

Section 6

Bill Validator

VMC/Peripheral Communication Specifications

6.1 Introduction

This section defines the communication bytes sent and received between a Bill Validator and the VMC. As defined in Section 2.3, the bill validator's address is 00110xxxB (30H).

Unless stated otherwise, all information is assumed to be in a binary format.

There are currently two levels of support defined for the bill validator interface, Level 1 and Level 2. The level of bill validator operation is sent to the VMC in the response to the STATUS command (defined later in this section). The following paragraphs will define how a VMC should differentiate between each level.

Level 1 Bill Validators

Level 1 bill validators support all standard functions, but do not support any optional features.

Level 2 Bill Validators

Level 2 bill validators support all standard functions plus various optional features as defined in Section 6.3 under the Expansion command 37-02H. Based on the optional feature information the VMC will determine the appropriate operating mode (in other words, modes that both the bill validator and the VMC can support), enable any appropriate features by sending an appropriate feature enable command back to the bill validator, and enter the proper operating mode. This technique allows all VMCs and peripherals to accommodate existing feature capabilities and provides a means for upgrading Level 2 equipment.

6.2 VMC Commands

<u>Command</u>	<u>Hex Code</u>	<u>Description</u>
RESET	30H	Command for bill validator to self-reset.
SETUP *	31H	Request for bill validator setup information.
SECURITY	32H	Sets Validator Security Mode
POLL	33H	Request for Bill Validator activity Status.
BILL TYPE	34H	Indicates Bill Type enable or disable. Command is followed by set-up data. See command format.
ESCROW	35H	Sent by VMC to indicate action for a bill in escrow.
STACKER	36H	Indicates stacker full and the number of bills.
EXPANSION COMMAND	37H	Command to allow addition of features and future enhancements. Level 1 and above bill validators must support this command.

NOTE: The expansion command is always followed by a sub-command.

* In Version 1.0 & 2.0, **SETUP** was called **STATUS**.

6.3 VMC Command Format

<u>VMC Command</u>	<u>Code</u>	<u>VMC Data</u>
RESET	30H	No data bytes

This command is the vehicle that the VMC should use to tell the validator that it should return to its default operating mode. It should reject any bills in the validation process, return any bills in the escrow position, and disable all other activity until otherwise instructed by the VMC.

The following initialization sequence is recommended for all new VMCs designed after July, 2000. It should be used after “power up”, after issuing the RESET command, or after issuing the Bus Reset (pulling the transmit line “active” for a minimum of 100 mS).

POLL – 33h

To obtain “JUST RESET” response

SETUP – 31h

To obtain bill validator level and configuration information

EXPANSION IDENTIFICATION – 37 00h (Level 01+)

To obtain additional bill validator information

EXPANSION IDENTIFICATION w/ OPTION BITS – 37 02h (Level 02+ only)

To obtain additional bill validator information and options

EXPANSION FEATURE ENABLE – 37 01h (Level 02+ only)

To enable desired options

STACKER – 36h

To obtain stacker status and number of bills

BILL TYPE – 34h

To enable desired bill acceptance and desired bill escrow capability

VMC Command **Code** **Validator Response Data**

SETUP

31H

27 bytes: Z1 - Z27

Z1 = Bill Validator Feature Level - 1 byte
Indicates current feature level of the bill validator. Currently defined levels are:

Level 1 - does not support option bits (Z1 = 01h)

Level 2 - supports option bits (Z1 = 02h)

Z2 - Z3 = Country / Currency Code - 2 bytes
The packed BCD country / currency code of the bill validator 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 validator is set-up for. For example, the USA code is 00 01H (Z2 = 00 and Z3 = 01).

If the left most digit is a 1, the latest version of the ISO 4217 numeric currency code is used (see Appendix A1). For example, the code for the US dollar is 18 40H (Z2 = 18 and Z3 = 40) and for the Euro is 1978 (Z2 = 19 and Z3 = 78).

All new designs after July, 2000 must use the ISO 4217 numeric currency codes as listed in Appendix A1.

Z4 - Z5 = Bill Scaling Factor - 2 bytes
All accepted bill values must be evenly divisible by this number. For example, this could be set to 0064H for the USA.

Z6 = Decimal Places - 1 byte
Indicates the number of decimal places on a credit display. For example, this could be set to 02H for the USA.

Z7 - Z8 = Stacker Capacity - 2 bytes
Indicates the number of bills that the stacker will hold. For example, 400 bill capacity = 0190H.

