

Magic Lantern 0.2 for Canon 550D, firmware 1.0.9

User's Guide

<http://magiclantern.wikia.com/550D>

March 10, 2011

Magic Lantern is an open (GPL) framework for developing enhancements to the amazing Canon 5D Mark II and 550D/T2i digital SLRs. Magic Lantern is being [developed](#) by a small team, helped by a very enthusiastic and respectful [user community](#).

Initial version by [Trammell Hudson](#) (the author and lead of Magic Lantern project)

Main developer for 550D branch: [Alex](#)

Crypto tools and 550D/1.0.9 port by [Arm.Indy](#)

Code review and insights by [AJ](#)

Patches by [piersg](#), [nandoide](#), [stefano](#), [trho](#), [deti](#), [tapani](#), [phil](#)

Card tools by [Pel](#), [Zeno](#), [lichtjaar](#)

Cropmarks by [CameraRick](#), [Robert](#), [bwwd](#), [turbinicarpus](#)

Tutorials by [sawomedia](#), [Renny](#), [Jeremy](#), [Daniel](#), [Dod3032](#), [MediaUnlocked](#), [3615geek](#), [CineDigital.tv](#), [jeveuxdoncjevilm](#)

Thanks to all the users who [provided feedback](#) and [reported bugs](#)!

Special thanks for people who [donated](#) in order to help the development of Magic Lantern; your help is very much appreciated!

Also, thanks to the [CHDK team](#) and all the [contributors and donors for the 5D2 Magic Lantern](#)!

Magic Lantern is being developed by independent film makers in our spare time and at risk to our beloved cameras. We hope that it saves you time and aggravation on set, and we'd appreciate your support. You can help by [donating via PayPal](#), or through equipment donations. You can also [contact me \(Alex\) via email](#). Thanks!

[Donate](#)

Features

- Audio: [disable AGC](#) and digital filters, [audio meters](#), [manual audio controls](#), selectable [input source](#) (internal, internal+external, external stereo, [balanced](#)), [audio monitoring](#) via USB.
- Exposure helpers: [zebras](#), [false color](#), [histogram](#), [waveform](#), [spotmeter](#).
- Focus tools: [focus peaking](#), [focus graph](#), [trap focus](#), [rack focus](#), [follow focus](#), [focus stacking](#), [zoom in Face Detect mode](#).
- Movie helpers: [Bitrate control](#) (QScale or CBR), [custom AF algorithm](#), [movie logging](#) (Exif-like metadata), [auto-restart](#) after buffer overflow or 4 GB limit, [time remaining display](#), [clean LiveView display](#) without any overlays, [change movie position](#) on the mode dial.
- [Cropmark](#) images: user-editable overlays to assist framing and composition.
- Fine control for [ISO](#), [Shutter](#), [Kelvin white balance](#) and other [image settings](#).
- Remote release with [LCD face sensor](#) and [audio trigger](#), without extra hardware.
- Bracketing: [exposure bracketing](#), [focus stacking](#).
- Timelapse: [intervalometer](#) (for photos and movies), [silent pictures](#) without shutter actuation; integration with bracketing.
- Astro- and night photography: [bulb timer](#) for very long exposures (up to 8h).
- Info displays: [focus and DOF info](#), [CMOS temperature](#), [shutter count](#), [clock](#).
- For strobists: [flash exposure compensation](#) from -10 to +3 EV; auto-toggle [flash / no flash](#) (even pics without flash, odd pics with flash).
- Power management: [Turn off display](#) in LiveView mode; quickly adjust [LCD backlight level](#).
- Fun stuff: [slit-scan pictures](#).

Important notes

- If you have a bootable SD card and have the DISKBOOT flag set in the camera (which the installer does), and you do not have an AUTOEXEC.BIN file on the card the camera **WILL NOT BOOT!** It will hang and not wake up until the battery is removed.
- If you encounter a “locked up” camera, **quickly remove the battery**. Otherwise the ARM might be in a tight-loop and get very hot, very quickly. Your battery will run down and your LCD might show some discoloration.
- When in doubt, remove the battery and reboot.
- **And, remember that this software can damage or destroy your camera.**

Contents

Features	2
Important notes	2
FAQ	6
How do I erase all the images without removing ML?	6
How do I see shutter counter / CMOS temperature?	6
How do I get exposure times longer than 30 seconds?	6
How do I adjust ISO in smaller steps? And Kelvin white balance?	6
Why can't I set the ISO under 200?	6
Do I have to adjust ISO/shutter/aperture/WB from ML menu only?	6
Does ML eat batteries faster, or cause overheating?	6
How do I record more than 12 minutes?	6
Can I record more than 30 minutes / 4 GB continuously?	7
Why the audio is so quiet after disabling AGC?	7
Why does the camera take pictures when pressing the shutter half-way?	7
Can the intervalometer be more accurate?	7
My camera freezes and I have to remove the battery, or saves corrupted files. Why? .	7
Why feature X doesn't work properly?	7
Known issues	7
Keyboard shortcuts	8
Menu options	9
Audio	9
Audio Meters: ON / OFF / MovieOnly	9
Analog Gain (dB)	9
L-DigitalGain and R-DigitalGain (dB)	9
AGC: ON/OFF	9
DigitalFilters: ON/OFF	9
Input	10
Monitoring-USB: ON/OFF	10
Output volume (dB)	10
Loopback: ON/OFF	10
LiveV	11
Global Draw: ON/OFF	11
Histo/Wavefm: ON/Luma/RGB for histogram, OFF/Small/Large for waveform	11
Zebras: ON/OFF/NRec, lo_level..hi_level	11

False color	12
Cropmks(x/n)	12
Spotmeter: OFF / Percent / IRE	13
ClrScreen: OFF / HalfShutter / WhenIdle	13
Focus Peak: OFF/HDIF/MORE, threshold, color_mode	13
Focus Graph: ON/OFF	14
LiveView Zoom: x5 / x10 / :-)	14
Movie	14
Bit Rate: FW default / CBRe / QScale	14
Movie Restart: ON/OFF	15
Movie logging: ON/OFF	16
Movie AF: OFF/Hold/Cont	16
Start with LV: ON / Movie mode / All modes	17
MovieModeRemap: A-DEP / CA	17
DOF adjust: ON/OFF	17
Time Indicator: OFF / Elapsed / Remain.Card / Remain.4GB	17
Shoot	18
HDR Brack	18
Take a pic every X seconds / Record Y seconds, pause X seconds	19
Intervalometer: ON/OFF, Wait/NoWait	19
LCD Remote Shot: OFF/Near/Away/Wave	20
Audio RemoteShot: ON/OFF	20
Trap Focus: OFF/Hold/Cont.	20
Flash / No flash: ON/OFF	21
Silent Picture / Silent Pic HiRes / Silent Pic LongX / Slit-scan Pic	21
Bulb Timer: 1s...8h	22
Mirror Lockup: OFF / ON / Timer+Remote	22
Expo	23
ISO: 100-25600	23
WhiteBalance: 1700...10000	23
WBShift G/M: Green 0..9 / Magenta 0..9	23
Shutter: 1/30...1/4000	24
Aperture: f/1.2...f/45.0	24
Light Adjust: OFF/ALO strong/HTP	24
PictureStyle	24
Contrast/Saturation: -4..4	24
Flash AEcomp: -10..3 EV	24
Focus	25

