND IN-HOUSE SAFETY REGULATIONS AND PROCEDURES. ATTENTION SHOULD BE GIVEN TO DISTANCE, ANGLE, AND PERSONAL PROTECTIVE EQUIPMENT (PPE).

WARNING

ENSURE THAT SECOGEAR IS PROPERLY MAINTAINED AND IN GOOD WORKING ORDER BEFORE USING THE RSO ON YOUR SECOGEAR. CONTACT YOUR LOCAL SALES REPRESENTATIVE FOR PROPER CARE AND MAINTENANCE FOR YOUR SWITCHGEAR.

PRODUCT DESCRIPTIONS

Remote Switch Actuator (RSA)

The SecoGear Remote Switch Actuator (RSA) product line is made up of various application-specific, remote-operating devices. These products allow service personnel to remotely perform all aspects of an operation for a particular type of electrical equipment from outside the arc flash boundary – reducing or eliminating the possibility of serious injury or death resulting from an arc flash.

Remote Switch Operator (RSO)

During a remote operation, the SecoGear RSO functions as both the power supply and user interface for the device being remotely operated by the user. When paired with an applicable SecoGear device, this portable standalone system allows service personnel to remotely perform a racking or switching procedure from outside the arc flash boundary – reducing or eliminating the possibility of injury or death resulting from an arc flash.

SECTION 2. INSTALLATION

DANGER

BEFORE SERVICING ANY BREAKER, MAKE SURE THAT IT MATCHES THE BREAKER DISCUSSED. IF THE BREAKER DOES NOT MATCH THE EXPECTED MODEL OF GE SECOVAC VB2+, PLEASE CONTACT YOUR LOCAL SALES REPRESENTATIVE FOR MORE INFORMATION.

CAUTION

The location of certain items such as mimic bus, stickers, and/or placards may interfere with the installation of the remote operating equipment. These items may need to be removed or repositioned for proper installation.

PREPARE THE BREAKER DOOR AND RSA

Before proceeding, ensure that the breaker is free from any obstruction that may interfere with proper installation.

Also, set the torque limiter on the RSA correctly to allow proper operation, as described in "Torque Limiter."

1. Open the racking mechanism door (also known as the "drawout interlock"), in order to clear the access port. The lockout tab must be oriented upward, as shown in Figure 2-2, to avoid interference with the RSA.

Figure 2-1: Racking Mechanism Door, Locked

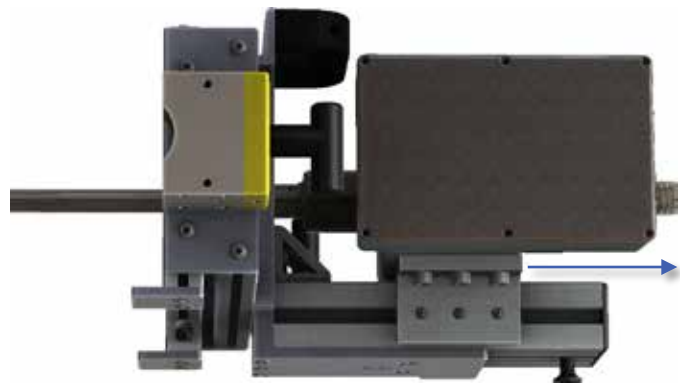


Figure 2-2: Racking Mechanism Door, Unlocked



2. Fully retract the slide assembly until the black locking pin clicks into place (Figure 2-3).

Figure 2-3: RSA Slide Assembly



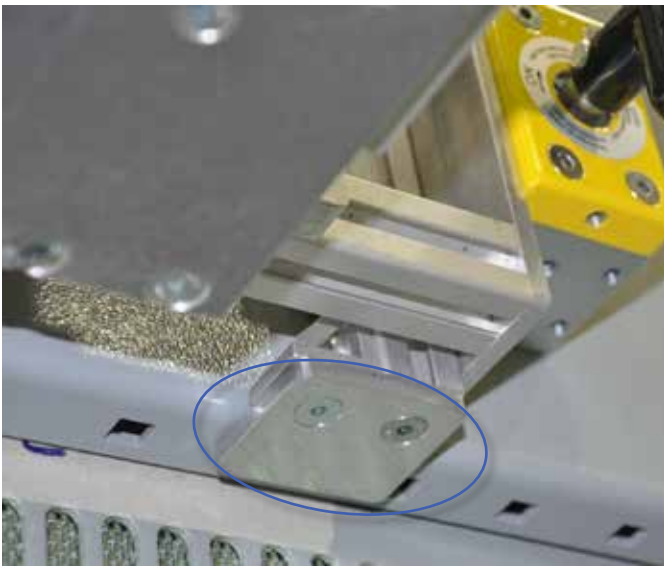
INSTALL THE RSA ONTO THE BREAKER

1. First, insert the racking tool into the racking mechanism access port.
2. Then, while holding the RSA against the switchgear, lift up to align the locators on the RSA flush with the bottom edge of the switchgear (Figure 2-4 and Figure 2-5).

Figure 2-4: Bottom Left Locator



Figure 2-5: Bottom Right Locator



3. Finally, slide the RSA to the side until the center locator fits around the racking tool escutcheon (Figure 2-6).

Figure 2-6: Center Locator

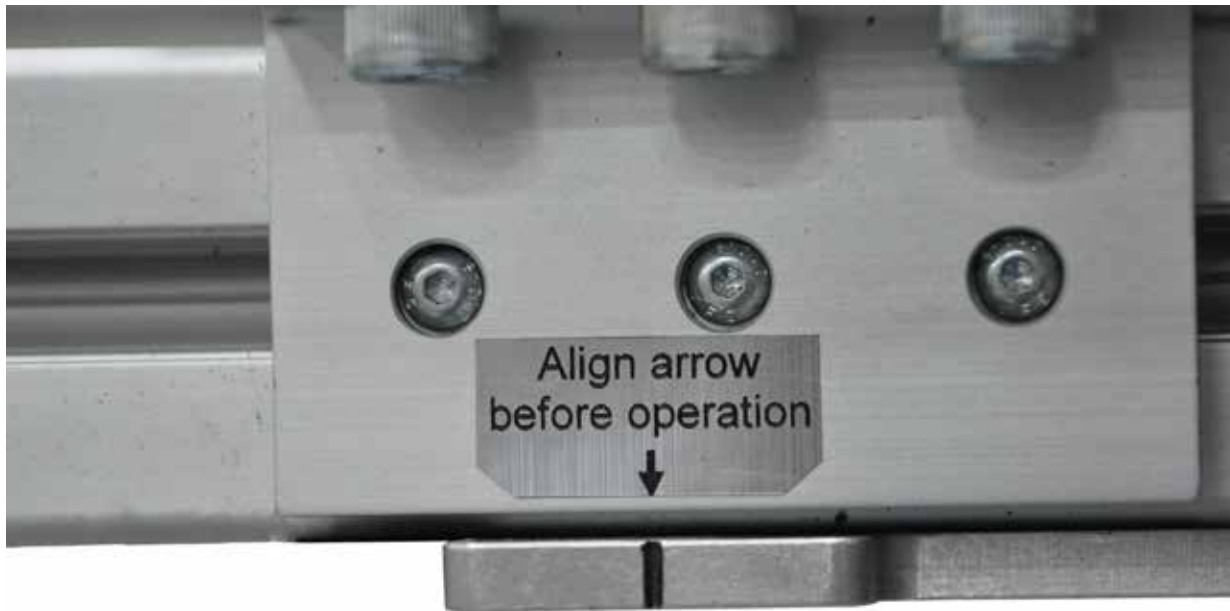


4. Secure the RSA to the breaker by turning the handles of the twist magnets 180° clockwise.
5. Grip the racking motor with one hand, and with the other pull upwards on the black locking pin until the slide assembly is released.

