HC – MPEG2 encoder

General information

- ***What is HC***
  HC is a simple to use MPEG2 video encoder and is meant for creating MPEG2 video streams with a strong focus on DVD-compliancy.

- ***Installation***
  Not needed, just copy the exe file into a directory.
  Only a MPEG2 decoder is needed to deliver the YUV input planes for d2v project files because HC has no (complete) MPEG decoder built in.

- ***Hardware requirements***
  The encoder will run on any Intel and AMD processor using Windows XP/2000/9x/ME.
  HC uses the next CPU extensions if available: MMX/SSE, SSE2, SSE3, at least MMX/ISSE must be present, if SSE2 or SSE3 is present HC will also use it, run time will be 5 - 10% faster with SSE2 and 5 – 30% with SSE3. The encoder will automatically detect the CPU extensions.
  Memory requirements: HC will run with only 256 MB installed, more is, as always, better.
  On a multi-processor or hyperthreaded PC, HC will use only one processor or thread.

- ***Input***
  Input can be a d2v project or input using Avisynth.
  HC expects as input YUV-planes (YV12 color space 4:2:0).
  During the encoding process there are no color plane conversions, the encoder keeps the color planes in YV12 color space.

- ***Versions***
  Two versions are available, a GUI version which is easy to use and a batch version which is controlled by a serie of commands in an ini file, it can also take parameters.

- ***Output***
  Output is a regular m2v file which can be used directly in your favourite authoring program.

Features

- **Multipass**
  HC is a 2 pass encoder which produces a VBR MPEG2 stream.
  Bitrate control is controlled by an average bitrate value and a maximum bitrate value.
  Intermediate results are written in the database file HC.dbs.

- **Bit Rate control**
  Bit rate is controlled by two commands: *BITRATE and *MAXBITRATE.
  Buffer underflows will never occur, while encoding the frames, the VBV (Video Buffer Verifier) is constantly checked for buffer underruns, if buffer underruns occur the bit stream will be adapted so the stream will always be DVD-compliant.

- **Encoding quality**
  Encoding quality is controlled by the encoding profile: FAST, NORMAL, BEST.
  For the *PROFILE command, see the command section.

- **GOP structure**
  User controllable, maximum GOP length is 36, maximum consecutive B-pictures is 2.
  You can for instance give the command *GOP 15 2 or *GOP 12 1, see the command section.
  If the *GOP command is omitted, HC wil run in AUTOGOP mode, this probably is the best way to run the encoder. In AUTOGOP mode HC scans frames to be encoded and measures the activity of the frames. Based on the activity of the frames HC tries to create an optimal GOP structure.
  A sequence header is written for each GOP.

- **Scene change detection**
  HC has a scene change detection algorithm built in, on each scene detection an I-frame is inserted and the GOP will be closed so you can cut the video at each scene change.
  If necessary the frames in the two previous GOP's will be redistributed to maintain a nice general GOP structure.

- **Restart**
  HC has a *RESTART option (see the command section) to re-run the second pass (GUI version only).
  It's required that the database file HC.dbs is still present because it contains all the necessary information to run the second pass again.
  You can not change every command during a restart, for instance the GOP structure as calculated in the first pass is fixed and can not be changed.
  If you do a restart the database will be scanned for info to do the second pass, this might take approx. 1 minute for a whole movie depending on the speed of your system.
  See the command section for further information.

- **Quantization matrices**
  You can use any matrix you like, some well known matrices are already built in which can be activated by the *MATRIX command. If you want to use your own matrix (intra and non-intra) just give the command *CUSTOMMATRIX and specify the two matrices, see the command section.
  If the *MATRIX command is omitted HC will use the standard "adapted" MPEG matrices, see the matrix section for these matrix specifications.

- **Encoding speed**
  Encoding speed is highly dependent of:
    - Complexity of the video material
    - Speed of your system: CPU, cache size and memory speed
    - Availability of CPU extensions
  A fast system will encode a 2 hour movie (DVD backup) in approx. 3 hours, 2 hours for the first pass and 1 hour for the second pass with *PROFILE BEST.
  Encoding (interlaced) DV video might take a lot longer to encode.

