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INTERNATIONAL STANDARD

NORME INTERNATIONALE

MIDI (musical instrument digital interface) specification 1.0 (Abridged Edition, 2015)

Spécification MIDI (musical instrument digital interface) 1.0 (Edition abrégée, 2015)

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MIDI (MUSICAL INSTRUMENT DIGITAL INTERFACE) SPECIFICATION 1.0 (Abridged Edition, 2015)

FOREWORD

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International Standard IEC 63035 has been prepared by IEC technical committee 100: Audio, video and multimedia systems and equipment.

The text of this standard is based on the following documents:

CDV	Report on voting
100/2597/CDV	100/2858/RVC

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

IEC 63035 contains the same first 8 pages as in the MIDI 1.0 Detailed Specification (the original core specification text) published by the MIDI Manufacturers Association (MMA). These are included within this standard as Clauses 1 to 4. This specification was submitted to the IEC under the auspices of a special agreement between the IEC and the MMA.

The MMA is a non-profit corporation that serves as a support organization and forum for the advancement and adoption of MIDI technology (along with the Association of Musical Electronics Industry, or AMEI, in Japan).

The MIDI 1.0 technology dates back to 1983 when the protocol and electrical specification comprised 8 pages and the majority of the message identifiers were not yet defined. Over the subsequent years, the MMA and AMEI determined consensus of the worldwide MIDI industry, and defined numerous additional messages (via Confirmation of Approval documents), as well as many Recommended Practices for the use of MIDI technology, all the while maintaining MIDI as "1.0" (meaning that no significant changes were made to the initial specification).

The MMA documentation for MIDI 1.0 now encompasses more than 50 different documents in print or on the World Wide Web. This standard contains the same first 8 pages as in the MMA's MIDI 1.0 Detailed Specification but does not contain all of the subsequent information developed by MMA/AMEI. Rather, this document contains a complete listing (with basic description) of all defined MIDI messages to date, with references to the appropriate MMA documentation. Companies that want to implement MIDI technology are advised to also consult the MMA documentation that is listed in the Biography.

Although the MIDI 1.0 Detailed Specification includes an electrical connection specification ("MIDI-DIN"), other transports (USB, Firewire, etc.) have also been approved by MMA/AMEI for use with MIDI Protocol. For details and documentation of approved physical transports, please contact the MIDI Manufacturers Association.

The term "MIDI" is known all around the world as referring to the technology which is defined in the MMA/AMEI documents, and so should not be used for any other purpose. Companies that implement MIDI technology in their products in compliance with MMA specifications may use the term MIDI to describe their products, but may not use the term to describe any extensions or enhancements that are not defined by MMA/AMEI. Only MMA/AMEI can define the messages, transport payloads, and Recommend Practices which are promoted as "MIDI" so as to prevent any dilution and confusion of the meaning of "MIDI". Implementers of MIDI technology should consult MMA and/or AMEI (depending on the relevant market) for specific trademark usage policies.

MIDI (MUSICAL INSTRUMENT DIGITAL INTERFACE) SPECIFICATION 1.0 (Abridged Edition, 2015)

1 Scope

This International Standard specifies a hardware and software specification which makes it possible to exchange symbolic music and control information between different musical instruments or other devices such as sequencers, computers, lighting controllers, mixers, etc. using MIDI technology (musical instrument digital interface).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60130-9, *Connectors for frequencies below 3 MHz – Part 9: Circular connectors for radio and associated sound equipment*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
velocity
parameter which typically changes the intensity and resultant volume of the note that is being played and varies according to the force applied

Note 1 to entry: Velocity is used as Key Velocity as in a piano key.

3.2
aftertouch
parameter that measures the level of intensity applied to a note after it has been played and continues to be depressed

Note 1 to entry: Typically, Aftertouch is useful for adding vibrato or tremolo effects to a sound in much the same way that a violin can add volume or pitch changes to a sustained note using finger vibrato or additional bowing intensity.

3.3
modulation wheel
wheel controller found on synthesizers that players can use to progressively introduce modulation depth to a sound

3.4
pitch wheel
wheel type device, normally found to the left of a synthesizer keyboard, used to manipulate the pitch of a played note or notes

3.5
pitch bend
activity or message, generally initiated by a pitch wheel, that smoothly raises and/or lowers the pitch of note or chord

3.6
oscillator
circuitry or software program that generates the kernel of a synthesizer sound

Note 1 to entry: In the early days, oscillators generated fairly basic sound types (sawtooth, square, pulse etc). In modern synthesizer engines, oscillators can be driven by myriad waveforms and samples.

