

EFM / EFM+

EFM (Eight to Fourteen Modulation) is a method of encoding source data for CD formats into a form that is easy to master, replicate and playback reliably.

With EFM, each 8 bits of source data is converted into a 14 bit code from a lookup table of the 256 possible combinations. In the resulting fourteen bit code, the '0's are used to denote land or pit and the '1's are used to signal a transition from land to pit or vice versa. There are always at least three and no more than eleven '0's between transitions giving nine discrete lengths of pit or land.

If the source binary data were recorded without encoding in this way, the disc would frequently need to represent a single '1' or '0' requiring mastering and replication to reproduce very small artifacts on the disc. EFM encoding ensures that the smallest artifact on the disc is three units long and the average artifact is seven units long.

Within the EFM lookup table, it is possible for the 14 bit code to start or end with a '1'. In order to prevent a situation in which one 14 bit code ends and the next one both start with a '1', three merging '0' bits are added between each 14 bit code. So in reality, EFM is eight-to-seventeen modulation.

EFM+ is the equivalent method of encoding employed for DVD formats. It works in the same way as EFM for CD, except that the 8 bit source code is converted to a 16 bit code. The lookup tables for EFM+, however, are constructed such that all combinations start and end in such a way that merging bits are not required, making it 17 / 16 times more efficient.