Command section

HCbatch is controlled by a serie of simple commands in the ini file.
It can also use parameters, see the next section.

Commands may be given in any order, they all start with *, commands may be uppercase or lowercase and must start at the first column.

You can simply deactivate a command by putting a space before the command.

The next commands are available:

*ASPECT

parameter	1:1, 4:3, 16:9, 2.21:1	***type***	character string
Status	not required		
Default	16:9		
Example	*ASPECT 4:3 (3:4 is also allowed)		

This command sets the desired aspect ratio.

*BFF

parameters	-	***type***	-
Status	not required		
Default	NA for progressive, TFF for interlaced		
Example	*BFF		

This command specifies bottom field first, only used for interlaced encoding.

*BITRATE

parameters	bitrate	***type***	integer
Status	required		
Default	-		
Example	*BITRATE 3250		

This command specifies the average bitrate per second in kbits/s. (1 kbit = 1000 bit)

*CLOSEDGOPS

parameters	-	***type***	-
Status	not required		
Default	-		
Example	*CLOSEDGOPS		

This command closes all gops.
CLOSEDGOPS is disabled by default.

*CPU

parameters	AUTO, MMX, SSE2, SSE3	***type***	character string
Status	not required		
Default	AUTO		
Example	*CPU MMX		

This command can be used to force the cpu to use specific extensions.

*CQ

parameters	quantization	***type***	real
Status	not required		
Default	-		
Example	*CQ 5.8		

This command orders the encoder to do a 1-pass with a constant quantization factor.
The value for quantization is the non-linear scale value.
No database is created, the output file is created in the first pass.
NOTE: this is not the same as CBR encoding, HC doesn't do CBR encoding.

*CQ_MAXBITRATE

parameters	quantization	***type***	real
Status	not required		
Default	-		
Example	*CQ_MAXBITRATE 5.8		

This command orders the encoder to do a 1-pass with a constant quantization factor.
If the actual bitrate overshoots the maximum bitrate set by the *MAXBITRATE command the quantizer is temporally raised. Output will be DVD-compliant.
The value for quantization is the non-linear scale value.
No database is created, the output file is created in the first pass.
NOTE: this is not the same as CBR encoding, HC doesn't do CBR encoding.

*CUSTOMMATRIX

parameter	-	***type***	-
Status	not required		
Default	-		
Example	*CUSTOMMATRIX		

```
 8 16 19 22 26 27 29 34
16 16 22 24 27 29 34 37
19 22 26 27 29 34 34 38
22 22 26 27 29 34 37 40
22 26 27 29 32 35 40 48
26 27 29 32 35 40 48 58
26 27 29 34 38 46 56 69
27 29 35 38 46 56 69 83

16 17 18 19 20 21 22 23
17 18 19 20 21 22 23 24
18 19 20 21 22 23 24 25
19 20 21 22 23 24 26 27
20 21 22 23 25 26 27 28
21 22 23 24 26 27 28 30
22 23 24 26 27 28 30 31
23 24 25 27 28 30 31 33
```

This command defines custom intra and non-intramatrices to be used and supersedes the default matrix and the *MATRIX command.
The matrices must be supplied as given in the example, 8 values per line.

*DC_PREC

parameters	dc_precision	***type***	integer
Status	not required		
Default	9		
Example	*DC_PREC 8		

This command defines the DC_precision to be used, range 8 - 10.

*FRAMES

parameters	startframe endframe	***type***	(2X) integer
Status	not required		
Default	-		
Example	*FRAMES 1001 2500		

This command specifies the frames to be encoded, if this command is not present all frames will be encoded. In case of Avisynth input don't use this command but use the trim option in the Avisynth file.

*GOP

parameters	goplength B-frames	***type***	(2X) integer
Status	not required		
Default	-		
Example	*GOP 12 2		

This command defines the GOP structure.

