THE MIDI BATON III

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ABSTRACT

The MIDI Baton III is a third-generation prototype controller for use by a conductor in coordinating—via conventional motions normally associated with a conductor's baton—live performers and MIDI-compatible systems.

INTRODUCTION

The MIDI Baton is intended to enable a conductor to coordinate (1) live performers and (2) a computer and/or hardware-based MIDI sequencer in real-time performance. The system accommodates human variance in timing on stage and provides the singers/actors with the interpretive freedom to which they are accustomed when accompanied by conventional instruments.

The MIDI Baton III is a refinement of its predecessors reported on in the Proceedings of the 1989 and 1990 ICMC. The current system allows for broadly flexible tempo control as well as for start, pause, continue, and restart functions. Note that the system detects and generates only timing information. The MIDI baton is based upon the premise that the conductor will not control loudness information. Traditionally, conductors use the baton and/or other motions only to "suggest" loudness modifications to the performer, and the performer actually executes the alterations. In the present work, the assumption has been made that direct control of loudness will rely upon either (1) programming outside of performance time or (2) performance-time intervention at a volume control, as appropriate to the situation.

SYSTEM OVERVIEW

Because the basic system has been described elsewhere (Keane et al., 1989; 1990), only a brief summary is provided here. The basic components of the baton are:

1. Baton Controller: detects changes of direction in the conductor's motions
2. Transmitter: eliminates the necessity for wires to connect the baton with the MIDI units
3. Receiver: detects transmitted signal from the baton
4. Microprocessor interface: interprets the baton pulses and sends out MIDI clocks and other messages
The transmitter is worn in the pocket or on the belt of the conductor. A small wire antenna hangs from the transmitter, and must be kept within the range of the receiver (approximately 2 to 3 meters with the current version) and unobstructed by metal objects. The receiver is a small box with an upstanding antenna. It can easily be placed near the conductor with only consideration for AC power and MIDI connections. Long MIDI cables (IN, OUT, THRU) allow for the sequencers, synthesizers, samplers, and other MIDI units to be a considerable distance from the conducting area, if desired. START, STOP, CONTINUE from the previous stop location, and BEGIN from the head of the sequence again, are commands that are easily sent by means of the baton system without necessity to interact with the MIDI equipment directly. However, it may be desirable in rehearsal to have the sound components and/or a keyboard controller near at hand.

The receiver has a small array of indicator lights that provide visual verification for the operator. These provide useful information for troubleshooting the MIDI setup and allow the conductor quickly to become acquainted with the parameters of the baton system as distinguished from the rest of the MIDI setup. The array includes:

- **RESET**: confirms RESET button has been pressed; system will reset to beginning of MIDI sequence on commencement of beating
- **STOP**: confirms STOP/CONT button has been pressed; system will discontinue MIDI clock output until STOP/CONT is pressed again and beating is started (system continues at point stopped, unless RESET button has been pressed)
- **WINDOW**: lights during the period that baton beats will be accepted (when the light is off, baton beats are ignored)
- **ACCEPTED**: verifies that a baton beat has been detected and accepted
- **TEMPO**: verifies the rate at which MIDI beats (every 24 clocks) are being sent out

**MICROPROCESSOR INTERFACE**

The heart of the MIDI Baton system is a Motorola 6811 microcontroller which interprets the beat and switch information and produces the appropriate MIDI codes on the basis of that information. This processor has an evaluation board that can be connected to a computer for testing and has the advantages of economy, good input/output capabilities, and an asynchronous serial interface that easily accommodates MIDI. It also has good timer functions. These include the ability to automatically capture the time of a hardware event before calling the software interrupt handler, and the availability of several timer interrupts for scheduling real-time events. These allow for an excellent event-based program structure capable of flexibly and simultaneously responding to varying baton beat rates and allowing for input from the MIDI sequencer as well as the control buttons (STOP/CONTINUE and RESET).
TIME CODE STRATEGY

When a baton beat is received and accepted, the time between the new beat and the last is used to calculate the new tempo—represented as MIDI time codes. There are 24 MIDI clocks sent per beat, but a discrepancy can arise should the tempo change. If the tempo increases, FEWER than 24 will have been sent and should the tempo decrease, MORE than 24 would be sent. To prevent this, the microcontroller monitors the clock output and inserts or withholds clocks as necessary.

CONTROL PARAMETERS

The MIDI sequencer may be used to deliver to the baton interface pre-programmed control settings to facilitate use of the baton. For example, a sudden tempo change from 50 beats/minute to 200 beats/minute would require at least 3-3.5 beats to realize the new tempo and the conductor would risk beating outside the detection window and the attendant possible consequence of losing control of the sequencer. The system allows for a MIDI controller value to be placed in the sequence and sent at the correct moment to the baton interface. On receipt of this value, the baton's reference tempo would instantly shift to the newly indicated tempo from the previous (current) reference tempo.

Changes sent on MIDI channel 16 are used for setting baton control parameters. The controller number determines which parameter and the controller value determines the setting of the parameter.

TEMPO: Controller #12; tempo = 2 x controller value (e.g., value 60 = a tempo of 120 beats per minute)

WINDOW SIZE: Controller #15; percentage of a beat in the current tempo in which the system will accept a baton beat (e.g., value 60 sets the window to accept a new beat during 60% of its duration); a setting of 0 turns off the window limitation allowing the system to generate a beat for EVERY baton motion (normally too sensitive to be desirable).

WINDOW SHIFT: Controller #14; percentage of the window (as specified by WINDOW SIZE) that is placed after the baton best in the current tempo; normally this is set to 62%*

LEAD-LAG: Controller #13; amount of time that beat is shifted ahead or behind the actual baton pulse; this adjustment allows for correction of discrepancies between the sound production and the perceived beat (caused by such things as a large distance between the conductor and the loud speakers or voices with sluggish attacks)

*ICMC 543
CONCLUSION

The present MIDI Baton provides a conductor of combined live and sequenced sources with basic tempo control as well as "Stop/Continue" and "Reset" functions. The system is independent of wired connections to the audio devices and requires (beyond a MIDI sequencer and MIDI sound system) only 120 VAC and three standard MIDI cables to function. The system is inexpensive and relatively easy to use by a conductor with no particular experience with electroacoustic devices. Improvement in the system might include removal of the control buttons from the transmitter pack to the grip or shaft of the baton itself for greater convenience of access. More problematic, however, is the ability of the live performer to ANTICIPATE future tempo changes (such as an accelerando, for example). A similar capability in the baton system would allow for greater synchrony in accelerandi and the like, but, at present, programming this creates more problems than it solves.

Notes

* The most desirable percentage of detection window on either side of the expected next beat would seem to be 50%. In fact, owing to the nonlinear relationship between time and frequency, a setting of 62% is necessary to create the sensation of 50/50. Space is insufficient to show the reason for this.

References