Focus dir	25
Focus A	25
Rack Focus	25
Focus speed	25
Follow Focus: OFF / Manual / AutoLock	25
Run Stack focus	26
Focal Dist	26
Hyperfocal	26
DOF Near	26
DOF Far	26
How rack focus works	26
Debug	27
ForceDisplayOFF	27
Backlight Keys: ON/OFF	28
Big Clock: ON/OFF	28
Auto Burst PicQ: ON/OFF	28
Draw palette	28
Screenshot (10 s)	28
Dump dmlog	28
Spy prop/evt/mem	28
Extra info displays	29
Main shooting screen (outside LiveView)	29
MENU→DISP	29
LiveView	29
Power saving	30
Configuration file	31
Saving settings	31
Hidden settings	31

FAQ

How do I erase all the images without removing ML?

Canon menu (Play) → Erase images → All images on card.

Notes:

- This will not remove files created by ML (like *.LOG, *.422, *.SH). You will have to delete these files from PC.
- Formatting the card will remove ML from that card. If you did this, you will have to make the card bootable again and then copy ML files.

How do I see shutter counter / CMOS temperature?

MENU → DISP.

How do I get exposure times longer than 30 seconds?

Use [Bulb timer](#) together with [LCD remote shot](#), [audio trigger](#) or [intervalometer](#).

How do I adjust ISO in smaller steps? And Kelvin white balance?

These settings are in the [Expo](#) menu.

Why can't I set the ISO under 200?

Turn off HTP and read the camera manual.

Do I have to adjust ISO/shutter/aperture/WB from ML menu only?

No, you can adjust them both from ML menu or Canon user interface.

Note: when you use Kelvin WB, the WB icon from Canon menu will not be displayed, but it works (you can change it).

Does ML eat batteries faster, or cause overheating?

Yes and no, depending on what features you have enabled. For example, focus peaking, false colors, waveform, zebras (and maybe others) are CPU hungry. It can even reduce power consumption by turning off the LCD screen, or by letting you change the backlight level quickly. See [Power saving](#) for details.

How do I record more than 12 minutes?

There's no 12 minute limit. There's a 30 minute limit and a 4 GB limit, whichever comes first. You can either lower the [bitrate](#) or use [Movie restart](#).

Can I record more than 30 minutes / 4 GB continuously?

You can use [Movie Restart](#), but you will lose a few seconds when a new file is created.

Why the audio is so quiet after disabling AGC?

You have to adjust the volume manually, the camera won't do it for you any more :)

Why does the camera take pictures when pressing the shutter half-way?

[Trap focus](#) may be active.

Can the intervalometer be more accurate?

Select the NoWait mode and it will be as accurate as the camera's realtime clock.

My camera freezes and I have to remove the battery, or saves corrupted files. Why?

You may have an unstable build of ML. Upgrade to the latest one; if you still have problems, [report an issue](#).

Why feature X doesn't work properly?

- Read the manual. In many cases you will find the solution.
- Try upgrading to the latest build. In some cases, downgrading to an earlier build will also help.
- Search the [Vimeo ML user group](#), the [issue tracker](#) and the [mailing list](#).
- If you still have problems, [report an issue](#) (if you've found a bug) or ask on the forums.

Known issues

- First second of recorded audio may be very loud
- Certain actions may clear the 16:9 bars in Movie mode. A workaround is to use a crop-mark which has those bars.
- Stack focus only works in Live View, after going through Play mode first. Sometimes, rack & stack focus simply refuse to work, and you need to restart your camera.
- After closing ML menu, screen may not redraw automatically (half-press the shutter or press MENU to trigger a redraw)
- Sometimes the menu gets overwritten by Canon's drawing routines, or flickers.
- Camera may become unstable if you change modes while ML menu is active.

- External monitors are not yet fully supported (some functions may not work / display correctly). It is recommended to use a cropmark image.

The following functions are known not to work with external displays:

- Histogram
- Waveform
- False color
- Spotmeter
- Auto ISO / Shutter / Kelvin
- ML displays may be shifted (menu not centered)

Keyboard shortcuts

These buttons have special meaning with Magic Lantern:

- Half-shutter press in virtually any Canon dialog window/box will **activate** the current selection. This helps you change settings faster in photo mode. It works by emulating a SET button press when GUI_STATE property is equal to PLAYMENU, which includes dialogs like WB, AF, pic style, pic quality, Canon menu and submenus and others. To restore default firmware behavior (i.e. **cancel** the current selection on half-shutter press), disable [set.on.halfshutter](#).
- Zoom In button works right after you take a picture, which is done by going to PLAY mode instead of Quick Review. For this to work, set Image review: Hold in Canon menu. To restore default behavior, disable [quick.review.allow.zoom](#).
- Zoom In and Zoom Out are faster in Play mode (while zooming on an image), compared to standard firmware.
- DISP in LiveView has 3 extra display modes specific to ML, which are fully customizable from [LiveV](#) menu. Each display mode has its own set of LiveV settings.
- LCD sensor (not really a button, but can be used as one): see [LCD Remote Shot](#).
- LCD sensor + UP / DOWN: see [Backlight Keys](#) (adjust LCD backlight level).
- LCD sensor + Arrows: see [Follow Focus](#).
- LCD sensor + aperture change in LiveView: [DOF adjust](#) (changes aperture and ISO while keeping the same exposure).
- Flash / DOF preview: see [False color](#).
- Flash + UP / DOWN in Movie mode: adjust [audio](#) gain.
- Half-shutter / *: see [ClrScreen](#), [Trap Focus](#), [Silent Picture](#), [Movie AF](#), [Rack focus](#), [Bulb timer](#).
- MENU while recording will clear the screen and force a redraw of ML elements.
- SET in LiveView: center AF area (the little rectangle).
- MENU → DISP: display extra info like [shutter count](#) and [CMOS temperature](#).

