MPEG-1 Data Structures

The **ISO/IEC 11172** specification defines the audio, video and multiplexing standards collectively and colloquially referred to as the MPEG-1 (**Motion Picture Experts Group**) compression standard. The data structures for the various components in an encoded bitstream are given in a pseudo-C syntax, and are extensively discussed. However, it is difficult to get the big picture from reading the spec.

More practically, in order to parse an MPEG-1 bitstream, it is necessary to know byte offsets within each structure. To make this information more readily accessible, we have condensed it into graphic form. Of course, this is no substitute for the original spec. Where more information is required than can be squeezed into the diagram, references are provided to the spec.

The Big Picture

A multiplexed MPEG-1 stream is composed of distinct **Packs**.

- Each Pack consists of a Pack header and any number of Packets.
- Within those Packets is either video or audio data.

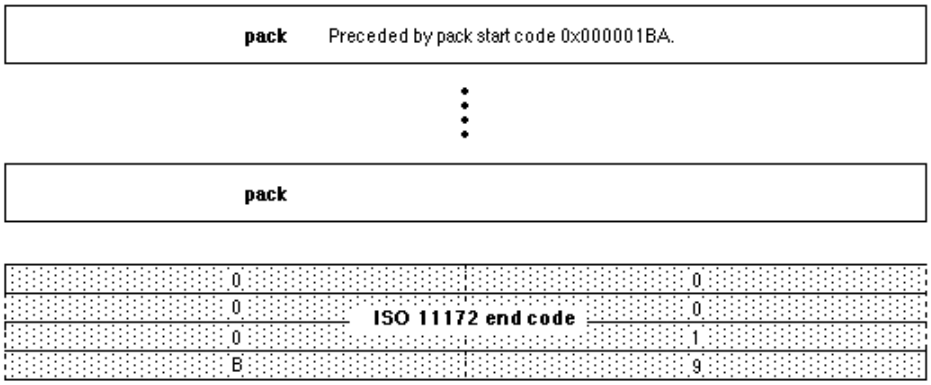
These structures above the video or audio level are called the system layer.

Video or audio data is divided into **Packets** without regard to lower-level structures -- Groups, Pictures, etc. may break across Packet boundaries.

- Video information is composed of individual Pictures. We will not discuss the substructures of Pictures.
- Pictures themselves are of three types:
  - I (intra) Pictures are self-contained, compressing the image using **Discrete Cosine Transform** (DCT) processing.
  - P (predictive) Pictures use less data and are predicted from the preceding I Picture.
  - B (bidirectional) Pictures use the least data and are interpolated using information from surrounding P and I Pictures
- Pictures are organized into Groups of (typically) 15 or so Pictures. If a Group is preceded by a Sequence header, its first Picture is called an entrypoint.

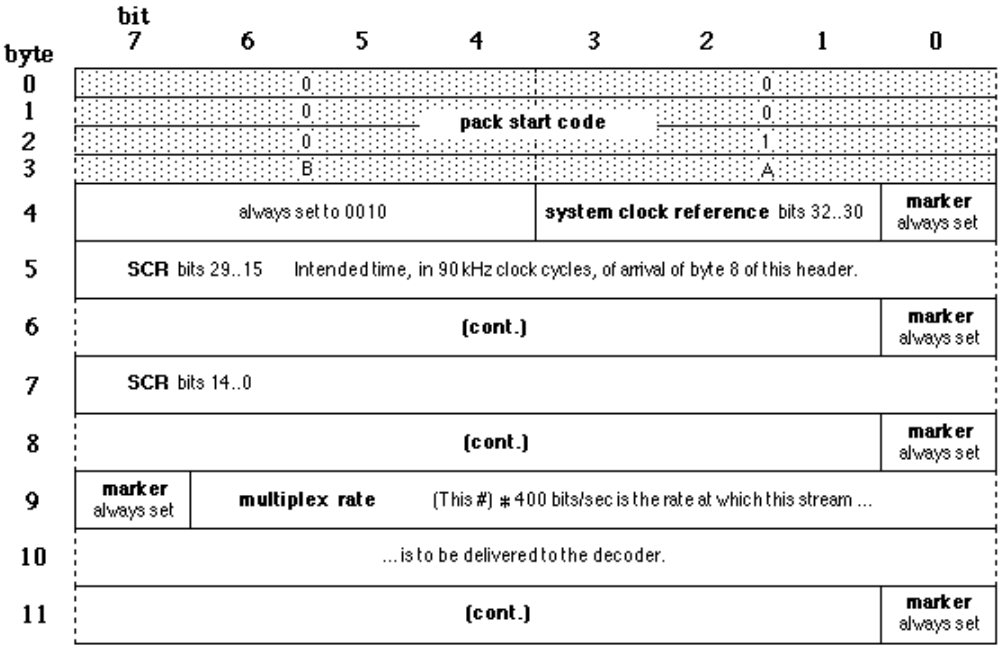
Audio information is composed of Frames. We will not discuss the substructure of Frames. There are no higher-level audio structures.

