Revision	Date	Written by	Description

CASH DISPENSING UNIT

(Model: GBM-M)

COMMUNICATION & COMMAND REFERENCE MANUAL

3rd edition

Document History

NO	History	Date	Writer	Remarks
1	First edition	2003. 6.26	G.S.GIM	
2	Second edition	2003. 8.20	G.S.GIM	
3	Third edition	2003. 10.2	G.S.GIM	

Contents

1. INTRODUCTION

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This document explains software protocol interface connection for Cash Dispensing Unit (Model name: GBM-M) and host. The GBM supports one type of interfaces through standard RS-232C 9pin connector.

- RS – 232C SERIAL

Also, it explains the electrical interface about interface and power cable connections.

This document is based on Taenam's independent design.

2. ELECTRICAL INTERFACE

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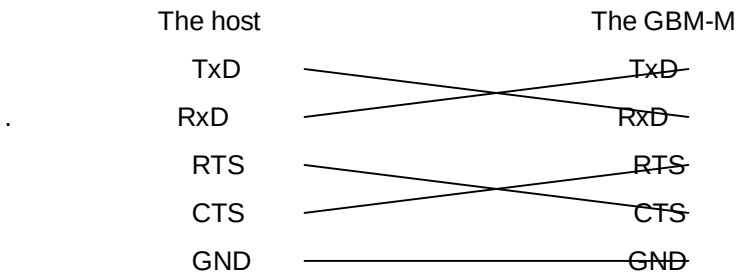
(1) Connector

The interface connector is a standard male, 9 pin RS-232C 'D-type' connector. The opposite connector should be standard 9 pin RS-232C female connector.

The pin connections are as follows:

PIN	NAME	FUNCTION	DIRECTION	REMARKS
1				
2	RxD	Received data	Out	
3	TxD	Transmitted data	In	
4			Out	
5	GND	System ground	In	
6				
7	RTS	Request to Send	Out	
8	CTS	Clear to Send		
9				



(2) POWER CHANNEL SPECIFICATION

- Channels required

5Vdc ± 0.2V : Normal 1A (Peak 1.6A)

24Vdc ± 2V : Normal 4A (Peak 5A)

Use 0.165” pitch crimp terminal housing of Molex. The manufacturer’s part number is 5557-06.

- Pin description

Pin 1: +24V

Pin 2: +5V

Pin 3: +5V

Pin 4: F.G

Pin 5: GND

Pin 6: GND

The GBM-M body must be earthed. To accomplish this, make the GBM-M body connected to earth thru system case (preferred), or use F.G. connection.

- Recommended – power rating.

(Power supply, of that power rating is 150 W or more, is recommended.)

3. DATA TRANSFER SPECIFICATIONS

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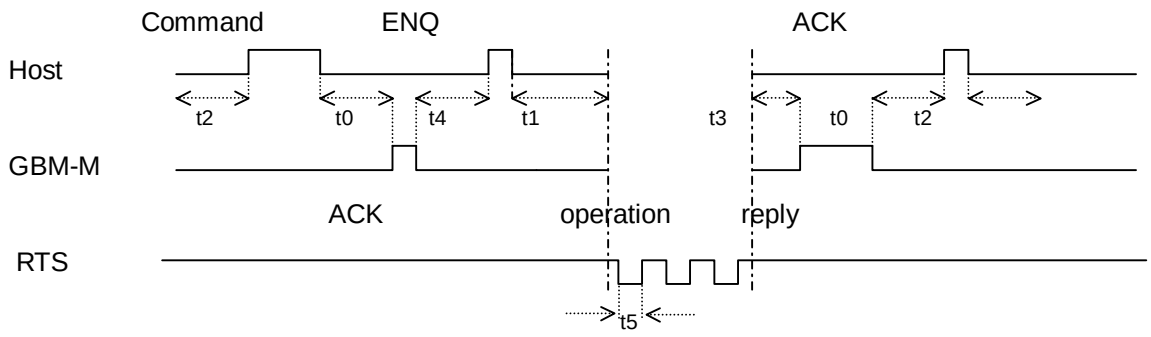
(1) DATA CHARCATERISTICS

