I. INTRODUCTION TO SEECO MNM MOTOR OPERATORS

Thank you for purchasing a SEECO motor operator. We are excited to be able to provide this product to you and we are certain that it will fulfill your performance expectations. The SEECO motor operator is designed and fabricated with the philosophy of quality, functionality and reliability, as well as installation (application) simplicity in mind. We appreciate all comments with regard to our product and welcome any suggested modifications to the design, which would better suit your future application needs. We are particularly interested in hearing any suggestions related to field installation which may help you perform a more timely and efficient installation.

Following are the installation and operation instructions for the SEECO motor operator. The purpose of these instructions is to outline a step-by-step, descriptive procedure for the field installation of SEECO motor operators.

If you need assistance please contact our factory:
Phone: (704)-893-0222 (7am – 5pm EST)
Phone: (704)-907-9674 (outside normal business hours)
Email: Engineering@seecoswitch.com
Website: www.seecoswitch.com (for additional product information)

II. MOTOR OPERATOR INSTALLATION INSTRUCTIONS

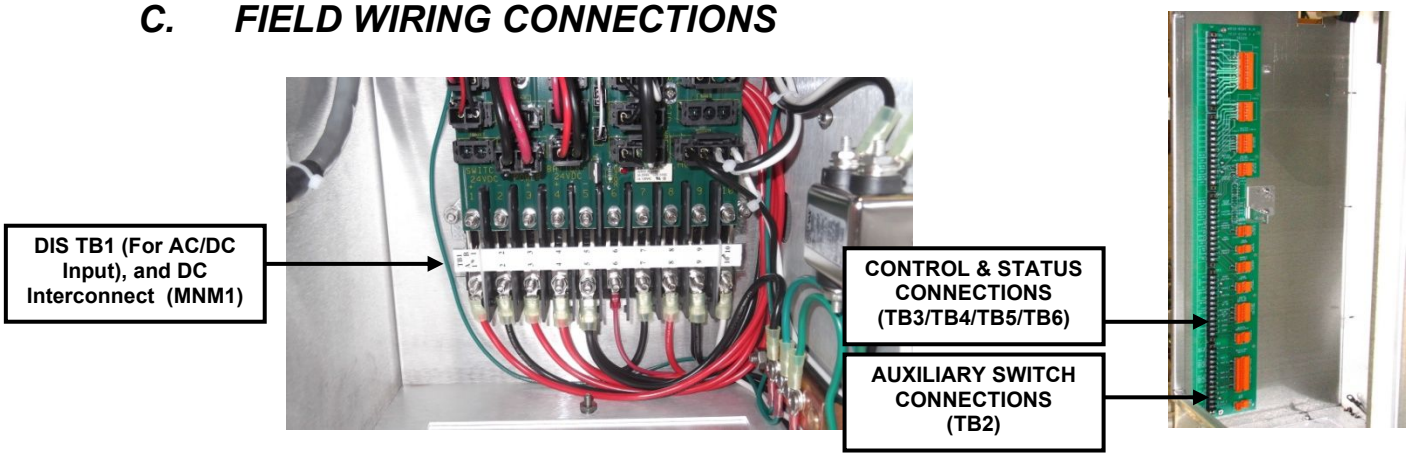
A. SWITCH ADJUSTMENT

1) The switch **must** be properly adjusted before beginning the installation of the motor operator. Please refer to the separate installation instructions provided with the switch assembly documentation.

B. MOTOR ATTACHMENT

1) Remove the existing switch lever handle, lock segment assembly and ground strap (If applicable)
2) Determine the motor mounting position as outlined on the mounting drawing provided, trying to use as many existing holes on the structure or pole as possible.
3) Determine the switch control pipe cutting point; pipe is to extend down into the coupling or universal joint far enough to allow the self-piercing setscrews to firmly grasp the pipe.
4) Cut switch control pipe to required length.
5) Attach the motor with the mounting bracket to the structure or pole, inserting the switch control pipe into the MNM coupling or universal joint.
6) **DO NOT** pierce the pipe coupling setscrews until final adjustments have been completed later in this procedure.

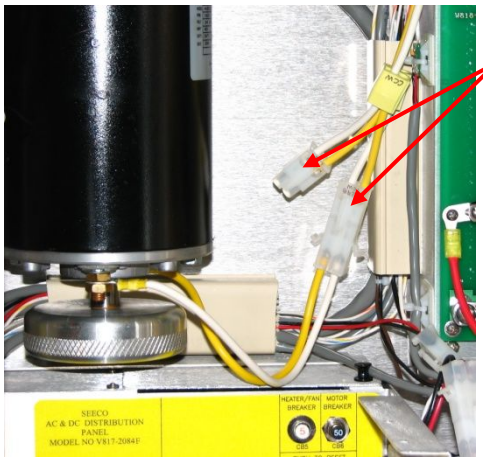
C. FIELD WIRING CONNECTIONS

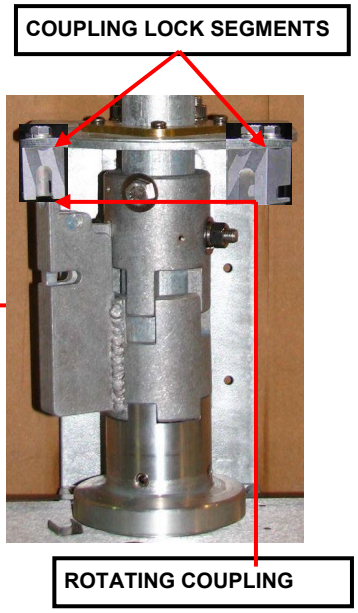


1) Connect field wiring, (AC voltage, and DC voltage). Refer to Termination Board (TMB) connection labels or appropriate wiring diagram for the connection points at the screw terminal blocks or plug connectors as required.

2) Connect main power connector, close knife switches and circuit breakers. Verify proper operation of battery charger (MNM2 models only. Refer to Section J on Page 13 of this manual for further information concerning the battery charger unit).

D. POSITIONING OF COUPLING COMPONENTS





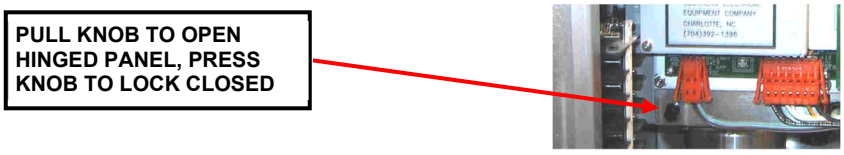
1) Press the OPEN (or CLOSE) pushbutton and make certain that the direction of motor rotation matches the direction of rotation required to open (or close) the switch.

2) If direction of rotation is not correct, perform the following steps:

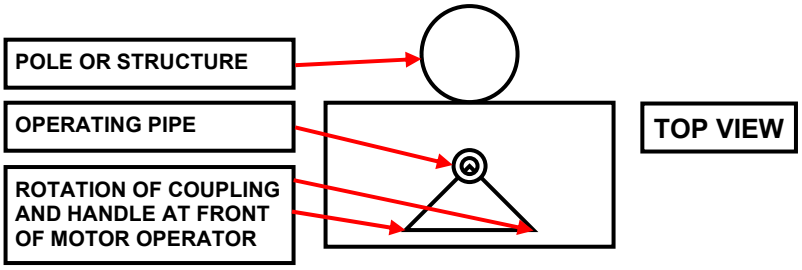
! ! ! CAUTION ! ! !	MAKE SURE COUPLING LOCK SEGMENTS ARE CLEAR OF ROTATING COUPLING TAB BEFORE OPERATING MOTOR (SEE PHOTO ABOVE)

a) Reposition connector exiting motor to adjacent unoccupied connector (see photo at left above). Connector is located behind the hinged swing panel on MNM2 models with LAB Tester assembly. Open panel by pulling on black plastic knob located at lower left corner of LAB Tester mounting plate (see photo below).

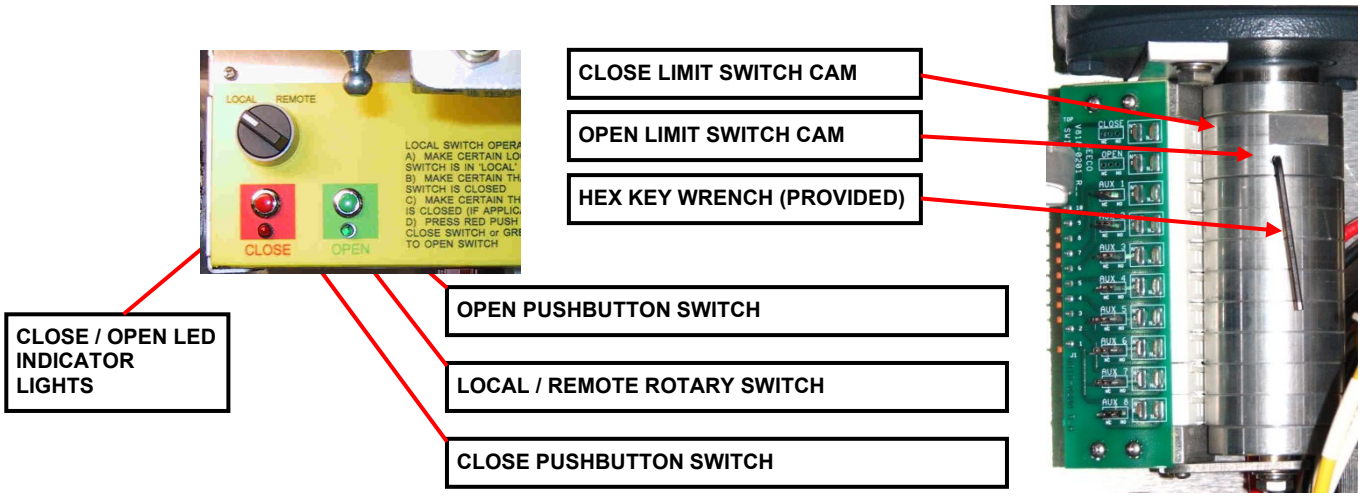
b) Proceed with the OPEN/CLOSE limit switch cam adjustments as described on the following two pages.



3) Place the overhead switch in the closed position. Press the CLOSE pushbutton. Adjust the close limit switch using the hex key wrench (provided) until the closed-to-open range of travel is centered at the front of the motor operator enclosure as shown in the diagram below. This allows easy access to the coupling and swing handle in both the open and closed positions.



4) Pierce the setscrews on the coupling or universal joint. Remove the coupling temporary nylon spacer blocks and padlock the movable portion of the coupling in the uncoupled position.



