Introduction to the test protocol for the Hedén Carat system

Requirements for running the test protocol:

- a test rig or camera lens with fixed end stops to mount the motor
- a PC-computer with the Hedén GUI installed
- A voltmeter with a Run/Stop adapter cable.

Alternatively, lacking the possibility to test the system on a test rig or camera lens, it is possible to have the motor and equipment laying on a worksurface and manually calibrate end stops by stopping the motor by hand. This has several disadvantages such as not being able to detect potentiometer calibration issues and a risk, not to be taken lightly, of getting injured/pinched by the motor when it speeds to the control knob position after calibration. It is very advantageous to have set end stops and a marked scale to judge how well the system performs. A known issue only detectable when used on a lens/test rig is when the system fails to reach the infinity mark after successful calibration. This requires a “soft” recalibration of the potentiometer in the GUI (no adjustments of screws).

A PC-computer with the Hedén GUI is sometimes required to judge whether the potentiometer is functioning properly, testing the AUX channel, to calibrate the potentiometer, turning on and of vibrators and selecting the appropriate motor type and encoder, if different motors are used. Not using the GUI for testing the potentiometer means that you have to rely on detecting issues by sight. As potentiometer issues can be intermittent and movements caused by issues can be very small, using the GUI is highly recommended.

Lacking a voltmeter with a Run/Stop adapter cable, a suitable camera can be used to test the Run/Stop function. The disadvantage is in the difficulty in detecting issues before damage is done. Using a voltmeter, it is possible to detect differences in output between uses, thus finding out if there has been a shortcut or other issue damaging the internals and the run/stop function. It is theoretically possible to get a signal through damaged cables, but using a unit damaged like this is inadvisable.

We recommend you follow the full testing protocol. If the test rig and PC is located together the whole test should take no longer than 2-5 minutes when the steps are more familiar. This is the most safe way to detect and prevent costly issues at an early stage, and to determine when and how damage has occurred.
In the event that it is not possible to conduct the full test we have included a shortened version. This test should detect the most basic problems but has its limitations. Feel free to add the stages that is possible to perform at your location and build your own procedure. If you discover any issues when using the shortened version, we recommend examining the affected part of the system using the methods in the full test protocol.

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Test protocol for the Hedén Carat system

1	Check all exterior parts for damage	⚠ -Check Transmitter, Receiver, Motor and accessories[1]
2	Check the resistance in the control knob	⚠ -Too loose is a sign of possible damage and need of recalibration
3	Mount the system on your test rig/lens	⚠ - Don't connect the motor gear[2]
4	Connect the transmitter to a PC and start the transmitter	
5	Start the Hedén GUI	⚠ - Make sure the appropriate motor is selected[3] - Check general parameters - Check for potentiometer drift or jumps at the potentiometer calibration tab
6	Camera Run - Connect the CR-test cable to the CR-connector - The multimeter should show ≈ 0V - Turn on camera run on the transmitter - The multimeter should show = 3.4V[4]	
7	Canon/Fujinon[5] - Temporarily select Canon in the option "External lens config." - the LED on the receiver should turn pink - Re-select the Fujinon option - The LED should return to blue	
8	Connect the motor gear and calibrate end stops	
9	Check that the motor reaches both calibrated end stops	⚠ -Test multiple times
10	Test the Knob limits function	⚠ -Is the vibrator activated at the limits?
11	Test the Lens limit function	
12	Check for play issues, potentiometer drift or any un-smooth operation	
13	Test Bluetooth range	⚠ -Minimum 12 meters[6]

Appendix

1) **Exterior examination**

On the Transmitter:

- Antenna, cracks or indentations
- Stickers (can show signs of tampering)
- Battery lid, cracks or indentations
- Control knob, loose or damaged
- Screwheads (can show signs of tampering)
- Battery cable, holes, splits or fraying
- Lanyard attachment, bent
- USB connector, damage or debris
- Connectors, alignment and condition
- General signs of drop damage

On the Receiver:

- Antenna, Cracks or indentations
- Threading on the back plate, condition (a screwed through backplate is usually cause of damage to the motherboard, direct or later at next use)
- Screwheads (can show signs of tampering)
- Button, alignment
- USB connector, damage or debris
- Connectors, alignment and condition
- General signs of drop damage

On the motor:

- General signs of drop damage (usually clearly visible on the gear assembly or around the screw holes in the end cap)
- Wear on the slot of the hub, deformities (can cause play between gear and hub)
- Connector, alignment, fixed in place, pins are not pushed in or damaged
- Small lock screws on gear assembly (located one on top in silver plate, two on each side), signs of tampering (will cause issues with tuning and longevity of motor)
- Gears, carrier pin is firmly in place and not damaged, carrier shaft is in 90-degree angle, gear has normal end even wear

Other equipment:

- Cables, any sign of damage, punctures, pinches, cuts, damaged connectors or damaged connector pins (damages can cause encoder failures on motor)
- Rod mount, correct operation and signs of damage

2) Some issues cases the motor to spin at maximum speed as soon as it is powered. Not connecting the gear to the test equipment protects both motor and test equipment.
3) Appropriate motors include:

- M26VE-**F**256 (notice the F)
- M26VE-**F**512 (notice the F)
- M21VE-L;
  256 -selected in the righthand menu
  512 -selected in the righthand menu
- M21VE-256 CAUTION: Short type motor
- M21VE-512 CAUTION: Short type motor

All other selections are no longer used. The motor parameters are optimized for each motor type and encoder. Selecting the wrong motor for the wrong encoder or motor type may result in the system showing ”motor error”, or decrease performance.

4) The value should show between 3.40 and 3.49
5) Older versions of the Carat system might not have this option or may only be compatible with one lens manufacturer. If the system is not compatible at all the option will not show. If the lens is only compatible with one manufacturer, de-selection will result in automatically re-selection of the original choice.
6) The Bluetooth module can broadcast up to approximately 12 meters with a faulty antenna. To detect a faulty antenna the distance needs to be greater than this.

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Short Version Test protocol for the Hedén Carat system

1	Check all exterior parts for damage, especially antennas, threading on receiver and signs of drop damage on the motor	⚠	-Check Transmitter, Receiver, Motor and accessories[1]
2	Check the resistance in the control knob	⚠	-Very loose is a sign of possible damage and need of recalibration
3	Connect motor and receiver and connect to power source, turn om transmitter		
4	Start automatic calibration and set enpoints by stoping the gear by hand or have the equipment mounted on a test rig with fixed end stops.	⚠	Risk of getting hurt as the motor rapidly goes back to control knob position after calibration. Watch your fingers.
5	Check for play issues, potentiometer drift or any un-smooth operation		

Appendix

Exterior examination

1) On the Transmitter:
    - Antenna, cracks or indentations
    - Stickers (can show signs of tampering)
    - Battery lid, cracks or indentations
    - Control knob, loose or damaged
    - Screwheads (can show signs of tampering)
    - Battery cable, holes, splits or fraying
    - Lanyard attachment, bent
    - USB connector, damage or debris
    - Connectors, alignment and condition
    - General signs of drop damage

    On the Receiver:
    - Antenna, Cracks or indentations
    - Threading on the back plate, condition (a screwed through backplate is usually cause of damage to the motherboard, direct or later at next use)
    - Screwheads (can show signs of tampering)
    - Button, alignment
    - USB connector, damage or debris
    - Connectors, alignment and condition
    - General signs of drop damage

    On the motor:
    - General signs of drop damage (usually clearly visible on the gear assembly or around the screw holes in the end cap)
    - Wear on the slot of the hub, deformities (can cause play between gear and hub)
    - Connector, alignment, fixed in place, pins are not pushed in or damaged
    - Small lock screws on gear assembly (located one on top in silver plate, two on each side), signs of tampering (will cause issues with tuning and longevity of motor)
    - Gears, carrier pin is firmly in place and not damaged, carrier shaft is in 90-degree angle, gear has normal and even wear

    Other equipment:
    - Cables, any sign of damage, punctures, pinches, cuts, damaged connectors or damaged connector pins (damages can cause encoder failures on motor)
    - Rod mount, correct operation and signs of damage