Max. GOP length is 36, max. B-frames is 2.
If this command is omitted, HC wil run in AUTOGOP mode.
Running in AUTOGOP mode means the encoder tries to distribute the I, P and B frames in an optimal manner based on the activity of the frames.

*INFILE

Parameter	input file name	*type*	character string
Status	required		
Default	-		
Example	*INFILE D:\movies\ test.avs		

This command defines the input filename. This file should be a d2v project or an Avisynth file, so the extension is d2v or avs.

*INTERLACED

Parameter	-	*type*	-
Status	not required		
Default	-		
Example	*INTERLACED		

Use this command if your source is interlaced, it might improve quality.
If this command is used also the alternate scanmethod is set.

*LOGFILE

Parameter	log file name	*type*	character string
Status	not required		
Default	-		
Example	*LOGFILE D:\movies\test.log		

This command defines the log filename, if omitted no logfile will be written.
If the logfile already exists the logs will be appended.

*MATRIX

parameter	matrix	*type*	character string
Status	not required		
Default	MPEG matrix		
Example	*MATRIX HC		

This command defines the intra and non-intra matrix to use.
See the matrix section for available built-in matrices and the default matrix specification.

*MAXBITRATE

parameter	bitrate	*type*	integer
Status	required		
Default	-		
Example	*MAXBITRATE 9000		

This command specifies the maximum bitrate per second in kbits/s. (1 kbit = 1000 bit)

*NOSEQ_ENDCODE

parameter	-	*type*	-
Status	not required		
Default	-		
Example	*NOSEQ_ENDCODE		

This command disables output of the sequence endcode (00 00 01 B7).

*NOSCD

parameter	-	*type*	-
Status	not required		
Default	-		
Example	*NOSCD		

This command disables the scene change detection.
Scene change detection is enabled by default, at each scene change an I-frame is inserted and the GOP is closed.

*NOVBV
parameter	-	***type***	-

Status   not required
Default   -
Example   *NOVBV
This command disables the VBV (Video Buffer Verifier) checking.
VBV checking is enabled by default. This command should not be used for DVD creation.

*OUTFILE
parameter	output file name	***type***	character string

Status   required
Default   -
Example   *OUTFILE D:\movies\test.m2v
This command defines the output filename, required.

*PROFILE
parameter	FAST, NORMAL, BEST	***type***	character string

Status   not required
Default   NORMAL
Example   *PROFILE BEST
This command defines the encoding quality. As usual the best encoding will take the most time

*SCANMETHOD
parameter	ZIGZAG*,* ALT	***type***	character string

Status   not required
Default   ZIGZAG
Example   *SCANMETHOD ALT
This command defines the scanning method to be used.
If interlaced is flagged it defaults to ALT but can be set to ZIGZAG with this command.

*TFF
parameter	-	***type***	-

Status   not required
Default   NA for progressive, TFF for interlaced
Example   *TFF
This command specifies top field first, only used for interlaced encoding.

*TIMECODE
parameters	hour minute second frame	***type***	(4X) integer

Status   not required
Default   0 0 0 0
Example   *TIMECODE 1 2 3 4
This command sets the timecode

*WAIT
parameter	second	***type***	integer

Status   not required
Default   5
Example   *WAIT 0
This command sets the waiting time before HC exits after an encoding session, range 0 – 99.
If you have a lot of short encodes it's best set to *WAIT 0.

Using parameters

The next parameters can be passed:

-i	input file (full path)
-o	output file (full path)
-b	bitrate (kbit/s)
-maxbitrate	max. bitrate (kbit/s)
-log	log file (full path)
-ini	ini file (full path)
-profile	fast, normal, good, best
-aspectratio	1:1, 4:3 or 3:4, 16:9 or 9:16, 2.21:1 or 1:2.21 or 2:21
-scene	
-noscene	
-interlaced	
-nointerlaced	
-matrix	mpeg, hc, qlb, notch, jawor1cd, bach1, hvsgood, hvsbetter, hvsbest, autoq2
-tff	
-bff	

HC will always look if there's an HC.ini file in the same directory as the exe file and will also read values from it.
Parameters passed have a higher priority than the values supplied in the ini file.

