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PRODUCT SPECIFICATION

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Compiled by:- Mars Electronics  
Eskdale Road  
Winnersh Triangle  
Wokingham  
Berkshire  
RG11 5AQ

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5	21/09/88	J. MacDonald L. McLaren	Marketing <i>D. Ashall</i>	Engineering <i>B. Campbell</i>

BDV

## TABLE OF CONTENTS

<u>SECTION</u>	<u>DESCRIPTION</u>	<u>PAGE NUMBER</u>
1	INTRODUCTION	1
2	GLOSSARY OF TERMS	2
3	DATALINK HISTORY	7
4	DATALINK HARDWARE SPECIFICATION	
	4.1 Serial Datalink	9
	4.2 Link Master to VMC Interface	9
5	PROTOCOL SPECIFICATION	
	5.1 Global Concepts	11
	5.2 Protocol 'BDV001' Datafile Transfers	15
	5.3 Protocol 'BDV001' Real Currency Pricing	17
	5.4 Audit Unit Operation	18
	5.5 Cashless Payment Operation	28
	5.6 VMC Operation	41
	5.7 Link Master Compulsory Features	56
6	APPENDIX A - Audit Details	57
7	APPENDIX B - File Type Definitions	
	7.1 Checksum Derivation	60
	7.2 Datafile Data-bytes	62
8	APPENDIX C - DATALINK TRANSFER SCHEMATICS	86
	8.1 VMC/Audit Datafile Source	86
	8.2 Failure Modes	98
	8.3 Cashless Payment Sourcing Datafiles	106
	8.4 Requested Vend Price	108
	8.5 Cashless Payment Credit Vend	110
	8.6 Audit Transfers	113
	8.7 Audit Failure Modes	115
9	APPENDIX D - DIAGRAMS	
	9.1 Figure 1 : Serial Datalink Interface Circuit	119
	9.2 Figure 2 : D.C. Power Requirements	120
	9.3 Figure 3 : Current Profile	121
	9.4 Figure 4 : Mechanical Envelope (1)	122
	9.5 Figure 5 : Mechanical Envelope (2)	123
10	CHANGE HISTORY	124

## PRODUCT SPECIFICATION

Description: BDV 001

### 1. INTRODUCTION

This document defines the serial link protocol to be adopted by the vending industries standardisation body BDV as the industry standard method of communication between specified Electronic Devices employed in a vending machine.

Section 2, the Glossary of Terms, explains some of the more unusual technical phrases and words used in the body of the document.

Section 3, the Datalink History, presents an overview of the history of the Datalink and the background to this document.

Section 4, the Hardware Specification, specifies the hardware requirements of the Serial Datalink.

Section 5, comprises the main body of the Protocol Specification. This is subdivided into three sections specifying the Protocol between Link Master and VMC, Link Master and Cashless Payment Controller, and Link Master and Audit Unit.

Sections 6 to 9 comprise appendices to the document which define the Audit parameters and File Types, present the Diagrams quoted in the text and, by means of schematic diagrams, illustrate the various data transfer mechanisms employed in the Protocol.

## PRODUCT SPECIFICATION

Description: BDV 001

### 2. GLOSSARY OF TERMS

#### ACK :

The mnemonic for the Serial Datalink Character ACKNOWLEDGE (HEX 00). This reply is used by any peripheral to a command that it does not understand yet has not suffered a Parity, Framing or over-run error.

#### Audit Frame Pointer :

Identifies the Audit Frame to be transferred to the Audit Unit.

#### Audit Unit

The link unit which performs the auditing function and responds to the peripheral identifier of 010.

#### Byte :

Name given to a grouping of 8 bits, identified from bit 0 to bit 7 with bit 7 being the most significant.

#### Byte Index :

Position of a data-byte within a Datafile or Datablock.

#### Character :

The smallest unit of information that may be transmitted on the link. It comprises 8 data bits, 1 parity bit, 1 start bit and 1 or 2 stop bits.

#### CPC

Cashless Payment Controller. The link unit which accepts the cashless credit and responds to the peripheral identifier of 011.

#### Datafile

The structure in which data is transferred over the serial link.

#### Datafile Index Pointer :

Identifies the following byte in a Datafile.

## PRODUCT SPECIFICATION

Description: BDV 001

### Escrow Return :

Termination of the current vend by depressing the 'Reject' lever. At this point any remaining credit held may be returned to the user.

### Even Parity :

The parity bit is set when there is an odd number of set bits in the byte.

### File Type :

The identifying number (in decimal) given to a particular Datafile which conforms to the Datafile structure defined in Protocol 'BDV001'.

### Frame :

A sequence of one address and three data-bytes holding Audit information.

### Framing :

Name given to an invalid stop bit error, when receiving asynchronous serial data.

### Handshake :

The transmitter of a character is informed of its reception by the receiver via a returned character.

### High Order Byte :

The highest value byte in a multi-byte value.

### Inventory :

Coins dispensed from the Coin Mechanism but not given as change.

### L.S.Nibble :

The lowest value 4 bits of a byte, i.e. bits 0 -> 3 inclusive.

### Link Master :

The Link Unit which sources the datalink current and performs the System Executive role.

## PRODUCT SPECIFICATION

Description: BDV 001

### Link Peripheral :

A Link Unit which performs a specific function in the Vending Environment under the direction of the Link Master.

### Link Unit

Any device - master or peripheral - which conforms to the BDV001 Serial Datalink Specification.

### Low Order Byte :

The lowest value byte in a multi-byte value, i.e. bits 0 -> 7 inclusive.

### Mark :

A logic 1 ( less than 10uA current flow ) on the Serial Datalink.

### Middle Order Byte :

A byte holding bits 8 -> 15 inclusive in a 24 bit value.

### NAK :

The mnemonic for the Serial Datalink character, Negative Acknowledge. It is normally Command Code 15 of the Link Master to peripheral command dictionary. It will be sent to the peripheral whose previous character was received by the Link Master with a Parity, framing or Overrun error.

### Overrun :

Name given to an error, caused by receiving a character before a previous character was read, when receiving asynchronous serial data.

### PNAK :

The mnemonic for the Serial Datalink character, Peripheral Negative Acknowledge ( HEX FF ). All peripherals must use this reply to any character addressed to them which has suffered a Parity, Framing or Overrun error.

### Polling

When the Link Master sends STATUS commands in sequence to all the peripherals fitted on the link.

## PRODUCT SPECIFICATION

Description: BDV 001

### Protocol A :

The original Serial Datalink Protocol developed and utilised by major OEMs and payment system manufacturers.

### Protocol 'BDV001' :

An enhanced version of Protocol A ( not completely compatible ) developed as a standard for use of BDV members or any other person or organisation.

### Real Currency Unit

This is the smallest unit of reference for all currencies except for Italian Lire where 1 real currency unit = 10 lire.

### Real Time System :

A system in which the processing time is negligible compared to the user's requirements.

### Reserved :

A reserved bit is currently unused but is reserved for future use. User must return a "0".

### Selection Info

A block of 6 bytes by which the VMC can send the vend request information to the Link Master in reply to a CREDIT command. It consists of 5 BCD digits, a selection number and a checksum.

### Selection Number

Product classification code, stored in the VMC.

### Single Byte Frame

A sequence of 1 address and 1 data byte holding Audit information. Used by peripherals conforming to Protocol A.

### Space :

A logic 0 ( more than 2mA current flow ) on the Serial Datalink.

### Static Audit Data :

Audit data that is not reported when the event occurs.

PRODUCT SPECIFICATION

Description: BDV 001

Triple Byte Frame :

A sequence of 1 address and 3 data bytes holding Audit information

VMC :

Vending Machine Controller - the Link Unit which controls the Vending Machine and responds to the Peripheral Identifier of 001.

Word :

Any 16 bit value.

## PRODUCT SPECIFICATION

Description: BDV 001

### 3. DATALINK HISTORY

The Serial Datalink was developed by Mars Electronics as a means of controlling the functions of various Electronic Units employed in the Vending and Ticketing environment. The Link philosophy is based on a Single Link Master controlling many Link Peripherals.

The first generation of Mars Electronics products designed for this Datalink based environment executed Protocol 'A' as defined in the documents :

- » i) MS1600 Executive to VMC Datalink Description Version 1.2
- » ii) MS1600 Series to Multicard Unit Datalink Description Version 1.0

Products of Mars Electronics which execute the Protocol A Link Master role are :

- i) MS1600 Series MkI Changegivers
- ii) MS1600 Series MkII Changegivers
- iii) Cashless Payment Executive Controller

These products provided a 9 way Molex Type 1625-9P connector to allow connection of Link Peripheral units to the Datalink. Power was provided to the above Link Master Units by a 15 way Molex Type 1991-15P connector.

Products of Mars Electronics which execute the Protocol A Link Peripheral role are :

- i) Cashless Payment Peripheral Controller
- ii) Vending Audit Unit
- iii) Numerous Vending Machine Controllers.

Both the protocol and the hardware by which it is implemented are now fully field proven in a wide range of machines and operating environments.

Extensions to Protocol 'A' were requested by the BDV committee as a prerequisite for acceptance of the Serial Datalink concept and Protocol as the BDV standard. The resultant protocol, Protocol 'BDV 001', is defined in this document. This Protocol (or subsets of it) will be implemented in future Mars Electronics products intended for the Datalink based Environment.

PRODUCT SPECIFICATION

Description: BDV 001

Protocol BDV001 offers many features to the VMC designer that were not available in Protocol A. It is the intention that all new designs will be designed to BDV001 Protocol.

The Serial Datalink hardware has remained unchanged throughout these enhancements.

## PRODUCT SPECIFICATION

Description: .BDV 001

The pin-out is defined:

PIN NOS.	ALLOCATION
1	D.C. RTN.
2	24v D.C. (See later for tol.)
3	* unused. Reserved for future use
4	* unused. Reserved for future use
5	Link Master TX +
6	Link Master TX -
7	Link Master RX +
8	Link Master RX -
9	Screen (connection to Link Master 0v)

### 4.2.2 D.C. POWER REQUIREMENT

Absolute Maximum D.C. = 40V at peak of ripple  
Minimum Average D.C. = 22V with 7V max peak->peak ripple (94-126Hz)  
@ 80W maximum

Available Power should not exceed 110W for supply voltages above  
32V average

Figure 2 of Appendix D presents the above requirement in  
graphical form. The current requirement profile is presented in  
Figure 3.

All voltage levels are defined at the Link Master connector.

DC power must be supplied from a supply conforming to S.E.L.V.  
standards as defined in IEC 380/950.

### 4.2.3 MECHANICAL ENVELOPE

The outside dimensions of the Link Master, when that device is a  
Coin Mechanism, are defined in figures 4 and 5 of Appendix D.

## PRODUCT SPECIFICATION

Description: BDV 001

### 4. DATALINK HARDWARE SPECIFICATION

#### 4.1 Serial Datalink

4.1.1 Communication between the Link Master and any peripheral is via a serial transmit and receive data link. Both links are housed in a single screened twisted pair cable similar to Belden 8723. The Link connecting any peripheral to the Link Master may be up to 2m long. It is imperative that the screen continuity is maintained throughout the whole datalink length and that it is only connected to OV at the Link Master.

4.1.2 The Link Master transmitter switches on (min 4.0V max, 5.0V) to signal 'space' and switches off to signal 'mark'. In this 'space' condition it is designed to source a minimum of 40mA. The receive circuit of any Peripheral should consist of a resistor and the L.E.D. of an opto-coupler configured to sink a maximum of 10mA. The peripherals are connected in parallel therefore the transmit circuit is capable of driving up to 4 Peripheral receive circuits. The receiver circuit of the Link Master is designed to recognise a 'space' when between 2 and 30mA is sensed and a 'mark' when less than 10uA is sensed. The transmit and receive circuits of both Link Master and Link Peripheral must be designed to withstand continuous short circuit and be electrically isolated.

Figure 1 of Appendix D shows a recommended interface circuit for the send and receive data channels of a Link peripheral.

4.1.3 All Link Units must conform to the VDE0871 and VDE0875 Noise Specification.

#### 4.2 Link Master to VMC Interface

4.2.1 A combined Datalink and power loom must be provided to meet the BDV Specification. This combined loom, measuring 700mm in external length, is terminated in a 9 way AMP UNIVERSAL MAT-N-LOK plug connector, AMP TYPE 350720-1 (Universal number) having split pin contacts AMP TYPE 350699-1 (U.K. part number) 926886-1 (German part number). The mating connector to the Link Master loom is an AMP TYPE 350828-1 (U.K. part number) 927231-3 (German part number).

# PRODUCT SPECIFICATION

Description: BDV 001

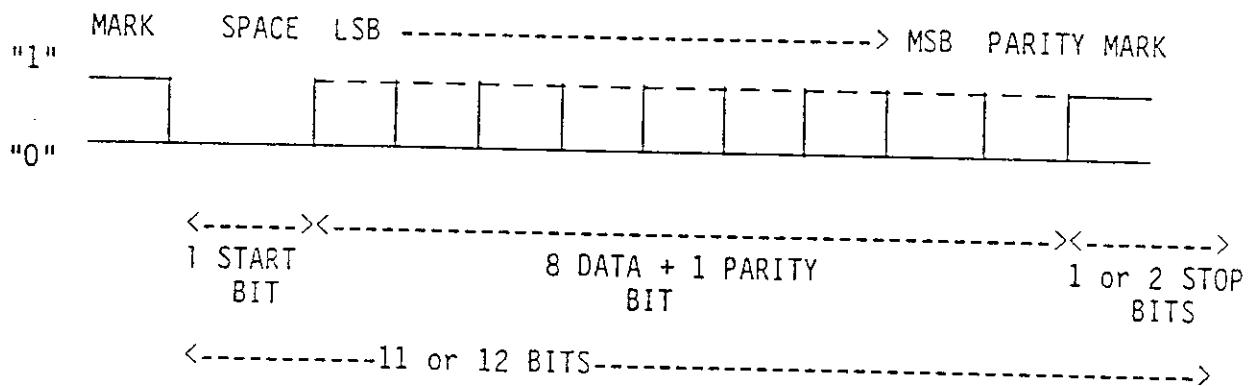
## 5. PROTOCOL SPECIFICATION

### 5.1 Global Concepts

5.1.1 The Serial Datalink Protocol Philosophy is one of a unique Link Master and several Link Peripherals. The roles of Link Master and Peripheral are determined at the Design stage. Unlike some Serial Links it is not possible for these roles to be exchanged dynamically during operation.

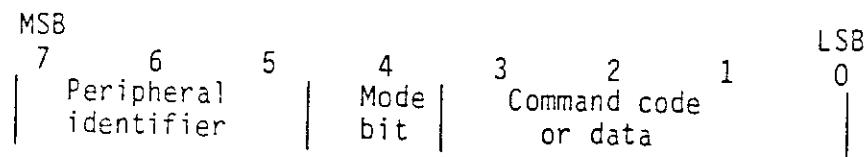
5.1.2 The Serial Datalink Protocol is truly asynchronous operating at a baud rate of 9600 baud. With the exception of fault determination, neither the Link Master nor any Peripheral are constrained to operate within defined time boundaries. However, to ensure adequate real time system operation recommended timing parameters are presented.

The character format is as follows:



Even parity is assumed throughout.

5.1.3 The 8 bits of information sent by the Link Master consist of a 3 bit code identifying the peripheral to which the message is addressed, a mode bit and 4 bits of command code or data.



## PRODUCT SPECIFICATION

Description: BDV 001

The Peripheral Identifier address codes are allocated thus:

<u>Peripheral Identifier</u>	<u>Allocation</u>
0x0/0x30 001	* Unused. Reserved for Future Products
0x0/0x50 010	Vending Machine Controller
0x0/0x70 011	Audit Unit
100	Cashless Payment Controller
101	* Unused. Reserved for Future Products
110	* Unused. Reserved for Future Products
111	* Unused. Reserved for Future Products
<b>1000</b>	<b>MASTER</b>

Bit 4, Mode, of the character transmitted by the Link Master informs the peripheral whether bits 0 -> 3 should be interpreted as a Command or as Data. When set to '1' bits 0 to 3 of the word are to be interpreted as a command code whereas a '0' indicates that bits 0 to 3 are data.

5.1.4 The Link Master controls all transmissions on the Link by issuing Commands or Data to specific peripherals. The Link Master will expect one reply character from the addressed peripheral only. It is imperative that all peripherals only answer to commands and data addressed to it, otherwise the Link will become severely corrupted. Thus, it is mandatory that all peripherals check that the received character is addressed to itself (prior to checking the parity) before issuing a reply.

5.1.5 A peripheral is forbidden to originate anything onto the Link except in reply to a Link Master's character addressed to it. This rule may be violated only at power up when it is necessary to ensure efficient startup of the system, then the peripheral may transmit a single PNAK (HEX FF) to the Link Master. It is recommended that peripherals transmit this 'reset PNAK' within 1 second of powering up and that Link Masters do not poll peripherals before 1.5 seconds has elapsed since power-up.

5.1.6 Should a peripheral receive a character that it does not understand and yet has not suffered a Parity, Framing or Over-run error then it must reply to the Link Master with an ACK (HEX 00). A character received with a Parity, Framing or Over-run error must be replied to with a PNAK. The latter will cause the Link Master to re-issue the previous character.

## PRODUCT SPECIFICATION

Description: BDV 001

5.1.7 The normal sequence of events when there is no transaction in progress is for the Link Master to send STATUS commands to the peripherals in sequence, each of which would normally respond with a null (nothing to report) code. Under these circumstances, all peripherals responding with a null code, the Link Master should poll a peripheral within 40 ms of the reply from the previously polled peripheral.

NOTE: The timing parameters are ~~recommendations~~, no link unit is constrained concerning timing.

5.1.8 The Command dictionary of the Link Master is dependent on which Peripheral it is addressing. There is a maximum of 15 Command codes for each Peripheral, some of which are common to all. One such Command code is the NAK. This command is issued by the Link Master to a Peripheral when it detects a Parity, Framing or Over-run error in a word transmitted to it from that Peripheral. On receiving this command the Peripheral must repeat its last transmission.

5.1.9 Severe Hardware degradation of the link will be assumed by the Link Master if it is necessary for the Command NAK to be issued for the fifth consecutive time. A similar assumption will be made by the Link Master if it receives 4 consecutive PNAK's. Under these circumstances the Link Master should ~~refrain~~ from issuing any further Datalink commands for approximately 100ms. This will allow time for the interfering signal to decrease if it is of a transient nature. The Link Master must not memorise NAK as the previous character, but the peripheral must memorise PNAK as the previous character.

5.1.10 The STATUS commands, and also the CREDIT command for a VMC, must be responded to quickly in order that the Link Master is not diverted from its business for too long. The maximum period between the beginning of a STATUS or CREDIT command character and the end of the reply character must not be greater than 20mSecs.

5.1.11 The Link Master must await the reply from the addressed Peripheral. If this wait period exceeds 75 seconds the Link Master will assume that no reply character is going to be sent and will repeat the last character sent. If the addressed Peripheral is an Audit Unit or a VMC then the Link Master will continue polling the Peripheral every 75 seconds until a reply is obtained. If the addressed Peripheral is a Cashless Payment Controller the Link Master may decide to continue operation without this Peripheral.

PRODUCT SPECIFICATION

Description: BDV 001

5.1.12 Protocol 'BDV001' Link Units offer the system the ability to transfer variable length Datafiles between any two Link Units in the system including the Link Master. If the Link Units in question are both Peripherals then Datafile transfer is via the Link Master. During Datafile transfers all other functions will be inhibited.

5.1.13 All currency related data within a BDV001 system is held in real currency units. This allows the VMC prices to be set independently of the coin set implemented on the Link Master. A Protocol 'BDV001' Link Master will also allow communication with a Cashless Payment Peripheral Controller which may hold a credit value of up to 99999 units of real currency. The minimum increment of credit held is one real currency unit, i.e. 1 pence, 1 centime, 1 Pfennig.

Note: All unused and reserved bits of commands, replies and datafile bytes must be set to zero. If a peripheral receives commands with reserved bits set, but does not understand the command it should be acknowledged with an ACK (HEX 00) but ignored. The order of Link Master Commands and its timing should not be assumed by any peripheral. A peripheral must be capable of responding with an appropriate reply to any Link Master command received at any time. Every peripheral has a responsibility to execute the Protocol 'BDV001' in an intelligent manner that does not restrict or degrade the performance of other peripherals.

Description: BDV 001

## 5.2 Protocol 'BDV001' Datafile Transfers

5.2.1 Section 5.1 above introduced this feature offered by Protocol 'BDV001' Link Units. Datafiles may be transferred around the system by this Peripheral to Peripheral transfer mode. Such Datafiles must be constrained to occupy the following Datafile structure:

Byte 1 Least Significant Nibble	:	Receiving Peripheral ident	8 = <i>Master</i>
Byte 1 Most Significant Nibble	:	Transmitting Peripheral ident	
Byte 2	:	Datafile length in Bytes,	
Byte 3	:	Filetype Identification Number	
Byte 4->n-2	:	Data Bytes (value <251 i.e. codes 251 to 255 are not allowed)	
Byte n-1	:	Checksum Byte 1	
Byte n	:	Checksum Byte 2	

Byte 1 holds the Peripheral ident of the receiving Link Unit in the least significant nibble and the Peripheral Ident of the transmitting Link Unit in the most significant nibble. Byte 2 holds the number of bytes contained in the Datafile including the header and the checksum. This is limited to less than 128 thus restricting the size of Datafiles that may be transferred. Byte 3 holds a number which uniquely identifies the file type. Each Datafile is protected by a Checksum which is transmitted at the end of the Datafile. This Checksum is defined in Appendix B. For very sensitive Datafiles extra Checksums may be included within the Datafile itself.

5.2.2 There is a maximum of 250 Filetypes, although this may be expanded by reserving Filetype 250 to be an expansion Filetype. Filetypes are defined in Appendix B.

5.2.3 Only one Datafile may be transferred in the system at any one time. During this transfer period all other functions are inhibited.

5.2.4 All Datafile transfers are controlled by the Link Master. The commands utilised to transfer a Datafile are defined in the relevant section for each of the three Link Peripherals. However the following section presents a descriptive overview of the transfer mechanism, which is presented diagrammatically in schematic 8.1 of Appendix C.

## PRODUCT SPECIFICATION

Description: BDV 001

5.2.5 The Datafile sourcing Peripheral indicates its desire to transfer a Datafile by its response to a Link Master's STATUS command. It is the Link Master's decision when to initiate the Datafile transfer. Once begun each byte of the Datafile is requested by the Link Master by use of the SEND DATA command. The Link Master need not buffer the whole Datafile before transferring it to the intended Datafile receiving Peripheral. The receiving Peripheral is informed of an imminent Datafile by the ACCEPT BLOCK command. It may decline to accept the Datafile at any time, in which case the Datafile sourcing Peripheral is informed of this by the ACCESS DENIED command. Once transferred the receiving Peripheral is instructed that the Datafile has finished, and should be checked against its checksum, by the DATA SYNC command. Following this the Datafile sourcing Peripheral may either be informed of the successful Datafile transfer by the BLOCK ACK command or, (should the transfer be unsuccessful due to Checksum failure or synchronisation problems) informed of its failure by a STATUS command.

5.2.6 For Datafile transfers the Link Master assumes the address identifier of 1000 binary.

5.2.7 Datafiles may be requested from a Peripheral by firstly sending to that Peripheral a Filetype 0 Datafile. Link Unit A may even instruct Link Unit B to send a Datafile to Link Unit C.

5.2.8 As stated above Datafiles may be transferred to the Link Master and received from the Link Master. Owing to the Multi-Slave nature of the datalink, each data-byte that is transferred from the Link Master to any Peripheral must be transmitted in two nibbles, least significant first. Data-bytes transferred to a Link Master either directly or indirectly in a peripheral to peripheral datafile transfer may be byte size but are restricted to a value of between 0 and 250 inclusive to avoid interpretation as control codes by the Link Master.

5.2.9 On Power up and reset a Protocol 'BDV001' Link Master must issue a STATUS command to each of its peripherals before attempting any other Link transaction.

## PRODUCT SPECIFICATION

Description: BDV 001

### 5.3 Protocol 'BDV001' Real Currency Pricing

5.3.1 VMC's which implement Protocol 'BDV001' must communicate the selection price in real currency units. This allows the VMC operator to set prices independently of the coin set implemented in the Link Master.

5.3.2 When a Vend has been requested the VMC will transfer the Datafile 'Selection Info' holding the real currency price to the Link Master in response to the CREDIT command.

5.3.3 On initialisation the CPC may request via Filetype 8 the credit display information from the Link Master. The credit display information will always be transferred to the VMC.

5.3.4 All currency related audit parameters must be in real currency units. This requirement introduces the need to transmit triple byte data for a particular Audit address.

5.3.5 Protocol 'BDV001' VMC's also transmit the Selection Number, in the range of 0 - 99 decimal, of the requested vend. The Link Master may use this information in its decision whether to grant the vend.

5.3.6 A maximum price of 99999 real currency units is allowed for in Protocol 'BDV001'.

5.3.7 Real currency units are defined as the smallest unit of reference for all currencies except for Italian Lire, where 1 Real Currency Unit = 10 lire.

## PRODUCT SPECIFICATION

Description: BDV 001

### 5.4 AUDIT UNIT OPERATION

5.4.1 The Link Master may communicate with an Audit Unit which performs Protocol 'BDV001'. This section outlines the command structure between the Link Master and such an Audit unit.

The commands issued to a Protocol 'BDV001' Audit unit comprise:

<u>COMMAND</u>	<u>ATTRIBUTE</u>	<u>HEX CODE</u>
0	* unused. Reserved for future use.	50
1	STATUS	51
2	SYNC	52
3	INITIATE DATA TRANSFER	53
4	SEND DATA	54
5	ACCEPT BLOCK	55
6	DATA SYNC	56
7	BLOCK ACK.	57
8	ACCESS DENIED	58
9	BDV SYNC	59
10	* unused. Reserved for future use.	5A
11	* unused. Reserved for future use.	5B
12	* unused. Reserved for future use.	5C
13	* unused. Reserved for future use.	5D
14	* unused. Reserved for future use.	5E
15	NEGATIVE ACKNOWLEDGE.	5F

### 5.4.2 Command code 1 : STATUS 51

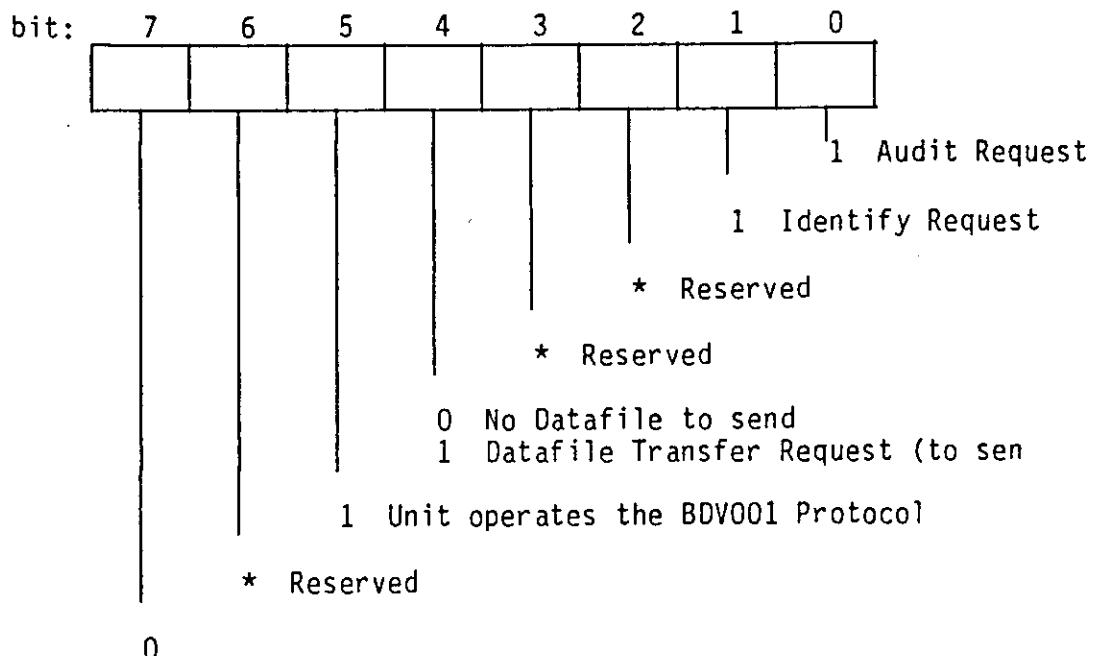
The Link Master periodically polls the Audit Unit with the status command (HEX Code 51) starting at power up. The Audit Unit must respond to each STATUS command from the Link Master with a reply. The Command may be interleaved between other commands or between Datafiles, but not within a Datafile or audit file transfer sequence.

Note: The Audit Unit must reply to all commands as well as the Status command.

## PRODUCT SPECIFICATION

Description: BDV 001

The reply must take the following structure:



(N.B. 'reserved' bits must be assigned '0' )

In Protocol 'BDV001' bits 5 and 4 are used to signify certain states:

Bit 5 : Must be set to a 1 indicating that the Audit Unit operates Protocol 'BDV001'.

Bit 4 : Set to a 1 indicates to the Link Master that the Audit Unit has a Datafile it wishes to transfer to another Link Unit.

Allowed replies to STATUS are thus :

- i) Nothing to report: HEX 20 (Protocol 'BDV001')  
Used as a reply under normal conditions.
  - ii) Audit Request : HEX 21 (Protocol 'BDV001')  
Bit 0 ( Audit request ) of the STATUS reply will be set by the Audit Unit to initiate a mandatory transfer of Audit data.

## PRODUCT SPECIFICATION

Description: BDV 001

The Link Master will, upon receipt of this Audit Request, control a system audit by sending an Audit command to any other identified peripheral (e.g. Cashless Payment, VMC) on the datalink.

### iii) Identification Request : HEX 22 (Protocol 'BDV001')

Each time that power is applied to the Audit Unit it initiates a system identify sequence by setting bit 1, i.e. replying HEX 22 if Protocol 'BDV001', in response to a STATUS command. The Link Master will pass on the request to all other peripherals by issuing to them the command IDENTIFY. In the same manner as the Audit request, these peripherals will forward to the Audit Unit via the Link Master, ID codes and Static Audit Data.

#### 5.4.3 Command code 2 : SYNC S2

The Link Master issues this command to terminate an audit Frame consisting of one address and data byte.

Allowed replies are:

	HEX CODE
a. Single byte Frame Received	00
b. Sync lost	FE
c. PNAK	FF

Reply b, is returned when the Audit Unit was expecting data nibbles but received this command. Synchronisation between the Link Master and the Audit Unit has therefore been lost. This reply will be interpreted by the Link Master as a request for a retransmission of the Frame.

This command will be indicative of Audit data originating from a non BDV Link Unit.

#### 5.4.4 Command code 3 : INITIATE DATA TRANSFER S3

This is issued by the Link Master following a request by the Audit unit to transfer data to a peripheral ( bit 4 of STATUS reply set ). The Audit Unit must use this command to zero its Datafile index pointer. Following this command the Audit Unit will expect the Link Master to ask for the data-bytes of the Datafile by SEND DATA commands. The structure of the Datafile to be transferred by this command was defined in section 5.2 above.

This command is only issued to Protocol 'BDV001' Audit Units.

## PRODUCT SPECIFICATION

Description: BDV 001

Allowed replies are:

	HEX CODE
a. Cancel Request	00
b. O.K.	FD
c. PNAK	FF

Reply a, will cause the Link Master to abort the Datafile transfer request by returning to its peripheral polling routine.

### 5.4.5 Command code 4 : SEND DATA 54

This command is issued by the Link Master to transfer each byte of a Datafile from the Audit Unit to the Link Master. This command is used by the Audit unit to increment its Datafile index pointer. The Datafile transfer is initiated by an INITIATE DATA TRANSFER command. If a STATUS command is received during a Datafile transfer then the Datafile sourcing peripheral will assume that the transfer has failed due to a Checksum failure or loss of Synchronisation. The peripheral may decide whether to attempt a retransmission of the Datafile. This SEND DATA command is only issued to Protocol 'BDV001' Audit Units.

Allowed replies are

	HEX CODE
a. Next data byte	00 - FA
b. Sync Lost/Abort	FE
c. PNAK	FF

Reply b, above is returned when the Datafile sourcing Peripheral was expecting a Datafile terminating command, i.e BLOCK ACK (successful transfer), STATUS ( failed checksum or synchronisation) or ACCESS DENIED (receiver terminated) but received another SEND DATA requesting data. This will signify to the Link Master to terminate the transfer by issuing a DATA SYNC command to the receiving peripheral unless it was the first SEND DATA command after the command INITIATE DATA TRANSFER. In this case the receiving peripheral would not yet have been involved in the datafile transfer. The Link Master returns to its peripheral polling routine.

In the case a DATA SYNC command has been issued to the receiving peripheral the reply "CHECKSUM FAILED/SYNC LOST" would be the most appropriate.