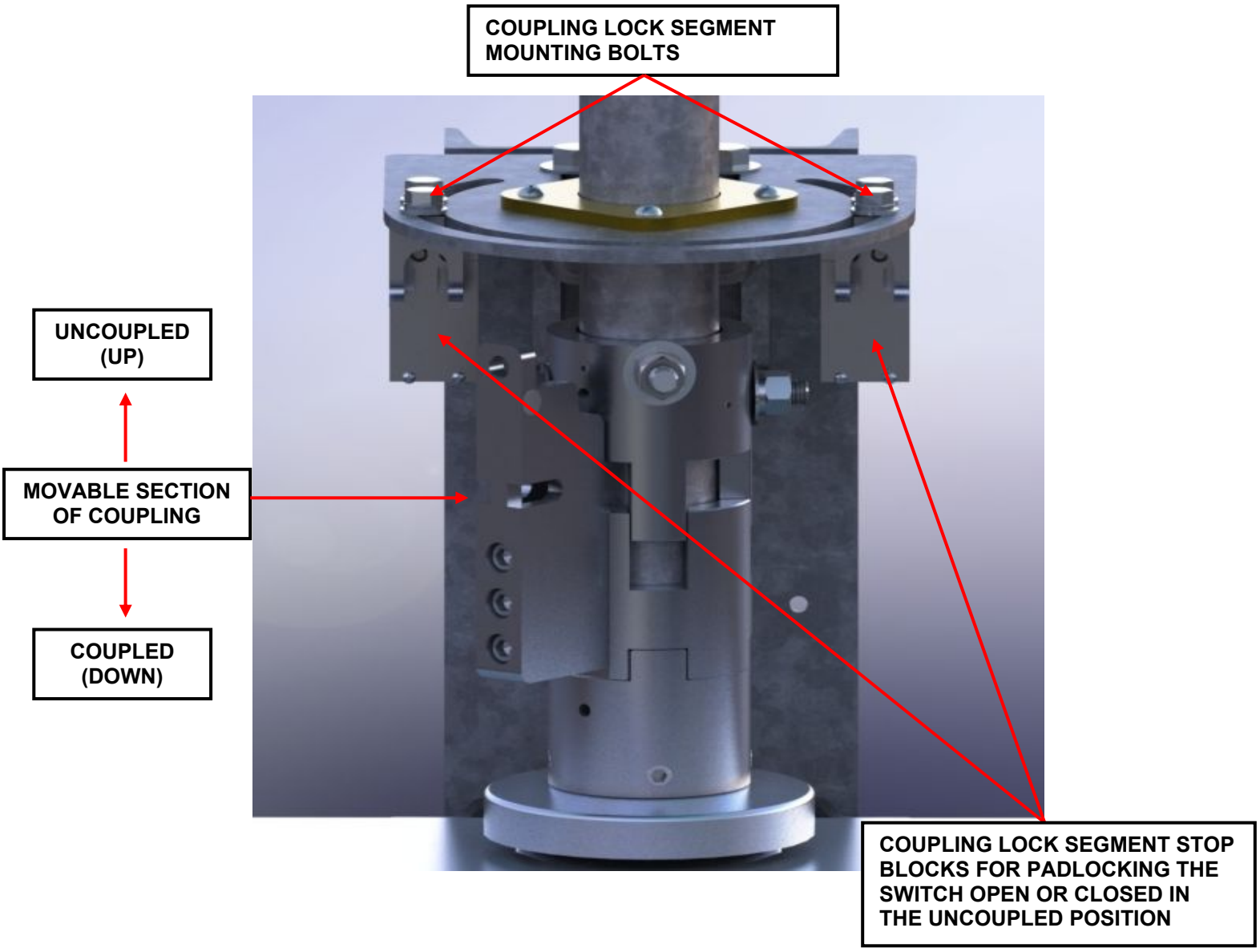
E. ADJUSTING OPEN/CLOSED LIMIT SWITCHES

1) At this time the limit switch should be correctly positioned for the CLOSED switch position.
2) Move the switch to the OPEN position using the manual operation swing handle. Leave the switch in the decoupled position.
3) Press the OPEN pushbutton on the motor operator.
4) Using the hex key wrench (provided), loosen the setscrew on the OPEN switch cam.
5) Rotate the cam in the OPPOSITE direction of the desired rotation. Lightly tighten the cam setscrew. Press the related pushbutton.
6) Repeat Step 5 to allow the motor to incrementally step forward until the arrow on the switch section of the coupling matches the arrow on the motor section of the coupling.

7) Press the CLOSED pushbutton, and then manually move the switch to the CLOSED position with the swing handle. Make certain the arrows on the coupling match.
8) Padlock the movable coupling into the coupled position and operate the switch with the motor operator.
9) Fine-tune the adjustment of the limit switch cams in both the OPEN and CLOSED positions to compensate for the twist in the control pipe by repeating Step 5.

F. HANDLE, LOCK SEGMENT ADJUSTMENT

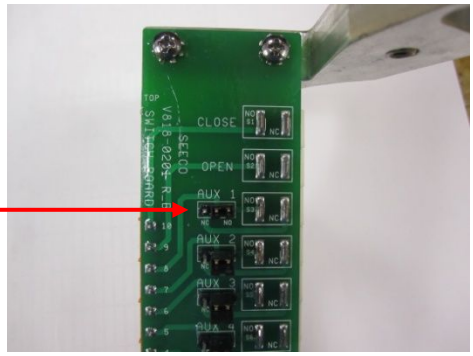
1) Make certain the swing handle is correctly positioned for the OPEN and CLOSED positions. Tighten the swing handle bolt and piercing setscrews.
2) Adjust and tighten the coupling lock segment stop block mounting bolts for the switch OPEN and CLOSED positions (see photo below).



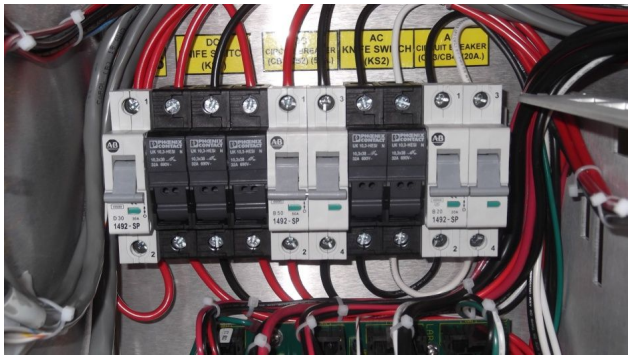
G. FINAL ADJUSTMENTS AND INSPECTION

1) Adjust any required auxiliary switches in the same manner as the motor operator limit switches. A shunt is provided to set each of the (8) auxiliary switches to N.O. or N.C. as required (see photo below). Note that each pair of auxiliary switches shares a 'common' connection terminal as marked on the Termination Board (TMB) terminal strip TB2.

Move shunts from N.O to N.C position to change from N.O to N.C in the field.



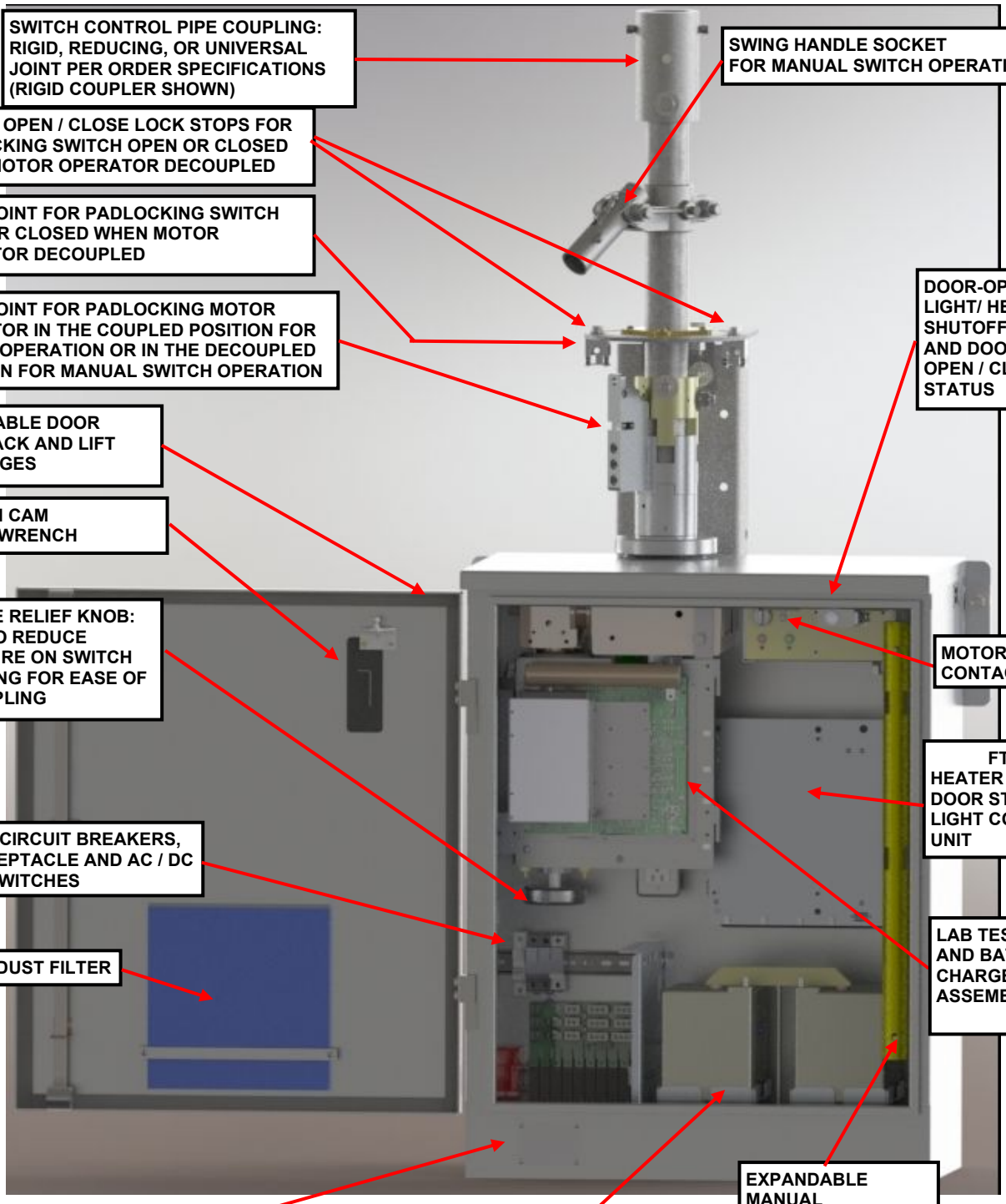
2) Change LAB Tester settings for LOAD and CHECK tests if desired (factory preset at 30 days for the LOAD test and 90 days for the CHECK test). Refer to the LAB Tester instructions beginning on Page 10 of this Manual for information on how to view and change the various settings.
3) Change the Fan/Temp/Door (FTD) controller settings if desired. The factory-preset temperature settings are 77°F (25°C) for the upper limit and 59°F (15° C) for the lower limit. Refer to the FTD instructions beginning on Page 7 of this Manual for information on how to view and change settings.
4) Make certain all sliding links on the TB1 terminal strip are in the closed position.
5) Make certain ground wires are connected to the ground connection points supplied.
6) Leave the AC and DC knife switches and circuit breakers in the CLOSED and ON positions.
7) Leave the LOCAL/ REMOTE switch in the REMOTE position.
8) Make certain all bolts and setscrews have been tightened.
9) Operate the switch multiple times to ensure a reliable and accurate installation.
10) Make certain the grounding strap has been reconnected to the operating pipe.



