corporate headquarters
553 Basaltic Road Concord, Ontario Canada L4K 4W8
phone (905) 303-8874 fax (905) 303-8875
web www.cashcode.com

Isolated Pulse
&
CashCode® Serial

Interfaces

Interface Descriptions

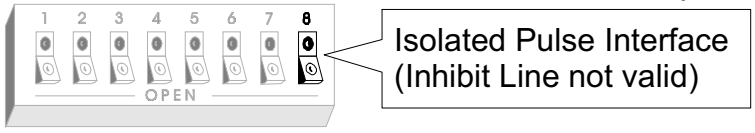
PT# MAN-CCS Rev.B 11/99

1. Interfaces Description

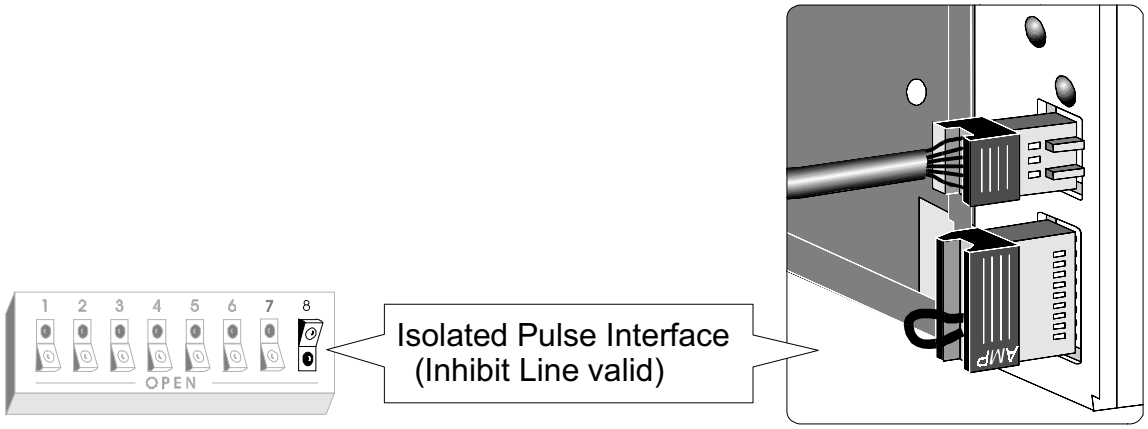
The Bill Acceptor is capable of operating with two interfaces:

1.1. Isolated Pulse Interface

The Isolated Pulse Interface provides the OUTPUT PULSE signal as one or more credit pulses per each dollar value accepted. The credit pulses are transmitted to the external equipment through uncommitted bounce free contacts of a solid state relay.
The interface allows the Bill Acceptor to be ready to accept a banknote or to support the Lockout feature using the isolated INHIBIT LINE input signal. With the INHIBIT LINE feature enabled, the voltage within +4 and +24 VDC applied to +INHIBIT LINE and
-INHIBIT LINE terminals will allow the Bill Acceptor to accept banknotes, but the voltage within +1 and -24 VDC will fully prohibit the Bill Acceptor to accept banknotes.
The OUTPUT PULSE and INHIBIT LINE signals are located on the 6 pin connector (power and isolated pulse interface) of the Bill Acceptor.
The interface has an additional non-isolated TTL-level CREDIT PULSE output signal (18 pin serial interface connector, pin 1). This signal requires that GROUND (18 pin serial interface connector, pin 4) be connected to the digital ground of the external equipment. The signal has the same timing as the isolated OUTPUT PULSE signal.
To use the Bill Acceptor in the Isolated Pulse Interface mode with the INHIBIT LINE feature disabled:
- set the on-board DIP switch SW1-8 to the ON position as shown:



To use the Bill Acceptor in the Isolated Pulse Interface mode with the INHIBIT LINE feature enabled:
- set the on-board DIP switch SW1-8 to the OFF position as shown:

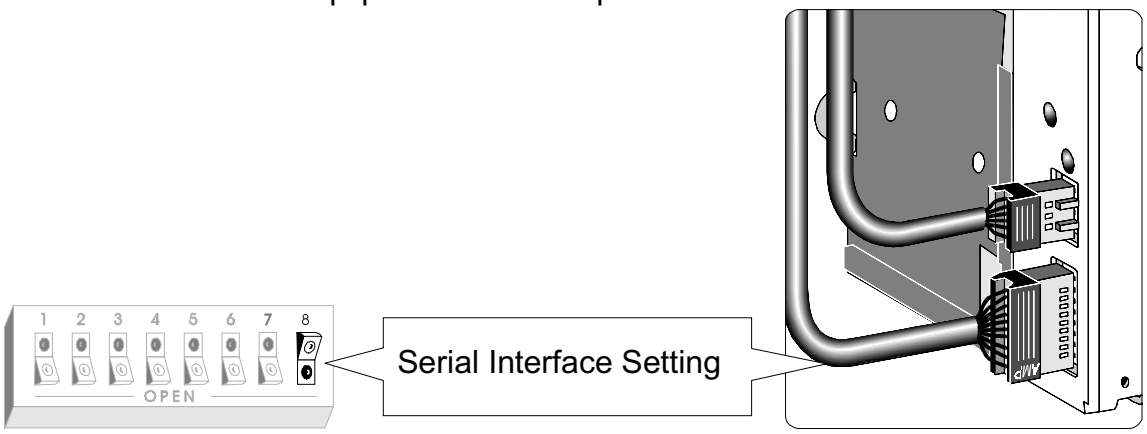


- connect the Jumper Connector PT# AMZ-XXX-PUL-18 (supplied with the Bill Acceptor) to the 18 pin interface connector of the Bill Acceptor

1.2. CashCode® Serial Interface

The CashCode® Serial Interface provides TTL/CMOS level logic and one way serial communication with the external equipment. The interface uses one SERIAL DATA output to carry 8-bit messages about banknote denomination and Bill Acceptor status from the Bill Acceptor. Four additional signals are used to control the interface in the query / acknowledge mode: the ACCEPT ENABLE and SEND input signals and the INTERRUPT and OUT OF SERVICE output signals. This interface requires that GROUND (18 pin serial interface connector, pin 4) be connected to the digital ground of the external equipment.
All these signals are located on the 18 pin serial interface connector of the Bill Acceptor.
To use the Bill Acceptor in the CashCode® Serial Interface mode:
- set the on-board DIP switch SW1-8 to the OFF position as shown:

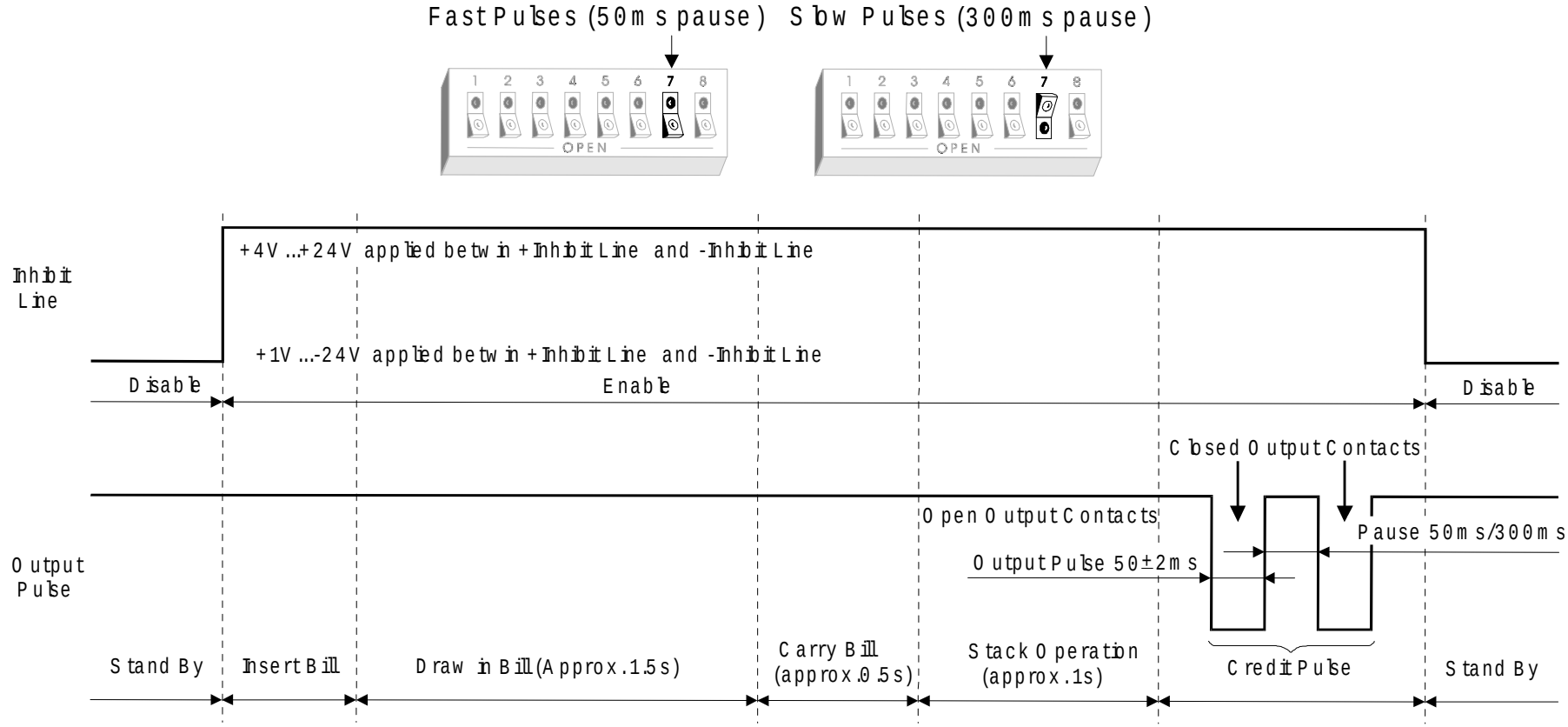
■ connect the external equipment to the 18 pin serial interface connector of the Bill Acceptor.



