General Guidance, Secondary Injection

The following details the procedure for basic secondary injection to determine and verify the correct operation of the Motorvision2, the procedure therefore is applicable to all Vision relays.

There is no general requirement for an annual maintenance/calibration check due to continual self-check procedures internal to the unit. It is however always constructive to perform some form of injection during commissioning to familiarise oneself with the Motorvision2s protective functions and overall operation, as well as fulfilling necessary Site Acceptance Tests. The following is intended as a guide to assist site or commissioning engineers and to provide a method trouble-shooting if ever required.

Equipment

Single phase or three phase current generator, variable 0-50Amps.
Clamp or suitably rated DMM.

Note: A current generator of lesser output can be used, but this may limit the ability of performing overcurrent tests.

The following figure illustrates a typical test circuit for use with the Motorvision2.
### Testing

Before carrying out overcurrent injection tests it is always worth confirming that the digital inputs and output relays operate as expected, this can save a lot of time later on when it appears that a function fails to work correctly.

The Motorvision2 has a wide ranging power supply, the supply can be anywhere from 80-265VAC and 80-265VDC. The digital inputs (dig_in) also need a live(+) and neutral(-) control supply, either in parallel with the Aux Supply or from a separate source, the only requirement is that the control live is in phase and voltage level with the dig_in signals. In the case of the 3000 or the MR relays, the digital input live is derived directly from the live supply of the auxiliary source.

### To ensure the correct operation of digital inputs:

The digital inputs can be viewed in the following page:

> Data Menu  > Measured Values  > Digital Values

The status of each dig_in can be checked by energising the appropriate signal for each dig_in. The status of a digital input is illustrated using a “bit box”. A shaded “bit box” indicates an energised input. It is recommended that the operation of all digital inputs be verified. For all de-energised input channels the “bit box” will not be shaded. Confirm the integrity of all digital inputs by applying a signal to the digital input and ensuring the “bit box” changes state on the Motorvision2 screen.

### To ensure correct operation of output relays:

Use a DMM (Digital Multi meter) to check the continuity between terminals on the output relays at the rear of the Motorvision2. When the output relays are de-energised continuity should be between terminals 20&21, 23&24, 26&27, 29&30.

You may also check the physical operation of the output relays by toggling the state. If you have the output relays connected to a series of lamps ensure the lamps illuminate on energisation of the relay.

The output relays may be toggled in the following page:

> Settings Menu   > System Settings   > Unit Settings   > Calibration > O/p Relay Tests

Note: The password will be required to access the Calibration Sub Menu. Default password is “6363”. Highlight the appropriate output relay using the “UP” and “DOWN” buttons and press the “TOGGLE” button to change its state.

Note: Only 4 output relays are available on the Motorvision2 although 8 are displayed for special orders.

To ensure the correct operation of output relays the user may also set the Starter type to “DOL” and program all programmable relays to “Follow A”. This may be performed using the following page:

**To set the Starter Type to DOL**:

> Settings Menu   > Control Settings   > Starter Settings > Highlight “Starter” and press the “SELECT” button> select “DOL” in the “pop up option screen” and press “SAVE”.

**Set all programmable output relays to “Follow A”**

> Settings Menu   > Control Settings   > Relay Outputs > Assign “Follow A” function to output relays 2, 3 and 4 in the “pop up option screen”.

**Ensure the front panel has been configured as a valid source for control commands.**

> Settings Menu   > Control Settings   > Starter Settings > Start Setup Sources and ensure a tick (✓) has been placed below “panel” for each configuration of the Local “L”/Remote “R” and Auto “A”/Manual “M” or just for the current configuration of these switches.

Test the transition of all output relays using the following page:

> Drive Control   > Operate > press the “RUN” button.

All relay outputs should have changed state, continuity should now be across terminals 19&20, 22&23, 25&26, 28&29 on the rear of the unit.
For the following current injection tests, terminals 44&45 and 46&47 should be connected to link the internal CT’s together if using a single phase kit. Terminals 43 and 48 are connected [via the DMM] to the injection unit. A further link between 43&42 can be used if Earth Current testing is desired. If a timer function is available on the injection equipment set Relay 2, 3 or 4 of the MV2 to trip and connect the timer to terminals 25&26.

To set Relays 2, 3 and 4 to Trip:
>Settings Menu >Control Settings >Relay Outputs >Assign “Trip” function to output relays 2, 3 and 4 in the “pop up option screen”.

Note: Consideration must be given when injecting any device with current, continuous overcurrent conditions can cause permanent damage. Do not attempt to inject in excess of 10x the rated current at any time.

The internal CT’s are rated in several variations 1A, 2A, 5A, 10 and 15A. 1A and 5A rated devices are by far the more common.