MOTOR BREAKER, DC DISCONNECT, DC BREAKER, AC DISCONNECT, AC BREAKER SHOWN.
(DC AND AC BREAKERS AND AC KNIFE SWITCH ARE OPTIONAL).

**MOTOR BREAKER AND DC DISCONNECT ARE STANDARD.*

MNM Motor Operator
Installation and Operation Instructions



H. FTD OPERATION INSTRUCTIONS

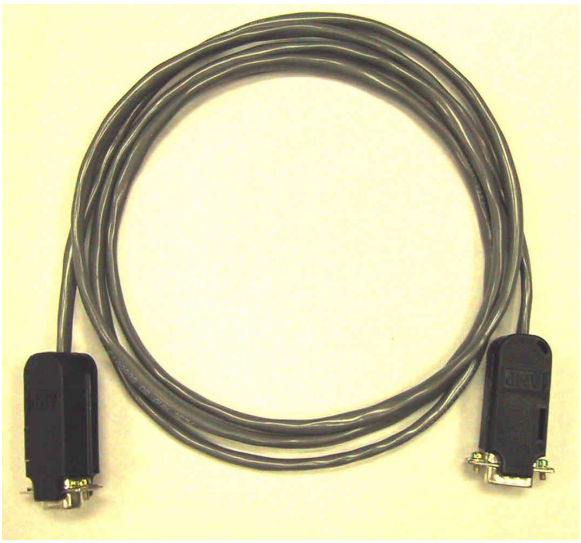


Figure 1
Null Modem Cable

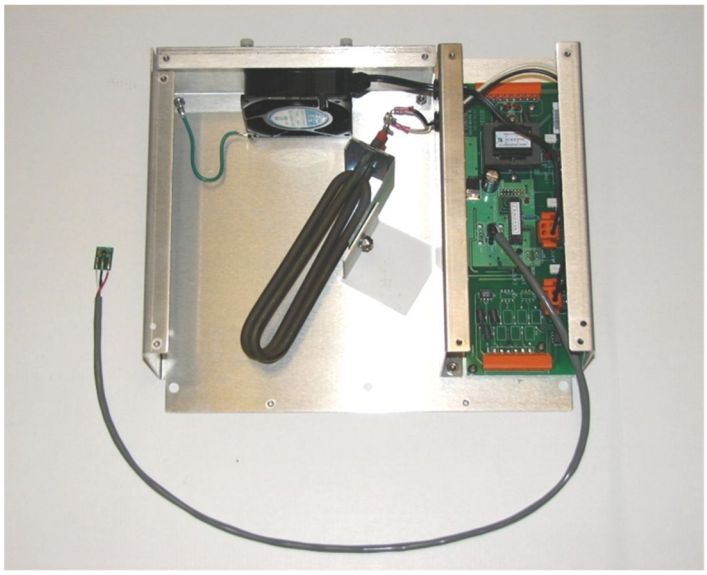


Figure 2
FTD Assembly (shown with top cover removed)

Figure 3
Hyper-terminal Setup CD

Step 1: Confirm all above listed and shown components are present. One cable and setup CD is provided for each Motor Operator FTD assembly.

Step 2: Insert CD provided (Figure 3) into Computer, drag contents to desktop within Windows.

Step 3: Connect Null Modem Cable (Figure 1) into Computer and 9 pin connector at front of FTD top cover panel (See Figure 4).

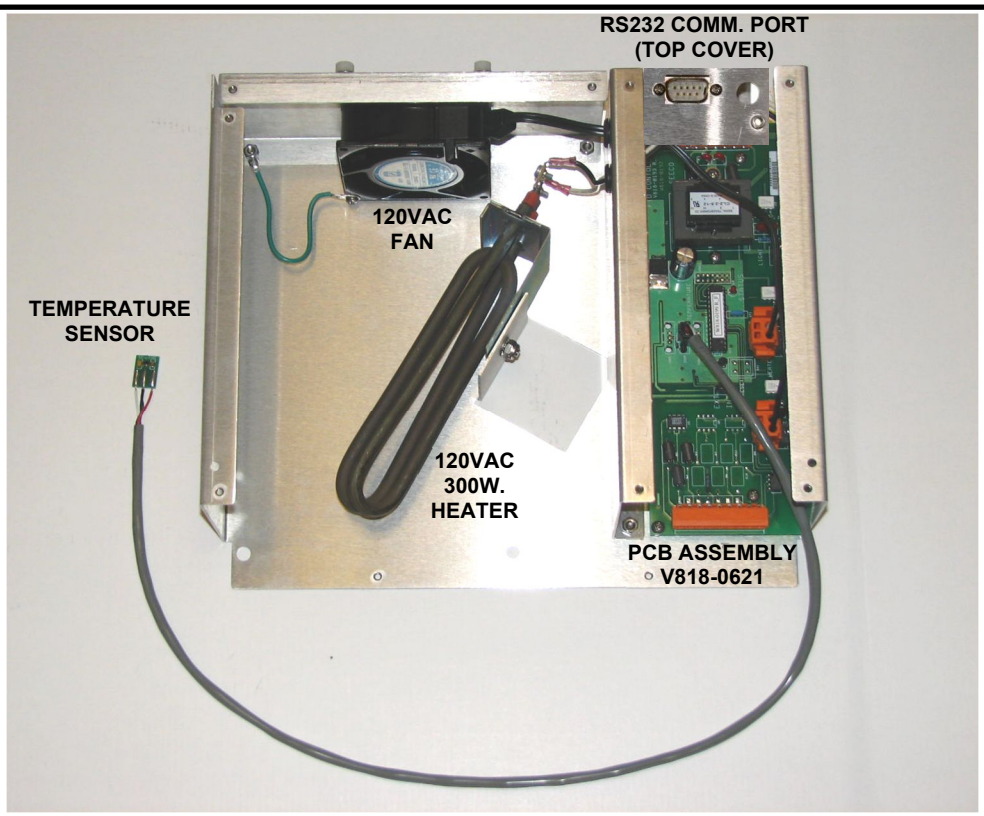


Figure 4
FTD Controller Assembly Layout

Step 4: Verify that the FTD Controller assembly has AC and DC power applied. Make connector at batteries (if applicable), close DC knife switch, AC knife switch (if applicable) and AC & DC circuit breakers (if applicable).

Step 5: Type <Shift> "?" <Enter>. At this point the command menu as shown in Figure 5 on the next page should be visible.

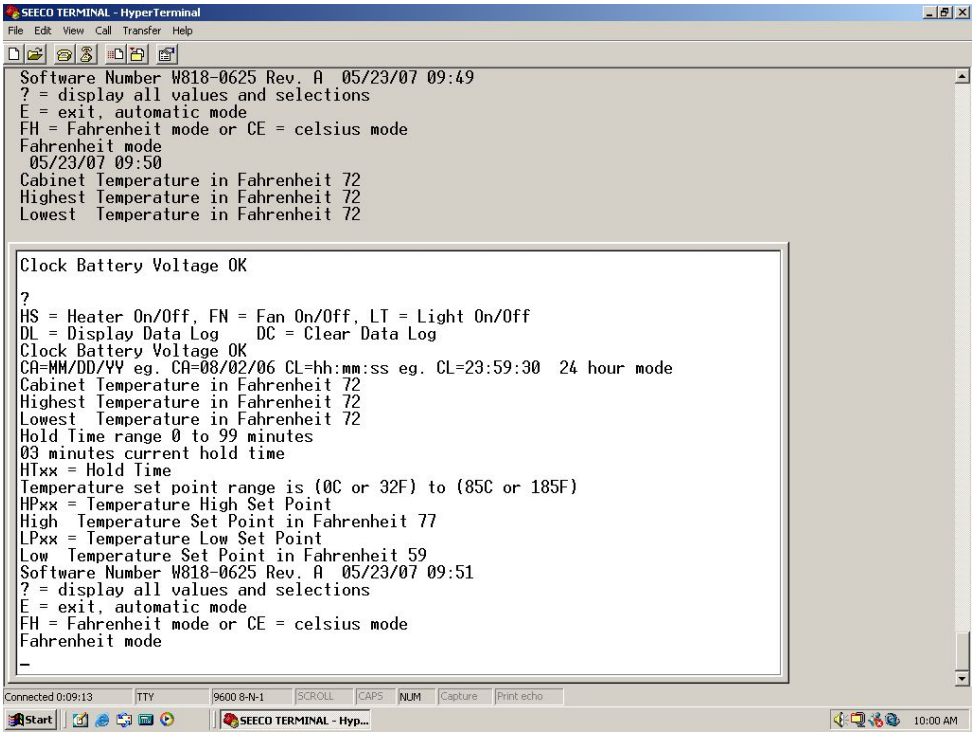


Figure 5
FTD Screen Menu

Step 6: Modify and/or view desired parameters as described below:

Type “?” followed by <enter> key to access the main menu.

Type the letters of the menu option (upper or lower case) and press <enter> to make the selection.

The heater ("HS"), fan ("FN") and illumination ("LT") functions toggle on / off with each selection.

When entering the High/Low temperature set points and Hold time, do not put a space between the "HP", "LP" or "HT" and the desired 2-digit temperature or time value.

The hold time value specifies the minimum time required for a change in temperature to remain stable before any control action is taken. This effectively provides a hysteresis band to avoid unnecessary on/off cycling of the fan and heater element.

The data log ("DL") will show the last 30 sets (1 month) of high and low temperatures recorded every 24 hours.

Type “DC” to clear the data log.

Type “CA” followed by MM/DD/YY to set date.

Type “CL” followed by HH:MM:SS to set time (24-hour format)

Type “FH” (Fahrenheit) or “CE” (Celsius) for desired temperature units.

Type “?” to refresh the screen and display all values and selections.

Type “E” to exit from the menu and store all updated values.

I. *LAB (Lead Acid Battery) Tester Board Assembly*

(Provided as standard equipment with the MNM2 Motor Operator)

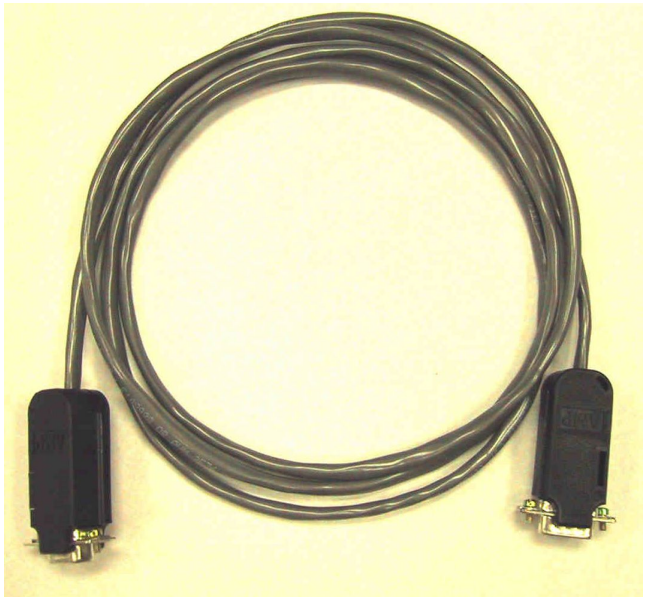


Figure 1
Null Modem Cable

Figure 2
LAB Tester PCB Assembly (shown with optional Operation Counter/Display Board)

Figure 3
Hyper-terminal Setup CD

Step 1: Confirm all above listed and shown components are present. One cable and setup CD is provided per unit.

