

# The PC2MDB User's Guide

Version 1.5

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## Introduction

The latest version of PC2MDB™ User's Guide, along with technical support and information about Upstate Networks, may be found on the Upstate Networks World-Wide Web server at <http://www.upstatenetworks.com/>.

## Overview

The PC2MDB™ enables a PC to act as a cashless device when combined with any multi-drop bus (MDB) vending product. It is installed as a slave device for an already existing vending machine controller (VMC).

This document describes the Interface Protocol for the PC2MDB™ hardware circuit. The PC2MDB™ interfaces any MDB vending device (6-pin molex/5pin MTA) to a PC via the serial port (DB-9). Future support may include Universal Serial Bus. The PC2MDB™ protocol is compatible with the standard RS-232 protocol.

## System Requirements

- An IBM PC compatible, with 486 or better processor.
- A serial COM port.
- An MDB compatible vending device
- External Power supply (Typically 24VDC)
- DB-9 (F-M) cable and MDB cable

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## Quick Start

Install the PC2MDB™ on a free serial port either 9 pin or 25 pin (adapter required for 25 Pin) and designate it COM2. Serial port settings are 9600, 8, 1, none. Interrupt conflicts must be avoided.

Connect 24Vdc power and MDB connections (6-pin Molex). Apply power. Check for LED1 (Green) indicating power is OK.

Install and run **SETUP.EXE** from the MDBLAB directory on Disk or CD-ROM provided. Insert different dollar bill denominations, coins OR magnetic swipe, etc. and check to see that they register in the MDBLAB™ program. If all currency is registered the HARDWARE INSTALLATION is complete. Proceed to SOFTWARE DEVELOPERS KIT.

**Hardware Installation**

**Hardware Specifics**

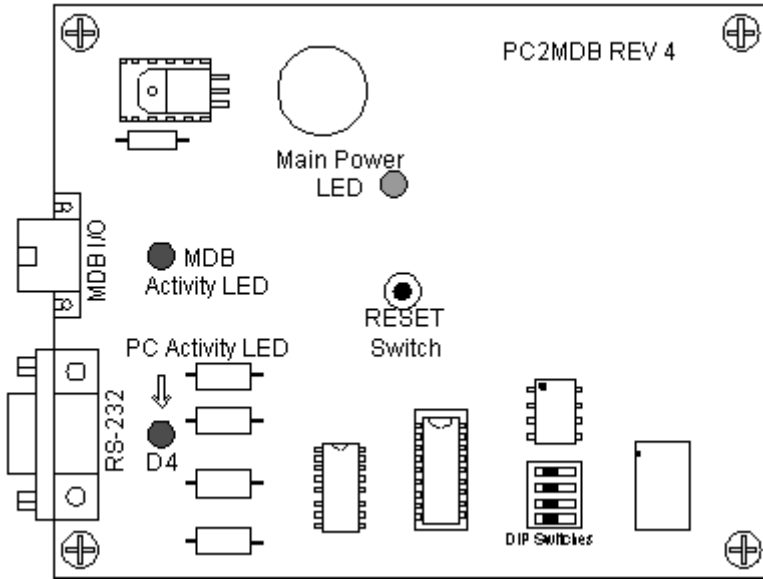


Figure 1 - Connector, Jumper, and LED locations

Using the Y-Cable provided, connect the 6 pin male MOLEX connector on the red end to the VMC and the 6pin male MOLEX connector on the black end to the PC2MDB board, while using the 6 pin female MOLEX for power or to connect other MDB compliant devices to the bus.

	OFF	ON
1	10H	60H
2	Level 1	Level 2/3
3	ASCII	Binary
4	HW Flow Control	N/A
ALL	Normal	Self Test

Table 1 – DIP Switch Settings

LED DESIGNATION	INDICATION
D2	+5 VDC
D3	TRANSMIT TO MDB
D4	TRANSMIT TO PC

Table 2 - LED Functions

**PC2MDB Option Selection**

The four-position dip switch controls the selection of various configurable options these include the cashless device address, the cashless device level (1 or 2), ASCII or Binary transfer from the MDB to the PC and selftest.

**Cashless Device Address**

DIP Switch Position 1 controls the cashless device MDB address. If the switch is off the PC2MDB board will respond to 10hex, the primary cashless device address. If the switch is on the PC2MDB board will respond to 60hex, the secondary cashless device address.

