Serving the Electrical Utility Industry Since 1920

Motor Operator Overview

SEECO motor operators are designed specifically for the control and remote operation of group operated switches in distribution, substation and transmission switching applications. Available in a wide range of motor control voltages, output torques (thrusts) and operating speeds, SEECO motor operator devices will operate any make or brand of group operated switch without limitation. SEECO operators can be provided for either torsional or reciprocating styles of switch operation. A two speed unit is also available for switches with blade latching mechanisms requiring normal open and fast slam close.

Substation

Our newest generation of operators (type MNM) is the most advanced and cost effective operator available, providing more user features and functionality with an automation-ready and maintenance-free design. MNM operators offer exceptional value by providing features in our standard units that other manufacturers typically offer as options at additional cost.

Standard features on all MNM operators include a galvanized steel mounting bracket, an operator control panel with local/remote switch, open/close push buttons and local indicating lights, 8 form “c” auxiliary contacts for customer use, DC knife switch, heater with thermostat control, recirculating fan and temperature data logger, 15 amp GFI receptacle, terminal blocks, door operated interior convenience light, torque relief knob, swing handle for manual operation, external coupling mechanism, removable door with lift-off hinges, door hold back, screened louvre with dust filter, heavy duty stainless steel three point latch, drawing pocket and an aluminum enclosure.

Transmission

Power for the operators is provided by either 48 or 125 VDC station service or a 24 VDC integral power supply (batteries and charger) contained within the main enclosure. For remote switching applications where station service or 120 VAC source voltage is not available, a highly reliable solar power supply package can be provided. Units with the 24 VDC power supply include an advanced battery management system with “smart” charger, battery testing function with user definable test cycles and two 12 volt, 33 amp hour batteries as standard features.

MNM operators also provide numerous local and remote indications of operating status and condition as standard features. Status indications include operator position (open or closed), door open, local/remote switch position, DC knife switch position and swing handle removed. For units with batteries and a charger, additional status indications include loss of AC alarm and low voltage DC alarm. Optional status indications include coupling status and motor current draw (switch maintenance indication). Most status indications can be easily checked locally through LED lights.

Distribution

For distribution and transmission switching applications MNM operators are automation-ready and provide an excellent platform for the integration of an RTU, communication device (radio, modem, cell phone, pager, etc.), current/voltage sensors and other automation-related equipment. SEECO operators are compatible with all RTU’s and communication devices irrespective of manufacturer or brand. Locating these devices within the MNM operator enclosure eliminates the need for additional customer-supplied enclosures on the pole structure; this reduces pole clutter, field installation time and cost.

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Construction Details

SEECO MNM operators are designed for maintenance-free operation in severe operating and environmental conditions. Operator components and systems are rugged, reliable and of the most contemporary design available for their intended function.

Figure 1

Modular Design

The overall design (figure 1) is highly modular and the interior cabinet lay-out is spacious and well organized. Access to all systems and components is available through the front door, eliminating the need for removable side panels. The modular design makes extensive use of separate sub-systems (assemblies) and molex-style connectors (figure 2); each sub-system is initially assembled and tested external to the operator. In final assembly each sub-system or component is secured to a sheet metal chasis or interior cabinet wall. Electrical sub-systems are then connected to the control circuitry through molex-style connectors making final assembly essentially “plug and play.” A rigorous final unit assembly test of all operator functions involves over 40 separate tests.

Powertrain

The powertrain is electro-mechanical (non-hydraulic) and utilizes a powerful 1 horse-power permanent magnet motor, heavy-duty worm gear mechanism and advanced motor control circuitry. The full rated torque and speed are available throughout the entire range of operation.

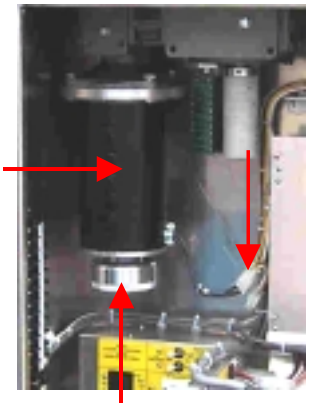

Figure 2

Motor

The motor (figure 2) is high torque, starting and running, at minimum ANSI and NEMA voltages with the full rated torque available at nominal voltage. All bearings are permanently lubricated and sealed and require no maintenance. The motor has a standard NEMA face mount, which allows the motor to be easily changed out without the use of heat or pullers to remove gears or coupling halves.