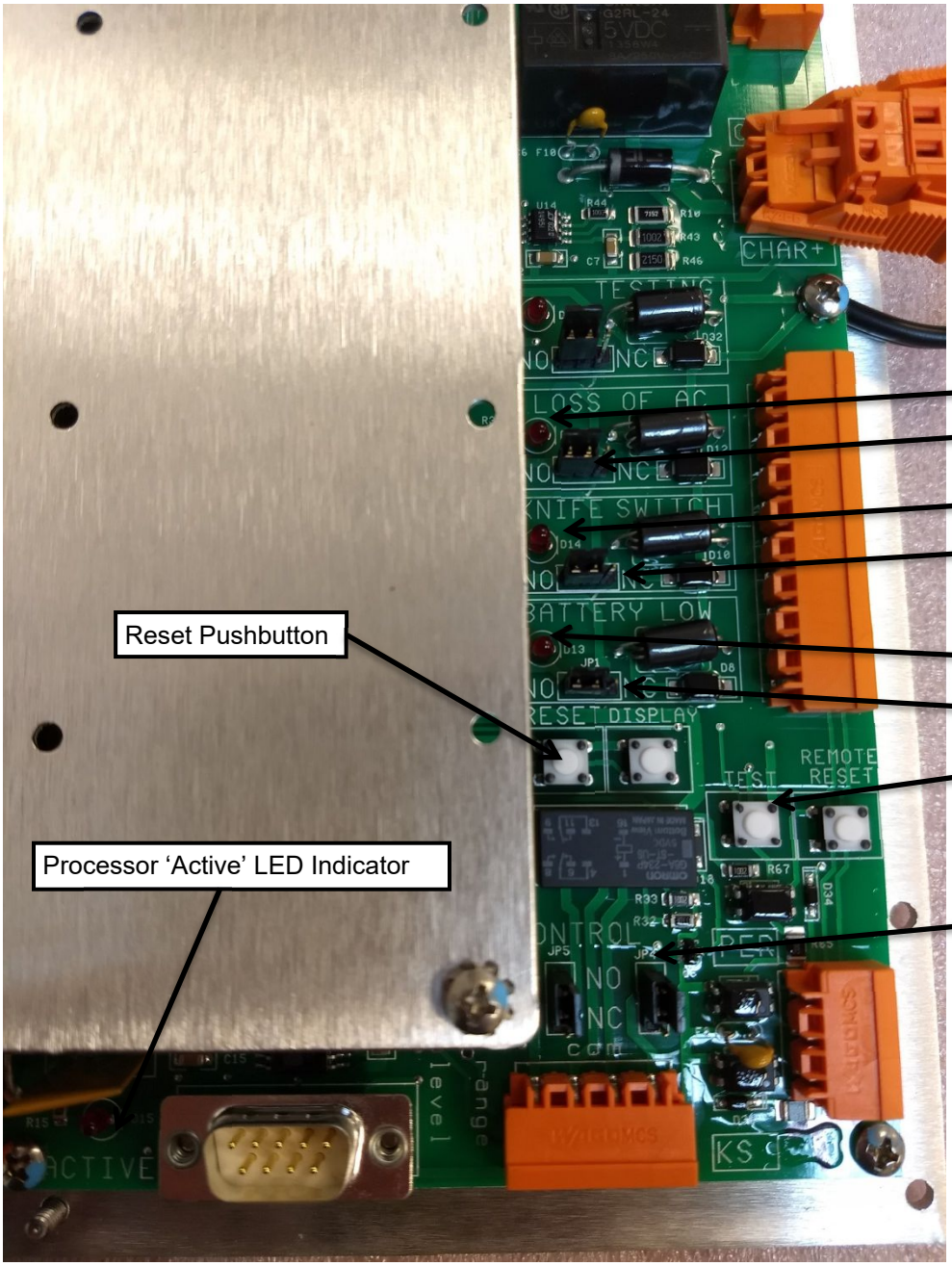
Step 2: Insert CD provided (Figure 3) into Computer, drag contents to desktop within Windows.

Step 3: Connect Null Modem Cable (Figure 1) into PC and 9 pin connector at front of LAB Tester (See Figure 2).

Step 4: Verify that the LAB Tester has AC and DC power applied. Make 24V connector at batteries (if applicable), close DC knife switch, AC knife switch (if applicable) and AC & DC circuit breakers (if applicable).

Step 5: Type <Shift> "?" <Enter>. At this point the menu as shown in Figure 6 on the page 13 should be visible.

Figure 5
LAB Tester Status/Manual Load Test



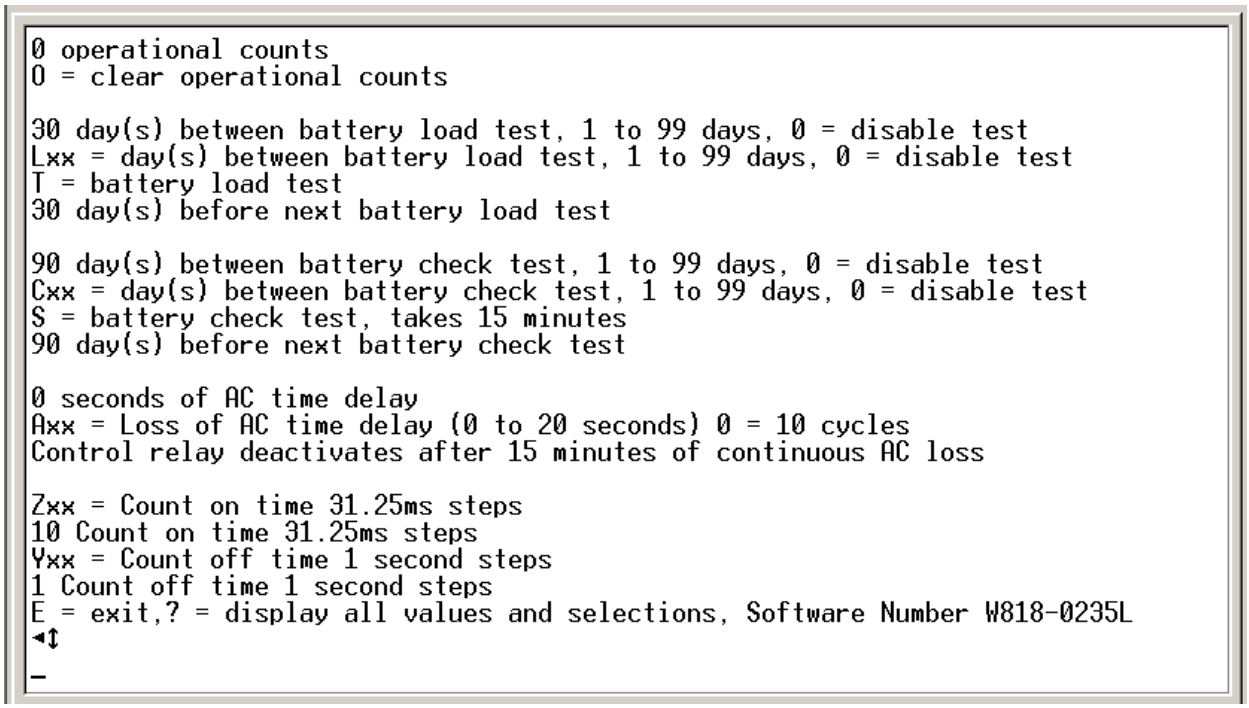


Figure 6: Screen Menu Layout

Step 6: Modify and/or view desired parameters, the menu parameters are shown below displaying the default settings.

0 operation counter (count value increments by 1 for each 'Close-to-Open' or 'Open-to-Close' motor operation cycle)
Type "O" <enter> to clear (zero) the operation counter

30 day(s) between Battery Load Test
Displays the number of days between the battery load tests. This test automatically disconnects the charger and places a load resistor across the battery for 15 seconds. If the battery voltage drops below 20 volts during the test duration, a contact and indicating light alarm are provided.

Lxx = day (s) between Battery Load Tests (1-99 days)
Type "Lxx" <enter> , where xx is the number of days between the load tests. For example, "L20" would set the load test interval to 20 days between load tests.

T = Battery Load Test (duration = 15 seconds)
Type "T" <enter> to initiate a Battery Load Test immediately.

90 day(s) between Battery Check Test
Displays the number of days between the battery check tests. This test automatically disconnects the charger and lets the normal motor operator load run off the battery for 15 minutes. If the battery voltage drops below 20 volts during the test duration, a contact and indicating light alarm are provided.

Cxx = day (s) between Battery Check Tests (1-99 days)
Type "Cxx" <enter> , where xx is the number of days between the check tests. For example, "C60" would set the check test interval to 60 days between check tests.

S = Battery Check Test (duration = 15 minutes)
Type "S" <enter> to initiate a Battery Check Test immediately.

0 seconds of AC time delay

Axx = 'Loss-of-AC' Status Time Delay (0-20 seconds)
Type "Axx" <enter> , where xx is the number of seconds AC time delay. For example, "A10" would set the AC status time delay interval to 10 seconds. This parameter is useful to help eliminate false AC alarms due to momentary AC power interruptions.

Zxx = Count on time (internal use)
Yxx = Count off time (internal use)

? = Display all values and selections
Type <shift> "?" <enter> to refresh the screen and display all values and selections.

E = exit
Type "E" <enter> to exit from the menu and store all updated values.

Step 7: Confirm that the 'Loss-of-AC' and 'Battery Low' dry contact status alarms are as desired (Normally Open or Normally Closed). If a change is needed, reposition the related shunt to the opposite pins. The location of each of these shunts is shown in Figure 5 on Page 11.