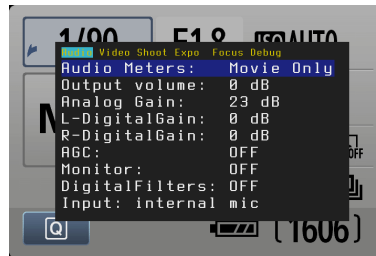
- ERASE: display Magic Lantern menu.
- Arrows, SET, DISP/PLAY, Q: ML menu navigation (see below).

Menu options

Press ERASE button to show the menu. Use arrows to navigate, SET to change values forwards and DISP to change values backwards. Some options may also use the Q button, or may have a different meaning for DISP.

For one-handed navigation in ML menu, PLAY is the same as DISP.

Audio



[Video: Ryan's T2i Tips and Reviews - Onboard Mic vs. ATR-3350 Lav vs Rode VideoMic](#)
Audio tweaks.

Audio Meters: ON / OFF / MovieOnly

Draw the audio meters or not. The Movie Only settings enables audio meters in movie mode only (default).

Analog Gain (dB)

Gain applied to both inputs in the analog domain - intended as mic-type preamp, but always preferable to digital gain (unless you want different gain or run out of analog).

L-DigitalGain and R-DigitalGain (dB)

Digital gain applied separately to the L and R channel.

AGC: ON/OFF

Enable/disable Automatic Gain Control. Turn this to OFF to prevent hiss noise when recording silence.

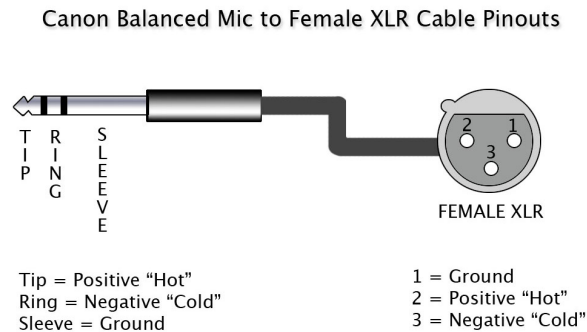
DigitalFilters: ON/OFF

Enable/disable digital audio filters (High Pass Filter, Low Pass Filter and stereo emphasis). Does it actually work?!

Input

Audio input source for recording:

- **internal mic**
- **int Left ext Right**
- **external stereo**
- **int Left ext Balanced** (internal Left + Right from both external pins as balanced audio)
- **Auto int/ext:** camera detects if a mic is plugged in. Int is dual mono, ext is stereo. Does not work with AudioMon builds.



"Balanced audio allows for very long cable runs without interference. Usually balanced mics have three pin XLR connectors and it is very easy to put together an XLR to Canon mic input cable. Balanced allows us to use such pro mics with our little Canons and this is a very welcome surprise for audio guys." ([source](#))

Monitoring-USB: ON/OFF

Audio monitoring with headphones, via USB port.

To use this feature, you may use a modified USB - RCA cable or a USB - jack adapter. See [here](#) for details. You have to plug the USB cable *after* ML is loaded.

When audio monitor is enabled, it will disable USB, HDMI and maybe other functions, so if you don't use this feature, leave it OFF.

To change this setting, a camera restart may be required; ML will tell you to do so if it's needed. This setting is saved as soon as you change it (so you don't have to save the config file before restarting).

Output volume (dB)

Volume for audio monitoring. It does not have effect on the internal camera speaker.

Loopback: ON/OFF

Enable loopback for audio monitoring. If this setting can be kept always on without any side effects, it will be removed from the menu (need feedback on this).

LiveV



LiveView overlays: histogram, zebras, cropmarks, spotmeter, focus peaking, false color...

Global Draw: ON/OFF

Enable/disable drawing extra graphics elements (zebra, cropmarks, histogram, waveform, false color, spotmeter, audio meters, ML shooting info...).



Tip: use this to quickly turn them off.

Histo/Wavefm: ON/Luma/RGB for histogram, OFF/Small/Large for waveform

Shows the distribution of image brightness levels with:

- a histogram plot (Luma or RGB, toggle with SET)
- a waveform plot (toggle with Q)

Zebras: ON/OFF/NRec, lo_level..hi_level

Enable/disable zebra stripes, which indicate overexposed  or underexposed  areas.

NRec setting: zebras are only displayed while not recording.

Keys:

- SET: toggle between ON/OFF/Auto
- DISP: change threshold for underexposure
- Q: change threshold for overexposure

Brightness values are between 0 and 255. A threshold equal to 0 will disable blue zebras, and 255 will disable red zebras.

False color

This is an aid for evaluating the exposure. See [this thread](#) for details.

- **Always ON:** self-explaining.
- **Hold Flas/DOF:** false color overlay will appear only when you press this key:
 - flash button in Movie mode
 - DOF preview button in Photo mode
- **Togg Flas/DOF:** false color appearance will be toggled by the shortcut keys above-mentioned.

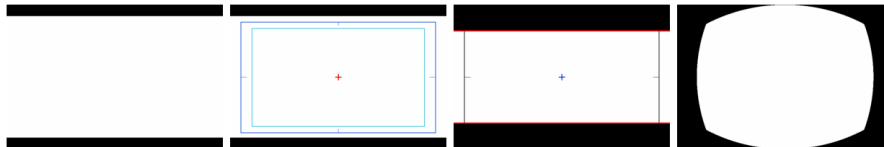
The implementation uses a half-resolution C code.

Cropmks(x/n)

Select cropmarks (cycle between them).

There are 4 predefined cropmarks in the zip archive:

- 16:9 black bars
- HD with Title & Action Safe
- Cinemascope
- Fisheye for stills framing with Samyang/8mm.



By default, cropmarks are displayed only in Movie mode. To display them in photo modes, disable [crop.movieonly](#).

If you use custom cropmarks, place them in CROPMKS folder on your SD card and give them short 8.3 names. The number in paranthesis Cropmks(x/n) shows the selected cropmark number and the number of detected cropmarks. You can place at most 9 cropmarks on the card.

An exclamation mark (!) displayed in the menu means there was an error loading the cropmark image.

Get more cropmarks created by Magic Lantern users [from the ML cropmark repository](#).

See [Cropmarks](#) for how to create custom cropmarks.

Tip: use Debug→Screenshot to get a bitmap with the correct palette.

Press Q to enable cropmarks in Playback mode.

Spotmeter: OFF / Percent / IRE

Measure brightness in the center of the frame, and display it as a percentage or IRE value.