## PRODUCT SPECIFICATION

Description: BDV 001

### 5.4.6 Command code 5 : ACCEPT BLOCK 55

This is issued by the Link Master when it wishes the Audit Unit to receive a Datafile. The Audit Unit uses this command to initialise its Datafile index pointer. Should the Audit Unit receive this command when it is currently receiving a Datafile, then the initial Datafile will be terminated and the subsequent Datafile accepted.

This command is only issued to a Protocol 'BDV001' Audit Unit.

Allowed replies are :

	HEX CODE
a. Access Denied	00
b. Busy	FB
c. O.K.	FD
d. PNAK	FF

Reply a, above is returned when the Audit Unit cannot receive Datafiles. The Link Master will use this reply to issue an ACCESS DENIED command to the data sourcing peripheral, this will terminate the transfer.

Reply b, is returned when the Audit Unit may receive Datafiles but is currently busy. The Link Master should reattempt the transfer after a wait period of approximately 100ms. Four consecutive Busy replies will be interpreted by the Link Master as an inability of the Audit Unit to receive Datafiles at this time and cancel the Datafile transfer by issuing a STATUS command to the sourcing peripheral.

Reply c, is returned to indicate that the Audit Unit is prepared to receive a Datafile. Upon receipt of this reply the Link Master will continue with the Datafile transfer process.

The Audit Unit should now expect to receive data bytes from the Link Master. These will be identified by the mode bit, bit 4, cleared to a 0. Each databyte will be transmitted as two nibbles, least significant first. To each data-nibble the Audit Unit must reply with one of the following :

## PRODUCT SPECIFICATION

Description: BDV 001

	HEX CODE
a. Access Denied	00
b. O.K.	FD
c. Sync Lost	FE
d. PNAK	FF

Reply a, above is returned when the Audit Unit does not wish to continue to receive the Datafile. The Link Master will, on receiving this reply, issue an ACCESS DENIED command to the data sourcing peripheral.

Reply c, above is returned when the Datafile receiving Peripheral was expecting a Datafile terminating command, i.e DATA SYNC, but received another data-nibble. This reply may also be returned when the receiving peripheral wants the Datafile transfer process to recommence at some time later. This reply will signify to the Link Master to terminate the transfer by issuing a STATUS command to the sourcing peripheral.

### 5.4.7 Command code 6 : DATA SYNC S6

This is issued by the Link Master to terminate a preceding Datafile initiated by the Accept Block Command. This is only issued to Protocol 'BDV001' Audit Units. The Audit Unit upon receipt of this command will confirm the Datafile checksum as defined in Appendix B.

Allowed replies are :

	HEX CODE
a. Access Denied	00
b. Checksum Failed /Lost Sync	FB
c. Checksum Passed	FD
d. PNAK	FF

Reply a, above is returned when the Audit Unit does not wish to continue to receive the Datafile. The Link Master will, on receiving this reply, issue an ACCESS DENIED command to the data sourcing peripheral unless the DATA SYNC command resulted from reply b of the SEND DATA command (sync lost/abort), or from a Link Master checksum failure. In these cases the Link Master returns to its peripheral polling routine.

## PRODUCT SPECIFICATION

Description: BDV 001

Reply b, is returned to signify to the Link Master that the checksum protecting the block transfer has failed. It is also returned when the Datafile receiving Peripheral was expecting a data-nibble. This will signify to the Link Master to terminate the transfer by issuing a STATUS command to the sourcing peripheral. The Datafile sourcing peripheral may then choose to request a retransmission of the complete Datafile unless the DATA SYNC command resulted from reply b of "SEND DATA" or from a Link Master checksum failure. In these cases reply b is the reply to be expected and the Link Master returns to the peripheral polling routine.

### 5.4.8 Command code 7 : BLOCK ACK. 57

This is issued by the Link Master to the Datafile sourcing Peripheral following a successful Datafile transfer sequence. It signifies that the Block was transferred and received without error by the intended peripheral. The Audit Unit, as the Datafile sourcing Peripheral, will use this to cancel the request for a Data file transfer. This command is only issued to Protocol 'BDV001' Audit Units.

Allowed replies are :

	HEX CODE
a. System Error	00
b. O.K.	FD
c. PNAK	FF

Reply a, will cause the Link Master to attempt retransmission of the command. If this reply is returned a second time then the transfer will be aborted by the Link Master returning to its peripheral polling routine.

### 5.4.9 Command code 8 : ACCESS DENIED 58

This is issued to the Audit Unit by the Link Master when the Audit Unit has requested to send a Datafile to a peripheral that is incapable of receiving the datafile. This will normally be issued when the requested transfer path is not available, or the receiving peripheral has returned an ACCESS DENIED to the Link Master indicating that it does not wish to receive that Datafile. The Audit Unit should use this command as an indication to cancel its desire to send data to this peripheral.

## PRODUCT SPECIFICATION

Description: BDV 001

Allowed replies are :

	HEX CODE
a. System Error	00
b. O.K.	FD
c. PNAK	FF

Reply a, will cause the Link Master to attempt retransmission of the command. If this reply is returned a second time then the transfer will be aborted by the Link Master returning to its peripheral polling routine.

### 5.4.10 Command code 9 : BDV SYNC 59

The Link Master issues this command to terminate an audit Frame consisting of one address and three data bytes. It will only be issued to Protocol 'BDV001' Audit Units.

Allowed replies are :

	HEX CODE
a. System Error	00
b. Frame received	20
c. Sync lost	FE
d. PNAK	FF

Reply a, will cause the Link Master to assume a Peripheral incompatibility problem and take appropriate action.

Reply c, is returned when the Audit Unit was expecting data-nibbles but received this command. Synchronisation between the Link Master and the Audit Unit has obviously been lost. This reply will be interpreted by the Link Master as a request for a retransmission of the Frame.

### 5.4.11 Command Code 15 : NEGATIVE ACKNOWLEDGE (NAK) 5F

This command is issued by the Link Master when it detects a Parity, Framing or Over-run error in a character transmitted to it. On receiving this command the Audit Unit must repeat its last transmission.

## PRODUCT SPECIFICATION

Description: BDV 001

### 5.4.12 Audit Data Transfer

In addition to the above commands, whenever a coin is accepted or dispensed or a vend takes place, the relevant audit data is transmitted to the Audit Unit via the address /data/ sync sequence described below. Audit information generated by Peripherals following the Audit and Identify Requests of the Audit Unit may also be transmitted to the Audit Unit in this manner.

Such an address/data/sync sequence is referred to as a FRAME. The Link Master will reformat each Frame received from a Peripheral for transmission to the Audit Unit as described below.

The Link Master will transmit each audit Frame received from each peripheral or generated by itself in the following uninterrupted sequences where Address and Data nibbles consist of data transfers as described above with mode set to "0".

L.S. Address nibble  
M.S. Address nibble  
L.S. Data nibble (Low order byte)  
M.S. Data nibble (low order byte)  
L.S. Data nibble (Middle order byte)  
M.S. Data nibble (Middle order byte)  
L.S. Data nibble (High order byte)  
M.S. Data nibble (High order byte)  
BDV Sync

The Address byte is transmitted in binary and may assume any value between 0 and 250. The triple byte data value is transmitted in packed BCD format, least significant first.

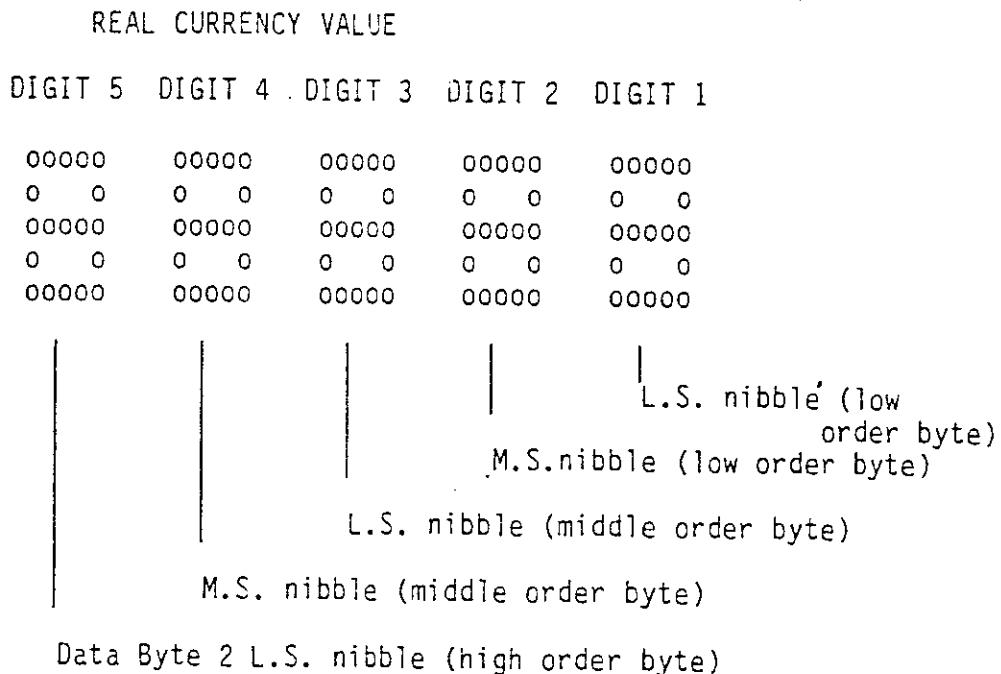
BDV Sync is the Link Master to Audit Unit command (HEX Code 59).

Should the number represent a Real Currency Value then it must be sent as a 5 digit packed BCD number with the M.S. Data nibble of the high order byte set to 0.

## PRODUCT SPECIFICATION

Description: BDV 001

This may be represented diagrammatically:



Each received data character in the Frame requires a response which is normally HEX 00 ("nothing to report"). However, if the Audit Unit detects loss of synchronisation i.e it expected the BDV Sync command but received data it will reply 'lost sync' HEX FE. The Link Master will retry transmission of that Frame.

Note that in the event that no response is forthcoming from the Audit Unit, the Link Master suspends all activities until the link is re-established. This has the main purpose of preventing fraudulent disconnection of the Audit Unit from the serial link.

Peripherals should update the Audit Unit during the course of normal operation, rather than only on an AUDIT command. This will reduce the data collection period when the System is audited.

### 5.4.13 Compulsory Features

Any device performing the BDV Audit Unit role must be capable of executing the Standard Audit File as defined in Appendix A and of receiving Filetype 21 as defined in Appendix B. Additionally, the Audit Unit must be capable of handling the following Datafiles: 0,16.

## PRODUCT SPECIFICATION

Description: BDV 001

### 5.5 CASHLESS PAYMENT OPERATION

5.5.1 The Link Master can operate with Cashless Payment Peripheral Controller units which conform to the BDV Protocol as defined below. This communication is via the Serial Link as described earlier in this document.

<u>COMMAND</u>	<u>ATTRIBUTE</u>	<u>HEX CODE</u>
0	* Unused. Reserved for Future Use	70
1	STATUS	71
2	REQUEST GRANTED	72
3	SEND DATA	73
4	ACCEPT BLOCK	74
5	DECREMENT	75
6	RE-INSTATE	76
7	TERMINATE TRANSACTION	77
8	DATA SYNC	78
9	AUDIT	79
10	SEND AUDIT ADDRESS	7A
11	SEND AUDIT DATA	7B
12	IDENTIFY	7C
13	BLOCK ACK.	7D
14	ACCESS DENIED	7E
15	NEGATIVE ACKNOWLEDGE	7F

The replies to the above commands are defined in this section of the BDV 001 Protocol Definition.

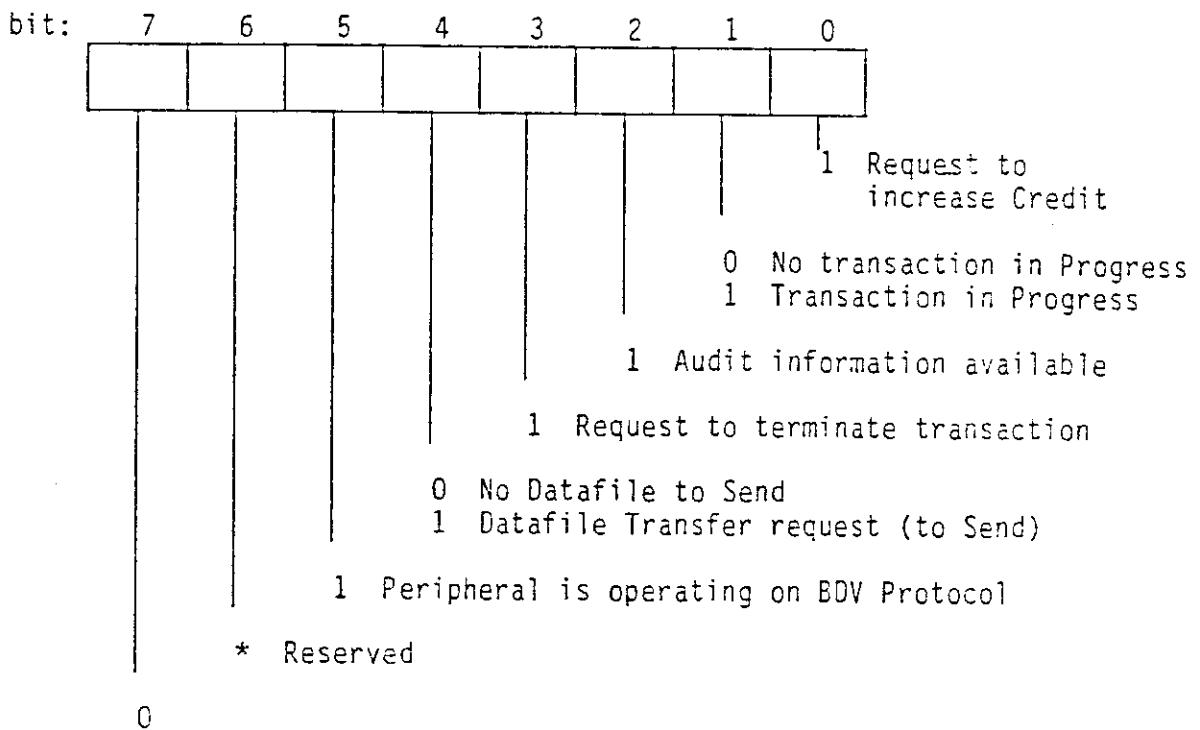
## PRODUCT SPECIFICATION

Description: BDV 001

### 5.5.2 Command code 1 : STATUS

The Link Master will periodically poll the Cashless Payment Controller with this command to ascertain the current status of the Cashless Payment Controller. It may be interleaved between other commands or Datafiles, but not within a Datafile sequence.

The allowed reply must have the following format:



(N.B. reserved bits must be returned as 0 ).

## Notes

- 1) The audit information flag indicates that the Cashless Payment Controller has audit information in a stack. This could include information volunteered by the Cashless Payment Controller as opposed to information requested by the AUDIT or IDENTIFY commands.
  - 2) Bit 5, which must be set to a 1, is used to indicate to the Link Master that the Cashless Payment Controller operates the BDV Protocol.

## PRODUCT SPECIFICATION

Description: BDV 001

- 3) Bit 4, set to a 1 indicates to the Link Master that the Cashless Payment Controller has a Datafile it wishes to transfer to another Link Unit.

### 5.5.3 Command code 2 : REQUEST GRANTED

This is issued by the Link Master to the Cashless Payment Controller when the latter has indicated in its reply to a STATUS command (bit 0 of STATUS reply asserted) that it wishes to add to the current credit level. It is the Link Masters decision when to grant this authority. Within any one transaction only one credit increase from a Cashless Payment Controller is permitted.

Allowed replies to the REQUEST GRANTED command are:

	HEX CODE
a. Proceed	00
b. Cancel Request	FB
c. PNAK	FF

Reply a, is returned if the Cashless Payment Controller wishes to continue with the credit increase and hence the transaction. Following this reply it should then indicate its desire to transfer the credit increase value to the Link Master by requesting a Datafile transfer by setting bit 4 in its reply to the following STATUS command. It should also set bit 1 of the Status reply to indicate that a Transaction is in Progress. This bit 1 must remain set until the transaction is terminated.

Reply b, is returned when the Cashless Payment Controller wishes to cancel its request to increase the credit value.

### 5.5.4 Command code 3 : SEND DATA

A Cashless Payment Controller following a REQUEST GRANTED command will, should it wish to continue, normally indicate its desire to transfer the credit increase value to the Link Master by a Datafile transfer request. On setting this bit (bit 4 of STATUS reply) the Cashless Payment Controller must be prepared to transfer FILETYPE 13 when requested by the Link Master.

Alternatively should the Cashless Payment Controller not indicate its readiness to supply the FILETYPE 13, even though it indicated its desire to continue with the credit increase in its REQUEST GRANTED reply, then the Link Master may request it via a FILETYPE 0.

## PRODUCT SPECIFICATION

Description: BDV 001

This SEND DATA command is issued by the Link Master to a Cashless Payment Controller to transfer each byte of a Datafile from the Cashless Payment Controller to the Link Master. If a STATUS command is received during a Datafile transfer then the Datafile sourcing peripheral will assume that the transfer has failed due to a Checksum failure or loss of Synchronisation. The peripheral may decide whether to attempt a retransfer of the Datafile.

Allowed replies are :

	HEX CODE
a. Next data byte	00 - FA
b. Sync Lost/Abort	FE
c. PNAK	FF

Reply b, above is returned when the Datafile sourcing Peripheral was expecting a Datafile terminating command, i.e BLOCK ACK (successful transfer), STATUS (failed checksum or synchronisation) or ACCESS DENIED (receiver terminated) but received another SEND DATA command. This will signify to the Link Master to terminate the transfer by issuing a DATA SYNC command to the receiving peripheral.

### 5.5.5 Command code 4 : ACCEPT BLOCK

This is a general command issued by the Link Master whenever it wants to transfer a Datafile to a BDV Protocol Cashless Payment Controller.

The Cashless Payment Controller uses this command to initialise its Datafile index pointer. Should the Cashless Payment Controller receive this command when it is currently receiving a Datafile, then the initial Datafile will be terminated and the subsequent Datafile accepted.

Allowed replies are :

	HEX CODE
a. Access Denied	00
b. Busy	FB
c. O.K.	FD
d. PNAK	FF

## PRODUCT SPECIFICATION

Description: BDV 001

Reply a, above is returned when the Cashless Payment Controller cannot receive Datafiles. The Link Master will use this reply to issue an ACCESS DENIED command to the data sourcing peripheral.

Reply b, is returned when the Cashless Payment Controller may receive Datafiles but is currently busy. The Link Master should reattempt the transfer after a wait period of approximately 100ms. Four consecutive Busy replies will be interpreted by the Link Master as an inability of the Cashless Payment Controller to receive Datafiles at this time and cancel the Datafile transfer by issuing a STATUS to the sourcing peripheral.

Reply c, is returned to indicate that the Cashless Payment Controller is prepared to receive a Datafile. Upon receipt of this reply the Link Master will continue with the Datafile transfer process.

The Cashless Payment Controller should now expect to receive data bytes from the Link Master. These will be identified by the mode bit, bit 4 cleared to a 0. Each data-byte will be transmitted as two nibbles, least significant first. To each data-nibble the Cashless Payment Controller must reply with one of the following:

	HEX CODE
a. Access Denied	00
b. O.K.	FD
c. Sync Lost	FE
d. PNAK	FF

Reply a, above is returned when the Cashless Payment Controller does not wish to continue to receive the Datafile. The Link Master will, on receiving this reply, issue an ACCESS DENIED command to the data sourcing peripheral.

Reply c, above is returned when the Datafile receiving Peripheral was expecting a Datafile terminating command, i.e DATA SYNC but received another data-nibble. This reply may also be returned when the receiving peripheral wants the Datafile transfer process to recommence some time later. This reply will signify to the Link Master to terminate the transfer by issuing a STATUS command to the sourcing peripheral.

## PRODUCT SPECIFICATION

Description: BDV 001

### 5.5.6 Command code 5 : DECREMENT

Following a vend selection and successful transfer of that Decrement value to the Cashless Payment Controller, but before the vend takes place, the Link Master will issue this command to instruct the Cashless Payment Controller to deduct the Decrement value from its current credit value.

Allowed replies are :

	HEX CODE
a. Successful Decrement	00
c. PNAK	FF

### 5.5.7 Command code 6 : REINSTATE

The Link Master will issue this command to a Cashless Payment Controller following an unsuccessful vend. It should be used to the effect of reinstating the credit value to the level before the Decrement command was issued.

Allowed replies are :

	HEX CODE
a. Successful	00
c. PNAK	FF

### 5.5.8 Command code 7 : TERMINATE TRANSACTION

At the termination of the transaction, either following a successful vend in Single Vend Mode or by the Cashless Payment Controller requesting a transaction termination in its STATUS reply, the Link Master will normally instruct the Cashless Payment Controller to terminate the transaction by issuing this command.

Allowed replies are :

	HEX CODE
a. Successful	00
b. Unsuccessful	FB
c. PNAK	FF

## PRODUCT SPECIFICATION

Description: BDV 001

Following reply a, the Cashless Payment Controller must reset bit 1 of its STATUS reply.

Should reply b be returned when the Link Master is in Single Vend Mode then TERMINATE TRANSACTION commands will be issued every 100ms until it is successful. In Multi Vend Mode this TERMINATE TRANSACTION will be issued when the Cashless Payment Controller requests it in its STATUS reply.

### 5.5.9 Command code 8 : DATA SYNC

This is issued by the Link Master to terminate a preceeding Datafile transfer initiated by the ACCEPT BLOCK command.

The Cashless Payment Controller upon receipt of this command will confirm the Datafile checksum.

Allowed replies from a BDV Protocol Cashless Payment Controller :

	HEX CODE
a. Access Denied	00
b. Checksum Failed /Lost Sync	FB
c. Checksum Passed	FD
d. PNAK	FF

Reply a, above is returned when the Cashless Payment Controller does not wish to continue to receive the Datafile. The Link Master will, on receiving this reply, issue a ACCESS DENIED command to the data sourcing peripheral.

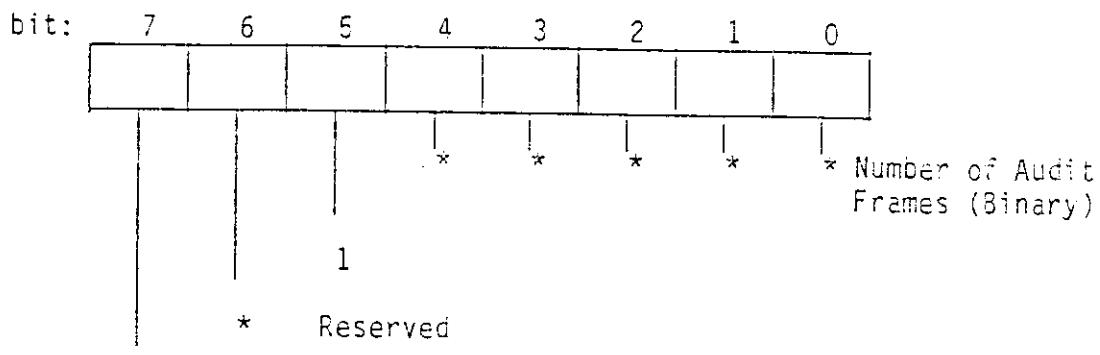
Reply b, is returned to signify to the Link Master that the checksum protecting the block transfer has failed. It is also returned when the Datafile receiving Peripheral was expecting a Data-nibble. This will signify to the Link Master to terminate the transfer by issuing a STATUS command to the sourcing peripheral. The Datafile sourcing peripheral may then choose to request a retransmission of the complete Datafile.

### 5.5.10 Command Code 9 : AUDIT

The Link Master will send the Audit command to the Cashless Payment Controller as a result of a "request for audit", from the Audit unit. The Cashless Payment Controller must respond to this command with the number of Audit Frames it wishes to transmit. The response must take the following format:

## PRODUCT SPECIFICATION

Description: BDV 001



(N.B. reserved bits should be returned as 0)

Examples of replies:

HEX CODE

- a. Number of triple Byte Audit Frames 20 -3F
- b. PNAK FF

A Triple Audit Frame consists of four bytes, firstly a byte address which specifies a location pointer in the Audit Unit followed by three data bytes, transmitted least significant first.

The Link Master will obtain this Audit information from the Cashless Payment Controller a Frame at a time by implementing a send sequence via the commands SEND AUDIT ADDRESS and SEND AUDIT DATA as described below. If the Link Master loses synchronisation then the transfer will be aborted by the Link Master immediately issuing another Audit command to restart the transfer. The Cashless Payment Controller must respond to the subsequent Audit command with the number and type of Audit Frames remaining (including the failed Frame) to complete the transfer. The Cashless Payment Controller should not increment its Frame Pointer until it receives the following SEND AUDIT ADDRESS command.

Description: EDV 001

#### 5.5.11 Command Code 10 : SEND AUDIT ADDRESS

This command is used in conjunction with the SEND AUDIT DATA command to handshake audit data from the Cashless Payment Controller to the Audit unit via the Link Master following notification by the Cashless Payment Controller (bit 2 of STATUS reply set) that it has audit information to report.

Each Audit Frame is individually called for by the Link Master. The Frame address is firstly requested by the Link Master issuing the SEND AUDIT ADDRESS command.

Allowed replies are :

	HEX CODE
a. Audit address character	0 - FA
b. Sync lost	FE
c. PNAK	FF

The Audit Address or location pointer character is transmitted in binary and may be of any value between 0 and 250.

Reply b, is returned if the Cashless Payment Controller was expecting a SEND AUDIT DATA command, i.e sync between Link Master and Cashless Payment Controller has been lost. If this happens then the Link Master will abort the data transfer by immediately issuing another AUDIT command. The Cashless Payment Controller should indicate in its reply the number and type of Audit Frames remaining (including the failed Frame) to complete the transfer.

If there is no breakdown in synchronisation the Link Master will follow the SEND AUDIT ADDRESS command with a SEND AUDIT DATA command.

In an Audit Frame transfer when there is no loss of synchronisation and yet all the Audit Frames have not been transferred the Link Master will follow three SEND AUDIT DATA commands with a SEND AUDIT ADDRESS command.

In such a transfer of Triple Byte Frames the low order data byte is transmitted in reply to the initial SEND AUDIT DATA command following the SEND AUDIT ADDRESS command. The next least significant byte is transmitted in reply to the subsequent SEND AUDIT DATA command, with the most significant byte being transmitted in response to the final SEND AUDIT DATA command of that FRAME.

Description: BDV CCI

5.5.12 Command Code 11 : SEND AUDIT DATA

Following every SEND AUDIT ADDRESS command the Link Master will request the Audit data byte with this command.

Allowed replies are :

	HEX CODE
a. audit data character	0 - 99
b. handshake sync lost	FE
c. PNAK	FF

The Audit Data character is transmitted in packed BCD format.

Reply b, is returned if the Cashless Payment Controller was, expecting a SEND AUDIT ADDRESS command, i.e sync between Link Master and Cashless Payment Controller has been lost. If this happens then the Link Master will abort the data transfer by immediately issuing another AUDIT command. The Cashless Payment Controller should indicate in its reply the number and type of Audit Frames remaining (including the failed Frame) to complete the transfer.

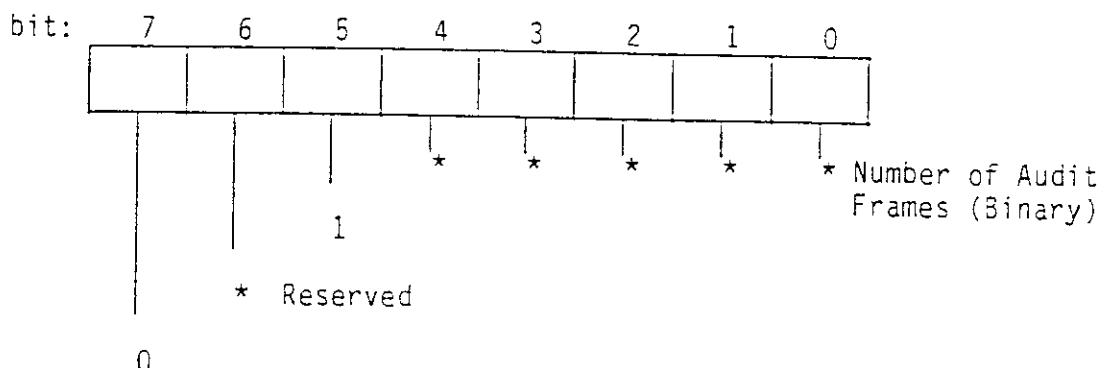
For each received Frame the Link Master will reformat the Cashless Payment Controller address and data replies and, providing the Link Master is programmed for an Audit Unit will then transmit the reformatted Frame to the Audit unit.

5.5.13 Command Code 12 : IDENTIFY

On power up the Audit unit will, if fitted, send an Identification request to the Link Master. The Link Master will in turn request the Cashless Payment Controller and all other peripherals to identify themselves by issuing an IDENTIFY command. The reply must take the following format:

## PRODUCT SPECIFICATION

Description: BDV 001



(N.8. reserved bits should be returned as 0)

Examples of replies:

	HEX CODE
a. Number of Triple Byte Audit Frames	20 -3F
b. PNAK	FF

The Link Master will obtain this identification data by issuing SEND AUDIT ADDRESS and SEND AUDIT DATA commands as described above. The Cashless Payment Controller may also transmit all Static Audit data upon receipt of an IDENTIFY command.

### 5.5.14 Command Code 13 : BLOCK ACK.

This is issued by the Link Master to the Datafile sourcing Peripheral following a successful Data file transfer sequence. It signifies that the Block was transferred and received without error by the intended peripheral. The Cashless Payment Controller, as the Datafile sourcing Peripheral, will use this to cancel the request for a Data file transfer.

Allowed replies are :

	HEX CODE
a. System Error	00
a. O.K.	FD
b. PNAK	FF

## PRODUCT SPECIFICATION

Description: BDV 001

On receiving reply a, the Link Master will attempt retransmission of the previous command. If this reply is returned a second time then the transfer will be aborted by the Link Master returning to its peripheral polling routine.

### 5.5.15 Command code 14 : ACCESS DENIED

This is issued to the Cashless Payment Controller by the Link Master when the Cashless Payment Controller has requested to send a Datafile to a peripheral that is incapable of receiving the Datafile. This will normally be issued when the requested transfer path is not available, or the receiving peripheral has returned an ACCESS DENIED to the Link Master indicating that it does not wish to receive that Datafile. The Cashless Payment Controller should use this command as an indication to cancel its desire to send data to this peripheral.

Allowed replies are :

	HEX CODE
a. System Error	00
b. O.K	FD
c. PNAK	FF

On receiving reply a, the Link Master will attempt retransmission of the previous command. If this reply is returned a second time then the transfer will be aborted by the Link Master returning to its peripheral polling routine.

### 5.5.16 Command Code 15 : NEGATIVE ACKNOWLEDGE (NAK)

This command is issued by the Link Master when it detects a Parity, Framing or Over-run error in a character transmitted to it. On receiving this command the Cashless Payment Controller must repeat its last transmission.

Description: BDV 001

5.5.17 Compulsory Features

Any device performing the BDV Cashless Payment Controller role must be capable of handling the Filetypes 10,12,13,15 and 16. In addition, it is their responsibility to reply to Filetype 10 (VMC Vend Request) with Filetype 15 (Vend Parameters) within 200mS. This time period is measured from the reception of Filetype 10's DATA SYNC to the transmission of the first byte of Filetype 15. If this timing is not met then the Link Master may proceed with the vend as detailed in Filetype 10. Also any Filetype 15 transferred to a Link Master must be in answer to the MOST RECENT Filetype 10 transferred to the CPC.

## PRODUCT SPECIFICATION

Description: BDV 001

### 5.6 VMC OPERATION

5.6.1 The serial commands issued to a VMC by the Link Master may be summarised :

<u>COMMAND</u>	<u>ATTRIBUTE</u>	<u>HEX CODE</u>
0	*Unused.Reserved for future use	30
1	STATUS	31
2	CREDIT	32
3	VEND	33
4	AUDIT	34
5	SEND AUDIT ADDRESS	35
6	SEND AUDIT DATA	36
7	IDENTIFY	37
8	*Unused.Reserved for Protocol 'A'	38
9	DATA SYNC	39
10	SEND DATA	3A
11	INITIATE DATA TRANSFER	3B
12	BLOCK ACK.	3C
13	ACCEPT BLOCK	3D
14	ACCESS DENIED	3E
15	NEGATIVE ACKNOWLEDGE	3F

The Link Master periodically polls the VMC with the STATUS and, should credit exist, CREDIT commands. The remaining commands are issued by the Link Master during the granting of a vend; the transferring of Audit details to an Audit Unit or to perform a Datafile transfer.