A Hall Effect Sensor MV2 is also available, injection must be made via the Sensor and not directly to the Motorvision2. To achieve currents above the scope of the supply equipment the HES may be multiple wound to the desired effect i.e., HES rated at 100A, can be double wound with a injection current of 50A. Beware that errors in these circumstances will also be doubled. i.e., a 5% variation is equivalent to a 10% variation.

The following instructions assume the Motorvision2 to have 1A internal CT’s.

Therefore:
Where In = CT Primary,
Injecting 1A = In.

Inject 1A into the unit, all three phases should show balanced current at the value of In (CT primary setting on the Motorvision2), if the Full Load Current “FLC” setting is less than the “CT Primary” setting then ‘Thermal’ will be displayed on the screen with a countdown to trip.

If the phases are not balanced, ensure wiring is correct and contact P&B or your local distributor for assistance.
Testing Protection Features: The following procedures outline methods of testing several of the primary protection features.

**Overcurrent**
The overcurrent protection is not enabled until the Motorvision2 has considered the Motor to be “Running”. The energisation of the “TEST” digital input removes the starting sequence therefore allowing immediate overcurrent protection for test purposes.

If the unit is not in “TEST” then the relay will more than likely trip on Thermal protection.

**To test the Overcurrent protection feature:**
Set Overcurrent Characteristics to: Function=Enabled, set to Trip, set to Panel Reset, trip level 150%, trip time 2s. Configure a digital input channel as TEST.

If the “TEST” digital input has been configured energise this input and press the “RUN” button to simulate a motor running without having to complete a starting sequence. Inject in excess of 150% of the motor Full Load Current Setting with respect to the secondary side of the current transformer. For example If motor Full Load Current = 100A and the relay has a CT primary setting of 100A, inject above 1.5A (~2A). The screen should display an “Overcurrent/Stall” warning with a count down timer and trip on expiry of the timer.

To reset the fault condition stop injecting current and press the “Reset” button.

If the “TEST” digital input has not been configured the user will have to inject current >105% FLC (with respect to CT secondary) then lower this injected current to or below 100%FLC (with respect to CT Secondary) to allow the Motorvision II to consider the motor “Running”.

**Short Circuit**
Note: “Test” digital input not required.
Short circuit protection offers a very fast trip time for large current faults. (<100ms)
Set Short Circuit Characteristics to: Function=Enabled, Panel Reset.
Press the “RUN” button to simulate a motor starting. Inject 10A and the MV2 should trip and display “Short Circuit” on the “Active Faults” page.

To reset the fault condition stop injecting current and press the “Reset” button.

If, due to the setting of the injection equipment the MV2 trips on Thermal and not Short Circuit as expected it may be an idea to set the t6x to its maximum in the Thermal Model settings, hence moving the thermal characteristics curve away from this fault current level.

**Earth Fault**
Note: “TEST” digital input not required.

**To test the Earth Fault protection feature:**
Set Earth Fault Characteristics to: Function=Enabled, set to Trip, set to Panel Reset, trip level 10%, trip time 2s.

Press the “RUN” button to simulate a motor starting. Inject more than 10% of the Earth Fault CT primary setting with respect to the CT secondary directly to terminals 41&42 and the Motorvision2 should display “Earth Fault” with a countdown timer. The relay will trip on expiry of this timer. For example if the Earth Fault CT primary setting is 100A, inject >100mA to test this feature. To reset the fault condition stop injecting current and press the “Reset” button.

**Thermal Protection**
Thermal protection is the primary protection function and can not be turned off. The curve formula is quite complex but can be tested in a very simple way.

In order to test the thermal protection then current injection of 6x FLC is required. From 0% thermal capacity to 100% thermal capacity (and trip) we can assume that the t6x setting is directly equivalent to a trip time in seconds.

Example.

\[ t6x = 10 \]
\[ FLC=78 \text{ (or 0.78 for a 1A in relay)} \]
H/C & CTF settings are not relevant during this form of test.

⚠️ For this test to work correctly the thermal capacity must be 0% prior to injection
To reset enter >Settings Menu >Unit Settings >press “Reset TC” and enter password.

Inject 4.68A (6x 0.78A) in all three phases. The relay will display “Thermal Trip in …” and begin to count down to 0s. The relay does not need to be in running mode or in test mode.

The recorded trip time will be 10s.
Remove the current and press reset. To repeat the test, Reset TC must be selected before current injection, this will force the thermal capacity to 0%. Otherwise the trip time will be shorter than 10 seconds and is a product of the remaining thermal capacity.

If t6x=20

The trip time using the method above will be 20s.