

Getting the Most from your CDQPrima

*This chapter discusses the different compression algorithms and modes and how to select the best combination to get the most from your **CDQPrima**. Pre-programmed Quick Configurations are also listed.*

6. Codec Compression Algorithms and Modes

There are currently three coding algorithms used in the **CDQPrima**. Each has its advantages and disadvantages. Which algorithm you use depends on a number of factors, including desired audio quality, delay and compatibility with other codecs. This chapter serves as a guide for choosing the best algorithm and mode for your applications when a choice is available.

6.1 Stereo and Dual Mono

Users have expressed a great deal of confusion concerning the differences between stereo, dual mono and joint stereo. From a coding and compression standpoint, stereo and dual mono are identical. That is, half of the total bits are assigned to the left channel, and half of the total bits are assigned to the right channel. Left is always left, and right is always right...no blending, no sound-stage manipulations.

6.2 Joint Stereo

Unlike dual mono or stereo, joint stereo employs real-time bit allocation techniques and dynamically assigns bits to the channels and frequency bands that need them the most. Bits are allocated to the channel and frequency bands that need them on a frame-by-frame basis. This dynamic bit allocation results in wider bandwidths and higher signal-

to-noise ratios than possible with the fixed bit allocation of the other modes. If the bit allocation circuitry determines that enough capacity is available for true stereo, than stereo frames will be sent.

Unlike stereo and dual mono, joint stereo may manipulate the left-right sound stage and stereo separation at high frequencies. The infinite left-right sound stage is blended into seven locations at high frequencies should the bit allocation circuitry deem it necessary. However, it has been shown that any spatial blending performed by the bit allocation is in frequency bands where the human brain would normally blend stereo signals. This is one of the basic premises behind psychoacoustic modeling. A detailed discussion of joint stereo bit allocation techniques can be found in the *CDQPrima* Technical Reference Manual.

After rigorous testing with trained listeners, joint stereo audio has been determined to yield higher perceived audio quality than stereo or dual mono at low bit rates, such as those encountered with single ISDN lines.

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6.3 ISO/MPEG Layer III

ISO/MPEG Layer III can deliver full duplex, 15 kHz monaural audio using only one 56 or 64 kb/s ISDN 'B' channel. When using 112 or 128 kb/s, transparent 20 kHz audio is possible in monaural. Near-transparent 20 kHz audio is possible in joint-stereo mode. In dual mono or stereo modes, near-transparent 15 kHz audio is obtained. Although at low bit rates, Layer III offers a wider bandwidth than other algorithms, the inherent drawbacks of this algorithm may outweigh this benefit. The disadvantages of using Layer III are the long coding delay times and poor cascading ability. In addition, audible artifacts may be noticeable when using Layer III at lower bit rates, and post-processing may further degrade the audio.

At 112/128 kb/s, the only advantage of using Layer III over MUSICAM is that Layer III can deliver true stereo with 15 kHz bandwidth. Other than that, at 112/128 kb/s data rates, we recommend using Layer III only when communication with Layer III-only codecs is required. Even at 112/128 kb/s, digital artifacts may be noticeable, and the delay, cascading and post-processing limitations are still present. At bit rates higher than 128 kb/s, there is no advantage to using Layer III over MUSICAM or standard Layer II. Bit rates up to 320 kb/s are included only for compatibility.

6.4 MUSICAM and ISO/MPEG Layer II

The premier coding algorithm used in **CDQPrima** is MUSICAM, MUSICAM USA's enhancement to the ISO MPEG Layer II encoding algorithm. MUSICAM offers the best possible combination of fidelity, moderate delay and excellent transcoding ability at all bit rates. MUSICAM encoding is fully compatible with all MPEG Layer II codecs, and since the enhancements are only in the encoder, any decoder will sound better when connected to a **CDQPrima**. MUSICAM can deliver full duplex, 10.2 kHz audio on one 'B' channel with 24 kHz sampling. Although a narrower bandwidth at 56 and 64 kb/s than MPEG Layer III, the advantages are higher signal-to-noise ratio, higher transparency, lower delay, less noticeable artifacts and better results when transcoding and post-processing.

When using 112 or 128 kb/s, the **CDQPrima** delivers transparent, 20 kHz monaural or joint stereo or 10.2 kHz dual mono audio. At bit rates higher than 128 kb/s the **CDQPrima** delivers transparent stereo with immunity to degradation even after up to 15 cascades (at 384 kb/s).