**Cashless Device Level**

ASCII / Binary Data Transmission DIP Switch Position 2 controls the cashless device level selection. If the switch is off the PC2MDB board

will identify itself as a level 1 cashless device. If the switch is on the PC2MDB board will identify itself as a level 2 cashless device.

## **ASCII / Binary Data Transmission**

DIP switch position 3 controls ASCII or binary data transmission. If switch 3 is in the off position all data transferred from the MDB will be in HEX ASCII format. All ASCII strings are terminated by a CR/LF sequence. Binary data transmission, from the MDB to the PC, is selected by turning position 3 of the DIP switch to the on position. When switch #3 is on, all data from the MDB will be sent to the PC in its original 8 bit binary form. In order to define the length of the data string being sent to the PC a length byte is added to the beginning of the string. The length count is a count of the total number of bytes sent including the length byte.

## **Flow Control**

DIP switch position 4 controls flow control. When this DIP is set to OFF, RS-232 handshaking using DTR and CTS is used as described in the handshaking section in this user's guide. When this DIP switch is set to ON, hardware flow control is OFF.

## **Self Test**

All DIP switches set to ON invokes self test after reset.

## **SPECIFICATIONS**

### **Power requirements**

24 to 35 Vdc  
90 ma Typical  
300 ma Maximum

### **Environmental**

Operating Temp 32°F to 158°F  
0°C to 70°C  
Storage Temp -22°F to 165°F  
-30°C to 74°C  
Relative Humidity 5% to 95% Non-condensing

### **Physical Weight**

< 1 lb

### **Physical Dimensions**

Length 4.0 inches Width 3.0 inches Height 1.1 inches

### **Connector Info**

*PWR 24-35V Pin 2 +24Vdc Nominal*

Pin 4 Ground

*MDB Pin 1 +24Vdc Nominal*

Pin 2 Ground

Pin 3 N/C

Pin 4 MDB Receive Data

Pin 5 MDB Transmit Data

Pin 6 Common

*RS-232 Pin 1 N/C*

Pin 2 PC Transmit Data

Pin 3 PC Receive Data

Pin 4 DTR

Pin 5 Ground

Pin 6 N/C

- Pin 7 N/C
- Pin 8 CTS
- Pin 9 N/C
- LED/Jumper Designations**
- D2 +5Vdc
- D3 MDB Activity
- D4 PC Activity
- D6 Pulse Output Activity
- Switch 1: Mode Select 1
- Switch 2: Mode Select 2

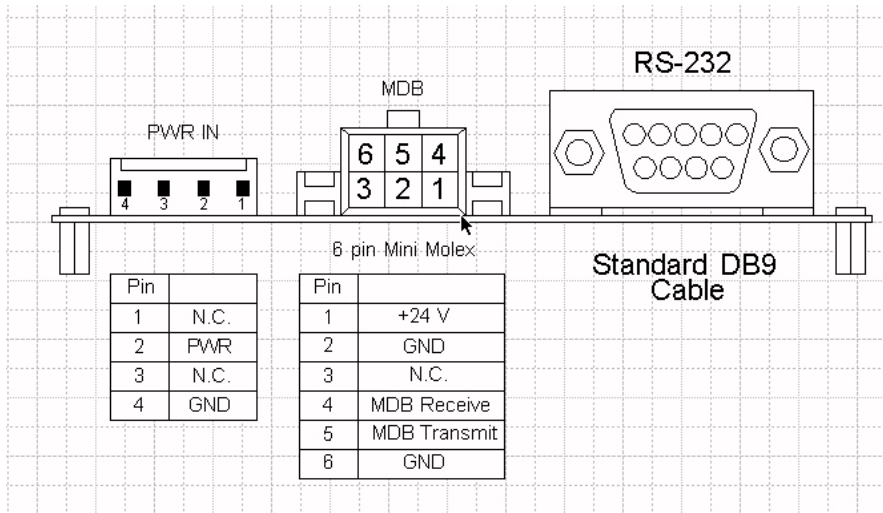


Figure-2 Connector Pin Outs

**Install the PC2MDB™**

It is time to install the PC2MDB™ itself and move on to the testing phase. Installation is relatively simple; there are only three connections that must be made for full functioning of the device. There are connectors on the edge of the board. One cable plugs into a 24VDC power supply. The 6-pin Molex connects to the VMC. The final connector is a DB-9 and connects into the back of the computer. There should be an open port on the back of the computer labeled “SERIAL2” or “COM2.”

