MOV Backseat Relay
Model 201602
Functional Test and Calibration

1. Introduction

The purpose of this procedure is to provide a means of bench verifying that the Camp Creek Technologies 201602 MOV Backseat Relay responds correctly to current inputs.

Since the relay operates on relative current readings to detect increased motor load as the valve reaches the backseat, calibration of current reading is not required for proper functioning of the device.

Calibration affects the displayed value of current. In practice, this device is not intended to be a high precision MOV analyzer.

This test does not exercise the full three phase operation sequence; however, it will verify that each phase current input is operational. The backseating operational sequence is defined by the firmware and may be verified by operating valves as described in the User's Manual.

This model requires the use of transformer type AC current probes, and includes an internal current shunt at each phase input.

This procedure applies to versions 2.x of the relay firmware.

Firmware update to latest version 3.x for AC motors is recommended. See Reference 2.12.2.

2. References

2.1 MOV Backseat User's Manual, TM201602

2.2 Documentation and updates: http://campcreektech.com/mov.html

3. Equipment Required

3.1 MOV Backseat Relay

3.2 Digital Multimeter (DMM)

3.3 Variable 60 Hz sine wave AC voltage or current source, 0 to 1 volt, 1 amp, single phase. A variable transformer with step down transformer and resistor may be used.

4. Precautions

4.1 Each phase input contains a 1 ohm, 1 watt, 1% shunt resistor between the red and black jacks. Do not exceed 1 amp actual RMS current input to the device.

4.2 The black jacks are connected to a common reference through a small gauge sense wire. Do not connect a current source in through one phase red jack and out through a different phase black jack as this may affect the readings.

5. Procedure

5.1 Using the DMM 4 wire resistance range, measure the resistance of each phase input at the panel jacks. Verify resistance is 1.00 ohm (0.99 to 1.02, allowing for jack resistance).

5.2 Turn on the backseat relay.

NOTE: (Applicable to versions 2.0, 2.1, 2.4) The relay performs a self calibration of each phase zero while it is in the PREREQ and STOPPED states. If any current is applied to an input during these states, an error message may display (Error Current/noise in STOPPED state only) and the following tests will not be valid. A display of Autozero Error in other screens indicates this condition occurred. In that case, you must return to STOPPED and disconnect any signal source.

5.3 Enable the Calibrate menu:

5.3.1 With the PREREQ or STOPPED screen showing, press the [+] key exactly 7 times.

5.3.2 With the PREREQ or STOPPED screen still showing, press the [-] key exactly 5 times.

NOTE: If key presses are wrong, press STOP to reset count and try again.

5.4 (Optional) Press SETUP to step through the date and time menu items. Correct if needed, though date and time will be lost if batteries are removed.

5.5 Zero Check for Versions 2.0 and 2.1 only

NOTE: The screen shows four numbers. The first is the input current in amps x 1000, followed by the range (0, 1, 2). Next is the zero setting and finally is a gain constant. The zero setting is automatically determined while in the PREREQ or STOPPED states.

5.5.1 Press SETUP until Phase A Zero screen appears. Verify zero setting shows 511 (505 to 517). Record As Found and As Left zero settings on Data Sheet. There is no zero adjustment.

5.5.2 Repeat Step 5.5.1 for Phase B.

5.5.3 Repeat Step 5.5.1 for Phase C.

5.5.4 Press STOP.

5.6 Zero Check for Version 2.2 only

NOTE: The display will show input current in amps x 1000, along with a zero setting of 511 (505 to 517).

5.6.1 Press SETUP until Phase A Zero screen appears. Verify zero setting shows 511 (505 to 517). Record As Found zero setting on Data Sheet.

5.6.2 With no connection to the Phase A jacks, press [+] or [-] to obtain minimum amps reading. Record As Left zero setting on Data Sheet.