Please note that the CCSO and CCSN algorithms in the **CDQPrima** are all MUSICAM algorithms, but these are used when connecting to early CCS and MUSICAM USA products manufactured before MPEG Layer II was standardized.

6.5 G.722


G.722 is one of the earliest audio coding algorithms to be standardized. G.722 is a relatively simple algorithm based on ADPCM (adaptive pulse code modulation) offering full duplex 7.5 kHz audio over a single ISDN or Switched-56 channel. The key advantages of G.722 are its compatibility with most other codecs and very low delay times. G.722 is ideal for situations where instantaneous talk-back is required, such as dial-in talk shows and distant interviews. The main disadvantages are the limited audio fidelity, poor signal-to-noise ratio and poor cascading properties. G.722 is not recommended for all music applications.

6.6 Algorithm, Mode, Bit and Sample Rate



Since no one algorithm/mode/sample rate/bit rate combination is ideal for all applications, the **CDQPrima** offers several different combinations, each with advantages and disadvantages. In addition, the full range of available algorithms insures that your **CDQPrima** can

connect with the widest number of codecs. The tables below compares the available algorithms and bit rates. Recommended algorithms are indicated with a . In some instances, especially at the lower bit rates, using a lower sample rate will result in better audio, with wider bandwidths and reduced artifacts.



56/64 Kb/s:

Algorithm	Sample rate	Mode	Bandwidth	Delay	Cascade	
G.722	16 kHz	mono	7.5 kHz	very low	poor	
MUSICAM	24 kHz	mono	10.2 kHz	moderate	good	
MUSICAM	48 kHz	mono	8.5 kHz	moderate	fair	
MUSICAM	24 kHz	JS	10 kHz	moderate	fair	
Layer III	32 kHz	mono	15 kHz	long	fair	
Layer III	48 kHz	mono	15 kHz	long	poor	
Layer III	32 kHz	JS	14 kHz	long	poor	

112/128 kb/s:

Algorithm	Sample rate	Mode	Bandwidth	Delay	Cascade	
MUSICAM	48 kHz	mono	20 kHz	moderate	excellent	
MUSICAM	48 kHz	JS	20 kHz	moderate	very good	
MUSICAM	48 kHz	DM	10.2 kHz	moderate	fair	
MUSICAM	24 kHz	DM	10.2 kHz	moderate	good	
Layer III	48 kHz	mono	20 kHz	long	good	
Layer III	48 kHz	JS	20 kHz	long	fair	
Layer III	48 kHz	DM	15 kHz	long	poor	

> 128 kb/s:

Algorithm	Sample rate	Mode	Bandwidth	Delay	Cascade	
MUSICAM	48 kHz	JS	20 kHz	moderate	excellent	
MUSICAM	48 kHz	DM	20 kHz	moderate	excellent	
Layer III	48 kHz	JS	20 kHz	long	good	

Layer III	48 kHz	DM	20 kHz	long	good	
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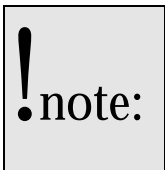
Other combinations of algorithm, mode, bit rate and sample rate are possible, but not *all* combinations are valid. Your **CDQPrima** will not let you set up an invalid combination. If you get an error message such as “BAD TOGGLE ON ...” or “INVALID PARAMETERS”, it is because you have entered an invalid combination. Refer to the **CDQPrima Technical Reference Manual** for valid bit and sampling rate combinations.

Please remember that MUSICAM is a fully compatible enhancement to the ISO/MPEG Layer II standard algorithm. Since the ISO standard defines the encoded bit stream, and hence the decoder, all enhancements are to the encoder. Therefore, when connecting to a standard Layer II codec at the far end, the audio you hear will be Layer II, but the audio heard at the far-end will be MUSICAM. MUSICAM encoding makes *any* Layer II decoder sound better.

Layer III provides the widest bandwidth at low bit rates, up to 15 kHz at bit rates of 56 or 64 kb/s. Layer III may be useful at these low bit rates when wide bandwidths are required. However, even at high bit rates, Layer III has long delay, does not cascade well and is adversely affected by post-processing. There is no advantage to using Layer III over MUSICAM. In some applications, Layer III may provide better audio than *standard* Layer II, but in most applications, MUSICAM has been judged to be the superior algorithm.