Keys:

- SET: change display mode:
 - OFF
 - small square \square with text below
 - centered text only
- Q: change measurement unit:
 - Percent (0..100%)
 - IRE -1..101 (formula used by AJ, which maps 0-255 brightness levels to approx. -1..101 IRE)
 - IRE 0..108 (formula proposed by Piers, which maps 16-235 brightness levels to 7.5-100 IRE)

Note: when using low-contrast picture styles (like Marvels Cine or Superflat), the brightness might not reach the extreme values, even under strong under/over-exposure. This is OK.

ClrScreen: OFF / HalfShutter / WhenIdle

Clear image overlays from LiveView display.

- **HalfShutter:** Hold the shutter half-pressed, or the * button, or DOF preview for around 1 second, and this will clear all the overlays from the Live View display (audio, zebra, crops, shutter speeds...). It allows you to compose the picture without any extra distractions.
This works best when autofocus is assigned to the * button (from Custom Functions, set CFn.9 to 1: Shutter/AE lock button = AE lock/AF).
- **WhenIdle:** In this mode, all the overlays are erased from the screen (100% clean display) when the camera is idle.
The overlays (zebras & friends) will be back when you enter the Q menu or when you press the shutter half-way, and then disappear.

This function works by temporarily disabling the bitmap overlay. All the overlay graphics will be restored when the overlay is enabled again. To clear garbage left on the screen, press MENU twice (don't use ClrScreen for this).

Focus Peak: OFF/HDIF/MORE, threshold, color_mode

Experimental focus peaking.

See [Focus Assist](#) and [discussion thread](#).

- SET: toggle between available algorithms or turn the setting off

- HDIF: looks at difference between adjacent pixels. Detects horizontal edges only. It is fooled by high-contrast, out of focus edges.
- MORF: looks for fine detail lost by morphological opening and closing (which is a kind of blurring). It handles high-contrast OOF edges well, but is very sensitive to ISO noise.
- Q: adjust percentile threshold, between 0.1% and 5%.
- DISP: select color mode
 - one of R,G,B,C,M,Y (a single color)
 - cc1: color coding 1 (show edge detection threshold as color, a single color for the entire frame; warmer = higher)
 - cc2: color coding 2 (show edge strength as color for every pixel)

The implementation uses heavy downsampling to maintain speed.

Focus Graph: ON/OFF

Draws a small graph which shows the *amount* of focus in the AF frame (the little rectangle), over the last few seconds. Focus computation is done by Canon's autofocus algorithm.

Since the function which measures the amount of focus is heavily influenced by other factors (like contrast and exposure), ML attempts to normalize the value.

If you are focusing manually, try to position the lens such as you get a local maxima on the focus graph.

LiveView Zoom: x5 / x10 / :-)

Control the zoom feature in LiveView. Change x5/x10 settings with DISP and toggle :-) with SET.

- x5: only x5 zoom will be available (disables x10 zoom)
- x10: only x10 zoom will be available (disables x5 zoom)
- x5x10: both settings available (Canon default)
- :-) Enable zoom in Face Detection mode

Movie

Functions specific to movie mode.

Bit Rate: FW default / CBR / QScale

Controls H.264 bitrate used for video recording.

Modes:

- FW default: default bitrate used by Canon firmware (CBR, around 41mbps)
- CBR: constant bitrate, emulated. Range: 1...120mbps.

- QScale: constant quality, variable bitrate (VBR). Available values: -16..-1; +16. Lower numbers mean higher bitrates.

Keys:

- Change mode with SET
- Change numeric value with Q and DISP

Notes:

- There is a bitrate / QScale display near the red recording dot, updated every second.
- Slower cards will not handle high bitrates, and recording will stop automatically if you try to use them. This includes certain cards labeled as Class10.
- CBR mode (emulated CBR) is implemented as variable QScale, as follows:
 - QScale is adjusted in a simple feedback loop, based on bitrate estimation (sampled 5 times per second).
 - Bit rate will not be equal to the prescribed value, but it will oscillate around it. In certain cases (e.g. strong defocus→focus transitions) it will overshoot badly and stop recording. True CBR mode or a better control algorithm would fix this. Patches welcome :)
 - The feedback loop adjusts only local (instantaneous) bitrate, which means the video file may have different average bitrate than the one prescribed in the menu. This is normal. To adjust the bitrate over the entire video, a controller with integration component (e.g. PI) is required.
 - If the buffer becomes full, ML will temporarily lower the bitrate by 10mb/s.
- In QScale mode, bitrate varies a lot. Try not to use very high bitrates in this mode, because the chances of video stopping recording are very high.
- QScale can be changed during recording, but only by one unit (1) at a time. ML will take care of this.
- Since CBR is implemented as variable QScale, you can freely change between CBR and QScale during recording.
- It is not possible to change from non-QScale mode to QScale modes during recording (which means between FW default and the other settings). If you try to, the change will be applied only for the next video file, and CBR may stop working properly.

See [Bit rate](#) page for details.

Movie Restart: ON/OFF

While this setting is on, movie recording will restart automatically, unless stopped by you. There will be a few seconds skipped during restarting.

Movie logging: ON/OFF

If this setting is ON, Magic Lantern will write out a metadata file for the each movie to MVI_1234.LOG (numbered after the movie). The log file contains lens and exposure info, as well as a timestamp every time any of the parameters is changed during recording.

Log files are placed in the same folder as the movies: DCIM/100CANON/, 101CANON etc.

Tip: you can rename LOG files to CSV and import them in Excel.

Movie AF: OFF/Hold/Cont

Experimental autofocus in movie mode. It overrides the default autofocus algorithm.

Modes:

- **Hold:** AF only works when you press and hold the shutter halfway, or the * button. - If you press the Canon AF button (which is half-shutter or *, depending on your CFn.9 setting), the exposure will be changed during autofocus. - If you press the other button, the exposure will not change during AF, but the AF will be slower.
- **Cont:** AF works continuously. It will be faster when you hold the AF button.
- **CFPk:** a very experimental version which does not use Canon's focus estimation, but focus peaking data. It only uses the center area and computes the absolute value of edge strengths and divides by the image brightness.

Internals

To see how the algorithm works, disable [ClrScreen](#). You'll see:

- **NEAR/FAR:** the direction in which it's currently moving the lens.
- **percentage of focus change from last step.**
- **red bar:** current *focus step size*, between 0 and 64.
- **blue bar:** *target focus rate*, which is between 20% and 100% of the *aggressiveness* setting. It is used to adjust the focus step size.
- **mood**, which can be:
 - **!! (confused):** it doesn't know if it's going in the right way or not, because the focus change rate is too small. It will avoid changing the search direction until focus info becomes better. If you see it hunting in the wrong direction, a quick press of half-shutter or * will fix this. If you are holding the AF button pressed, de-press it and press it again to reverse the direction.
 - **:) (happy):** in this case, the focus change rate is high enough and the algorithm believes it's going in the correct direction (and will ignore any hints from you regarding this).

