

AES information document for digital audio engineering – Engineering guidelines for the multichannel audio digital interface AES10 (MADI)

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Abstract

This document provides guidance for areas of application of the MADI standard (AES10) that might be unclear. It is not intended to replace AES10, but to supplement it in those areas that are not suitable for definition in a standards document.

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Foreword

Foreword from the first edition, 1995

[This foreword is not a part of *AES information document for digital audio engineering — Engineering guidelines for the multichannel audio digital interface (MADI) AES10*, AES-10id-1995.]

Since its introduction in 1991, AES10 has become the accepted standard for the transmission of more than two channels of linearly represented digital audio data in a professional audio environment. From time to time, requests have been made to the AESSC SC-02 Subcommittee on Digital Audio for additional help in implementing the MADI interface and particularly for completion of subclause 6.2 on fiber-optic transmission, which has remained under consideration. The working group decided to place the requested guideline in an AES information document, together with a recommendation for the use of fiber-optic transmission. The working group hopes that experience gathered during use of this recommendation will help in the final drafting of subclause 6.2.

A writing group of AESSC SC-02-02 Working Group on Digital Input/Output Interfacing under the leadership of Paul Lidbetter prepared these guidelines.

Robert A. Finger
Chairman, SC-02-02 Working Group on Digital Input/Output Interfacing
1 June 1994

Foreword to the second edition, 2004

The second edition was prepared by a writing group led by R. Caine. It incorporates comments from K.Kondakor, C.Travis and J.Honor.

J. Grant
Chairman, SC-02-02 Working Group on Digital Input/Output Interfacing
2004-10-18

Corrigendum 2011-04-26

Clause 9.4 has been updated editorially to reflect experience of newer integrated circuits.

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1 Introduction and Scope

1.1 Introduction

The MADI standard, AES10-1991, is a proven, long-standing interface based on the FDDI standard ISO 9314 that has been in use since the 1980s.

The original purpose of MADI was for the interconnection of sound consoles to multi-track tape recorders and the standard has not been found wanting in any respect for that purpose. It was, however, adopted immediately by a large broadcaster as a means to route many programmes round large installations and hence formed an interface to routing switchers. This gave rise to slightly different requirements, so that the revision of MADI known as AES10-2003 includes the option of dropping the ‘varispeed’ capability in exchange for 64 rather than 56 audio channels. MADI also exploits the FDDI provision for signalling in the carrier ‘sync symbol’ characters. The original standard has been used many times in large routing installations, so that probably more MADI interfaces exist for routing than for console-to-tape interconnection. The 2003 revision was also driven by the need to accommodate 96 kHz sampling (and other double-rate sampling frequencies).

1.2 Scope

This document deals with a number of details not laid down in the AES10 standard, or unnecessarily restricted by the standard, concerning synchronisation, packing, and so on which have given rise to delivery problems. The first edition of this document, AES-10id-1995, has many explanatory notes but was mostly written before there was very much experience of using MADI operationally.

This revision of AES-10id is divided into sections dealing with: input from AES3 bitstreams, output to AES3 bitstreams and including additional concerns for other digital audio interfaces, synchronisation of AES3 to MADI decoders, synchronisation of MADI to AES3 decoders, and some general problems uncovered by experience.

This document should be read in conjunction with the current revision of the standard, AES10-2003, described in text as “the standard”.

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2 References

AES3-2003 *AES Recommended Practice for Digital Audio Engineering – Serial Transmission format for two-channel linearly represented digital audio data*, Audio Engineering Society, New York, NY., US.

AES10-2003 *AES Recommended Practice for digital audio Engineering – Serial Multichannel Audio digital Interface (MADI)*, Audio Engineering Society, New York, NY., US.

AES11-2003 *AES Recommended Practice for Digital Audio Engineering – Synchronisation of digital audio equipment in studio operations*, Audio Engineering Society, New York, NY., US.

AES47-2002 *AES standard for digital audio - Digital input-output interfacing - Transmission of digital audio over asynchronous transfer mode (ATM) networks*, Audio Engineering Society, New York, NY., US.

EN 50083-9 *Cable networks for television signals, sound signals and interactive services - Part 9: Interfaces for CATV/SMATV headends and similar professional equipment for DVB/MPEG-2 transport streams*, European Committee for Electrotechnical Standardization (CENELEC), Brussels, Belgium

ISO/IEC 9314-3 *Information Processing Systems – Fibre Distributed Data Interface (FDDI) Part 3 Physical Layer Medium Dependent*, International Electrotechnical Commission, Geneva, Switzerland

SMPTE 297M *Television – Serial digital fiber transmission system for ANSI/SMPTE 259M signals*, Society of Motion Picture and Television Technicians, White Plains, NY., US.

SMPTE 320M *Television - Channel Assignments and Levels on Multichannel Audio Media*, Society of Motion Picture and Television Technicians, White Plains, NY., US.

SMPTE 323M *Motion-Picture Film - Channel Assignments and Levels on Multichannel Audio Media*, Society of Motion Picture and Television Technicians, White Plains, NY., US.

3 Definitions

3.1 Varispeed

Variation of sample rate continuously over $\pm 12,5\%$ relative to 48 kHz.

3.2 5B4B

A form of binary code in which four payload bits are mapped to five transmission bits in order to reduce DC content and increase energy at clock frequency.

3.3 Sync symbol

A group of ten transmission bits not derived from payload data but used as part of the transmission system to facilitate decoding, and able to carry a form of signalling in the transmission channel, as distinct from the audio channels.

3.4 Quadlet

A group of four associated bytes comprising a 32-bit word

3.5 Subframe

data associated with a single sample of one audio channel in an AES3 signal.

3.6 Channel

data corresponding to a single audio signal (for example, a mono signal or the left channel of a stereo pair). In AES3, when referring to one sample of that signal it is referred to as a subframe. In this document, the word 'channel' is also used in the single-sample sense.