Asahi Seiko (EUROPE) LTD.

Title :	**RS-232 Serial Control Interface PCB for CD Range Specification**
Number :	*06B01672*
Issue :	*Rev E*
Project No.	#E121
Author : **Title :**	A.Massey Electronics Engineer
Signatures :	**Date:**
Approved : **Title :**	
Signature :	**Date:**

Contents

1.0 Introduction

This document details the technical specifications for the RS232 Serial Control Interface PCB utilised by the #E121 CD Variants.

It is assumed that the user is already familiar with the CD Range and therefore the scope of this document is limited to the PCB, its electrical characteristics and interface. It also covers any additional functionally offered.

For the purposes of this document, the Card Dispenser will be referred to as “the Mechanism” and the equipment that connects to and controls the Mechanism will be referred to as “the Host”.

2.0 General Specifications

Key features of the new PCB:

- Retains CD functionality, covering all existing parallel functions (inputs and outputs) offered by PCB part number CD9603 (as fitted to the current CD Range), over a standard RS232 serial interface.
- Serial interface replicating the functionality, inputs and output signals of the current parallel interface control PCB (part number CD9603) used on the CD range of Card Dispensers.
- Functions at either 12VDC or 24VDC (switchable).
- Firmware is a development of the SCD2500 firmware and retains similar ‘family’ protocol and functions including LLS monitoring when fitted with a suitable sensor.
- PCB has similar mechanical properties, and therefore is a ‘like-for-like’ physical fit.
- Depending on the required specification one of two harnesses will be used to interface the new PCB to the Mechanism. If LLS is not required harness ASE-003824 will be used. If LLS is a requirement then harness ASE-003771 will be used, this provides a suitable 3 way connection to the standard ASE-003476 LLS Harness as fitted to the SCD2500 card dispenser.

3.0 Electrical Specifications

This section details the electrical interfaces between the Mechanism and the Host Machine.

3.1 Interfaces

The Mechanism has a single Control Interface which is used to control and power the mechanism through the various functions listed in this document.

RS-232 and parallel host connections are included within the Control Interface as standard. A USB interface can be provided as an option.

3.2 Power Supply Requirements

The mechanism can function at one of two supply voltages selected by a switch on the PCB assembly. It is imperative that this switch is correctly set. Incorrect setting will result in damage to the control board.

The specifications for the power supply follow:

3.2.1 12V Power Supply

Supply Voltage	12.0 Volts DC ±5%	
Ripple Voltage	0.2 Volts peak-peak (maximum)	
Current Consumption:	Average	Peak
Stand-By	200mA	850mA
Operational	400mA	2.5A

Note: The 12V Unit cannot be used with the '445' style cassette.

3.2.2 24V Power Supply

Supply Voltage	24.0 Volts DC ±15%	
Ripple Voltage	1.0 Volt peak-peak (maximum)	
Current Consumption:	Average	Peak
Stand-by	100mA	600mA
Operational	250mA	2.0A

3.3 Power Connections

The power supply connection is made via the 24-way Control Interface Connector (refer to section 3.6.3 for pin connections). The same pin connections are used for both 12V and 24V units, so care must be taken to ensure the correct voltage is applied.

3.4 Insulation Resistance

10M Ohms or greater when 500V DC is applied between each Interface Connection and the Metal Chassis.

3.5 Dielectric Strength

500V AC when applied between each Interface Connection and the Metal Chassis.

3.6 Parallel Control Interface

3.6.1 Description

The Control Interface Connector is a 24-way (2x12) Molex shrouded header (Part number 90130-3124) fitted to the Control PCB, located on the under side of the Mechanism.

3.6.2 Mating Connector

IDC ribbon cable type connectors are NOT compatible with this connector and MUST NOT BE USED.

The Mating Connector is a Molex C-Grid III™ type 24-way socket. The specific crimp, housing and contact part numbers are shown in Table 1.

Manufacturer	Description	Wire size (AWG)	Part Number
Molex	Housing – Dual Row 24 way	-	90142-0024
Molex	Crimp contact – Reel / Plating A	22-24	90119-0109
Molex	Crimp contact – Reel / Plating E		90119-0110
Molex	Crimp contact – Reel / Plating F		90119-0111
Molex	Crimp contact – Reel / Plating A	26-28	90119-0120
Molex	Crimp contact – Reel / Plating E		90119-0121
Molex	Crimp contact – Reel / Plating F		90119-0122
Molex	Crimp contact – Loose / Plating A	22-24	90119-2109
Molex	Crimp contact – Loose / Plating E		90119-2110
Molex	Crimp contact – Loose / Plating F		90119-2111
Molex	Crimp contact – Loose / Plating A	26-28	90119-2120
Molex	Crimp contact – Loose / Plating E		90119-2121
Molex	Crimp contact – Loose / Plating F		90119-2122

Table 1 – Parallel Control Interface Connector Details

Plating A: 1.75µm (69µ") Tin/Lead over Nickel.
Plating E: 0.38µm (15µ") selective Gold over Nickel and 4µm (160µ") Tin/Lead over Nickel.
Plating F: 0.76µm (30µ") selective Gold over Nickel and 4µm (160µ") Tin/Lead over Nickel.

This information was correct at time of writing. Information may be confirmed at www.molex.com

3.6.3 Pin Connections

Pin Number	*Signal Description*	*Type*
12	Dispense Signal	Input
15	Future use	
16	Future use	
17	Future use	
18	Future use	
19	Reset Signal	Input
20	Stuck Signal	Output
21	Future use	
22	Future use	
23	Payout Signal	Output
24	Empty Signal	Output
11	Signal Ground	0V
1	Supply Positive (12V or 24V DC)	See Section 3.2
2	Supply Positive (12V or 24V DC)	See Section 3.2
3	Supply Negative (0V)	See Section 3.2
4	Supply Negative (0V)	See Section 3.2
5	Future use	
6	Future use	
7	RS-232 RX	See Section 4.4.1
9	RS-232 TX	See Section 4.4.1
14	LED Output -	
8	LED Output +	
10	Control Input +	
13	Control Input -	

Table 3 – Parallel Control Interface Pin Connections

The Signal Ground reference (pin 11) is internally connected to the 0V Supply Negative (pins 3 & 4) on the Control PCB. The Signal Ground connection is used for both parallel and serial interfaces.

Figure 1 shows pin number allocation for Mating Connector, viewed from wire insertion side of the housing:

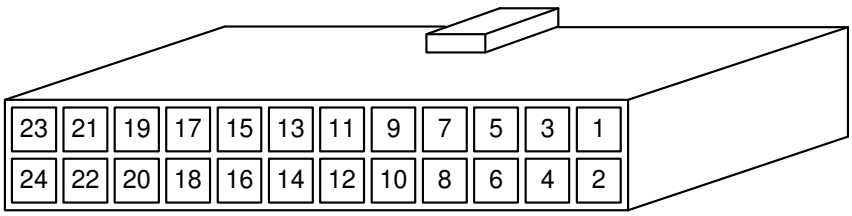


Figure 1 – Control Interface Mating Connector Housing

NOTE:
Pin allocation is in accordance with an Asahi Seiko (Europe) Ltd reference scheme.
Pin 23 as illustrated above, is designated pin 1 by Molex.