This is a modified gradient descent algorithm. It does not have global convergence, so in strong OOF situations it may not find focus. This can be solved with:

- Better math in the focus evaluation function, which should only have a local max at the perfect focus point. Current functions also have small local maxima in strong OOF regions (besides noise).
- Workarounds to avoid hunting (like the *mood* hack).

Tuning parameters (change with Q/DISP):

- A=1..64: maximum aggressiveness (maximum target % rate of change for focus magnitude).
- N=0..9: noise filter (for focus derivative).

Tip: get an external microphone and place it far away from the camera (AF is noisy)

Start with LV: ON / Movie mode / All modes

Force LiveView on startup. In movie mode, this only has effect if you use unchipped lenses. You can also force LiveView at startup in all modes.

MovieModeRemap: A-DEP / CA

Changes movie position on the mode dial. You can swap movie mode with either A-DEP or CA.

This seems to have some side effects (like not remembering Kelvin setting).

DOF adjust: ON/OFF

Enables a shortcut key for adjusting the DOF while maintaining the same exposure. This is done by changing aperture and ISO at the same time.

To adjust DOF, cover the LCD sensor and change the aperture.

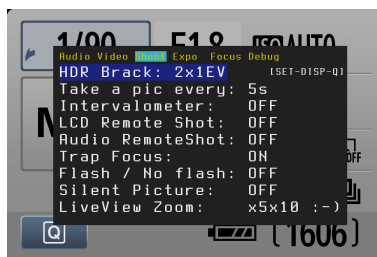
Time Indicator: OFF / Elapsed / Remain.Card / Remain.4GB

When recording a movie, ML will display a small time counter in the upper right corner, which can be:

- Elapsed: duration of the current clip
- Remain.Card: estimated amount of recording time remaining on the card.
- Remain.4GB: estimated amount of recording time until reaching 4GB (or until filling the card, whichever comes first).

Unlike Canon's timer which assumes constant bitrate, ML timer assumes variable bitrate and works even if QScale is enabled. However, due to variations in bitrate, the estimated value will fluctuate a lot, and this is normal.

Shoot



Functions for stills shooting (some of them work for movies, too).

HDR Brack

AE Bracketing for HDR images and timelapses.

Select number of images with SET and step size with DISP. To turn this off quickly, press Q.

In M mode, this function does shutter bracketing. In the other modes it does exposure compensation bracketing.

HDR images can be taken with:

- ML remote triggers: LCD face sensor & audio trigger.
- ML intervalometer (for HDR timelapse)
- Press the shutter. In this case, the first image will have the middle exposure (without EV compensation), and the 2-second self-timer will be used. Also, this mode only works with 3 images or more.

For best results, switch to manual focus.

For each HDR picture set, Magic Lantern also writes a bash script for stacking the exposures with [enfuse](#). The scripts are stored in DCIM/###CANON and are named after the first picture in set, e.g. if the HDR sequence is created from IMG_1001.JPG . . . IMG_1005.JPG, the HDR script will be named HDR_1001.SH and the resulting HDR image will be saved as HDR_1001.JPG.

To run the HDR scripts on the computer, move the scripts and the JPGs in the same directory and run (for example):

```
bash HDR_1001.SH
```

or, for processing all the images at once:

```
for f in $(ls *.SH); do bash $f ; done
```

On Windows, you can use Cygwin or MSYS to run the scripts.

Don't forget to delete the scripts from the card; the camera won't delete them!

Take a pic every X seconds / Record Y seconds, pause X seconds

Change the intervalometer settings (first setting appears in photo mode, second appears in movie mode).

There is also a mode named `Take pics like crazy`, which does exactly that. This is the best tool for killing your shutter.

Intervalometer: ON/OFF, Wait/NoWait

Video:T2i Timelapse

Start/stop intervalometer.

- In photo mode, it takes a sequence of photos with a fixed rate or delay (toggle with Q):
 - `Wait`: intervalometer waits until the picture is taken and saved to card, then starts counting the time for the next picture (default, fixed delay with 1-second resolution).
 - `NoWait`: timer for next shot starts as soon as current shot was triggered (it does not wait for exposure to finish, nor for picture to be saved). This ensures precise timing between shots (fixed rate). If the total time required for taking a picture is larger than the interval between two shots, it will miss some frames.

The `Wait/NoWait` setting has no effect in movie, [HDR](#) or [bulb timer](#) modes.

- In movie mode, it takes a sequence of small videos
 - When `HDR Bracket` is active, each movie will be exposed according to the bracketing settings, and the duration of the movie will be multiplied by number of exposures.
 - To use the intervalometer in movie mode, make sure [Silent Picture](#) is OFF.

You can stop the intervalometer either from ML menu, or by pressing MENU or PLAY. You can pause the intervalometer by holding the shutter halfway.

Tips:

- Shoot in manual mode and switch the lens to MF.
- To save the shutter count when doing timelapses, enable [Silent Picture](#) or use the intervalometer in Movie mode.
- Do not use the intervalometer in LiveView with “noisy” mode (otherwise your shutter will wear twice as fast than outside LV).
- If the intervalometer can’t be stopped (it may happen in crazy mode), turn the camera off or open the card door.

Power Saving:

- When not in LiveView, press DISP to turn the display off. You may also cover the LCD sensor with something.
- In LiveView, enable [Force display off](#) and disable [Global Draw](#). You also have to assign the focus on the * button (otherwise the screen will wake up). ML will NOT turn off the sensor.

- While the intervalometer is running, the card led will blink once per second to let you know it's alive and kicking.

Note: ML will emulate half-shutter presses every second to prevent the camera from entering stand-by mode. You have to make sure it won't autofocus.

LCD Remote Shot: OFF/Near/Away/Wave

Start/stop remote shutter release mode with the LCD sensor.

- ☒ **Near**: To take a picture, put your hand near the LCD sensor.
- ☉ **Away**: Picture is taken when you get your hand away from the sensor. You may combine this setting with [Mirror Lockup](#).
- ♫ **Wave**: Picture is taken after you wave your hand 3 times near the sensor. You can leave it on without interfering (too much) with normal shooting.

This is useful for avoiding camera shake without extra \$\$\$, especially if you don't have a sturdy tripod.

In Movie mode, the Wave ♫ setting is able to start and stop recording movies. The other modes can only start recording (because it's too easy to stop recording by mistake).

Audio RemoteShot: ON/OFF

Start/stop remote audio trigger. To take a picture (or start recording a movie), make some loud noise, for example, clap your hands or pop a balloon.