2. Timing Diagrams

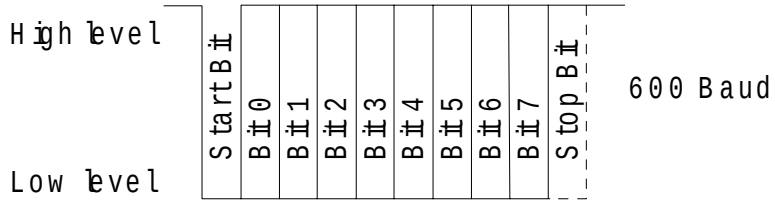
2.1. Isolated Pulse Interface

The timing diagram for the Bill Acceptor operating with the Pulse Interface is shown in the figure below. The time interval between the pulses is controlled by DIP switch SW1-7:



2.2. CashCode® Serial Interface
(Mars and JCM Serial interface compatible)

When the Bill Acceptor is operating with CashCode® Serial Interface, it sends serial messages (8 bit asynchronous, one start, one stop, without parity), using the SERIAL DATA output. Each message consists of logic “0” (LOW) Start Bit, 8 bit NRZ (nonreturn - to - zero) format data message (Least Significant Bit first), and logic “1” (HIGH) Stop Bit. The message speed is 600 baud. The format of the message is shown below:



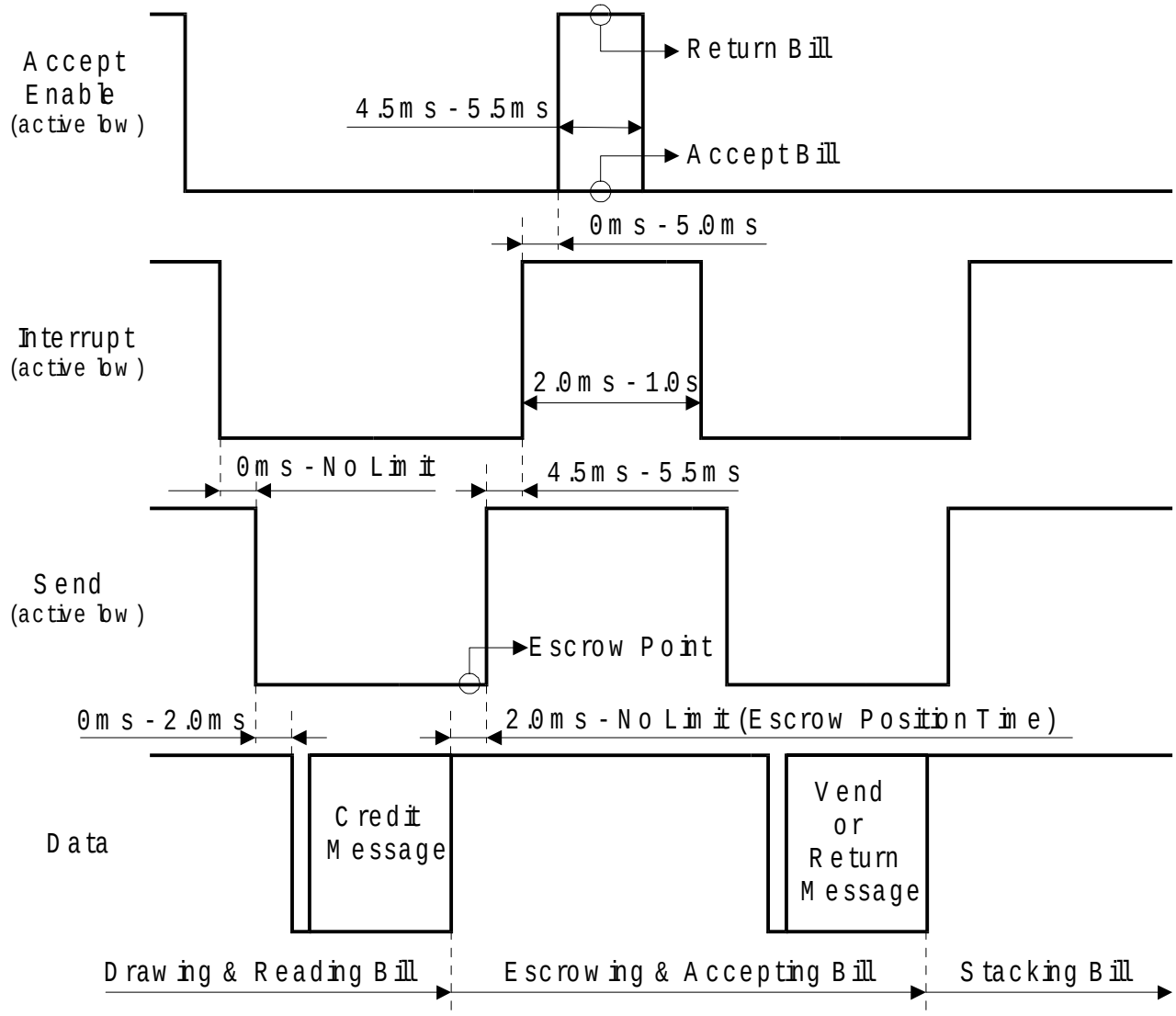
The Bill Acceptor sends the message only after some activity has taken place. The transmit procedure is controlled by the INTERRUPT and SEND signals. Different situations (activities) make the Bill Acceptor generate from one to four messages.
In the most typical case when a banknote is accepted and stacked or returned by the command of the external equipment, the two following messages are generated:
the first message - CREDIT message on the banknote denomination:
the second message - confirmation of accepting (VEND) or returning (RETURNED) of the banknote depending on the command of the external equipment.
In some cases the Bill Acceptor may send one or three messages.

2.2.1. Two Messages

After a banknote has been inserted and validated, the Bill Acceptor drops the INTERRUPT output LOW and waits for the activating (level LOW) of the SEND signal from the external equipment. After receiving it, the Bill Acceptor sends the CREDIT message. Then, the external equipment can make a decision whether the banknote has to be accepted or not and give the following commands to the Bill Acceptor within the required time intervals:
1) To keep the banknote in the ESCROW position - continues to hold the SEND signal active (LOW) until making the final decision.
2) To accept the banknote - de-activates (level HIGH) the SEND signal and keeps the ACCEPT ENABLE signal active (level LOW). After getting this command, the Bill Acceptor finishes processing the banknote by accepting and stacking it, and sends the second VEND message, thus confirming the command execution.
3) To return the banknote - de-activates (level HIGH) SEND signal and within 5 ms de-activates (level HIGH) ACCEPT ENABLE signal for a period of 4.5 - 5.5 ms. After getting this command, the Bill Acceptor finishes processing the banknote by returning it back and sends the second RETURNED message, confirming the command execution.