Z9 - Z10 = Bill Security Levels - 2 bytes
Indicates the security level for bill types 0 to 15. Since not all validators support multiple security levels, validators that do not have this feature must report a "high" security level.

xxxx = Bill Type (0 to 15)

Status:

(00000001) =	Defective Motor ³ - One of the motors has failed to perform its expected assignment.
(00000010) =	Sensor Problem ³ - One of the sensors has failed to provide its response.
(00000011) =	Validator Busy ² - The validator is busy and can not answer a detailed command right now.
(00000100) =	ROM Checksum Error ³ - The validators internal checksum does not match the calculated checksum.
(00000101) =	Validator Jammed ³ - A bill(s) has jammed in the acceptance path.
(00000110) =	Validator was reset ¹ - The validator has been reset since the last POLL.
(00000111) =	Bill Removed ¹ - A bill in the escrow position has been removed by an unknown means. A BILL RETURNED message should also be sent.
(00001000) =	Cash Box out of position ³ - The validator has detected the cash box to be open or removed.
(00001001) =	Unit Disabled ² - The validator has been disabled, by the VMC or because of internal conditions.
(00001010) =	Invalid Escrow request ¹ - An ESCROW command was requested for a bill not in the escrow position.
(00001011) =	Bill Rejected ¹ - A bill was detected, but rejected because it could not be identified.
(00001100) =	Possible Credited Bill Removal ¹ - There has been an attempt to remove a credited (stacked) bill.

Note:

- validators must have a means to disable this code due to potential older VMC issues.
- virtually all VMCs designed prior to this code's introduction (10/16/02) will not support it.
- It is a vending machine system issue as to what is done when this code is received.

(010xxxx) = Number of attempts to input a bill while validator is disabled.¹

NOTE: The validator may send several of one type activity up to 16 bytes total.

- 1 Sent once each occurrence.
- 2 Sent once each POLL
- 3 Sent once each occurrence. The unit is then disabled until the condition is removed. Validator will respond with unit disabled until repaired or replaced.

File Transport Layer POLLED responses:

Note that all FTL responses are defined in Section 2.6. For the bill validator, the source address will always be the validator (30H) as defined in Section 2.3.

Z1

1B	REQ TO RCV	<p>The bill validator is requesting to receive data from a device or VMC.</p> <p>Z2 = Destination address of response Z3 = Source address of response (30H) Z4 = File ID Z5 = Maximum length Z6 = Control</p>
1C	RETRY/DENY	<p>The bill validator is requesting a device or VMC to retry or deny the last FTL command.</p> <p>Z2 = Destination address of response Z3 = Source address of response (30H) Z4 = Retry delay</p>
1D	SEND BLOCK	<p>The bill validator is sending a block of data (maximum of 31 bytes) to a device or VMC.</p> <p>Z2 = Destination address of data Z3 = Block # Z4-Z34 = Data (maximum of 31 bytes)</p>
1E	OK TO SEND	<p>The bill validator is indicating that it is OK for the device or VMC to send it data.</p> <p>Z2 = Destination address of response Z3 = Source address of response (30H)</p>
1F	REQ TO SEND	<p>The bill validator is requesting to send data to a device or VMC.</p> <p>Z2 = Destination address of response Z3 = Source address of response (30H) Z4 = File ID Z5 = Maximum length Z6 = Control</p>

<u>VMC Command</u>	<u>Code</u>	<u>VMC Data</u>
BILL TYPE	34H	4 bytes: Y1 - Y4

Y1 - Y2 = Bill Enable - 2 bytes

Indicates what type of bills are accepted.

b15 b14 b13 b12 b11 b10 b9 b8 | b7 b6 b5 b4 b3 b2 b1 b0
 Y1 Y2

Bill types are 0 to 15. A bit is set to indicate acceptance of bill type.

NOTE: Sending 0000H disables the bill validator.

Y3 - Y4 = Bill Escrow Enable:

b15 b14 b13 b12 b11 b10 b9 b8 | b7 b6 b5 b4 b3 b2 b1 b0
 Y3 Y4

Bill types are 0 to 15. A bit is set to indicate enable of escrow for a bill type.

NOTE: On power-up or reset all bill acceptance and escrow are disabled.

<u>VMC Command</u>	<u>Code</u>	<u>VMC Data</u>
ESCROW	35H	1 byte: Y1

Y1 = Escrow status - 1 byte

If Y1 = 0; Return bill in the escrow position.
 If Y1 = xxxxxx1; Stack the bill ("x" indicates don't care)

NOTE: After an ESCROW command the bill validator should respond to a POLL command with the BILL STACKED, BILL RETURNED, or INVALID ESCROW message within 30 seconds. If a bill becomes jammed in a position where the customer may be able to retrieve it, the bill validator should send a BILL RETURNED message.