- Transmission rate: 9600 bps
- Parity: None
- Character length: 8 bits
- Number of stop bits: 1
- Message BCC: LRC

(2) DATA PROTOCOL DIAGRAM

- SERIAL INTERFACE WITH EIXT COUNT BACK-UP



(3) SERIAL TRANSMISSION TIMINGS

Sign	Min(ms)	Max(ms)	Explanation
t0	50	150	Delay to transmit ACK, NAK
t1		500	Delay for starting of operation after ENQ
t2	100		Delay to send a command after it has sent ACK
t3	50		Delay to send a reply after finishing operation.
t4	50	150	Delay to receive ENQ(05 hex) after it has sent ACK
t5	50	100	Exit count pulse on RTS

When GBM-M doesn't receive a message by time out, it returns to wait status for receiving STX.

(4) CHARACTER FORMAT

The protocol is half duplex and is inactive when an operation is in progress. The characters are a combination of ASCII, and binary for data.

All commands from the host and response from the GBM-M are on a one-to-one basis. It means the GBM must reply to a message before another command will be received, and GBM-M cannot send an unexpected response. Messages are accepted by the transmission of an ACK(06 hex) and rejected by the transmission of a NAK. A NAK requests the message to be repeated.

When either the host or the GBM-M does not accept the message, it transmits NAK (ASCII, 15 hex) in place of ACK. Then, the message is resend until host or GBM accepts the message by sending an ACK. This can be repeated until ACK is received.

When the host does not accept the message, it decides when to stop trying for repeating and to terminate it by sending an ACK. Any character in place of ACK is treated as a NAK.

Characters with incorrect parity are treated as NULL character (ASCII, 0 hex). This has the effect of forcing a NAK to a message or of treating an ACK character with parity error as an NAK.

All messages are followed by a BCC (Block Check Character), which is generated by an LRC (Longitudinal Redundancy Check) of the entire message. If the BCC character is valid, the message is accepted with an ACK. If not so, that message is ignored by a NAK.

The GBM-M will not action any command for a period of 500ms after an ENQ has been received. When receives new command for this period, the GBM-M adopts the new command in place of previous command. This procedure protects the communications interface confusion.

- Standard Command Message Form (from the host)

STX	LI(0)	LI(1)	XN	Cmd	Data1	Data2	Data3	Data4	ETX	BCC

STX: Start of text (02H)

LI(0): Lower byte of data lengths (06H)

LI(1): Higher byte of data lengths (00H)

(Length is the number of characters: XN ~ Data4)

XN: XORing number (00H ~ 03FH)

Cmd: A command character **(XORed, refer to the XORing method on page 16)**

Data1~Data4: Data of each command message **(XORed, refer to the XORing method on page16)**

ETX: end of text (03H)

BCC: Character for checking whether a message is valid or invalid with the LRC.

The LRC is XOR for all character in the message (except STX).

- Standard Response Message Form (from: GBM-M)

STX	LI(0)	LI(1)	XN	Cmd	Data1 ~ Data65	ETX	BCC

STX: Start of text (02H)

LI(0): Lower byte of data lengths (41H)

LI(1): Higher byte of data lengths (00H)

(Length is the number of characters: XN ~ Data65)

XN: XORing number (00H ~ 03FH)

****Note) Cmd ~ Data65 are XORed by XN character.**

Refer to the XORing method on page 16

Cmd: Received command character

Data1: First data of the GBM-M's firmware version (Ver.: VXX0000)

Data2: 2nd data of the GBM-M's firmware version (Ver.: V00XX00)

Data3: 3rd data of the GBM-M's firmware version (Ver.: V0000XX)

Data4: Error code (Refer to ERROR CODE on page 26)