**Software**

**Overview**

When the master/VMC has data to send, the mode bit is checked to differentiate between ADDRESS bytes and DATA bytes. The upper five bits (MSB) of the Address Byte are used for addressing. The lower three bits of the Address Byte contain peripheral-specific commands. This will allow up to eight instructions to be embedded in the first byte of block.

The PC2MDB sends information generated by the VMC device directly to the PC via RS-232 serial communication. It responds to polls issued by the VMC. PC2MDB will ACK only the polls, and commands issued to correct addresses. It then forwards the commands to the PC. Once the data has been processed, the PC sends back another set of instructions to the PC2MDB, which forwards these instructions to the VMC only when desired poll/polls have been received. The information sent to the PC is sent as hexadecimal bytes. The first byte sent is the device ID. For example, 30 XX means that a bill validator has sent information, whereas 08 XX means that a coin mechanism has sent data. The PC2MDB responds to the VMC as Cashless Device type 10. Consult your manual for commands specific

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to your MDB device. We have included command sets for various MDB devices in this document. Please note that all examples of source code are written in MS Visual Basic 6.0.

## SELFTEST

Selftest mode is designed to provide a go-no-go test of the PC2MDB hardware using HyperTerminal or similar program to display the results. It is entered by setting all dip switches of the on position. The following items and paths are tested: the processor on board (DIP) switches and indicators, the RS-232 Interface with the PC, and the interface with MDB bus and connectivity to the vending machine controller (VMC). In selftest mode the PC2MDB will ultimately attempt to cause the VMC to vend a user-selected item.

The following sequence is a typical display generated by selftest.

Launch hyperterminal with the following parameters:

(list baud settings etc....)

PC2MDB V1.4.01 0x10 (version / revision of firmware  
0x10 indicates primary address  
being used)

**(Note if the title message is displayed the PC receive portion of the interface has been verified)**

```
SELFTEST
FLASH LEDS (PC and MDB leds will flash for 4 seconds)
PRESS c KEY (Test of the PC send interface)

RECV - d (Displays data received from the PC)
PRESS c KEY

RECV - c
00
```

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```
1010 (Indicates that a Reset command
has been received from the MDB
buss)

RESET
RR1 (Indicates that the poll has been
received from the VMC. This
indicates that we are able to
send to the VMC.)

110002000000C2 (Indicates the VMC is requesting
our configuration info)

11010028001431 (VMC sends its configuration
info)

(VMC sends expansion data)
17004155001830303130101818181818094A64D22989490404040002024AFF
17004155543130101818181818180D8C184A24D329894904040400060594FF
17004155543130101818181818088C8D194A24D229894904040400060494FF
17004155543130101818181818088C8D194A24D229894904040400060494FF
17004155543130101818303031301018184A24D32989490404040002024AFF
140115 (VMC enables the PC2MDB)
```

**(Note: The sequence from RESET to enable may be repeated several times. This varies from VMC to VMC.)**

```
VEND STRT (PC2MDB starts a vend session)
00
1300002800808F (User selects an item)
VEND REQ
FF
1302000102 (item should vend)
VEND SUCCESS
1302000102
VEND SUCCESS
130417
VEND DONE

SELFTEST DONE (SELFTEST IS DONE)
CLR SWITCHES
PWR CYCLE MACH
```

**Remember to reset the switches to the desired configuration and power cycle the vending machine.**

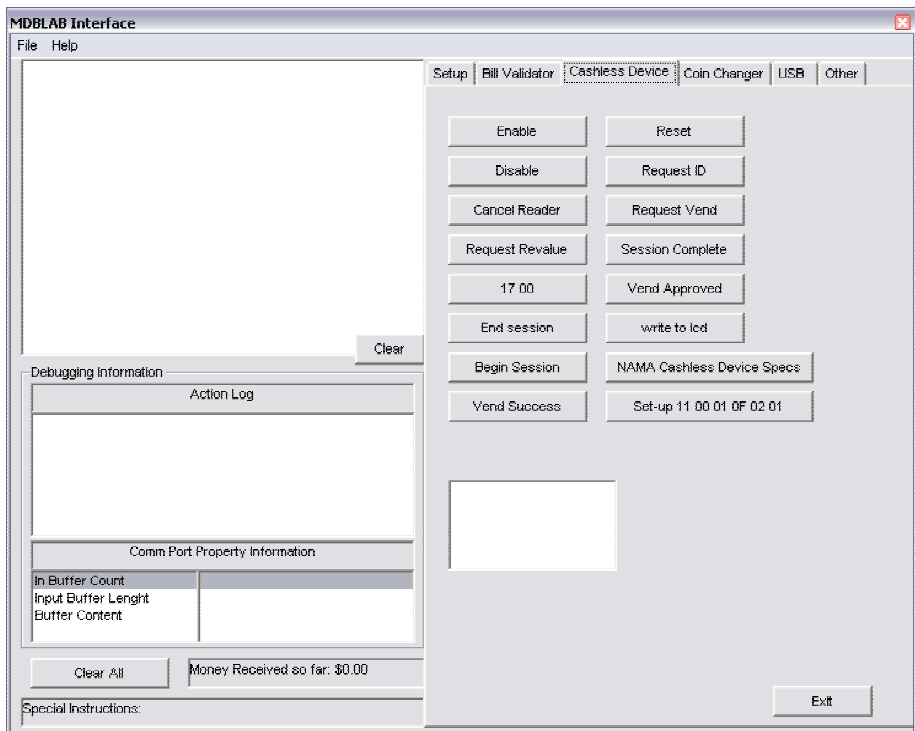


Figure-3 MDBlab Screenshot

## MDB2PC Software Communication

### Receive

Use an interrupt driven comm event on the appropriate port. Settings are 9600-8-1-None. Set the receive threshold to 1. Empty the contents of the receive buffer as soon as there is at least one character ready. See the sample source code provided on CD-ROM for an example.

