

MIDI Coffee Machine Control

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1 Introduction

MIDI Coffee Machine Control is a protocol which allows MIDI systems to communicate with and to control coffee machines (coffee pot, individual capsule machine).

This protocol has been heavily inspired on the Hyper Text Coffee Pot Control Protocol (HTCPCP/1.0) [RF2324] which is designed to control coffee pots. In order to make this protocol more widespread, it has been designed to be simpler to implement :

- cheap microcontroller boards (Arduino) can easily be used in a MIDI environment,
- the protocol can be used without any development with most Digital Audio Workstation softwares,
- the real-time considerations of the RFC2324 are easily taken into account in a MIDI environment, without any configuration.

Moreover, while the MIDI protocol is usually used with an opto-isolated link (safer with a coffee machine), it may be encapsulated with other protocols : USB (Universal Serial Bus Device Class Definition for MIDI Devices), Internet Protocol (RFC 4695 – RTP Payload Format for MIDI), Bluetooth (Specification for MIDI over Bluetooth Low Energy).

Some provisions were added for capsule coffee machines. Decaffeinated coffee is now supported.

2 Standard specifications

Introduction

MIDI Coffee Machine Control is based on the MIDI Machine Control protocol (MMC) and defines specific commands needed to control a coffee machine.

As stated by MIDI Machine Control (MMC), MMC RESET (0D) must be supported by the MIDI coffee machine. This command should put the machine in a safe mode (stopping any action in progress).

The following specific commands are defined :

Hex	Command	Type	Number of data bytes
60	LOAD CAPSULE	Ctrl	4
61	START BREWING	Ctrl	0
62	STOP BREWING	Ctrl	0
63	START POURING ADDITIVE	Ctrl	1
64	STOP POURING ADDITIVE	Ctrl	0

All the commands may be used in an open-loop or in a closed-loop operation.

60 LOAD CAPSULE

This command is intended to select a capsule of coffee on a machine which supports them.

F0 7F <device_ID> <mcc> 60 <count=04> <type> <strength> <subtype LSB> <subtype MSB>
F7

The type of capsule may be selected among :

- 00 espresso
- 01 lungo
- 02 decaffeinated espresso
- 03 decaffeinated lungo
- 04 americano coffee
- 05 aromatised coffee
- 06 chocolate
- 07 tea
- 7F special — descaler

The strength range is dependant of the coffee product.

The subtype is used when multiple coffees of the same type and the same strength are available. The subtype is coded on 2 bytes (14 bits). As with MIDI program and bank numbers, subtypes begin counting from 1. Thus the actual subtype number will be (MIDI value +1). We can't insist enough on this point.

61 START BREWING

This command is intended to start brewing a coffee. On a capsule machine it must be sent after the capsule loading. Its use in an open-loop operation must be done after a delay which permits the loading of the capsule. The delay is implementation dependant.

```
F0 7F <device_ID> <mcc> 61 <count=00> F7
```

62 STOP BREWING

This command is intended to stop brewing a coffee. The delay between the START BREWING (61) and the STOP BREWING (62) define the quantity of coffee the MIDI coffee machine will prepare.

```
F0 7F <device_ID> <mcc> 62 <count=00> F7
```

63 START POURING ADDITIVE

This command is intended to start pouring some additive.

```
F0 7F <device_ID> <mcc> 63 <count=01> <type> F7
```

The following types of additive are supported :

00-0F: milk additive

- 00 Cream
- 01 Half-and-half
- 02 Whole-milk
- 03 Part-skim
- 04 Skim
- 05 Non-Dairy

10-1F : syrup additive

- 10 Vanilla
- 11 Almond
- 12 Raspberry
- 13 Chocolate
- 14 Caramel

20-2F : Sweetener additive

- 20 Sugar
- 21 Honey
- 22 Aspartam
- 23 Sucralose
- 24 Stevia

30-3F : spice additive

to be defined

40-4F : alcohol additive

- 40 Whiskey
- 41 Rum
- 42 Kahlua
- 43 Aquavit

64 STOP POURING ADDITIVE

This command is intended to stop pouring some additive.

F0 7F <device_ID> <mcc> 64 <count=00> F7

The STOP POURING ADDITIVE (64) command is equivalent of the WHEN query of the RF2324 which tell "when" to stop.

Error report

Common failures are reported by the FAILURE (65) response. The following ASCII data must be used when required :

no water
no coffee
no additive
still heating
capsule not loaded

Plug'n play

Simple MIDI coffee machine will be easily controlled by the protocol as described. But some more specifications could enable a plug'n play use.

Plug'n play MIDI coffee machines must respond to the MIDI DEVICE INQUIRY command. The device family code is 24 (number of atoms in a caffeine molecule). The device family member code is 24 too.

The MIDI coffee machine must also respond to a FILE DUMP REQUEST command according to the MIDI protocol. A single file MCMC.xml must be available with the type "XML<space>".

The MCMC.xml file must conform to the the W3C XML format and be validated against the the following schema :

```
<?xml version="1.0"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:element name="MCMC_description">
    <xs:complexType>
      <xs:sequence>
```

```

<xs:element name="support">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="capsule" type="xs:boolean"/>
      <xs:element name="additive" type="xs:boolean"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="capsule" minOccurs="0" maxOccurs="unbounded">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="name" type="xs:string"/>
      <xs:element name="type" type="xs:hexBinary"/>
      <xs:element name="strength" type="xs:int"/>
      <xs:element name="subtype_number" type="xs:int"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="additive" minOccurs="0" maxOccurs="unbounded">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="name" type="xs:string"/>
      <xs:element name="value" type="xs:hexBinary"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

One example of a MIDI coffee machine file description is given :

```

<?xml version="1.0" encoding="utf-8" ?>
<MCMC_description>
  <support>
    <capsule>true</capsule>
    <additive>true</additive>
  </support>
  <capsule>
    <name>Delicioso Caffeineto</name>
    <type>00</type>
    <strength>10</strength>
    <subtype_number>24</subtype_number>
  </capsule>
  <additive>
    <name>Cream</name>
    <value>00</value>
  </additive>
</MCMC_description>

```

3 Recommendations

This protocol is intended to be used in a controlled environment. Using Internet Protocol to relay it should be done with security measures (dedicated LAN, VLAN, VPN) and a quality of service which guarantee the latency.

Since the protocol is designed to be used on a MIDI bus with multiple coffee machines, the `Device_ID` should be parameterized to differentiate the coffee machines.

On a capsule coffee machine controlled with a Bluetooth link, the machine should be prepared to not receive `STOP BREWING` (62) and `STOP POURING ADDITIVE` (64) commands, and should stop by itself after a defined delay.

The `GROUP` command (52) may be supported. This command simplifies the preparation of multiple coffee of the same type with multiple machines. Using grouped commands with multiple capsule coffee machines of different brands is not recommended.

4 Acknowledgements

Many thanks to Larry Masinter, the author of the Hyper Text Coffee Pot Control Protocole (HTCPCP/1.0), [RFC2324].