J. *BATTERY CHARGER SPECIFICATIONS AND INSTRUCTIONS*

(Provided as standard equipment with the MNM2 LAB Tester Assembly)

Figure 1
SEECO Battery Charger

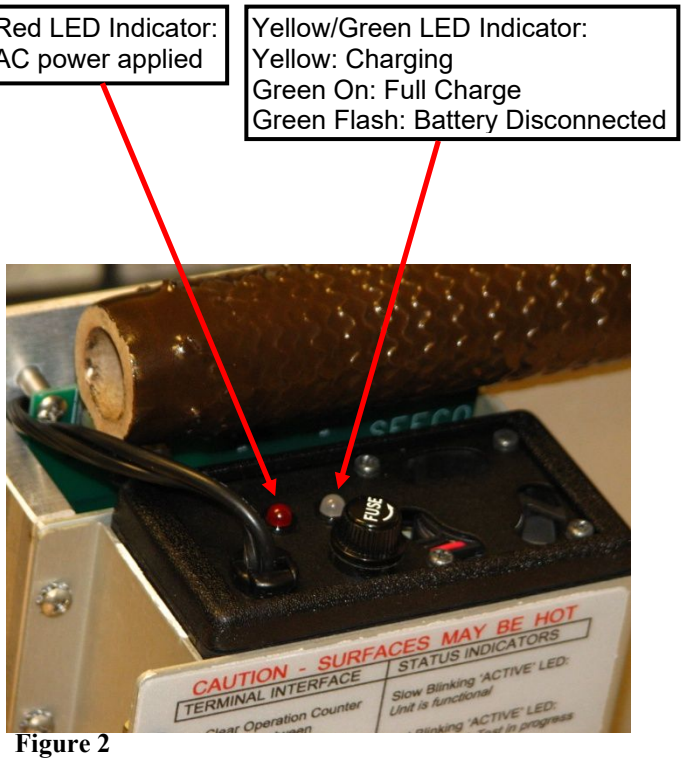


Figure 2
Battery Charger LED Indicator Lights
(visible with LAB Tester in secured position)

Specifications:

- Switch-selectable 115 (90-140) / 230 (180-280)VAC operation, 47-63Hz line frequency
- International safety approvals and listings (UL/CSA)
- Switch-mode power supply
- Output: 24VDC, 6Amp.
- Line regulation: 2% @ full load
- Load regulation: 3% @ 115/230VAC
- DC output ripple: <200mv @ 24VDC
- Designed to charge (2) 12 Volt, 35 Amp-hour sealed lead acid batteries wired in series
- Three-stage charging: Deep-discharge, Full charge, Pulse charge
- AC input fuse protection
- AC input voltage surge suppression
- DC output fuse protection
- Output short circuit protection
- Output reverse polarity protection
- Over-voltage protection
- Over-current protection
- Soft start/stop operation
- Temperature Compensation
- Constant current, with pulsed output for overcharge protection
- Cooling fan
- LED status indicator lights

K. Motor Speed Adjustment for 2-Speed Operation (MNM1, 48V and 125V) (optional equipment, provided with suffix 'T' in Catalog Number)

Motor Operators used on certain switches require a variable open and close speed. MNM Option 'T' provides a dual resistor circuit board assembly (see Figure 1 below) to allow the opening and closing motor speeds to be adjusted independently. The left-hand resistor is used to control the open speed. The right-hand resistor is used to control the close speed. For each resistor, loosening the clamp and increasing the distance between the upper terminal connection and the clamp (lowering the clamp) will slow the motor operator speed. Decreasing the clamp to upper terminal distance (raising the clamp) will increase the motor operator speed. Typically, a slow open operation and a fast close operation is desirable. The fast closing speed allows proper operation of the switch blade latching mechanism.

NOTE: For maximum closing speed, the black wire for the "close speed" resistor can be disconnected from the adjustable clamp and attached directly to the top terminal of the right-hand resistor.
For maximum opening speed, the red wire for the "open speed" resistor can be disconnected from the adjustable clamp and attached directly to the top terminal of the left-hand resistor.

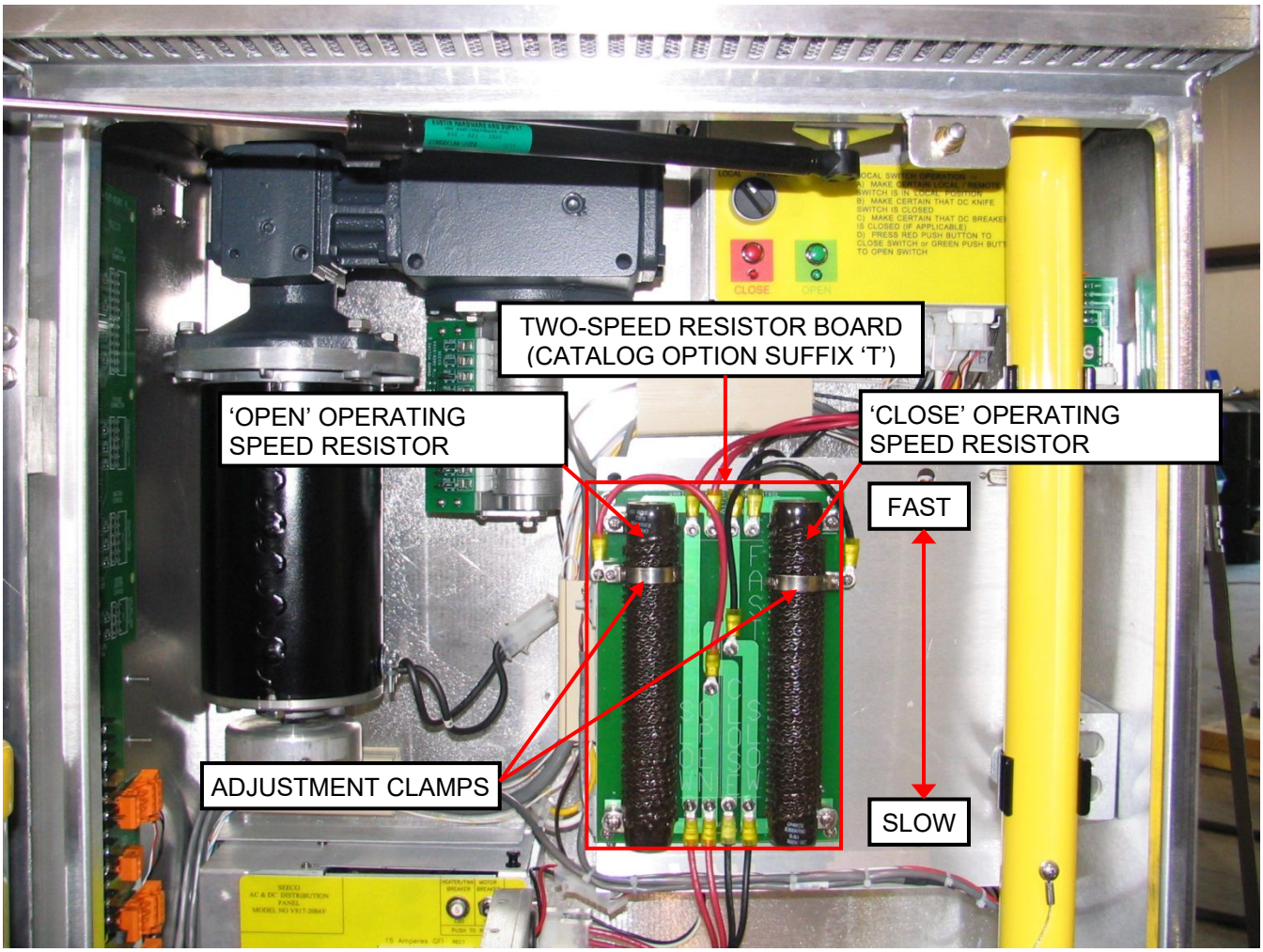


Figure 1: MNM1 Two-Speed Resistor Circuit Board Assembly Layout

L. MSM - Motor / Switch Monitor
(optional equipment, provided with suffix 'G' and 'H' in Catalog Number)

MSM option 'G' provides true switch position status (independent of motor position) as well as motor operator coupled/uncoupled status. MSM option 'H' allows monitoring the motor power (current and voltage measurement) required to operate the switch via the motor operator. Jumper-selectable NO/NC status relay contacts are provided, reference the applicable wiring diagram.

Figure 1
Null Modem Cable

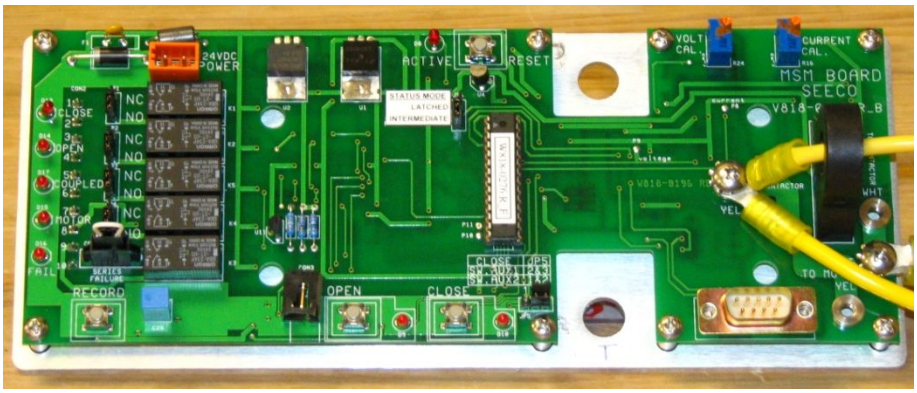


Figure 2
MSM Board

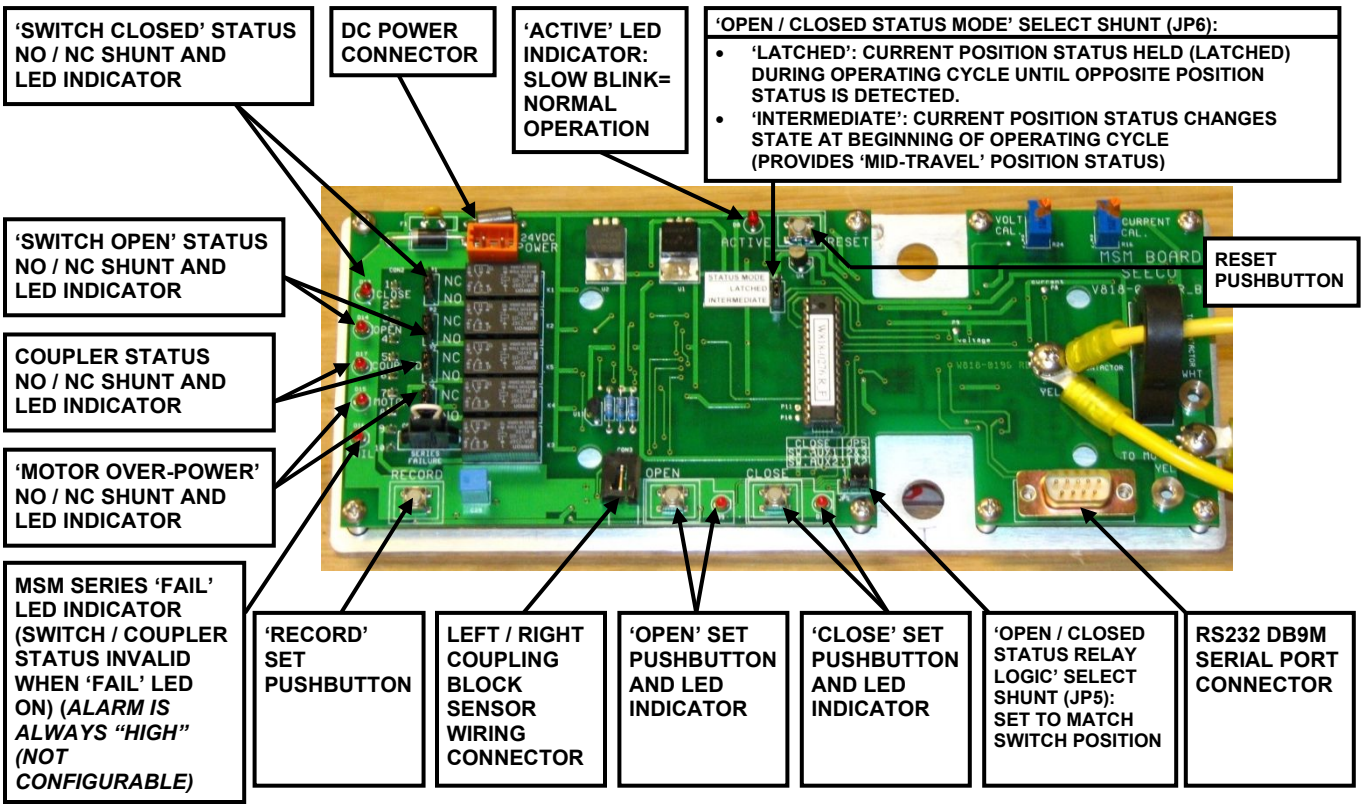
Figure 3
Hyper-terminal Setup CD

Step 1: Confirm all above listed and shown components are present. One cable and setup CD is provided per MSM assembly.

