MOV Backseat Relay
Model and Version History

This document provides a consolidated summary of the versions of the MOV Backseat Relay, along with comments describing the reasons for some changes. It may be used to determine if specific relays should be updated prior to use. Only versions that were supplied to customers are listed below, along with changes since the previous release. Significant changes that may affect operation are listed. For additional specifications, refer to User Manuals applicable to a specific version, available at https://campcreektech.com/mov.html.

In general, update to version 3.1.2 is recommended.

Model 201602, Version 1.4, 8/7/2017

A prototype of the relay was supplied to Kalsi Engineering for evaluation. Firmware version 1.4 was the final validated with an SMB-00 actuator for the BWROG VTRG. Specifications for this relay included:

- Single range input for 3 phase AC MOVs up to 35 Amps
- No data logging capability

Model 201602, Version 2.0, 3/2/2018

The first production version included a membrane keyboard and three input ranges to allow use with motor currents up to 1000 Amps.

Model 201602, Version 2.1, 5/4/2018

- Sample Filter moved to standard settings menu
- Add threshold setting to advanced settings menu
- Add phase balance compensation
- Allow change of menu level when in stopped state
- Deleted the save changes menu item. Changes are saved automatically.
- Add lost phase test during delay state.
- Add data logging to Micro SD card

Model 201602, Version 2.2, 5/29/2019

This was the first version supplied with a bootloader which allows firmware update in the field using the SD memory card.

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- Auto zero eliminated in favor of fixed calibration
- Time/date update now prompted in standard menu after battery replacement
- Added bootloader to allow firmware update from SD card

Model 201602, Version 2.2.1, 6/18/2019

- Adjusted some internal gain settings, not significant

Model 201602, Version 2.3, 6/20/2019

- Restored auto zero, using improved algorithm for all 3 ranges

Model 201602, Version 2.4, 9/1/2019

A training session using a valve was done at Calvert Cliffs using relays supplied with version 2.3. Some issues were found and other suggestions for improvement were made. These changes were implemented in version 2.4.

- Logged run data points now viewable on display
- Added setup selection of AC current probes with various sensitivities
- Lost phase trip is now independent of threshold setting
- Fixed bug that prevented display update when logging to SD card in diagnostic mode (this did not affect trip functionality)
- Fixed bug in Phase Balance option that could affect calibration

Model 201602, Version 2.4.1, 3/12/2023

A training session using a valve was done at Limerick using a relay updated to version 2.4. These changes were implemented in version 2.4.1.

- Perform scale changes at end of peak instead of end of delay, to preventing glitches that could give spurious trip

Models 201602-DC, 201602-AC, Version 3.0, 12/8/2021

The BWROG VTRG requested Kalsi Engineering to come up with a similar backseat method for DC valve motors.

A major firmware update was made to allow the relay to be used with AC or DC valves. New model designations were made, 201602-AC and 201602-DC to differentiate between configurations. The AC model contains a 1 ohm shunt resistor on each phase input for use with transformer type AC probes, same as on the earlier 201602 models. The 201602-DC model replaces the shunt resistors with protection diodes. This allows the use of Hall Effect AC/DC current probes for DC and small AC motors. A factory setting configures display for AC or DC.

Model 201602-DC version 3.0 was tested by Kalsi Engineering on a DC MOV.

A major difference between 3.X and 2.X versions is the method of sampling incoming probe signals. 2.X uses a summation of voltages with filtering while 3.X uses an RMS calculation over ½ or 1 cycle. See https://campcreektech.com/201602/TB201602-1r1.pdf for a discussion of the methods.

If settings for a particular MOV have been established under version 2.X, they should be reviewed before use with 3.X. The RMS calculation provides more effective ripple and noise filtering than 2.X, thus increasing the margin between operating current and trip current. The operating trip setpoint may need to be reduced slightly to provide a trip at the expected torque.

Summary of changes:

- Signal processing algorithm changed to RMS calculation over 1/2 cycle. This improves noise margin and allows operation with one, two, or three probes on a 3 phase AC motor.
- Deleted loss of phase trip
- Deleted phase compensation option
- Changed sequence and wording of some setup menu items
- Provides ability to control DC MOVs. This requires a hardware change

Models 201602-DC, 201602-AC, Version 3.1, 2/27/2022

Additional testing by Kalsi identified some issues with 3.0.

- Add failed probe trip to protect against disconnected or failed probe
- Improved calculation of inrush peak for logging
- Added Motor Start From menu option to allow motor start from remote panel

Models 201602-DC, 201602-AC, Version 3.1.1, 2/27/2022

- Update RMS calculation to full cycle instead of 1/2. This reduces 60 Hz AC ripple caused by any relay DC offset.

Models 201602-DC, 201602-AC, Version 3.1.2, 3/16/2023

A training session using an AC valve was done at Limerick using a relay updated to version 3.1.1. These changes were implemented in version 3.1.2.

- Fixed bug preventing scale change to increase resolution at low currents
- Perform scale changes at end of peak instead of end of delay, to preventing glitches that could give spurious trip
- Fixed bug incorrectly reporting surge peak duration in log file for long delays

Models 201602-DC, 201602-AC, Version 3.2, 10/17/2023

Continued testing at Limerick with and AC valve identified additional issues. Other enhancements were also made.

- Provisions for soft start or VFD motor starter
- Add option to disable maximum current trip
- Eliminate upper limit of noise filter
- Extend failed probe test timeout to specified inrush time
- Add Standby Time readout and logging
- Add log entries for Operate MOV Clicked and Current Detected
- Logged time starts with 0 when Operate MOV Clicked

Model 201602-ACDC, Version 4.0

Due to supply chain issues, a revision to the circuitry was needed for use with a different microprocessor and display. This provided the opportunity to design for use with both AC and DC MOVs in one relay by including a switched shunt resistor on the input.

- Revised hardware supports both AC and DC motors, depending on probes
- Signal input conversion increased from 10 bits to 12 bits for better resolution
- Add menu item to select AC or AC/DC probe
- Automatic detection of which phases have probe connected
- Delete probe sensitivity options menu. Standard sensitivity is 1 mA/A (AC) and 10 mV/A (AC/DC). The AC/DC probe should be used with small AC valves for best results.

- Delete key codes to select advanced menu display. Now the advanced menu screens show following a PREREQ Complete notification screen.

Firmware update from 2.X or 3.X to 4.0 is not possible due to incompatibility of hardware.

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