

Thank you for purchasing a SEECO Phase-Over-Phase GOABS® switch. We are pleased to be able to provide this product to you and we believe that it will meet your performance expectations. SEECO products are designed and manufactured with the philosophy of quality, functionality, and reliability, as well as installation simplicity in mind. We appreciate all comments with regard to our product and welcome any suggested modifications to the design or installation procedures, which would better suit your future application needs.

The following pages provide a generalized, step-by-step, descriptive procedure for field installation and adjustment of a SEECO-style Phase-Over-Phase switch. This procedure covers many of the common configurations and mounting applications, however it cannot cover all details or every variation in equipment.

AS YOU LOOK OVER THE INSTRUCTIONS, PLEASE REFER TO THE ACCOMPANYING DRAWINGS, WHICH PROVIDE THE COMPLETE BILL OF MATERIALS WITH QUANTITIES, LOCATION, AND ADJUSTMENT PARAMETERS FOR THE SPECIFIC OPERATOR BEING INSTALLED. THESE INSTRUCTIONS ARE TO BE READ IN CONJUNCTION WITH THE DRAWINGS PROVIDED AND ARE NOT A REPLACEMENT OR SUBSTITUTE FOR THE DRAWINGS. SEE FIGURE 1 FOR QR CODES FOR OUR YOUTUBE INSTALLATION/ADJUSTMENT VIDEOS.

If at any point during the installation process you have any questions or need any additional information or assistance, call us at 704-392-1396.



Figure 1: QR code to YouTube Installation Videos.

A word about safety. These instructions are general guidelines and should not supersede your organization's own work or safety procedures. These guidelines must always be interpreted in light of the specific workplace or site conditions, personal experience, and equipment capabilities.



I. Suggested Tools and Equipment

- 1. Adjustable Wrench (up to $1 \frac{1}{2}$)
- 2. 7/16" Open-End Wrench
- 3. 1/2" Open-End Wrench
- 4. 9/16" Open-End Wrench
- 5. 3/4" Open-End Wrench
- 6. 15/16" Open-End Wrench
- 7. 1/2" Drive Ratchet
- 8. 1/2" Extension, 6" Long
- 9. 1/2" Socket
- 10. 9/16" Socket
- 11. 3/4" Socket

II. Receiving and Storage

A. Receiving

- 12. 15/16" Socket
- 13. Round / Flat File
- 14. Lineman Pliers
- 15. Channel lock Pliers
- 16. Tape Measure
- 17. Hammer
- 18. Crowbar
- 19. Metal Cutting Saw
- 20. Level
- 21. Battery Powered Impact

Each Phase-Over-Phase switch typically consists of the following major components: frames, phases (whether pre-assembled from factory or shipped in crates), a crate of control mechanism components and one or more bundles of pipe. Depending on the requirements/application there may also be a pallet of insulators, vacuum interrupters, galvanized steel beams or mounting assemblies. When the switch is received, all materials should be checked against the accompanying bill of lading. Confirm that the number of shipping units received matches the exact number of shipping units on the bill of lading.

All shipping units must be visually inspected for physical damage. If physical damage is apparent, please check the contents of each shipping unit against the packing slip to determine if there are any broken or missing components. A detailed packing slip accompanies each shipping unit and is attached to the exterior of the control component crate.

In the event that you receive less than the bill of lading indicates or that the visual inspection reveals physical damage, you should file a claim as soon as possible with the transportation company and notify your SEECO representative. The responsibility to determine if the shipment is complete and without damage rests with the customer. Failure to identify any shortages or transit damage at the time the material is delivered may



compromise your claim with the transportation company and result in the material being replaced at an additional cost to your organization.

B. Storage

Material may be stored outdoors. All parts should be left in their original shipping containers until ready for use and installation. Moisture absorbing cartons or containers should be covered or in some means protected. Please exercise care in handling and storage of the switch. Damage due to rough handling <u>IS NOT</u> covered under warranty and will be corrected at additional cost.

C. Uncrating materials at the job site

- 1. Do not remove the Vacuum Bottle Interrupter from its crate until it is ready to be installed onto the single-phase assembly.
- 2. All hardware is pre-sorted by application. At this time, do not remove the hardware from their bags.
- 3. If your switch is sent factory pre-assembled skip section III. If the switch was not sent pre-assembled, then uncrate the switch components and inside the control crate there is a black bag with all of the drawings for your switch enclosed. Use the single-phase drawing to assemble each phase.