<u>VMC Command</u>	<u>Code</u>	<u>Validator Response Data</u>
STACKER	36H	2 bytes: Z1 - Z2

Indicates stacker full condition and the number of bills in the stacker.

Z1 Z2

(Fxxxxxxx) (xxxxxxx)
 F = 1 if stacker is full, 0 if not.

xxxxxxxxxxxxxx = The number of bills in the stacker.

LEVEL ONE and TWO+ CAPABILITIES - EXPANSION COMMAND

In order to allow existing VMCs to operate with original Level 1 or new Level 2 bill validators, a separate identification sub-command has been introduced to handle the additional 4 bytes of Option Bit information.

The original sub-command 00H is used for obtaining Z1 to Z29 identification information from bill validators. This information includes the model number, serial number, software version, etc, but **not the option bits**. Note that if a Level 2+ bill validator is sent the 00H sub-command, it must **not** report the Z30 to Z33 option bytes.

Sub-command 01H is used for Level 2+ bill validators to enable option bits reported in the expansion command 02H sub-command below.

The new sub-command 02H is used for obtaining Z1 to Z33 identification information from Level 2+ bill validators. This information includes the model number, serial number, software version, etc, and the **option bits (Z30-Z33)**.

<u>VMC Command</u>	<u>Code</u>	<u>Sub-Command</u>	<u>Validator Response Data</u>
EXPANSION COMMAND	37H	00H	29 bytes: Z1 - Z29
		LEVEL 1 IDENTIFICATION WITHOUT OPTION BITS	

Z1 - Z3 = Manufacturer Code - 3 bytes
 Identification code for the equipment supplier. Sent as ASCII characters. Currently defined codes are listed in the **EVA** document entitled "**European Vending Association Data Transfer Standard**" (**EVA-DTS**), the Audit Data Lists section, sub-section 2, "Manufacturer Codes".

- Z4 - Z15 = Serial Number - 12 bytes
Factory assigned serial number. All bytes must be sent as ASCII characters, zeros (30H) and blanks (20H) are acceptable.
- Z16 - Z27 = Model #/Tuning Revision - 12 bytes
Manufacturer assigned model number. All bytes must be sent as ASCII characters, zeros (30H) and blanks (20H) are acceptable.
- Z28 - Z29 = Software Version - 2 bytes
Current software version. Must be sent in packed BCD.

<u>VMC Command</u>	<u>Code</u>	<u>Sub-Command</u>	<u>VMC Data</u>
EXPANSION	37H	01H	4 bytes: Y1 - Y4
COMMAND		LEVEL 2+ FEATURE ENABLE	

This command is used to enable each of the Level 2+ optional features defined in the Level 2+ Identification response bytes Z30-Z33 below. To enable a feature a bit is set to one. **All optional features are disabled after reset.**

<u>VMC Command</u>	<u>Code</u>	<u>Sub-Command</u>	<u>Validator Response Data</u>
EXPANSION	37H	02H	33 bytes: Z1 – Z33
COMMAND		LEVEL 2+ IDENTIFICATION WITH OPTION BITS	

- Z1 - Z3 = Manufacturer Code - 3 bytes
Identification code for the equipment supplier. Sent as ASCII characters. Currently defined codes are listed in the **EVA** document entitled "**European Vending Association Data Transfer Standard**" (**EVA-DTS**), the Audit Data Lists section, sub-section 2, "Manufacturer Codes".
- Z4 - Z15 = Serial Number - 12 bytes
Factory assigned serial number. All bytes must be sent as ASCII characters, zeros (30H) and blanks (20H) are acceptable.
- Z16 - Z27 = Model #/Tuning Revision - 12 bytes
Manufacturer assigned model number. All bytes must be sent as ASCII characters, zeros (30H) and blanks (20H) are acceptable.
- Z28 - Z29 = Software Version - 2 bytes
Current software version. Must be sent in packed BCD.
- Z30 - Z33 = Optional Features - 4 bytes

Each of the 32 bits indicate an optional features availability. If the bit is set the feature is available. Bits should be sent in descending order, i.e. bit 31 is sent first and bit 0 is sent last. Currently defined options are:

- b0 - File Transport Layer (FTL) supported as defined in Section 2.6.
- b1 - b31 Available for future use

<u>VMC Command</u>	<u>Code</u>	<u>Sub-command</u>	<u>VMC Data</u>	<u>Validator Response</u>
EXPANSION COMMAND	37H	FAH FTL REQ TO RCV	Y1-Y5	Z1 (immediate or POLLed)

The VMC is requesting to receive data from the bill validator whose destination address will always be (30H). Note that all FTL Commands / Responses are defined in Section 2.6.