3.7 Signal Electrical Specification

3.7.1 Input Signals

The Mechanism Input signals may be driven using either open collector or a TTL compatible output. All signal inputs are level sensitive. Figure 2 shows a typical input connection:

Input characteristics: $V_{IL\ (max)}$ = 1.5V

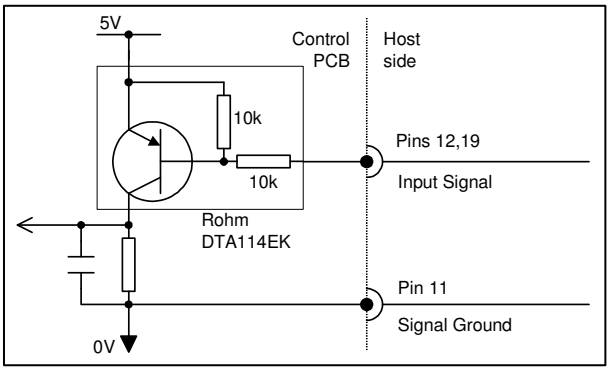


Figure 2 – Input Circuit

3.7.2 Output Signal

The Output signal configuration is of an open collector type. Figure 3 shows a typical output connection.

Output characteristics: $V_{o\ (max)}$ = 30V, $I_{o(max)}$ = 100mA

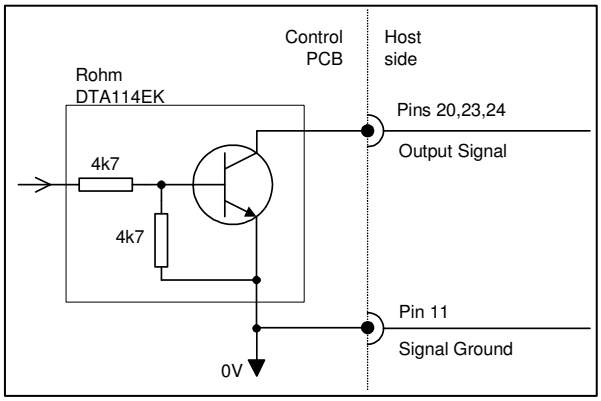


Figure 3 – Output Circuit

3.7.3 Control Signal Operation

The Parallel Control Interface allows the Host to control all the functions of the Mechanism.

The Mechanism can exist in one of two states, Idle or Active.

- IDLE State: The Mechanism is in the idle state, with or without a card in the unit, when all of the control signal inputs are high.
- ACTIVE State: The Mechanism is in the Active state with or without a card in the unit, when any of the control signal inputs are low.

3.7.4 Stuck Output

The stuck output can be in one of three states:

- Normal - Output is Permanently High
- Card Not Taken - Pulsing
- Card Stuck - Output is Permanently Low

Refer to section 5.1 for further information regarding stuck conditions.

3.7.5 Empty Output

The Empty output is used to indicate when the cassette is empty of cards. The Mechanism drives this output low when there are no cards in the cassette, and high when there are one or more cards.

If the cassette is empty the Dispense function will not operate.

3.7.6 Dispense Input

The signal diagram in Figure 4 below shows a typical successful dispense procedure.

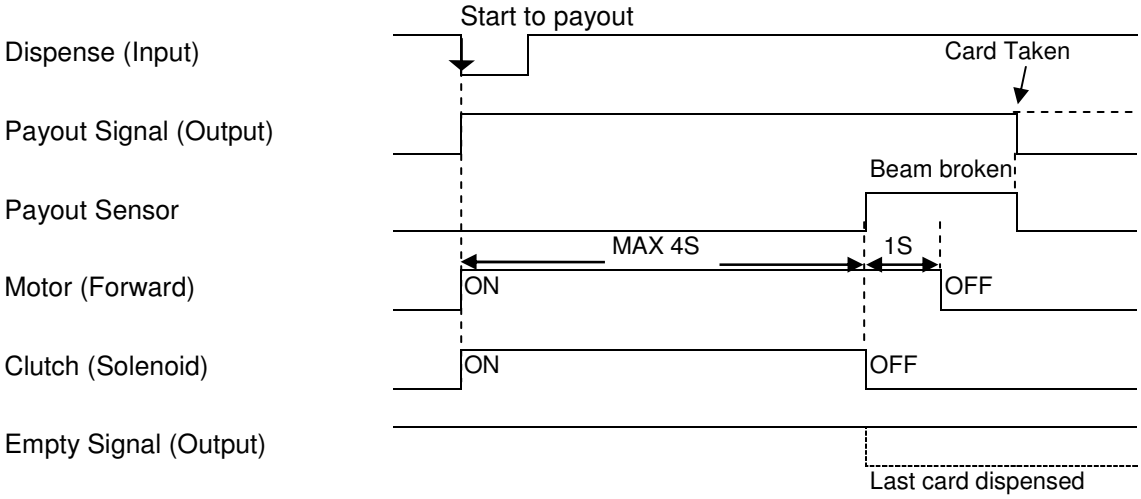
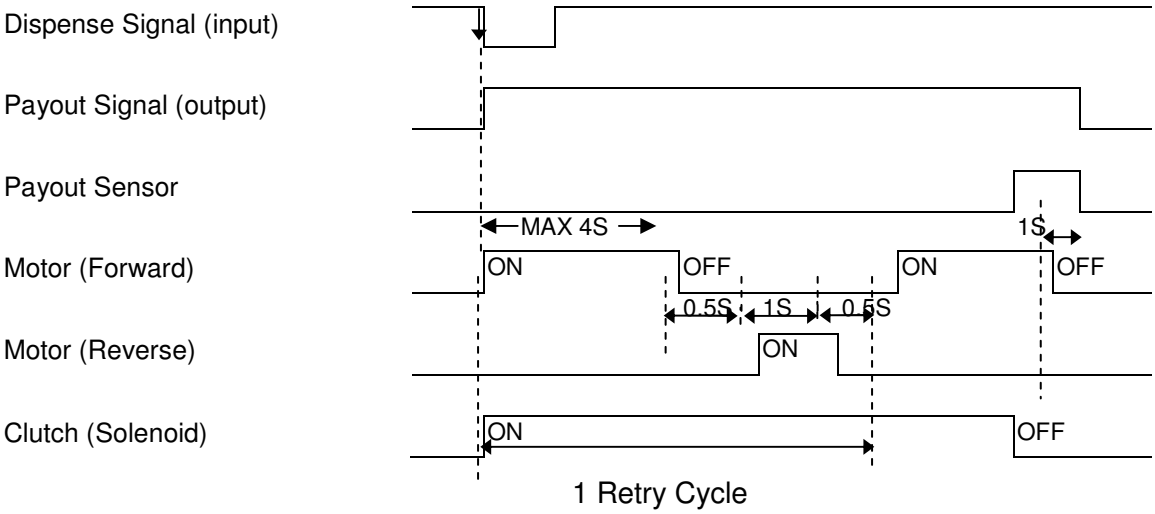


Figure 4 - Dispense Card (Successful) - Signal Diagram

The signal diagram in Figure 5 below shows a typical dispense procedure that utilises the retry / joggle routine when dispensing fails because of a card jam or similar:

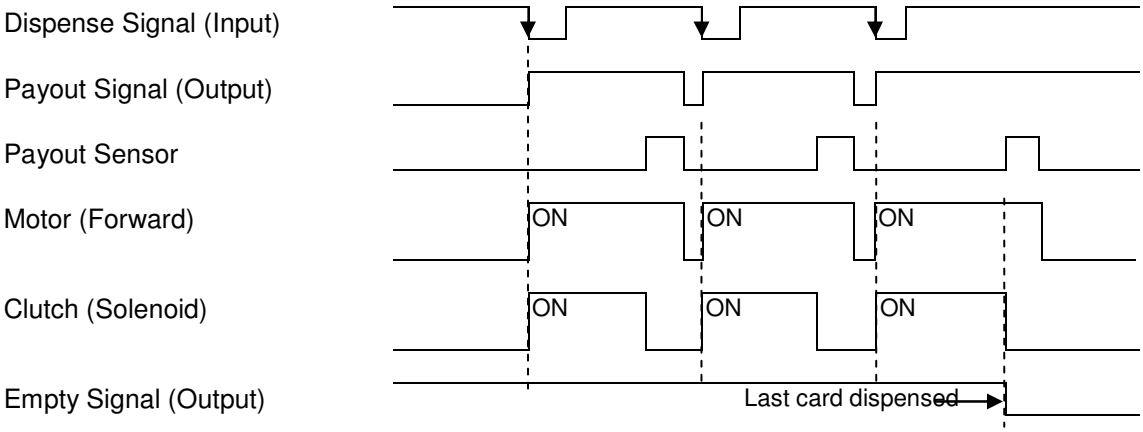


Note: The number of retries can be set to 9 maximum see section 4.7.10, 4.7.11 and 4.7.13.1

Figure 5 - Dispense Card - Signal Diagram

3.7.7 Dispense - Continuous

The signal diagram in Figure 6 below shows how a continuous dispensing cycle maybe initiated:

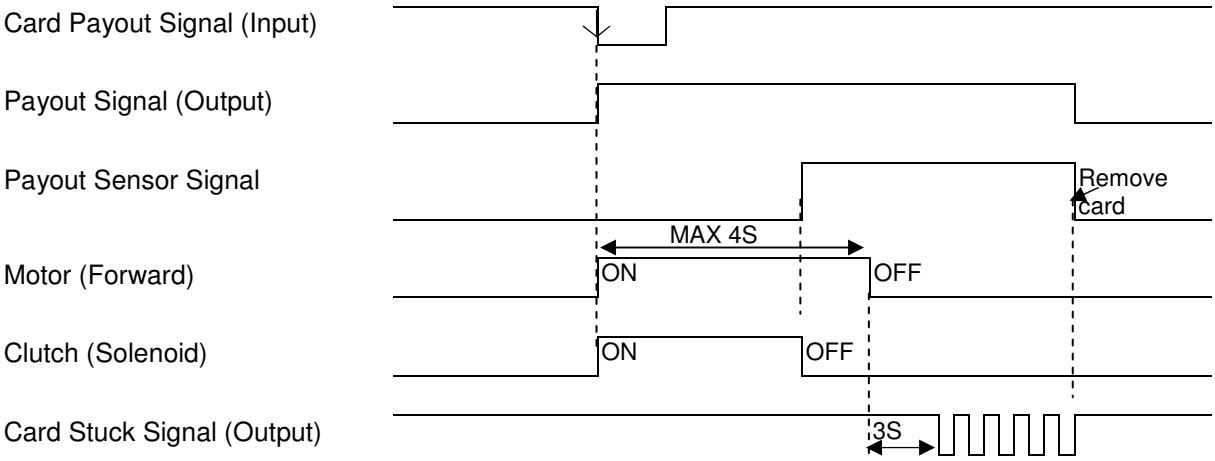


Successive payout demands can be made as soon as the card is removed.

Figure 6 – Continuous Dispensing - Signal Diagram

3.7.8 Dispense – Failure To Remove Card

The Signal Diagram in Figure 7 shows a dispense procedure that has failed because the card was not removed after it was dispensed:



For any sensor problem, jam or failure to remove card, the Card Stuck signal flashes.

Figure 7 – Dispense Failure or Failure To Remove Card.

3.7.9 Reset Stuck Condition

If a stuck condition occurs, the Host can attempt to recover the situation by operating the Reset Input. The Signal Diagram in Figure 8 shows illustrates how this maybe achieved:

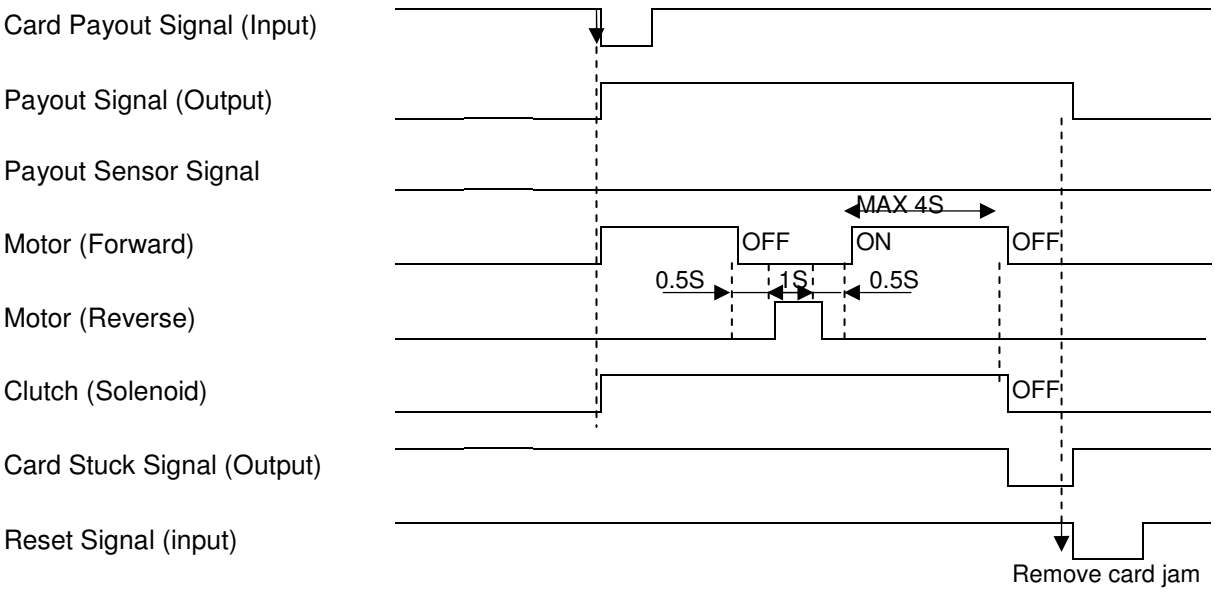


Figure 8 – Dispensing Failure and Reset - Signal Diagram

4.0 Serial Communications

If the Unit is being controlled via the Serial RS-232 interface, the Parallel interface must not be used at the same time. Some of the parallel inputs are overridden by the serial commands.

4.1 Communications Specification

Electrical Specification

- TIA/EIA-232-E

Mode

- Asynchronous, Half Duplex, No Handshaking

Baud Rate

- 1200, 2400, 4800, or 9600 BPS

Frame Structure

- Fixed 11-bit frame length.
- Start bit : 1
- Data bits : 8
- Parity : None, Odd, or Even
- Stop bits : 1 or 2

Error detection

- Vertical Parity in frame.
- Horizontal parity BCC (Block Check Character).

Message Protocol

- Command / Response and Enquire.