III. Frames and frame assembly

In addition to these installation instructions, please reference the drawings supplied in the black weatherproof bag that was shipped along with the equipment. These instructions are intended to be read with the drawings and are <u>not</u> a substitute for the drawings.

A. Frame assembly of switches rated 69kV & below.

1. Most switches rated 69kV & below are provided with frame assemblies that require no field assembly. For these switch frames, the rotating insulator bearings and the sub-bases have already been installed. The rotating insulator stops have also been factory installed, but customer field personnel may adjust their position later as required.



2. For those switch frames that require some field assembly, retrieve the frame assembly drawing for the hardware list and assembly guidance. Where available, utilize a level surface for frame and single-phase assembly.

B. Frame assembly of switches rated 115kV – 230kV.

- 1. Most one-way, 115kV frames are completely assembled; all other one-way, two-way, and three-way aluminum frames are factory welded, but broken down into major sub-assemblies for more economical shipment.
- 2. Retrieve the frame assembly drawing for the hardware list and assembly guidance. Use the frame assembly hardware and make certain the correct hardware size and lengths are used in the proper locations per the drawing.
- 3. Different practices have been adopted by customers for the assembly of the frames. The most common method is described in this document. Your choice of method should be influenced by the equipment and site conditions available to you, and your established safety procedures.
 - i. Assemble only the two halves of the top section of two-way and threeway frames together with their channel spacers. The assembled top section serves as a platform to assemble the single-phase units. Figure 2 shows a 3-way top section and phase fully assembled.



Figure 2 : Top Section and Phase assembled and ready for hoisted.

Southern Electrical Equipment Co. Inc. 4045 Hargrove Ave. Charlotte, NC 28208

phone (704)-392-1396 fax (704)-392-7033

Web: http://www.seecoswitch.com E-mail: engineering@seecoswitch.com



- ii. Depending on the frame supplied, bolting the center support section and the side braces to the assembled frame halves may require loosening the hardware, which connects the channel spacers to the frame halves. If required, loosen the bolted connections only enough to allow the center support section to fit into position. The fit will be tight, and you will need to loosen one bolted channel spacer at a time until the entire center support section has been attached. Tighten all hardware.
- iii. After frame assembly is complete, lift the entire assembly directly to the pole structure. See Figure 3.



Figure 3: Frame and Phase fully assemblied and ready to be installed.

iv. Reference the control drawing to identify the upper and lower frame spacers (galvanized I-Beams) and the frame assembly print to identify the hardware. Assemble the spacers to the frame using the specified hardware.



IV. Assembly and adjustment of Single-phases

In addition to these installation instructions please refer to the accompanying single-phase drawing(s), which provide the complete bill of materials with quantities, location and adjustment parameters for the switch being assembled. These instructions are intended to be read in conjunction with the single-phase drawings and are <u>not</u> a replacement or substitute for the drawings. During assembly of the phases, be sure that the frame assembly is fully supported and leveled for proper adjustments.

A. Insulators

1. Make certain that the rotating insulator levers are correctly positioned according to the drawings and then use the phase assembly hardware to bolt the insulators to the base bearings and sub base. Figure 4 shows the installation of the insulators.







2. Mount insulators perpendicular to the frame. Switches rated 69kV and below can be shimmed though they typically do not require it. For switches rated 115kV and above utilize the leveling bolts, which are located on the base bearing and sub bases.

B. Mounting live parts on insulators

- 1. Using the phase assembly hardware, attach the clip cap to the stationary insulator. Reference the single-phase drawing for proper orientation of the clip cap and hardware quantities and location.
- 2. Attach the clip (jaw) and fully retract it back toward the center of the stationary insulator using the slotted hardware feature. Now tighten the hardware.
- 3. Slightly rotate the bearing and insulator toward the open position. This rotation allows the hinge/blade to be installed without the blade end interfering with the jaw. Mounting hardware supplied in the phase assembly hardware; Figure 5.



Figure 5: Installation of live parts.

Southern Electrical Equipment Co. Inc. 4045 Hargrove Ave. Charlotte, NC 28208 phone (704)-392-1396 fax (704)-392-7033 Web: http://www.seecoswitch.com E-mail: engineering@seecoswitch.com



4. For two-way and three-way switches, be sure to confirm that the blade/hinge assembly has the correct blade end orientation before installation on each insulator. Each blade end has a long side and a beveled side. The long side leads when closing into each jaw assembly and the beveled side leads when the switch is opening. See Figure 6 for blade orientation.



Figure 6: Blade and jaw orientaion.