Data5: Sensor status value 1

Bit 7							Bit0
GS17L	GS17R	GS16	GS15	GS14L	GS14R	GS13L	GS13R

On: 1

Off: 0 ****Note) Refer to the GBM-M's sensor layout on page 17**

Data6: Sensor status value 2

Bit 7							Bit0
X	GS29	GS21L	GS21R	X	GS19	GS11L	GS11R

On: 1

Off: 0

X: Ignore

Data7: Sensor status value 3

Bit 7							Bit0
X	GS49	GS41L	GS41R	X	GS39	GS31L	GS31R

On: 1

Off: 0

X: Ignore

Data8: Sensor status value 4

Bit 7							Bit0
X	H.P	Dip s/w 1	Dip s/w 2	X	H.P	Dip s/w 1	Dip s/w 2
	Cassette #2				Cassette #1		

On: 1

Off: 0

X: Ignore

H.P: Home position sensor in a cassette

Dip s/w: Dip switch in a cassette

***** Note) Dip s/w is used for checking the note type of a cassette.**

Data9: Sensor status value 5

Bit 7							Bit0
X	H.P	Dip s/w 1	Dip s/w 2	X	H.P	Dip s/w 1	Dip s/w 2
	Cassette #4				Cassette #3		

On: 1

Off: 0

X: Ignore

H.P: Home position sensor in a cassette

Dip s/w: Dip switch in a cassette

***** Note) Dip s/w is used for checking the note type of a cassette.**

Data10: Double sensor value (00H ~ FFH)

Data11: Stacker sensor value

Bit 7							Bit 0
X	X	X	X	GS53L	GS53R	GS52	GS51

X: Ignore, On: 1, Off: 0

GS52: Stacker home position

GS51: Stacker end position

Data12: Start section code of total dispensed information from all cassettes (BBH)

Data13: Higher byte of total passed number (from cassette #1 to cassette #4)

Data14: lower byte of total passed number (from cassette #1 to cassette #4)

Ex) If total passed number is 400, Data13 is 01H and Data14 is 90H.

Data15: Total rejected number (from cassette #1 to cassette #4)

Data16: Higher byte of total picked up number (from cassette #1 to cassette #4)

Data17: Lower byte of total picked up number (from cassette #1 to cassette #4)

Ex) If total picked up number is 400, Data16 is 01H and Data17 is 90H.

Data18: Total rejected number with double note (from cassette #1 to cassette #4)

Data19: Total rejected number with long note (from cassette #1 to cassette #4)

Data20: Total rejected number with short note (from cassette #1 to cassette #4)

Data21: Total rejected number with space short note (from cassette #1 to cassette #4)

Data22: Total rejected number with left skew note (from cassette #1 to cassette #4)

Data23: Total rejected number with right skew note (from cassette #1 to cassette #4)

Data24: Total rejected number with etc. abnormal note (from cassette #1 to cassette #4)

Data25: Start section code of dispensed information from cassette #1(C0H)

Data26: Rejected number from cassette #1

Data27: Picked up number from cassette #1

Data28: Rejected number with double note from cassette #1

Data29: Rejected number with long note from cassette #1

Data30: Rejected number with short note from cassette #1

Data31: Rejected number with space short note from cassette #1

Data32: Rejected number with left skew note from cassette #1

Data33: Rejected number with right skew note from cassette #1

Data34: Rejected number with etc. abnormal note from cassette #1

Data35: Start section code of dispensed information from cassette #2(C1H)

Data36: Rejected number from cassette #2

Data37: Picked up number from cassette #2

Data38: Rejected number with double note from cassette #2
Data39: Rejected number with long note from cassette #2
Data40: Rejected number with short note from cassette #2
Data41: Rejected number with space short note from cassette #2
Data42: Rejected number with left skew note from cassette #2
Data43: Rejected number with right skew note from cassette #2
Data44: Rejected number with etc. abnormal note from cassette #2