4.2 Time-outs

4.2.1 Inter-character Time-out

Inter-character time-out is set at 50ms as default but is re-programmable to either 10ms or 100ms (Refer to section 4.7.10, 4.7.11 and 4.7.13.1).

Inter-character time out is the maximum allowed between consecutive characters with a single command string.

4.2.2 Reply Time-out

The host should allow sufficient time for the Mechanism to process and respond to a command before sending any further commands.

This time will vary depending on the command. It is recommended that a time out period of at least 300mS is allowed before attempting to resend a command.

4.3 Automatic Baud and Parity Detection Mode

Automatic Baud rate and Parity detection mode is activated immediately after power up. Using the transmission of the <DLE><ENQ> characters the Control can change the Baud rate and Parity from the settings defined in the User EEPROM.

The Control must transmit the <DLE><ENQ> characters repeatedly until the Unit returns an <ACK> character. The delay between consecutive <DLE><ENQ> transmissions must be at least 50ms for successful detection. If the detection mode is successful the Unit will automatically program the new Baud Rate and Parity into the User EEPROM. Successful automatic detection should take no more than four transmissions of <DEL><ENQ>.

To by-pass the Automatic detection the Control should transmit <ENQ> repeatedly until a standard ENQ reply is received. If other characters are transmitted the automatic detection procedure will eventually fail.

The automatic detection mode may also be by-passed on power up by driving the Control input low (i.e. shorting the Control + and - inputs) while the power to the Unit is switched on.

4.4 Interface Connections

4.4.1 Pin Connections for RS-232

The pin connections on the Molex C-Grid III 24-way Unit interface connector are as follows: -

Pin Number	***Pin Function***	***Description***
7	RXD	Receive Data for RS-232
9	TXD	Transmit Data for RS-232
11	SG	Signal Ground

4.4.2 Typical RS-232 Interconnection

The following diagram shows a typical interconnection between the Unit and a PC compatible serial port.

Unit Pin No.	**Unit Signal**	**Description**	**Interconnection**	**Control**	**Pin No.**
9	TXD	Unit Transmit	---------->	RX	2
7	RXD	Unit Receive	<----------	TX	3
11	SG	Signal ground	----------	SG	5

4.5 Communications Protocol

This section details the communications protocol for the RS-232 serial interface.

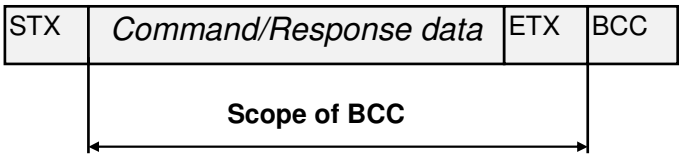
4.5.1 Control Codes

A number of control codes are used to act as format delimiters and for data exchange handshaking.

Code	***Hex Value***	***Function***
DLE	10	Used with ENQ in Automatic detection mode.
STX	02	Indicates the start of text in message transfer.
ETX	03	Indicates the end of text in message transfer.
ENQ	05	Enquire: Request to connect the communication line.
ACK	06	Positive acknowledge.
NAK	15	Negative acknowledge.

4.5.2 Message Format

The format used for information exchange between the Control and the Unit is as follows: -



4.5.3 Block Check Character (BCC)

The BCC is the 8-bit Exclusive-OR of all the data within the defined scope. The BCC is only used in Message Transfers.

4.5.4 ENQuire

The ENQ control code is used to enquire the Mode of a Unit. The Unit can exist in one of two modes indicates by the following two characters: -

'R' (52Hex) meaning Ready, or
'B' (42Hex) meaning Busy

If the Unit is Busy then it cannot process any Message Transfers. If the Unit is Ready then it is able to process all Message Transfers. The following table shows the two possible replies: -

Control		**Unit**	
<ENQ>	⇒		Control requests Mode of Unit
	⇐	R<ACK>	Unit indicates Ready to process message transfer.
<ENQ>	⇒		Control requests Mode of Unit
	⇐	B<ACK>	Unit indicates Busy.

4.5.5 Communications Sequence

The following sections show how the Control and Unit exchange information using the command and response method. Details of all the failure modes and error recovery are also shown in these sections.

The example sequences show an ENQ exchange before a message transfer. This is strictly not necessary for a system implementation but is merely included to demonstrate all possible situations.

4.5.5.1 Normal Operation A – Two way message transfer

Control		**Unit**	
<ENQ>	⇒		Control requests Mode of Unit
	⇐	R<ACK>	Unit indicates Ready
Command	⇒		Control transmits Command and Unit receives
	⇐	Response	Unit transmits Response

4.5.5.2 Normal Operation B – One way message transfer

Control		**Unit**	
<ENQ>	⇒		Control requests Mode of Unit
	⇐	R<ACK>	Unit indicates Ready
Command	⇒		Control transmits Command and Unit receives
	⇐	<ACK>	Unit transmits <ACK> to confirm valid data

4.5.5.3 Error Operation 1 – ENQ Unit reply time-out and Control re-send

Control		**Unit**	
<ENQ>	⇒		Control requests Mode of Unit
Time-out			Unit does not respond - Reply time-out
<ENQ>	⇒		Control requests Mode of Unit again
	⇐	R<ACK>	Unit indicates Ready

This corresponds to a Reply Time-out as defined in section 4.2.2

4.5.5.4 Error Operation 2 – Control ACK receive error and resend

Control		**Unit**	
<ENQ>	⇒		Control requests Mode of Unit
	⇐	R<ACK>	Unit indicates Ready
Error			Control receive error
<ENQ>	⇒		Control requests Unit to transmit again
	⇐	R<ACK>	Unit indicates Ready

A Control receive error can be either a receive data error or an inter-character time-out as defined in section 4.2.

4.5.5.5 Error Operation 3 – Command Unit reply time-out and Control resend

Control		**Unit**	
<ENQ>	⇒		Control requests Mode of Unit
	⇐	R<ACK>	Unit indicates Ready
Command	⇒		Control transmits a Command
Time-out			Unit does not respond - Reply time-out
Command	⇒		Control transmits a Command again
	⇐	Response	Unit replies with Response

This corresponds to a Reply Time-out as defined in section 4.2.
The same sequence applies to a Command-ACK (Normal Operation B) reply.

4.5.5.6 Error Operation 4 – Command Unit receive error and Control resend

Control		**Unit**	
<ENQ>	⇒		Control requests Mode of Unit
	⇐	R<ACK>	Unit indicates Ready
Command	⇒		Control transmits a Command
	⇐	<NAK>	Unit receive error - replies with <NAK>
Command	⇒		Control transmits a Command again
	⇐	Response	Unit replies with Response

The same sequence applies to a Command-ACK (Normal Operation B) reply.

4.5.5.7 Error Operation 5 – Control Response receive error and resend

Control		**Unit**	
<ENQ>	⇒		Control requests Mode of Unit
	⇐	R<ACK>	Unit indicates Ready
Command	⇒		Control transmits a Command
	⇐	Response	Unit transmits Response
Error			Control receive error
Command	⇒		Control transmits the same Command again
	⇐	Response	Unit replies with Response

The same sequence applies to a Command-ACK (Normal Operation B) reply.

4.6Command and Response Messages

This section defines the format and data used in the Command and Response communication.

4.6.1 Message Format

The block of data described as the “Command / Response data” in section 4.1 is structured as follows: -

Identifier Fixed 2 characters	**Parameters** Variable number of characters

The *Identifier* is fixed at two ASCII characters and is used to define the meaning of the Command and Response. The *Parameters* vary in the number of ASCII characters depending upon the Identifier.