C. Single-phase adjustment of live parts

- 1. Vertical adjustment of blade end for proper contact engagement:
 - i. Pull each blade toward the closed position so that the blade end is just short of touching the contact fingers of the open jaw assembly.
 - ii. For proper contact engagement the blade end must be centered between the two back contact fingers. This determination can be made with simple visual inspection, a precise measurement is not required.
 - iii. If adjustment is required, raise or lower the blade end by manipulating the two hex head bolts on the rocker bottom of the hinge assembly that are in line with the blade. To raise the blade end, loosen the front bolt and tighten the rear bolt. To lower the blade end, loosen the rear bolt and tighten the front bolt.
 - When the blade end is centered on the two rear contact fingers, tighten iv. hardware so that all lock washers are fully compressed and flat. Reconfirm the vertical alignment.



Repeat for all blades. See Figure 7 shows the assembled live parts. v.



Figure 7: Alignment of blade and jaw.

- 2. Horizontal adjustment of jaw assembly for proper contact engagement:
 - i. Push the blade into the fully closed position where the blade and jaw assembly are completely straight and in-line with each other. Do not push the blade beyond this position; maximum contact pressure and operating performance is achieved when the blade and jaw are in straight alignment. The jaw assembly can be damaged if you push the blade substantially beyond this point. See step 3 for stop adjustment if blade is unable to, or goes beyond the fully closed, in-line position.
 - ii. Visually inspect the insertion depth of the blade into the jaw. Optimal contact engagement is achieved when the circular silver contact buttons extend past the visible seam of the blade by 1/4" - 3/8".



iii. To adjust the depth, loosen the hardware that attaches the jaw to the clip cap and slide the jaw in or out to reach the desired blade depth. As you slide the jaw be sure to keep the movement parallel to the original position, not allowing one side of the jaw to lead the other. Tighten hardware and operate to confirm position is secure. See Figure 8.



Figure 8: Blade depth adjustment.

- 3. Closed stop adjustment:
 - i. The stops located at the base of the rotating insulators are intended to allow the blade to travel approximately 90°. The open and closed position can be adjusted here. Stops vary in size and shape based on the kV rating. Refer to the single-phase drawing for positioning.
 - ii. To determine if stop adjustment is required, pull the blade into the closed position with the blade and jaw completely straight and in-line. Visually inspect the rotating insulator lever arm and closed stop to confirm that the lever is in contact with the stop; if not, loosen the stop hardware and gently tap the stop toward the lever until they are in contact. Reconfirm that the blade and jaw are still straight and in-line and then tighten the stop hardware. For two-piece stops repeat this process on the open stop to ensure blades rotate approximately 90° to the open position. See Figure 9.





4. Interrupting device may vary depending on application, see control drawing for specific interrupting device and part number. Refer to the corresponding drawings and instructions for installation and adjustment procedures.

D. Pipe guide (Control Bracket) installation

- 1. Refer to the control drawing for guidance on installation of these components, including quantity, location, and orientation.
- 2. For most phase-over-phase switches rated 69 kV and below, and one-way switches rated 115 kV and up, the outboard bearing and the guide plates will be mounted directly to the frame assemblies. Mounting hardware is included with each assembly. If provided, do not tighten the set screws at this time.
- 3. For two-way and three-way switches rated 115 kV and up, depending on the type and size of pole structure, the outboard bearing and guide plates will be mounted to the upper frame spacers, or, directly to the pole structure. The control drawing will indicate the required location for these components.
- 4. Outboard bearings are mounted on the top phase and guide bearings mounted on the middle and bottom phases. Figure 10 show an example of each.



Outboard bearing



Guide bearing





V. Mounting the Switch to the structure

A. Frame mounting hardware

SEECO provides all mounting hardware necessary to mount the frame assemblies to the structure (except for through bolt applications). The hardware may vary with the type of pole structure (wood, concrete, steel, light duty steel, laminated wood). All mounting hardware provided is required for proper operation and performance of the switch. If hardware provided is not fully utilized (apparent excess or un-used components), please consult the installation drawings to verify the locations and quantities indicated. Failure to utilize the mounting hardware as specified in the drawings can result in diminished performance, field failure and/or invalidation of the product warranty. Consult the factory for assistance if you have questions confirming use of mounting hardware.