Replies to the above commands are defined:

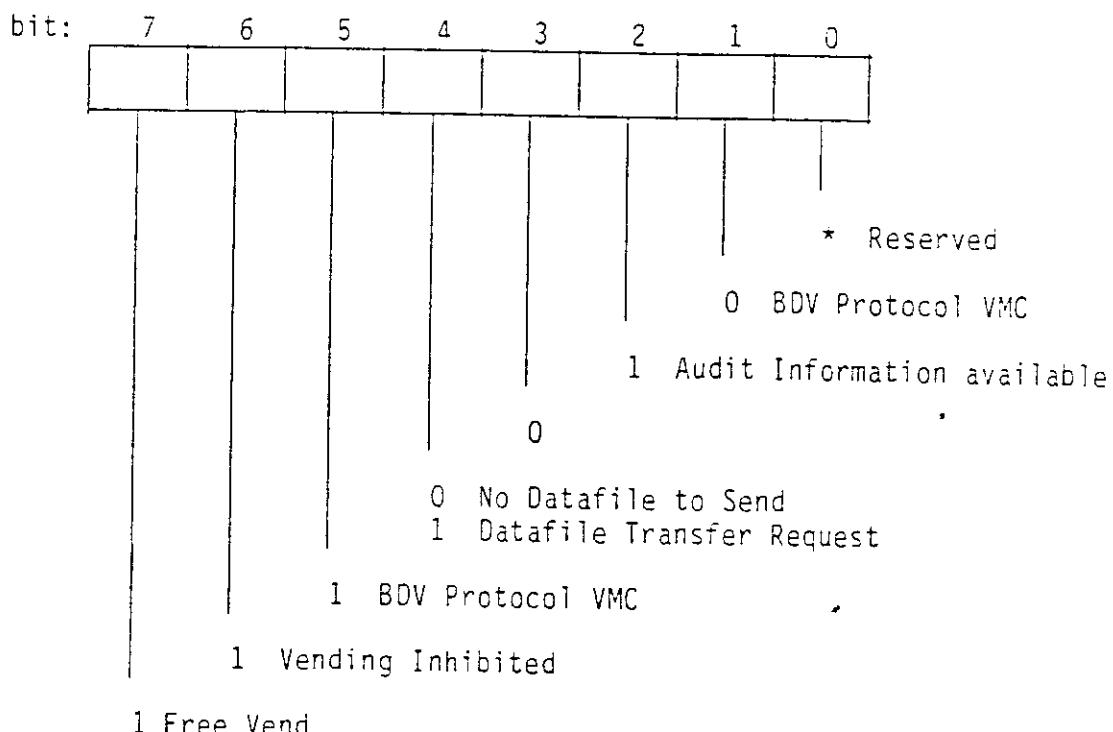
### 5.6.2 Command Code 1 : STATUS ~~30~~ 31

The STATUS command is issued by the Link Master during each poll of the VMC peripheral. It may be interleaved between other commands or Datafiles, but not normally within a Datafile or Audit transfer sequence.

## PRODUCT SPECIFICATION

Description: BDV 001

The reply must take the following format:



(N.B. Reserved bits must be returned as zero).

Examples of replies:

	HEX CODE
a. Nothing to report	20
b. VMC inhibited- stop accepting credit & issuing CREDIT commands.	60
c. Free vend required	A0
d. Free vend and inhibited	E0
e. Request to send Data	30
f. Request to send Audit Frames	24
g. PNAK	FF

The Audit Information flag indicates that the VMC has audit information in a stack. This could include information volunteered by the VMC as opposed to information requested by the AUDIT or IDENTIFY commands.

Description: BDV 001

The "inhibited" response to a STATUS command causes the Link Master to stop accumulating credit and issuing CREDIT commands until the next reply from a STATUS command is received. The "free vend" reply causes the Link Master to inhibit credit accumulation and then to send a CREDIT command even though the credit level may be zero. Should they both be set then the "Vending Inhibited" flag will be observed. (Seminar)

### 5.6.3 Command Code 2 : CREDIT 32

This command is used during each poll of the VMC provided vending has not been inhibited and the Link Master has credit or a Free Vend has been requested as described above or there is a cashless token present in the system, i.e. bit 1 of the CPC.reply to a STATUS command is set.

Allowed reply codes are:

	HEX CODE
a. Selection Info Data	0 ~ 99
b. No vend requested	FE
c. PNAK	FF

Reply a, is a block of data representing the price and selection number of the requested product. If the current credit level is greater than or equal to the vend price then, provided a Cashless Payment Controller has not <sup>been given</sup> contributed to the system credit, the Link Master will send a VEND command. If the system credit does consist of Cashless Payment credit then the requested price must be transferred to the Cashless Payment Controller via FILETYPE 10 for possible modification.

The Link Master on receiving this reply will transfer the 'Selection Info' datablock from the VMC to itself via SEND DATA commands. The first three data-bytes of this Datablock indicate the selected vend price in real currency units, (packed BCD format )low order byte first. The fourth data-byte signifies the Product Selection Number. This Selection Info Datablock is defined in 5.6.17.

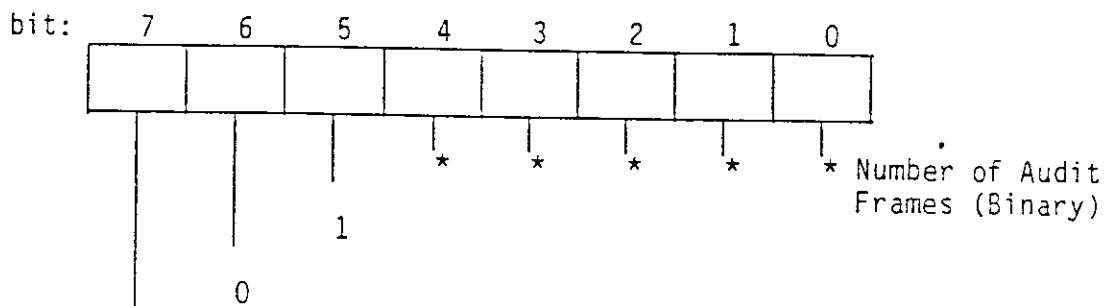
## PRODUCT SPECIFICATION

Description: BDV 001

### 5.6.4 Command Code 3 : VEND

33

If the reply to the CREDIT command indicates a requested vend at a price and selection number that is permitted by the Link Master then the Link Master will issue the VEND command. The VMC takes this as authority to attempt the requested vend. The VMC will reply to this command either immediately with a PNAK (if it suffered a Parity, Framing or Over-run error) or at the end of the vend with a response which has the following format:



0 Vend Succeeded  
1 Vend Failed

Examples of Replies :

	HEX CODE
a. Vend succeeded	20
b. Vend Failed	A0
c. Vend Succeeded, 4 Triple Byte Audit Frames	24
d. Vend Fail, 4 Triple Byte Audit Frames	A4
e. PNAK	FF

The lower 5 bits of the returned word for codes a. -> b. above, i.e. bits 0 - 4, are used by the VMC to indicate to the Link Master the number of audit Frames (see later) it wishes to transfer. All frames to be transferred are triple byte, i.e. three data bytes for each address byte. Audit information need not be reported i.e the number of Audit Frames may be 0.

## PRODUCT SPECIFICATION

Description: BDV 001

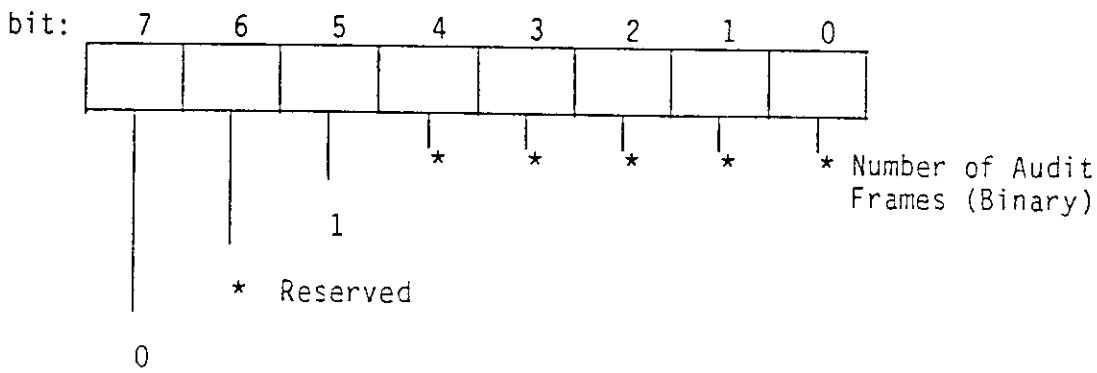
At the time that the VEND command is transmitted the Link Master subtracts the vend price from the accumulated credit and then waits for a response to the VEND command.

The Vend Succeeded reply will cause the Link Master to send Datafile 9, actual vend price, to the VMC and the remaining credit value to be returned if the Link Master is operating in single vend mode. The Link Master will then return to its normal peripheral polling routine.

The Vend failed reply causes the Link Master to reinstate the vend price to the accumulated credit. The Link Master will then return to its normal peripheral polling routine.

### 5.6.5 Command Code 4 : AUDIT 34

The Link Master will send the Audit command to the VMC either as a result of a "request for audit", from the Audit unit or in response to the VMC indicating in its STATUS reply that Audit Information is available. The VMC must respond to this command with the number of Audit Frames it wishes to transmit. The response must take the following format:



(N.B. reserved bits must be returned as 0)

Examples of replies :

	HEX CODE
a. Nos of Triple Byte Audit Frames	20 - 3F
b. PNAK	FF

## PRODUCT SPECIFICATION

Description: BDV 001

A Triple Byte Audit Frame consists of three bytes, firstly a byte address which specifies a location pointer in the Audit Unit followed by three data bytes, least significant first.

The Link Master will obtain this Audit information from the VMC a Frame at a time by implementing a send sequence via the commands SEND AUDIT ADDRESS and SEND AUDIT DATA as described below. If the Link Master loses synchronisation when the transfer has been initiated by an AUDIT command then the transfer will be aborted by the Link Master immediately issuing another Audit command to restart the transfer. The VMC must respond to the subsequent Audit command with the number of Audit Frames remaining ( including the most recent Frame transmitted ) to complete the transfer. The VMC should not increment its Audit Frame pointer until it receives the following SEND AUDIT ADDRESS command.

### 5.6.6 Command Code 5 : SEND AUDIT ADDRESS

35

This command is used to handshake audit data from the VMC to the Audit unit via the Link Master following notification by the VMC that it has audit information to report. This notification is given by a non zero Audit Frame content in the reply to a Link Master's VEND, IDENTIFY or AUDIT command.

Each Audit Frame is individually called for by the Link Master. The Frame address is firstly requested by the Link Master issuing the SEND AUDIT ADDRESS command.

Allowed replies are :

	HEX CODE
a. Audit address character	0 - FA
b. Sync lost	FE
c. PNAK	FF

The Audit Address, or location pointer, character is transmitted in binary and may be of any value between 0 and 250.

## PRODUCT SPECIFICATION

Description: BDV 001

Reply b, is returned if the VMC was expecting a SEND AUDIT DATA command, i.e sync between Link Master and VMC has been lost. If this happens and the Audit sequence was initiated by either the STATUS, IDENTIFY or VEND commands then the Link Master will abort the data transfer process and return to the normal peripheral polling routine. The VMC should indicate in its reply to the next STATUS byte that there is further Audit Information to be audited. The number of Audit Frames remaining including the failed Frame) to complete the data transfer should be indicated in the reply to the subsequent AUDIT command. If synchronisation is lost and the transfer was initiated by an AUDIT Unit initiated command then the Link Master will abort the data transfer by immediately issuing another AUDIT command. The VMC should indicate in its reply the number of Audit Frames remaining (including the failed Frame) to complete the transfer.

If there is no breakdown in synchronisation the Link Master will follow the SEND AUDIT ADDRESS command with a SEND AUDIT DATA command.

In a transfer of Triple Byte Frames the Link Master will follow three SEND AUDIT DATA commands with a SEND AUDIT ADDRESS command.

In such a transfer the low order data byte is transmitted in reply to the initial SEND AUDIT DATA command following the SEND AUDIT ADDRESS command. The next least significant byte is transmitted in reply to the subsequent SEND AUDIT DATA command, with the most significant byte being transmitted in response to the final SEND AUDIT DATA command of that FRAME.

### 5.6.7 Command Code 6 : SEND AUDIT DATA 36

This is issued following a SEND AUDIT ADDRESS command and is used to handshake audit data bytes to the Link Master.

Allowed replies are :

#### HEX CODE

- |                         |        |
|-------------------------|--------|
| a. Audit data character | 0 - 99 |
| b. Sync lost            | FE     |
| c. PNAK                 | FF     |

The Audit Data character is transmitted in packed BCD format.

## PRODUCT SPECIFICATION

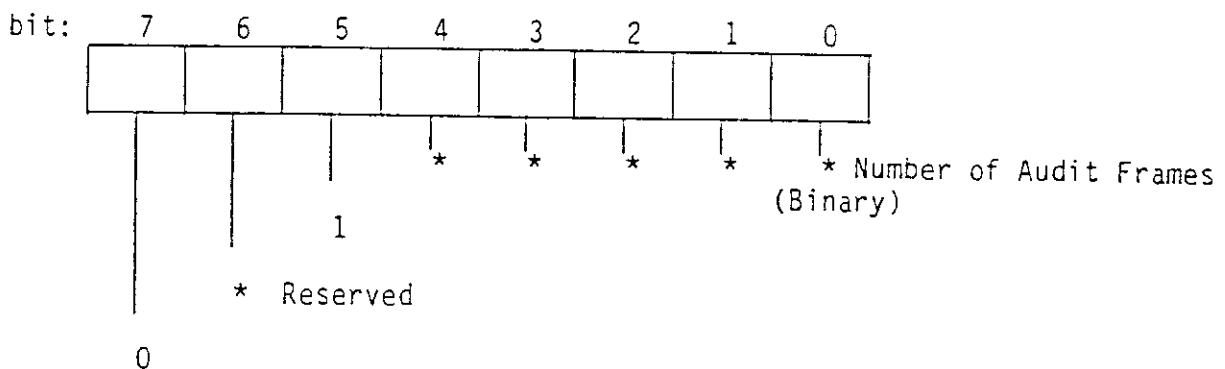
Description: BDV 001

Reply b, is returned if the VMC was expecting a SEND AUDIT ADDRESS command, i.e sync between Link Master and VMC has been lost. If this happens then the Audit sequence will be aborted as described in Command code 5 above.

For each received Frame the Link Master will reformat the VMC address and data replies and, providing the Link Master is programmed for an Audit Unit will then transmit the reformatted Frame to the Audit unit.

### 5.6.8 Command Code 7 : IDENTIFY

On power up the Audit unit will, if fitted, send an Identification request to the Link Master. The Link Master will in turn request the VMC and all other peripherals to identify themselves by issuing IDENTIFY commands. The reply must take the following format:



(N.B. reserved bits returned as 0)

#### Examples of replies:

	HEX CODE
a. Number of Triple Byte Audit Frames	20 - 3F
b. PNAK	FF

The Link Master will obtain this identification data by issuing SEND AUDIT ADDRESS and SEND AUDIT DATA commands as described above. The VMC may also transmit all Static Audit data upon receipt of an IDENTIFY command.

## PRODUCT SPECIFICATION

Description: BDV 001

5.6.9 Command Code 8 : Unused in BDV001 *0 38*

5.6.10 Command Code 9 : DATA SYNC *39*

This is issued by the Link Master to terminate a Datafile transfer initiated by the ACCEPT BLOCK command.

Allowed replies are:

### HEX CODE

- |                               |    |
|-------------------------------|----|
| a. Access Denied              | 00 |
| b. Checksum Failed /Lost Sync | FB |
| c. Checksum passed            | FD |
| d. PNAK                       | FF |

Reply a, is returned when the VMC does not wish to continue to receive the Datafile. The Link Master will, on receiving this reply, issue an ACCESS DENIED command to the data sourcing peripheral unless the DATA SYNC command resulted from reply b, of the SEND DATA command (sync lost/abort), or from a Link Master checksum failure. In these cases the Link Master returns to its peripheral polling routine.

Reply b, is returned to signify to the Link Master that the checksum protecting the block transfer has failed. It is also returned when the Datafile receiving Peripheral was expecting a Data-nibble. This will signify to the Link Master to terminate the transfer by issuing a STATUS command to the sourcing peripheral. The Datafile sourcing peripheral may then choose to request a retransmission of the complete Datafile unless the DATA SYNC command resulted from reply b of "SEND DATA" or from a Link Master checksum failure. In these cases reply b is the reply to be expected and the Link Master returns to its peripheral polling routine.

5.6.11 Command Code 10 : SEND DATA *3A*

This command is issued by the Link Master to transfer each byte of a Datafile or each byte of the 'Selection Info' datablock from the VMC to the Link Master. This command is used by the VMC to increment its Datafile index pointer. The Datafile transfer is initiated by either an INITIATE DATA TRANSFER command or in response to a CREDIT command. If a STATUS command is received during a Datafile transfer then the Datafile sourcing peripheral will assume that the transfer has failed due to a Checksum failure or loss of Synchronisation. The peripheral may decide whether to attempt the retransmission of the Datafile. This SEND DATA command is only issued to Protocol 'BDV001' VMC's.

## PRODUCT SPECIFICATION

Description: BDV 001

Allowed replies are :

	HEX CODE
a. next data byte	00 - FA
b. Sync Lost/Abort	FE
c. PNAK	FF

Reply b, is returned when the Datafile sourcing Peripheral was expecting a Datafile terminating command, i.e BLOCK ACK (successful transfer), STATUS (failed checksum or synchronisation) or ACCESS DENIED (receiver terminated) but received another SEND DATA requesting data. This will signify to the Link Master to terminate the transfer by issuing a DATA SYNC command to the receiving peripheral unless it was the first SEND DATA command after the command INITIATE DATA TRANSFER. In this case the receiving peripheral would not yet have been involved in the Datafile transfer. The Link Master returns to its peripheral polline routine. In the case a DATA SYNC command has been issued to the receiving peripheral the reply "checksum failed/sync lost" would be the most appropriate.

### 5.6.12 Command Code 11 : INITIATE DATA TRANSFER 3B

This is issued by the Link Master following a request by the VMC to transfer data to a peripheral (bit 4 of STATUS reply set).

The VMC must use this command to zero its Datafile index pointer. Following this command the VMC will expect the Link Master to ask for the data-bytes of the Datafile by SEND DATA commands.

The structure of the Datafile to be transferred by this command was defined in section 5.2 above.

This command is only issued to Protocol 'BDV001' VMCs.

Allowed replies are :

	HEX CODE
a. Cancel Request	00
b. O.K.	FD
c. PNAK	FF

Reply a, will cause the Link Master to abort the Datafile transfer by returning to its Peripheral polling routine.

## PRODUCT SPECIFICATION

Description: BDV 001

### 5.6.13 Command Code 12 : BLOCK ACK. ~~1B11~~ 3C

This is issued by the Link Master to the Datafile sourcing Peripheral following a successful Datafile transfer sequence. It signifies that the Block was transferred and received without error by the intended peripheral. The VMC, as the Datafile sourcing Peripheral, will use this to cancel the request for a Datafile transfer.

This command is only issued to Protocol 'BDV001' VMC's.

Allowed replies are :

	HEX CODE
a. System Error	00
b. O.K.	FD
c. PNAK	FF

Reply a, will cause the Link Master to attempt retransmission of the command. If this reply is returned a second time then the transfer will be aborted by the Link Master returning to its peripheral polling routine.

### 5.6.14 Command Code 13 : ACCEPT BLOCK "3D"

This is issued by the Link Master when it wishes the VMC to receive a Datafile. The VMC uses this command to initialise its Datafile index pointer. Should the VMC receive this command when it is currently receiving a Datafile, then the initial Datafile will be terminated and the subsequent Datafile accepted.

This command is only issued to a Protocol 'BDV001' VMC.

Allowed replies are :

	HEX CODE
a. Access Denied	00
b. Busy	F8
c. O.K.	FD
d. PNAK	FF

Reply a, above is returned when the VMC cannot receive Datafiles. "00" The Link Master will use this reply to issue an ACCESS DENIED command to the data sourcing peripheral.

PRODUCT SPECIFICATION

Description: BDV 001

"3D"

Reply b, is returned when the VMC may receive Datafiles but is currently busy. The Link Master should reattempt the transfer after a wait period of approximately 100ms. Four consecutive Busy replies will be interpreted by the Link Master as an inability of the VMC to receive Datafiles at this time and cancel the Datafile transfer by issuing a STATUS to the sourcing peripheral. "FB"

Reply c, is returned to indicate that the VMC is prepared to receive a Datafile. Upon receipt of this reply the Link Master continues with the Datafile transfer process. "FD"

The VMC should now expect to receive data bytes from the Link Master. These will be identified by the mode bit, bit 4, cleared to a 0. Each data-byte will be transmitted as two nibbles, least significant first. To each data nibble the VMC must reply with one of the following :

	HEX CODE
a. Access Denied	00
b. O.K.	FD
c. Sync Lost	FE
d. PNAK	FF

Reply a, above is returned when the VMC does not wish to continue to receive the Datafile. The Link Master will, on receiving this reply, issue an ACCESS DENIED command to the data sourcing peripheral.

Reply c, above is returned when the Datafile receiving Peripheral was expecting a Datafile terminating command, i.e DATA SYNC, but received another data-nibble. This reply may also be returned when the receiving peripheral wants the Datafile transfer process to recommence at some time later. This reply will signify to the Link Master to terminate the transfer by issuing a STATUS command to the sourcing peripheral.

## PRODUCT SPECIFICATION

Description: BDV 001

### 5.6.15 Command Code 14 : ACCESS DENIED

*3E*

This is issued to the VMC by the Link Master when the VMC has requested to send a Datafile to a peripheral that is incapable of receiving the datafile. This will normally be issued when the requested transfer path is not available, or the receiving peripheral has returned an ACCESS DENIED to the Link Master indicating that it does not wish to receive that Datafile. The VMC should use this command as an indication to cancel its desire to send data to this peripheral.

Allowed replies are :

	HEX CODE
a. System Error	00
b. O.K.	FD
c. PNAK	FF

Reply a, will cause the Link Master to attempt retransmission of the command. If this reply is returned a second time then the transfer will be aborted by the Link Master returning to its peripheral polling routine.

### 5.6.16 Command Code 15 : NEGATIVE ACKNOWLEDGE (NAK)

*3F*

This command is issued by the Link Master when it detects a Parity, Framing or Over-run error in a character transmitted to it. On receiving this command the VMC must repeat its last transmission. If it does not then the Link Master will wait, with all its functions inhibited, until it receives a word from the VMC.

### 5.6.17 Datablock 'Selection Info'

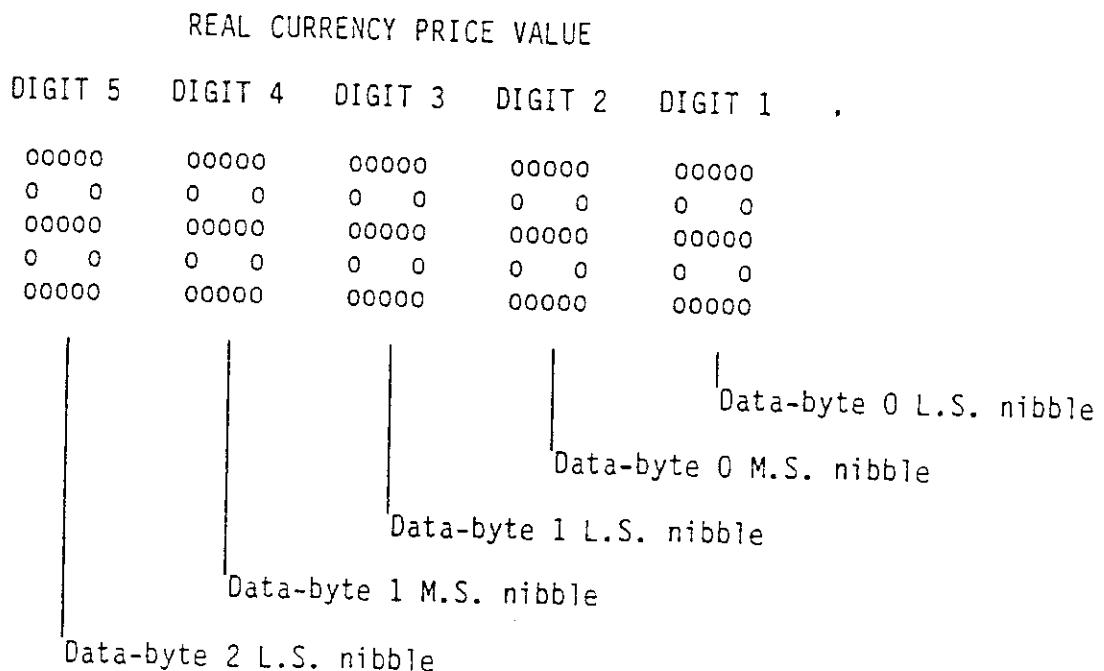
The Selection Info datablock is transferred to the Link Master from a VMC in response to a CREDIT command when a product has been selected. This datablock is transferred via SEND DATA commands in a similar manner to datafiles. A header is however unnecessary in this instance and so is omitted. The checksum is calculated as for datafiles. Refer to Section 7.1. It is defined thus:

## PRODUCT SPECIFICATION

Description: BDV 001

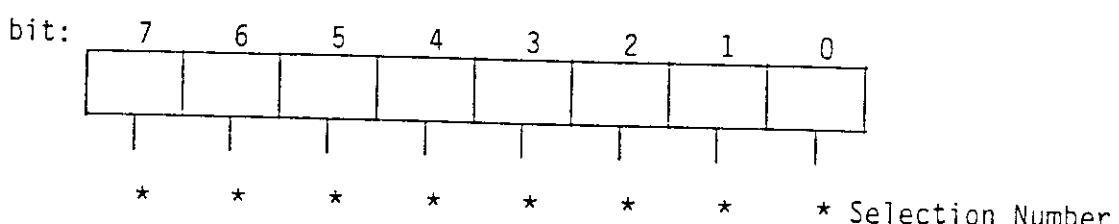
<u>Date-byte Index</u>	<u>Data</u>
0	BCD Price Value Digits 1 & 2
1	BCD Price Value Digits 3 & 4
2	BCD Price Value Digit 5
3	Selection Number (0-99) BCD
4	Checksum Byte 1
5	Checksum Byte 2

This may be represented diagrammatically:



The Most Significant nibble of Data-byte 2 must be returned as 0 and used as such in the Checksum calculation.

The bits of Byte 3 of this data block are defined:



## PRODUCT SPECIFICATION

Description: BDV 001

### 5.6.18 Compulsory Features

Any device performing the BDV VMC role must be capable of handling the 'Selection Info' datablock, Filetypes 16 and 9. It is also compulsory for these VMCs to supply a valid Selection Number within the 'Selection Info' datablock.

## PRODUCT SPECIFICATION

Description: BDV 001

### 5.7 LINK MASTER COMPULSORY FEATURES

Although the Protocol puts no restriction on which unit performs the role of Link Master, it will normally be executed by a Coin Mechanism.

Any Unit which functions as a Link Master must execute the appropriate Link Master to Peripheral command structure defined in Sections 5.4, 5.5 and 5.6 of this Specification.

The Link Master must report the Standard Audit file to the Audit Unit when fitted and support the Datafile structure defined in this document.

Whilst providing the medium and control for a Peripheral to Peripheral Datafile transfer, it should also, to increase Link Security, confirm the checksum protecting that Datafile. The Link Master must be capable of handling the following Datafiles if appropriate: Filtetype 0, 2, 8, 9, 10, 11, 12, 13, 15, 16 and the Selection Info datablock.

The Link Master must only grant a Datafile transfer request which is independent of the Vend Process when zero credit exists, except for filetype 17, maintenance request.

To increase its product base the Link Master may also execute Protocol 'A'.

## PRODUCT SPECIFICATION

Description: BDV 001

6.

### APPENDIX A

#### AUDIT DETAILS

The BDV001 Protocol allows certain parameters to be audited as standard. The BDV Audit file may be considered to comprise two sections:

- a. That File which is accessed by the Link Master to Audit the cash and vend payment parameters, and
- b. A general purpose file which is accessed by the VMC to Audit data specific to that VMC and its Vending Environment. This is accessed by sending frames to audit addresses 26-243.

The former, termed the Standard Audit file is accessed by the address/data"sync sequence defined above. The following table describes the format:

<u>AUDIT ADDr</u>	<u>INFORMATION</u>	<u>DATA FORMAT</u>	<u>FRAME SYNC</u>	
0	Audit Unit I.D.	Generated by the Audit Unit		
1	CPC I.D. No.	5 BCD Digits	BDV	SYNC
2	VMC I.D. No.	5 BCD Digits	BDV	SYNC
3	Link Master I.D. No.	5 BCD Digits	BDV	SYNC
4	Real/Base Unit factor	5 BCD Digits	BDV	SYNC
5	Transaction No.	Count of successful Audits		
6	Power count	count of Audit Unit Power Ups	→ Edition 5.0	
7	Money to Tubes	5 BCD Real Currency Units	BDV	SYNC
9	Money to Cashbox	5 BCD Real Currency Units	BDV	SYNC
11	Dispensed Change	5 BCD Real Currency Units	BDV	SYNC
13	Invented Money	5 BCD Real Currency Units	BDV	SYNC
15	Value of Overpay	5 BCD Real Currency Units	BDV	SYNC
17	Value of Pay Vends	5 BCD Real Currency Units	BDV	SYNC
19	Pay Vends (Ex Chng)	5 BCD Real Currency Units	BDV	SYNC
21	Value of Discount Vnds	5 BCD Real Currency Units	BDV	SYNC
23	Vended Miscell. Cash	5 BCD Real Currency Units	BDV	SYNC
25	Manual Fill Money	5 BCD Real Currency Units	BDV	SYNC
244	Audit Unit Software Version No.	5 BCD Digits	BDV	SYNC
245	CPC Software Version No.	5 BCD Digits	BDV	SYNC
246	VMC Software Version No.	5 BCD Digits	BDV	SYNC
247	Link Master Software Version No.	5 BCD Digits	BDV	SYNC
248	Negative Vend	5 BCD Real Currency Units	BDV	SYNC
249	D.Point Position	5 BCD Digits	BDV	SYNC

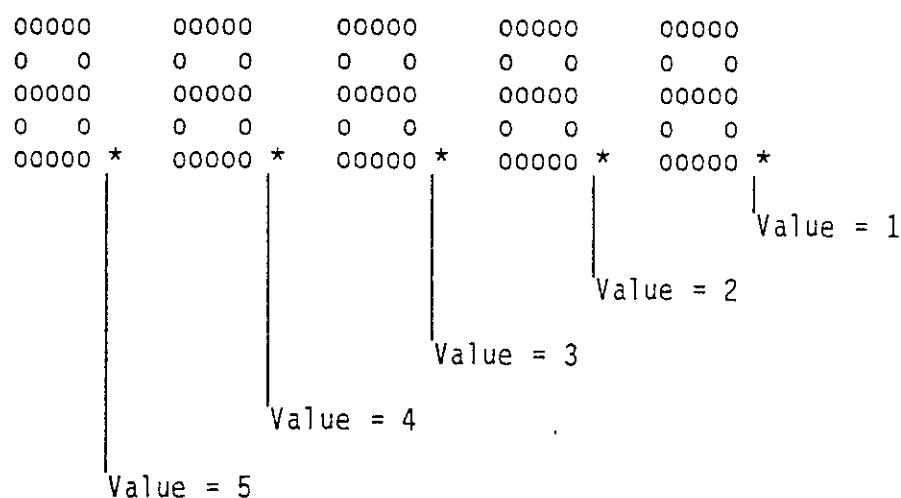
PRODUCT SPECIFICATION

Description: BDV 001

NOTE 1: In the event that no response is forthcoming from the audit Unit the Link Master must suspend all activities until the link is re-established. This has the main purpose of preventing fraudulent disconnection of the Audit Unit from the serial link.

NOTE 2: The Real/Base Unit factor is that factor necessary to convert a coin set base unit value into a real currency value.

NOTE 3: The decimal point position value indicates the digit to the immediate left of the decimal point position. A value of zero is defined as no decimal point illuminated. This is represented diagrammatically below:



Note 4: The above parameters are limited to the following values:

## PRODUCT SPECIFICATION

Description: BDV 001

<u>AUDIT</u>	<u>INFORMATION</u>	<u>TRANSMITTED VALUE</u>
0	Audit Unit I.D.	Not Transmitted
1	CPC I.D. No.	0 - 9999
2	VMC I.D. No.	0 - 9999
3	Link Master I.D. No.	0 - 9999
4	Real/Base Unit factor	1 - 1000
5	Transaction No.	Not Transmitted
6	Power count	Not Transmitted
7	Money to Tubes	Coin Set Dependent
9	Money to Cashbox	Coin Set Dependent
11	Dispensed Change	Coin Set Dependent
13	Invented Money	Coin Set Dependent
15	Value of Overpay	0 - 99999
17	Value of Pay Vends	0 - 99999
19	Pay Vends (Ex Chng)	0 - 99999
21	Value of Discount Vnds	0 - 99999
23	Vended Miscellaneous Cash	0 - 99999
25	Manual Fill Money	0 - 99999
244	Audit Unit Software Version No.	0 - 250
245	CPC Software Version No.	0 - 250
246	VMC Software Version No.	0 - 250
247	Link Master Software Version No.	0 - 250
248	Negative Vend	0 - 9999
249	D.Point Position	0 - 5

The Protocol allows for the collection of machine specific Audit Data via the address/data/sync sequence defined above into Audit address pointers currently unspecified, viz address pointers 26 - 243 inclusive. Further, a Filetype has been specified, Filetype 21 the Standard VMC Audit File, which allows the VMC to dump up to 122 machine specific Audit bytes into the Audit Unit.