4.7 Message Identifiers

The Identifiers for the Command and Response messages are detailed in the following table:

Message type	***Identifier (ASCII)***	***Description***
Status Request	SR	Request Unit status information.
Configuration Request	CR	Request Unit configuration data.
Card Dispense	CD	Dispense a card from cassette to the exit.
Reset Stuck	RS	Reset the stuck condition.
Write EEPROM User	WU	Write to user accessible EEPROM area.
Read EEPROM User	RU	Read user accessible EEPROM area.
Read Operational Data	RO	Read the data pertaining to the number of Dispense operations.
Sensor Status	SS	Read the status of the opto sensors.
Cleaning Cycle	CY	Starts / Stops Cleaning Cycle
Dispense History	DH	Request the dispense cycle counter
History Reset	HR	Resets the dispense cycle counter
Dispense Time	DT	Request timings of previous dispense cycle

4.7.1 Message Definitions

The following sections define the parameters for the Command and Response of each Identifier. All data exchanged is from the ASCII character set.

There are two types of message transfers as follows: -

- Type A (See Section 4.5.5.1) where a message is transmitted by both Control and Unit.
- Type B (See Section 4.5.5.2) where a message is transmitted only by the Control, and an ACK or NAK by the Unit.

4.7.2 Status Request (SR)

The Status Request is used to identify the status of the Unit throughout its various modes of operation.

Command Data	SR
Response Data	SR <a> <b> <c> <d> <e> <f> <g> <h> <i> <j>

Parameter Values:

<a> STATE
- 0 Idle
- 1 Busy
- 2 Ejected
- 3 Card Not Removed
- 4 Stuck
- 5 Cleaning
- 6 Card Error

<b> CARD POSITION
- 0 No card in unit
- 1 Card in unit
- 2 Entry / Exit bezel

<c> CASSETTE LEVEL
- 0 Empty
- 1 Not Empty

<d> FUTURE USE
- Always 0

<e> Power up flag
- 0 Unit running
- 1 Unit power up occurred since last Status Request

<f> LOW LEVEL
- 0 Near Empty cards getting empty.
- 20h Not Near Empty

<g> to <j> Future Use = SPACE (20hex)

Example: Unit responds with status indicating an Idle state with no card in the unit, the cassette is empty and the unit is running.

Control:<STX>SR<ETX><02h>
Unit: <STX>SR00000<20h><20h><20h><20h><20h><ETX><12h>

The Status Request supplies information as to the status of the Unit as follows: -

<a> STATE : The Unit can exist in one of the following states: -

0 - Idle	Unit is in a static condition with or without a card in the transport path.
1 - Busy	Unit is in process of dispensing.
2 - Ejected	The card has been ejected and is waiting to be removed.
3 – Card Not Removed	The card has not been removed after a period of 3 seconds has elapsed (from the end of the eject process).
4 - Stuck	Unit can be in a stuck condition for various reasons. (Refer to the Technical Information for details).
5 - Cleaning enabled	The Unit Cleaning Mode is active.
6 – Card Error	The card has remained in the unit for a period of 60 seconds or more after a dispense procedure. This can be due to various reasons (Please refer to 5.1 for further details).

<b> CARD POSITION : The Card Position can be in one of the following: -

0 - No card in Unit	Unit has no card in the transport path this is the normal idle state.
1 - Card in Unit	A card is in the transport path'
2 - Exit Bezel	From condition '1' the card is transported forwards for a preset time (see sections 4.7.10, 4.7.11 & 4.7.13.1). After this point the card is regarded as being at the exit bezel.

<c> CASSETTE LEVEL : The card level in the cassette is as follows: -

0 - Empty	The cassette is empty.
1 - Not Empty	The cassette is not empty (i.e. one or more cards are in the cassette).

<d> FUTURE USE: Reserved for future use

0	This always returns '0'

<e> POWER UP FLAG : Flag to indicate the Unit has just powered up: -

0 - Unit Running	The Unit has NOT powered up since the last Status Request (SR) communication.
1 - Unit Power Up	The Unit has powered up since the last Status Request (SR) communication.

Note: this flag is automatically reset following the transmission of the first SR response.

<f> **LOW LEVEL :**

0 – Near Empty	The cassette level is low.
20h - Not Near Empty	Cassette level is OK or no LLS sensor fitted

4.7.3 Configuration Request (CR)

The Configuration Request returns the product description and the software version number of the Unit.

Command Data	CR
Response Data	CR <a(13)> <b(7)> <c(12)>
Parameter Values <a(13)>PRODUCT DESCRIPTION Fixed 13 characters e.g. “ASE-003772 , <b(7)> FIRMWARE VERSION Fixed 7 character firmware version number e.g. “V01.01,” <c(12)>Future Use = SPACE (20hex)	

4.7.4 Card Dispense (CD)

The Card Dispense command is used to dispense a card from the cassette through the unit to the exit bezel.

This command is only operative with the Unit in the idle state (SR<STATE> = 0).

Command Data	CD
Response Data	ACK or NAK
Parameter Values: none	

4.7.5 Dispense History (DH)

Dispense History returns a counter that represents the number of successful dispense cycles since the counter was last reset using the History Reset (HR) command. (See also Read Operational Data (RO) 4.7.12.

A dispense cycle is defined as starting when a valid Dispense (CD) command is received (unit must not be empty) and completing when the card is removed from the bezel irrespective of how long this may take. If the card enters a 'Stuck' condition (SR <a> = 4 see section 4.7.2) the counter is not incremented.

If the power fails during the dispense cycle the counter will increment when the unit next operates, unless there is still a card in the unit in which case it will increment once it has been removed.

The counter maybe polled during a dispense cycle and used to determine a successfully dispense, the increment of the counter confirming the card has been removed.

The counter register has a maximum value of 65535. When the counter reaches this value the next increment will cause it to loop around to 0, each subsequent increment will cause it to count upwards until it once again reaches 65535 whereupon the process will repeat again.

It is recommended that in the event a card needs to be forcibly removed as a result of card jam that the counter be reset using the History Reset (HR) command.

The dispense counter will also increment when a cleaning cycle is terminated as the cleaning card is dispensed (see section 4.7.8 Card Cycle (CY)). It is recommended that the dispense counter is reset after a cleaning cycle.

Command Data	DH
Response Data	DH <a(8)>
Parameter Values <a(8)> COUNTER VALUE Fixed 8 Characters e.g. "00048251" Please note the first 3 characters of the response are reserved for possible future use and will always be '0'.	

4.7.6 History Reset (HR)

History Reset returns the Dispense History Counter (see section 4.7.5) to zero.

History reset may only be used whilst the device is in idle state.

It is recommended that in the event a card needs to be forcibly removed as a result of card jam that the counter be reset using this command.

Command Data	HR
Response Data	HR <a(8)>
Parameter Values <a(13)>COUNTER VALUE Fixed 8 Characters e.g. "00000000"	

4.7.7 Dispense Times (DT)

Dispense Times returns the timings of the previous dispense cycle, the values of which maybe used for diagnostic purposes.

Three times are returned:

Card Dispense Time is the time in Milliseconds it takes for the card to be transported from the cassette to the Card Position Sensor.