```
*****
*****
Case comEvReceive          'Received RThreshold # of Chars

Do While comm_port.InBufferCount > 0
  MDB2PC_input$ = comm_port.Input
  ' MDB2PC_input$ is the output of the MDB to the PC
  looking at the first five
  'characters of MDB2PC_input$
  'enables the PC to determine current action of the MDB.
  To look at the first five
  'characters of MDB2PC_input$, use Mid$(MDB2PC_input$, 1,
  2)

  b$ = Mid$(MDB2PC_input$, 1, 5) ' shorthand for looking at
the first 5 characters

  'The following are the typical actions produced
by the MDB
  If b$ = Mid$(MDB2PC_input$, 1, 2) = 50 Then
    Label3.Caption = "Nickel received"
    nickins = nickins + 1
    RXSum = RXSum + 0.05
  End If
*****
```



**Transmit**

Use an interrupt driven comm event on the appropriate port. Settings are 9600-8-1-None. Set the transmit threshold to 1. Send the address of the device followed by the command parameters.

```
*****
Private Sub Command6_Click()
    MDB_output_string = Chr$(13) & Chr$(&H52) 'Dispense Quarter
    comm_port.DTREnable = True                'Start Handshaking
End Sub

Case comEvCTS
    'Change in the CTS line
    ' this is the output routine for transmitting
    ' outbuffersize set to 32 bytes, SThreshold = 1

    comm_port.Output = MDB_output_string
    comm_port.DTREnable = False

'END transmit one character on change of CTS line
*****
```

**Handshaking**

When the PC has data to send to a slave device the following is required for sending this data:

- Send DTR high (DTR.Enabled=TRUE)
- On Change in CTS line (generated by the VMC) set output buffer=string to be transmitted
- Place contents of string in output buffer and transmit
- Set DTR low after transmitting entire string

Note: Place the string to be transmitted in a temporary variable and then place the temporary variable in the output buffer.

```
For example (2):
Private Sub cmdDispenseNickel_Click()
    On Error GoTo ErrorHandler

    ' Dispense a Nickel
    MDB_output_string = Chr$(13) & Chr$(&H10)
    comInterface.DTREnable = True

    ' Update the Activity Log
    lstActionLog.AddItem "Dispense Nickel"

Exit Sub

ErrorHandler:
    Resume Next
End Sub
```

Since we have the contents to be transmitted in a temporary string (MDB\_output\_string) and we have set DTR high (comInterface.DTREnable = True) we now wait for a comm. Event to be generated 'namely a change in the CTS line For Example(2&3):

```
Case comEvCTS
    'Change in the CTS line
    ' this is the output routine for transmitting
    ' outbuffersize set to 32 bytes
    comInterface.Output = MDB_output_string
'END transmit one character on change of CTS line
```

At this point the data has been sent to the output buffer of the serial port UART. By setting the Send Threshold to 1 we fire a comm. Send event when the entire contents of the output buffer have been sent and set DTR low to indicate that we have completed transmission. For example(4):