MPEG-1 Multiplexed Stream



©1994 Philips Interactive Media. All rights reserved.

MPEG-1 Pack



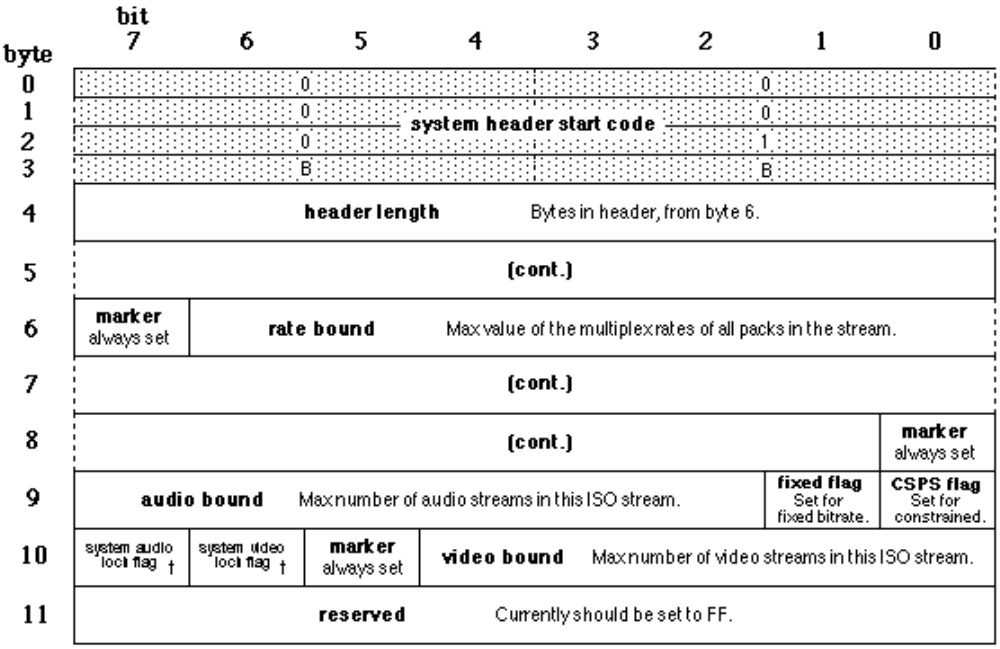
(Optional)

system header	Preceded by system header start code 0x000001BB.

packets	Arbitrary number, each preceded by packet start code prefix 0x000001.

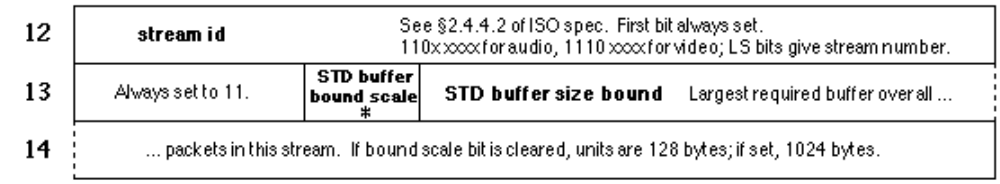
© 1994 Philips Interactive Media. All rights reserved.