- Y1 = Destination address of command (30H)
- Y2 = Source address of command
- Y3 = File ID
- Y4 = Maximum length
- Y5 = Control

- Z1 = 1DH which indicates SEND BLOCK
- Z2 = Destination address of data
- Z3 = Block #
- Z4 - Z34 = Data (maximum of 31 bytes)

or

- Z1 = 1CH which indicates RETRY / DENY
- Z2 = Destination address of response
- Z3 = Source address of response (30H)
- Z4 = Retry delay

<u>VMC Command</u>	<u>Code</u>	<u>Sub-command</u>	<u>VMC Data</u>	<u>Validator Response</u>
EXPANSION COMMAND	37H	FBH FTL RETRY / DENY	Y1-Y3	None

The VMC is retrying, denying, or aborting a data transfer to/from the bill validator whose destination address will always be (30H). Note that all FTL Commands / Responses are defined in Section 2.6.

- Y1 = Destination address of command (30H)
- Y2 = Source address of command
- Y3 = Retry delay

<u>VMC Command</u>	<u>Code</u>	<u>Sub-command</u>	<u>VMC Data</u>	<u>Validator Response</u>
EXPANSION	37H	FCH	Y1-Y33	None
COMMAND	FTL SEND BLOCK			

The VMC is sending data to the bill validator whose destination address will always be (30H). Note that all FTL Commands / Responses are defined in Section 2.6.

Y1 = Destination address of command & data (30H)
 Y2 = Block #
 Y3 - Y33 = Data (maximum of 31 bytes)

<u>VMC Command</u>	<u>Code</u>	<u>Sub-command</u>	<u>VMC Data</u>	<u>Validator Response</u>
EXPANSION	37H	FDH	Y1-Y2	Z1-Z34 (immediate or
COMMAND	FTL OK TO SEND			POLLed)

The VMC is indicating that it is OK for the bill validator to transfer data. The destination address will always be the validator (30H). Note that all FTL Commands / Responses are defined in Section 2.6.

Y1 = Destination address of command (30H)
 Y2 = Source address of command

 Z1 = 1DH which indicates SEND BLOCK
 Z2 = Destination address of data
 Z3 = Source address of data
 Z4 - Z34 = Data (maximum of 31 bytes)

<u>VMC Command</u>	<u>Code</u>	<u>Sub-command</u>	<u>VMC Data</u>	<u>Validator Response</u>
EXPANSION	37H	FEH	Y1-Y5	Z1 (immediate or
COMMAND	FTL REQ TO SEND			POLLed)

The VMC is requesting to send data to the bill validator whose destination address will always be (30H). Note that all FTL Commands / Responses are defined in Section 2.6.

Y1 = Destination address of command (30H)
 Y2 = Source address of command
 Y3 = File ID
 Y4 = Maximum length

Y5 = Control

- Z1 = 1EH which indicates OK TO SEND
 Z2 = Destination address of response
 Z3 = Source address of response (30H)
 or
 Z1 = 1CH which indicates RETRY / DENY
 Z2 = Destination address of response
 Z3 = Source address of response (30H)
 Z4 = Retry delay

<u>VMC Command</u>	<u>Code Sub-Command</u>	<u>VMC Data</u>	<u>Val Response</u>
EXPANSION COMMAND	37H FFH DIAGNOSTICS	Y1-Yn	Z1 - Zn

Y1 - Yn = Device manufacturer specific instruction for implementing various manufacturing or test modes. Y1 - Yn implies that any number of bytes can be used for the VMC data to the peripheral.

Z1 - Zn = Device manufacturer specific responses after receiving manufacturing or test instructions. Z1 - Zn implies that any number of bytes can be used for the bill validator response data from the peripheral.

6.4 Bill Validator Non-Response Time

The maximum non-response time for the bill validator is five seconds.

6.5 Bill Validator Power Requirements

The current draw for any bill validator must fall within the following limits. All measurements are at the minimum VMC Voltage Output.

Idle mode = 200 mA. (avg.) continuous

Bill transport = 2.5 A. (max.) up to 10 seconds

Note: If both peripherals are supported, vending machines should be able to provide sufficient power to simultaneously supply the above power requirements for both the bill validator **Bill Transport** and coin mechanism **Coin Acceptance** as specified in Section 5.5.

(this page intentionally left blank)