The timing diagram of two messages communication is shown in the figure “Two Messages Diagram” below:

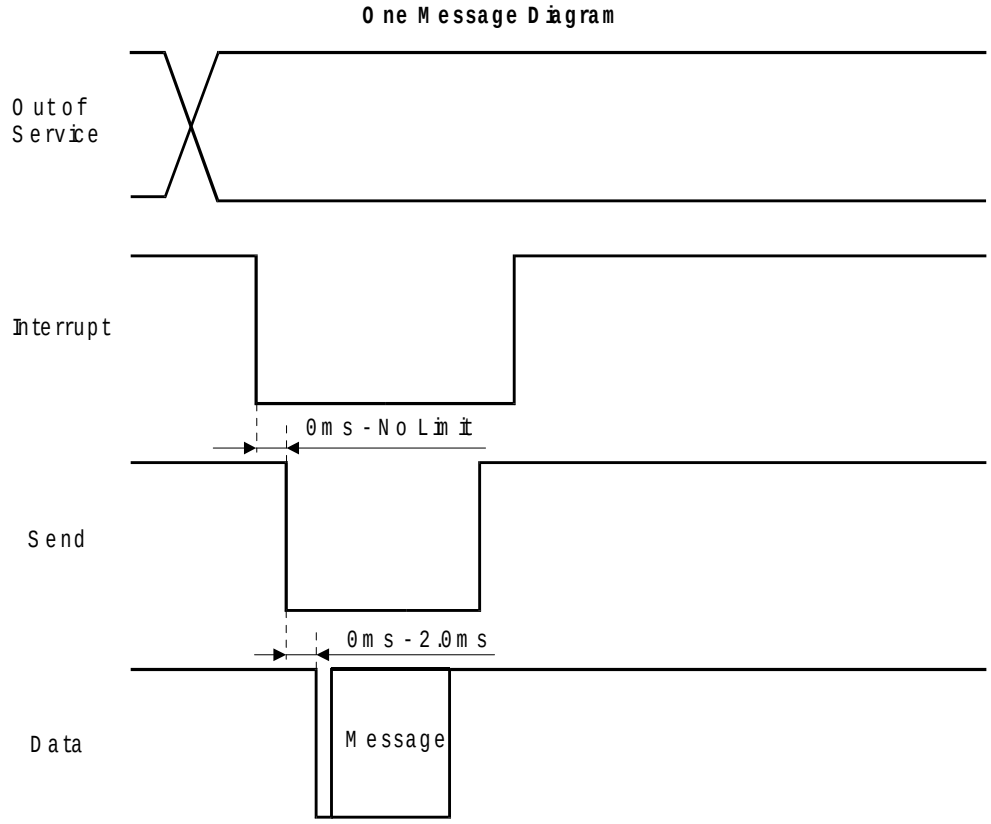
Two Messages Diagram



2.2.2. One message

One message is generated in the following cases:
1. If a banknote was not validated as a genuine one, or if it is of a denomination prohibited for acceptance, the banknote is rejected without being placed into the ESCROW position, and the REJECT message is sent to the external equipment.
2. In a similar case, if a jam in the banknote pathway has occurred and the Bill Acceptor has failed to execute the operation, the FAILURE message is sent, and the OUT OF SERVICE output signal is activated (level LOW).
3. If the Bill Acceptor, while in the stand-by mode, has failed in the self-testing procedure and can not accept banknotes any more, the FAILURE message is sent, and the OUT OF SERVICE output signal is activated (level LOW).
4. If the Bill Acceptor returns to its normal condition, the CASSETTE ATTACHED message is sent after a successful self-testing procedure, and the OUT OF SERVICE output signal is de-activated (level HIGH).
5. If the Cassette is removed from the Bill Acceptor, while in stand-by mode, the CASSETTE REMOVED message is sent, and the OUT OF SERVICE output signal is activated (level LOW).
6. If the Cassette is attached to the powered-up Bill Acceptor, the CASSETTE ATTACHED message is sent, and the OUT OF SERVICE output signal is activated (level HIGH).

The timing diagram of one-message communication is shown in the figure “One Message Diagram” below:



2.2.3. Three Messages

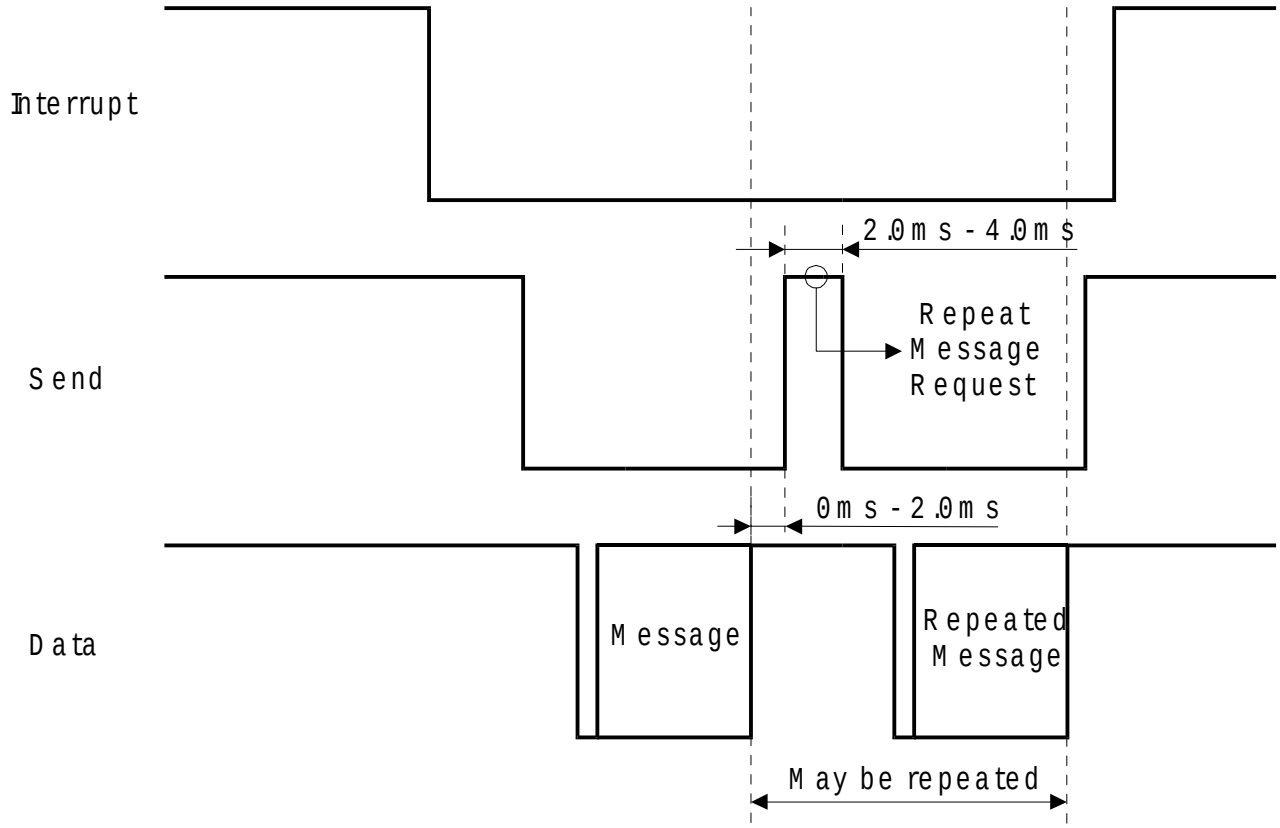
Three messages are generated if, after stacking a banknote, the STACKER FULL sensor of the Bill Acceptor comes ON. The third STACKER FULL message is added to the regular CREDIT and VEND messages.

2.2.4. Message Retransmission

All messages described above are not to be confused with the retransmission of the latest message by the Bill Acceptor upon request of the external equipment. Such retransmission is used by the external equipment for confirming the validity of the latest transmitted message. Any message can be retransmitted. To get the latest message retransmitted, the external equipment has to de-activate (level HIGH) the SEND signal not later than 2 ms after the end of the message for a period of 2 - 4 ms. The Bill Acceptor keeps the INTERRUPT signal LOW and retransmits the requested message. After the message is retransmitted, it can be requested to be retransmitted again in the same manner. There is a limit of up to ten retransmissions for one message.

The timing diagram of the retransmission of the message is shown in the figure “Repeated Message Timing Diagram” below (all non-marked time intervals are equal to the same intervals in the figure “Two Messages Diagram”):