Once released, the slide assembly will attempt to slide forward on its own.

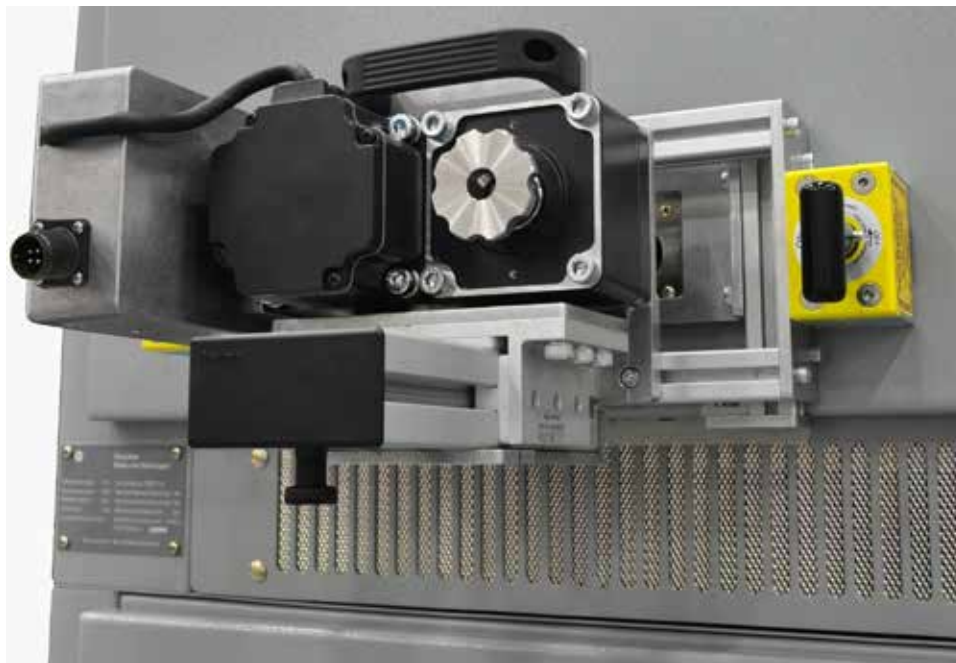
6. Guide the tooling carefully so that it mates with the racking mechanism inside the cabinet. Ensure the alignment arrows on top of the RSA are aligned exactly (Figure 2-7), to ensure that the tooling is properly seated on the breaker racking mechanism and engaging both the racking mechanism and the ring interlock surrounding it.

Figure 2-7: Align Arrows Before Operation



7. Rotate the tooling as required for it to seat properly onto the racking mechanism. The RSA is now ready for operation.

Figure 2-8: RSA Installed



SECTION 3. OPERATION**CAUTION**

Please ensure that all cables are clear of moving parts. Failure to do so may result in damage to cables and/or actuator.

CAUTION

Please ensure that the batteries to the RSO are fully charged or that the unit is plugged into AC power.

For detailed instructions on the operation of the RSO, please see the RSO Manual.

Before racking the circuit breaker, ensure that the RSA is properly installed, as described in SECTION 2: "Installation."

1. Connect the cable from the RSO to the motor control box on the RSA
2. Turn the power switch on the RSO to the ON position.

Figure 3-1: Remote Switch Operator



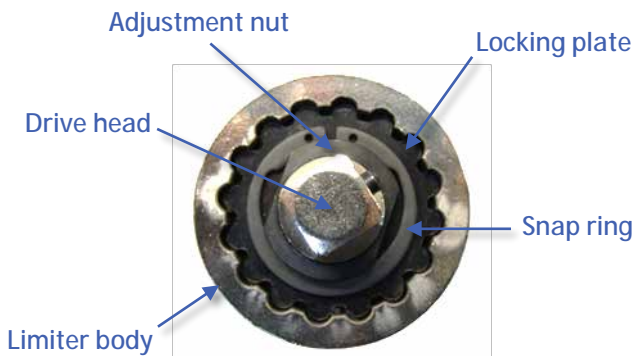
3. Program the settings for the RSA into the RSO. (These settings can be found on the placard on the RSA. For more information on programming the RSO, please refer to the RSO Technical Manual.)
4. Exit the arc flash boundary.
5. Once the current limits have been properly set, press and release the REMOVE button on the RSO control panel or remote pendant to rack the breaker out.
6. Press and release the INSTALL button on the RSO control panel or remote pendant to rack the breaker in.

SECTION 4. ADJUSTMENTS

TORQUE LIMITER

The torque limiter is designed as the primary safety system to reduce the possibility of damaging the circuit breaker racking mechanism with the RSA. The torque limiter attaches to the drive coupling and mates with the racking tool.

Figure 4-1: Torque Limiter



The torque limiter is set from the factory for your particular breaker, so adjust only as needed for your specific situation. Use a ½ in. drive torque wrench to perform the adjustment described below:

1. First, remove the racking tool adapter from the RSA by pushing in the locking pin at the base of the adapter, as shown in Figure 4-2. The racking adapter can then be fitted to a standard ½ in. drive torque wrench.

Figure 4-2: Remove Adapter



2. On the de-energized and OPEN test breaker, extract the breaker's racking handle, and fit the racking adapter to the handle as shown in SECTION 2: "Installation."
3. To determine the proper torque required to rack the breaker, first rack the breaker out, measure the

maximum amount of torque needed, and record the value.

CAUTION

When the breaker reaches either the TEST or DISCONNECTED position the torque will rise as various interlocks and mechanical limits engage. DO NOT apply any torque to the racking mechanism greater than that seen during the racking process.

Next, reset the torque wrench (if needed) and proceed to rack the breaker in, again measuring the maximum torque applied. Record this value.

CAUTION

As you begin racking the breaker onto the stabs, the torque should rise. Then, almost immediately after the breaker is on the stabs, the torque will lower and then spike as you hit the racking limits. This spike is caused when the breaker is starting to be racked in too far. DO NOT continue to rack in the breaker at this point. The maximum amount of force the breaker needs to rack will be found as the breaker goes onto the stabs.

⚠ WARNING

AS BREAKERS AGE AND/OR DO NOT SEE REGULAR MAINTENANCE, THE TORQUE NEEDED TO RACK A BREAKER MAY INCREASE. HOWEVER, LARGE INCREASES OF TORQUE NEEDED TO RACK A BREAKER INCLUDING AMOUNTS OVER 10% OF THE AVERAGE TORQUE MAY INDICATE BREAKER PROBLEMS, WHICH COULD LEAD TO AN ARC FLASH.

IF THE RRS DOES NOT SEEM TO HAVE ENOUGH TORQUE, FIRST DOUBLE CHECK THAT THE BREAKER IS OPERATING PROPERLY BEFORE RACKING OUT BY HAND.

Take the higher of the two recorded values and multiply by 1.1. This adds an additional 10% margin of error for the torque limiter. This new value is the setting for the torque limiter.

4. Next, attach the torque wrench to the spring-loaded drive head. (Various socket adapters may be necessary depending on the drive size of the torque wrench.) Use the torque wrench to determine the present setting of the torque limiter.