Motor rotation (direction) can be easily changed in the field by reversing the two wires exiting the motor using the supplied molex-style connectors. A torque relief knob is also provided, which allows the torque on the switch control pipe to be relieved for ease of coupling and de-coupling. The torque relief knob can also be used for fine adjustment of the auxiliary (limit) switches.

Worm Gear Mechanism

The gear mechanism (figure 3) is a heavy duty, industrial worm gear reducer with totally enclosed gearing. The entire gear is factory submersed in grease to eliminate corrosion and requires no further field maintenance by customer personnel. The use of a worm gear prohibits the gear mechanism from being back driven from the output shaft eliminating the need for continuous braking. The gear housing is provided with a separate gear reducer output shaft seal and cabinet output shaft seal that prevents contamination of the interior of the gearbox.

Figure 3

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Braking

To prevent overtravel of the motor beyond the open and close limit switch positions, dynamic braking is utilized to control motor rotation. When the output shaft of the worm gear mechanism reaches the open or closed limit switch position, a relay is de-energized and the motor is shorted; braking is simple, precise and immediate without hesitation or delay. Also, the inherently self-locking nature of the worm gear mechanism makes continuous braking unnecessary and eliminates the need for solenoid actuated brake components or other mechanical devices, which can fail or require periodic maintenance and adjustment.

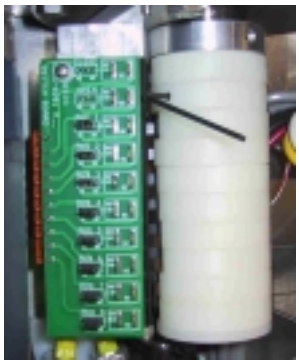

Figure 4

Auxiliary (Limit) Switches

The operator is provided with ten auxiliary switches (figure 4), which follow the output shaft of the worm gear mechanism; two are reserved as motor control limit switches and the remaining eight are for customer use. These eight limit switches are form “c” contact and can be easily changed from NO to NC by repositioning shunts. The use of shunts makes field change quick and simple, eliminating the need for traditional wires and ring terminals. The cams are independently adjustable using setscrews.

For customers who require indication of switch position independent of the position of the worm gear output shaft, SEECO has two different optional mechanisms available. One mechanism is the traditional cannister-style auxiliary switch (barrel switch), which is available in increments of two up to a maximum of fourteen switches. The second mechanism is a newer, more contemporary concept that utilizes limit switches in conjunction with the coupling mechanism to provide absolute indication of coupling status (coupled or de-coupled) as well as overhead switch position in a more compact package.

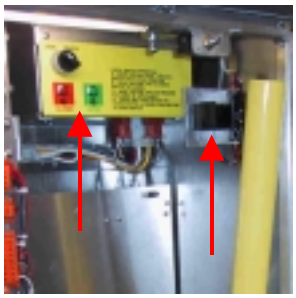

Figure 5

Operator Control Panel

The operator control panel (figure 5) is provided with open (green) and close (red) push buttons for local operation, motor open and motor closed indication lights and a local/remote switch with position status indication (dry contact). The control panel is colored yellow for easy identification by customer personnel .

Figure 6

Power Distribution Panel

The Power Distribution Panel (figure 6) includes a 15 amp GFI receptacle, motor over- current breaker, heater breaker, an AC present indication light, loss of AC status indication (dry contact), MOV surge protection and RF filters. A DC knife switch is provided as standard equipment in conjunction with the Power Distribution Panel. The panel is also colored yellow for ready identification. Optional features include an AC knife switch, a two pole AC breaker and a two pole DC breaker.