Through bolts and lag screws, when required, are supplied by the customer or the customer's contractor. Rectangular and/or curved washers are provided for wood, concrete and light duty steel pole structures and are used in conjunction with through bolts. Rectangular washers must be between the bolt head of the through bolt and the slotted hole of the aluminum frame channel to prevent the bolt head from being pulled through the slotted hole. Do not place the rectangular washer between the pole side of the channel and the welded curved plate.

B. Lifting the equipment to the structure

The procedures provided here for lifting the single-phase switch units are suggested guidelines only and should not replace or supersede the customer's own work and safety procedures. These guidelines must always be interpreted in light of specific site conditions, personnel experience and equipment capability.

- 1. Slings, cables, ropes, hoists, and chain falls must all be properly rated for the weight of the lifting load. If you are unsure of the weight of the single-phase switch units, contact SEECO for confirmation.
- 2. For switches 115kV to 230kV, use nylon slings to lift the frame into place.
- 3. For switches 69kV and below, either a sling or the factory drilled frame holes may be used to attach rope, cable, or any other suitable lifting device.



- 4. Place lifting hooks over the switch units' center of gravity. <u>Do not lift un-balanced loads</u>.
- 5. Maintain at least three points of contact when lifing the single-phase units. Do not lift from the insulators. See Figures 11 and 12.



Figure 11: 1-Way

Figure 12: 3-Way

- 6. Adjust the three phases into direct vertical alignment on the structure and tighten the mounting hardware.
- 7. If a multi-bottle Monoruptr® (interrupter) is provided with the switch, the interrupter should be lifted separately. Do not attempt to mount the multi-bottle interrupter to the single-phase switch unit on the ground.
 - i. To lift the interrupter unit; carefully wrap the sling around the top fiberglass tube immediately below the flat plate of the interrupter "head."
 - ii. Pull the sling up under the flat plate of the head as much as possible before tightening the sling around the fiberglass housing. Do not attempt to lift the interrupter by the horizontal u-tube arms; the arms are not a lifting point. Note: Always maintain the interrupter in an upright and vertical position. Do not lay interrupter horizontal or at an angle. Failure to keep the interrupter upright may damage the device and void the warranty.



iii. Attach a hand line to the switch or interrupter to provide stability while lifting. See figure 13 to see how to properly hoist a Monoruptr®.



Figure 13: Lifting Monoruptr®

C. Hanging the control pipe and associated parts

- 1. Using the control drawing as a guide, install the top portion of the control pipe through the crank and outboard bearing assembly of the top phase. Position the top of the pipe approximately 12" above the top of the outboard bearing plate unless noted otherwise. Pierce the control pipe with the two set screws of the outboard bearing assembly.
- 2. If the pole has not been drilled for the pipe guides and operators, do so now, using the pipe guides and operator as templates. Elevations are noted on the control drawing.
- 3. Continue to install the pipe and couplings down the structure using the materials specified in the control drawing. Using the correct length of control pipe where specified on the control drawing will ensure that the couplers and universal joints (if provided) are properly located relative to the pipe guides and frames.



4. Do not forget to feed the pipe through the crank assemblies, which should be located at frame level (above the guide or bearing plate) of each phase of the switch before adding the next coupling and pipe section. See figure 14. Pierce the set screws of pipe couplings, universal joints and outboard bearing assemblies as they are added. See figures 15 and 16. Do not pierce the set screws of crank or clevis assemblies at this time. Be sure to properly phase universal joints as shown in Figure 17.



Figure 14: Pipe & Crank

Figure 15: Rigid Coupler

Figure 16: Universal joint



Figure 17: Phasing of universal joints.

- 5. Attach all components per the control drawing including the operator, ground strap, name tag, etc.
- 6. See control drawing for operator type and mounting location. Cut the control pipe accordingly and paint the freshly cut pipe with cold galvanizing spray to prevent corrosion. For swing handle assemblies, install at a comfortable operating height relative to the lock segment and tighten the bolt and set screw only enough to keep the handle from slipping. **Do not pierce the set screws at this time**.
- 7. Repeat steps 1 through 7 for each way on two-way and three-way switches.



D. Outboard bearing and guide plate adjustment

- 1. Starting at the top phase of the switch, adjust the position of the bearing and guide plates to allow the vertical control pipe to hang as straight as possible to the base of the pole and the pipe to rotate freely without kinking or binding. Partial loosening of the slotted hardware on the bearing and guide plates will often allow the pipe to straighten out under its own weight.
- 2. It is helpful to view the pipe from two different positions (90 degrees apart) to determine the correct alignment. The pipe should follow the natural taper of the pole. It is not necessary for the pipe to orient in a true vertical orientation. Tighten the bearing and guide plate hardware once the vertical control pipe has been aligned.