Step 2: Insert CD provided (Figure 3) into Computer, drag contents to desktop within Windows.

Step 3: Connect Null Modem Cable (Figure 1) into Computer and 9 pin connector at front of MSM (See Figure 4).

Figure 4: MSM Circuit Board Assembly Layout
(Installed in upper left-hand corner of MNM Motor Operator cabinet)



Step 4: Make certain that the motor operator cabinet has power applied. Make connector at batteries, close DC knife switch and DC Breaker (if applicable).

Step 5: Type "Shift ? Enter" twice. At this point the menu as shown in Figure 5 below should be visible.

```
?
C = Close Status Relay On/Off
O = Open Status Relay On/Off
U = Coupled Status Relay On/Off
M = Motor Status Relay On/Off
F = Failure Status Relay On/Off
D = Data Log
R = Clear Data Log
Yxx = Open power percentage, input range  (0 to 90)
30 Open power percentage
0000 Open power threshold
0000 Open average power
Zxx = Close power percentage, input range (0 to 90)
30 Close power percentage
0000 Close power threshold
0000 Close average power
? = display all values and selections
Software Number = W818-0276 REV.F
E = exit, automatic mode
_
```

Connected 0:02:16 | TTY | 9600 8-N-1 | SCROLL | CAPS | NUM | Capture | Print echo

Figure 5: MSM Menu Screen Layout

Step 6: Modify and/or view desired parameters, refer to Figure 5 on previous page displaying the default settings:

C = 'Closed' Status Relay On/Off
Type "C" <enter> to toggle the 'Closed' status relay on / off for functional testing.

O = 'Open' Status Relay On/Off
Type "O" <enter> to toggle the 'Open' status relay on / off for functional testing.

U = 'Coupled' Status Relay On/Off
Type "U" <enter> to toggle the 'Coupled' status relay on / off for functional testing.

M = 'Motor' Status Relay On/Off
Type "M" <enter> to toggle the 'Motor' status relay on / off for functional testing.

F = 'Fail' Status Relay On/Off
Type "F" <enter> to toggle the 'Fail' status relay on / off for functional testing.

D = 'Data Log'
Type "D" <enter> to view the stored data log for switch/motor power operation data.

R = 'Clear Data Log'
Type "R" <enter> to delete (erase) all stored data log values.

Yxx = OPEN power percentage (Value range: 0 to 90%)
Type "Yxx" where 'xx' is the percentage above the initial set (stored) OPEN power value that an alarm contact indication is desired (factory default setting = 30%).

30 OPEN power percentage (Indicates the currently set OPEN power percentage value)

xxxx OPEN power threshold ("xxxx" is calculated OPEN power threshold value based upon OPEN power % value)

xxxx OPEN average power ("xxxx" is calculated average OPEN power based upon measured motor current and voltage)

Zxx = CLOSE power percentage (Value range: 0 to 90%)
Type "Zxx" where xx is the percentage above the initial set (stored) CLOSE power value that an alarm contact indication is desired (factory default setting = 30%).

30 CLOSE power percentage (Indicates the currently set CLOSE power percentage value)

xxxx CLOSE power threshold ("xxxx" is calculated CLOSE power threshold value based upon CLOSE power % value)

xxxx CLOSE average power ("xxxx" is calculated average CLOSE power based upon measured motor current and voltage)

? = Display all values and selections.
Type "?" <enter> to redisplay all current values & selections (refresh screen)

Software Number = : Current software number and release in use.

E = Exit, return to automatic mode
Type "E" <enter> to exit and allow system to return to automatic mode.

Step 7: With the motor operator coupled to the switch and the overhead switch in the fully open or closed position, ensure that the correct MSM 'OPEN' or 'CLOSE' LED indicator at left side of MSM board is illuminated. If a change is required, reposition the 'OPEN/CLOSED Status Relay Logic'('SW. AUX.") shunt (JP5) in the alternate position to reverse the status relay operation and LED indicators.

Step 8: Confirm that the CLOSE, OPEN, COUPLED and MOTOR contact status alarms are as desired (NO or NC). If a change is needed, reposition the related shunt located to the right of each LED indicator to the opposite pair of pins.

Step 9: Set the 'OPEN/CLOSED Status Mode' select shunt (JP6) to the desired setting as described below:

- 'LATCHED': The current position status is held (latched) during the motor operating cycle transition until the opposite position status is detected.
- 'INTERMEDIATE': The current position status changes state after the motor operating cycle begins when a valid OPEN or CLOSED position status is no longer detected. During the operating cycle transition (CLOSED →OPEN or OPEN→CLOSED), both the 'OPEN' and 'CLOSE' status relays and LED indicators are de-energized. This status alarm mode can thus be used to provide 'mid-travel' position status.

NOTE: The MSM software incorporates an internal timer during each OPEN/CLOSE operation cycle. If the opposite position status is not detected within 15 seconds after the OPEN or CLOSE operation cycle begins, the 'FAIL' status alarm relay changes state.

Step 10: The following procedure records the average power (measured motor current multiplied by motor voltage) required to perform both the OPEN and CLOSE motor operation cycle. The calculated average power values are then stored in the MSM memory. These stored reference values are then compared to the values measured/calculated during each subsequent OPEN or CLOSE operation. If the value exceeds the reference value by more than the preset percentage amount, the 'MOTOR' status alarm relay is energized.

NOTE: This procedure should not be performed until the switch is operating properly with the motor operator and all necessary switch and motor operator adjustments have been completed.

Procedure to Record Open / Close Motor Power Values:

a) Connect PC to MSM RS232 serial port using SEECO-supplied interface cable.

b) Verify normal serial communication via MSM screen menu (<shift> "?" <enter>)

c) Clear MSM data log: (menu option "R", <enter>)

d) Verify that motor is coupled to switch and switch is closed.

e) Press and hold "RECORD" and "OPEN" pushbuttons on MSM circuit board.
(MSM 'OPEN' LED next to 'OPEN' pushbutton will blink fast to indicate "record" mode is active)

f) Release MSM buttons, press motor contactor green "OPEN" pushbutton to operate motor and open switch.
(MSM 'OPEN' LED will remain on continuously after switch opens to indicate data value has been stored)

g) Press and hold "RECORD" and "CLOSE" pushbuttons on MSM circuit board.
(MSM 'CLOSE' LED next to 'CLOSE' pushbutton will blink fast to indicate "record" mode is active)

h) Release MSM buttons, press motor contactor red "CLOSE" pushbutton to operate motor and close switch.
(MSM 'CLOSE' LED will remain on continuously after switch closes to indicate data value has been stored)

i) View data log: (menu option "D", <enter>) to verify open and close motor power data values.

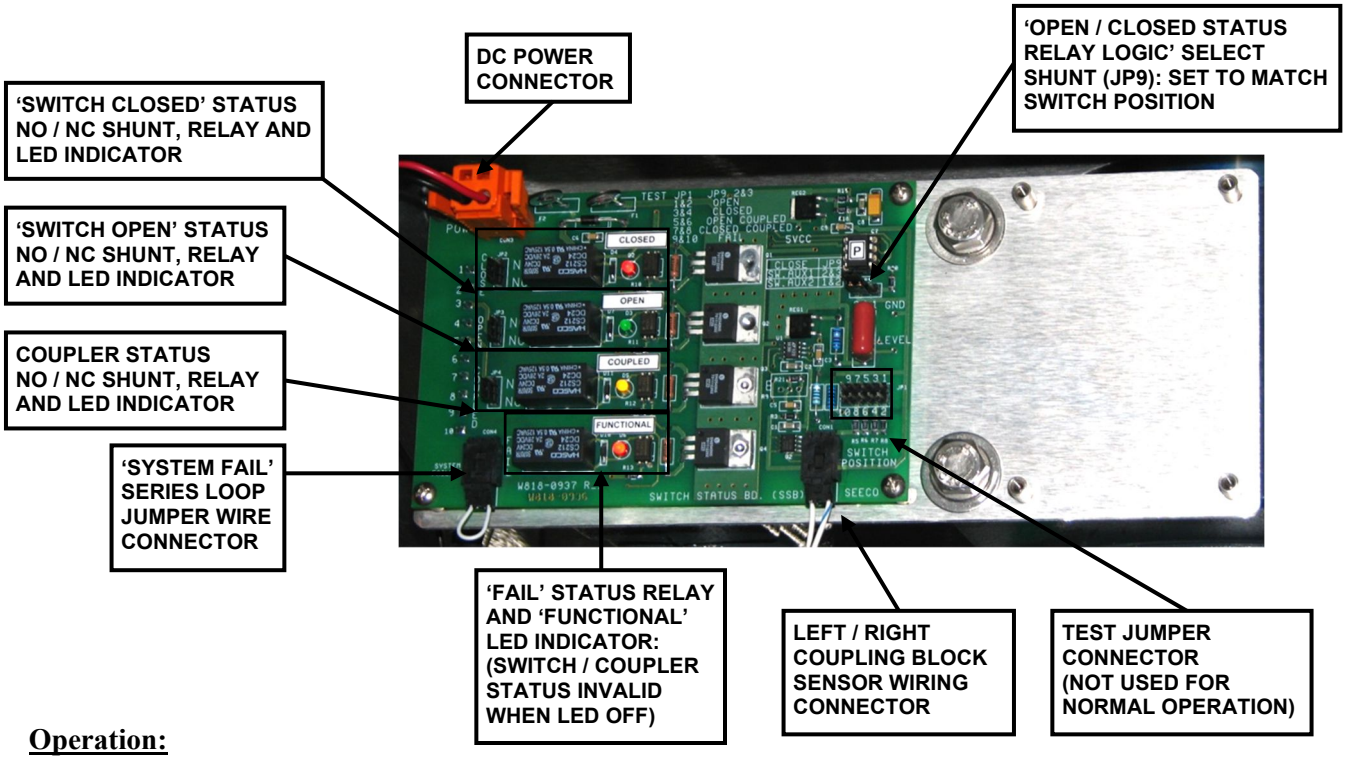
j) Exit MSM setup/test mode (menu option "E", <enter>) to return to MSM automatic mode. Disconnect PC RS232 interface cable.

k) Momentarily press and release MSM "Reset" pushbutton to clear any status alarms and restore normal MSM operation.