Card Take Time is the time in Milliseconds that the card remains in the unit. If the card is removed from the unit very quickly then this value will be relatively small (maybe less than 1000 mS), however if the card is left in the unit for an extended period the value could be quite large (anything up to 65535 mS).

Dispense Time is the time for the total dispense cycle and is the sum of Card Dispense Time and Card Take Time.

All three of these time registers have a maximum value of 65535. If when requesting this data one or more of these registers returns '65535' it is indicating that the time represented by the register is equal to or in excess of 65535 mS.

Command Data	HR
Response Data	HR <a(5)> - <b(5)> - <c(5)>

Parameter Values

<a(5)> Card Dispense Time
Fixed 5 Characters e.g. "02412"

Delimiting Character ' – ' (Hex 2D)

<b(5)> Card Take Time
Fixed 5 Characters e.g. "10754"

Delimiting Character ' – ' (Hex 2D)

<c(5)> Total Dispense Time
Fixed 5 Characters e.g. "13166"

4.7.8 Card Cycle (CY)

The Card Cycle command is used to enable or disable the Cycle mode. When the Cycle mode is enabled the card is moved forwards and backwards repeatedly, from the dispense position to the exit. This mode of operation is used to cycle a cleaning card to remove deposits from the transport rollers. When the cycle mode is disabled the card is stopped at the card exit.

Before using Card Cycle the cassette must be removed and a suitable cleaning card placed in its location above the empty sensor.

If the card is removed during the cleaning cycle the device will return to its idle state.

Whilst Card Cleaning is active any additional commands sent may take a longer period of time to respond. To reflect this, timeouts should be increased to a value of at least 350mS. This should be observed until a valid response is received from CY0.

The Cycle Enable (CY1) command is only operative when the Unit is in the Idle state (SR<STATE> = 0).

If CY is issued whilst the device is empty it will return immediately to its idle state.

The Cycle Disable command is only operative in the Cycle Enabled state (SR<STATE> = 5).

When a cleaning cycle is terminated the dispense history counter will be incremented as the cleaning card is dispensed (see section 4.7.5 Dispense History (DH)). It is recommended that the dispense counter is reset after a cleaning cycle.

Command Data	CY <a>
Response Data	ACK or NAK
Parameter Values: <a> Cycle mode Disable Cycle mode Enable Cycle mode	
Example: Enable Cycle mode Control:<STX>CY1<ETX><28h> Unit: <ACK>	

4.7.9 Reset Stuck (RS)

The Reset Stuck command allows the Control to reset a stuck condition. This command can only be used when the Unit is in the stuck state (SR<STATE> = 2).

The Unit is unable to physically clear a stuck card so it is recommended that a physical inspection be carried out should the unit enter this state repeatedly.

Command Data	RS
Response Data	ACK or NAK
Parameter Values: none	
Example: Reset Stuck condition. Control:<STX>RS<ETX><02h> Unit: <ACK>	

4.7.10 Write to User EEPROM

This command writes (programs) one byte of the User EEPROM memory.

Command Data	WU <a> <b> <c> <d>
Response Data	WU <e> <f>

Parameter Values

<a> EEPROM Address High nibble (hex character 0 to F)
<b> EEPROM Address Low nibble (hex character 0 to F)

Address range = 00h to 3Fh

<c> EEPROM Data High nibble (hex character 0 to F)
<d> EEPROM Data Low nibble (hex character 0 to F)

<e> EEPROM Response Data High nibble (hex character 0 to F)
<f> EEPROM Response Data Low nibble (hex character 0 to F)

If EEPROM write is successful: -
<e><f> = data written to EEPROM

If EEPROM write is unsuccessful: -
<e><f> = "X0" for invalid address.
<e><f> = "X1" for invalid data.

User EEPROM is limited to 10,000 write operations.

Example: Write User EEPROM Number of Dispense Retries (address 02) to be 4. Unit response shows that the number programmed into EEPROM was 4.

Control:<STX>WU0204<ETX><07h>
Unit: <STX>WU04<ETX><05h>

4.7.11 Read User EEPROM

This command is used to read one byte of the User EEPROM memory.

Command Data	RU <a> <b>
Response Data	RU <c> <d>
Parameter Values <a> EEPROM Address High nibble (hex character 0 to F) <b> EEPROM Address Low nibble (hex character 0 to F) <c> EEPROM Data High nibble (hex character 0 to F) <d> EEPROM Data Low nibble (hex character 0 to F) If EEPROM read is successful: - <c><d> = data read from EEPROM If EEPROM read is unsuccessful: - <c><d> = "X0" for invalid address. Address range = 00h to 3Fh	
Example: Read User EEPROM Number of Dispense Retries (address 02). Unit response shows that the number of dispense retries is set at 4. Control:<STX>RU02<ETX><06h> Unit: <STX>RU04<ETX><00h>	

4.7.12 Read Operational Data (RO)

It is used to return count information pertaining to the number of Dispense operations. (See also Dispense History (DH) 4.7.5. It can be used by the Control to determine when a Unit requires cleaning and or a unit requires servicing with respect to scheduled replacement parts (refer to the relevant Technical Information regarding cleaning intervals part replacement recommendations).

Command Data	RO
Response Data	RO<a[7]>
Parameter Values <a[7]>"D" followed by the Number of Dispense operations as 6 digit decimal	
Example: Unit responds with the number of Dispenses = 210,800 Control: <STX>RO<ETX><1Eh> Unit: <STX>ROD210800<ETX><50h>	
Notes: ***The count for this data is stored in RAM for the Units and the Tens. All the other digits are stored in EEPROM. Hence if the unit is powered down then Units and Tens count will be lost and zeroed following a subsequent power up.***	

4.7.13 Sensor Status (SS)

The Sensor Status is used to interrogate the status of each of the opto sensors fitted to the Unit. It is intended to be used as a fault finding command.

Command Data	SS
Response Data	SS <a> <b> <c> <d> <e> <f> <g> <h> <i> <j>

Parameter Values:

"0" = Sensor Open
"1" = Sensor Broken

For Reflective sensors, "Broken" means an object has broken the transmitters' path such that the receiver has detected the reflected light source off that object.

For Slotted sensors, "Broken" means that an object has broken the transmitters beam such that the receiver no longer detects the light source.

For details of the location of each sensor refer to the specific Unit's Technical Information document.

<a> Reserved for future use
<b> Reserved for future use
<c> Card In Unit Sensor
<d> Reserved for future use
<e> Reserved for future use
<f> Cassette Empty Level Sensor (Slotted) Status
<g> Cassette Near Empty Level Sensor (Reflective) Status (Optional)
Used in conjunction with <f>, parameter is set as follows.
"0" = Sensor Open
"20h" = Sensor Broken(sensor not fitted)

<h> to <j> Future Use = SPACE (20hex)

Example: Unit responds indicating the sensor <c> Broken and all the other sensors Open.

Control: <STX>SS<ETX><03h>
Unit: <STX>SS001000<20h><20h><20h><20h><ETX><02h>

4.7.13.1 EEPROM Memory Usage

The following table details the User EEPROM memory. If data that is out of the working range is written to an EEPROM location the default value will apply.