Audio threshold can be set from `magic.cfg` by changing `audio.release.level` (default 700), or by adjusting the [audio](#) gain.

You can also start movie recording with this feature.

In photo mode, you can combine this option with the self-timer (may be useful for group or self pictures).

Be careful: this may trigger the shutter from the sounds made by camera (like focus beep or liveview switch).

Trap Focus: OFF/Hold/Cont.

Takes a picture when the subject comes into focus.

Modes:

- **Hold**: You hold the shutter half-pressed; camera takes a picture when something comes into focus.
- **Cont.**: You don't have to hold the shutter half-pressed; ML will emulate half-shutter presses instead. This will disable some buttons (like MENU and PLAY), so turn it off from ML menu before doing anything else.

Trap focus works only when the lens is set to Manual focus (MF).

- Outside LiveView, it only works with lenses with chip.

- In LiveView it only works for photos, in HoId mode, and it will take a picture when the focus indicator has (almost) maximum value on the [focus graph](#).

Notes:

- You may have to turn the lens back and forth a few times in order to let ML compute the correct focus scaling for the current scene.
- If you move from a high-contrast scene to a low-contrast one, you will also have to wait a bit until the high-contrast data disappears from the focus graph.

To use Trap Focus in LiveView, make sure [focus graph](#) is ON and [silent pictures](#) are OFF.

Flash / No flash: ON/OFF

This will toggle flash setting (on/off) after each photo:

- Even pictures (by file number) will be taken without flash
- Odd pictures will be taken with flash

This function works only in P,A,S,M modes. The effect is somewhat similar to Fuji's Natural Light with Flash mode.

Don't forget to pop up the flash :)

Silent Picture / Silent Pic HiRes / Silent Pic LongX / Slit-scan Pic

This can take pictures in LiveView mode without moving the mirror. When enabled, it saves uncompressed YUV422 frames from the LiveView buffer when you press the shutter halfway.

- Make sure you don't have autofocus assigned to half-shutter press (put it on * or turn it off)

Modes:

- **Silent Picture**: simple, low-resolution. Image resolution is usually around 1 or 2 MPix, and depends on the current mode (zoom or not, recording or not, and movie resolution). [Details here](#).
- **Silent Pic Hi-Res**: emulates high-resolution by taking a matrix of small silent pics, in zoom x5 mode. You need to have the camera on a tripod and the scene should be almost stationary (a pic is taken in a few seconds). Useful for timelapse. Only works well with manual focus.
- **Silent Pic LongX**: **(does not work yet)** emulate a long exposure and/or a very low ISO, by stacking lots of simple silent pics. This may fail in high-resolution modes due to lack of memory.
- **Slit-scan Pic**: this takes distorted images [like these](#). This mode is basically an extreme jello effect which can be used in creative ways.

Keys:

- SET: toggle modes (normal or hi-res)
- DISP/Q: toggle between:

- Single/Burst in normal mode
- available matrix sizes (which give the image resolutions) in Hi-Res mode.
- exposure time (0.1s ... 8h) and image stacking method for luma channel (AVG or MAX) in long exposure mode. Chroma is always stacked with AVG.
- timing (number of clocks to skip after each line) in Slit-scan mode.

Silent picture setting is applied to [intervalometer](#) and [remote triggers](#) when used in LiveView mode.

Images are saved in DCIM/1xxCANON/ after the following rules:

- If intervalometer is OFF, silent pics are named after last picture/ movie taken without this function (e.g. 1234-001.422). You are limited to 1000 silent pictures for each “noisy” picture.
- If intervalometer is ON, silent pics have names like 12345678.422.
Tip: use File Numbering → Manual Reset from Canon menu to increase folder number (to sort them easier).

To convert a 422 image to JPEG on the PC, use [422-jpg.exe](#) (Windows and Wine) or [422-jpg.py](#) (all platforms, you need to install Python, PIL and numpy). Double-click it, then select a single 422 file, or click Cancel and select a folder with 422 files. You can also use this program in command-line.

TODO:

- avoid that horizontal cut in pictures (vsync doesn't help and there's not enough RAM to buffer an entire image)

Bulb Timer: 1s...8h

Very long exposures with Bulb mode and ML timer. Only works with remote triggers and intervalometer. You should select M mode and BULB setting from Canon UI before using this.

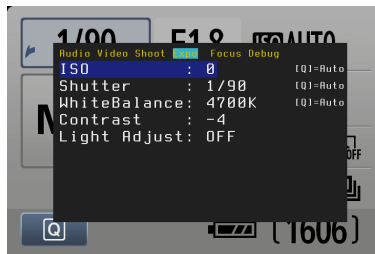
Tip: you can cancel the exposure earlier by half-pressing the shutter button.

Mirror Lockup: OFF / ON / Timer+Remote

Mirror Lockup. ML will always override this setting => you can't change it from Canon menu any more.

- OFF: always off
- ON: always on
- Timer+Remote: this will auto-enable MLU under one of the following conditions (and disable it otherwise):
 - self-timer mode is on (either 2 second or 10 second, but not continuous)
 - [LCD Remote Shot](#) is in Away mode.

Expo



Adjusting the exposure parameters. Most of these settings only work in Manual (photo and video), and some of them work in P, Av and Tv too.

ISO: 100-25600

Custom steps for ISO. Possible values:

0 (Auto), 100, 110, 115, 125, 140, 160, 170, 185, 200, 220, 235, 250, 280, 320, 350, 380, 400, 435, 470, 500, 580, 640, 700, 750, 800, 860, 930, 1000, 1100, 1250, 1400, 1500, 1600, 1750, 1900, 2000, 2250, 2500, 2750, 3000, 3200, 3500, 3750, 4000, 4500, 5000, 5500, 6000, 6400, 7200, 8000, 12800, 25600.

To get ISO values higher than 6400, turn on ISO Expansion from Custom Functions (CFn 1). To get ISO lower than 200, turn HTP off. In video mode, ISO only goes up to 6400. These is also true without ML.

To get only “round” ISO values, i.e. 100, 160, 200, 320, 400, 640, 800, 1250, 1600, 2500, 3200, 6400, 12800 and 25600, enable [iso.round.only](#) from [magic.cfg](#).

In manual exposure modes (photo and video), press the Q button on this entry to set the ISO value automatically.

- When LiveView is active, a binary search algorithm is used; the search criteria is a good balance between overexposure and underexposure; search resolution is 1/8EV. If the contrast is very low, the histogram will be centered.
- When LiveView is off, ISO is set using the Auto ISO feature from Canon firmware, in 1EV steps.