M. SSB - Switch Status Board
(optional equipment, provided with suffix 'G' in Catalog Number)

The SSB option board provides true switch position status (independent of motor position) as well as motor operator coupled/uncoupled status. Jumper-selectable NO/NC status relay contacts are provided, reference the applicable wiring diagram.

Figure 1: SSB Circuit Board Assembly Layout
(Installed in upper left corner of MNM Motor Operator cabinet)



Operation:

1. Verify correct setup and adjustment of the MNM coupling mechanism and that the SSB 'FUNCTIONAL' LED indicator is ON when the motor operator is stopped at either the 'Open' or 'Closed' limit position.

2. With the motor operator coupled to the switch and the overhead switch in the fully OPEN or CLOSED position, ensure that the correct SSB 'OPEN' or 'CLOSED' LED indicator is illuminated. If a change is required, reposition the 'OPEN/CLOSED Status Relay Logic' ('SW. AUX.") shunt (JP9) in the alternate position to reverse the status relay operation and LED indicators.

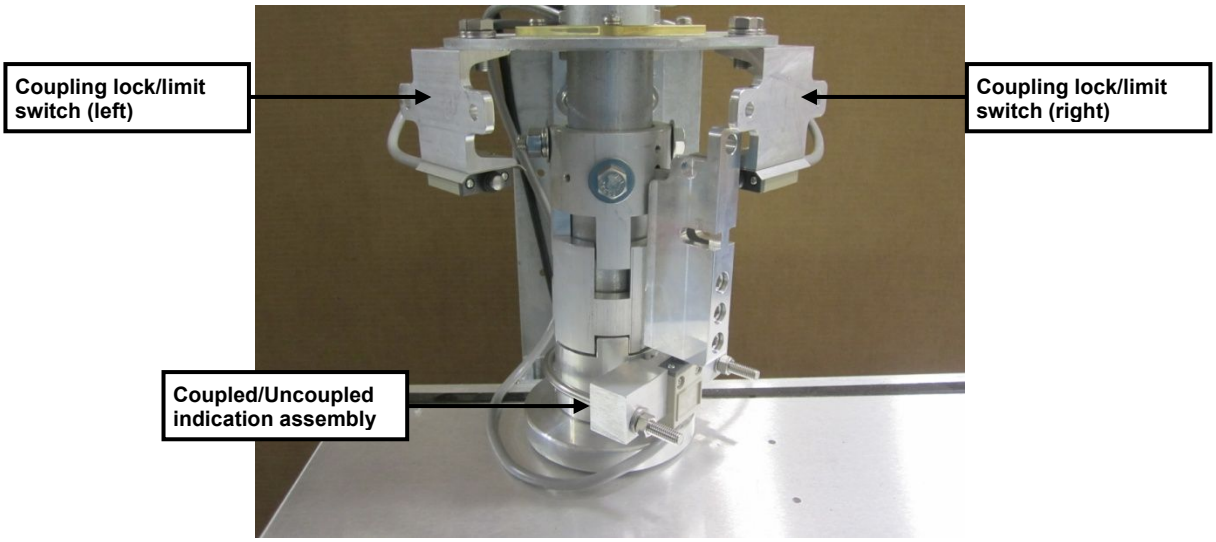
NOTE: The appropriate status relay is energized for each indicated switch/coupler position (CLOSED/OPEN/COUPLED).

3. Confirm that the CLOSED, OPEN and COUPLED status alarm relay contacts are set as desired (NO or NC). If a change is needed, reposition the related shunt located to the left of each status relay to the opposite pair of pins.

NOTE: The SSB software incorporates an internal timer during each OPEN/CLOSE operation cycle. If the opposite switch position status is not detected within 15 seconds after the OPEN or CLOSE operation cycle begins, the 'FUNCTIONAL' LED indicator turns OFF and the status alarm relay contacts open to indicate a 'FAIL' condition.

N. Switch Open/Closed, Coupled/Uncoupled (Dry Contact) assembly – (optional equipment, provided with suffix 'G' in Catalog Number)

The Switch Open/Closed, Coupled/Uncoupled assembly provides true switch position status (independent of motor position, if uncoupled) as well as motor operator coupled/uncoupled status, utilizing dry contact limits switches.



Setup/Adjustment:

1. Adjustment has four primary steps.
   1. Make sure that the motor rotation to open and close the switch is fully adjusted.(**See Section 'D'**)
   2. Adjusting the Coupled/Uncoupled limit switch adjustment **(Figure 1.)**
   3. Adjusting the Coupling lock/limit switch adjustment, right and left. **(Figure 2.)**
   4. Plug in the correct switch position plug to TMB CON18. **(Figure 3.)**

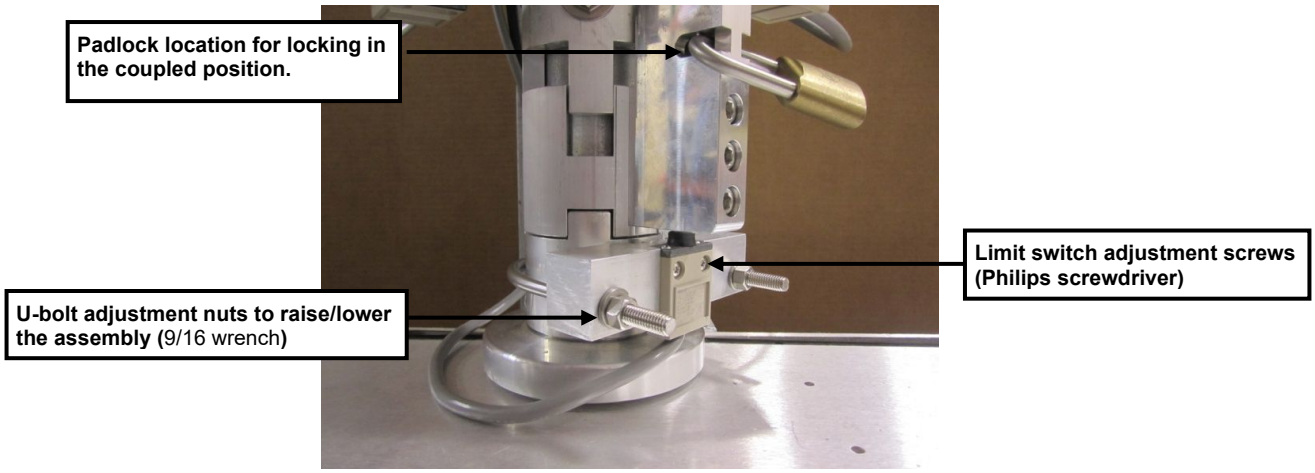


Figure 1: Coupled/Uncoupled Adjustment

Step 2. With the coupler engaged and padlocked, the coupled/uncoupled limit switch should be raised up enough to push the limit switch in so that the limit switch will show coupled status when the coupler is engaged, and show uncoupled when the coupler is raised (disengaged). If the aluminum block that retains the limit switch cannot be adjusted enough to push in the limit switch, there is a secondary adjustment for the limit switch to the aluminum block itself.

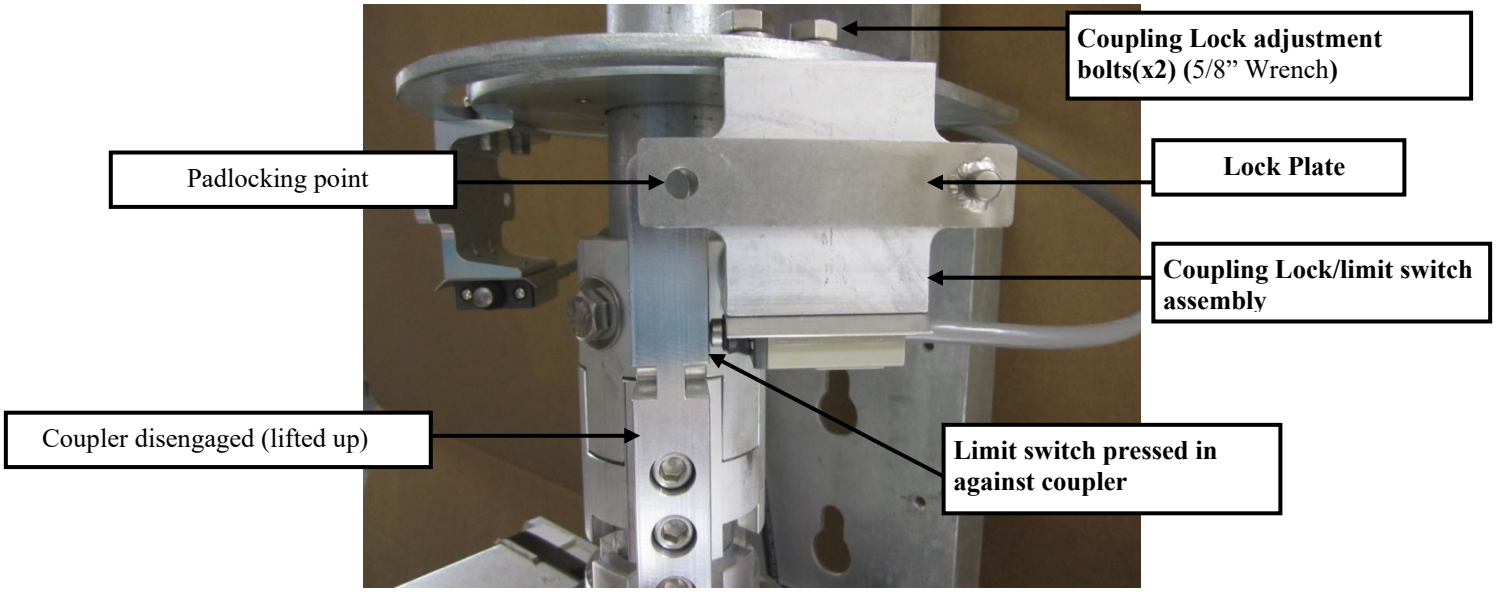
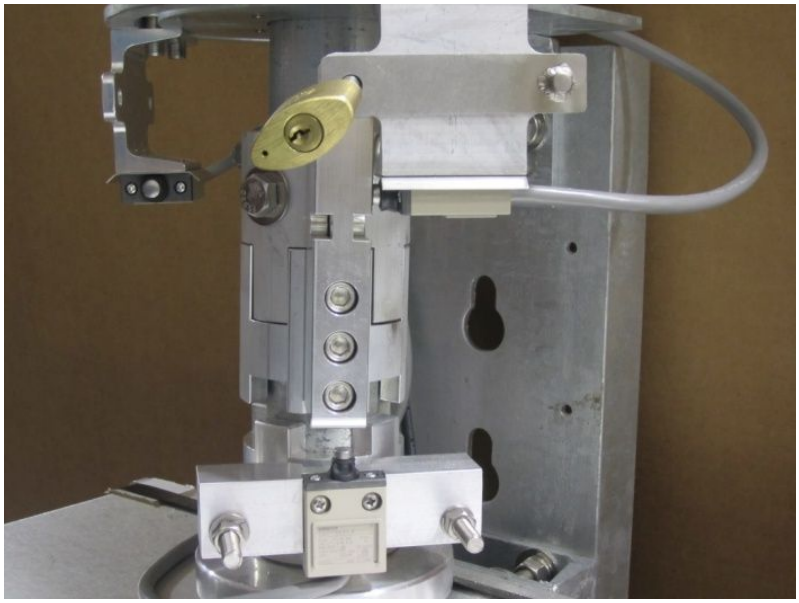


Figure 2: Coupling Lock/limit switch Adjustment (shown uncoupled)

Step 3. With the motor and switch in either the fully open or fully closed position, lift the coupler and disengage from the coupled position. Loosen the coupling lock adjustment bolts, and position the coupling lock so that a padlock can be placed through the lock plate, coupling lock, and coupler . The limit switch on the coupling lock should be pressed in when a padlock is through the padlocking point.