User EEPROM Address (Hex)	***Function***	***Data Usage (two character Hex)***
00	Not used	-
01	Dispense Motor Run On Time *(See section 4.7.13.2)*	"01" = 1.0 Second *(default)* "02" = 1.5 Seconds "03" = 2.0 Seconds "04" = 2.5 Seconds "05" = 3.0 Seconds "06" = 3.5 Seconds "07" = 4.0 Seconds "08" = 4.5 Seconds "09" = 5.0 Seconds "00" defaults to "01" "0A" to "FF" defaults to "01"
02	Number of Dispense Re-tries *(See section 4.7.13.3)*	"00" = 0 "01" = 1 "02" = 2 *(default)* "03" = 3 "04" = 4 "05" = 5 "06" = 6 "07" = 7 "08" = 8 "09" = 9 "0A" to "FF" default to "02"
03 to 1F	Not used	-
20	Baud Rate *(See section 4.7.13.4)*	"00" = 1200 "01" = 2400 "02" = 4800 "03" = 9600 *(default)* "04" to "FF" default to "03"
21	Frame Parity bit *(See section 4.7.13.5)*	"00" = No parity [2 stop bits] *(default)* "01" = Even parity [1 stop bit] "02" = Odd parity [1 stop bit] "0A" to "FF" default to "00"
22	Inter character time-out *(See section 4.7.13.6)*	"00" = 10ms "01" = 50ms *(default)* "02" = 100ms "0A" to "FF" default to "01"
23 to 30	Not used	-

4.7.13.2 Motor Run On

Once the dispense cycle has been started and the card has moved sufficiently forward to be detected by the mechanisms internal sensor, the motor is instructed to run on for a period of time before stopping. The default period of time is 1 second and in most cases this should be sufficient to ensure the card is correctly produced at the exit. However if cards appear to not be ejected far enough during dispensing this time maybe adjusted in 0.5 Second increments between 1 and 5 seconds by programming the EEPROM address 02h. The factory default for this setting is 1 which produces 1 second run on time.

4.7.13.3 Dispense Retry

When a card is being dispensed there is a retry procedure if the card fails to enter the transport path within a pre-defined time. The number of times the Unit carries out a dispense retry is programmable (at address 02h) in EEPROM. The factory default for the number of dispense retries is 2. This can be programmed between 0 and 9. If the maximum number of retries is reached the Unit indicates a stuck condition.

4.7.13.4 Baud Rate

An alternative method for changing the Baud rate, as opposed to the Automatic detection mode, is to write to the User EEPROM location that defines the Baud rate. When programming the Baud rate using the Write User (WU) command the new baud rate does not take effect until after the Unit's response to this command.

The factory default baud rate is 9600bps.

4.7.13.5 Frame Parity

The frame parity can be programmed to one of three options (none, even or odd). Once the frame parity has been programmed using the Write User (WU) command the response to this command and any following commands incorporate the new parity system. It is important to note that the frame size should always be 11 bits, so when using parity "none" two stop bits are required, whereas with parity "even" or "odd" only one stop bit is required.

The factory default parity is "none".

4.7.13.6 Inter Character Time-out

The Inter Character time-out is the maximum time the Unit will allow between consecutive characters of a communication from the Control. If this time is exceeded the Unit will not respond to the Control's communication.

The factory default is 50ms.

5.0 Conditions

5.1Stuck Condition

When the stuck output is high or Status Request State indicates idle (see section 4.7.2) the unit is its 'Normal' condition and there are no cards stuck or waiting to be removed.

If a card has been dispensed and not removed after 3 seconds the stuck output will begin to pulse and Status Request State will return 'Card Not Removed' (see section 4.7.2) to indicate this condition. Once the card has been taken the stuck output will return to its 'Normal' high condition and Status Request State will show idle.

It must be noted that this condition may also occur if the card has not been dispensed correctly.

If a card becomes stuck or jammed during operation, the Mechanism drives the Stuck Signal Output low and Status Request State will indicate a Stuck condition. The conditions under which this can occur are as follows: -

- Failure to dispense a card after the preset number of retries has expired.
- Connecting power to the unit when a card or object is in the transport path.
- Malfunction of the Mechanism.

In most cases, the Host can reset a Stuck condition once the card has been removed. Refer to sections 3.7.9 and 4.7.9 for details.

A further stuck condition may also be reported when using the serial interface. If a card remains in the unit for a period of approximately 60 seconds or more Status Request State will return a Card Error state (see section 4.7.2).

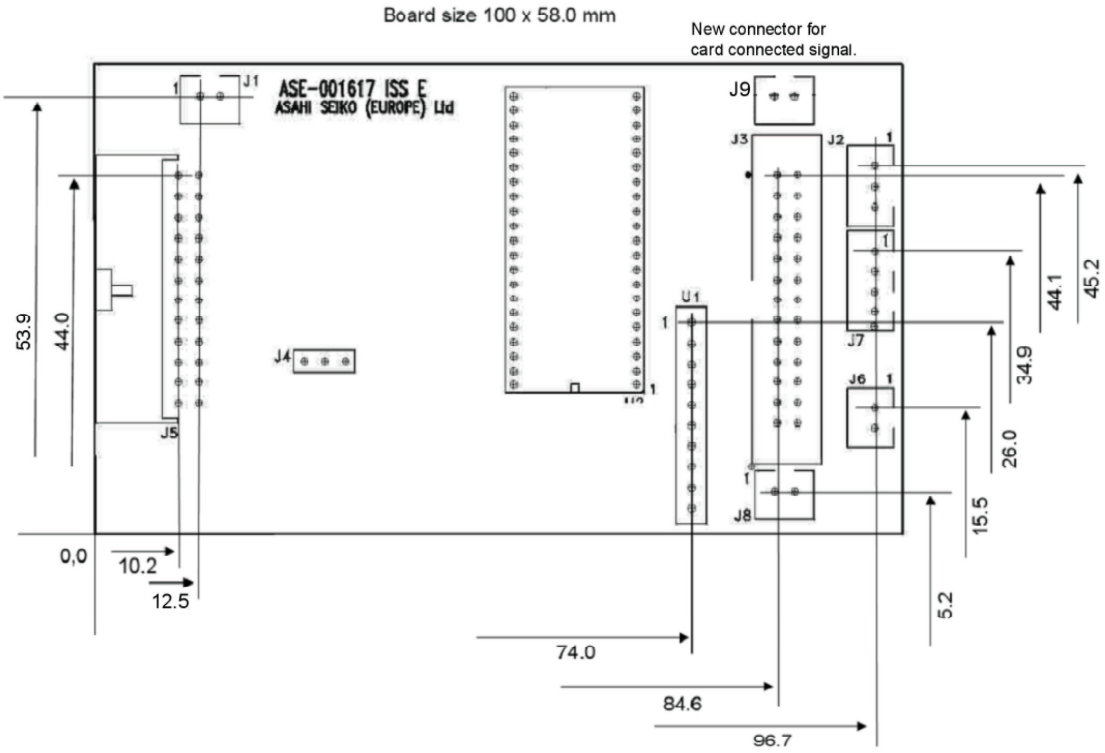
This condition maybe caused by one of the following reasons:-

- A card has been successfully dispensed and not removed.
- A card has become jammed whilst dispensing and cannot be removed by the customer.

Generally if this condition occurs, manual recovery (card removal) will be required.

NB: It is recommended that in the event a card needs to be forcibly removed as a result of card jam that the dispense counter (DH see section 4.7.5) be reset using the History Reset (HR see section 4.7.6) command.

6.0 PCB Dimensions



7.0 Firmware

The PCB assembly should be programmed and tested with the correct firmware package:

ASE-003772: ASE-003772 V*nnn*.mot

Where *nnn* represents the current revision of the firmware.