6.7 Pre-Programmed Quick Configurations

Your **CDQPrima** is shipped pre-programmed with over two dozen of the most common configurations pre-loaded as Quick Configurations. These pre-loaded configurations are held in the first Speed Dial table entries. In some cases we have set the same parameters in two or more entries. We did this to enable you to use the alphanumeric description to configure to various devices without needing to know the details.



The best way to assure trouble-free communication with another CDQPrima user is to both use the same Quick Configuration. If both users have loaded the same configuration, and the lines have been dialed correctly, the connection *will* work. It’s as simple as that.

More Quick Configuration can be added at any time. Details on using, editing, and creating your own Quick Configurations can be found in

Section 5.4.2 and elsewhere in Chapter 5. If you do not find a pre-programmed configuration that meets your needs, simply use the one that is closest, changing the parameters that need modifying, and save it.

To use a quick-configuration, simply speed dial the entry. The following entries have been pre-programmed:

Entry	Description	Bit rate	Sample rate	Encoder algorithm	Mode	Line format	BW (kHz)	Decoder independent
0	CDQ1000_24K:QS	64	24	CCSN	M	L1	10.2	NO
1	CDQ20002LNS:QS	128	48	MPEGL2	JS	CCSL12	20	NO
2	H221_2LINES:QS	128	48	MPEGL2	JS	H221L12	20	NO
3	H221_4LINES:QS	256	48	MPEGL2	JS	H221L1234	20	NO
4	H221_6LINES:QS	384	48	MPEGL2	JS	H221L123456	20	NO
5	MICRO56:QS	56	16	G.722	M1	L1	7.5	NO
6	G.722_56K:QS	56	16	G.722	M1	L1	7.5	NO
7	G.722_64K:QS	64	16	G.722	M1	L1	7.5	NO
8	MPEGL2/64K:QS	64	48	MPEGL2	M	L1	8.5	NO
9	MPEGL2/56K:QS	56	48	MPEGL2	M	L1	8.5	NO
10	CCSN/64K:QS	64	48	CCSN	M	L1	8.5	NO
11*	CCSTEST64	64	48	MPEGL2	M	L1	8.5	NO
12*	CCSTEST128	128	48	MPEGL2	JS	CCSL12	20	NO
13*	CCSTESTH221	128	48	MPEGL2	JS	H221L12	20	NO
14*	CCSTEST56	56	48	MPEGL2	M	L1	8.5	NO
15*	CCSTEST112	112	56	MPEGL2	JS	CCSL12	20	NO
16	CDQ1000/56K:QS	56	24	CCSN	M	L1	10.2	NO
17	CDQ2000/112:QS	112	48	MPEGL2	JS	CCSL12	20	NO
18	CCSN/56K:QS	56	48	CCSN	M	L1	8.5	NO
19	G.722_H.221:QS	64	16	G.722	M1	H221L1	7.5	NO
20	CCSN/128K:QS	128	48	CCSN	JS	CCSL12	20	NO
21	CCSN/112K:QS	112	48	CCSN	JS	CCSL12	20	NO
22	CDQ2001/128:QS	128	32	MPEGL2	JS	CCSL12	15	NO
23	CDQ2001/112:QS	112	32	MPEGL2	JS	CCSL12	15	NO
24	ZEPHYR/56K:QS	56	48	MPEGL2	M	L1	8.5	YES
25	ZEPHYR/64K:QS	64	48	MPEGL2	M	L1	8.5	YES
26	ZEPHYR/112K:QS	112	48	MPEGL2	JS	CCSL12	20	YES
27	ZEPHYR/128K:QS	128	48	MPEGL2	JS	CCSL12	20	YES
28	LYR3/56K:QS	56	48	MPEGL3	M	L1	15	NO
29	LYR3/64K:QS	64	48	MPEGL3	M	L1	15	NO
30	LYR3IND56:QS	56	48	MPEGL3	M	L1	15	YES
31	LYR3IND64:QS	64	48	MPEGL3	M	L1	15	YES

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* - These entries dial numbers, and will not work unless an internal terminal adapter is used and an ISDN line is connected.