5.6.3 Repeat Steps 5.6.1 and 5.6.2 for Phase B.

5.6.4 Repeat Steps 5.6.1 and 5.6.2 for Phase C.

5.6.5 Press STOP.

5.7 Zero Check for Versions 2.3 and 2.4 only

NOTE: The screen shows four numbers. The first three are the average analog/digital (A/D) converter zero readings obtained during PREREQ or STOPPED states for ranges 0, 1, and 2. The fourth is the "live" A/D reading. It should be close to the range 0 reading. These readings are for information only and there is no adjustment. A value out of range could indicate a hardware problem or actual current on the input.

5.7.1 Press SETUP until Phase A Zero screen appears. Verify all four readings are 511 (506 to 517). Record on Data Sheet.

5.7.2 Repeat Step 5.7.1 for Phase B Zero.

5.7.3 Repeat Step 5.7.1 for Phase C Zero.

5.7.4 Press STOP.

5.8 Press SETUP to obtain the Phase A Gain screen.

NOTE: The Gain screens display:

- Versions 2.0 and 2.1 show amps, range, zero, and gain
- Version 2.2 shows amps, range, and gain
- Versions 2.3 and 2.4 show amps, range, and gain

5.9 Connect the AC current source, with the DMM (AC current range) in series, to Phase A input

NOTE: There are three sensitivity ranges in the relay that are automatically selected. The range will be identified as 0, 1, or 2 on the display. Range 0 is lowest, switching to range 1 at about 18 amps and switching to range 2 at about 150 amps. Clipping will occur above about 680 amps indicated (680 millivolts at the jacks), so readings above this will have considerable error and should be disregarded. On the Phase Gain screens, a caret (^) will show in place of range number 2 if clipping is taking place.

5.10 Adjust source until DMM measures approximately 18 milliamps with range 0 showing. If the range shows 1, decrease input to show range 0.

5.11 The relay reading, in amps, should match the source current, in milliamps, within 5%. If adjustment is required, press [+] or [-] to obtain the best match. Record As Found and As Left on Data Sheet.

5.12 Adjust source until DMM measures approximately 120 milliamps with range 1 showing. If the range shows 2, decrease input to show range 2.

5.13 The relay reading, in amps, should match the source current in milliamps, within 5%. If adjustment is required, press [+] or [-] to obtain the best match. Record As Found and As Left on Data Sheet.

5.14 Adjust source until DMM measures approximately 400 milliamps with range 2 showing. If the range shows ^, decrease input to show range 2.

5.15 The relay reading, in amps, should match the source current, in milliamps, within 5%. If adjustment is required, press [+] or [-] to obtain the best match. Record As Found and As Left on Data Sheet.

5.16 Disconnect source.

5.17 Repeat steps 5.8 through 5.16 for Phase B

5.18 Repeat steps 5.8 through 5.16 for Phase C

NOTE: If you cycle past the Phase Gain screens before completing gain calibrations, press STOP, disconnect all inputs, and Repeat steps 5.8 through 5.16 as needed. See note before step 5.3.

5.19 Connect DMM across the relay contact jacks. Set to ohms.

5.20 Press STOP.

5.21 Verify green LED is lit and there is open circuit at the relay jacks.

5.22 Press OPERATE MOV. Verify red LED comes on and resistance is less than 1 ohm at the relay jacks.

5.23 Press STOP.

5.24 Select the Advanced menu by pressing he [+] key exactly 1 time and the [-] key exactly 3 times.

5.25 Step through the SETUP and if you reach a *Restore Defaults?* screen after time and date, select [+]Yes (this screen will only appear if a setting is not at default).

5.26 Turn off relay and disconnect test equipment.

5.27 For long term storage, remove batteries to prevent damage from alkaline battery leakage.

6. Firmware Update

Firmware versions 2.2 and above may be updated easily in the field using the latest code downloaded from the web site referenced in Section 2. The installed version is displayed momentarily on power up.