## PRODUCT SPECIFICATION

Description: BDV 001

7.

### APPENDIX B

#### FILE TYPE DEFINITIONS

##### 7.1 Checksum Derivation

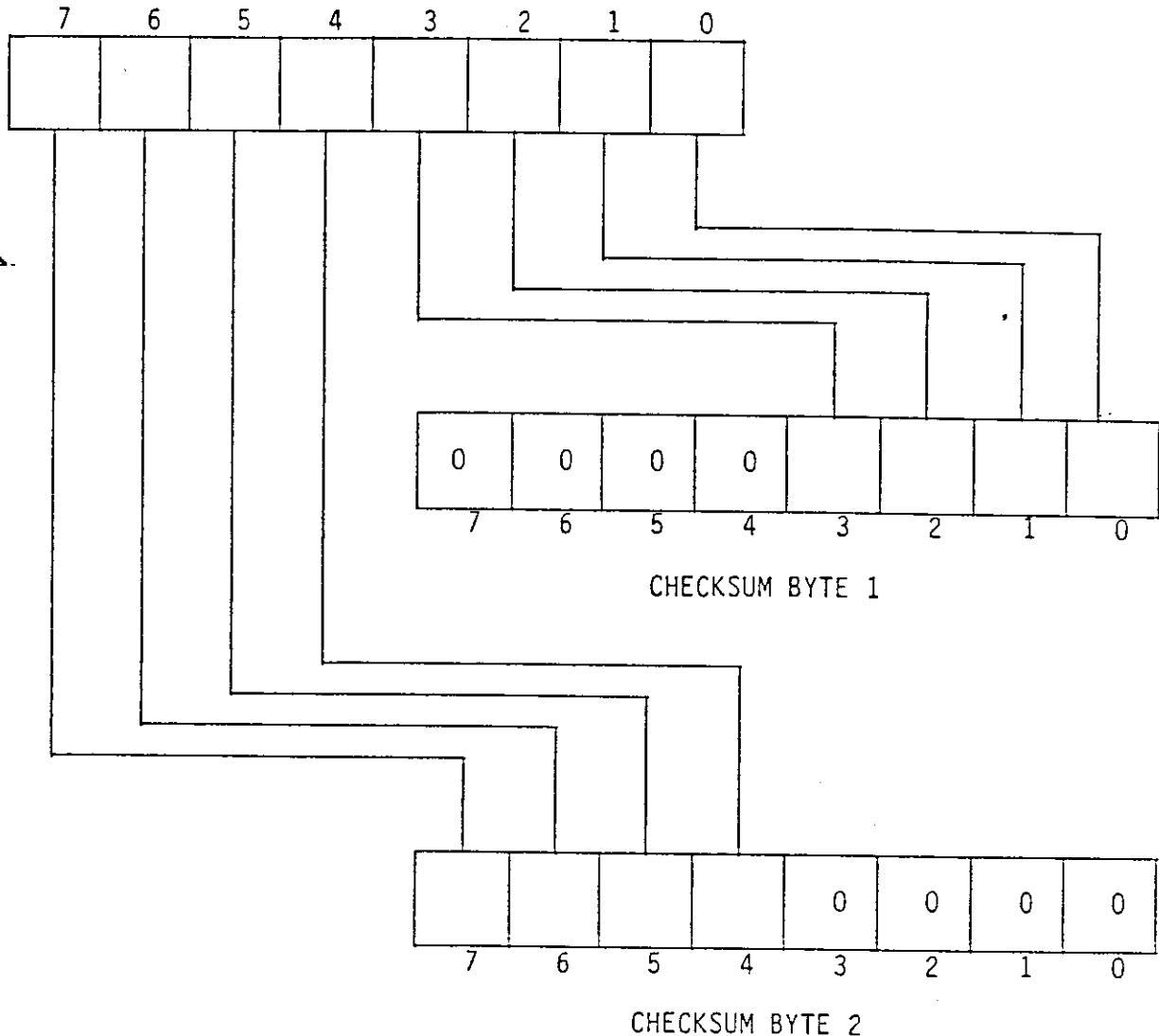
All Datafiles are protected against corruption by a standard checksum. This checksum will be calculated by the receiving peripheral and the Link Master if it is a Peripheral to Peripheral Datafile transfer. Only if they both verify the checksum will the transmitting peripheral be informed of the successful Datafile transfer via the BLOCK ACK command.

The checksum is 1 byte calculated such that the binary sum of the total Datafile, ignoring any overflow, has a value equal to 0. This single Checksum byte is converted into two nibble significant bytes for transmission. This construction is shown below :

PRODUCT SPECIFICATION

Description: BDV 001

Calculated Checksum



Description: BDV 001

## 7.2 Datafile Data-bytes

File Type identifying numbers as presented here are in decimal.

### 7.2.1 FILE TYPE 0 : REQUEST DATAFILE

This File Type may be used by any peripheral. It is used by a Link Unit to request a transfer of a Datafile from any other Link Unit. Link Unit A (Transmitting Peripheral Ident) instructs Link Unit B (receiving peripheral ident) to send a file (requested file type) to Link Unit C (send to peripheral ident). Link units A and C may be the same peripheral.

<u>Data-byte Index</u>	<u>Data</u>
0	Requested File Type
1	Send to Peripheral Ident
2	CHECKSUM Byte 1
3	CHECKSUM Byte 2

Datafile Sources : Link Master, VMC, Audit Unit, Cashless Payment Controller.

Datafile Receivers : Link Master, VMC, Audit Unit, Cashless Payment Controller

### 7.2.2 FILE TYPE 1 : Status Block

This File Type may only be sent to a Link Master by a VMC. It is used to transfer a change in the VMC's status which is of concern to the Link Master.

<u>Data-byte Index</u>	<u>Data</u>
0	status nibble - see below
1	Checksum Byte 1
2	Checksum Byte 2

Description: BDV 001

## 7.2 Datafile Data-bytes

File Type identifying numbers as presented here are in decimal.

### 7.2.1 FILE TYPE 0 : REQUEST DATAFILE

This File Type may be used by any peripheral. It is used by a Link Unit to request a transfer of a Datafile from any other Link Unit. Link Unit A (Transmitting Peripheral Ident) instructs Link Unit B (receiving peripheral ident) to send a file (requested file type) to Link Unit C (send to peripheral ident). Link units A and C may be the same peripheral.

<u>Data-byte Index</u>	<u>Data</u>
0	Requested File Type
1	Send to Peripheral Ident
2	CHECKSUM Byte 1
3	CHECKSUM Byte 2

Datafile Sources : Link Master, VMC, Audit Unit, Cashless Payment Controller.

Datafile Receivers : Link Master, VMC, Audit Unit, Cashless Payment Controller

### 7.2.2 FILE TYPE 1 : Status Block

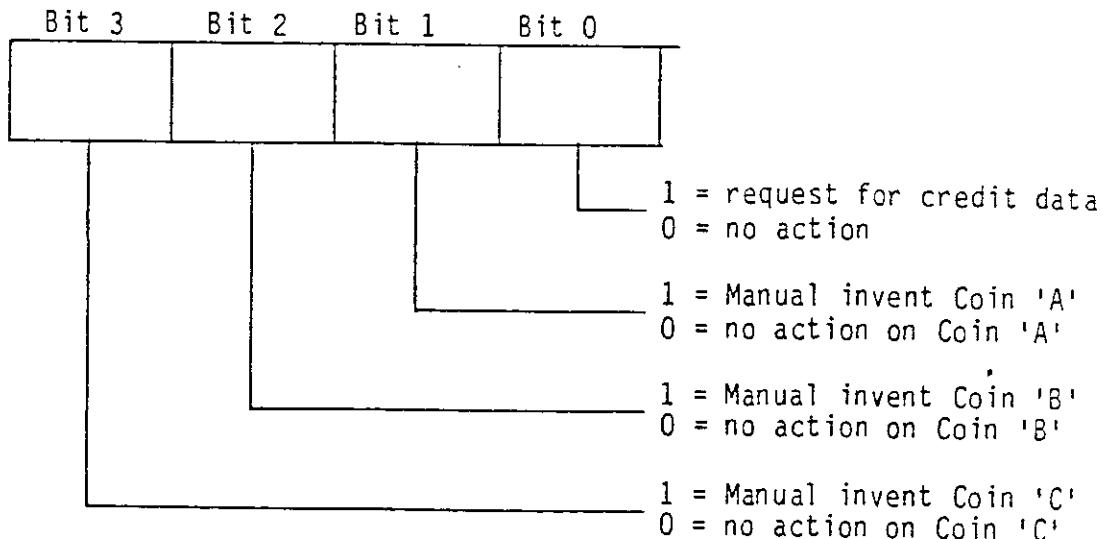
This File Type may only be sent to a Link Master by a VMC. It is used to transfer a change in the VMC's status which is of concern to the Link Master.

<u>Data-byte Index</u>	<u>Data</u>
0	status nibble - see below
1	Checksum Byte 1
2	Checksum Byte 2

## PRODUCT SPECIFICATION

Description: BDV 001

Index 0 data 1.s. nibble:



The m.s. nibble is reserved and should be set to 0 and used as such in the checksum calculation. If bit 0 is set then the Link Master should send the credit datafile, filetype 11. If any of bits 1 to 3 are set, and the Link Master is a coin mechanism, then the coin mechanism dispenses the required coin. If more than 1 coin is requested then the coin mechanism dispenses a coin from the highest value tube.

Datafile Sources : VMC

Datafile Receivers : Link Master

### 7.2.3 FILE TYPE 2 : Negative Vend

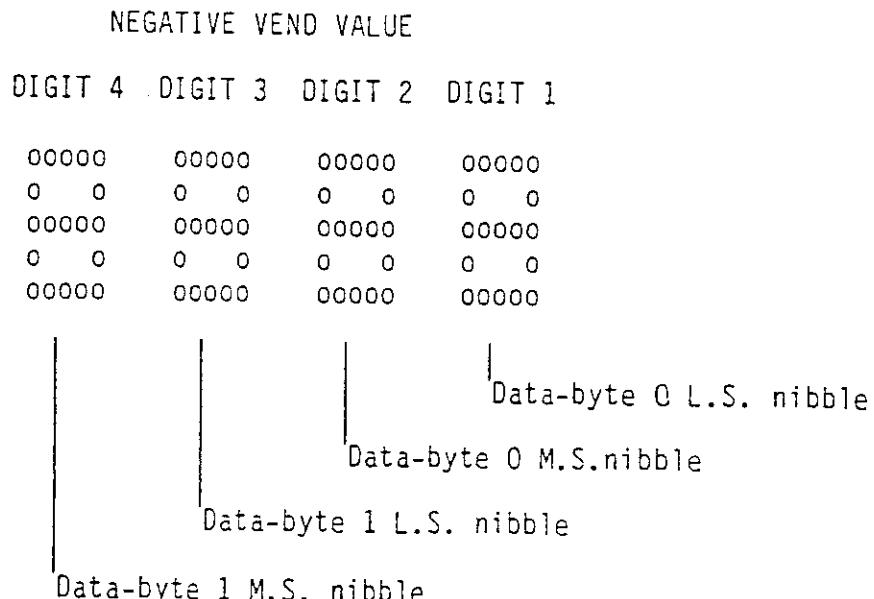
This File Type may only be sent to a Link Master by a VMC. It is used to transfer the value of negative vend, i.e. increase in credit by product depository, to the Link Master. This is transferred in real currency units - packed BCD format with a maximum value of 9999 real currency units. This value must be added to the System Credit by the Link Master.

<u>Data-byte Index</u>	<u>Data</u>
0	BCD Negative Vend Value Digits 1 & 2
1	BCD Negative Vend Value Digits 3 & 4
2	CHECKSUM Byte 1
3	CHECKSUM Byte 2

## PRODUCT SPECIFICATION

Description: BDV 001

This may be represented diagrammatically:



Datafile Sources : VMC

Datafile Receivers : Link Master

NOTE: Link master action following addition of the value to the System Credit is undefined.

### 7.2.4 FILE TYPE 3 : Max Credit

This File Type may only be sent to a Link Master by a VMC or Audit Unit. It is used to inform the Link Master of the maximum coin credit that should be accrued.

The value may only be sent in real currency units, BCD. The value should be a multiple of the lowest coin, otherwise it will be rounded down. The value must not exceed 64K multiples of the lowest coin value. Note: if all data-bytes are 0 then the Coin Mechanism will assume its own internal credit limit.

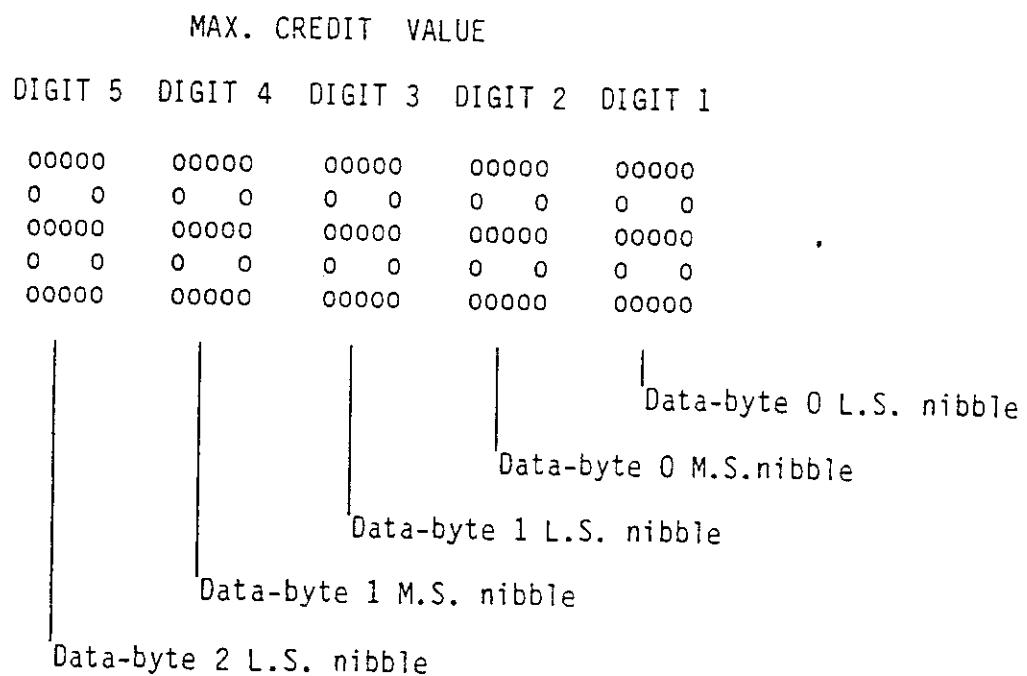
<u>Data-byte Index</u>	<u>Data</u>
0	BCD max credit , Digits 1 & 2
1	BCD max credit , Digits 3 & 4
2	BCD max credit Digit 5
3	Checksum Byte 1
4	Checksum Byte 2

## PRODUCT SPECIFICATION

Description: BDV 001

The nibbles of data-bytes 0,1 and also the least significant nibble of databyte 2 are the digits (in BCD) of the 5 digit max credit value. The most significant nibble of data-byte 3 should be returned as 0 and used as such in the checksum calculation.

This may be represented diagrammatically:



Datafile Sources : VMC, Audit Unit

Datafile Receivers : Link Master

## PRODUCT SPECIFICATION

Description: BDV 001

### 7.2.5 FILE TYPE 4 : FUNCTIONAL TABLE 1 - COIN DISCOUNTS

This File Type is used to change the Coin Mechanism Link Master discount features of Discount Trigger and Discount Award.

<u>Data-byte Index</u>	<u>Data</u>
0	Discount Award BCD Digits 0 and 1 Real Currency
1	Discount Award BCD Digits 2 and 3 Real Currency
2	Discount Trigger BCD Digits 0 and 1 Real Currency
3	Discount Trigger BCD Digits 2 and 3 Real Currency
4	CHECKSUM Byte 1
5	CHECKSUM Byte 2

The value of the 4 digit BCD Discount Award and Discount Trigger must be limited to a maximum of 250 multiples of the lowest coin value. The Coin Mechanism will round down should non coin dependent values be transferred.

Link Unit Datafile Sources: Link Master, VMC, Audit Unit, Cashless Payment Controller

Link Unit Datafile Receivers: Link Master, VMC, Audit Unit, Cashless Payment Controller

### Filetype 4 Parameter Definition

#### Discount Award:

The operator has the option of promoting sales by offering a discount feature. If, when in Multivend, a number of vends are taken, whose total cash sales vend value equals or exceeds the Discount Trigger value (see later) then the Discount Award value programmed (in coin multiples) will be added to the level of credit remaining in the accumulator. When credit is reduced to zero, either during a Multivend sequence or when change is paid back by an ER request, any contribution to a possible discount is cancelled. This has a range of 0 to 250 lowest coin multiples transferred as a BCD Real Currency value.

Note: This feature is restricted to coin credit only, not Cashless Payment credit. Only vends paid for by coin credit will contribute to the Discount Trigger value.

## PRODUCT SPECIFICATION

Description: BDV 001

### Discount Trigger:

This is the value of vends paid for by coin credit only that must be taken without termination of the vend (by credit falling to 0) to trigger the Discount Award.

This has a range of 0 to 250 lowest coin multiples transferred as a BCD Real Currency value.

Should the credit fall to 0 on attainment of the Discount Trigger Level then the Discount Award is allocated.

### ~~7.2.6~~ FILE TYPE 5 : FUNCTION TABLE 2 - COIN CHANGE

This Filetype is used to allow access to the Coin Mechanism Link Master user alterable parameters of Maximum Multivend Change, Exact change Offset and the Exact Change Equation.

#### Data-byte Index      Date

0	XT Change Offset (BCD value limited to 15 max)
1	XT Change Equation (l.s. nibble)
2	Maximum Change BCD Digits 0 and 1 Real Currency
3	Maximum Change BCD Digits 2 and 3 Real Currency
4	CHECKSUM BYTE 1
5	CHECKSUM BYTE 2

The most significant nibbles of Data byte 1 must be set to 0 and used as such for the checksum calculation.

The 4 digit BCD value in databytes 2 and 3 must be limited to a maximum value equal to 250 multiples of the lowest coin. The Coin Mechanism will round down should non coin dependent values be transferred.

Link Unit Datafile Sources: Link Master, VMC, Audit Unit, Cashless Payment Controller

Link Unit Datafile Receivers: Link Master, VMC, Audit Unit, Cashless Payment Controller

## PRODUCT SPECIFICATION

Description: BDV 001

### Filetype 5 Parameter Definition

#### Exact Change Offset:

To allow a more advanced warning of a possible short change situation to be given to the customer, one can increase the number of coins required in the tubes before the Exact Change state will be released. To do this, the user can program a number between 0 and 15 which will be added to the preprogrammed empty number before determining the empty state of the tube.

#### Exact Change Equation:

This data defines the exact change "equation" - the combination of tube empty states which results in the Coin Mechanism assuming the Exact Change state. A list is shown below of the possible combinations of tube empty states.

For convenience, the equation is described with reference to the A, B and C tubes, where the A tube holds the lowest valued and the C tube the highest valued of the change coins.

- 0 = A or (B and C)
- 1 = A and B and C
- 2 = A and B only
- 3 = A and (B or C)
- 4 = A only
- 5 = A or B only
- 6 = A or B or C
- 7 = A and C only
- 8 = A or C only
- 9 = B and C only
- 10 = B only
- 11 = B or C only
- 12 = C only
- 13 to 15 not used

#### Maximum Change:

A limit on the amount of change the mechanism will pay back at the end of a Multivend transaction. This may assume a value between 0 and 250 multiples of the lowest coin, in lowest coin steps. If the coin credit remaining following a Multivend transaction is greater than this programmed value no change will be paid. The full credit will be retained until further vends are taken to reduce the credit below this "Maximum Change" level.

## PRODUCT SPECIFICATION

Description: BDV 001

### 7.2.7 FILE TYPE 6 : FUNCTION TABLE 3 - COIN INHIBITS

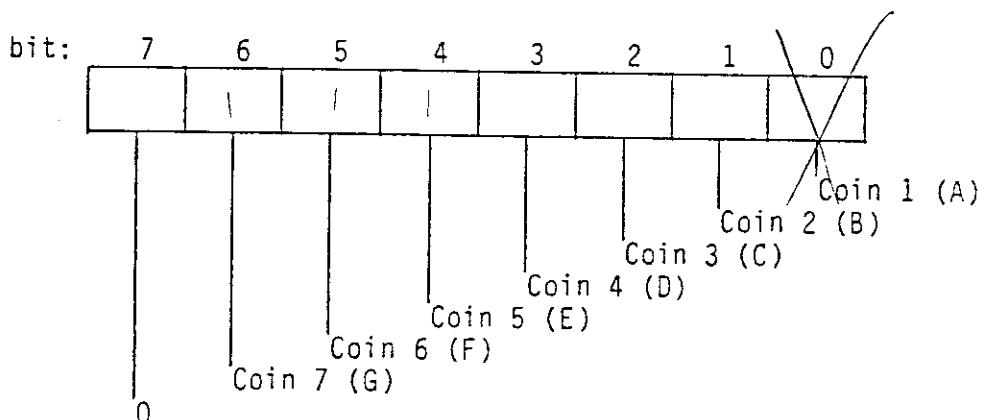
This File Type is used to change the Coin Mechanism Link Master parameters of Low change acceptance and Individual Coin Inhibit.

#### Data-byte Index      Data

0	Low Change Inhibit (Coins 1 - 7)
1	Low Change Inhibit (Coins 8 - 14)
2	Individual Coin Inhibit (Coins 1 - 7)
3	Individual Coin Inhibit (Coins 8 - 14)
4	CHECKSUM Byte 1
5	CHECKSUM Byte 2

The bits of each of the Data-bytes 0 - 3 of this datablock, indicate when set, that the relevant coin is inhibited when the situation occurs, i.e.

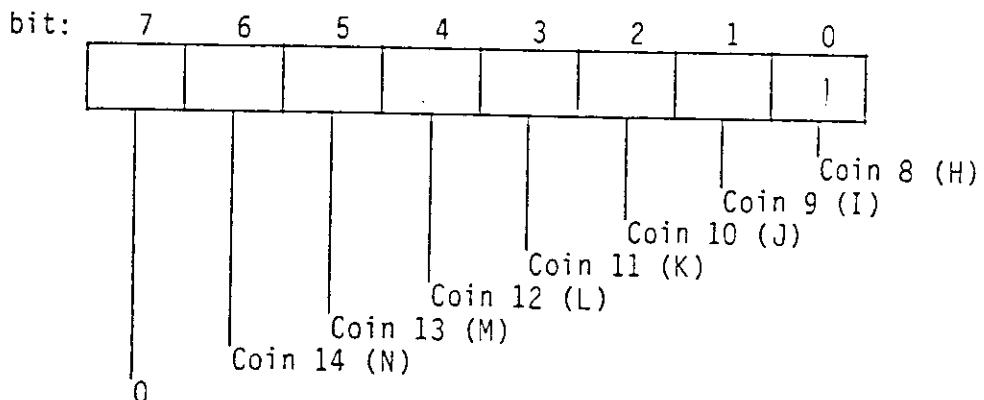
Byte 0 and Byte 2



## PRODUCT SPECIFICATION

Description: BDV 001

Byte 1 and Byte 3



Reserved codes must be returned as 0 and used as such for calculation of the Checksum.

Link Unit Datafile Sources: Link Master, VMC, Audit Unit, Cashless Payment Controller

Link Unit Datafile Receivers: Link Master, VMC, Audit Unit, Cashless Payment Controller

### Filetype 6 Parameter Definition

Low Change Coin Acceptance Group:

This defines the coin or group of coins that can be accepted when the coin mechanism is signalling a low change situation. The Highest value coin is N, Coin 14.

Individual Coin Inhibits:

This specifies individual coins which will be inhibited at all times.

### 7.2.8 FILE TYPE 7 : FUNCTION TABLE 4 - OPERATION

This File Type is used to change the Coin Mechanism parameters of Multivend/Singlevend, Escrow Return Inhibit, and set which Peripheral is installed. The Link Master I.D. for Audit purposes is also programmed via this Filetype.

Note: Once installed the Audit Unit cannot be removed.

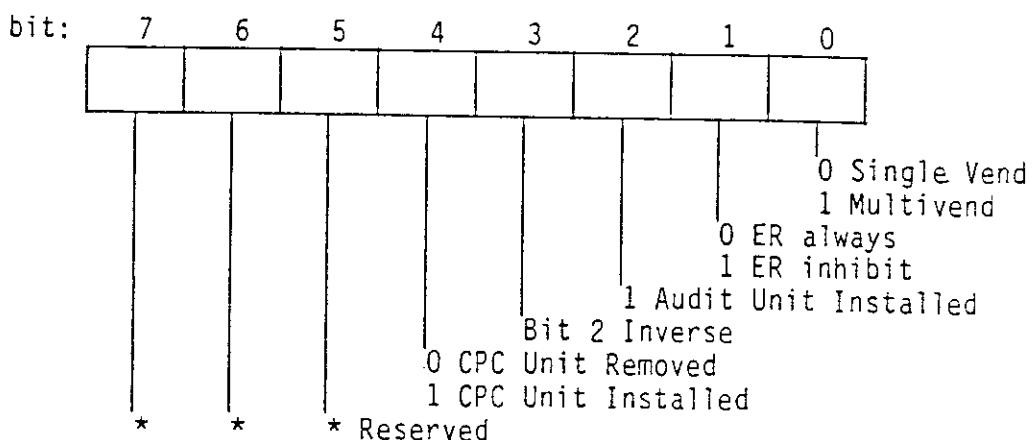
## PRODUCT SPECIFICATION

Description: BDV 001

### Data-byte Index      Data

0	Multi/Singlevend; ER Inhibit; Installed Peripheral
1 -> 3	Link Master I.D. - 3 bytes BCD
4	CHECKSUM Byte 1
5	CHECKSUM Byte 2

The bits of Data-byte 0 of this data block are defined:



Reserved codes must be returned as 0 and used as such for calculation of the Checksum.

The link master I.D. has a maximum value of 9999.

Link Unit Datafile Sources: Link Master, VMC, Audit Unit, Cashless Payment Controller

Link Unit Datafile Receivers: Link Master, VMC, Audit Unit, Cashless Payment Controller

### Filetype 7 Parameter Definition

Multivend/Singlevend:

This allows the selection of Multi or Single vend mode of operation. In Multivend change is not automatically returned on completion of a successful vend. Instead the remaining credit is held by the coin mechanism so allowing further vends to take place without inserting more credit. Transaction termination is indicated by operating ER (via the reject lever) whereupon, providing the credit held is less than the max change value, change will be paid and the credit zeroed.

## PRODUCT SPECIFICATION

Description: BDV 001

### Escrow Return Inhibit:

This controls whether the coin mechanism inhibits the ER function until after the first vend or allows it at all times. If set then changegiving will be inhibited until the first vend has taken place. However, if a vend was attempted and failed for whatever reason, change would be paid if requested.

### Installed Peripheral:

This notifies the coin mechanism that peripherals have been installed on to or removed from the serial link.

The Audit Unit, once installed, is not removable by the user.

### Link Master I.D.:

This value (3 byte packed BCD) is sent to the Audit Unit as the Link Master identification code in response to the Audit Unit Identify request.

### 7.2.9 FILE TYPE 8 : CPC DISPLAY

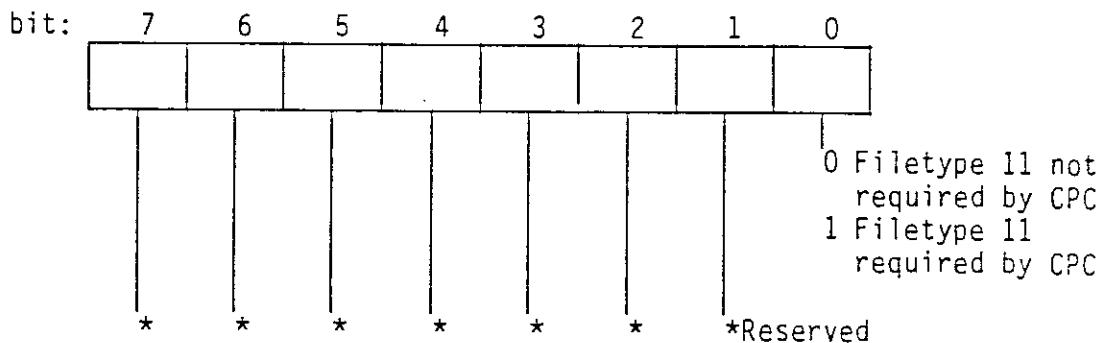
This File type is required by the Link Master to determine whether to transfer the System Credit value (Filetype 11) to the CPC connected to the System. The Link Master will use this instruction as a volatile switch requiring updating on every power up. The default will be not to issue the CPC with Filetype 11. Note this transfer will be in addition to the Filetype 11 transferred to the VMC.

<u>Data-byte Index</u>	<u>Data</u>
0	Display Mode
1	CHECKSUM Byte 1
2	CHECKSUM Byte 2

## PRODUCT SPECIFICATION

Description: BDV 001

The bits of Byte 0 of this data block are defined:



Reserved bits must be returned as 0 and used as such for calculation of the Checksum.

Datafile Sources: CPC  
Datafile Receivers: Link Master

### 7.2.10 FILE TYPE 9 : ACTUAL VEND PRICE

The Link Master uses this File Type to inform the VMC what price (in real currency) was charged for the requested vend. The VMC will use this information for internal auditing.

<u>Data-byte Index</u>	<u>Data</u>
0	BCD Actual Vend Price Digits 1 & 2
1	BCD Actual Vend Price Digits 3 & 4
2	Vend Veto & BCD Actual Vend Price Digit 5
3	CHECKSUM Byte 1
4	CHECKSUM Byte 2

## PRODUCT SPECIFICATION

Description: BDV 001

The Nibbles of Data-bytes 0 and 1 and also the Least Significant Nibble of Data-byte 2 are the digits (in BCD) of the 5 digit actual vend price, i.e.

DIGIT 5 DIGIT 4 DIGIT 3 DIGIT 2 DIGIT 1

00000	00000	00000	00000	00000
0 0	0 0	0 0	0 0	0 0
00000	00000	00000	00000	00000
0 0	0 0	0 0	0 0	0 0
00000	00000	00000	00000	00000

22  
Data-byte 0 L.S.nibble

1  
Data-byte 0 M.S.nibble

1  
Data-byte 1 L.S. nibble

1  
Data-byte 1 M.S. nibble

1  
Data-byte 2 L.S. nibble

The most significant bit of Data-byte 2 is set to a 1 if the requested vend was vetoed by the CPC.

Bits 4, 5 and 6 of Data-byte 2 are reserved and should be returned as zero and used as such in the Checksum calculation.

Datafile Sources : Link Master

Datafile Receivers : VMC

### 7.2.11 FILE TYPE 10 : VMC VEND REQUEST

The Cashless Payment Controller may be sent this Datafile from the Link Master only. It indicates the price (in real currency) and the Selection Number of the requested vend. Should the Vend Request come from a non BDV001 Standard VMC and so not supply a Selection Number then the Selection Number byte will be identified as invalid.

## PRODUCT SPECIFICATION

Description: BDV 001

<u>Data-byte Index</u>	<u>Data</u>
0	BCD Price Value Digits 1 & 2
1	BCD Price Value Digits 3 & 4
2	Valid Sel. Nos. & BCD Price Value Digit 5
3	Selection Number (0-99) BCD
4	CHECKSUM Byte 1
5	CHECKSUM Byte 2

The Nibbles of Data-bytes 0 and 1 and also the Least Significant Nibble of Data-byte 2 are the digits (in BCD) of the 5 digit price level. The M.S. bit of Data-byte 2 must be cleared to a 0 if the Selection Number in Data-byte 3 is valid. When set this indicates that Data-byte 3 is an invalid representation of the Selection Number. The remaining bits of Data-byte 3's M.S. nibble must be set to 0 and used as such in the checksum calculation.