Assembly Padlocked, Uncoupled

Step 3. With the coupling locks and coupler now set, the open/closed status indication can be set. There are two plugs provided to plug into CON18 on the termination board. (Labeled 'CCW to open' and 'CW to open'). The plug that represents the switch control pipe rotation to move into the open position should be plugged into CON18, the plug not used can remain unplugged (Figure 3). Once the correct plug is in CON18, make sure that there are three shunt connectors present (**JP16, JP17, JP18**). Field wiring for switch open, close and coupler status points are wired to the Termination board, point TB5- 7,8 for switch closed status, TB5- 9,10 for switch open status, and TB5- 11,12 for Coupler status. (Figure 4.)

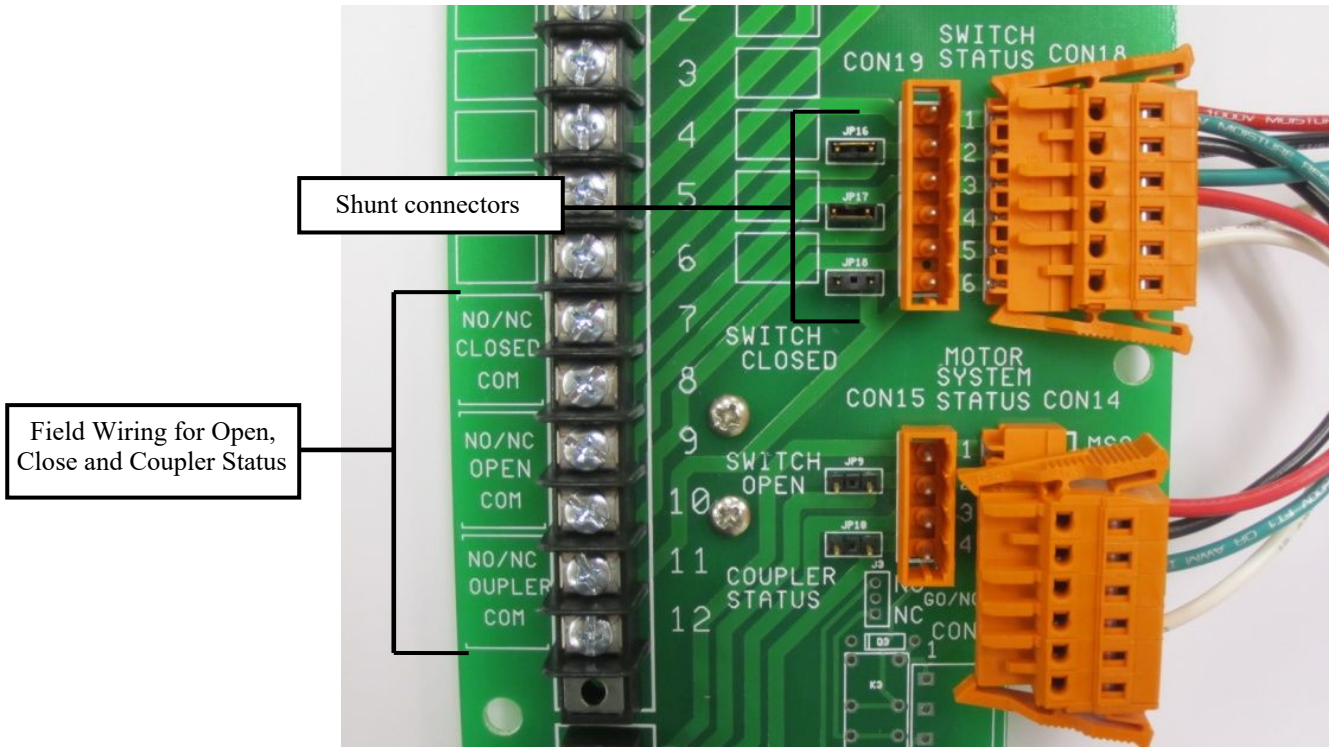
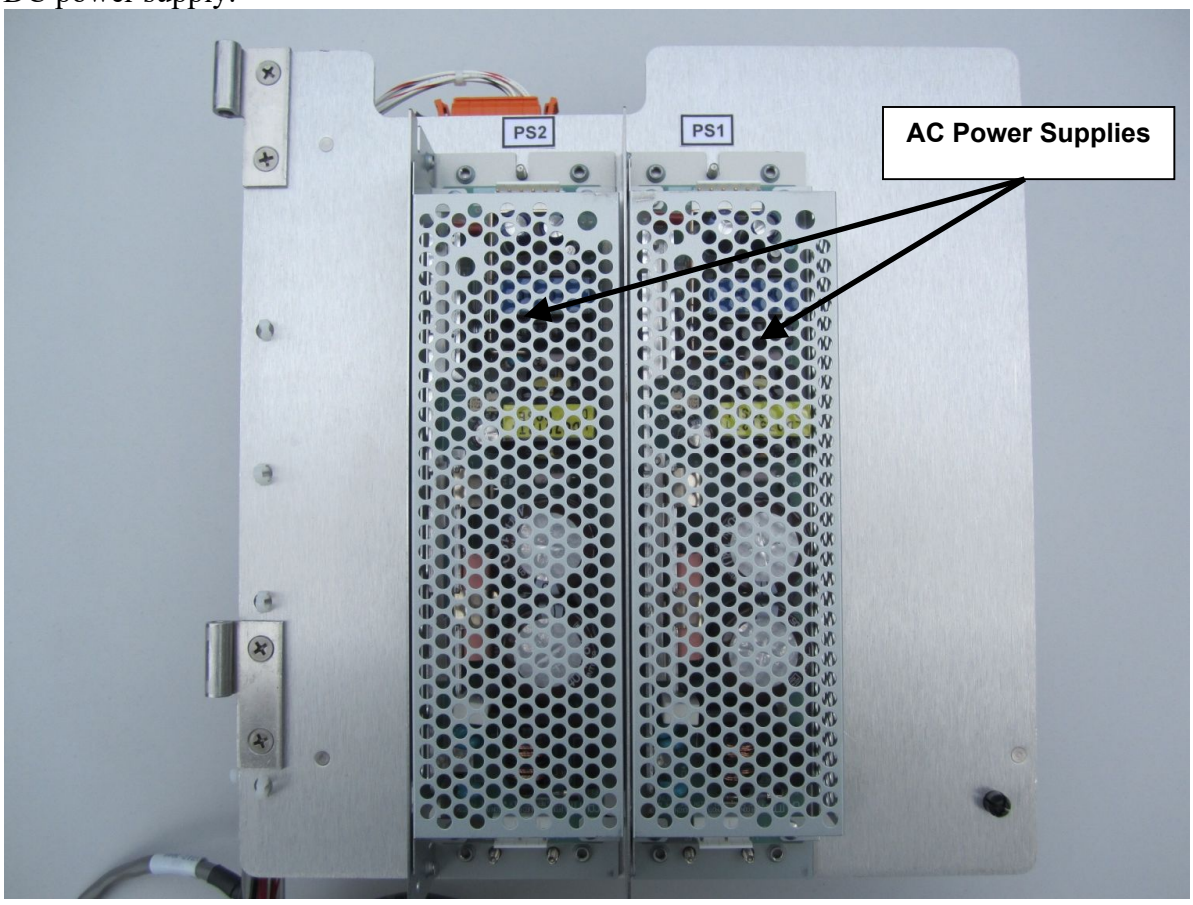


Figure 3: Open/Close and Coupler status field wiring, and open/close directional status plugs.

O. AC Power Supply Assembly (optional equipment for MNM2 Motor Operator, provided with suffix 'U' and 'V' in Catalog Number)

This option functions as an Uninterruptible Power Supply (UPS) system for the SEECO sense output unit. As long as AC power is present, the SEECO-Sense Output Amplifier electronics is supported by the DC power supply. This allows the batteries to remain fully charged at no load with only trickle-charge required by the charger. If AC power is lost, the load is automatically transferred to the batteries using solid-state diode switching. After 15 minutes of continuous loss of AC, the LAB Tester hardware/software 'load-shed' feature is enabled, which automatically disconnects only the +/-12V DC converter power supply assembly powering the sensor Output Amplifier electronics . Since the amplifier electronics represents a relatively high constant-current load, this feature prevents excessive battery discharge in a short period of time and allows the maximum battery capacity to be available as needed for motor-operated switch operation. This also extends battery life and minimizes the battery recharge time. When AC power is restored, DC power is automatically restored to the sensor amplifier electronics (the amplifier's hardware/software automatically resets) and all loads are automatically transferred back to the DC power supply.



P. Motor AC Power Supply (optional equipment for MNM2 Motor Operator, provided with suffix 'X' in Catalog Number)

The motor AC power supply option provides the capability for motorized switch operation directly from 120V AC power. The power supply operates in conjunction with the MNM2 internal batteries as an uninterruptible AC/DC power system (UPS) for the DC drive motor. Transfer between AC and DC power supplies utilizes automatic solid-state switching. Provides complete battery isolation (AC operation of all motor electrical loads) when installed in current production MNM2.

The AC power supply option consists of the following components and subassemblies (refer to photos below):

a) Toroid step-down transformer: 120V AC primary / 32V AC secondary.
b) Full-wave high-current bridge rectifier circuit with solid-state load-switching / isolation diodes.

THEORY OF OPERATION

Transformer T1 steps down the 120V AC input to approximately 32-34V AC. The secondary AC voltage connects to diode packages D1 and D2, configured as a full-wave bridge (FWB) rectifier circuit. The bridge DC output is summed with the battery DC voltage by diode package D3, which also serves as a solid-state switch and to isolate the dc sources. The D3 summing point connects to the DC drive motor through the main DC contactor assembly. When AC power is present, the higher DC output of the FWB provides the full motor voltage and allows the batteries to remain fully charged at no load with only short-duration current-pulse (PWM) charger operation. This feature allows the maximum battery capacity to be available when needed during an AC outage. During motor operation (switch open/close cycle) the FWB rectifier provides the primary DC power with the batteries acting as a filter to smooth the rectifier output. If AC power is lost, the motor load is automatically transferred to the batteries via D3. for motor-operated switch operation. When AC power is restored, the motor load is automatically transferred back to the FWB rectifier output.