MPEG-1 System Header



† Set if there is, for all (audio/video) elementary streams in the ISO multiplexed stream, a constant rational relationship between the (audio sampling rate/video picture rate) and the system clock frequency in the decoder. See §2.4.4.2.

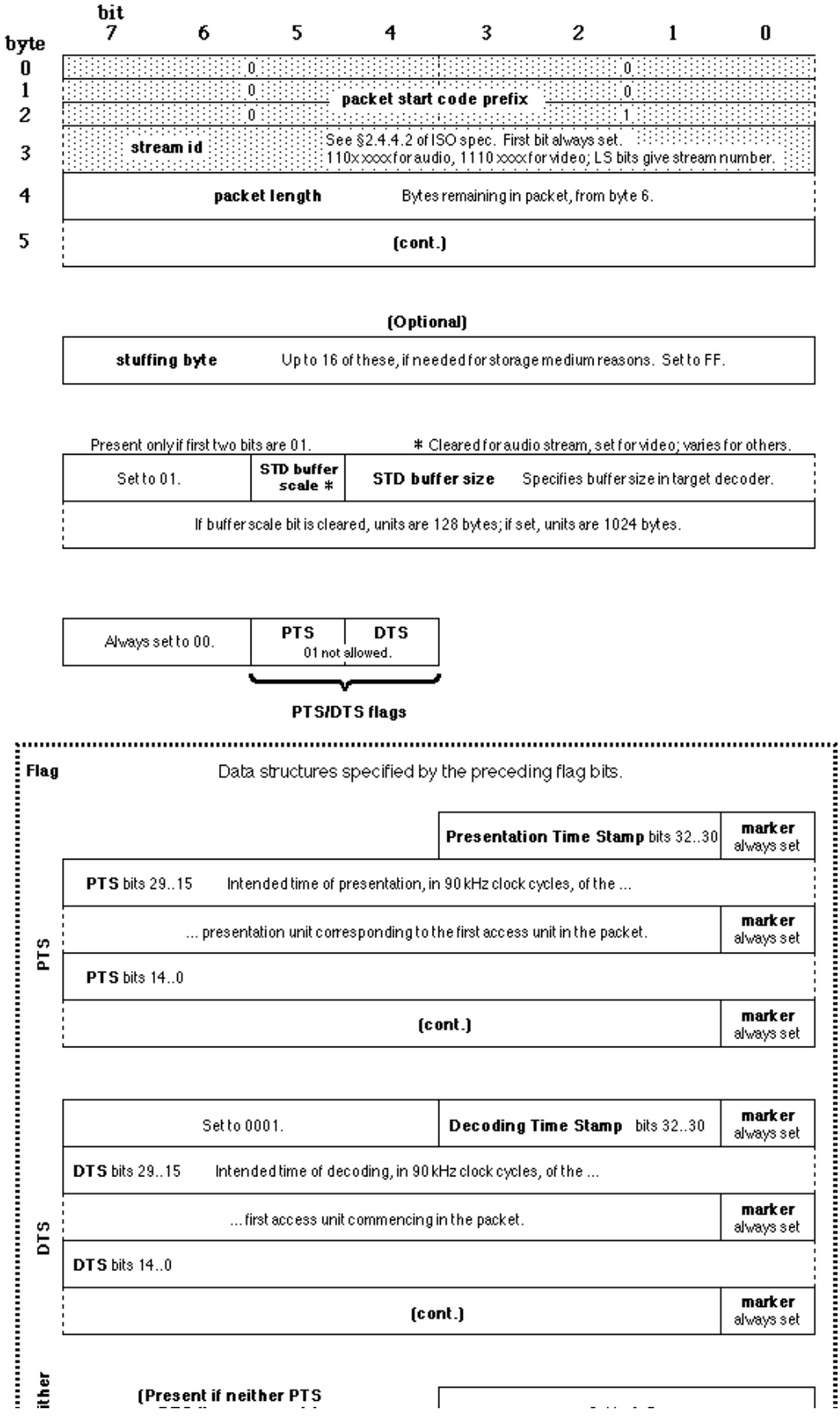
The following stream specs are present only if the first bit is a 1. Any number of stream specs may follow.