The torque limiter body must be held still during this operation.

5. Remove the snap ring and locking plate from the torque limiter (Figure 4-1).

6. Adjust the nut clockwise to increase torque, and counter-clockwise to decrease torque.
7. Obtain a new torque reading with the torque wrench to verify the new torque setting. Repeat step 6 until the torque value determined in step 3 is reached.
8. Replace the locking plate and snap ring onto the torque limiter.

⚠ WARNING

INACCURATE SETTING OF THE TORQUE LIMITER MAY RESULT IN EXCESSIVE SLIP DURING RACKING OPERATIONS OR, IF OVERTIGHTENED, THE REMOTE RACK'S PLACING EXCESSIVE TORQUE ON THE BREAKER RACKING MECHANISM; POSSIBLY LEADING TO EQUIPMENT DAMAGE.

ACTUATOR LOCATION ADJUSTMENT

In order to adjust the horizontal and vertical location of the actuator and slide assembly on the RSA, several adjustment points are given on the frame. The RSA comes pre-adjusted from the factory for its breaker, so these adjustments should not normally need to be made.

To adjust horizontal positioning of the slide assembly:

1. Install the RSA on the breaker as described in the installation, ensuring that the tooling is properly seated in the racking mechanism.
2. Loosen the four bolts on the slide assembly mount, as indicated in Figure 4-3.

Figure 4-3: Slide Assembly Mount Bolts, A&B



Figure 4-4: Slide Assembly Mount Bolts, C&D



3. Move the assembly left or right as required.
4. Re-tighten the bolts loosened previously.

SECTION 5. OPERATING PROCEDURES

This section describes in detail the available functionality of the RSO, as well as lists and describes the basic features of the unit. These features will be discussed at length in the following sections of this manual.

SCOPE OF OPERATIONS

The Remote Switch Operator (RSO) system enables service personnel to stand outside the arc flash protection boundary while operating electrical equipment; reducing or eliminating the need for a full-body arc flash hazard suit. The RSO is a rechargeable 24 Vdc power supply that, when used in conjunction with a single use Remote Racking System (RRS), remotely performs any switching procedure that would normally require local operation by trained personnel.

Common tasks the RSO and RRS can perform include, but are not limited to, the following operations:

- Installing and removing any switchgear utilizing a rotary racking mechanism
- Installing and removing any switchgear utilizing a non-rotary racking mechanism
- Engaging or disengaging mechanical or electrical interlocks, such as circuit breaker interlock foot-pedals or buttons

MAIN COMPONENTS

The RSO unit provides both the power and control to the RRS being operated. The power and control components are housed inside a rugged case that can withstand the harsh industrial environments where use is likely to occur.

This section explains the main components of the entire unit, as well as the main components of the user control interface.

Figure 5-1: RSO Main Components



Figure 5-2: RSO Control Panel Components



Figure 5-3: RSO Control Panel Components



SECTION 6. PREPARATION

Prior to beginning any remote racking procedure, GE recommends that you first inspect both the RSO and the RRS to be operated for both mechanical and electrical integrity. Improper operation, storage, or transport prior to usage may have affected the operational ability of the RSO or RRS.

Specific RRS setup and preparation may be found in the applicable manual received with the RRS. If the manual accompanying the RRS is not available, please contact us for a replacement hard copy or electronic copy. This section describes in detail the necessary preparation for the RSO before beginning any remote racking operation.

Prior to using the RSO with any RRS for a remote racking operation, please address the following items:

1. Inspect the exterior of the RSO. Examine the case for any signs of misuse including scratches, dents, holes, or any other cosmetic issues. These may be signs of misuse, which could result in more serious problems.
2. If no exterior problems are found, open the case and inspect the interior. Again, look for any signs of prior misuse or interior damage. Remove all cords and accessories from the cord storage area and check for any loose or missing components.
3. With the cords and accessories removed, inspect the 25 ft. cord to ensure that it is in proper working order. If the unit is equipped with the radio remote option, inspect the radio remote pendant station, as well.
4. Next, power on the RSO. The switch should illuminate when turned on and the battery indicator should read fully charged. If the RSO is not fully charged, allow the RSO to charge before continuing. Charge time will vary depending on starting charge level.
5. Lastly, in a suitable work area, connect the RSO to the applicable RRS per the instructions in the RRS manual. Operate the RRS using the RSO and ensure that users are familiar with all settings and controls prior to installing and operating the RRS on live switchgear.

CAUTION

We recommend that the RSO remain plugged into AC power when not in use. The RSO is equipped with a “smart charger” that monitors battery voltage and automatically applies appropriate charging voltage without the need for setting the charger.

SECTION 7. BATTERY CHARGING AND MAINTENANCE

The batteries within the RSO provide the power necessary to perform all remote switching functions available with the unit. However, if the batteries are not maintained properly, they will lose their effectiveness and be useless when needed.

Please follow these guidelines when operating the RSO on battery power or charging the batteries. Following these guidelines guarantees the most life out of the batteries.

- Exercise the batteries regularly. Run the unit on battery power at least once a month to keep the batteries in functional condition.
- Do not fully discharge the batteries. This will severely shorten the service life of the batteries.
- Charge the batteries as soon as possible after use. Charging the batteries immediately after use will reduce effect of sulfation on the batteries and increase their life.
- Use only the charger supplied with the RSO to charge the batteries. This charger is equipped with a monitor that allows it to provide the optimum charging voltage based on the battery's current state.
- Do not let the batteries remain discharged for long periods of time. Ensure that they are charged regularly to a level near their capacity.

- Store the unit only in locations that will be kept at moderate temperatures. Extreme cold and extreme heat will severely reduce the life of the batteries.

CAUTION

Storing the RSO extreme temperatures will drastically reduce battery performance and life. GE recommends storing the unit in a temperature controlled environment when available.

- If operation must occur in locations with extreme temperatures, plug the unit into AC power during operation to reduce the strain on the batteries.

CAUTION

At extreme temperatures, battery performance will be reduced below its normal level. GE recommends that the unit be operated only when plugged into AC power in these environments to prolong battery life and ensure proper RSO performance.

SECTION 8. CONFIGURATION

This section details the various steps required to set up the RSO for the appropriate RRS to be operated and describes the operational aspects pertaining to the remote operation of the RRS. For more detailed information, please see the manual for the specific RRS.

Before performing any remote racking procedure, please ensure that the following prerequisites have been met:

1. The circuit breaker racking mechanism is in working order.
2. The circuit breaker has been properly maintained.
3. The circuit breaker is fully in the CONNECTED/ DISCONNECTED/TEST position and OPEN according to manufacturer specifications.

Once these conditions have been addressed and verified, the setup procedure may begin. Please follow these steps to ensure that proper setup, installation, and operation are taking place:

1. Place the RSO near the area where the remote operation will occur.
2. Unlatch and open the lid to expose the controls. Ensure that the RRS torque guard is set to the proper amount of torque.

A placard on the inside of the RSO lid will inform the user of this value. For information on setting the torque guard, please see the applicable RRS manual.

3. Install the RRS onto the equipment that will be racked remotely. See the RRS manual for information regarding specific RRS setup and installation.
4. Install the spiral cable onto the RSO and the RRS.

CAUTION

The RSO and RRS use a four-pin twist style cable connection. These connectors utilize a special self-lubricating material coating. However, it is possible that other materials may build up on these connectors during operation, rendering the self-lubricating feature useless. If the connectors show any signs of binding or difficulty connecting, apply a light layer of lubrication over both sets of the threads to alleviate the problem.