NOTE: Calibration is retained when firmware is updated

6.1 Unzip the update file. It will contain these instructions and an image.hex file.

6.2 Copy the image.hex file to a micro-SD card. The card used for logging may be used for this purpose.

6.3 Turn relay off.

6.4 Insert SD card in the slot on the side of the relay, contact side facing up.

6.5 Press the [-] key. While holding it down, press the power key.

6.6 The screen should show *Bootloader v1.1, Press SETUP to pgm*.

6.7 The [-] key may be released once the bootloader screen displays.

6.8 If you wish to cancel the update, press the STOP or power key.

6.9 Press SETUP. The screen will show *Erasing* for about 3 seconds followed by *Programming* for about 3 seconds.

6.10 Once complete, the normal relay startup screen will appear, identifying the version number.

6.11 The SD card may now be removed.

7. Key Codes for Menu Selection

Pressing these [+] and [-] buttons multiple times in the PREREQ or STOPPED screen defines what menu items will appear when pressing SETUP: Some selections are not available in some versions.

1 x [+] 1 x [-] Standard (default menu)

Op Trip, Delay, Max Trip, Year, Month, Day, Hour, Min (if not previously set)

1 x [+] 3 x [-] Advanced

Op Trip, Delay, Max Trip,
Filter, Threshold, Log File, Phase Lost (AC), Line Frequency
Year, Month, Day, Hour, Min
Restore Defaults (only standard, advanced items if changed)

7 x [+] 5 x [-] Calibrate

Op Trip, Delay, Max Trip,
Filter, Threshold, Log File, Phase Lost (AC), Line Frequency
Year, Month, Day, Hour, Min
Phase A, B, C Zero (for info only)
Phase A, B, C Gain

Press STOP again while in the STOPPED screen if you need to retry the key counts.

Pressing the following buttons from the PREREQ or STOPPED screen will bring up a *Reset Calibration?* screen when SETUP is pressed. If [+] is then pressed, the calibration gain adjustments will be reset to default (1000). Any other key will cancel the reset. If reset, a new calibration should be performed, though the default may still be within the 5% specs.

14 x [+] 8 x [-] Reset Calibration

Settings except date & time are stored in non-volatile memory and saved when power is off or batteries removed. Date and time are maintained separately by a clock and will be lost if batteries are removed.

MOV Backseat Relay
201602 with firmware version 2.x
Data Sheet

Serial _____

Firmware Version _____

Zero, ADC counts

	Required 511 (505 to 517)					
	Range 0		Range 1		Range 2	
	As Found	As Left	As Found	As Left	As Found	As Left
Phase A						
Phase B						
Phase C						

Gain, Amps Displayed

	Range 0			Range 1			Range 2		
	As Found	Required ±5%	As Left	As Found	Required ±5%	As Left	As Found	Required ±5%	As Left
Phase A									
Phase B									
Phase C									

_____√ Verify Relay Output

Date _____

By_____

By design, NIST traceable calibration is not required.

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Revisions

Rev 1	Eliminated probe from test in favor of measured current application.
Rev 2	Step 5.8, changed “voltage” to “current”
Rev 3	Added note to step 5.3 regarding reset. Updated 5.14 note for ver 2.1.
Rev 4	Editorial changes
Rev 5	Version 2.2 firmware, separate zero and gain calibration menus.
Rev 6	Version 2.3 firmware. Zero is self calibrated.
Rev 7	Added Sections 6 and 6. Restore ALL Defaults is new to version 2.4. Other editorial changes for clarity.
Rev 8	Updated for DC option, menu and other editorial changes.
Rev 9	Update for Motor Start From and other editorial changes.
Rev 10	Deleted Rev 8 and Rev 9 changes. 201602-AC and 201602-DC models (versions 3.x) have been assigned new procedures TP201602-03 and TP201602-04. Rev 10 now applies to all firmware versions 2.x. Other editorial changes made for consistency.