6.7.1 Entry 0 CDQ1000_24:QS

This entry is used for communications with an older MUSICAM USA and CCS Audio Products Model CDQ1000 codec or another **CDQPrima** or **RoadRunner** user. Loading this speed dial entry will automatically configure the **CDQPrima** for 64 kb/s, single line (using line 1), mono, using the CCSN algorithm, with a 24 kHz sampling rate. You can modify this entry if you will be using a line other than line 1.

6.7.2 Entry 1 CDQ2002LNS:QS

This entry is used to communicate with another **CDQPrima**, **RoadRunner** or the CDQ2000 series of products, and others, using a bit rate of 128 kb, with 48 kHz sampling, MUSICAM algorithm, and joint stereo. Two line format is used, using lines 1 & 2. If other lines are to be used, edit this entry accordingly.

Please note that some older CDQ2000 units will require you to use the CCSN algorithm. For these units, use 'Quick Configuration' entry number 20.

6.7.3 Entry 2 H221_2LINES:QS

All encoder parameters are the same as entry 1, except that 2 line H.221 BONDING line format is specified, using lines 1 and 2.

6.7.4 Entry 3 H221_4LINES:QS

This entry, uses 4 lines and has a bit rate of 256kb/s, H.221 BONDING. Using 4 lines delivers transparent, true stereo capable of up to 5 transcodings.

6.7.5 Entry 4 H221_6LINES:QS

This entry is used for 384kb/s communications using 6 lines, H.221 BONDING. Using 6 lines delivers transparent, true stereo capable of up to 15 transcodings.

6.7.6 Entry 5 MICRO56:QS

Use this quick-configuration for communications with a MUSICAM USA Micro-56 codec or any other G.722 codec at 56 kb/s. The **CDQPrima** will be configured for 56 kb/s operation, 16 kHz sampling. The encoder algorithm is G.722 and line 1 is used. You can use other lines by editing this entry.

6.7.7 Entry 6 G.722_56:QS

This entry is identical to Entry 5, but with a generic description. Use this for communications with any industry standard G.722 codec at 56kb/s.

6.7.8 Entry 7 G.722_64:QS

Use this entry for communication with any industry standard G.722 codec at 64 kb/s, including the MUSICAM USA Micro-66 family of codecs.

6.7.9 Entry 8 MPEG2/64K:QS

Use this entry for communications with CCS Audio Products or MUSICAM USA Layer II codecs, single line, 64 kb/s, 48 kHz sampling, mono. For other manufacturers codecs, set the decoder to independent or use Quick Configuration 25.

6.7.10 Entry 9 MPEG2/56K:QS

Use this entry for communications with CCS Audio Products or MUSICAM USA Layer II codecs, single line, 56 kb/s, 48 kHz sampling, mono. For other manufacturers codecs, set the decoder to independent or use Quick Configuration 24.

6.7.11 Entry 10 CCSN/64K:QS

This entry is identical to entry 0, however, 48 kHz sampling and a generic name is used. Use this configuration for communicating with older CDQ1000 and CDQ2000 codecs.

6.7.12 Entry 11 CCSTEST64

Entries 11 through 15 are true Speed Dial entries, not 'Quick Configurations' since they will establish a connection to our 24 hour Music Line. You can use any of the pre-programmed test entries to test your **CDQPrima** at any time. Please note that for use outside North America you must edit these entries to add the overseas dialing codes for the United States. Also, the **CDQPrima** at our factory will automatically terminate all connections after about 15 minutes. Please be sure that your **CDQPrima** is not configured to automatically redial if the connection is dropped.



Entry 11 will call our 24-hour Music Line at 64 kb/s, 48 kHz sampling, mono. Please note, that the Music Line numbers are available for anybody to call at any time, and if you cannot connect, the line may be busy.

6.7.13 Entry 12 CCSTEST128

This entry will call our 24-hour Music Line using 128 kb/s, 48 kHz sampling, joint stereo. Please refer to entry 11 for special notes.

6.7.14 Entry 13 CCSTESTH221

This entry will call our 24-hour Music Line using 128 kb/s, 48 kHz sampling, joint stereo, H.221 BONDING. Allow up to 30 seconds to establish framing. Please refer to entry 11 for special notes.

6.7.15 Entry 14 CCSTEST56

This entry will call our 24-hour Music Line using 56 kb/s, 48 kHz sampling, mono. Please refer to entry 11 for special notes.