5. Power on the RSO by turning the main power switch to either the LOCAL (labeled "LOC") or REMOTE (labeled "REM") position.
 - a. If switched to local mode, a light within the switch will illuminate as the switch is turned on.
 - b. If switched to remote mode, ensure the remote is set up according to the instructions in the SECTION 11: "Radio Remote." Press any button on the remote to activate the unit – the green light within the switch on the RSO should illuminate.
6. Check the battery indicator and ensure that a full charge is present. If the batteries are not fully charged, please allow the unit to remain plugged into 120 Vac power until the battery indicator shows full charge for best results.

CAUTION

Connecting the RSO to 120 Vac power using the supplied charging cord will not immediately remedy a low battery issue. The built-in charger is intended to be used as a power supply in the event of a low battery; meaning that the unit will not solely run on 120 Vac power when plugged in. Disconnect 120 Vac power from the RSO to achieve an accurate reading on the battery indicator.

7. Set INSTALL and REMOVE current on the CCM to the prescribed setting listed on the placard located inside the lid of the RSO.

The INSTALL setting controls maximum allowable current draw on the install operation; while the REMOVE setting controls the maximum allowable current draw on the remove operation. The following sections will go into more detail describing the INSTALL and REMOVE current settings.

8. Check to ensure that all settings are correctly set. Once all settings have been set and verified as correct per the placard inside the lid, remote racking may begin.

SECTION 9. OPERATION

This section describes in detail the setup and operation of the RSO using the Current Control Module (CCM) in both manual and automatic modes.

The CCM is the “brains” of the RSO, which monitors the running current of the motor during operation and shuts down power to the unit when an overcurrent condition has been met. The CCM allows to users to customize several controls to tailor the RSO to the gear being remotely racked.

WARNING

THE CCM LIMITS MAXIMUM CURRENT TO 30 A TO PREVENT THE POSSIBILITY OF EXTREMELY HIGH VALUES OF TORQUE BEING PLACED ON THE SWITCHGEAR. IF THE CCM INSTALLATION OR REMOVAL CURRENT EXCEEDS 15 A OR OPERATORS NOTICE LARGE VARIANCES BETWEEN SIMILAR PIECES OF GEAR, IT IS RECOMMENDED TO INVESTIGATE THE PROBLEM AND DETERMINE THE UNDERLYING CAUSE.

MANUAL CCM OPERATION

Using manual current control allows for the monitoring and recording of the maximum current draw during the racking operation. This allows the user to set the current control module for future automatic remote rack operations. In order to set the current control module for manual control, both the INSTALL and REMOVE current limit settings must be set to 0.0 A.

Before performing any remote racking procedure, please ensure that the following prerequisites have been met:

1. The circuit breaker racking mechanism is in working order.
2. The circuit breaker has been properly maintained.
3. The circuit breaker is fully in the CONNECTED/ DISCONNECTED/TEST position and OPEN according to manufacturer specifications.
4. The RRS is connected properly to both the circuit breaker and the RSO.

DANGER

ALWAYS ENSURE THAT PERSONNEL USING THIS EQUIPMENT ARE ADEQUATELY TRAINED IN THE OPERATION OF THE SWITCHGEAR THEY ARE PLANNING TO WORK WITH; THAT THEY ARE CORRECTLY STATIONED OUTSIDE THE ARC FLASH BOUNDARY; AND THAT THEY COMPLY WITH ALL APPLICABLE FEDERAL, STATE, LOCAL, AND IN-HOUSE SAFETY REGULATIONS AND PROCEDURES. ATTENTION SHOULD BE GIVEN TO DISTANCE, ANGLE, AND PERSONAL PROTECTIVE EQUIPMENT (PPE).

Perform the following steps to operate the RSO in manual mode:

1. Ensure that the RSO and RRS have been properly set up for operation.
2. With the main power switch in either Local or Remote mode and illuminated showing that power is ON, press and hold the INSTALL set point button on the CCM. The display will read the current setting for the install operation.
3. Now, while still holding the INSTALL set point button down, press and hold the DOWN button as well. The displayed value will decrease until the current setting is set to 0.0 amps. Repeat this process for the REMOVE setting as well.

NOTICE

With both the install and remove set points at 0.0 A, the operator has momentary control over both the INSTALL and REMOVE operations.

4. To store the maximum current draw during the racking operation, prior to the beginning the operation, press the DOWN/MAX CURRENT button once so that the decimal point on the CCM display is blinking.

After the manual operation, the display will indicate the highest current recorded during the racking operation. Beginning another operation will automatically reset the value. Press the DOWN/MAX CURRENT button once more to turn this feature off.

DANGER

IF USING THE RRS IN MANUAL MODE PREVENTS THE SERVICE PERSONNEL FROM MOVING OUTSIDE THE ARC FLASH BOUNDARY, PLEASE REMEMBER TO COMPLY WITH ALL APPLICABLE FEDERAL, STATE, LOCAL, AND IN-HOUSE SAFETY REGULATIONS AND PROCEDURES REGARDING ARC-FLASH.

- Rack the circuit breaker in manual mode using the INSTALL and REMOVE command buttons on the user control panel, paying close attention to the values displayed on the CCM. Record the maximum values for the install and remove operations, for later use in automatic operation.

NOTICE

The RSO default setting for motor direction is CW for Install and CCW for Remove. The majority of racking mechanisms operate in this manner; however, there are types that do not. To swap the direction of operation, please see "Advanced CCM Setup Configuration."

- Once remote racking has been completed, the user may disconnect the RSO from the RRS and store for future use as directed. See applicable RRS manual for instructions on RRS removal.

AUTOMATIC CCM OPERATION

The main feature of the RSO is the ability to run in automatic mode and shut down the remote racking system once it has reached the end of its travel. This task is accomplished by the CCM within the RSO, which, when properly set up, will provide the ability to finely tune the operational aspects of the system.

Once you have found the appropriate set points in manual mode, automatic mode may be configured. This section describes the steps necessary to set up the RSO for automatic operation.

Before performing any remote racking procedure, please ensure that the following prerequisites have been met:

- The circuit breaker racking mechanism is in working order.
- The circuit breaker has been properly maintained.
- The circuit breaker is fully in the CONNECTED/DISCONNECTED/TEST position and OPEN according to manufacturer specifications.
- The RRS is connected properly to both the circuit breaker and the RSO.

DANGER

ALWAYS ENSURE THAT PERSONNEL USING THIS EQUIPMENT ARE ADEQUATELY TRAINED IN THE OPERATION OF THE SWITCHGEAR THEY ARE PLANNING TO WORK WITH; THAT THEY ARE CORRECTLY STATIONED OUTSIDE THE ARC FLASH BOUNDARY; AND THAT THEY COMPLY WITH ALL APPLICABLE FEDERAL, STATE, LOCAL, AND IN-HOUSE SAFETY REGULATIONS AND PROCEDURES. ATTENTION SHOULD BE GIVEN TO DISTANCE, ANGLE, AND PERSONAL PROTECTIVE EQUIPMENT (PPE).

The following steps describe how to operate the RSO in automatic mode:

- Ensure that the RSO and RRS have been properly set up for operation.
- Set the current control module install and remove settings by performing the following steps:
 - With the main power switch in either Local or Remote mode and illuminated showing that power is ON, press and hold the INSTALL set point button on the CCM. The display will read the current setting for the install operation.