3.7
pan
parameter that specifies the location of a sound within the stereo field

4 General

4.1 Hardware

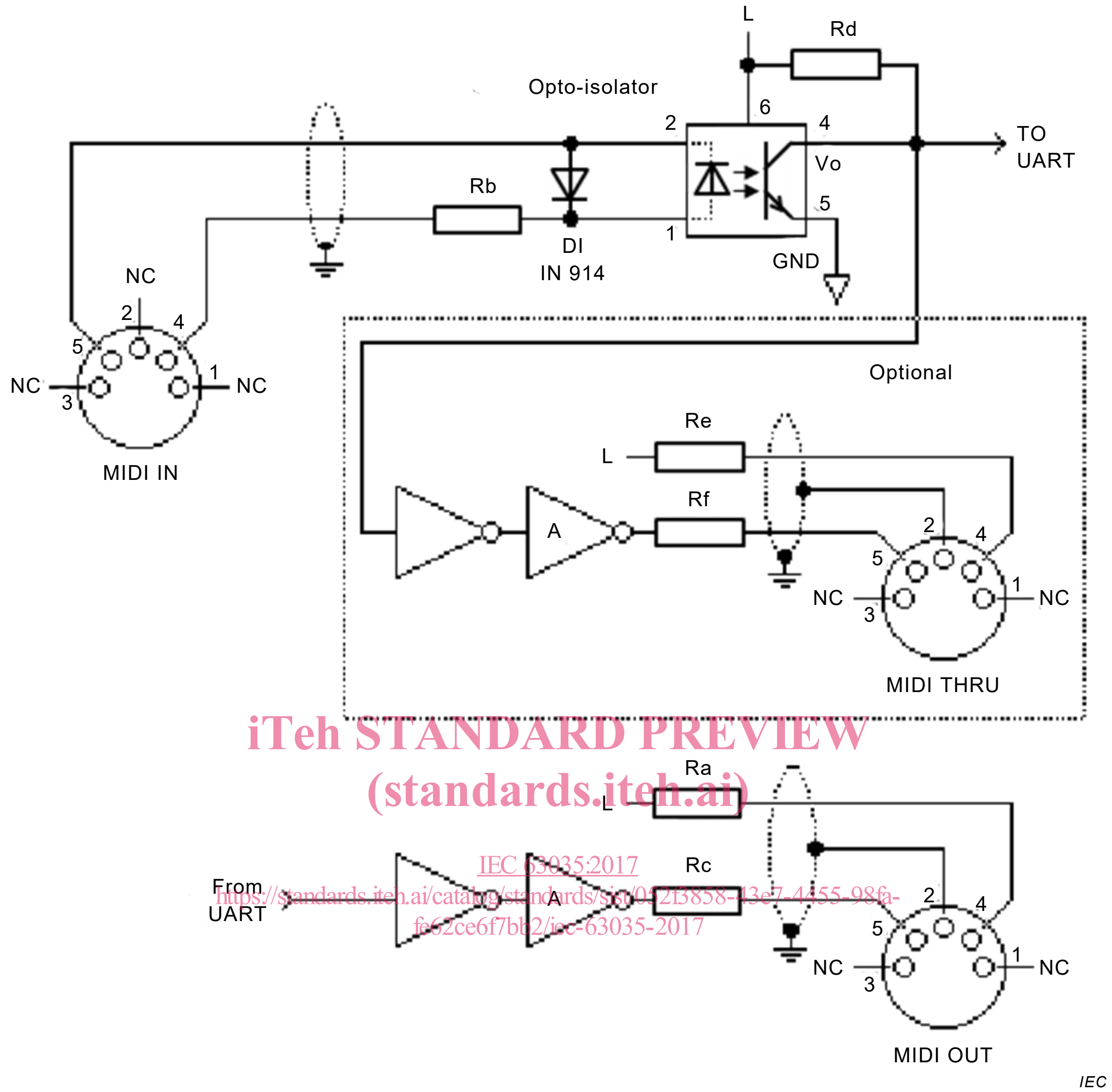
The hardware MIDI interface operates at 31,25 × (1 ± 1 %) kBd asynchronous, with a start bit, 8 data bits (D0 to D7), and a stop bit. This makes a total of 10 bits for a period of 320 µs per serial byte. The start bit is a logical 0 (current on) and the stop bit is a logical 1 (current off). Bytes are sent LSB first.