Repeated Message Timing Diagram



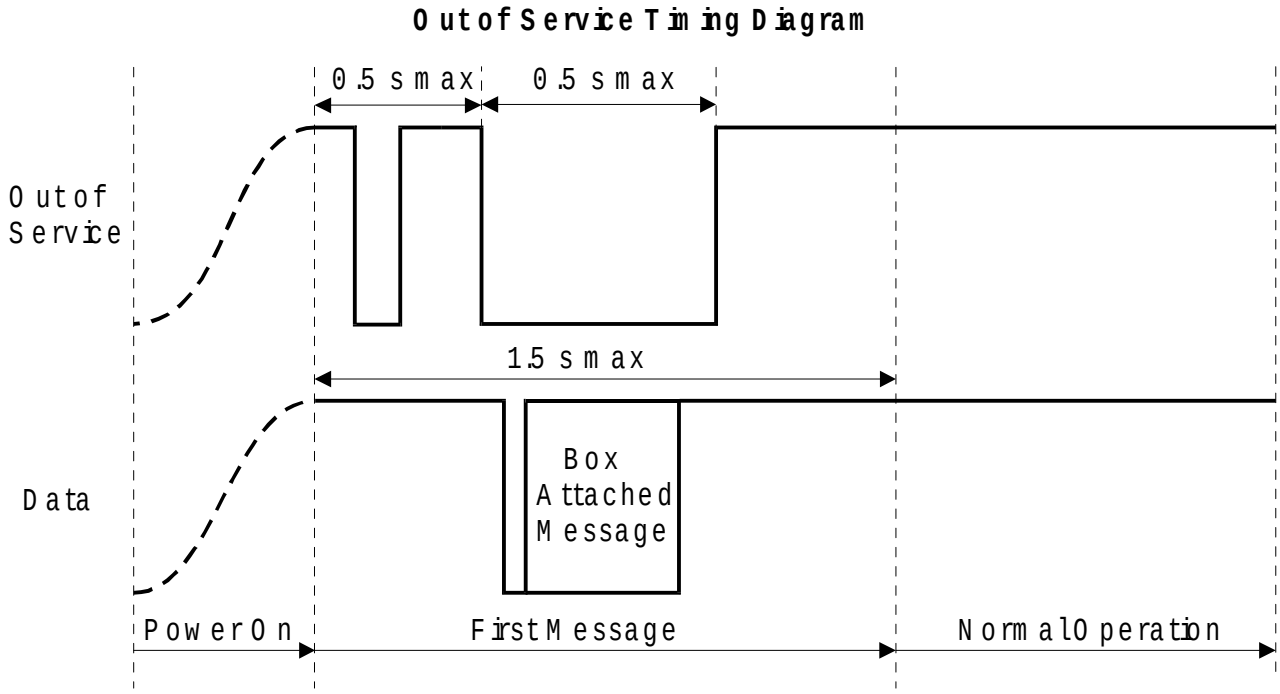
2.2.5. Special Cases Of Message Sending

1. The Bill Acceptor has been powered ON (one message).
When the Bill Acceptor is powered ON, it sends the initial one or two messages, depending on the results of the initial self-test procedure and the status of the Cassette. The messages are accompanied by the changing of the OUT OF SERVICE output.
One message is sent in the following cases:

The self-test procedure has not found any failures, the Cassette is attached to the Bill Acceptor and it is not full. In this case,after being turned ON, the Bill Acceptor starts with the OUT OF SERVICE output which is set to level HIGH for 0.2 - 0.5 second; then, this output is activated (set to level LOW) for the time of the self-test procedure, which takes approximately 0.5 second; and then, the Bill Acceptor de-activates the output (set to evel HIGH) and sends the LRC ATTACHED message.

The self-test procedure has not found any failures, the Cassette is not attached to the Bill Acceptor. After the self-test procedure, the Bill Acceptor sends the LRC REMOVED message and keeps the OUT OF SERVICE output activated (level LOW) unless the Cassette has been attached.