### PRICE VALUE

DIGIT 5 DIGIT 4 DIGIT 3 DIGIT 2 DIGIT 1

00000	00000	00000	00000	00000
0 0	0 0	0 0	0 0	0 0
00000	00000	00000	00000	00000
0 0	0 0	0 0	0 0	0 0
00000	00000	00000	00000	00000

  |   |   |   |   |  
Data-byte 1 L.S.nibble

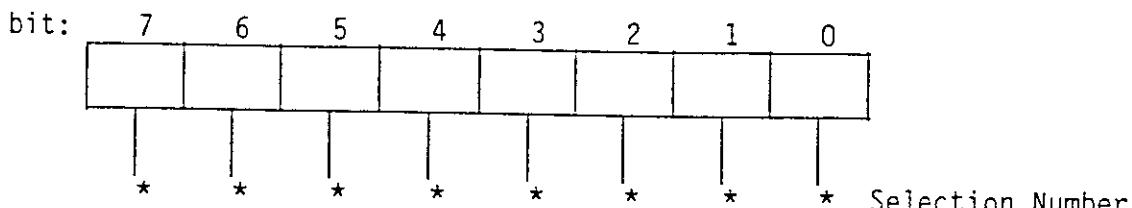
  |   |   |   |  
Data-byte 1 M.S.nibble

  |   |   |  
Data-byte 2 L.S. nibble

  |   |   |  
Data-byte 2 M.S. nibble

  |   |   |  
Data-byte 3 L.S. nibble

The bits of Byte 3 of this data block are defined:



Datafile Sources : Link Master

Datafile Receivers : Cashless Payment Controller

Page 75  
Edition 5

Prod.Spec.Ref: BDV-73

## PRODUCT SPECIFICATION

Description: BDV 001

### 7.2.12 FILE TYPE 11 : SYSTEM CREDIT

The Link Master will transfer the 5 digit credit value to a BDV Real Currency VMC via File Type 11. This Filetype also contains information on the coin set implemented on the Link Master. The VMC may need this information to aid its price setting and credit display function. This Filetype is transferred on Power up and immediately following every change in system credit value.

<u>Data-byte Index</u>	<u>Data</u>
0	BCD Credit, Display Digits 1 & 2
1	BCD Credit, Display Digits 3 & 4
2	Exact Change, Decimal Point Position, . BCD Credit Display Digit 5
3	Lowest Coin Real Currency Value BCD Digits 0 & 1
4	Lowest Coin Real Currency Value BCD Digits 2 & 3
5	CHECKSUM Byte 1
6	CHECKSUM Byte 2

The Nibbles of Data-bytes 0 and 1 and also the Least Significant Nibble of Data-byte 2 are the display digits (in BCD) of the 5 digit credit level. i.e.

CREDIT DISPLAY

DIGIT 5 DIGIT 4 DIGIT 3 DIGIT 2 DIGIT 1

00000	00000	00000	00000	00000
0 0	0 0	0 0	0 0	0 0
00000	00000	00000	00000	00000
0 0	0 0	0 0	0 0	0 0
00000 *	00000 *	00000 *	00000 *	00000

```

    | Data-byte 0 L.S. nibble
    | Data-byte 0 M.S. nibble
    | Data-byte 1 L.S. nibble
    | Data-byte 1 M.S. nibble
    | Data-byte 2 L.S. nibble
  
```

## PRODUCT SPECIFICATION

Description: BDV 001

The Most Significant bit of Data-byte 2 is used to signify the Exact Change state of the Link Master. When set this indicates that the Link Master is in an Exact Change state and the user should be informed of a possible short change condition. When clear then the Link Master has sufficient coin storage to pass the exact change equation as programmed via FILETYPE 5.

The value (in the range 0 - 5) of the 3 lower bits of the nibble (bits 4, 5 and 6 of the byte), represents the exponent plus 1 in the relationship between real currency units and any higher denomination in the currency. This thus indicates the position of the decimal point on the display, as defined below. A value of zero indicates no decimal point illuminated.

00000	00000	00000	00000	00000
0 0	0 0	0 0	0 0	0 0
00000	00000	00000	00000	00000
0 0	0 0	0 0	0 0	0 0
00000 *	00000 *	00000 *	00000 *	00000 *
Value 1, EXP = 0				
Value 2, EXP = 1				
Value 3, EXP = 2				
Value 4, EXP = 3				
Value 5, EXP = 4				

Data-byte 3 and 4 is the value in real currency units of the lowest coin in the coin set. This is transmitted in BCD format.

Datafile Sources : Link Master.

Datafile Receivers : VMC or Cashless Payment Controller.

### 7.2.13 FILE TYPE 12 : DECREMENT

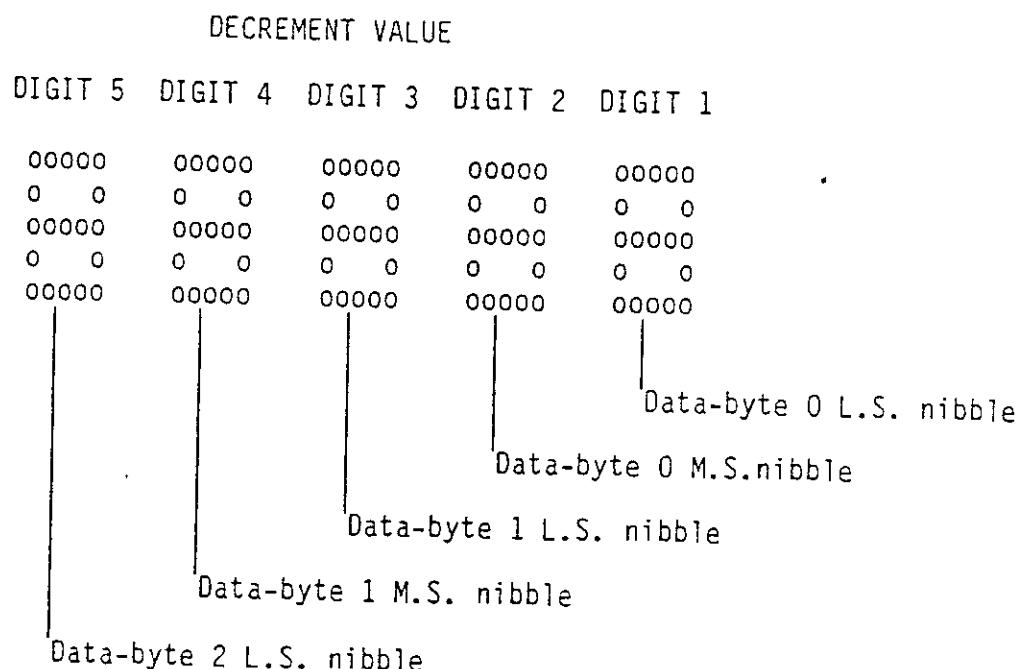
This Filetype is used by the Link Master to transfer to a Cashless Payment Controller the 5 BCD digit Decrement value. This may be transmitted prior to authorising the VMC to proceed with a vend.

## PRODUCT SPECIFICATION

Description: BDV 001

<u>Data-byte Index</u>	<u>Data</u>
0	BCD Decrement Value Digits 1 & 2
1	BCD Decrement Value Digits 3 & 4
2	BCD Decrement Value Digit 5
3	CHECKSUM Byte 1
4	CHECKSUM Byte 2

This may be represented diagramatically:



The Most Significant nibble of Data-byte 2 must be returned as 0 and used as such in the Checksum calculation.

Datafile Sources : Link Master.

Datafile Receivers : Cashless Payment Controller.

### FILE TYPE 13 : CREDIT INCREASE

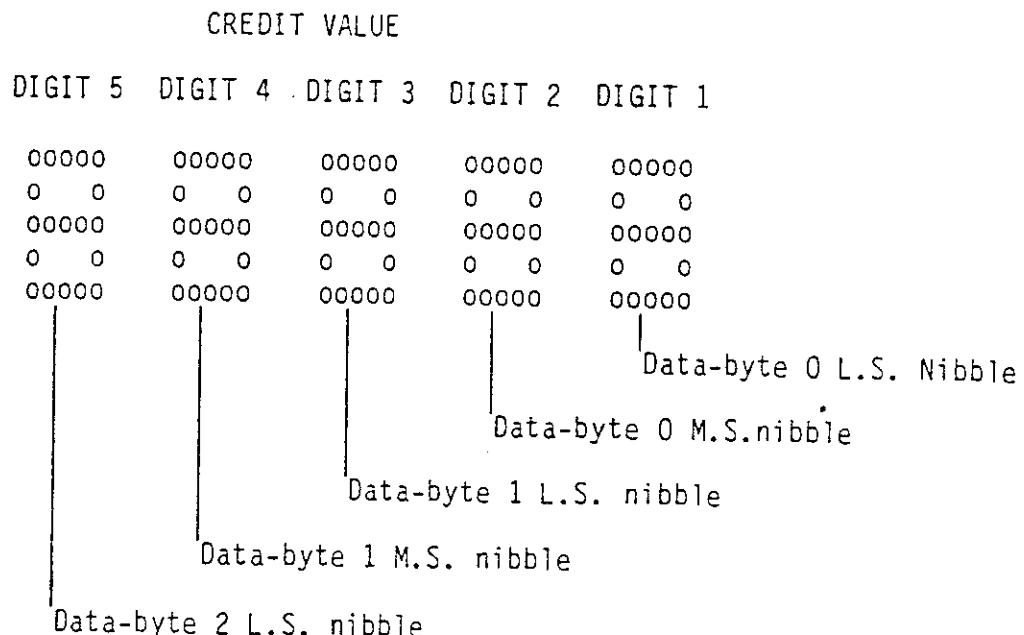
This Filetype is used by a BDV Protocol Cashless Payment Controller to transfer to the Link Master the 5 BCD digit credit increase value.

<u>Data-byte Index</u>	<u>Data</u>
0	BCD Credit Value Digits 1 & 2
1	BCD Credit Value Digits 3 & 4
2	BCD Credit Value Digit 5
3	CHECKSUM Byte 1
4	CHECKSUM Byte 2

## PRODUCT SPECIFICATION

Description: BDV 001

This may be represented diagramatically:



The Most Significant nibble of Data-byte 2 must be returned as 0 and used as such in the Checksum calculation.

Datafile Sources : Cashless Payment Controller  
Datafile Receivers : Link Master.

### 7.2.15 FILE TYPE 14 : MAINTENANCE

This file type will be used to download maintenance information from a Link Master to a VMC.

This file consists of 5 data bytes.

Datafile Source : Link Master  
Datafile Receiver : VMC

Refer to manufacturer's Product Specification for details.

### 7.2.16 FILE TYPE 15 : VEND PARAMETERS

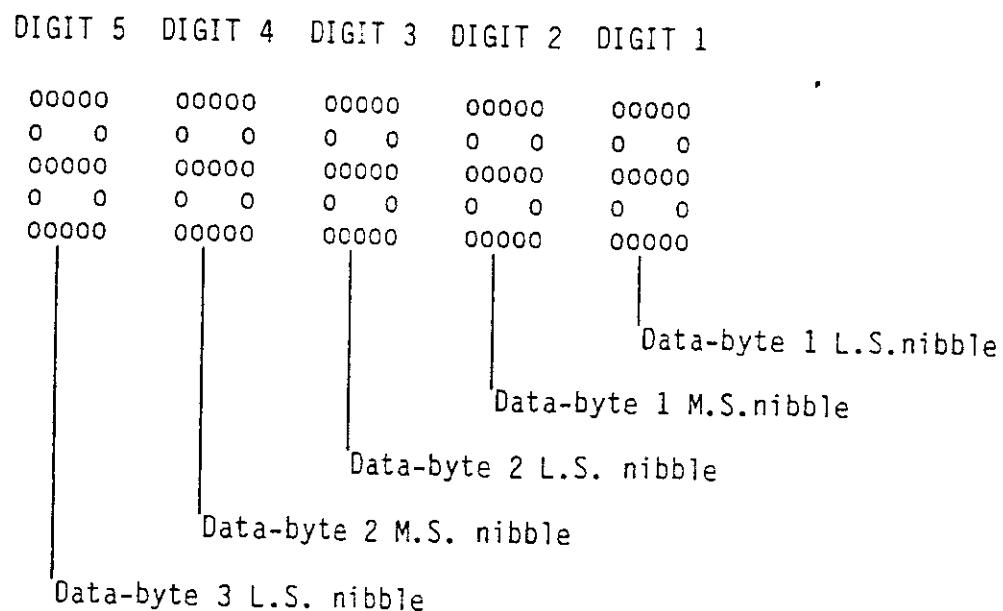
The Cashless Payment Controller uses this File Type to inform the Link Master what price (in real currency) should be charged for the requested vend. the Link Master will use this price to decide whether to grant or refuse authority to the VMC to vend that product line. The Cashless Payment controller may also instruct the Link Master to veto the vend.

## PRODUCT SPECIFICATION

Description: BDV 001

<u>Data-byte Index</u>	<u>Data</u>
0	BCD Price Value Digits 1 & 2
1	BCD Price Value Digits 3 & 4
2	Vend Veto & BCD Price Value Digit 5
3	CHECKSUM Byte 1
4	CHECKSUM Byte 2

The Nibbles of Data-bytes 0 and 1 and also the Least Significant Nibble of Data-byte 2 are the digits (in BCD) of the 5 digit price level. i.e.



The most significant bit of Data-byte 2 is set to a 1 if the requested vend should not proceed, irrespective of the credit level. If the decision is to be based on a price to credit comparison then this bit will be zero. Bits 4,5 and 6 of data-byte 2 are reserved and should be returned as zero and used as such in the Checksum calculation.

Datafile Sources : Cashless Payment Controller.

Datafile Receivers : Link Master.

## PRODUCT SPECIFICATION

Description: BDV 001

### 7.2.17 FILE TYPE 16 : DENIAL DATAFILE

This File Type may be used by any peripheral. It is sent by a Link Unit in answer to a FILETYPE 0 when it cannot transmit the requested file. Byte 1 (sourced from peripheral ident) is redundant and identical to the sourcing device (transmitting peripheral ident).

<u>Data-byte Index</u>	<u>Data</u>
0	Requested File Type
1	Sourced from Peripheral Ident
2	Checksum Byte 1
3	Checksum Byte 2

Datafile Sources : Link Master, VMC, Audit Unit, Cashless Payment Controller

Datafile Receivers : Link Master, VMC, Audit Unit, Cashless Payment Controller

### 7.2.18 FILE TYPE 17 : MAINTENANCE REQUEST

This File Type will be used by a VMC to request and terminate the downloading of maintenance information in Datafile 14 from a Link Master. Bit 2 is required when the Link Master is a coin mechanism for manual filling the tubes.

NOTE: For integrity of audit information no money should be taken from the cashbox during manual filling of tubes without being audited as collected.

If the coin mechanism contains a keyboard to dispense coins then this function must be inactive after power up/reset. The keyboard may be activated by setting bit 3 of databyte 0.

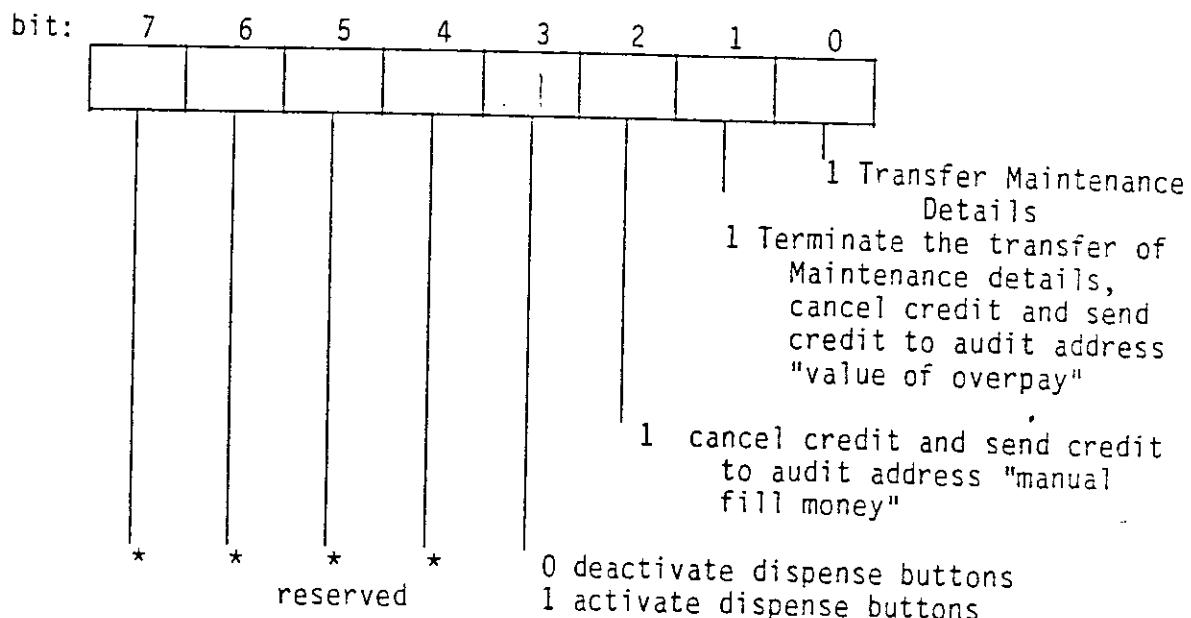
If a coin manufacturer desires, activation may also be carried out with a tool operated switch.

<u>Data-byte Index</u>	<u>Data</u>
0	Request/Terminate Maintenance; cancel credit; dispense buttons
1	Checksum Byte 1
2	Checksum Byte 2

## PRODUCT SPECIFICATION

Description: BDV 001

The bits of Byte 0 of this data block are defined:



Reserved bits must be returned as 0 and used as such for calculation of the Checksum.

Datafile Sources : VMC

Datafile Receivers : Link Master

### 7.2.19 FILE TYPE 18 : TOKEN "A" VALUE

This File Type may be used by a VMC to set a real currency value to token A. The value is limited to a maximum value equivalent to 65535 lowest coin multiples.

<u>Data-byte Index</u>	<u>Data</u>
0	Real Currency Value BCD Digits 1 & 2
1	Real Currency Value BCD Digits 3 & 4
2	Real Currency Value BCD Digit 5 (M.S. Nibble = 0)
3	Checksum Byte 1
4	Checksum Byte 2

Datafile Sources: VMC

Datafile Receivers: Link Master

Page 82  
Edition 5

Prod.Spec.Ref: BDV-80

## PRODUCT SPECIFICATION

Description: BDV 001

### 7.2.20 FILE TYPE 19 : TOKEN "B" VALUE

This File Type may be used by a VMC to set a real currency value to token B. The value is limited to a maximum value equivalent to 65535 lowest coin multiples.

<u>Data-byte Index</u>	<u>Data</u>
0	Real Currency Value BCD Digits 1 & 2
1	Real Currency Value BCD Digits 3 & 4
2	Real Currency Value BCD Digit 5 (M.S. Nibble = 0)
3	Checksum Byte 1
4	Checksum Byte 2

Datafile Sources: VMC

Datafile Receivers: Link Master

### 7.2.21 FILE TYPE 20 : TOKEN "C" VALUE

This File Type may be used by a VMC to set a real currency value to token C. The value is limited to a maximum value equivalent to 65535 lowest coin multiples.

<u>Data-byte Index</u>	<u>Data</u>
0	Real Currency Value BCD Digits 1 & 2
1	Real Currency Value BCD Digits 3 & 4
2	Real Currency Value BCD Digit 5 (M.S. Nibble = 0)
3	Checksum Byte 1
4	Checksum Byte 2

Datafile Sources: VMC

Datafile Receivers: Link Master

### Filetype 18, 19 and 20 Description

These filetypes allow tokens to be interpreted by Coin Mechanism Link Masters as a certain value of real currency credit. This credit level is not dependent on coin multiples. The credit from such tokens may be added to existing or subsequent coin or cashless credit. The acceptance of such a token commits the system to a vend. No change can be given from the remaining token credit, likewise token credit (full or remaining) cannot be added to cashless credit. The Coin Mechanism will use the token credit in preference to cash or cashless credit. Vends paid for by token will be audited as Vended Miscellaneous Cash (Audit Address 23).

## PRODUCT SPECIFICATION

Description: BDV 001

### 7.2.22 FILE TYPE 21 : STANDARD VMC AUDIT FILE

This Filetype is used to allow VMC access of the Standard Audit File. It is of variable length n, defined by byte 2 of the header.

<u>Data-byte Index</u>	<u>Data</u>
0->n-2	Standard Audit File
n-1	Checksum Byte 1
n	Checksum Byte 2

Datafile Sources: VMC

Datafile Receivers: Audit Unit

7.2.23 - 7.2.248 reserved for file types 22 - 247.

### 7.2.249 FILE TYPE 248

Reserved for use by Mars Electronics.

### 7.2.250 FILE TYPE 249

Reserved for use by Mars Electronics.

### 7.2.251 FILE TYPE 250 : EXPANSION BLOCK 1

This Filetype is used to allow an expansion capability beyond the maximum of 250 Filetypes allowed in the BDV001 File Type Header. The Filetype identity is now specified by data-byte 0.

<u>Data-byte Index</u>	<u>Data</u>
0	Expansion Block 1 Filetype Ident
1 -> n-2	Filetype data-bytes
n-1	Checksum Byte 1
n	Checksum Byte 2

Datafile Sources : Link Master, VMC, Audit Unit, Cashless Payment Controller

Datafile Receivers : Link Master, VMC, Audit Unit, Cashless Payment Controller

PRODUCT SPECIFICATION

Description: BDV 001

8.

APPENDIX C

DATALINK TRANSFER SCHEMATICS

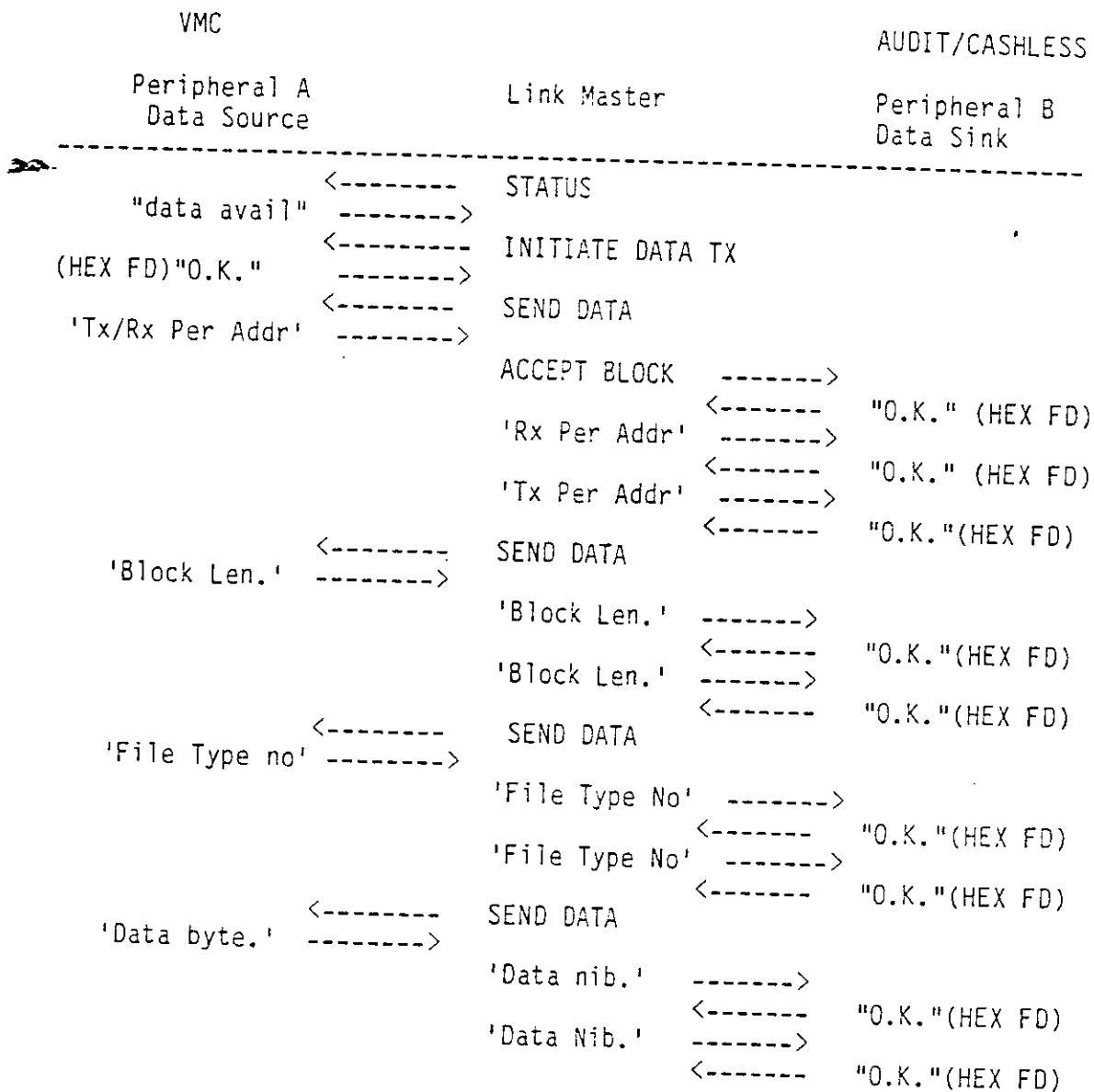
This section presents schematic diagrams illustrating the data transfer process defined in this document. It is by no means complete but is intended to clarify the key issues in the transfer process.

# PRODUCT SPECIFICATION

Description: BDV 001

## 8.1 VMC/AUDIT DATAFILE SOURCE

This data transfer path, from VMC/Audit to Cashless/Audit is used to demonstrate the Peripheral to Peripheral data transfer mechanism. The mechanisms demonstrated are applicable for all sourcing and receiving peripherals including the Link Master.



PRODUCT SPECIFICATION

Description: BDV 001

! ! !

'Data byte.' <-----> SEND DATA

'Data nib.' -----> <----- "O.K."(HEX FD)

'Data Nib.' -----> <----- "O.K."(HEX FD)

DATA SYNC -----> <----- "Checksum passed"(FD)

-----> BLOCK ACK

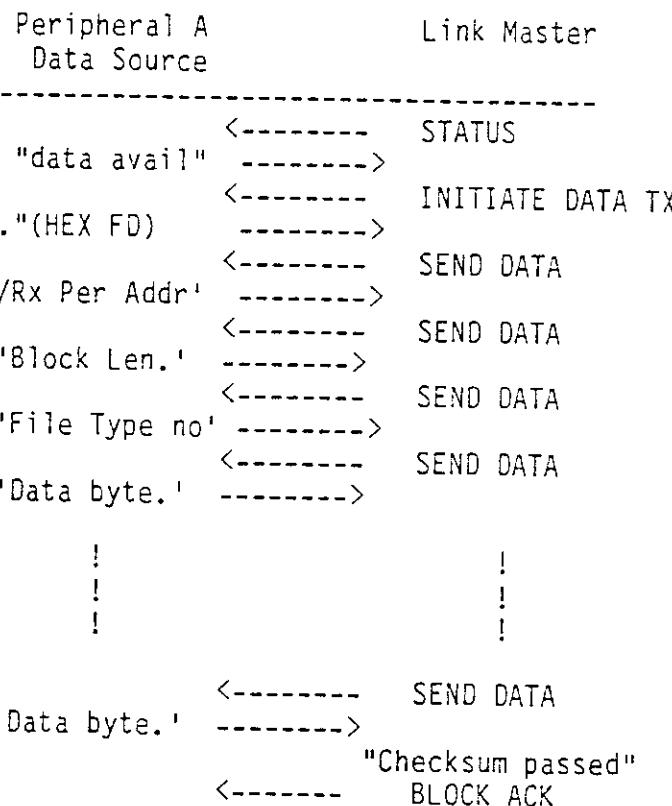
cancels "data avail"

## PRODUCT SPECIFICATION

Description: BDV 001

### 8.1.1 VMC/AUDIT -> LINK MASTER

This transfer is a subset of that described above.  
VMC/AUDIT



cancels "data avail"

## PRODUCT SPECIFICATION

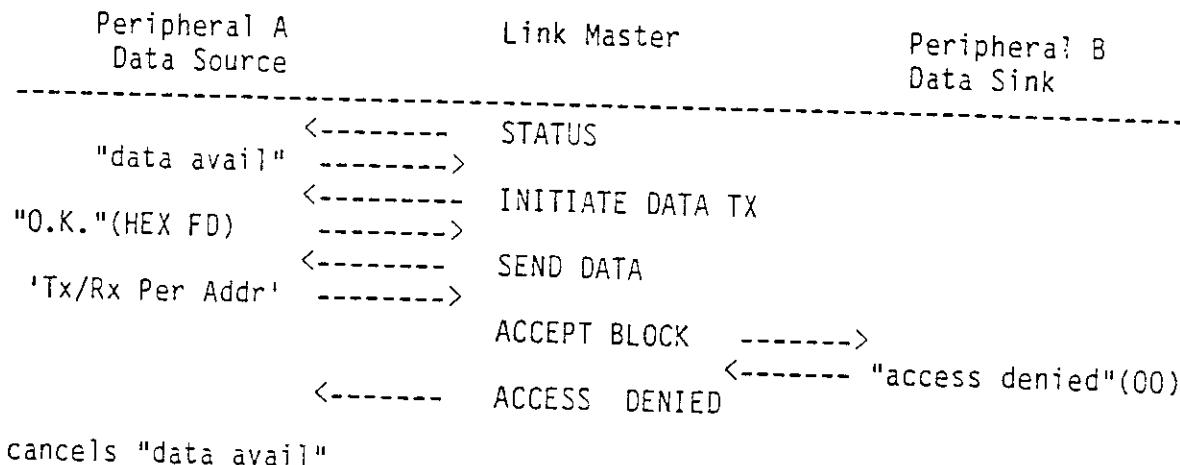
Description: BDV 001

### 8.1.2 Incomplete Transfers

This section describes various types of incomplete data transfers based on the VMC/AUDIT -> CASHLESS PAYMENT CONTROLLER transfer mechanism presented above.

#### 8.1.2.1 Receiving Peripheral Rejects 'A'

Should the receiving peripheral decide that it does not wish to receive a datafile, or be incapable of doing so then it will reply with "access denied" (HEX 00) to the ACCEPT BLOCK command. This will cause the Link Master to issue the ACCESS DENIED command, i.e.

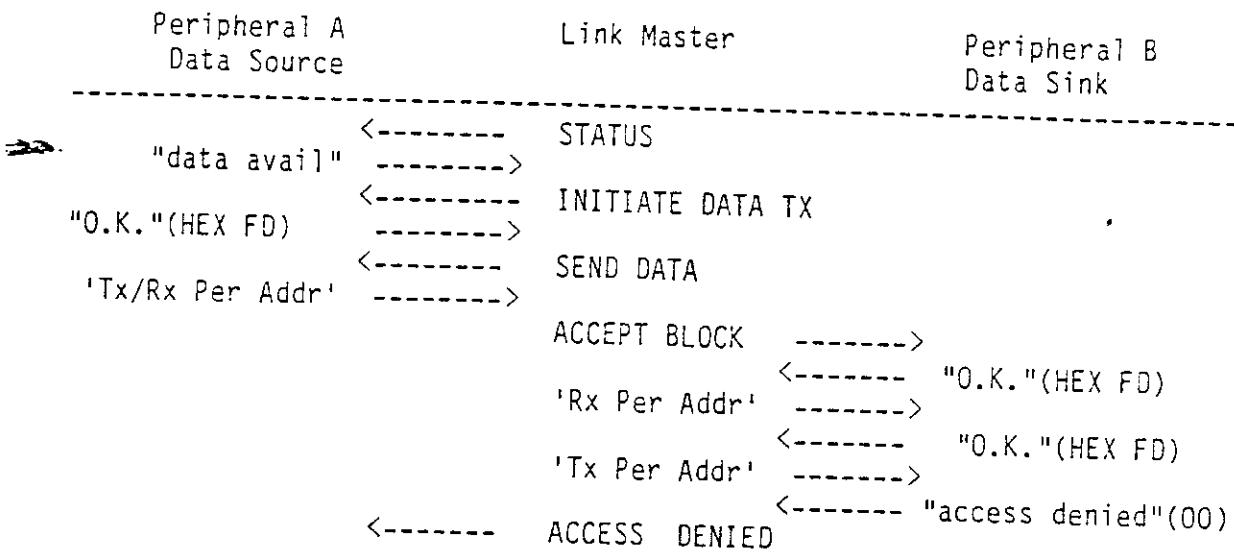


## PRODUCT SPECIFICATION

Description: BDV 001

### 8.1.2.2 Receiving Peripheral Rejects 'B'

Should the receiving peripheral decide at any time during its reception of a datafile that it does not wish to continue then it will reply with "access denied" (HEX 00) to any data nibble within the Datafile. This will cause the Link Master to issue the ACCESS DENIED command, i.e.

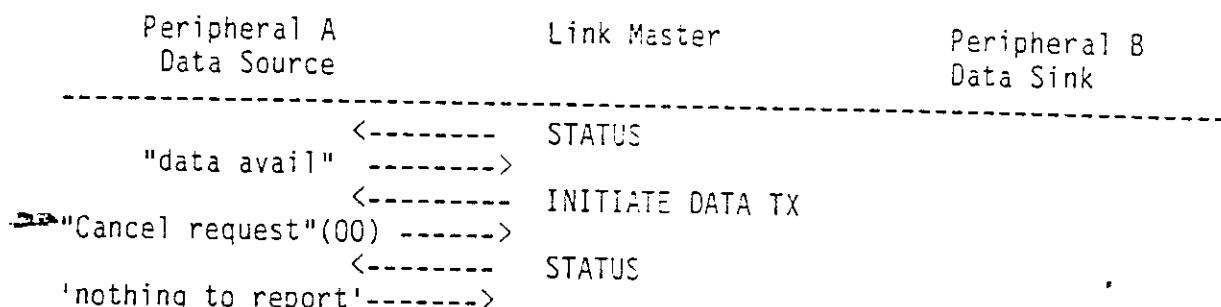


## PRODUCT SPECIFICATION

Description: BDV 001

### 8.1.2.3 Transmitting Peripheral Rejects 'A'

Should the Transmitting peripheral decide that it does not wish to send a datafile it will reply to the INITIATE DATA TRANSFER command with "Cancel request" (HEX 00).