Data45: Start section code of dispensed information from cassette #3(C2H)
Data46: Rejected number from cassette #3
Data47: Picked up number from cassette #3
Data48: Rejected number with double note from cassette #3
Data49: Rejected number with long note from cassette #3
Data50: Rejected number with short note from cassette #3
Data51: Rejected number with space short note from cassette #3
Data52: Rejected number with left skew note from cassette #3
Data53: Rejected number with right skew note from cassette #3
Data54: Rejected number with etc. abnormal note from cassette #3

Data55: Start section code of dispensed information from cassette #4(C3H)
Data56: Rejected number from cassette #4
Data57: Picked up number from cassette #4
Data58: Rejected number with double note from cassette #4
Data59: Rejected number with long note from cassette #4
Data60: Rejected number with short note from cassette #4
Data61: Rejected number with space short note from cassette #4
Data62: Rejected number with left skew note from cassette #4
Data63: Rejected number with right skew note from cassette #4
Data64: Rejected number with etc. abnormal note from cassette #4

Data65: End code of information (F0H)

****Note) If GBM-M is the two cassettes type, the response's Data46 ~ Data54 and Data56 ~ Data64 are always 00H.**

If GBM-M is the three cassettes type, the response's Data56 ~ Data64 are always 00H.

** D.E.S Xor Table**

Unit (Hex value)

XN	Xor	XN	Xor	XN	Xor	XN	Xor	XN	Xor	XN	Xor	XN	Xor	XN	Xor
00	57	08	58	10	59	18	60	20	61	28	62	30	63	38	64
01	25	09	26	11	27	19	28	21	29	29	30	31	31	39	32
02	49	0A	50	12	51	1A	52	22	53	2A	54	32	55	3A	56
03	17	0B	18	13	19	1B	20	23	21	2B	22	33	23	3B	24
04	41	0C	42	14	43	1C	44	24	45	2C	46	34	47	3C	48
05	09	0D	10	15	11	1D	12	25	13	2D	14	35	15	3D	16
06	33	0E	34	16	35	1E	36	26	37	2E	38	36	39	3E	40
07	01	0F	02	17	03	1F	04	27	05	2F	06	37	07	3F	08