Now, while still pressing the INSTALL set point button, press and hold the UP or DOWN/MAX CURRENT button to set the desired value. Repeat this process for the remove setting as well.

NOTICE

The required current setting will be determined by a number of factors including, but not limited to, breaker type, size, environment, and physical condition.

Recall the values from manual operation to find a suitable starting point for remote racking. See the previous section, "Manual CCM Operation," for more information.

- To store the maximum current draw during the racking operation, prior to the beginning the operation, press the DOWN/MAX CURRENT button once so that the decimal point on the CCM display is blinking.

After the automatic operation, the display will indicate the highest current recorded during the racking operation. Beginning another operation will automatically reset the value. Press the DOWN/MAX CURRENT button once more to turn this feature off.

- Press and release the applicable INSTALL or REMOVE command button on the user control panel to begin the remote racking operation.

The remote racking system will continue the operation until the current draw exceeds the current set point. The remote racking operation can be stopped at any time by pressing the opposite operation pushbutton on the remote pendant or user control panel.

NOTICE

The RSO default setting for motor direction is CW for Install and CCW for Remove. The majority of racking mechanisms operate in this manner, however there are types that do not. To swap the direction of operation, please see “Advanced CCM Setup Configuration.”

If the current control module has been set correctly, the racking operation will stop when the switchgear reaches the applicable DISCONNECTED or CONNECTED position. Depending on the breaker racking mechanism, it may also stop at the TEST position automatically.

To immediately perform another operation,

- For CCM firmware v3.0 and below, simply press the button corresponding to the next operation to be performed.
- For CCM firmware v3.0 and above, press either the INSTALL or REMOVE button on the RSO or radio remote to put the CCM in ready mode, then press the button corresponding to the next operation to be performed.

Once remote racking has been completed, you may disconnect the RSO from the RRS and store for future use as directed. See applicable RRS manual for instructions on RRS removal.

SECTION 10. ADVANCED CCM SETUP CONFIGURATION

Within the CCM is the ability to configure several of the features and operational aspects of the RSO. Some of the features will not be applicable on the RSO due to the CCM's role in other products where these features are used. However, these restrictions are noted below and any modifications to these settings will not affect the operation of the RSO.

OVERCURRENT DELAY TIMER

One of the key features of using RSO in automatic mode is being able to change the setting of the overcurrent delay timer. This parameter sets the amount of time that the running current is allowed to be greater than the current set point (in whichever direction you are currently operating) before the RSO shuts off operation.

Possible values range from 0.0 sec. to 0.9 sec., in increments of 0.1 sec. (For software versions older than 2.4 the available range is 0.1 sec. to 0.9 sec).

To change the overcurrent delay timer set points, see the following instructions:

1. Press and hold both the INSTALL and REMOVE set point buttons on the CCM at the same time for approximately 5 sec.
2. The display now shows the current set point for the overcurrent delay timer. To change the current set point, press the UP or DOWN buttons until the desired value has been reached.

CAUTION

The RSO overcurrent delay timer is preset to a value that has been found to work best with the RRS included. Changing this parameter will alter the operation of the RRS. Please take caution when making changes to the overcurrent delay timer.

3. To exit, press either the INSTALL or REMOVE set point button.

The new set point for the overcurrent delay timer will be automatically saved into memory. This setting will be saved even when the unit is powered off, eliminating the need to change the setting each time the unit is powered on.

MOTOR DIRECTION

As previously stated, use of the RSO in conjunction with the RRS assumes CW operation for an INSTALL command and CCW operation for a REMOVE command.

If this is not the case and operators wish to change the motor direction, please perform the following steps:

1. First, with the power on, press and hold the UP and DOWN/MAX CURRENT buttons together for approximately 5 seconds until the display reads either "nor" or "Rev." Normal (nor) operation is defined as CW rotation on the install direction and CCW in the remove direction. Reverse (Rev) operation is opposite of normal operation.
2. To change between the two options, press either the UP or DOWN/MAX CURRENT buttons.
3. Once the desired setting has been found, press either the INSTALL or REMOVE set point button to advance to the next screen.

NOTICE

For versions earlier than 3.0, this command returns to the home screen. For versions 3.0 and later there will be several other settings screens as follows.

4. Pressing either the INSTALL or REMOVE set point button will advance the user to the screen immediately following the normal/reverse selection screen. This screen will display a lowercase "n" followed by a number. This feature is used only on the RRS-1 product offered by GE. This setting has no effect on the RSO.
5. After pressing either the INSTALL or REMOVE set point button, the next screen will display a lowercase "r" followed by a number. Again, this feature is used only on the RRS-1 product offered by GE. This setting has no effect on the RSO.
6. After pressing either the INSTALL or REMOVE set point button again, the next screen will display an uppercase "J" followed by a number. This feature is used only on the RRS-1 product offered by GE. This setting has no effect on the RSO.
7. Pressing either the INSTALL or REMOVE set point button again will navigate the CCM to the next screen.

NOTICE

For CCM versions 3.4 or earlier, this command returns to the home screen. For CCM versions 3.5 and later there will be one more function available as described in "Output Sensing Shutdown."

OUTPUT SENSING SHUTDOWN

The most recent firmware revision of the CCM adds functionality to detect whether an RRS device is connected to the RSO output. Previously, if a command were given while a device was connected after the command, the device would begin the operation immediately upon connection.

This safety issue has been addressed in this firmware upgrade, which allows for an automatic shutdown based on whether a device is connected. When enabled, if you send a command and the CCM does not detect a connected device for 3 sec., then the command is canceled and the CCM returns to its previous state.

Follow the procedure below to enable or disable this functionality.

1. First, cycle through the steps in “Motor Direction,” above, to navigate to the output sensing shutdown function screen within the CCM.
2. Once you have navigated here, the screen will read either “nCE” or “nCd.”
 - a. If the screen reads “nCE” (No Current Enabled, the the default setting), then the unit will automatically shut down after 3 sec. if a command is given and no device is connected.
 - b. If the screen reads “nCd” (No Current Disabled), then the unit will continue to output signal when a command is given regardless of whether a device is connected. The UP and DOWN/MAX CURRENT soft pushbuttons toggle these two options.
3. Pressing either the INSTALL or REMOVE set point button navigates back to the home screen.

SECTION 11. RADIO REMOTE

The radio remote option is ideal for situations involving long-distance requirements or restrictions that allow for safe operation of the switchgear.

DIGITAL RADIO REMOTE

This section describes the setup and operation of the RSO using the digital radio remote. The digital radio remote was introduced in December 2012 and is the current style of radio remote installed on RSO units equipped with this option.

Digital Radio Remote Components

The radio remote option for the RSO consists of two main parts: the transmitter and the receiver. The transmitter is the handheld radio remote that the user will interact with when operating the device remotely. The receiver is mounted inside the RSO and receives the signal from the transmitter.

- **Radio Remote Transmitter** – The radio remote transmitter has a 6-button layout that is designed to wirelessly control the operational features of the RSO. The transmitter is not capable of making changes to the settings within the RSO, this must be performed locally.
- **Radio Remote Receiver** – The radio remote receiver receives the radio remote signals generated by the transmitter that are required to control the RSO. The radio remote receiver is housed inside the RSO beneath the CCM.

NOTICE

The provided radio remote transmitter is paired specifically for the system that it came with. Since the radio remote will NOT work with any other products, ensure that the radio remote transmitter is kept with the proper system.