For batch processing you can do something like this:

HCbatch –i d:\movies\test1.avs –o d:\movies\test1.m2v –b 4000 –maxbitrate 9000 –ini d:\movies\hc.ini
HCbatch –i d:\movies\test2.d2v –o d:\movies\test2.m2v –b 3500 –maxbitrate 8000 –ini d:\movies\hc.ini

Input file, output file, bitrate and maxbitrate are set as parameter, rest of the commands are read from HC.ini.

Reading all from (different) ini files:

HCbatch –ini d:\movies\hc1.ini
HCbatch –ini d:\movies\hc2.ini

Command section

Matrices

The next matrices will be used as default, the MPEG adapted matrices.
The intra matrix is the standard MPEG matrix and will not be written in the MPEG2 stream.

```
 8 16 19 22 26 27 29 34      16 17 18 19 20 21 22 23
16 16 22 24 27 29 34 37      17 18 19 20 21 22 23 24
19 22 26 27 29 34 34 38      18 19 20 21 22 23 24 25
22 22 26 27 29 34 37 40      19 20 21 22 23 24 26 27
22 26 27 29 32 35 40 48      20 21 22 23 25 26 27 28
26 27 29 32 35 40 48 58      21 22 23 24 26 27 28 30
26 27 29 34 38 46 56 69      22 23 24 26 27 28 30 31
27 29 35 38 46 56 69 83      23 24 25 27 28 30 31 33
```

The next **built-in** matrices can be used with the *MATRIX command:
(some of these matrices are copyrighted by their respective owners)

*MATRIX HC
```
 8  9 13 20 23 27 29 34      16 16 18 20 22 24 27 30
 9 11 16 23 26 29 34 39      16 17 19 22 24 27 30 34
12 16 21 25 28 33 39 45      18 19 22 24 27 30 34 39
15 20 25 28 33 38 44 52      20 22 24 27 30 34 39 45
19 24 28 33 38 43 51 60      22 24 27 30 34 39 45 52
23 27 32 38 42 49 58 68      24 27 30 34 39 45 52 60
27 31 37 42 48 57 67 77      27 30 34 39 45 52 60 69
30 36 41 47 55 65 76 87      30 34 39 45 52 60 69 79
```

*MATRIX NOTCH
```
 8  9 12 22 26 27 29 34      16 18 20 22 24 26 28 30
 9 10 14 26 27 29 34 37      18 20 22 24 26 28 30 32
12 14 18 27 29 34 37 38      20 22 24 26 28 30 32 34
22 26 27 31 36 37 38 40      22 24 26 30 32 32 34 36
26 27 29 36 39 38 40 48      24 26 28 32 34 34 36 38
27 29 34 37 38 40 48 58      26 28 30 32 34 36 38 40
29 34 37 38 40 48 58 69      28 30 32 34 36 38 42 42
34 37 38 40 48 58 69 79      30 32 34 36 38 40 42 44
```

*MATRIX QLB
```
 8 16 19 22 26 27 29 34      16 17 18 19 20 21 22 23
16 16 22 24 27 29 34 37      17 18 19 20 21 22 23 25
19 22 26 27 29 34 37 39      18 19 20 21 22 23 24 26
22 22 26 27 29 34 38 42      19 20 21 22 23 24 26 28
22 26 27 29 32 36 40 50      20 21 22 23 25 26 28 29
26 27 29 32 36 40 50 61      21 22 23 24 26 28 29 31
26 27 29 35 40 50 59 75      22 23 24 26 28 29 31 34
27 29 35 40 50 59 75 89      23 24 25 28 29 31 34 38
```