Xoring Method

STX	LI(0)	LI(1)	XN	Cmd	Data1	Data2	Data3	ETX	BCC

EX1) if Xn = 00H and Cmd = 40H Then,

i) Cmd = 40H XOR 57H

ii) Data1 = Data1 XOR 25H

iii) Data2 = Data2 XOR 49H

iv) Data3 = Data3 XOR 17H

v) Data4 = Data4 XOR 41H

EX2) if Xn = 3EH and Cmd = 40H Then,

i) Cmd = 40H XOR 40H

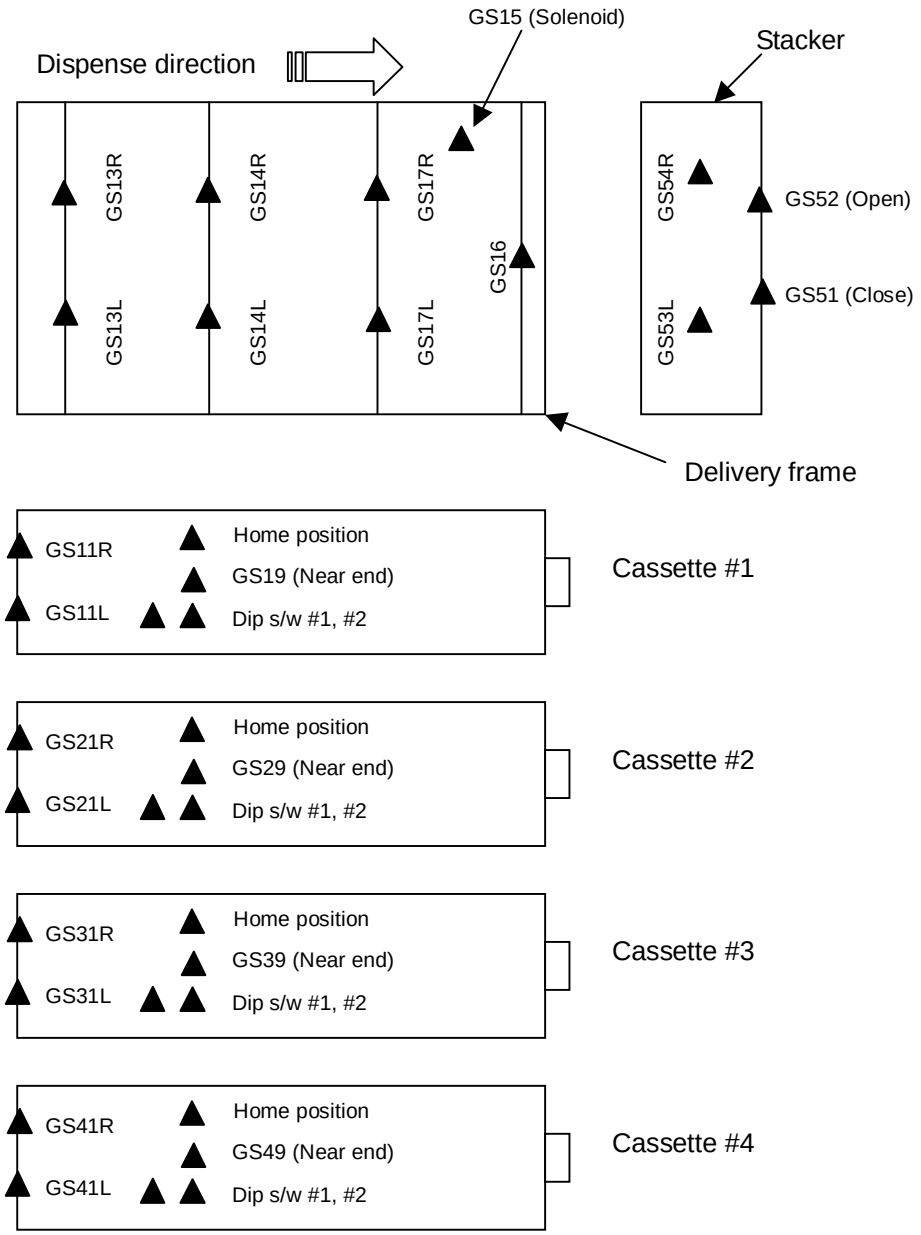
ii) Data1 = Data1 XOR 08H

iii) Data2 = Data2 XOR 57H

iv) Data3 = Data3 XOR 25H

v) Data4 = Data4 XOR 49H

** GBM-M's sensor layout **



4. MESSAGE PROTOCOL

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The host can send the following ten commands to the GBM-M.

STATUS
PURGE
DISPENSE
OPEN STACKER
CLOSE STACKER
LAST STATUS
TEST DISPENSE
SOLENOID TEST
MOTOR TEST
HALF SENSOR TEST

(1) STATUS COMMAND

The Status command instructs the GBM-M to return its sensor status.

The command message follows the standard one on page 11.

- Command message

STX	LI(0)	LI(1)	XN	Cmd	Data1	Data2	Data3	Data4	ETX	BCC

Cmd = 40H

Data1 ~ Data4 = 00H

- Response message

The response message is equal to the standard one's contents. Here Data12 ~ Data64 are ignorable data. (Refer to the character format on page 12)

(2) PURGE COMMAND

The Purge command instructs the GBM-M to remove all notes on delivering belts of the dispensing mechanism. Removed notes are sent to the reject bin of the GBM-M.

The command message follows the standard one on page 12.