Circuit: (See Figure 1). 5 mA current loop type. Logical 0 is current ON. One output shall drive one and only one input. To avoid ground loops, and subsequent data errors, the transmitter circuitry and receiver circuitry are internally separated by an opto-isolator (a light emitting diode and a photo sensor which share a single, sealed package). The receiver shall require less than 5 mA to turn on. Rise and fall times should be less than 2 µs.

Connectors: DIN 5 pin (180°) female panel mount receptacle which is specified in IEC 60130-9 as type designation IEC-04. The connectors shall be labelled "MIDI IN" and "MIDI OUT". Note that pins 1 and 3 are not used, and should be left unconnected in the receiver and transmitter. Pin 2 of the MIDI In connector should also be left unconnected.

The grounding shield connector on the MIDI jacks should not be connected to any circuit or chassis ground.

When MIDI Thru information is obtained from a MIDI In signal, transmission may occasionally be performed incorrectly due to signal degradation (caused by the response time of the opto-isolator) between the rising and falling edges of the square wave. These timing errors will tend to add up in the "wrong direction" as more devices are chained between MIDI Thru and MIDI In jacks. The result is that, regardless of circuit quality, there is a limit to the number of devices which can be chained (series-connected) in this fashion.



Key

Components		**Supplies**
Ra, Rb, Rc, Re, Rf	resistor R = 220 Ω	L +5 V
Rd	resistor R = 280 Ω	

NOTE 1 Opto-isolator shown is Sharp PC-900. (HP 6N138 or other opto-isolator can be used with appropriate changes.)

NOTE 2 Gates "A" are IC or transistor.

NOTE 3 Resistors are 5 %.

Figure 1 – MIDI standard hardware

Cables shall have a maximum length of 15 m, and shall be terminated on each end by a corresponding 5-pin DIN male plug which is specified in IEC 60130-9 as type designation IEC-03. The cable shall be shielded twisted pair, with the shield connected to pin 2 at both ends.

A MIDI Thru output may be provided if needed, which provides a direct copy of data coming in MIDI In. For long chain lengths (more than three instruments), higher-speed opto-isolators should help to avoid additive rise/fall time errors which affect pulse width duty cycle.

4.2 Data format

MIDI communication is achieved through multi-byte "messages" consisting of one Status byte followed by one or two Data bytes. Real-Time and Exclusive messages are an exception.

A MIDI-equipped instrument typically contains a receiver and a transmitter. Some instruments may contain only a receiver or only a transmitter. A receiver accepts messages in MIDI format and executes MIDI commands. It consists of an opto-isolator, Universal Asynchronous Receiver/Transmitter (UART), and any other hardware needed to perform the intended functions. A transmitter originates messages in MIDI format, and transmits them by way of a UART and line driver.

MIDI makes it possible for a user of MIDI-compatible equipment to expand the number of instruments in a music system and to change system configurations to meet changing requirements.

MIDI messages are sent over any of 16 channels which are used for a variety of performance information. There are five major types of MIDI messages: Channel Voice, Channel Mode, System Common, System Real-Time and System Exclusive.

A MIDI event is transmitted as a "message" and consists of one or more bytes. Figure 2 to Figure 5 show the structure and classification of MIDI data.