```
Case comEvSend
    'There are SThreshold number of characters in the
    transmit buffer
    comInterface.DTREnable = True
\*****
```

## Technical Support

UNI offers technical support for PC2MDB™ primarily by e-mail and at <http://www.upstatenetworks.com>.

Please read this manual thoroughly before contacting UNI.

Technical support is available via e-mail 24-hours-a-day, 7-days-a-week at [tech@upstatenetworks.com](mailto:tech@upstatenetworks.com).



Priority support will be given to people who have followed the instructions in the *Before Contacting Technical Support* section below.

### Before Contacting Technical Support

When contacting technical support with a question, please have the following information available or enclosed with your e-mail:

Your name, e-mail address, fax and telephone number.

PC2MDB™ serial number (Located on the packaging material).

A detailed description of the problem you are experiencing.

Computer software type (operating system name and version, brand and version of other network drivers, video driver settings, plus the name and version of any device drivers or other memory-resident programs).

Computer hardware type (type and make of CPU, RAM, hard disk type and size, video and network cards installed plus any other unusual cards)

## MDB Operation Notes

### EXAMPLE VEND SESSION #1\*

(Valid Single Vend) All values HEX

*VMC= Vending Machine Controller, PC2MDB= serial to MDB interface, Software= front end software or PLC*

VMC-10 (RESET) 10h

PC2MDB-00 (ACK) 00h  
Acknowledged

VMC-11 00 (SETUP CONFIGURATION DATA) 11 00:  
To send the VMC's configuration data and obtain the cashless device's data

PC2MDB-01 (PC2MDB RESPONSE) 8 BYTES Z1-Z8  
01 00 01 01 Z1: reader config data (indicates the payment media reader is responding to a SETUP) 01H  
01 30 00 Z2: Reader Feature Level  
01H: The reader is not capable or will not perform the advanced features. The reader will not provide advanced information to the VMC, but can do the advanced features internally. The reader has no revaluation capability.  
02H: The reader is capable and willing to perform the advanced features. The reader will provide advanced information to the VMC (if possible) and will not do the advanced features internally.  
03H: The reader is able to support level 02, but also supports some or all of the optional features listed in the EXPANSION ID command (i.e., file transfer, 32 bit credit, multi-currency/language features, negative vend, and/or data entry).  
Z3-Z4: Country/Currency Code- packed BCD. The packed BCD country/currency code of the reader can be sent in

two different forms depending on the value of the left most BCD digit. If the left most digit is a 0, the International Telephone Code is used to indicate the country that the reader is set-up for. For example, the USA code is 00 01H (Z3= 00 and Z4 = 01). If the left most digit is a 1, the latest version of the ISO 4217 numeric currency code is used. For example, the code for the US dollar is 18 40H (Z2= 18 and Z3 = 40). Use FFFFh if the country code is unknown. For level 3 cashless devices, it is mandatory to use the ISO 4217 numeric currency code (see Appendix A1)

Z5: Scale Factor. The multiplier used to scale all monetary values transferred between the VMC and the reader.

Z6: Decimal Places. The number of decimal places used to communicate monetary values between the VMC and the payment media reader. All pricing information sent between the VMC and the payment media reader is scaled using the scale factor and decimal places. This corresponds to:  $ActualPrice = P(X)(10^{-Y})$  where P is the scaled value send in the price bytes, and X is the sale factor, and Y is the number of decimal places.

Z7: Application Maximum Response Time - seconds. The maximum length of time a reader sill require to provide a response to any command from the VMC. The value reported here supercedes the payment reader's default NON-RESPONSE time defined in section 7.5 if the value reported here is greater.

Z8: Miscellaneous Options - xxxxyyyy

xxxx: Unused

yyyy: Option bits

b0=0: he payment media reader is not capable or restoring funds to the user's payment media or account. Do not request refunds.

b0=1: The payment media reader is capable of restoring funds to the user's payment media or account. Refunds may be requested.

b1=0: The payment media reader is NOT multivend capable. Terminate session after each vend. b1=1: The payment media reader is multivend capable. Multiple