8.0 Customisation Summary

Conversion kit ASE003777 contains all necessary parts to convert a CD variant card dispenser to serial RS232 specification.

Parts contained in conversion kit ASE003777:

- 1 x RS232 CD PCB ASE003776
- 1 x Exit Sensor Harness Assembly ASE-003771
- 1 x Conversion Procedure Document 06B01675

The PCB assembly is a direct replacement for the existing CD PCB assembly, with an identical footprint, picking up in the existing fixing points.

The harness assembly ASE-003771 replaces the harness from the exit sensor (mounted behind the security plate on front of the mechanism) and the PCB assembly. It also provides a connection for the optional LLS harness ASE-003476

Conversion kit ASE003777 is also supplied as part of a serial or parallel integration kit.

Kit ASE003780 is a serial integration kit comprising of:

- 1 x ASE003777 Conversion Kit
- 1 x ASE002293 Serial Power Harness

Kit ASE003781 is a parallel integration kit comprising of:

- 1 x ASE003777 Conversion Kit
- 1 x ASE003775 Parallel Harness*

***Important Note: Whilst Harness ASE-003775 replaces the host interconnecting harness ECM-8003, it is not a direct pin for pin replacement. Therefore when fitting this unit to an existing parallel design it should be noted that the host harness MUST be modified as outlined later in this document before attempting to use the unit. Failure to do so may result in damage to the unit.**

9.0 Integration Notes

Please read this section carefully, as incorrect integration could result in damage to the unit. If you are uncertain please contact Asahi Seiko (Europe) Ltd for further clarification before proceeding.

The following section describes likely integration scenarios and recommended methods to ensure trouble free operation.

Likely integration scenarios:

- New Serial Installation (using Harness ASE-002293 - Conversion Kit ASE-003780)
- New Parallel Installation (using Harness ASE-003775 - Conversion Kit ASE-003781)
- New Serial Installation (using Harness ASE-003775 - Conversion Kit ASE-003781)
- **I**nstallation into Host with previous/existing CD Parallel Harnessing – **Serial Operation Conversion** (using Harness ASE-003775 - Conversion Kit ASE-003781)
- **I**nstallation into Host with previous/existing CD Parallel Harnessing – Parallel **Operation** (using Harness ASE-003775 - Conversion Kit ASE-003781)

9.1 New Serial Installation (using Harness ASE-002293 - Conversion Kit ASE-003780)

- This is the recommend method of integration.

Harness ASE-002293 (supplied as part of the conversion kit ASE-003780) should be connected directly to a 9 Way D Type Serial RS232 Com Port on the host control. The Red and Black cables should be connected a suitable power supply.

9.2 New Parallel Installation (using Harness ASE-003775 - Conversion Kit ASE-003781)

Parallel integration to suitable host is achieved by means of harness ASE-003775 (supplied as part of conversion kit ASE-003781). It should be connected as described in the table in figure 8.1 below.

- If the serial connections on Pins 6 & 10 are not to be used they maybe left disconnected.

9.3 New Serial Installation (using Harness ASE-003775 - Conversion Kit ASE-003781)

For serial installations it is recommended that Conversion Kit ASE-003780 be used as described in section 8.1 above.

It is however possible to make a serial connection using harness ASE-003775 (supplied as part of conversion kit ASE-003781).

See Figure 8.1 below for pin descriptions.

- Power connections should be made to Pins 1 & 2.
- Serial connections to host serial port should be made to Pins 3, 6 & 10.
- All remaining pins maybe left disconnected if required.

9.4Installation into Host with existing CD Parallel Harnessing – Serial Operation Conversion (using Harness ASE-003775 - Conversion Kit ASE-003781).

The host side of cable harness ASE003775 is terminated in a JST ELP-12 connector. This is an identical connector to that used on the original standard parallel CD (ECM-8803). However due to the electrical interface characteristics of the new PCB assembly some of the connections and control lines do not correspond exactly with those in the original ECM-8003 harness.

When installing into systems where the original CD was specified, the unit maybe connected directly to the existing harness by use of harness ASE003775. However the host **must** be changed as described below to ensure damage does not occur and correct operation occurs.

See Figure 8.1 below for pin descriptions.

- Power should be connected to Pins 1 & 2. These connections maybe connected directly to any existing corresponding CD connections.

- The host harness should be modified such that serial connections to the host serial port are made to Pins 3, 6 & 10.

- It is recommended that all remaining connections are disconnected from the host harness.

9.5 Installation into Host with existing CD Parallel Harnessing – Parallel Operation (using Harness ASE-003775 - Conversion Kit ASE-003781).

The host side of cable harness ASE003775 is terminated in a JST ELP-12 connector. This is an identical connector to that used on the original standard parallel CD (ECM-8803). However due to the electrical interface characteristics of the new PCB assembly some of the connections and control lines do not correspond exactly with those in the original ECM-8003 harness.

When installing into systems where the original CD was specified, the unit maybe connected directly to the existing harness by use of harness ASE003775. However the host **must** be changed as described below to ensure damage does not occur and correct operation occurs.

See Figure 8.1 below for pin descriptions.

- Power should be connected to Pins 1 & 2. Pin 3 offers a second 0V connection. These connections maybe connected directly to any existing corresponding CD connections

- Input connections (Pins 4 & 7) are ‘Normally High’ - ‘Active Low’ and maybe connected directly to any existing corresponding CD connections.

The following changes must be made to the host harnessing ensure correct integration:

- Pins 6 & 10 must either be left disconnected (open circuit) or correctly connected to a Serial RS232 Comm Port.

- Pins 5, 9 and 11 are all open collector signal outputs. To ensure correct operation of these a suitable pull up circuit should be created between the relevant signal output and the desired pull up voltage supply. For example a 10K resistor should be fitted between each of these pins to a 5V rail.

- Pins 8 & 12 should be left disconnected.

10.0 ASE-003775 Pin Connections

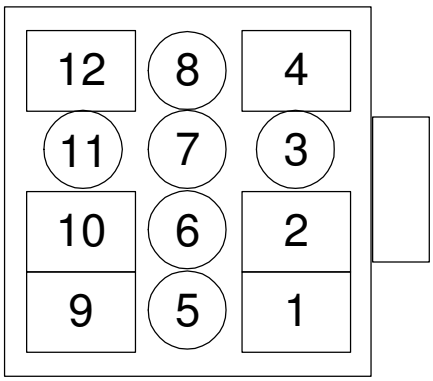


Figure 8.1
Mating Face View

Pin	Description	Colour
1	0V	Black
2	+VE	Red
3	0V	Black
4	Dispense Input	Brown
5	Payout Output	Orange
6	RS232 TX	Pink
7	Reset Input	Green
8	CTRL -	White
9	Stuck Output	Blue
10	RS232 RX	Violet
11	Empty Output	Grey
12	CTRL +	Yellow

11.0 Revision History

Issue	Status	Date	Initials
01	Original Issue	16/11/2009	APM
02	Amendments to SR & CY Sections	08/11/2010	RM
Rev C	Amendments to CY Sections. Addition of DH, HR & DT	13/12/2010	APM
	Renumbering and general document updates.		
Rev D	Amendments to 4.7.5 & 4.7.8 DH Counter in clean cycle	27/01/2011	APM
Rev E	Amended refs to Exit signal to Payout	26/10/2011	APM