*MATRIX BACH1
```
 8 16 19 22 26 27 29 34      16 18 20 22 24 26 28 30
16 16 22 24 27 29 34 37      18 20 22 24 26 28 30 32
19 22 26 27 29 34 34 38      20 22 24 26 28 30 32 34
22 22 26 27 29 34 37 40      22 24 26 30 32 32 34 36
22 26 27 29 32 35 40 48      24 26 28 32 34 34 36 38
26 27 29 32 35 40 48 58      26 28 30 32 34 36 38 40
26 27 29 34 38 46 56 69      28 30 32 34 36 38 42 42
27 29 35 38 46 56 69 83      30 32 34 36 38 40 42 44
```

*MATRIX JAWOR1CD

```
 8 16 20 23 27 30 32 34      17 19 21 23 25 27  29  31
16 16 23 24 29 31 34 38      19 21 23 25 27 28  29  33
20 23 27 28 30 35 38 40      21 23 25 27 29 30  32  37
23 24 28 29 35 39 40 44      23 25 27 30 31 34  40  45
27 29 30 35 39 42 45 50      25 27 29 31 38 46  54  60
30 31 35 39 42 46 54 59      27 28 30 34 46 58  72  74
32 34 38 40 45 54 62 72      29 29 32 40 54 72  90 100
34 38 40 44 50 59 72 84      31 33 37 45 60 74 100 124
```

*MATRIX HVSGOOD

```
 8 16 16 16 17 18 21  24     20 20 20 20 21 23  26  30
16 16 16 16 17 19 22  25     20 20 20 20 22 24  27  32
16 16 17 18 20 22 25  29     20 20 21 22 24 27  31  36
16 16 18 21 24 27 31  36     20 20 22 26 30 34  38  44
17 17 20 24 30 35 41  47     21 22 24 30 37 44  51  59
18 19 22 27 35 44 54  65     23 24 27 34 44 56  68  81
21 22 25 31 41 54 70  88     26 27 31 38 51 68  88 109
24 25 29 26 47 65 88 115     30 32 36 44 59 81 109 144
```

*MATRIX HVSBETTER

```
 8 16 16 16 17 18 21  24     19 19 19 19 20 22  25  29
16 16 16 16 17 19 22  25     19 19 19 19 20 23  26  30
16 16 17 18 20 22 25  29     19 19 20 21 23 26  29  34
16 16 18 21 24 27 31  36     19 19 21 25 28 32  37  42
17 17 20 24 30 35 41  47     20 20 23 28 35 42  48  56
18 19 22 27 35 44 54  65     22 23 26 32 42 53  64  77
21 22 25 31 41 54 70  88     25 25 29 37 48 64  83 104
24 25 29 36 47 65 88 115     29 30 34 42 56 77 104 137
```

*MATRIX HVSBEST

```
 8 16 16 16 17 18 21  24     18 18 18 18 19 21 23  27
16 16 16 16 17 19 22  25     18 18 18 18 19 21 24  29
16 16 17 18 20 22 25  29     18 18 19 20 22 24 28  32
16 16 18 21 24 27 31  36     18 18 20 24 27 30 35  40
17 17 20 24 30 35 41  47     19 19 22 27 33 39 46  53
18 19 22 27 35 44 54  65     21 21 24 30 39 50 61  73
21 22 25 31 41 54 70  88     23 24 28 35 46 61 79  98
24 25 29 36 47 65 88 115     27 29 32 40 53 73 98 129
```

*MATRIX AUTOQ2

```
 8 16 19 22 26 28 32 38      16 20 24 28 36 42 46 52
16 16 22 24 28 32 38 44      20 24 28 36 42 46 52 58
19 22 26 28 32 38 44 48      24 28 36 42 46 52 58 62
22 22 26 32 38 44 48 54      28 36 42 46 52 58 62 68
22 26 32 38 44 48 54 64      36 42 46 52 58 62 68 78
26 32 38 44 48 54 64 74      42 46 52 58 62 68 78 88
32 38 44 48 54 64 74 84      46 52 58 62 68 78 88 99
38 44 48 54 64 74 84 94      52 58 62 68 78 88 99 99
```