* Cleared for audio stream, set for video; varies for others.

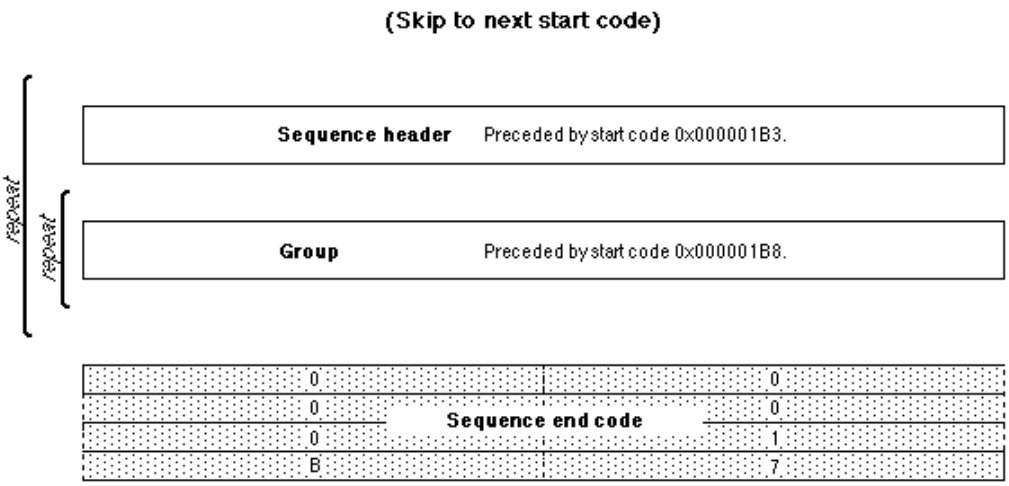
© 1994 Philips Interactive Media. All rights reserved.

MPEG-1 Packet



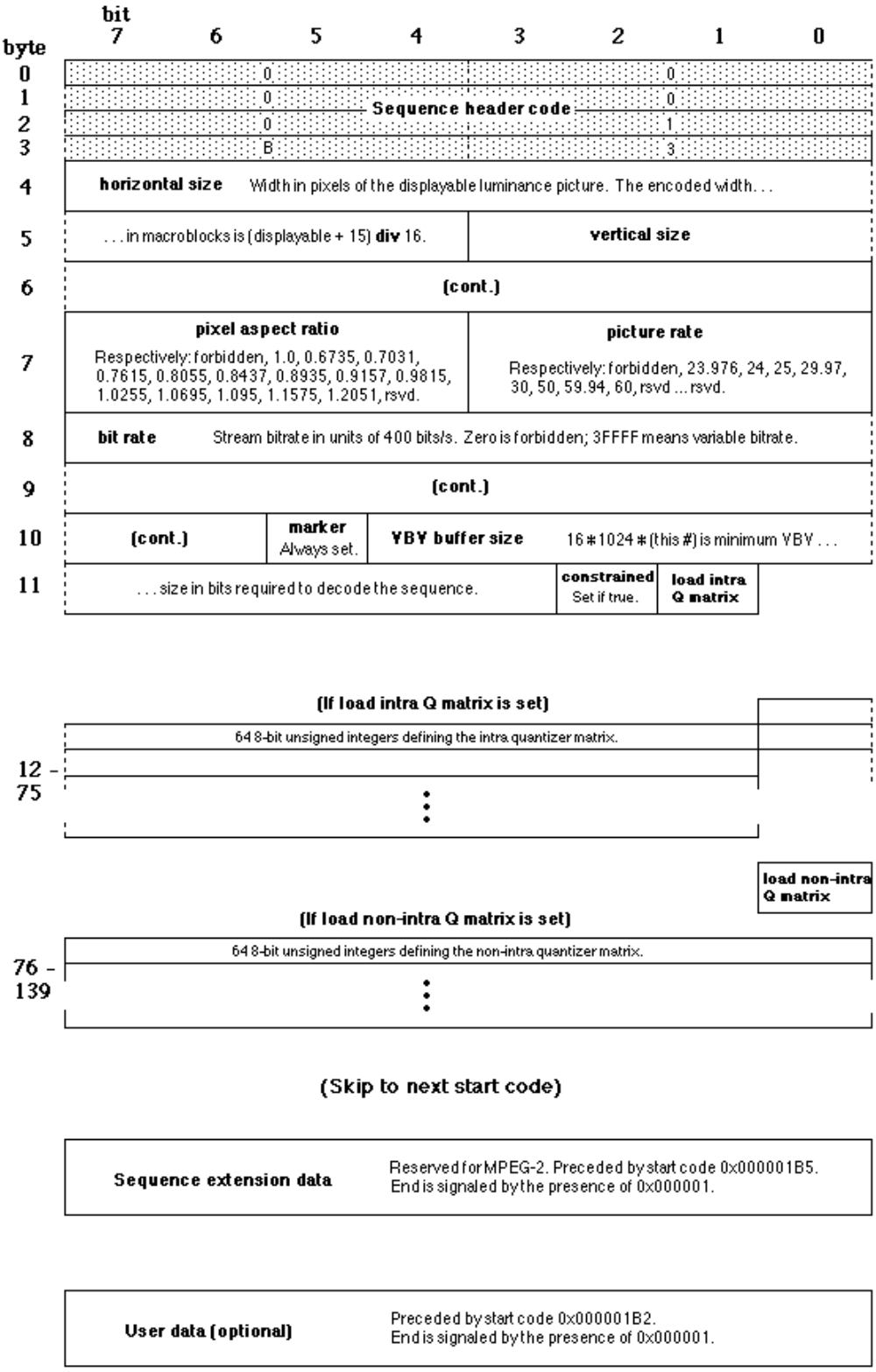
ne | or DTS flags were set.] | Set to 0xF.