items may be purchased within a single session.

b2=0: The payment media reader does NOT have a display

b2=1: The payment media reader does have its own display.

b3=0: The payment media reader does NOT support the VEND/CASH SALE subcommand.

b3=1: The payment media reader does support the VEND/CASH SALE subcommand.

b4-b7: Any future options must be covered by the EXPANSION COMMAND option bits.

VMC-11 01

**(SETUP MAX/MIN PRICE) 11 01:**

To send the maximum and minimum prices in the VMC. These prices must be sent as Level 01/02 16 bit credit n established and any time there is a change in the minimum price. If the VMC does not know the minimum price, 00 00h should be sent.

PC2MDB-01  
FF FF 00 00

**(PC2MDB RESPONSE) 5 BYTES Y1-Y5**

Y1: Max/Min prices. Indicates the VMC is sending the price range to the reader (01H)

Y2-Y3: Maximum Price- scaled. This information should be sent as soon as the VMC prices have been established and any time there is a change in the maximum price. If the VMC does not know the maximum price, FF FFh should be sent.

Y4-Y5: Minimum Price-Scaled. This information should be sent as soon as the VMC prices have been sent

VMC-17 00

**(EXPANSION REQUEST ID) 17 00:**

To obtain additional cashless device information and options

PC2MDB-00  
55 4E 49 00  
00 00 00

**(PC2MDB RESPONSE) 30 BYTES Y1-Y30**

Y1: Request ID. The VMC is requesting payment media reader identification information. The information included above (y2-Y30) provides the payment media reader with VMC identification information. 00h

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00 00 00 00  
00 00 00 00

00 50 43 32  
4D 44 42 20

20 20 20 20  
20 00 01

Y2-Y4: Manufacturer Code-ASCII. Identification code for the equipment supplier. Currently defined codes are listed in the EVA document entitled "The Data Transfer Standard EVA-DTS" document, the Audit Data Dictionary section, chapter 4, "Manufacturer Codes".  
Y4-Y16: Serial Number-ASCII. Factory assigned serial number. Y17-Y28: Model Number-ASCII. Manufacture assigned model number. Y29-Y30: Software Version-packed BCD. Current software version  
54 4E 49 00 00 00 00 00 00 00 00 00 00 00 01 50 43  
32 4D 44 42 00 00 00 00 00 00 00 01  
UNI0000000000001PC2MDB00000001

VMC-14 01 (ENABLE) 14 01/(DISABLE) 14 00

PC2MDB-00 (ACK) 00h  
Acknowledged

VMC-12 (POLL) 12h

PC2MDB-00 (ACK) 00h  
Acknowledged

SOFTWARE-03 (BEGIN SESSION) 03  
The Programmer will have to issue a BEGIN SESSION command (03h) which will be sent to the VMC on a poll.

VMC-12 (POLL) 12h

PC2MDB-03 (POLL) 12h  
This is the value that was passed from the PC via the PC2MDB indicating that the programmer wished to begin a session.

VMC-00 (ACK) 00h Acknowledged  
The VMC will ACK the BEGIN SESSION command

VMC- 13 00 (VEND REQUEST) 13 00

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00 14 00 01

The VMC issues a VEND REQUEST command (13 00 00 14 00 01h). The first two bytes 13 00 are vend request. The VMC is requesting vend approval from the payment media reader before dispensing the product. The next two bytes 00 14h are scaled item price. This scaled item price is set by bytes Z5 and Z6 in the reader response data for the MAX/MIN PRICES SETUP command. And the last two bytes 00 01h are item selection number.

PC2MDB-00 (ACK) 00h  
Acknowledged. The vend request command will be ACKed

VMC-12 (POLL) 12h

VMC-12 (POLL) 12h

SOFTWARE-05 (VEND APPROVED) 05  
passed on to the programmer to be approved with a VEND APPROVED command (05h) command

VMC-12 (POLL) 12h

PC2MDB-05 (VEND APPROVED) 05  
The vend approved command that was sent from the PC is relayed to the VMC via the PC2MDB

VMC-00 (ACK) 00h  
Acknowledged

VMC-13 02 (VEND SUCCESS) 13 02  
Once this command has been received a VEND SUCCESS command (13 02h) will be issued by the VMC, and ACKed by the cashless device.

PC2MDB-00 (ACK) 00h  
Acknowledged

**VMC-13 04 (SESSION COMPLETE) 13 04**  
Upon the receiving of an ACK, a SESSION COMPLETE command (13 04h) will be issued by the VMC and also ACKed by the cashless device.

**PC2MDB-00 (ACK) 00h**  
Acknowledged

**VMC-12 (POLL) 12h**

**PC2MDB-07 (END SESSION) 07**  
In order to end a vend session, and END SESSION command (07h) will have to be sent to the VMC on a poll by the end user.

*\*[1]. National Automatic Merchandising Association, March 26, 2003. Multi\_Drop Bus/Internal Communication Protocol: Section 7 "Cashless Device(s) VMC/Peripheral Communication Specifications": 7.1-7.53.*

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