- Command message

STX	LI(0)	LI(1)	XN	Cmd	Data1	Data2	Data3	Data4	ETX	BCC

Cmd = 41H

Data1 ~ Data4 = 00H

- Response message

The response message is equal to the standard one's contents. Here Data23 ~ Data64 are ignorable data. (Refer to the character format on page 12)

(3) DISPENSE COMMAND

This command instructs the GBM-M to dispense notes in the cassette past the exit of the dispensing mechanism. In process of delivery, abnormal notes are saved to the reject bin and extra notes are dispensed to replace them. The command message follows the standard one on page 11.

- Command message

STX	LI(0)	LI(1)	XN	Cmd	Data1	Data2	Data3	Data4	ETX	BCC

Cmd = 0x42H

Data1 = the number to dispense from the cassette #1

Data2 = the number to dispense from the cassette #2

Data3 = the number to dispense from the cassette #3 (If two cassette type, 00H)

Data4 = the number to dispense from the cassette #4 (If two or three cassettes type, 00H)

- Response message

The response message is equal to the standard one's contents. (Refer to the character format on page 12)

(4) OPEN STACKER COMMAND

This command instructs the GBM-M to open its stacker cover. The command message follows the standard one on page 11.

Note) Do not use If the GBM-M is not the stacker type.

- Command message

STX	LI(0)	LI(1)	XN	Cmd	Data1	Data2	Data3	Data4	ETX	BCC

Cmd = 43H

Data1 ~ Data4 = 00H

- Response message

The response message is equal to the standard one's contents. Here Data12 ~ Data62 are ignorable data. (Refer to the character format on page 12)

(5) CLOSE STACKER COMMAND

This command instructs the GBM-M to close its stacker cover. The command message follows the standard one on page 11.

Note) Do not use If the GBM-M is not the stacker type.

- Command message

STX	LI(0)	LI(1)	XN	Cmd	Data1	Data2	Data3	Data4	ETX	BCC

Cmd = 44H

Data1 ~ Data4 = 00H

- Response message

The response message is equal to the standard one's contents. Here Data12 ~ Data64 are ignorable data. (Refer to the character format on page 12)

(6) LAST STATUS COMMAND

This command instructs the GBM-M to return the status of last finished operation, such as last Dispense or Test dispense. The command message follows the standard one on page 11.

- Command message

STX	LI(0)	LI(1)	XN	Cmd	Data1	Data2	Data3	Data4	ETX	BCC

Cmd = 45H

Data1 ~ Data4 = 00H

- Response message

The response message is equal to the standard response message's contents. (Refer to the character format on page 12)

(7) TEST DISPENSE COMMAND

This command instructs the GBM-M to repeat dispense and reject operation till the value added the passed count and rejected count is equal to the request note number. This test is useful for checking the GBM-M's reject performance.

The command message follows the standard one on page 11.

- Command message

STX	LI(0)	LI(1)	XN	Cmd	Data1	Data2	Data3	Data4	ETX	BCC

Cmd = 46H

Data1 = the number to dispense from the cassette #1

Data2 = the number to dispense from the cassette #2

Data3 = the number to dispense from the cassette #3

Data4 = the number to dispense from the cassette #4

- Response message

The response message is equal to the standard one. (Refer to the character format on page 12)

(8) SOLENOID TEST COMMAND

This command instructs the GBM-M to close after opening the reject gate of the dispensing mechanism for about 2 sec. This test is useful for checking whether the reject gate operates normally or not.

The command message follows the standard one on page 11.

- Command message

STX	LI(0)	LI(1)	XN	Cmd	Data1	Data2	Data3	Data4	ETX	BCC

Cmd = 60H

Data1 ~ Data4 = 00H

- Response message

The response message is equal to the standard one's contents. Here Data12 ~ Data64 are ignorable data. (Refer to the character format on page 12)

(9) MOTOR TEST COMMAND

This command instructs the GBM-M to rotate one between the cassette and delivery motor or both with some speed for the request time.

The command message follows the standard one on page 11.

(**CAUTION**: ○,1 Under the condition that the cassette filled with notes is set in the dispensing mechanism, do not operate the cassette motor singly. If it happens, it causes a jam event.