MPEG-1 Video Sequence



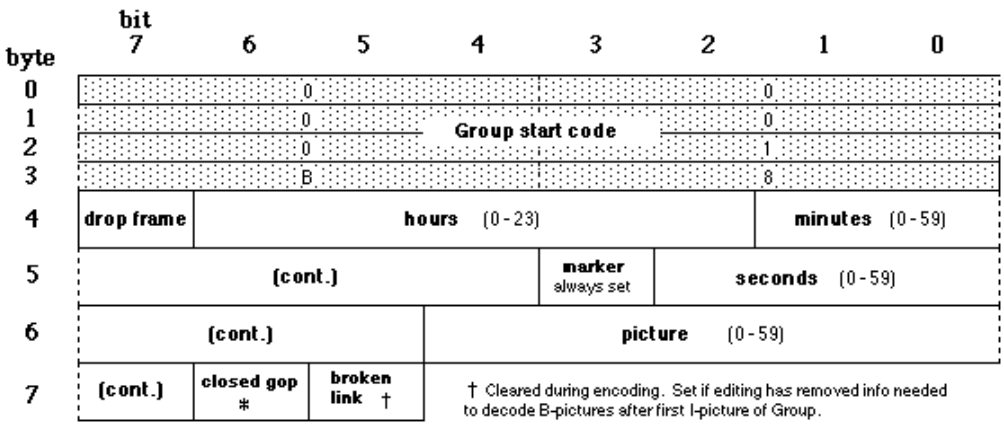
©1994 Philips Interactive Media. All rights reserved.

MPEG-1 Sequence Header



©1994 Philips Interactive Media. All rights reserved.