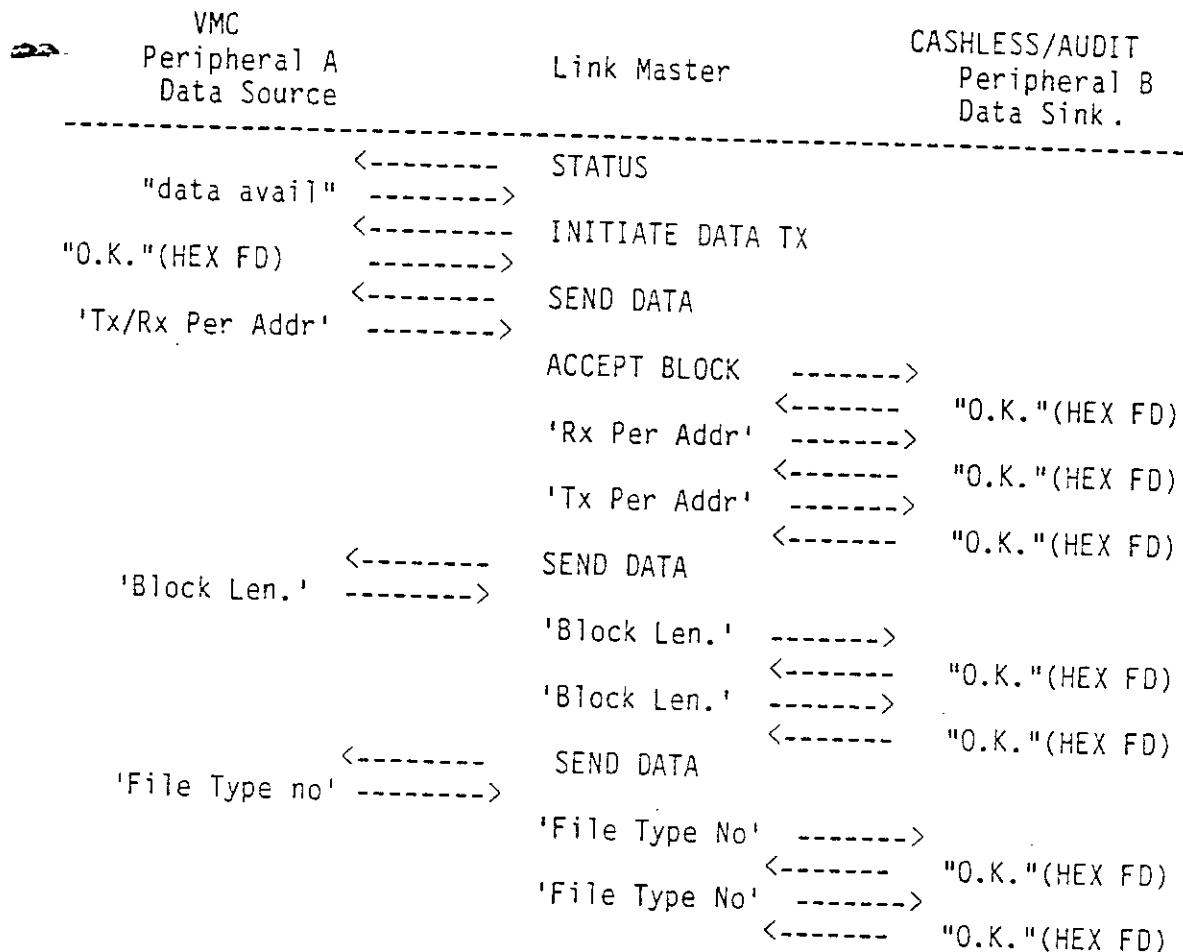
### 8.1.2.4 Transmitting Peripheral Rejects 'B'

Should the Transmitting peripheral decide that it does not wish to continue to send a datafile then it will reply to the following SEND DATA command with a "Sync Lost/Abort" (HEX FE) response. This will take the same format as a Sync Lost by Tx. (see later).

Description: BDV 001

8.1.2.5 Checksum Failure

Should the checksum fail for whatever reason then the Link Master will not issue a BLOCK ACK command. The transmitting peripheral on receiving a STATUS command when a BLOCK ACK was expected can decide whether to reattempt the Datafile Transfer. Should it decide to reattempt the transfer then its 'data available' bit will remain asserted, and the transfer will start again on the next STATUS. It may decide not to continue with the transfer in which case it must cancel its 'data available' bit. These are both illustrated below :



## PRODUCT SPECIFICATION

Description: BDV 001

'Link Master issues a STATUS command instead of a BLOCK ACK command to the Transmitting Peripheral. '

a) The Transmitting Peripheral may decide to reattempt the transfer i.e.

```

    <----- STATUS
"data avail" ----->
    <----- INITIATE DATA TX
"O.K."(HEX FD) ----->
    <----- SEND DATA
'Tx/Rx Per Addr' ----->
    <----- ACCEPT BLOCK ----->
                                <----- "O.K."(HEX FD)
                                etc.

```

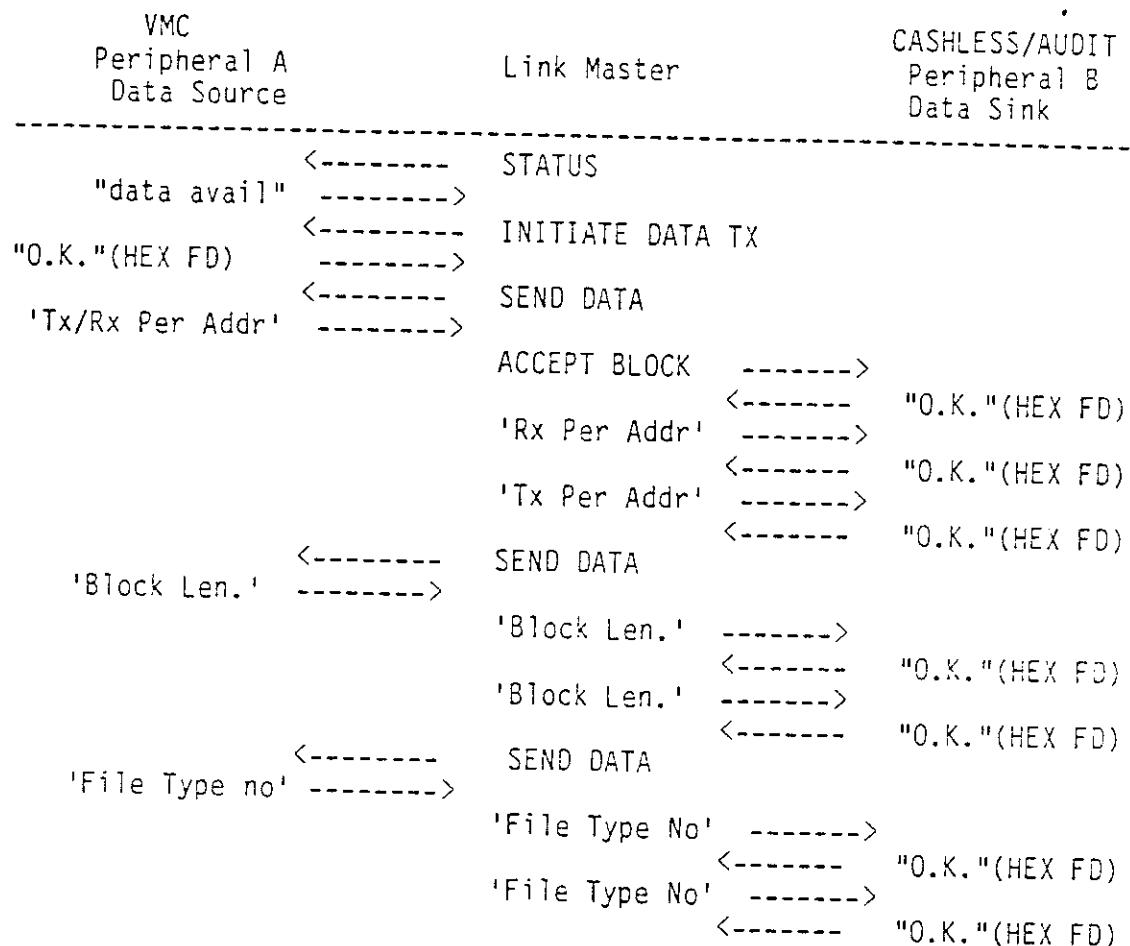
b) Alternatively the Transmitting Peripheral may decide not to reattempt the Datafile transfer i.e

# PRODUCT SPECIFICATION

Description: BDV 001

## 8.1.2.6 Sync Lost By Receiving Peripheral

Should the Synchronisation be lost by the Receiver, i.e. it expected a DATA SYNC command terminating the transfer but received a datanibble then it will return " Sync Lost " (HEX FE) to the data nibble. This will cause the Link Master not to issue a BLOCK ACK command. The transmitting peripheral on receiving a STATUS command when a BLOCK ACK was expected can decide whether to reattempt the Datafile Transfer. Should it decide to reattempt the transfer then its 'data available' bit will remain asserted, and the transfer will start again on the next STATUS. It may decide not to continue with the transfer in which case it must cancel its 'data available' bit. These are both illustrated below :



## PRODUCT SPECIFICATION

Description: BDV 001

```
'Data byte.' <----- SEND DATA
      -----> 'Data nib.' ----->
      'Data nib.' <----- "O.K."(HEX FD)
      -----> COUNT LOST
      'Data Nib.' ----->
      <----- " Sync Lost"(FE)
```

'Link Master issues a STATUS command instead of a BLOCK ACK command to  
the Transmitting Peripheral.'

a) The Transmitting Peripheral may decide to reattempt the transfer i.e.

```
"data avail" <----- STATUS
      -----> "O.K."(HEX FD) -----> INITIATE DATA TX
      'Tx/Rx Per Addr' <----- SEND DATA
      -----> ACCEPT BLOCK ----->
      etc. <----- "O.K."(HEX FD)
```

b) Alternatively the Transmitting Peripheral may decide not to  
reattempt the Datafile transfer i.e.

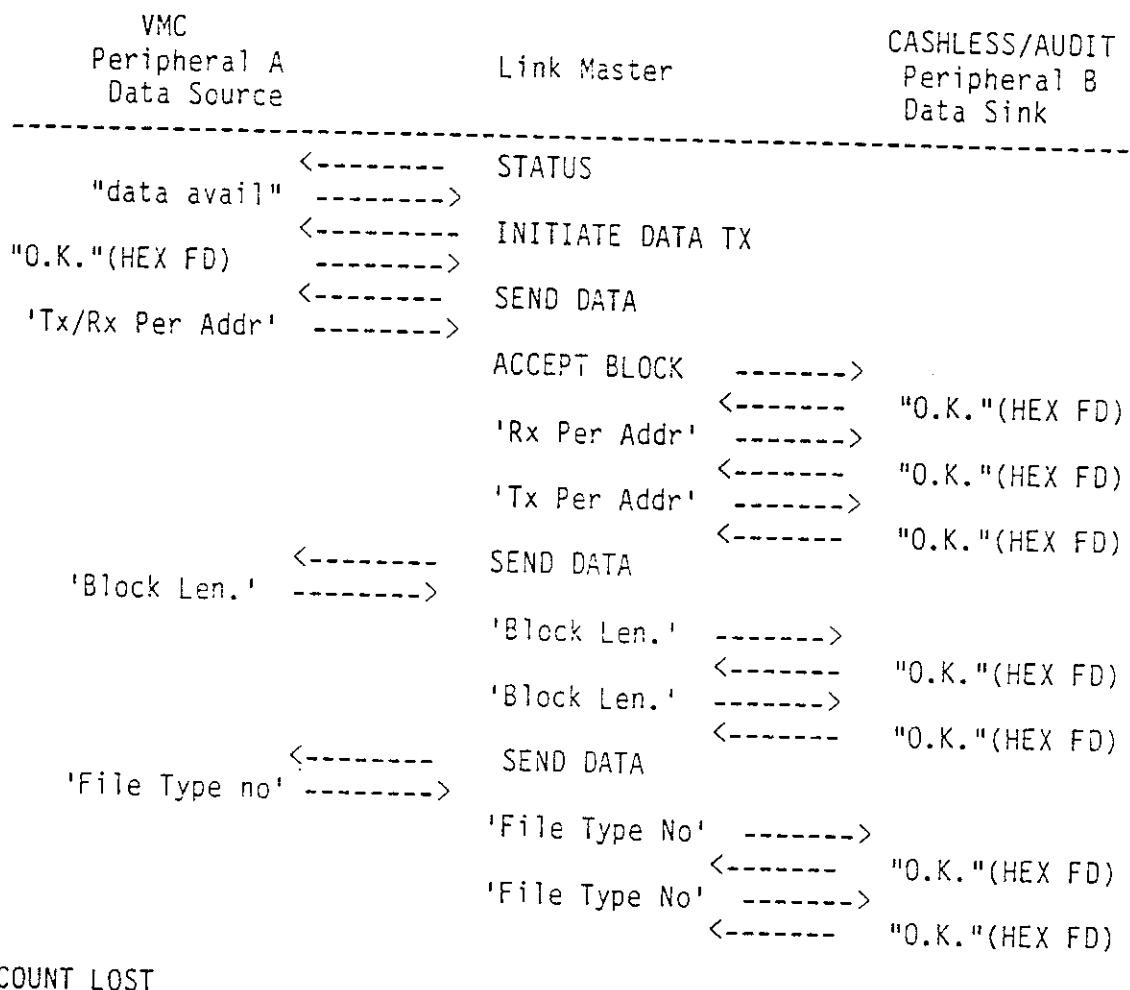
```
<----- STATUS
"nothing to report"-----> STATUS ----->
      etc. <----- "nothing to report"
```

## PRODUCT SPECIFICATION

Description: BDV 001

### 8.1.2.7 Sync Lost By Transmitting Peripheral

Should Synchronisation be lost by the Transmitter i.e. it expected a BLOCK ACK or a STATUS command but received a SEND DATA command then it will return " Sync Lost/Abort " (HEX FE) to the SEND DATA command. This will cause the Link Master to issue a DATA SYNC command to the Receiving Peripheral. A "Lost Sync" response will be replied. A BLOCK ACK will not be issued to the transmitting peripheral. The transmitting peripheral on receiving the following STATUS command can decide whether to reattempt the Datafile Transfer. Should it decide to reattempt the transfer then its 'data available' bit will remain asserted, and the transfer will start again on the next STATUS. It may decide not to continue with the transfer in which case it must cancel its 'data available' bit. These are both illustrated below :



## PRODUCT SPECIFICATION

Description: BDV 001

'Sync Lost '(FE) <----- SEND DATA  
-----> DATA SYNC ----->  
-----> "Lost Sync" (FB)

'Link Master returns to its Peripheral Polling Routine without issuing a BLOCK ACK command to the Transmitting Peripheral.'

- a) The Transmitting Peripheral may decide to reattempt the transfer i.e. '

"data avail" <----- STATUS  
-----> "0.K."(HEX FD) <----- INITIATE DATA TX  
-----> 'Tx/Rx Per Addr' <----- SEND DATA  
-----> ACCEPT BLOCK ----->  
etc. <----- "0.K."(HEX FD)

- b) Alternatively the Transmitting Peripheral may decide not to reattempt the Datafile transfer i.e.

"nothing to report"-----> STATUS  
-----> STATUS ----->  
etc. <----- "nothing to report"

### 8.1.2.8 Sync Lost By Link Master

Should Synchronisation be lost by the Link Master i.e. it transmitted a DATA SYNC before the file was transferred then the receiver will detect a lost Sync and respond accordingly. The transfer will appear identical to the Checksum Failure transfer.

Description: BDV 001

## 8.2 FAILURE MODES

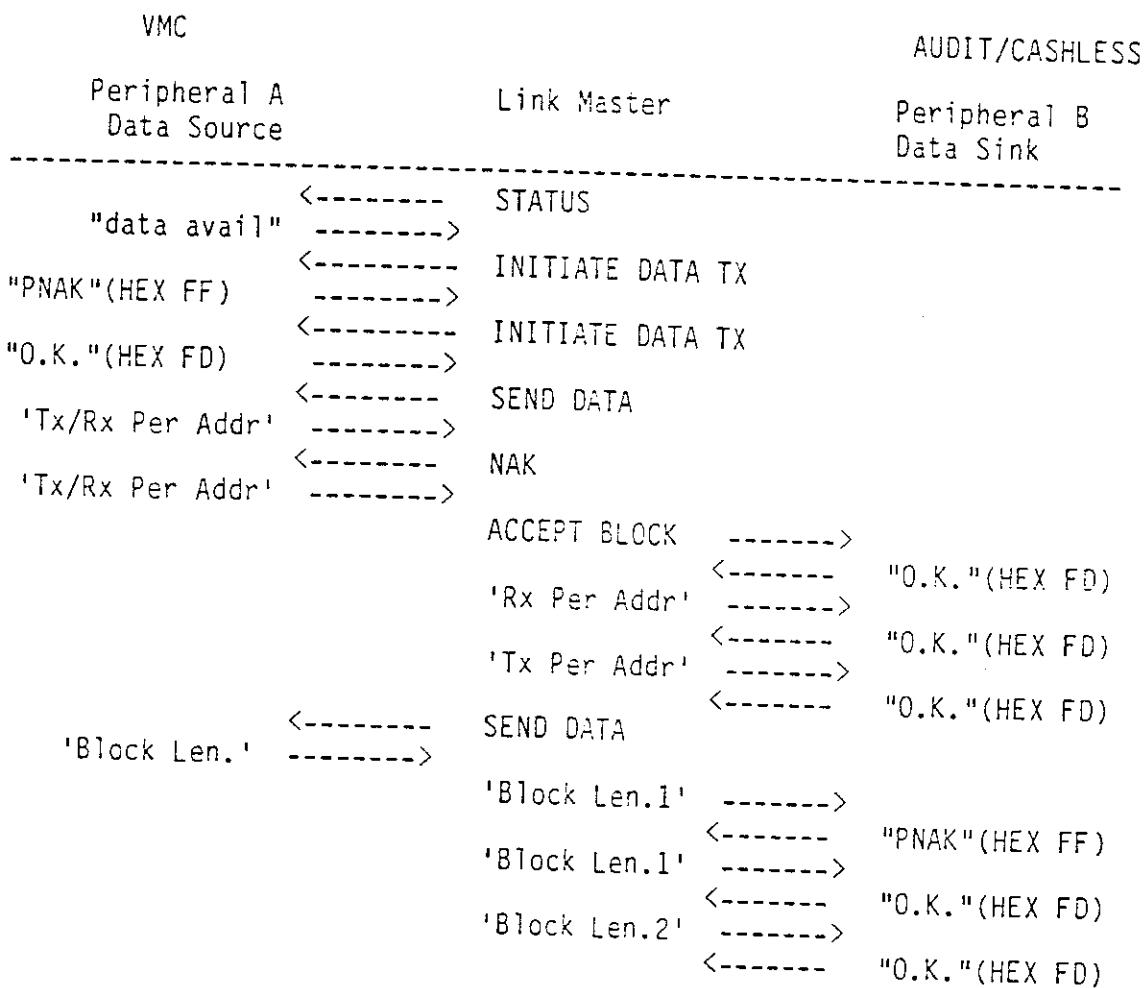
This section of Schematics describes the Link Protocol in various unlikely but possible Fault conditions.

### 8.2.1 Parity Errors

If any peripheral detects a parity, framing or overrun error in a command or data addressed to it then it may respond with a PNAK (HEX FF). This will cause the Link Master to retransmit its last character.

If the Link Master detects a parity, framing or overrun error in any reply from a peripheral it will demand the retransmission of that reply by issuing a NAK command to that peripheral.

Both these failure modes are shown below :



## PRODUCT SPECIFICATION

Description: BDV 001

Sequence of messages:

```
    'File Type no' -----> SEND DATA
    'File Type No' -----> "O.K."(HEX FD)
    'File Type No' -----> "O.K."(HEX FD)
    'Data byte.'  -----> SEND DATA
    'Data nib.1'  -----> "O.K."(HEX FD)
    NAK                  -----> "O.K."(HEX FD)
    'Data Nib.2'  -----> "O.K."(HEX FD)
    'Data Nib.2'  -----> "O.K."(HEX FD)
    etc.
```

If 4 consecutive PNAK's are received or it is necessary to transmit 5 NAK's the Link Master will abandon Datalink communications for 100ms to allow the corrupting noise source to diminish.

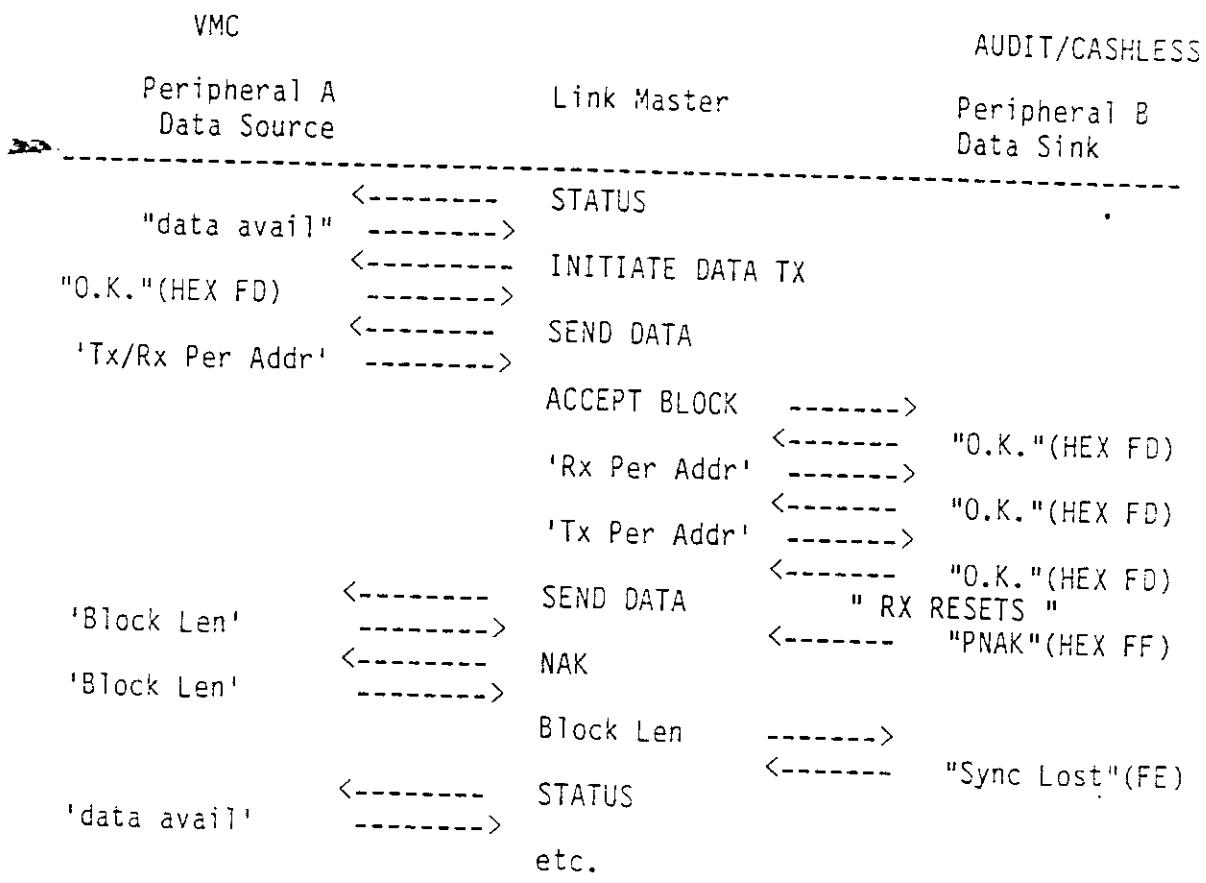
## PRODUCT SPECIFICATION

Description: BDV 001

### 8.2.2 Receiving Peripheral RESET

It is possible for any of the three Link Units to reset during the transfer of a datafile. The system will recover in the following way if the Rx resets during a peripheral to peripheral transfer.

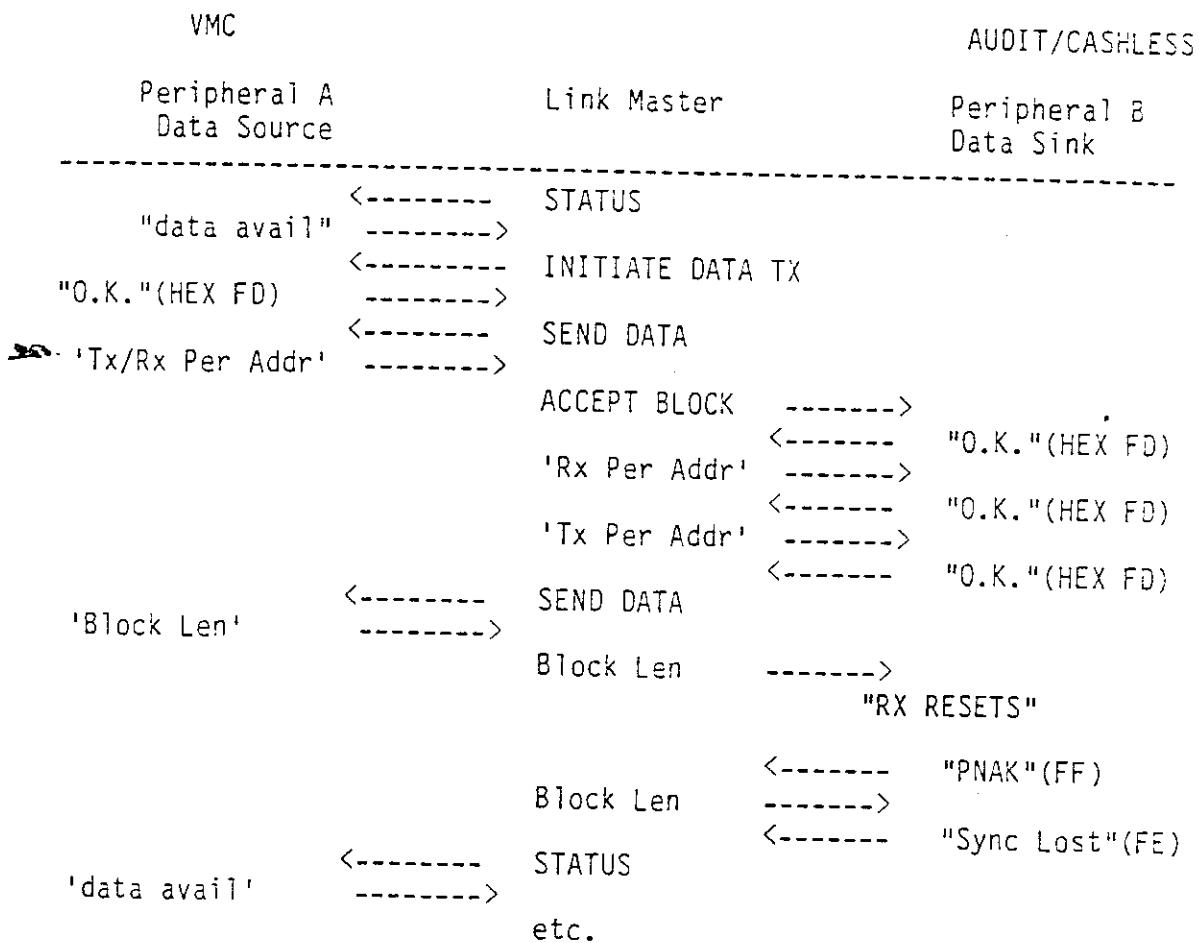
#### a) Power on PNAK corrupts Link Data



## PRODUCT SPECIFICATION

Description: BDV 001

b) Static Link during Peripheral reset.



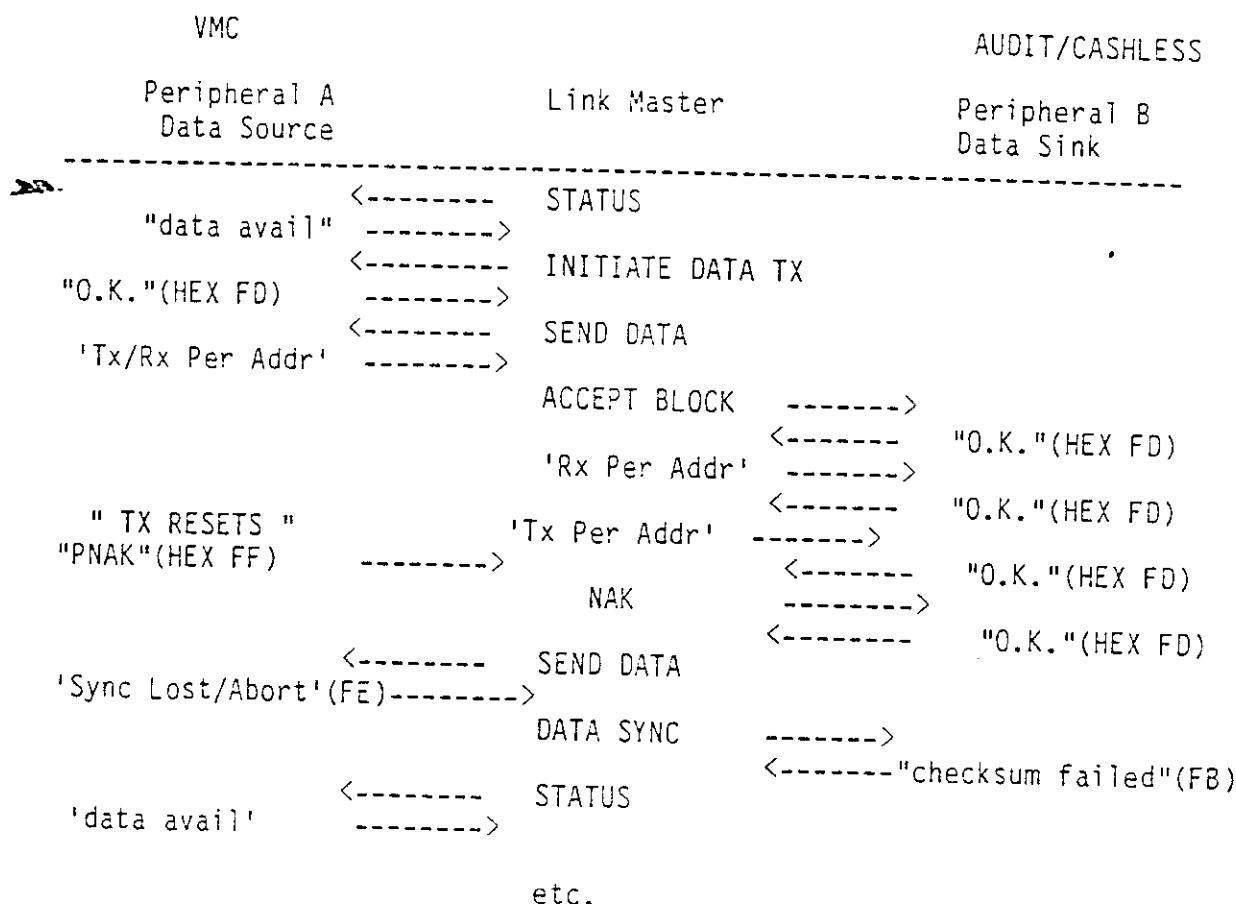
# PRODUCT SPECIFICATION

Description: BDV 001

## 8.2.3 Transmitting Peripheral RESETS

The system will recover in the following way if the Transmitting Peripheral resets.