WhiteBalance: 1700...10000

Kelvin white balance.

In LiveView, press the Q button on this entry to set the WB temperature using the center color as reference gray. The measurement area is 200x200 pixels, centered.

WBShift G/M: Green 0..9 / Magenta 0..9

Green-Magenta white balance shift. Useful for fluorescent lighting.

Shutter: 1/30...1/4000

Custom steps for shutter speed. Possible values:

1/30, 33, 37, 40, 45, 50, 53, 57, 60, 67, 75, 80, 90, 100, 110, 115, 125, 135, 150, 160, 180, 200, 210, 235, 250, 275, 300, 320, 360, 400, 435, 470, 500, 550, 600, 640, 720, 800, 875, 925, 1000, 1100, 1200, 1250, 1400, 1600, 1750, 1900, 2000, 2150, 2300, 2500, 2800, 3200, 3500, 3750, 4000.

In manual exposure modes (photo and video), press the Q button on this entry to set the shutter value automatically.

- When LiveView is active, a binary search algorithm is used; the search criteria is a good balance between overexposure and underexposure; search resolution is 1/8EV. If the contrast is very low, the histogram will be centered.
- When LiveView is off, the shutter value is computed with the help of Auto ISO feature from Canon firmware, in 1EV steps. This feature is still experimental and sometimes it does not work.

Aperture: f/1.2...f/45.0

Adjust aperture.

Light Adjust: OFF/ALO strong/HTP

Select the light adjustment algorithm:

- OFF
- Auto Lighting Optimizer (strong)
- Highlight Tone Priority.

PictureStyle

Change picture style. You can see the effect on LiveView instantly.

Contrast/Saturation: -4..4

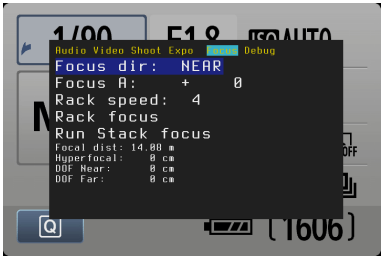
Adjusts the contrast and the saturation of the current picture style.

WARNING: this will modify your current picture style.

Flash AEcomp: -10..3 EV

Flash exposure compensation.

Focus



Video: Magic Lantern for Canon 550D - Rack Focus Tutorial

Focus dir

This is the direction the lens moves when pressing the camera's Zoom Out button to set the focus start and end points.

Focus A

This is end point of rack focus. To set, focus the lens with the Zoom Out button, then press "Set".

The start point will be the point where you are before selecting "Rack focus" in the menu.

Rack Focus

Triggers the rack focus operation that moves between the start and end focus points. After the move is complete pressing again reverses the move.

Focus speed

Adjust rack focus / follow focus speed, in focus steps.

Follow Focus: OFF / Manual / AutoLock

Very simple follow focus (like a rack focus controlled manually).

When this setting is enabled, it will change the default behavior of arrow keys. The default key assignment works well for Canon lenses and works according to the following table:

Key	Speed		Direction		
LEFT	slow	1x	far	+	↶
RIGHT	slow	1x	near	-	↷
UP	fast	5x	far	+	↵
DOWN	fast	5x	near	-	↴

You can reverse the direction for these keybindings:

- Press Q to reverse the direction for LEFT/RIGHT keys (slow speed)
- Press DISP to reverse the direction for UP/DOWN keys (fast speed)

To use the default behavior of the arrow keys (i.e. move the AF frame), cover the LCD sensor.

Modes:

- Manual: focus ring moves as long as you hold the key pressed.
- AutoLock: follow focus will stop automatically when a focus peak is detected in current AF frame (in a way similar to [Trap Focus](#)). Look at the [focus graph](#) to see when it's about to lock the focus. To focus past the peak point, de-press the button and press it again.

Tip: you can adjust [focus speed](#) (which is multiplied by the x from the table above).

Run Stack focus

This selection will shoot a series of photographs with varying focus points. You can also call this “focus bracketing”. It is used in macro photography to assemble sharper final images by merging photos where each has a different focus point.

To configure focus step and number of photos, use the hidden settings `focus.step` and `focus.count`.

The following items are display only:

Focal Dist

The distance to the focal point. Value is returned by most newer Canon lenses. If the lens does not report any distance information, 0 will be displayed and the DOF calculations will not be correct.

See also [Focus distance](#).

Hyperfocal

The hyperfocal distance is the point of focus where everything from half that distance to infinity falls within the depth of field. This is the largest depth of field possible for the current f-number.

DOF Near

The nearest distance in which objects appear in focus.

DOF Far

The farthest distance in which objects appear in focus.

How rack focus works

Now that you know what the buttons are about, here is how you make it work:

1. Pick the end point of rack focus by focusing on it (manually or with AF).
2. Open the Focus menu, go to Focus A and press Set to zero it out.
3. Pick the start point by focusing on it **from ML controls**. Do NOT use autofocus and do NOT focus manually from the lens ring.

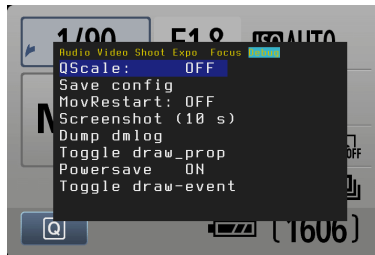
To focus the lens, make sure it is set on AF and use one of the following:

- Option 1: choose Focus dir and hold on the * button (Zoom Out) or Half Shutter while Focus menu is active.
 - Option 2: enable [Follow focus](#), close the focus menu and focus with the arrows.
4. Select the focus speed. The number varies between different lenses and represents raw encoder steps for the focus motor.
 5. Next, start movie recording (you can do that while ML menu is active).
 6. Go to Rack Focus and press SET to start rack focus. You should see the rack focus commence and complete its cycle.
 7. To return to the beginning point, you can press SET again to return to that point, once again.

Note: the rack focus command may “stutter” while racking with some lenses, causing overshoot or undershoot of the desired position. This feature is still under development and should be more mature in a later version.

See also the description from the [5D2 ML User Guide](#).

Debug



ForceDisplayOFF

This will turn off the LCD display while the camera is not expecting user input (i.e. when no menus are shown on the screen).

While the screen is off, the card led will blink once per 5 seconds to let you know the camera is alive and kicking. No card activity is actually taking place (just LED blinking).

See [Power saving](#) for more info.

Backlight Keys: ON/OFF

Enable quick adjustment of LCD backlight. To adjust it, hold the LCD sensor and press UP/DOWN.

Disabling this setting will restore the default behavior of UP/DOWN keys.

Big Clock: ON/OFF

This will display a little big clock.