MPEG-1 Group of Pictures

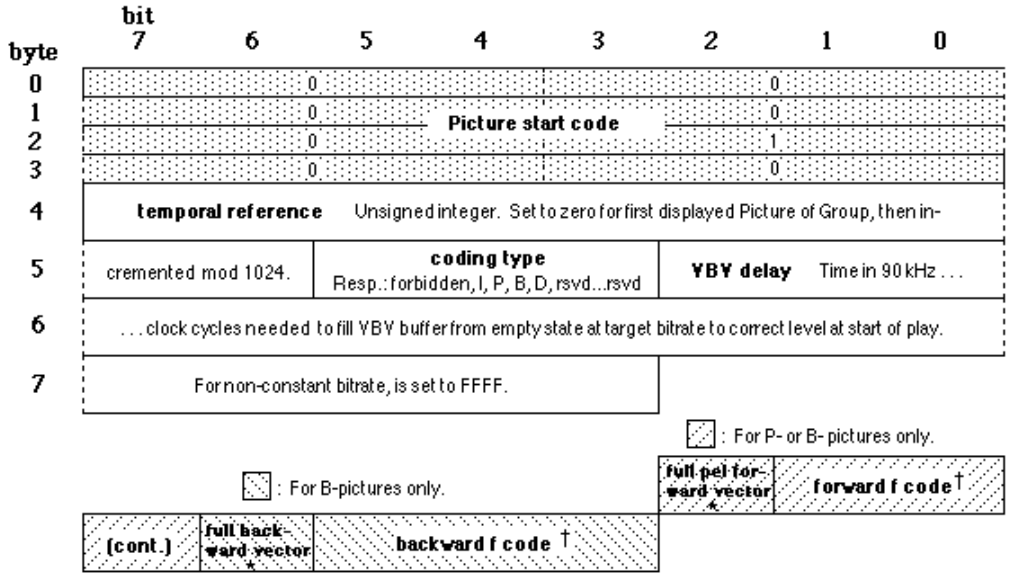


(skip to next start code)

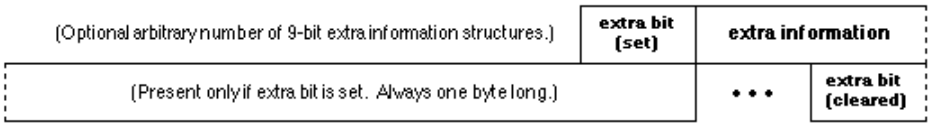
Group extension data	Reserved for MPEG-2. Preceded by start code 0x000001B5. End is signaled by the presence of 0x000001.
User data (optional)	Preceded by start code 0x000001B2. End is signaled by the presence of 0x000001.
Pictures	Arbitrary number, preceded by Picture start code 0x00000100.

©1994 Philips Interactive Media. All rights reserved.

MPEG-1 Picture



★ Full vector flags are set if motion vector values decoded represent integer pixel offsets rather than half-pixels.
† F codes are unsigned non-zero integers describing decoding motion vectors as per §2.4.4.3, ISO 11172.



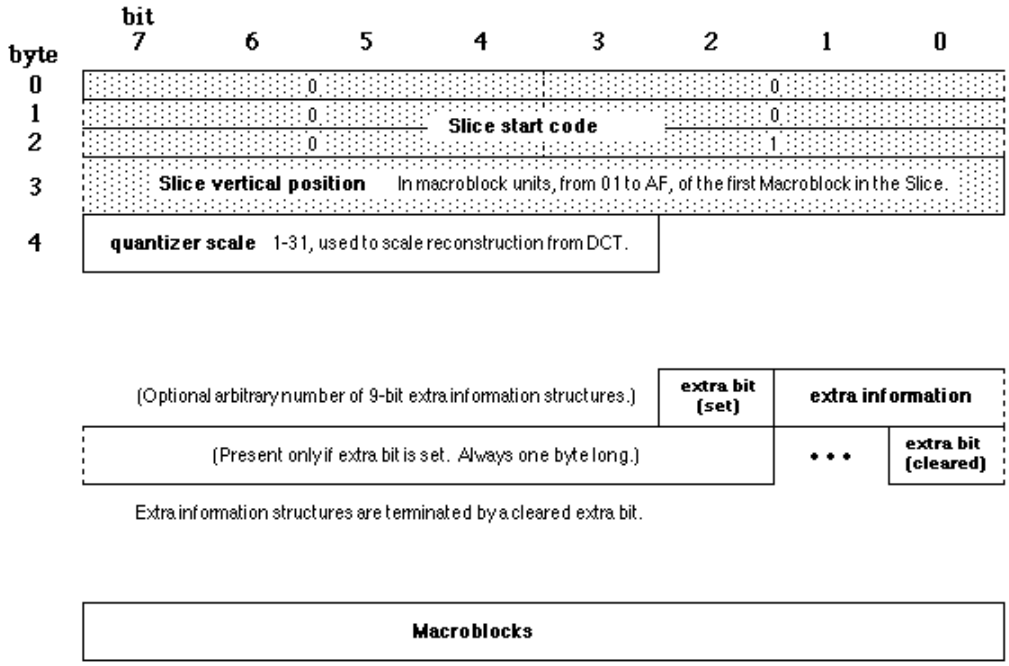
Extra information structures are terminated by a cleared extra bit.