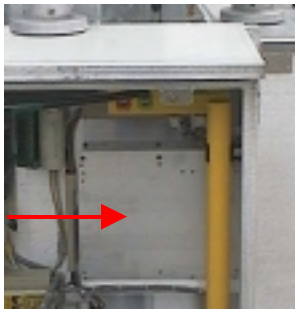

Figure 7

Temperature Control System

An advanced temperature control system (figure 7) is provided as standard equipment. The system includes a 120 VAC, 350 watt strip heater with recirculating fan, thermocouple, protective sheet metal enclosure, programmable control and data logger. Control of the fan and heater is based on two user definable setpoint values. When the lower setpoint value is exceeded the heating element is activated and the fan will distribute the heated air throughout the operator enclosure. When the upper setpoint value is exceeded the fan alone is activated and air is circulated through the

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enclosure to cool the cabinet interior. The setpoint values can be changed through Windows Hyper Terminal and the customer's laptop using the RS232 comm port provided. The data logger captures the interior cabinet high (max) and low (min) temperature, by day, for a rolling 30 day period. The daily max and min values can be displayed through the same Windows Hyper Terminal feature as the setpoint values.

Figure 8

Enclosure

The enclosure (figure 8) is completely maintenance-free and weatherproof. It includes a formed water channel (drip trough) around the door lip, entrance overhang and fully gasketed door to provide protection against windblown dust, rain and hose directed water. Other features include a removable door with lift-off hinges, a pneumatic door holdback, heavy-duty stainless steel three point latch with padlockable handle, a screened louvre with removable dust filter of washable nylon, a door activated convenience light, remote door open status indication (dry contact) and a 10" X 7" removable conduit plate located on the cabinet bottom. The standard enclosure is aluminum but a stainless steel enclosure can also be provided.

Figure 9

Mounting Brackets

Galvanized steel mounting brackets are designed and fabricated for each specific mounting structure (by order and location) or to a customer's standard structure. No modification to the structure is required, which reduces installation time and cost.

Swing Handle

An expandable telescoping swing handle (figure 9) is provided for manual operation of the overhead switch and is inserted into a socket above the coupling mechanism. The swing handle is stored within the enclosure utilizing a pivoting socket and latching mechanism. The latching mechanism (figure 5) incorporates an auxiliary contact (limit switch) that provides remote status indication of the presence, or absence, of the handle. As a safety feature for field personnel, removal of the handle from the latching mechanism disables the remote operation of the motor operator through the terminal blocks. Remote operation is restored when the handle is returned to the latching mechanism.

Figure 10

Coupling Mechanism

The coupling mechanism (figure 10) is located external to the enclosure, which allows manual operation of the overhead switch without entering the enclosure. The coupling mechanism is factory set and requires no field adjustment other than to pierce the set screws of the pipe coupler. The mechanism assembly consists of three components: an upper, center and lower coupling section. The lower coupling section is permanently tied to the worm gear output shaft and turns with the shaft. The upper coupling section is cross bolted to the operating pipe. The center coupling section slids freely up and down between the upper and lower sections to couple and de-couple the overhead switch to the motor operator.

The coupling mechanism is designed to be foolproof, as it can only be coupled in the one true correct position. This is accomplished by the machining of one dog ear different from the others in the mating coupling components. The mechanism is designed for a single padlock to be used in any sequence of actions. Locking stops are provided for padlocking the switch open or closed in the de-coupled position.

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Pipe Coupling

A heavy-duty, thick-wall pipe coupling (figure 11) is provided as standard equipment. The pipe coupling is physically located immediately above the handle socket and can be provided for any diameter of control pipe as required by the overhead group operated switch. An optional universal joint can be provided, at additional cost, where the off-set dimension or angle of the control pipe cannot be accommodated by a straight pipe coupler.

Figure 11

Terminal Blocks

Six hundred volt rated, high barrier terminal blocks with white marking strips are standard. All customer connections are made to one side of the terminal blocks. Optional sliding link terminal blocks can also provided at additional cost when specified.

AC Power Supply

For applications where 48 or 125 VDC is not available, an integral 24 VDC power supply can be provided (requires customer supplied 120 VAC). The 24 VDC power supply is housed within the main operator enclosure and consists of the following system components:

Gelled electrolyte batteries - Two 12 volt, 33 amp hour batteries.

