MOV Backseat Relay
Model 201602-DC
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-DC 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.

The DC option allows use of AC/DC hall effect/transformer type probes. It has a high impedance input at the inputs. It is designed for DC valve motors but also be used for AC motors in single or three phase using AC/DC probe(s).

This procedure revision applies to version 3.x of the relay firmware.

2. References

2.1 MOV Backseat User's Manual, TM201602DC

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 DC voltage source, 0 to 1 volt.

4. Procedure

4.1 Turn on the backseat relay.

NOTE: The relay performs a self calibration of each phase zero while it is in the PREREQ and STOPPED states. If any voltage 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. For purposes of this procedure, inputs are jumper shorted to properly establish zero.

4.2 Connect shorting jumpers red to black for each phase input.

4.3 Enable the Calibrate menu:

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

4.3.2 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.

4.4 (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.

4.5 Press SETUP until Phase A Zero screen appears. Verify all four readings are 511 (505 to 517). Record on Data Sheet.

NOTE: The screen shows four numbers. The first three are the average analog/digital (A/D) converter 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. If value is out of range, first verify shorted inputs (step 4.2); otherwise, a hardware problem may be suspected. There is no calibration adjustment for zero in firmware versions 3.x.

4.6 Press SETUP to obtain the Phase B Zero screen. Verify all four readings are 511 (505 to 517). Record on Data Sheet

4.7 Press SETUP to obtain the Phase C Zero screen. Verify all four readings are 511 (505 to 517). Record on Data Sheet

4.8 Press SETUP to obtain the Phase A Gain screen.

NOTE: The screen displays three values: amps, range (0, 1, or 2), and gain adjustment (1000 is nominal). The gain adjustment reading is informational and may be disregarded.

4.9 Remove jumper and connect the 0-1 VDC source, with the DMM (DC Volts range) in parallel, 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 22 amps and switching to range 2 at about 220 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.

4.10 Adjust source until DMM voltage measures approximately 20 millivolts with range 0 showing. If the range shows 1, decrease input to show range 0.

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

NOTE: Input sensitivity is 1 mV/A. In actual usage, the current probe typically has a sensitivity of 10 mV/A; thus, the currents displayed here will be 10 times the field readings using a 10 mV/A probe.

4.12 Adjust source until DMM voltage measures approximately 200 millivolts with range 1 showing. If the range shows 2, decrease input to show range 2.

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

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

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

4.16 Disconnect source and reinstall jumper.

4.17 Repeat steps 4.8 through 4.16 for Phase B

4.18 Repeat steps 4.8 through 4.16 for Phase C

NOTE: If you cycle past the Phase Gain screens before completing gain calibrations, press STOP, place jumpers on all inputs, and Repeat steps 4.8 through 4.16 as needed. See note at step 4.2.

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

4.20 Press SETUP until the *Motor Start From* screen is reached. Select B-Control Panel.

4.21 Press STOP.

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

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

4.24 Press STOP.

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

4.26 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).

4.27 Turn off relay and disconnect test equipment.

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

5. Firmware Update

Firmware 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

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

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

5.3 Turn relay off.

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

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

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

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

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

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

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

5.11 The SD card may now be removed.

6. 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:

1 x [+]	1 x [-]	Standard (default menu) Op Trip, Delay, Max Trip, Probe Type (DC), Probe, Probe Zero (DC) Year, Month, Day, Hour, Min (if not previously set)
1 x [+]	3 x [-]	Advanced Op Trip, Delay, Max Trip, Probe Type (DC), Probe, Probe Zero (DC) 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, Probe Type (DC), Probe, Probe Zero (DC) 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.

7. Revisions

Rev 1, 10/17/2023 Added note at step 4.11

Rev 2, 12/2/2023 Revise step 4.5 note. Revised Zero table in datasheet.

MOV Backseat Relay
201602-DC with firmware version 3.x
Data Sheet

Serial _____

Firmware Version _____

Zero, ADC counts (no adjustment possible)

	Required 511 (505 to 517)			
	Range 0	Range 1	Range 2	Live
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.

Camp Creek Technologies, Inc.
619 Camp Creek Rd,
Iron Station, NC 28080

Telephone (704) 748-2353
support@campcreektech.com