○,2 In case of rotation both the cassette and feed motor, those must be properly selected the ratio of each speed in balance. If not so, it causes a jam event with noise.)

- Command message

STX	LI(0)	LI(1)	XN	Cmd	Data1	Data2	Data3	Data4	ETX	BCC

Cmd = 0x61

Data1: Selection code to have GBM-M rotate only delivery motor, or the deliver motor and a cassette motor.

Value: 01H = only the delivery motor

10H = only the cassette motor

11H = delivery and cassette motor

Data2: This code is motor's PPS selection code.

Value: X1H = 2330 PPS
X2H = 1600 PPS
X3H = 1800 PPS
X4H = 2000 PPS
X5H = 2200 PPS
X6H = 2400 PPS
} Delivery motor's PPS

1XH = 1350 PPS
2XH = 1600 PPS
3XH = 1800 PPS
4XH = 2000 PPS
5XH = 2200 PPS
6XH = 2400 PPS
} Cassette motor's PPS

EX) If Data2 is 0x11, the delivery motor's PPS is 2330 and the cassette motor's PPS is 1350.

Data3: Cassette selection code

Value: 01H = the cassette #1

02H = the cassette #2

03H = the cassette #3

04H = the cassette #4

Data4: Request code to have the motor do what rotation.

EX1) To have the delivery motor do ten rotations with 2330 PPS, Data1 ~ Data4 are as follows;

Data1 = 01H

Data2 = 01H

Data3 = 00H

Data4 = 0AH

EX2) To have the delivery motor do ten rotations with 2330 PPS and the cassette #1 motor do ten rotations with 1350 PPS, Data1 ~ Data4 are as follows;

Data1 = 11H

Data2 = 11H

Data3 = 01H

Data4 = 0AH

(10) HALF SENSOR TEST COMMAND

This command instructs the GBM-M to return sensors' value when they are at half light status. The command message follows the standard one on page 11.

- Command message

STX	LI(0)	LI(1)	XN	Cmd	Data1	Data2	Data3	Data4	ETX	BCC

Cmd = 62H

Data1 ~ Data4 = 00H

- Response message

The response message is equal to the standard one's contents. Here Data12 ~ Data64 are ignorable data. (Refer to the character format on page 12)

5. ERROR CODES

5. ERROR CODES

The rest except 00 hex (good operation) are returned if only an abnormal event occurs during operation. For proper operation, there should not be notes on the delivering belts. If not, the GBM-M will automatically remove such notes into the reject bin before its operation.

Code	Error (hex)	The cause of errors, or explanation
00	Good operation	It is no error.
01	No detect cassette #1	Though required dispensing, cassette #1 is not found in the GBM-M's body.
02	No detect cassette #2	Though required dispensing, cassette #2 is not found in the GBM-M's body.
03	No detect cassette #3	Though required dispensing, cassette #3 is not found in the GBM-M's body.
04	No detect cassette #4	Though required dispensing, cassette #4 is not found in the GBM-M's body.
05	Cassette #1 leeno pin contect error	The cassette #1 was separated from the GBM-M's body in dispensing.
06	Cassette #2 leeno pin contect error	The cassette #2 was separated from the GBM-M's body in dispensing.
07	Cassette #3 leeno pin contect error	The cassette #3 was separated from the GBM-M's body in dispensing.
08	Cassette #4 leeno pin contect error	The cassette #4 was separated from the GBM-M's body in dispensing.
11	Cassette #1 empty or misfeed	The cassette #1 has no notes or its notes were not picked up as missed.
12	Cassette #2 empty or misfeed	The cassette #2 has no notes or its notes were not picked up as missed.
13	Cassette #3 empty or misfeed	The cassette #3 has no notes or its notes were not picked up as missed.
14	Cassette #4 empty or misfeed	The cassette #4 has no notes or its notes were not picked up as missed.
15	Cassette #1 jam	A jam event occurred at the GS11 sensor.
16	Cassette #2 jam	A jam event occurred at the GS21 sensor.
17	Cassette #3 jam	A jam event occurred at the GS31 sensor.
18	Cassette #4 jam	A jam event occurred at the GS41 sensor.