Figure 12

"Smart" charger - heavy-duty battery charger (figure 12), 130 watt, with 120 VAC input and 24 VDC constant voltage output. Provides three stage charging: bulk charge, over charge, and float charge. Charger has short circuit protected outputs and is temperature compensated. Also includes LED charge status indicators.

Advanced battery management system (LAB Tester) - unit (figure 13) has built-in loss of AC voltage alarm, low voltage DC alarm, battery load test function, battery check test function and DC knife switch position indication. Load and check tests are based on user defined time intervals which can be modfied through Windows HyperTerminal. Unit provides automatic scheduled testing of batteries, with local LED and remote (dry contact) indications of battery status and condition. See SEECO LAB24 catalog section for a more detailed description of features and functionality.

Figure 13

Solar Power Supply

For remote applications where 120 VAC is not available, or practical, an economical and highly reliable solar power supply (figure 14) can be provided. The solar power supply includes the solar modules (panels), mounting brackets, inter-wire kit, charge controller, batteries and the advanced battery management system (LAB Tester). The solar power supply is sized for the specific geographical location and the current draw (load requirements) of the associated equipment, including RTU, radio, etc.

As the solar power supply is a DC only system it will not include AC-specific functions such as loss of AC alarm, the heater and recirculating fan, GFI receptacle and interior cabinet light.

Figure 14

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Automation and Control

The trend within the industry is increasingly clear: the motor operator is becoming the central hub or point of integration for the various devices used to automate distribution and transmission group operated switches. It is a means for both remote operation and a data collection point to acquire and communicate the condition and status of the operator, the switch and the overhead line (voltage, current, fault direction).

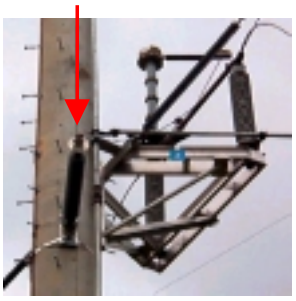

Figure 15

Use of line sensing devices (figure 15) in combination with motor operators provides electric utilities with powerful new capabilities that support more sophisticated automation strategies. Group operated switches can now be operated remotely or automatically upon a range of conditions including gain/loss of line potential, over current (fault) and fault direction. System operators can now base their switching decisions on real-time current and/or voltage information captured at the point where sectionalizing needs to occur. For more information on line sensing devices, please see our catalog section for SEECO SENSE current and voltage sensors.

Figure 16

MNM operators are intelligently designed to support the full range of automation strategies employed within the industry for sectionalizing and remote operation. They will readily accomodate and compliment automation devices such as RTU's, comm devices (radio, modem, fiber optic, etc.), line post sensors and relays. MNM operators are fully compatible with all major manufacturers of these devices.

For ease of installation and application efficiency, SEECO will factory install the RTU, comm device or other control devices within the operator enclosure, which eliminates the need for additional boxes or enclosures. A single enclosure reduces pole clutter and eliminates the time and cost of running wire and conduit between separate boxes. An optional 4" deep door with clear lexan cover (figure 16) can also be provided, at additional cost, when the size or shape of the devices requires more space than the standard door permits.

Figure 17

SEECO has also developed several optional add-on boards that can be used with MNM operators to provide enhanced automation capabilities and seamless integration of multiple devices. These boards (figure 17) act as interface devices between the MNM operator and line post sensors or traditional PT's and CT's. Voltage and current outputs provided by these line sensing devices are used as inputs to the add-on boards, which compare the actual voltage and current to stored threshold values or other parameters. If the threshold value is met or exceeded a contact closure is provided to the RTU (if available) and the MNM operator is then opened or closed automatically or remotely at the discretion of supervisory personnel through SCADA.

Figure 18

The boards can be configured for both simple sectionalizing applications as well as more complex schemes requiring timing and sequential coordination between multiple switches and breakers. All set point values can be viewed and configured through Windows Hyper-Terminal; factory assistance in configuring more complex schemes is available at additional cost. Add-on boards are available for applications requiring loss or gain of potential (MSM board), over current (OCB board) and fault direction (FBI board).

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