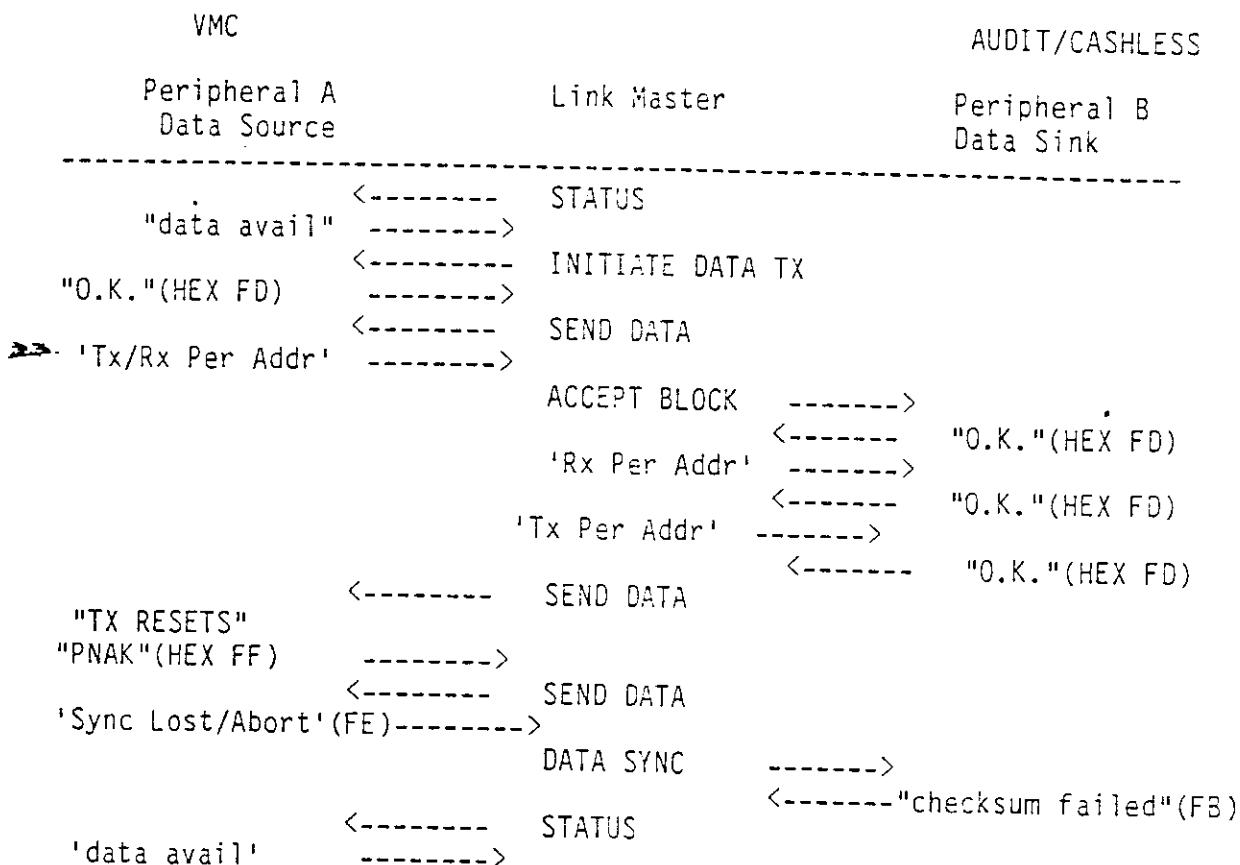
- a) Power up PNAK corrupts Link.



## PRODUCT SPECIFICATION

Description: BDV 001

b) Static Link during Peripheral reset.



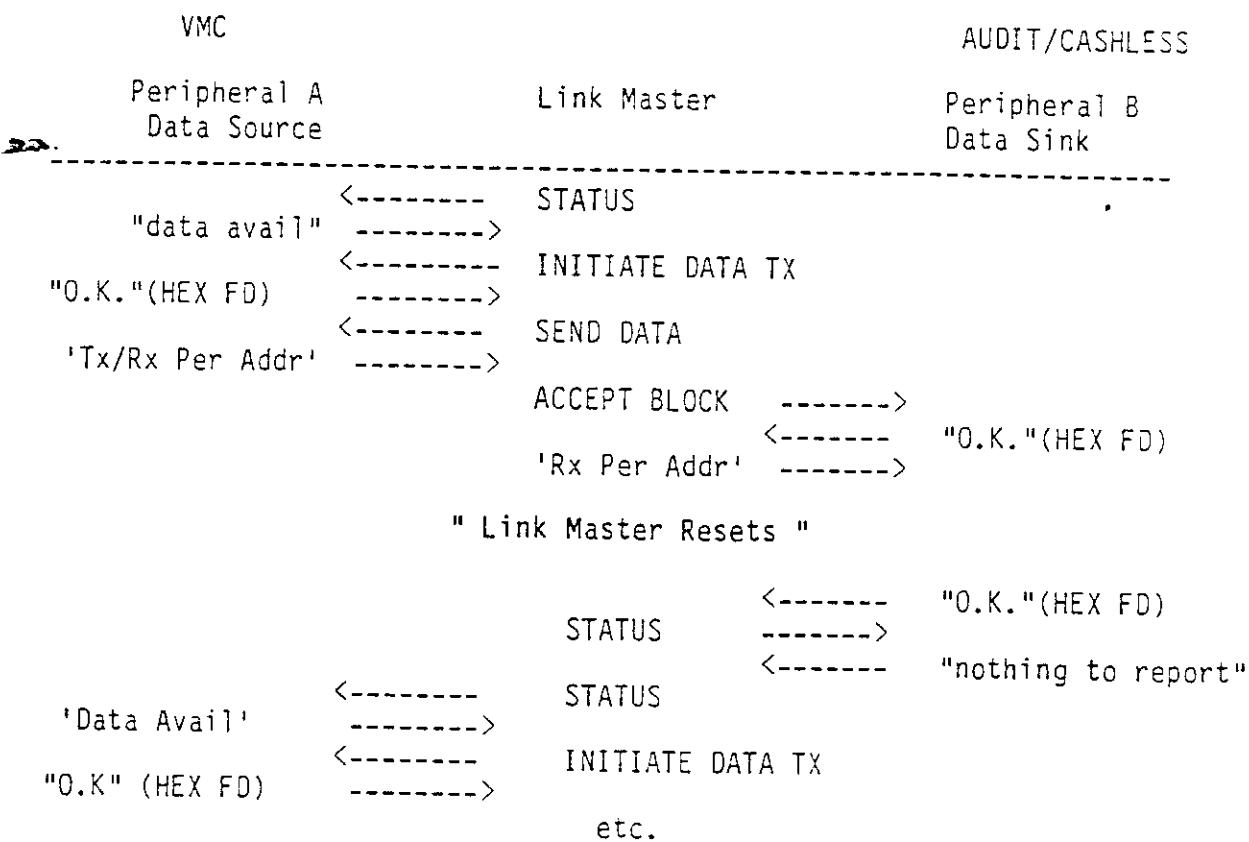
## PRODUCT SPECIFICATION

Description: BDV 001

### 8.2.4 Link Master Resets

The system will recover in the following way if the Link Master resets. It is not defined which Peripheral will be addressed first after the Link Master has reset.

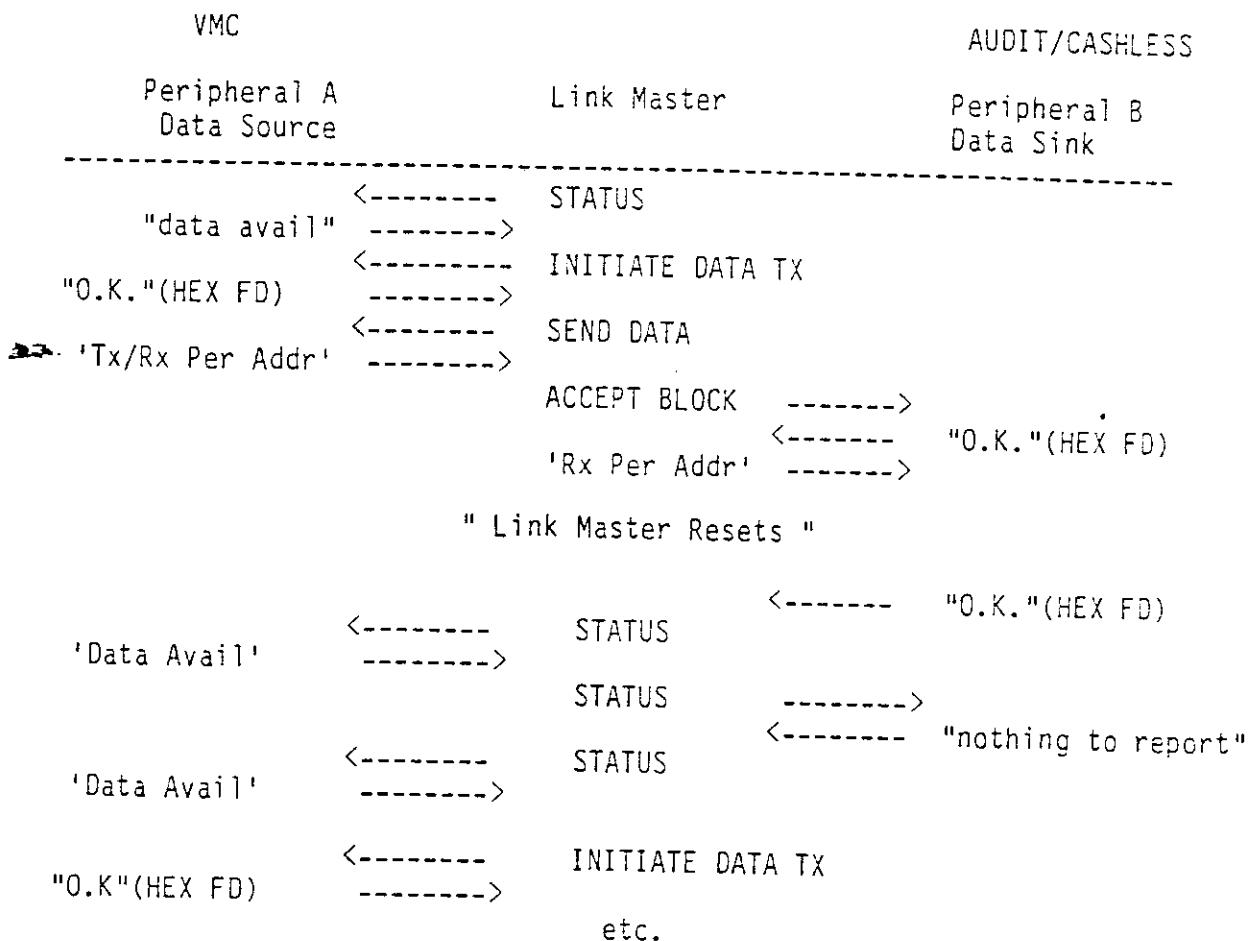
- a) Receiving Peripheral addressed first.



## PRODUCT SPECIFICATION

Description: BDV 001

b) Transmitting Peripheral addressed first.



# PRODUCT SPECIFICATION

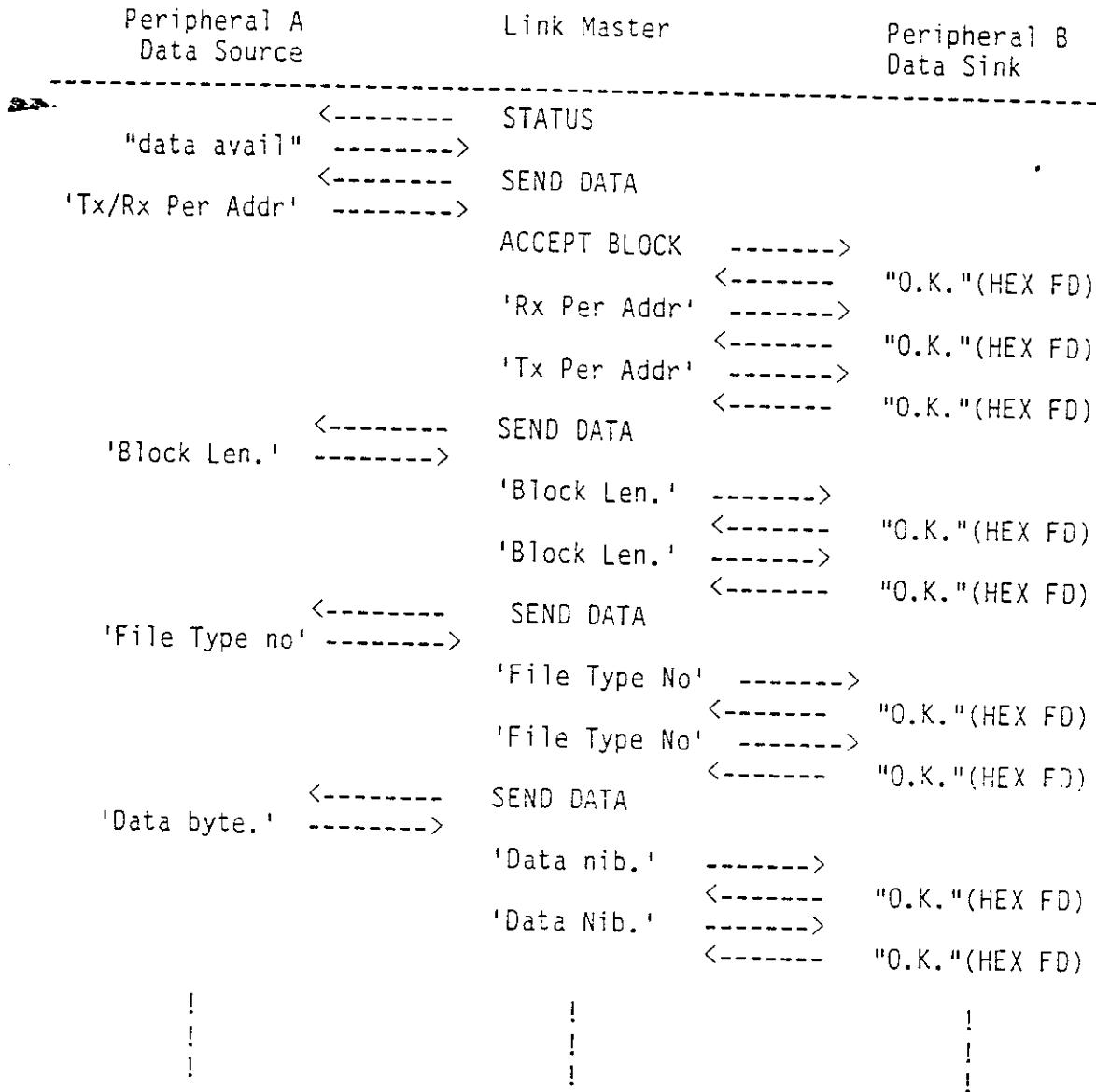
Description: BDV 001

## 8.3 CASHLESS PAYMENT SOURCING DATAFILES

This transfer is identical to VMC -> CASHLESS CONTROLLER except that an INITIATE DATA TRANSFER command is not required for CASHLESS CONTROLLER sourcing. Checksum failures and refusal to receive are dealt with as described above.

CASHLESS CONTROLLER

AUDIT/VMC



## PRODUCT SPECIFICATION

Description: BDV 001

! ! !

'Data byte.' <-----> SEND DATA  
'Data nib.' <-----> "Data Nib." <-----> "O.K."(HEX FD)  
DATA SYNC <-----> "O.K."(HEX FD)  
<-----> "Checksum passed"(FD)  
BLOCK ACK.  
cancels"data avail"

### 8.3.1 CASHLESS PAYMENT -> LINK MASTER

This transfer is a Subset of that described above.

CASHLESS CONTROLLER

Peripheral A Link Master  
Data Source

---

"data avail" <-----> STATUS  
'Tx/Rx Per Addr' <-----> SEND DATA  
'Block Len.' <-----> SEND DATA  
'File Type no' <-----> SEND DATA  
'Data byte.' <-----> SEND DATA

! ! ! !

'Data byte.' <-----> SEND DATA  
<-----> "Checksum passed"  
<-----> BLOCK ACK

cancels"data avail"

## PRODUCT SPECIFICATION

Description: BDV 001

#### 8.4 REQUESTED VEND PRICE

The VMC will transfer the requested vend price and selection numbers via the 'Selection Info' Datablock.

#### 8.4.1 Real Currency Prices

VMC Link Master

```

----- STATUS
"nothing to report"----->
----- CREDIT
'price byte 1' ----->
----- SEND DATA
'price byte 2' ----->
----- SEND DATA
'price byte 3' ----->
----- SEND DATA
'Selection Number' ----->
----- SEND DATA
'Checksum byte 1'----->
----- SEND DATA
'Checksum byte 2'----->
----- BLOCK ACK          (Checksum Passes)
"OK" (Hex FD) ----->
----- ACCEPT BLOCK
"OK" (Hex FD) ----->
----- FILE TYPE 11
----- (System Credit)
----- DATA SYNC
"Checksum passed"----->
----- (Hex FD)
----- VEND
'Vend Pass/Fail'----->
----- etc.

```

## PRODUCT SPECIFICATION

Description: BDV 001

Should the checksum fail or the credit be insufficient for the requested vend then the VEND command will not be issued. i.e.

VMC	Link Master
	<----- STATUS
"nothing to report"----->	
	<----- CREDIT
'price byte 1' ----->	
	<----- SEND DATA
'price byte 2' ----->	
	<----- SEND DATA
'price byte 3' ----->	
	<----- SEND DATA
'Selection Number' ----->	
	<----- SEND DATA
'Checksum byte 1'----->	
	<----- SEND DATA
'Checksum byte 2'----->	
	<----- STATUS (Checksum Fails)
"nothing to report"----->	
	<----- CREDIT
'price byte 1' ----->	
	<----- SEND DATA
	etc.

The reader should not assume that every successfully transferred selection info block (plus block acknowledge) will be followed by the VEND command; there might be a file transfer first or no VEND command at all (if the Link Master refuses the vend).

The VMC MUST NOT REPEAT the selection info in an endless loop (until a VEND command is issued by the Link Master) because such behaviour could lead to a situation where a following customer could be forced to buy the product, which was selected by the previous customer (but which was not granted, e.g. by veto).

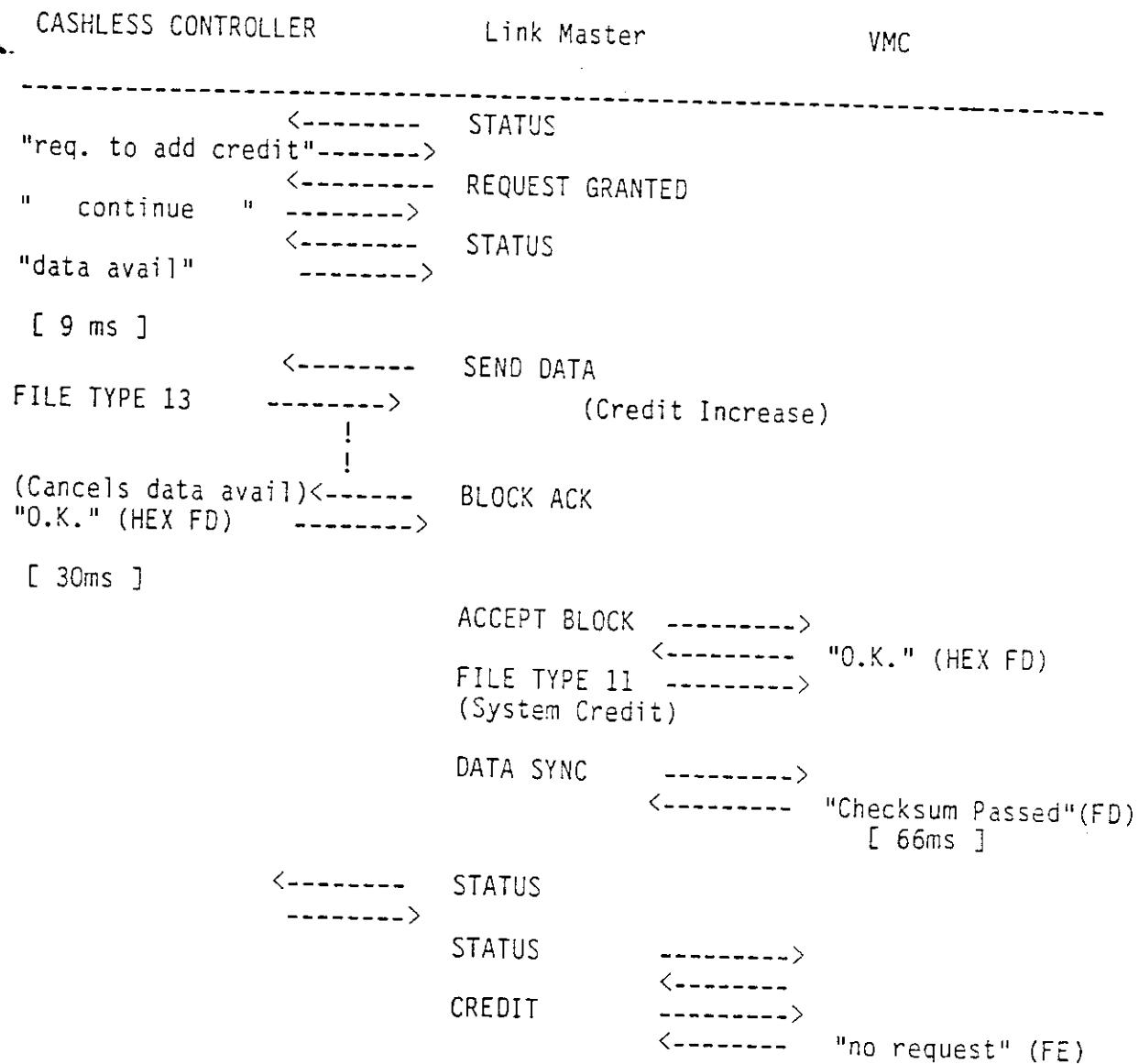
# PRODUCT SPECIFICATION

Description: BDV 001

## 8.5 CASHLESS PAYMENT CREDIT VEND

A Vend transaction paid for by the CASHLESS PAYMENT credit in a mixed (Coin and Cashless Payment) situation will result the following datafile transfers. For simplicity this is described in File Transfers and not explicitly in byte transfers. Also omitted from the diagram are the Audit transfers. Link transmission times are presented as a guide.

### a) Real Currency Price



## PRODUCT SPECIFICATION

Description: BDV 001

vend requested

CREDIT ----->  
SEND DATA <----- Price Byte 1  
----->  
(real currency price) <----- DATABLOCK  
! ! SELECTION INFO  
BLOCK ACK ----->  
<----- "O.K." (HEX FD)

[ 21 ms ]

"O.K."(HEX FD) <----- ACCEPT BLOCK  
----->  
<----- FILE TYPE 10  
! (VMC Vend Request)  
!  
<----- DATA SYNC  
"Checksum passed"(FD)----->

[ 60 ms ]

"data avail" <----- STATUS  
----->  
<----- SEND DATA  
FILE TYPE 15 -----> (Vend Parameters)  
!  
! (Cancels data avail)<----- BLOCK ACK.  
"O.K."(HEX FD) ----->

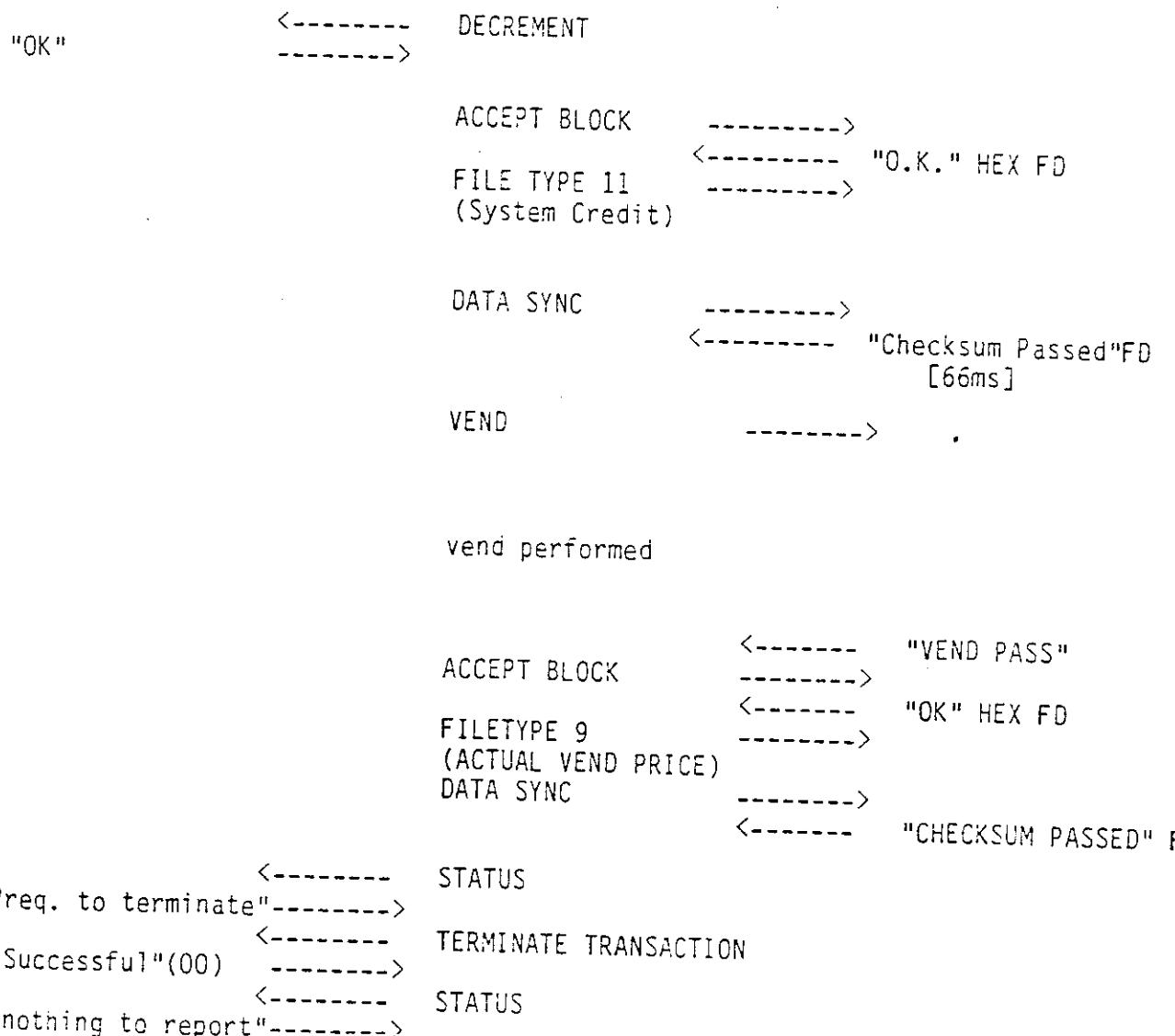
[ 30 ms ]

"O.K"(HEX FD) <----- ACCEPT BLOCK  
----->  
<----- FILE TYPE 12  
! (Decrement Value)  
!  
<----- DATA SYNC  
"Checksum Passed"(FD)----->

[ 57 ms ]

## PRODUCT SPECIFICATION

Description: BDV 001



### 8.5.1 Timing Summary

Timings are calculated assuming 3ms for a command/acknowledgement pair. This gives a time from Cashless deposit to Credit display of 105ms and from vend request to vend grant of 234ms. This ignores the polling loop and any processing time.

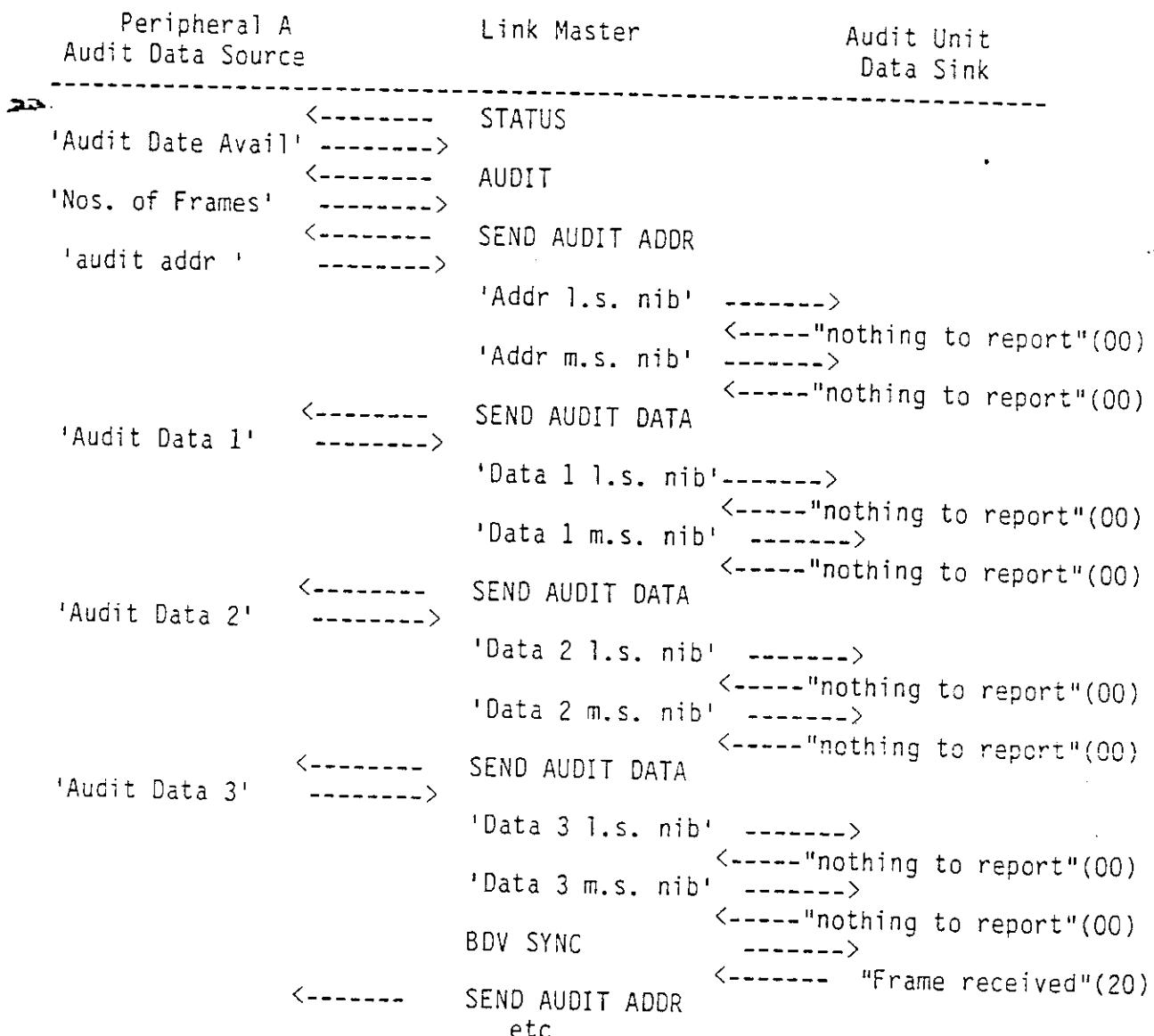
## PRODUCT SPECIFICATION

Description: BDV 001

### 8.6 AUDIT TRANSFERS

Audit Frames are triple data byte in length. The following schematics aim to demonstrate all audit transfers to the Audit Unit. The Link Master should buffer and interleave Audit Frames, as illustrated below, when transferring them to the Audit Unit.

#### 8.6.1 Triple Byte Frames



## PRODUCT SPECIFICATION

Description: BDV 001

### 8.6.2 Real Currency Frames

The Link Master may wish to communicate to certain Audit Unit locations in real currency values. Such a transfer may be represented

Link Master	Audit Unit Data Sink
'Addr 1.s. nib'	-----> <---- "nothing to report"(00)
'Addr m.s. nib'	-----> <---- "nothing to report"(00)
'Data 1 1.s. nib'	-----> <---- "nothing to report"(00)
'Data 1 m.s. nib'	-----> <---- "nothing to report"(00)
'Data 2 1.s. nib'	-----> <---- "nothing to report"(00)
'Data 2 m.s. nib'	-----> <---- "nothing to report"(00)
'Data 3 1.s. nib'	-----> <---- "nothing to report"(00)
'Data 3 m.s. nib'	-----> <---- "nothing to report"(00)
BDV SYNC	-----> <----- "Frame received"(20)
<----- STATUS	
etc	

## PRODUCT SPECIFICATION

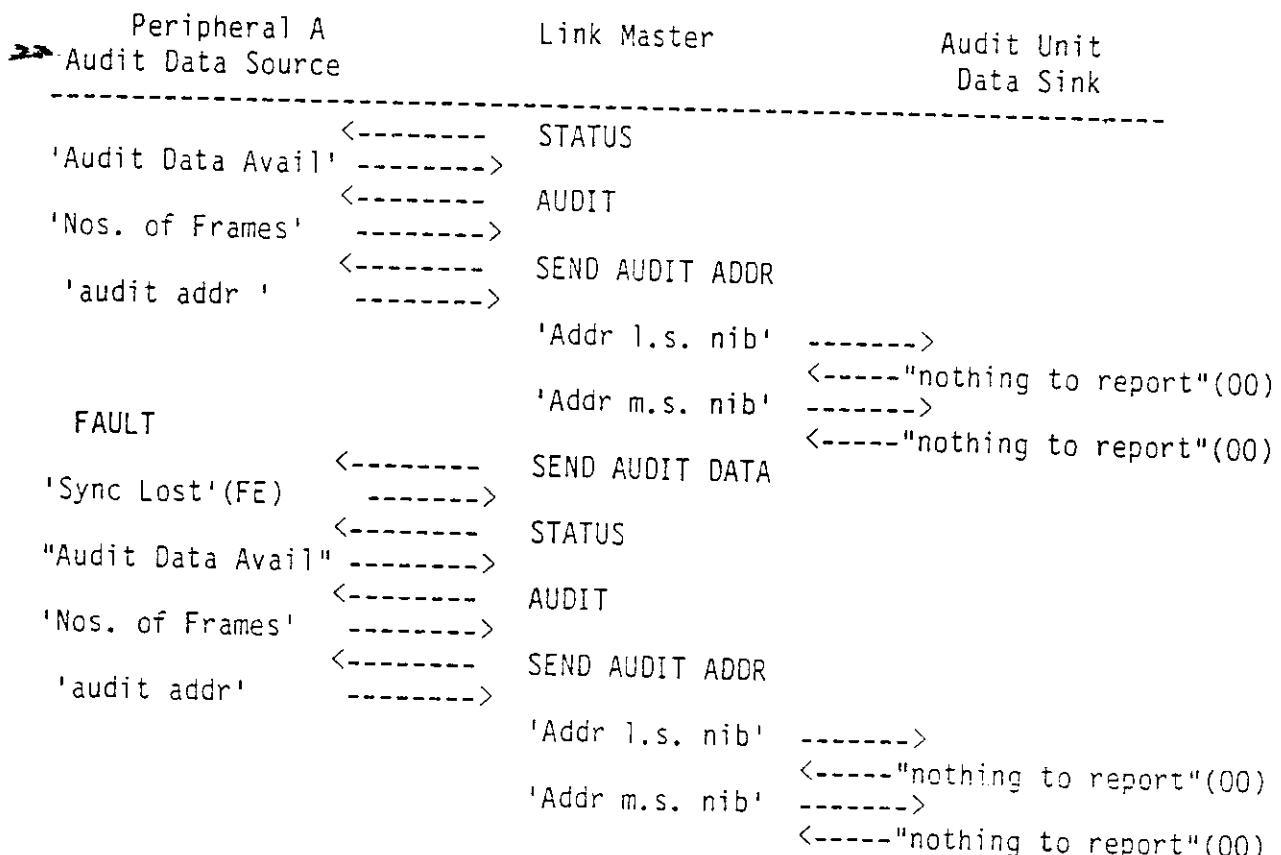
Description: BDV 001

### 8.7 AUDIT FAILURE MODES

During the transfer of Audit information, failures may occur. The following are examples of how the Protocol copes with various breakdowns.