Figure 2 – Types of MIDI bytes

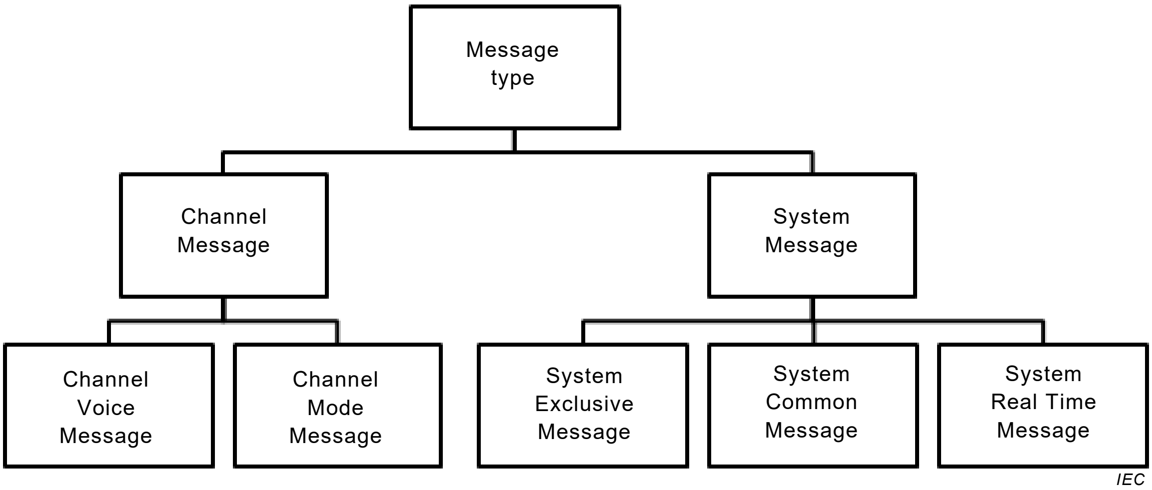


Figure 3 – Types of MIDI messages

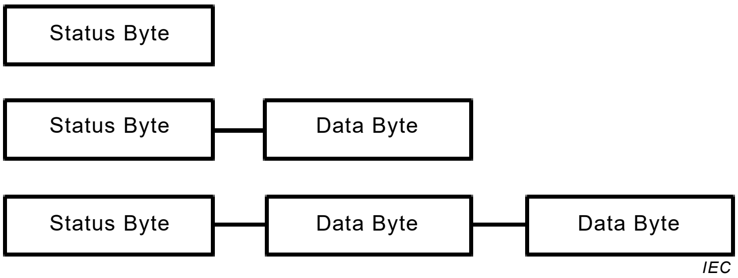


Figure 4 – Structure of a single message

Figure 5 – Structure of System Exclusive message

4.3 Message types

4.3.1 General

Messages are divided into two main categories: Channel and System.

4.3.2 Channel messages

A Channel message uses four bits in the Status byte to address the message to one of sixteen MIDI channels and four bits to define the message (see Annex A). Channel messages are thereby intended for the receivers in a system whose channel number matches the channel number encoded into the Status byte.

An instrument can receive MIDI messages on more than one channel. The channel in which it receives its main instructions, such as which program number to be on and what mode to be in, is referred to as its "Basic Channel". An instrument may be set up to receive performance data on multiple channels (including the Basic Channel). These are referred to as "Voice Channels". These multiple-channel situations will be discussed in more detail later (see 4.5).

There are two types of Channel messages: Voice and Mode.

- VOICE: To control an instrument's voices, Voice messages are sent over the Voice Channels.
- MODE: To define the instrument's response to Voice messages, Mode messages are sent over an instrument's Basic Channel.

4.3.3 System messages

System messages are not encoded with channel numbers. There are three types of System messages: Common, Real-Time, and Exclusive.

- COMMON: Common messages are intended for all receivers in a system regardless of channel.
- REAL-TIME: Real-Time messages are used for synchronization and are intended for all clock-based instruments in a system. They contain Status bytes only – no Data bytes. Real-Time messages may be sent at any time – even between bytes of a message which has a different status. In such cases the Real-Time message is either acted upon or ignored, after which the receiving process resumes under the previous status.

- EXCLUSIVE: Exclusive messages can contain any number of Data bytes, and can be terminated either by an End of Exclusive (EOX) or any other Status byte (except Real Time messages). An EOX should always be sent at the end of a System Exclusive message. These messages include a Manufacturer's Identification (ID) code. If a receiver does not recognize the ID code, it should ignore the following data.

  So that other users and third party developers can fully access their instruments, manufacturers shall publish the format of the System Exclusive data following their ID code. Only the manufacturer can define or update the format following their ID.

4.4 Data types

4.4.1 General

There are two types of bytes sent over MIDI: Status Bytes and Data bytes.

4.4.2 Status bytes

4.4.2.1 General

Status bytes are eight-bit binary numbers in which the Most Significant Bit (MSB) is set (binary 1). Status bytes serve to identify the message type, that is, the purpose of the Data bytes which follow it. Except for Real-Time messages, new Status bytes will always command a receiver to adopt a new status, even if the last message was not completed.