6.7.16 Entry 15 CCSTEST112

This entry will call our 24-hour Music Line using 112 kb/s, 48 kHz sampling, joint stereo. Please refer to entry 11 for special notes.

6.7.17 Entry 16 CDQ1000/56K:QS

This entry is similar to entry '0' for communications with a MUSICAM USA CDQ1000 or other codecs using 24 kHz sampling, but uses a line rate is 56 kb/s.

6.7.18 Entry 17 CDQ2000/112:QS

This entry is similar to entry '1', and is used for communications with another MUSICAM or Layer II codec, including the MUSICAM USA CDQ2000 series and all **CDQPrima** and **RoadRunner** models using 112 kb/s line rate, 48 kHz sampling, joint stereo.

Please note that some older CDQ2000 units will require you to use the CCSN algorithm. For these units, use 'Quick Configuration' entry number 21. For other manufacturers codecs, set the decoder to independent, or use Quick Configuration 26.

6.7.19 Entry 18 CCSN/56K:QS

This configuration is used for communications with older MUSICAM USA products using a line rate of 56 kb/s, 48 kHz sampling, mono.

6.7.20 Entry 19 G.722_H.221:QS

This entry is used for communications through some older European (PKI) phone systems, using G.722 encoding and H.221 BONDING.

6.7.21 Entry 20 CCSN/128K:QS

This is identical to entry '1', only the CCSN algorithm is used. This allows connections to older MUSICAM USA products.

6.7.22 Entry 21 CCSN/112K:QS

This is identical to entry '17', only the CCSN algorithm is used to communicate with older MUSICAM USA products.

6.7.23 Entry 22 CDQ2001/128:QS

Use this entry to communicate with another **CDQPrima** or other MUSICAM USA codec, including the CDQ200x series, using 128 kb/s line rate and 32 kHz sampling. 32 kHz sampling, although yielding lower overall bandwidth, results in better transcoding capabilities.

6.7.24 Entry 23 CDQ2001/112:QS

Use this entry to communicate with another **CDQPrima** or other MUSICAM USA codec, including the CDQ200x series, using 112 kb/s line rate and 32 kHz sampling. 32 kHz sampling, although yielding lower overall bandwidth, results in better transcoding capabilities.

6.7.25 Entry 24 ZEPHYR/56K:QS

Use this configuration to communicate with a Telos Zephyr and other manufacturers codecs at 56 kb/s, 48 kHz sampling, decoder independent. This is an MPEG Layer II configuration, so if the far end codec does not support Layer II, you must use a G.722 configuration (6) or a Layer III configuration.

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6.7.26 Entry 25 ZEPHYR/64K:QS

Use this configuration to communicate with a Telos Zephyr and other manufacturers codecs at 64 kb/s, 48 kHz sampling, decoder independent. This is a MPEG Layer II configuration, so if the far end codec does not support Layer II, you must use a G.722 or a Layer III configuration.

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6.7.27 Entry 26 ZEPHYR/112K:QS

Use this configuration to communicate with a Telos Zephyr and other manufacturers codecs at 112 kb/s, 48 kHz sampling, 2-lines, decoder independent. This is a MPEG Layer II configuration.

6.7.28 Entry 27 ZEPHYR/128K:QS

Use this configuration to communicate with a Telos Zephyr and other manufacturers codecs at 128 kb/s, 48 kHz sampling, 2-lines, decoder independent. This is a MPEG Layer II configuration.

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6.7.29 Entry 28 L YR3/56K:QS

Use this Layer III configuration to achieve monaural, 15 kHz frequency response using only one 56 kb/s line. This decoder dependent Quick Configuration is used to connect to other MUSICAM USA Layer III codecs.

6.7.30 Entry 29 L YR3/64:QS

Use this Layer III configuration to achieve monaural, 15 kHz frequency response using only one 64 kb/s line. This decoder dependent Quick Configuration is used to connect to other MUSICAM USA Layer III codecs.

6.7.31 Entry 30 L YR3IND56:QS

Use this Layer III configuration to achieve monaural, 15 kHz frequency response using only one 56 kb/s line. This decoder independent configuration is used to connect to other manufacturers Layer III codecs.

6.7.32 Entry 31 L YR3IND64:QS

Use this Layer III configuration to achieve monaural, 15 kHz frequency response using only one 64 kb/s line. This decoder independent configuration is used to connect to other manufacturers Layer III codecs.