Figure 11-1: Digital Radio Remote Transmitter,



Setup and Operation

Operating the RSO using the radio remote pendant station is very similar to standard local operation. The following steps will detail the setup and operation of the RSO using the radio remote.

1. Place the RSO near the area where the remote operation will occur, unlatch and open the lid to expose the controls.
2. Ensure that the RRS torque limiter is properly set to the correct amount of torque. A placard on the inside of the RSO will inform the user of this value.
3. Install the applicable RRS onto the equipment that will be racked remotely. See the RRS manual for information regarding specific RRS setup and installation.
4. Install the spiral cables first onto the RSO and then onto the RRS.
5. Power on the RSO by performing the following procedure:
 - a. Turn the main power switch clockwise to the REM position.
 - b. Press the ON button on the radio remote. Once the button has been pressed, a light within the main power switch on the RSO should illuminate, and the RSO will power on. Once the unit powers up continue to the next step.

CAUTION

If the radio remote was used to power down the RSO using the STOP button, there will be an approximately 5 sec. delay before the unit may be powered back up after the command has been given. (This prevents users from immediately turning the unit back on during a potentially dangerous situation.) This is also true even if the main power switch has been turned off on the RSO after the STOP command has been given using the radio remote. Wait approximately 5 sec. before pressing either CLOSE or TRIP to activate the RSO after a STOP command has been given.

6. Check the battery indicator to ensure that a full charge is present. If the batteries are not fully charged, please allow the unit to remain plugged into 120 Vac power until the battery indicator shows full charge.

NOTICE

Connecting the RSO to 120 Vac power using the supplied charging cord will not immediately remedy a low battery issue. The built-in charger is not meant to be used as a power supply in the event of a low battery, meaning that the unit will not run off of solely 120 Vac power when plugged in. Disconnect 120 Vac power from the RSO to achieve an accurate reading on the battery indicator.

7. Set the Install and Remove current on the CCM to the prescribed setting listed on a placard located inside the lid of the RSO.

The INSTALL setting controls maximum allowable current draw on the install operation; while the REMOVE setting controls the maximum allowable current draw on the remove operation.

NOTICE

Both the INSTALL and REMOVE settings are critical for proper RSO/RRS operation. Each of these settings is described in greater detail in the applicable the RRS technical manual, as well as in the preceding sections of this manual.

8. Check to ensure that all settings are correctly set. Once all settings have been set and verified as correct per the placard inside the lid, remote racking may begin.

NOTICE

The remote is equipped with a button labeled STOP. When pressed, this button will power off the RSO unit completely and immediately stop any operations in progress. To power on the unit after a STOP command, press any button to activate the RSO unit. The RSO is now ready to operate.

9. Check to ensure that all components are properly installed and connected. Once everything has been verified as being correct, exit the arc flash boundary with the radio remote.

Remote operation may now begin. At this point, refer to the RRS manual for operating instructions regarding specific RRS operation.

Once remote operation has been completed per the instructions given in the applicable RRS manual, the user may disconnect the RSO from the RRS. See applicable RRS manual for instructions on RRS removal.

Power down the RSO by turning the main power switch to the OFF position. Ensure that the remote is powered OFF by pressing the STOP button. Place all cords and the radio remote (if applicable) into the RSO and store for future use as directed.

CAUTION

The radio remote will automatically power itself down after 4 min. of inactivity to conserve battery life.

Radio Remote Specifications

Table 11-1 contains the relevant specifications relating to the optional radio remote pendant station.

Table 11-1: Digital Radio Remote Technical Specifications

Max Operating Distance	300 ft. (Line of Sight)
Frequency	Direct Sequence Spread Spectrum (DSSS) technology
Operating Temperature	-4 °F to 131 °F
Transmitter Power	3.6 V to 4.5V (three AAA batteries)
Auto Shutdown	4 min.
Indicators	TX – Transmitting RX – Receiving ER – Error A1 – Battery A2 – Unused A3 – Unused
Low Battery Warning	3.3 V and below (battery LED will blink approximately once per second regardless of operational status)
Low Battery Shutdown	3.1 V and below
Transmitter Weight	7.2 oz.
Transmitter Size	5.37" x 2.68" x 0.92"
Transmitter Button Life	5,000,000 Operations

Radio Remote Troubleshooting

Occasionally, a situation may occur when the handheld digital radio remote transceiver may lose contact with the base unit transceiver located within the RSO, causing the digital radio remote not to function properly. If this communication link is lost, the handheld transceiver will not operate the RSO in any way.

In this situation, perform the following procedure to re-establish this connection. You are also encouraged to contact GE to speak with a trained professional regarding the issue in addition to performing the procedure.

1. First, ensure that the remote that is malfunctioning belongs to the RSO in question. If there are multiple RSOs equipped with the digital Radio Remote in the area, check to ensure that the handheld transceivers have not been mismatched by checking the serial number printed on the remote to the serial number listed on the placard on the top of the RSO.

2. Next, open the RSO and remove the two flathead screws holding each side of the console in place. After each of the four screws has been removed, carefully remove both sides of the console from the case at the same time. Doing so will expose the radio remote base unit beneath the right side of the console below the CCM.
3. Next, power on the RSO and set the Main Power Switch to the REM setting. Inspect the lights on the exterior of the base unit transceiver located below the CCM. There are five indicating lights, each labeled with its function on the transceiver. Find the light labeled HEALTH and watch it closely. If the light is blinking green, the unit is in working condition and you may proceed. If the light is doing anything other than blinking green, this is a sign of a more serious problem. Power down the unit and contact GE for more information.
4. After the HEALTH light has been verified, power down the RSO. The RSO must be powered OFF to continue the process. Do not power down the handheld transceiver as it must be powered on for the next step.
5. Next, with a clear and unobstructed line of sight between the handheld transceiver and base unit, simultaneously press and hold the upper left and upper right buttons (REMOVE and INSTALL) on the handheld transceiver. The RX and ER lights should illuminate and begin blinking.

NOTICE

You have approximately 2 sec. to complete step 8 after step 7 is performed. If step 8 is not performed within the two second interval, the synchronization procedure is aborted and must be restarted from step 5 to establish the communication link.

6. Continue to simultaneously hold both buttons until the TX and RX LEDs illuminate steadily.

NOTICE

If the two buttons are held down simultaneously too long, the lower amber LED will stop flashing and remain lit. If this happens, you have held the two buttons for too long, and the procedure must be restarted.

7. Release the INSTALL and REMOVE command buttons. You have 2 sec. to perform step 8.

"ER" and the battery LED will light and begin blinking.
8. Within the 2 sec. window press and hold the upper left button (INSTALL) on the handheld transceiver.

All of the LEDs should light up, and TX should blink steadily.

9. While continuing to hold the upper left button on the handheld transceiver, apply power to the base unit by turning the Main Power Switch to the REM position.
10. At this point the handheld transceiver and base unit will begin to establish a communication link while the upper left button is being held.

All LEDs should light briefly then go out.

You may now release the upper left button, at which time the upper LED will begin to flash green, indicating that the link is complete and the unit is now transmitting data.

If everything was done properly, the RSO should be ready to operate using the handheld digital Radio Remote.