Auto Burst PicQ: ON/OFF

When enabled, it will temporarily reduce picture quality in burst mode in order to maintain a decent frame rate even when the buffer becomes almost full.

This function will reduce picture quality in the following steps:

- RAW+JPG → RAW → JPG Large Fine → JPG Medium Fine
- JPG Large Coarse → JPG Medium Coarse

Draw palette

Tests the 8-bit bitmap palette, which is used for video overlays. See [VRAM](#).

Screenshot (10 s)

Print screen after 10 seconds. It it saves a BMP file for the overlays and a 422 file (silent picture) for the LiveView image. The BMP does not contain transparency data. You can combine the two files in GIMP or other image editing programs.

A small timer is displayed. After 5 seconds, it won't be updated any more (which lets you remove it from the screenshot by triggering a redraw).

Dump dmlog

Saves a log which contains DebugMsg output. See [Debugging Magic Lantern](#) page.

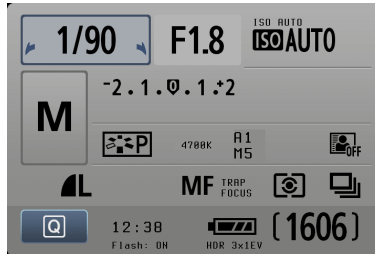
Spy prop/evt/mem

- prop: display property changes in real-time. See [Properties](#).
- evt: Display GUI events in real-time. See [GUI_Events/550D](#).
- mem: Display memory addresses which change, but not those which change like mad. Useful for detecting interesting addresses inside the camera RAM (like sensor & button locations).
Start address and size is selected with the hidden settings (from `magic.cfg`) `debug.mem-spy.*` (see `debug.c` for details). You can also display only "small" or "boolean" values.
Trying to spy the `camera_engine` addresses seems to cause trouble (camera freeze). Probably it's not safe to read data from those areas.

Some items from this menu may not be available in release builds; you can uncomment them from `debug.c` and create a custom `autoexec.bin`.

Extra info displays

Main shooting screen (outside LiveView)



- Clock (bottom of screen)
- ISO value in finer increments (above Canon's ISO display)
- Trap Focus status (near MF icon)
- Kelvin temperature (in the white balance box)
- WB shift values for BA and GM
- Flash setting (under clock)
- [HDR](#) setting (under battery icon)
- [MLU](#) setting (under Q icon)
- [LCD remote](#) status icon: ☒ ☐ ⌵

MENU→DISP

```
Shutter Count: 24574
CMOS Temperat: 158
Lens: EF50mm f/1.8 II
```

- Shutter counter. Only counts pictures taken, not LV switches or quick focus attempts.
- CMOS temp: temperature of the CMOS sensor (EFIC temperature), in raw units. Before, this was in the Debug menu.
- Lens name

This info also appears on error displays (e.g. ERR 70).

LiveView

- Bottom bar:
 - Current shooting mode
 - Aperture, [shutter](#), [ISO](#), [white balance](#)
 - Lens focal length and focus distance: see [Focus_distance](#)

- Exposure compensation (codenamed AE)
- In the middle of the screen:
 - [Spotmeter](#)
- Around the recording dot:
 - [Time remaining display](#)
 - [Bitrate](#) info (instant and average bitrate, and qscale factor)
- Left side:
 - Status for [trap focus](#) / [follow focus](#) / [movie AF](#).
- Top side:
 - [Audio meters](#) and audio input source for each channel
 - [LCD remote](#) status icon: ☒ ☉ ∞

Power saving

Magic Lantern can help you maximize battery life while shooting, which also results in reduced overheat.

You can:

- [Turn off display](#) in LiveView mode
- Turn off [Global Draw](#)
- Quickly adjust [LCD backlight level](#)

Power consumption in movie mode, idle, 24p (approximate figures derived from [this test](#)):

Item	Current (approx)
Camera body (without lens), LCD off	360 mA
Lens (Tamron 17-50/2.8)	20 mA
LCD backlight at level 1	40 mA
LCD backlight at level 7	100 mA
Magic Lantern with GlobalDraw off	around 10 mA
Zebras	around 15 mA
Focus peaking	maybe 25 mA (not tested)

Power consumption [varies with the frame rate](#). The following table shows the difference between video modes. The test was done on a 550d with ML, body cap only, movie standby, lcd brightness 4, default settings, i.e. no magic.cfg at startup.

NTSC		PAL	
Video mode	Current	Video mode	Current
1080 30p	480 mA	1080 25p	450 mA
1080 24p	440 mA	1080 24p	440 mA
720 60p	520 mA	720 50p	490 mA
480 60p	520 mA	480 50p	490 mA
crop 60p	430 mA	crop 50p	420 mA

According to [this message](#), by turning off Global Draw and LCD display, the camera will be able to record over 80 minutes continuously, without overheating (compared with around 30 minutes with default settings and 60 minutes without ML).

Configuration file

The configuration file (MAGIC.CFG) lets you tweak various hidden settings using a simple text editor (Notepad, gedit, vi...), and is also used to save Magic Lantern configuration from the GUI menu.

Saving settings

Settings are saved automatically to MAGIC.CFG when you turn off the camera, or when you open the card door.

Settings are NOT saved when you open the battery door.

Hidden settings

These settings can not be changed from the ML menu, so they are documented here:

```
# if set to 1, disable the bootdisk flag.
# This does the same thing as Debug→Autoboot menu item.
# Only for advanced users!!!
magic.disable_bootdiskf = 0

# Delay between clearing the overlay in Clear Preview mode
clear.preview.delay = 500

# Stack focus step size and frame count
focus.step = 100
focus.count = 5

# Threshold for audio trigger
audio.release.level = 700

# Delay between two sub-pics in hi-res silent pic mode
silent.pic.sweepdelay = 350

# Zebra density: 0, 1 or 2
zebra.density = 2
```

```
# Only select "round" ISO values in menu:
# 100,200,400,800,1600,3200,6400,12800,25600,
# 160,320,640,1250,2500.
iso.round.only = 1

# Emulate a SET press when you press the shutter half-way
# in photo dialogs and menu (so all dialogs like WB, self-timer,
# AF mode, flash setting etc. will behave like the ISO one)
#
# Set it on 0 to restore default firmware behavior
set.on.halfshutter = 1

# Allow zoom in Quick Review mode (only works when Image Review = Hold)
# This works by faking a Play button press after you take a pic.
# Side effect: some delay until you see the picture after you take it
quick.review.allow.zoom = 1

# If enabled, it will show cropmarks only in movie mode.
# Disable it to show cropmarks in photo mode too.
crop.movieonly = 0
```