Code	Error (hex)	The cause of errors, or explanation
1C	Cassette #1 misfeed	Cassette #1 failed in picking up a note with near-end off.
1D	Cassette #2 misfeed	Cassette #2 failed in picking up a note with near-end off.
1E	Cassette #3 misfeed	Cassette #3 failed in picking up a note with near-end off.
1F	Cassette #4 misfeed	Cassette #4 failed in picking up a note with near-end off.
21	GS13 pass time out	A note was not passed the GS13 sensor within the fixed time.
22	GS14 pass time out	A note was not passed the GS14 sensor within the fixed time.
23	GS17 pass time out	A note was not passed the GS17 sensor within the fixed time.
24	GS16 pass time out	A note was not passed the GS16 sensor within the fixed time.
25	Over pick up at the cassette #1	The note count detected by the GS11 sensor is more than the required number.
26	Over pick up at the cassette #2	The note count detected by the GS21 sensor is more than the required number.
27	Over pick up at the cassette #3	The note count detected by the GS31 sensor is more than the required number.
28	Over pick up at the cassette #4	The note count detected by the GS41 sensor is more than the required number.
29	Too many notes	The note count detected by the GS16 sensor is more than the required number.
2B	Gate close error	A normal note was failed to pass the GS17 sensor as the gate has been opened.
2C	One note's thickness detect error	A note's thickness is less than the basis.
2D	Gate open error	An abnormal note was failed to reject as the gate has been closed.
2E	More than three times re-dispense	Dispensing the required notes was repeated more than three times due to reject events.
30	Reject events of 5 notes and up	It occurred the reject events of 5 notes and up in a cassette.
34	RAM error	The GBM-M has identified whether its 'Random Access memory' is an error status or not. No operation is permitted.
35	ROM error	The GBM-M has identified whether its program memory is an error status or not. No operation is permitted.
38	Stacker open error	The stacker is not opened
39	Stacker close error	The stacker is not closed
40	Delivery motor echo error	The delivery motor failed to function or its cable was not connected.

41	Cassette #1 motor echo error	The cassette #1 motor failed to function or its cable was not connected.
42	Cassette #2 motor echo error	The cassette #2 motor failed to function or its cable was not connected.
43	Cassette #3 motor echo error	The cassette #3 motor failed to function or its cable was not connected.
44	Cassette #4 motor echo error	The cassette #4 motor failed to function or its cable was not connected.
45	Solenoid echo error	The solenoid failed to function or its cable was not connected.
48	Rejecting note detect at Gs16 (Exit)	Rejecting note is detected at the Gs16.
51	Jam at the cassette #1 during Purge.	A jam event occurred at the GS11 sensor during Purge operation.
52	Jam at the cassette #2 during Purge.	A jam event occurred at the GS21 sensor during Purge operation.
53	Jam at the cassette #3 during Purge.	A jam event occurred at the GS31 sensor during Purge operation.
54	Jam at the cassette #4 during Purge.	A jam event occurred at the GS41 sensor during Purge operation.
55	Jam at the GS13 sensor during Purge	A jam event occurred at the GS13 sensor during Purge operation.
56	Jam at the GS14 sensor during Purge	A jam event occurred at the GS14 sensor during Purge operation.
57	Jam at the GS17 sensor during Purge	A jam event occurred at the GS17 sensor during Purge operation.
58	Jam at the GS16 sensor during Purge	A jam event occurred at the GS16 sensor during Purge operation.
59	Note got out of the exit during Purge	A note got out of the GBM-M's exit during Purge operation.
5A	Gate open error during Purge	It failed to purge notes as the gate has been closed during Purge operation
6F	Command error	Received an abnormal Cmd (command) or Data character.