E. Dead-ending the conductors

1. All conductors and jumpers must be added prior to toggle adjustment. Any adjustment performed prior to sagging the conductors may be lost as a result of the frame or structure shifting.

F. Cranks, Clevises and Interphase Pipe

An interphase pipe drives each rotating insulator. For each interphase pipe perform the following adjustment procedures:

1. Attach two clevis assemblies to each interphase pipe. One clevis is then connected the crank assembly located on the vertical control pipe. The second clevis is attached to the lever arm under the rotating insulator. Figure 18 shows the components mentioned.





2. Using a ruler or tape measure extend the reach rod pipe 1" through the crankend clevis (extend 2" if using 2" pipe) and tighten. Note: the pipe must not extend beyond the required dimension or it will prohibit proper toggle adjustment. Figure 19 shows an example of a single reach rod.



Figure 19: Phase linkage in closed position

vi. Toggle Adjustment

Toggle adjustment of the control mechanism provides a simple but highly reliable means to keep the switch closed under conditions such as excessive pole deflection, vibration, and galloping conductors, without the use of blade locks or other latching devices. Proper toggle of the switch minimizes operating effort, extends the operating life of the switch, and minimizes future maintenance requirements. It is one of the most important adjustments covered in this manual, however the procedure is straightforward if these steps are followed:

Start at the top phase and adjust each phase of a control column in sequence: top, middle, and bottom. Optionally, for two and three-way switches you may wish to adjust the toggle of other switch(es) on the top frame before descending to the middle and bottom frames. For each phase do the following:

- 1. If you have not done so previously, back off the set screws on the shaft fitting/clevis assembly at the rotating insulator end of the reach rod so that the pipe can slide freely in and out of the clevis. This will temporarily permit operation of the vertical control pipe, crank assembly and reach rod without movement of the rotating insulator and insulator bearing.
- 2. Loosen the carriage bolt and nut and back off the set screws on the crank assembly so that the crank and reach rod can rotate freely around the axis of the vertical control pipe.
- 3. Raise or lower the reach rod and crank assembly so that the pipe is relatively level between the rotating insulator and the vertical control pipe.



- 4. Push the reach rod toward the closed position until the inside of the clevis or the end of the pipe contacts the crank and rotation stops. Tighten the carriage bolt on the crank, while continuing to apply force on the reach rod. Do not let the crank assembly and reach rod "relax" or back off from the completely closed position while tightening the carriage bolt. This is the toggled position.
- 5. Before proceeding, confirm that the blade of the switch is completely closed into the jaw. If not, pull the blade into the jaw until the blade and jaw are completely straight. At this point the down thumb of the rotating insulator lever should be in direct contact with the closed stop so that no further rotation of the insulator is possible. If not adjust the stop position before proceeding. Section IV-C, step 3.
- 6. Push the rotating insulator fitting/clevis outward away from the pole structure. Scribe a line on the reach rod on the inside of the clevis. The line should be flush against the clevis.
- 7. Open the switch until there is 1/4" between the end of the clevis and the scribed line. Push the fitting outward while the crank is rotating. Tighten the set screws, but do not pierce. See figure 20 for toggle process.





- 8. Operate the switch a few times. The switch should "snap" over center into the closed position. This motion is the "toggle."
- 9. If the switch does not close completely with the reach rod in compression and the control does not toggle in, repeat steps 1 through 4 using 3/16" as opposed to 1/4".

Note: If you are adjusting the middle or lower phase it is often sufficient to open the switch with the swing handle to the point where the crank assembly of the above phase(s) comes out of toggle. In most instances the reach rod of your phase will be pulled to the necessary 1/4" dimension. If the actual dimension you measure is greater or less than 1/4", continue to open or close the switch slowly using the swing handle as needed until you achieve the required dimension.

When the 1/4" dimension has been achieved, look upward to the phases above you to confirm that the blade(s) on the switches above have not begun to open out of their jaws. If the above phases have begun to open, you must close the switch with the swing handle and repeat steps 6 and 7. A visual guide to making this determination is to observe if all fingers of the jaw are still in contact with the blade. A slight relaxation (movement) of the blade-jaw engagement is permissible but significant movement toward the opening direction is not acceptable.

10. Upon satisfactorily opening and closing the switch a few times, all set screws can now be pierced.

Note: If the switch configuration is a one-way delta with one phase opposite, please refer to the supplemental instructions for toggle adjustment of the offset phase.