ANALOG RADIO REMOTE

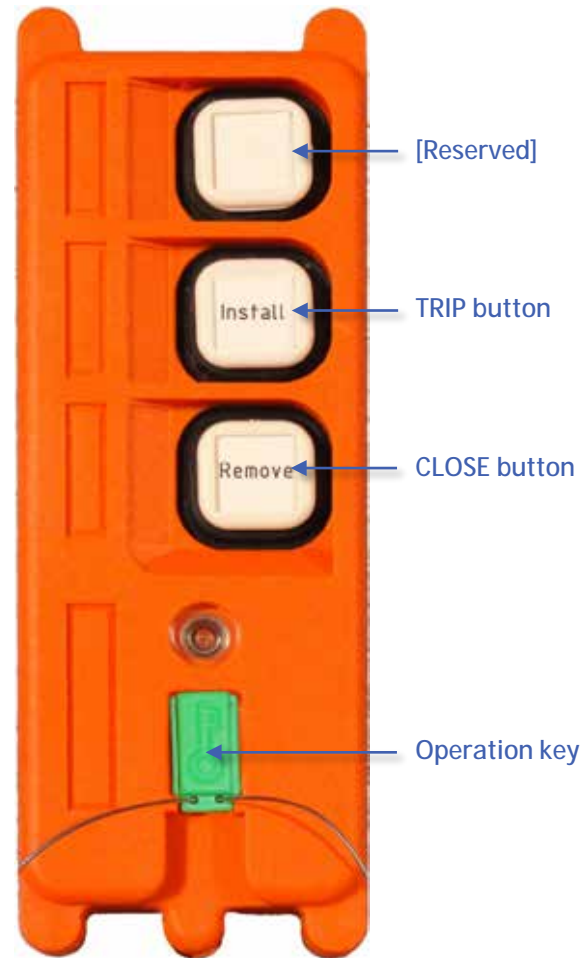
This section describes the setup and operation of the RSO using the analog radio remote. The analog radio remote was discontinued in December 2012, but it continues to support the product.

Radio Remote Components

The radio remote option for the RSO consists of two main parts: the transmitter and the receiver. The transmitter is the handheld radio remote that the user will interact with when operating the device remotely. The receiver is mounted inside the RSO and receives the signal from the transmitter. The following paragraphs and figures illustrate the key features of each.

- **Radio Remote Transmitter** – The radio remote transmitter has a 3-button layout that is designed to wirelessly control the operational features of the RSO. The transmitter is not capable of making changes to the settings within the RSO. That must be performed locally.
- **Radio Remote Receiver** – The radio remote receiver receives the radio remote signals generated by the transmitter that are required to control the RSO. The radio remote receiver is housed inside the RSO, beneath the CCM.

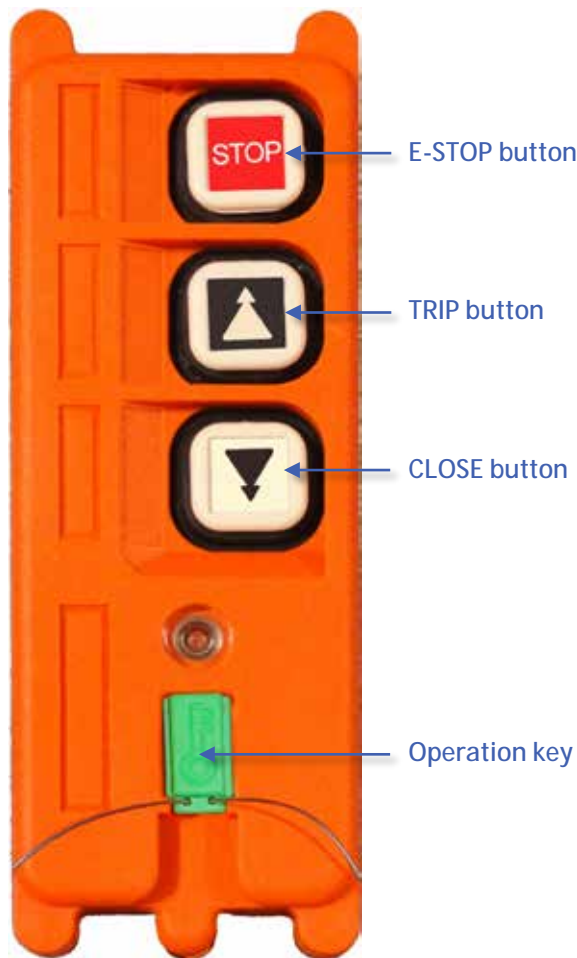
Figure 11-2: Analog Radio Remote Transmitter, Manufactured before June 2012



CAUTION

The provided radio remote transmitter is manufactured specifically for the system that it came with. Since the radio remote will NOT work with any other products, ensure that the radio remote transmitter is kept with the proper system.

Figure 11-3: Analog Radio Remote Transmitter,
Manufactured since June 2012



Setup and Operation

Operating the RSO using the radio remote pendant station is very similar to standard local operation. The following steps detail the setup and operation of the RSO using the radio remote.

1. Place the RSO near the area where the remote operation will occur. Unlatch and open the lid to expose the controls.
2. Ensure that the RRS torque limiter is properly set to the correct amount of torque. A placard on the inside of the RSO will inform the user of this value.
3. Install the applicable RRS onto the equipment that will be racked remotely. See the RRS manual for information regarding specific RRS setup and installation.
4. Install the spiral cables first onto the RSO and then onto the RRS.
5. Power on the RSO by performing the following applicable procedure. A design change within the RSO

radio remote control system beginning June 2012 led to the following change in procedure:

- a. First, ensure that the green operation key is inserted into the radio remote. The radio remote will not function unless the key is inserted into the slot. Next, turn the main power switch clockwise. If a light within the switch illuminates when the switch is in the "REM" position, then the unit was manufactured prior to June, 2012 and you may continue to the next step.
- b. If the light within the main power switch did not illuminate when the switch was turned to the "REM" position then the unit was manufactured after June 2012. In this case, the user may press either the "INSTALL" or the "REMOVE" pushbutton on the radio remote to activate the RSO. Once either button is pressed, the light within the switch should illuminate and the screen on the CCM should illuminate as well. This will signify that the link has been made the RSO will power on. Once the unit powers up, continue to step 6.

NOTICE

If the radio remote was used to power down the RSO using the "E-Stop" button, there will be an approximately 5 sec. delay before the unit may be powered back up once the command has been given. (This prevents the unit from immediately turning back on during a potentially dangerous situation). This is also true even if the main power switch has been turned off on the RSO after the E-Stop command has been given using the radio remote. Wait approximately 5 sec. before pressing either "CLOSE" or "TRIP" to activate the RSO after an E-Stop command.

6. Check the battery indicator to ensure that a full charge is present. If the batteries are not fully charged, please allow the unit to remain plugged into 120 Vac power until the battery indicator shows a full charge.

NOTICE

Connecting the RSO to 120 Vac power using the supplied charging cord will not immediately remedy a low battery issue. The built-in charger is not meant to be used as a power supply in the event of a low battery, meaning that the unit will not run solely on 120 Vac power when plugged in. Disconnect 120 Vac power from the RSO to achieve an accurate reading on the battery indicator.

7. Set the Install and Remove current on the CCM to the prescribed setting listed on a placard located inside the lid of the RSO. The "INSTALL" setting controls maximum allowable current draw on the install operation; while the "REMOVE" setting controls the maximum allowable current draw on the remove operation.

CAUTION

Both the Install and Remove settings are critical for proper RSO/RRS operation. Each of these settings is described in greater detail in the applicable the RRS technical manual, as well as in the following sections of this manual.

8. Check that all settings are correct. Once all settings have been set and verified as correct per the placard inside the lid, remote racking may begin.