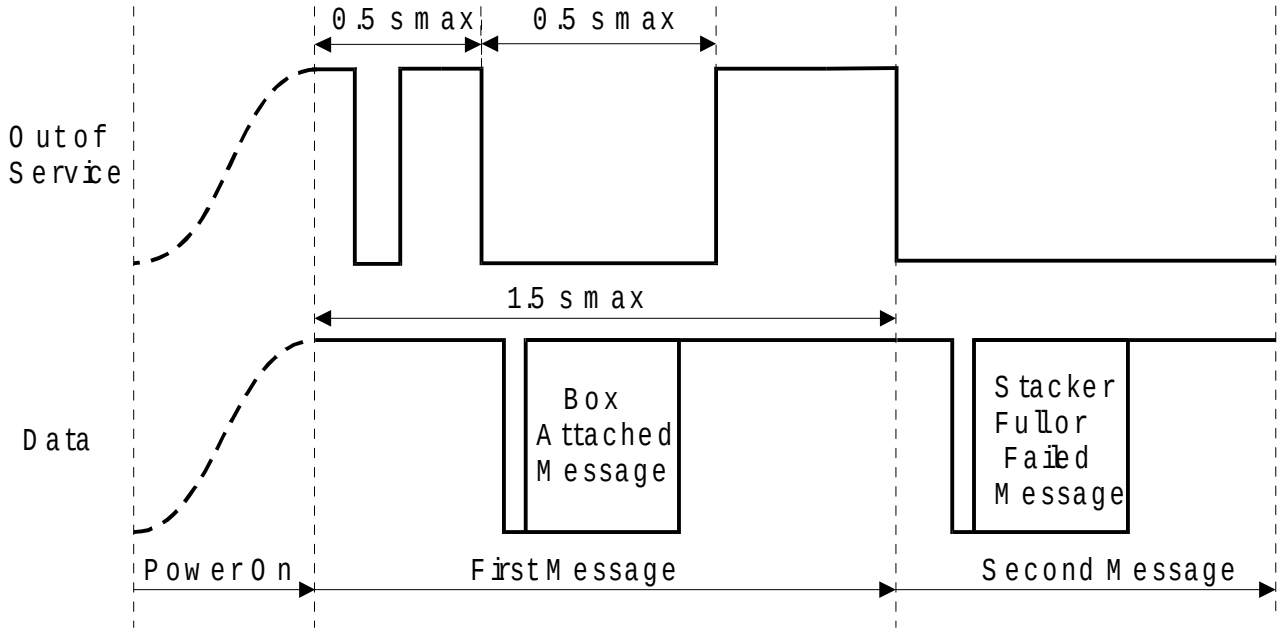
The time intervals for the initial message in the above cases are shown in the figure “Out of Service Timing Diagram” below:



2. The Bill Acceptor has been powered ON (two messages).

Two messages are sent in the following cases:
The self-test procedure has not found any failures, the Cassette is attached to the Bill Acceptor, but it is full. After the self-test procedure, the Bill Acceptor sends the first LRC ATTACHED message, then the second STACKER FULL message, and keeps the OUT OF SERVICE output activated (level LOW) unless the Cassette has have been replaced with an empty one.
The self-test procedure has found some failures. After the self-test procedure, the Bill Acceptor sends the first LRC ATTACHED message, then the second FAILURE message, and keeps the OUT OF SERVICE output activated (level LOW).
The time intervals for the initial messages in the above cases are shown in the figure "Power On Timing Diagram" below:

Power On Timing Diagram



3. Special case of sending three messages.
When a jam occurs, while a banknote is being stacked into the Cassette and the stacking procedure can not be finished, the following three messages are sent:
CREDIT message.
REJECT message.
FAILURE message.
The Bill Acceptor also activates (level LOW) the OUT OF SERVICE output.

4. Special case of sending four messages.
When a failure occurs, while a banknote is being stacked into the Cassette and the stacking procedure can not be finished, the following four messages are sent:
CREDIT message.
FAILURE message.
VEND message.
STACKER FULL message.
The Bill Acceptor also activates (level LOW) the OUT OF SERVICE output.

3. Codes of CashCode® Serial Interface Messages

Here are both binary and hex codes of the messages from the Bill Acceptor to the external equipment as shown in the table below.
All other available codes are reserved for future options and code extensions. If the external equipment has received a reserved code, the transmission error has already occurred.

Table of Message Codes

	7(MSB)	6	5	4	3	2	1	0(LSB)	
Message Description	Binary Code								HEX Code
$1 CREDIT	1	0	0	0	0	0	0	1	81
$2 CREDIT	1	0	0	0	0	0	1	0	82
$5 CREDIT	1	0	0	0	0	0	1	1	83
$10 CREDIT	1	0	0	0	0	1	0	0	84
$20 CREDIT	1	0	0	0	0	1	0	1	85
$50 CREDIT									
$100 CREDIT									
VEND	1	0	0	0	1	0	0	1	89
RETURNED	1	0	0	0	1	0	1	0	8A
REJECT	1	0	0	0	1	0	1	1	8B
FAILURE	1	0	0	0	1	1	0	0	8C
STACKER FULL	1	0	0	0	1	1	0	1	8D
LRC REMOVED	1	0	0	0	1	1	1	0	8E
LRC ATTACHED	1	0	0	0	1	1	1	1	8F
Reserved	All other available codes								

Credit messages may vary according to various currency denomination.