4.4.2.2 Running status

For Voice and Mode messages only. When a Status byte is received and processed, the receiver will remain in that status until a different Status byte is received. Therefore, if the same Status byte would be repeated, it can optionally be omitted so that only the Data bytes need to be sent. Thus, with Running Status, a complete message can consist of only Data bytes.

Running Status is especially helpful when sending long strings of Note On/Off messages, where "Note On with Velocity of 0" is used for Note Off.

Running Status will be stopped when any other Status byte intervenes. Real-Time messages should not affect Running Status.

4.4.2.3 Unimplemented status

Any status bytes, and subsequent data bytes, received for functions not implemented in a receiver should be ignored.

4.4.2.4 Undefined status

All MIDI instruments should be careful to never send any undefined status bytes. If an instrument receives any such code, it should be ignored without causing any problems to the system. Care should also be taken during power-up and power-down that no messages be sent out the MIDI Out port. Such noise, if it appears on a MIDI line, could cause a data or framing error if the number of bits in the byte is incorrect.

4.4.3 Data bytes

Following a Status byte (except for Real-Time messages) there are either one or two Data bytes which carry the content of the message. Data bytes are eight-bit binary numbers in which the Most Significant Bit (MSB) is always set to binary 0. The number and range of Data bytes which shall follow each Status byte are specified in Annex A and Annex B. For each Status byte the correct number of Data bytes shall always be sent. Inside a receiver, action on the message should wait until all Data bytes required under the current status are received. Receivers should ignore Data bytes which have not been properly preceded by a valid Status byte (with the exception of "Running Status," explained above).

4.5 Channel modes

Synthesizers and other instruments contain sound generation elements called voices. Voice assignment is the algorithmic process of routing Note On/Off data from incoming MIDI messages to the voices so that notes are correctly sounded.

NOTE When we refer to an "instrument", please note that it is possible for one physical instrument to act as several virtual instruments (i.e. a synthesizer set to a 'split' mode operates like two individual instruments). Here, "instrument" refers to a virtual instrument and not necessarily one physical instrument.

Four Mode messages are available for defining the relationship between the sixteen MIDI channels and the instrument's voice assignment. The four modes are determined by the properties Omni (On/Off), Poly, and Mono. Poly and Mono are mutually exclusive, i.e., Poly disables Mono, and vice versa. Omni, when on, enables the receiver to receive Voice messages on all voice Channels. When Omni is off, the receiver will accept Voice messages from only selected Voice Channel(s). Mono, when on, restricts the assignment of Voices to just one voice per Voice Channel (Monophonic.) When Mono is off (Poly On), a number of voices may be allocated by the Receiver's normal voice assignment (Polyphonic) algorithm.

For a receiver assigned to Basic Channel "N," (1 to 16) the four possible modes arising from the two Mode messages are shown in Table 1.

Table 1 – Modes for receiver

Mode	Omni	Poly/Mono	Description
1	On	Poly	Voice messages are received from all Voice channels and assigned to voices polyphonically.
2	On	Mono	Voice messages are received from all Voice Channels, and control only one voice, monophonically.
3	Off	Poly	Voice messages are received in Voice channel N only, and are assigned to voices polyphonically.
4	Off	Mono	Voice messages are received in Voice channels N through N+M-1, and assigned monophonically to voices 1 through M, respectively. The number of voices "M" is specified by the third byte of the Mono Mode Message.

Four modes are applied to transmitters (also assigned to Basic Channel N) (see Table 2). Transmitters with no channel selection capability should transmit on Basic Channel 1 (N=1).

Table 2 – Modes for transmitter

Mode	Omni	Poly/Mono	Description
1	On	Poly	All voice messages are transmitted in Channel N.
2	On	Mono	Voice messages for one voice are sent in Channel N.
3	Off	Poly	Voice messages for all voices are sent in Channel N.
4	Off	Mono	Voice messages for voices 1 through M are transmitted in Voice Channels N through N+M-1, respectively. (Single voice per channel).

A MIDI receiver or transmitter operates under only one Channel Mode at a time. If a mode is not implemented on the receiver, it should ignore the message (and any subsequent data bytes), or switch to an alternate mode, usually Mode 1 (Omni On/Poly).

Mode messages will be recognized by a receiver only when received in the instrument's Basic Channel – regardless of which mode the receiver is currently assigned to. Voice messages may be received in the Basic Channel and in other Voice Channels, according to the above specifications.