NOTICE

The remote is equipped with a button labeled “E-STOP”. When pressed, this button will power off the RSO unit completely and immediately stop any operations in progress. Removing the green operation key will produce the same result as pressing the “E-STOP” button. To power on the unit after an E-STOP command, ensure the green operation key is inserted and press any of the three buttons to activate the RSO unit. The RSO is now ready to operate.

9. Check to ensure that all components are properly installed and connected.

Once everything has been verified as being correct, exit the arc flash boundary with the radio remote. Remote operation may now begin. At this point, refer to the RRS manual for operating instructions regarding specific RRS operation.

Once remote operation has been completed per the instructions given in the applicable RRS manual, you may disconnect the RSO from the RRS. See applicable RRS manual for instructions on RSA removal.

Power down the RSO by turning the main power switch to the “OFF” position. Ensure that the remote is powered “OFF” by turning the removing the operation key. Place all cords and radio remote (If applicable) into the RSO and store for future use as directed.

Table 11-2: Analog Radio Remote Technical Specifications

Max Operating Distance	150 ft
Frequency	310 MHz to 320 MHz
Operating Temperature	-31 °F to 167 °F
Transmitter Power	2 AA batteries
Security Codings	128-bit framing protocol with 32-bit serial number embedded; error detection and correction encoded
Transmitter Size	5.2 in. x 1.75 in. x 0.9 in.
Transmitter Button Life	Tested to 2,000,000 operations

SECTION 12. SPECIFICATIONS

This section will detail the physical, mechanical, and electrical specifications of the RSO. This manual will cover only the basic specifications of the RSO that are critical for safe and informed use. For more detailed specifications of the RSO, please contact GE.

SIZE

Figure 12-1 shows the physical exterior dimensions of the RSO. Dimensions are in inches unless otherwise noted.

Figure 12-1: RSO Diagram, Front

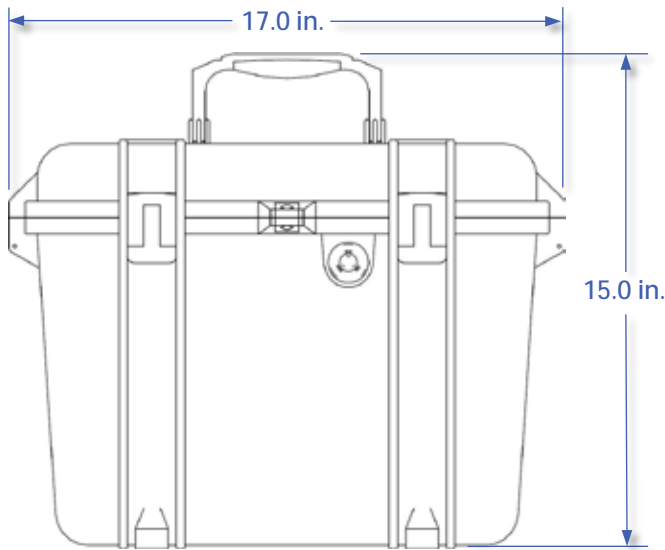


Figure 12-2: RSO Diagram, Top



TECHNICAL & OPERATIONAL SPECIFICATIONS

The following tables contain the relevant specifications relating to the technical and operational aspects of the RSO.

Table 12-1: RSO Technical Specifications

Weight (Without Radio Remote)	23 lb.
Battery Life	8 amp-hours
Output Voltage	24 Vdc
Input Voltage	100 Vac to 240 Vac/ 50 Hz to 60 Hz
Full Load Amps	2 A
Enclosure Rating	Type 1
Enclosure Material	Polypropylene copolymer

SECTION 13. BASIC TROUBLESHOOTING GUIDE

The following two sections will help customers' experiencing problems during setup or operation of the RSO. The following sections outline the most common symptoms experienced by users, the problems causing these symptoms, and the solutions.

If a problem is encountered, please refer to this basic troubleshooting guide prior to contacting GE. If the specific problem is not listed or a solution does not apply, please contact us.

Table 13-1: RSO Basic Troubleshooting Guide


Symptom	Problem	Solution
The system power will not energize when the main power switch is "ON."	The overcurrent protection relay has tripped.	Reset the over-current protection relay within the cord storage area.
	The battery leads have come disconnected.	Remove the faceplate and reconnect the battery leads.
	The batteries are completely discharged.	Charge the batteries until the battery charge indicator displays a full charge.
The system batteries will not charge/will not hold a charge.	Faulty batteries or charger.	Replace faulty equipment. Contact your Technical Sales/ Support Agent to obtain replacement parts.
	The batteries have aged from non-use.	Replace the batteries. In order to obtain the longest life out of batteries they must be maintained regularly. Contact your Technical Sales/ Support Agent learn about battery life extension practices.
	The RSO has been exposed to extreme temperatures for a prolonged time.	Replace the batteries. Extreme temperatures severely impact battery life in a negative way. Contact your Technical Sales/ Support Agent learn about battery life extension practices.
	The batteries are being stored without a charge.	Replace the batteries. Batteries must be charged before the unit is stored. recommends leaving the unit plugged in when not in use. Contact your Technical Sales/ Support Agent learn about battery life extension practices.
The system power will not turn on while the RSO is plugged into outlet power.	The batteries are completely discharged.	Wall outlet in and of itself is not enough to power the RSO. Please plug the RSO into outlet power and allow enough time to fully charge before using it.

Table 13-2: RSO Digital Radio Remote Troubleshooting Guide

Symptom	Problem	Solution
The system power will not energize when using the remote.	The batteries in the transmitter are dead.	Replace the 3 AAA batteries inside of the remote.
	The radio remote is not communicating with the receiver.	Ensure that the RSO is powered to the REM position.
		Ensure red LED on remote is not blinking.
		Ensure that the radio remote being used is the radio remote provided for the particular unit.

Table 13-3: RSO Analog Radio Remote Troubleshooting Guide

Symptom	Problem	Solution
The system power will not energize when using the remote.	The batteries in the transmitter are dead.	Replace the 3 AAA batteries inside of the remote.
	The radio remote is not communicating with the receiver.	Ensure that the remote has been turned on. This can be done by inserting the operating key.
		Ensure that the radio remote being used is the radio remote provided for the particular unit. The radio remotes are not interchangeable between systems and are unique for every system.
The remote pendant station is "dead," but the system power is on.	The radio remote is not communicating with the receiver.	Ensure that the remote has been turned on. This can be done by inserting the operating key.
	The radio remote is designed for another unit.	Ensure that the radio remote being used is the radio remote provided for the particular unit. The radio remotes are not interchangeable between systems and are unique for every system.
	The radio remote's batteries are dead.	Replace the 2 AA batteries inside of the remote.

 DANGER
<p>ENSURE THAT PERSONNEL USING THIS EQUIPMENT ARE ADEQUATELY TRAINED IN THE OPERATION OF THE SWITCHGEAR THEY ARE PLANNING TO WORK WITH; THAT THEY ARE CORRECTLY STATIONED OUTSIDE THE ARC FLASH BOUNDARY; AND THAT THEY COMPLY WITH ALL APPLICABLE FEDERAL, STATE, LOCAL, AND IN-HOUSE SAFETY REGULATIONS AND PROCEDURES. ATTENTION SHOULD BE GIVEN TO DISTANCE, ANGLE, AND PERSONAL PROTECTIVE EQUIPMENT (PPE).</p>



Imagination at work

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