(skip to next start code)

Sequence extension data	Reserved for MPEG-2. Preceded by start code 0x000001B5. End is signaled by the presence of 0x000001.
User data (optional)	Preceded by start code 0x000001B2. End is signaled by the presence of 0x000001.
Slices	Preceded by slice start codes 00000101 - 000001AF.

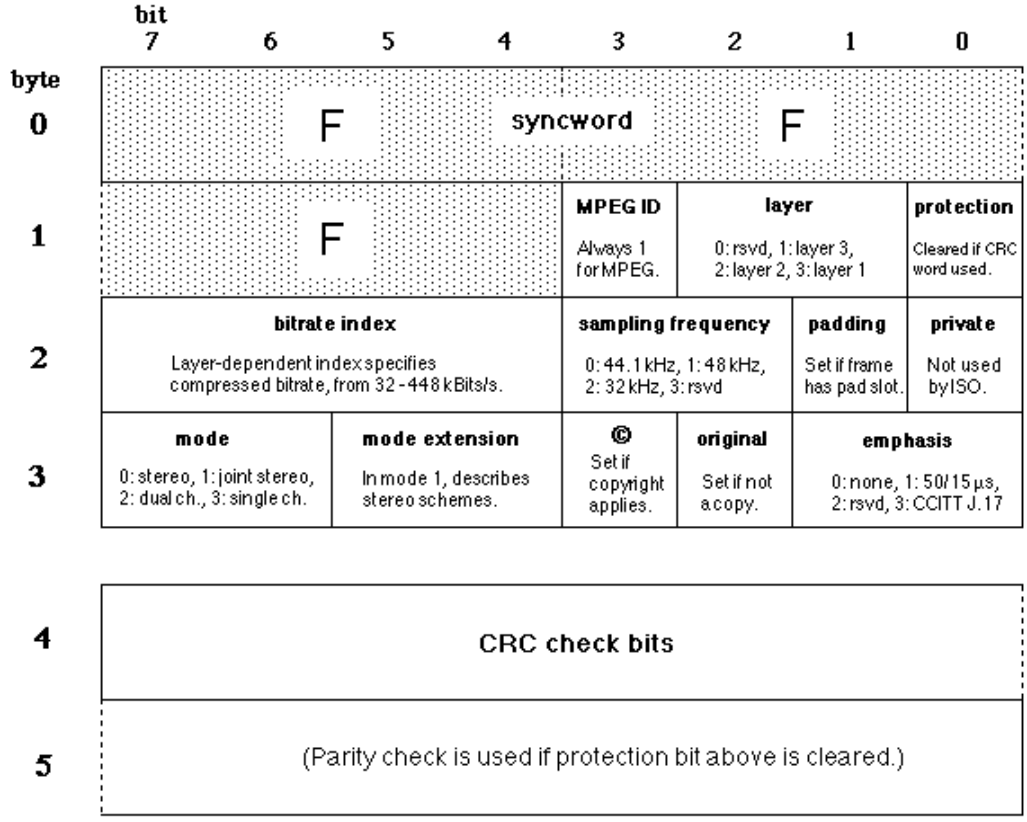
©1994 Philips Interactive Media. All rights reserved.

MPEG-1 Slice



©1994 Philips Interactive Media. All rights reserved.

MPEG-1 Audio Frame Header



©1994 Philips Interactive Media. All rights reserved.