#### 8.7.1 Transmitting Peripheral Sync Loss

This will occur when the Data Source expects a SEND AUDIT ADDR and receives a SEND AUDIT DATA or vice versa.



## PRODUCT SPECIFICATION

Description: BDV 001

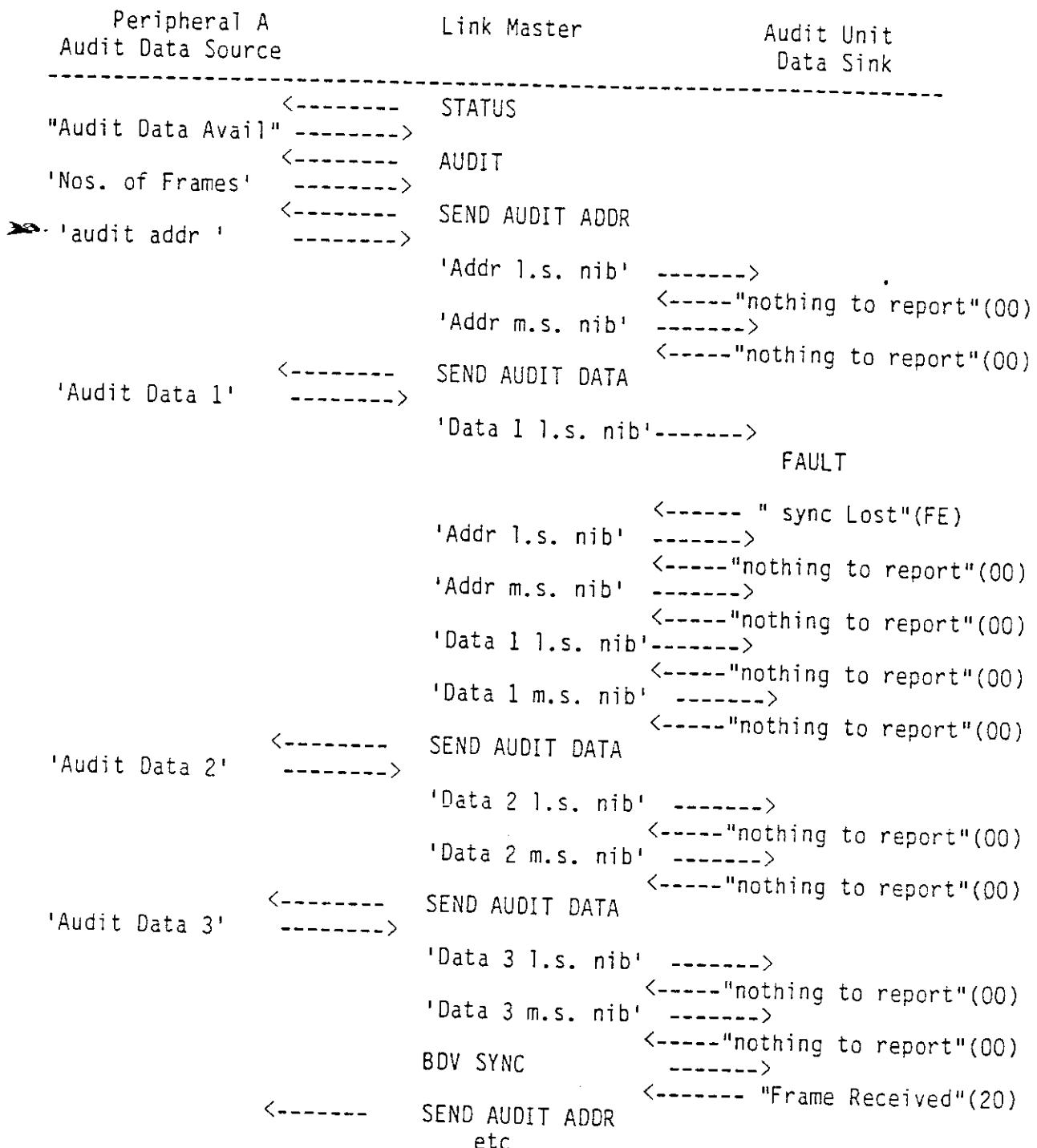
'Audit Data 1' <----- SEND AUDIT DATA  
----->  
'Data 1 l.s. nib'----->  
-----> "nothing to report"(00)  
'Data 1 m.s. nib'----->  
-----> "nothing to report"(00)  
'Audit Data 2' <----- SEND AUDIT DATA  
----->  
'Data 2 l.s. nib'----->  
-----> "Sync Lost" (FE)  
'Addr l.s. nib'----->  
-----> "nothing to report"(00)  
'Addr m.s. nib'----->  
-----> "nothing to report"(00)  
'Data 1 l.s. nib'----->  
-----> "nothing to report"(00)  
'Data 1 m.s. nib'----->  
-----> "nothing to report"(00)  
'Data 2 l.s. nib'----->  
-----> "nothing to report"(00)  
'Data 2 m.s. nib'----->  
-----> "nothing to report"(00)  
'Audit Data 3' <----- SEND AUDIT DATA  
----->  
'Data 3 l.s. nib'----->  
-----> "nothing to report"(00)  
'Data 3 m.s. nib'----->  
-----> "nothing to report"(00)  
BDV SYNC ----->  
-----> "Frame Received"(20)  
<----- SEND AUDIT ADDR  
etc

## PRODUCT SPECIFICATION

Description: BDV 001

### 8.7.2 Loss of Sync by the Audit Unit

This will occur when the Audit Unit receives a data byte but expected a SYNC command.



## PRODUCT SPECIFICATION

Description: BDV 001

### 8.7.3 Parity Failures

The Link Master and Link peripherals may detect parity or framing errors. The commands and replies of NAK and PNAK are used as before, i.e.

Peripheral A Audit Data Source	Link Master	Audit Unit Data Sink
	<----- STATUS	
"Audit Data Avail"	----->	
	<----- AUDIT	
'Nos. of Frames'	----->	
	<----- SEND AUDIT ADDR	
'PNAK'	----->	
	<----- SEND AUDIT ADDR	
'audit addr '	----->	
	'Addr l.s. nib' ----->	
	<----- "nothing to report"(00)	
	'Addr m.s. nib' ----->	
	<----- "PNAK"	
	'Addr m.s. nib' ----->	
	<----- "nothing to report"(00)	
'Audit Data 1'	----->	
	<----- SEND AUDIT DATA	
	'Data 1 l.s. nib'----->	
	<----- "nothing to report"(00)	
	'Data 1 m.s. nib' ----->	
	<----- "nothing to report"(00)	
	'NAK' ----->	
	<----- "nothing to report"(00)	
'Audit Data 2'	----->	
	<----- SEND AUDIT DATA	
	'NAK'	
'Audit Data 2'	----->	
	'Data 2 l.s. nib' ----->	
	<----- "nothing to report"(00)	
	'Data 2 m.s. nib' ----->	
	<----- "nothing to report"(00)	
'Audit Data 3'	----->	
	<----- SEND AUDIT DATA	
	'Data 3 l.s. nib'----->	
	<----- "nothing to report"(00)	
	'Data 3 m.s. nib' ----->	
	<----- "nothing to report"(00)	
	BDV SYNC ----->	
	<----- "Frame Received"(20)	
	<----- SEND AUDIT ADDR	
	etc.	

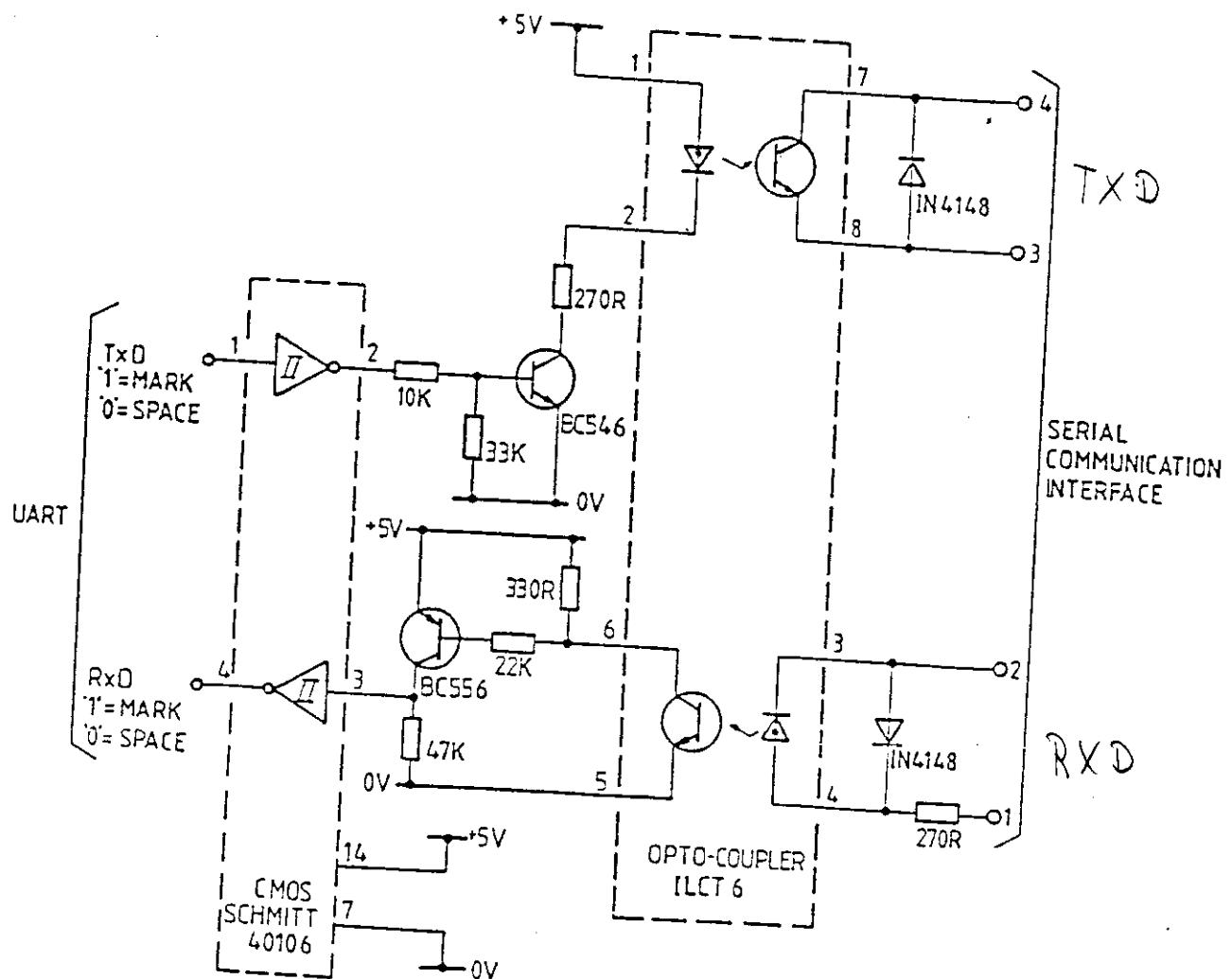
## PRODUCT SPECIFICATION

Description: BDV 001

## APPENDIX D

## DIAGRAMS

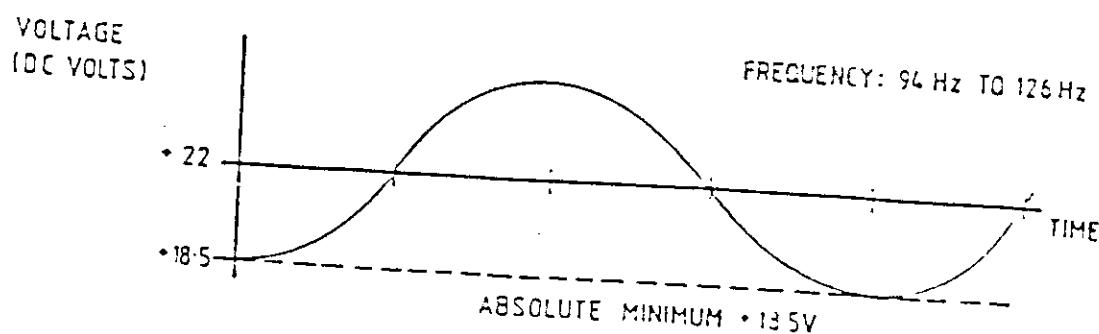
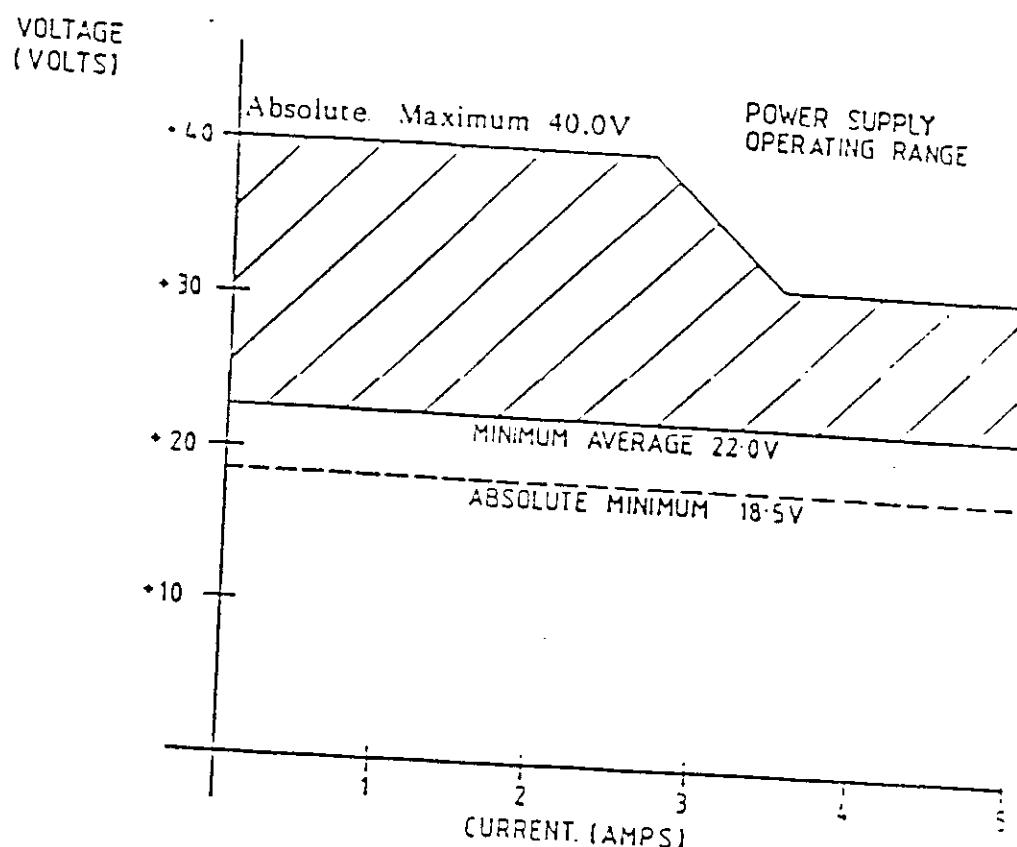
Figure 1.: Serial Datalink Interface Circuit



PRODUCT SPECIFICATION

Description: BDV 001

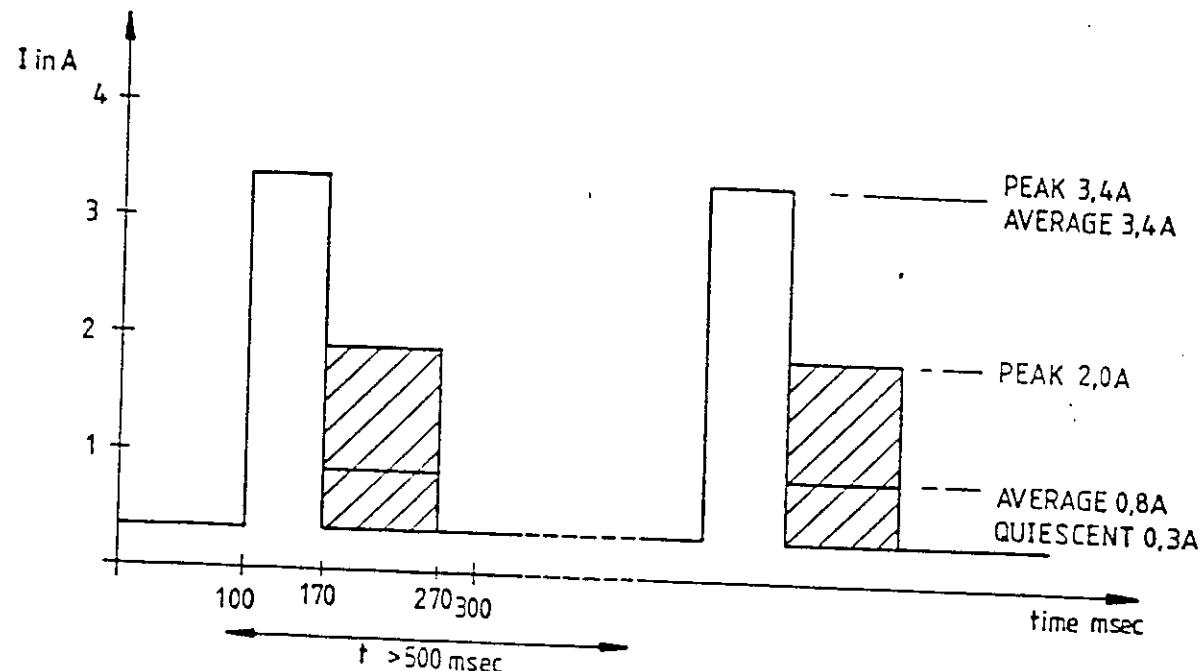
Figure 2 : D.C. Power Requirements



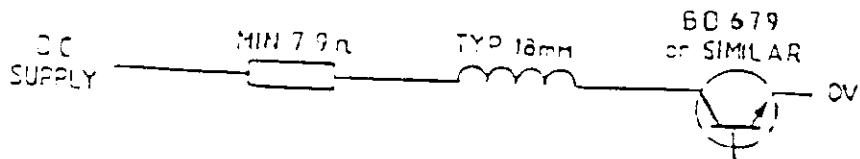
PRODUCT SPECIFICATION

Description: BDV 001

Figure 3 : Current Profile at 24V D.C.



The current profile comprises a quiescent D.C. current of 0.3A plus a Voltage Dependent pulsed current when activating solenoids. The equivalent circuit of the solenoids may be considered to be:

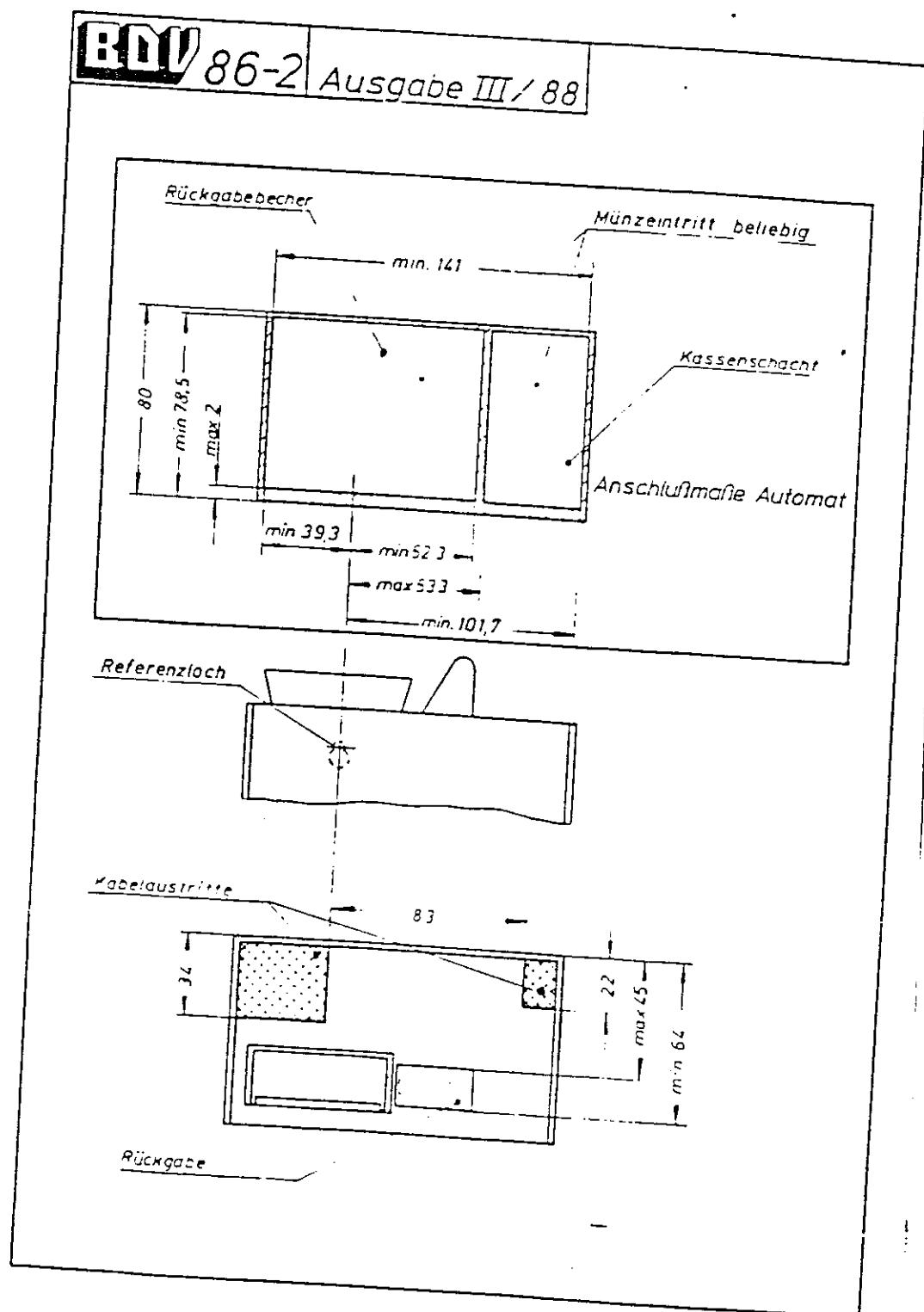


The long term duty cycle depends on the frequency of vending and the number of change coins dispensed in the vend.

PRODUCT SPECIFICATION

Description: BDV 001

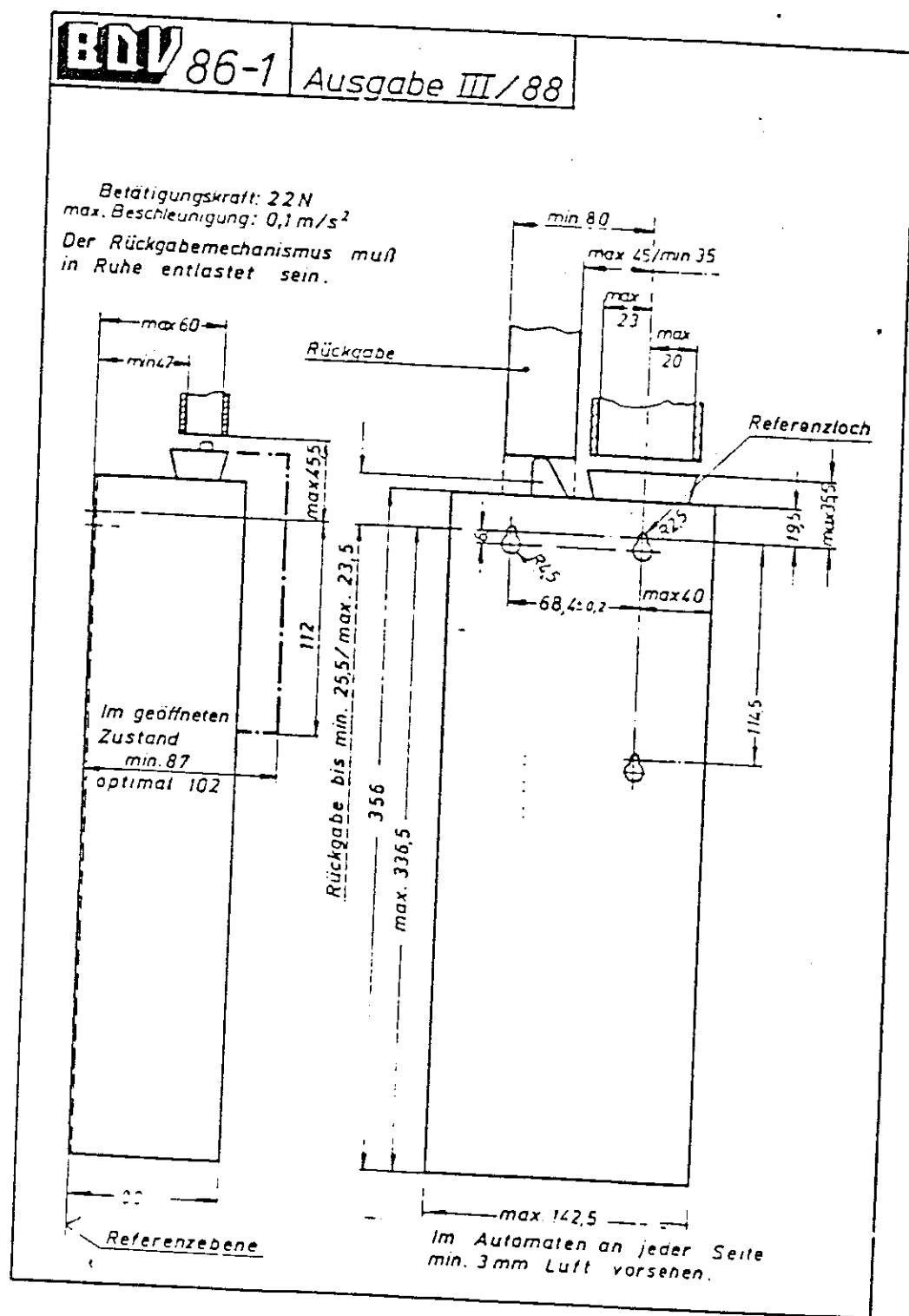
Figure 4 : Mechanical Envelope (1)



PRODUCTION SPECIFICATION

Description: BDV 001

Figure 5: Mechanical Envelope (2)



## PRODUCTION SPECIFICATION

Description: BDV 001

### CHANGE HISTORY

<u>Date</u>	<u>Alteration</u>	<u>Approved</u>
26 November 1986	: Initial Release	:
12 December 1986	: Issue 0.1	
	1. Absolute maximum DC power reduced from 40V to 32V	
	2. Current profile added	
19 January 1987	: Issue 0.2	
	1. Link Units must conform to VDE0871 and VDE0875 Noise Specification.	
	2. Absolute maximum DC power increased to 40V	
	3. Current profile at 24V DC presented	
	4. Connector type number changed to 350720	
	5. Real currency units defined as the smallest unit of reference for all currencies except Italian lire where: 1 Real Currency Unit = 10 Lire	
	6. Typographical errors in sections 7.2.4, 7.2.10, 7.2.12, 7.2.13	

## PRODUCTION SPECIFICATION

Description: BDV 001

### CHANGE HISTORY continued

<u>Date</u>	<u>Alteration</u>	<u>Approved</u>
19 January 1987	7. Filetype 6 and 7 renumbered to 248 and 249 respectively 8. Figure 1, connector pinout changed	
25 April 1987	ISSUE 0.3	
	1. Only real currency pricing permitted in BDV 001. 2. VMC Vend request now called 'Selection Info' 3. Filetype 8 now requests the credit display information for a Cashless Payment Controller 4. Audit Frames are all triple byte, Real Currency and Triple Byte Syncs replaced with one BDV Sync. 5. Conformity in Status replies: i) Bit 4 - Datafile transfer request ii) Bit 5 - Signifies BDV operation iii) Bit 2 - Audit Request 6. Compulsory features for Link Masters, CPCs, VMCs and Audit Units stated. 7. CPC Status reply indicates when transaction in progress. 8. Command 8 for VMC operation is unused in BDV 001.	

## PRODUCT SPECIFICATION

Description: BDV 001

### CHANGE HISTORY continued

<u>Date</u>	<u>Alteration</u>	<u>Approved</u>
	9. Standard Audit File and Standard VMC Audit File defined.	
30.4.87	10. References to 'Base Unit' prices removed from Filetypes. 11. Filetypes 4,5,6,7,18,19 and 20 redefined. 12. Schematics describing Selection Info, Audit Frames and Cashless Payment Credit transfer rewritten. Timing for Cashless Payment recalculated. 13. Figure 4 Cashbox Exit dimension enlarged. 1. Version 0.003 raised to Edition 1.	
29.6.87	Edition 2	
	1. Section 4.2.1 Loom length changed from 1m to 700mm. The mating connector to link master loom is specified as AMP TYPE 927231-3.	
	2. Section 4.2.2 Added that the DC power must be supplied from a supply conforming to S.E.L.V. standards as defined in IEC 380/950.	
	3. Section 5.3.5 "BDV001 VMCs may also transmit" changed to "BDV001 VMCs also transmit".	
	4. Section 7.2.8. Filetype 7 Link master I.D. changed from binary to 3 bytes BCD with a max of 9999.	

## PRODUCT SPECIFICATION

Description: BDV 001

### CHANGE HISTORY continued

<u>Date</u>	<u>Alteration</u>	<u>Approved</u>
	5. Figure 4: Mechanical Envelope Changed to Mechanical Envelope (1) BDV drawing 86-1	
	6. Figure 5. Mechanical Envelope (2) A new drawing BDV 86-2.	
16.11.87	Edition 3 LM	
	1. Added to Glossary of terms:  CPC Audit Unit Polling Real Currency Unit Selection Info Selection Number Single Byte Frame  Replaced "Datalink unit" with "Link Unit"	
	2. 5.1.9  Added "The Link Master must not memorise NAK as the previous character, but the peripheral must memorise PNAK as the previous character."	
	3. 5.4.2 Audit: Status  Added "Note: The Audit Unit must reply to all commands as well as the STATUS command."  "Reserved bits should be assigned 0" changed to "Reserved bits must be assigned 0."	

PRODUCT SPECIFICATION

Description: BDV 001

CHANGE HISTORY continued

<u>Date</u>	<u>Alteration</u>	<u>Approved</u>
	4. 5.4.3 Audit: Sync	
	a. Frame received 00 changed to a. single byte frame received 00	
	5. 5.6.4 VMC: Vend	
	Changed "classification" to "selection no." Removed "(N.B. reserved bits should be returned as 0)"  "At the time that the Vend command is transmitted the Link Master subtracts the vend price from the accumulated credit and then works with all functions inhibited for a response to the Vend command".  Now reads: "At the time that the Vend command is transmitted the Link Master subtracts the vend price from the accumulated credit and then waits for a response to the Vend command".	
	6. 5.6.4 VMC: Audit	
	"reserved bits should be returned as 0" now reads "reserved bits must be returned as 0"	
	7. 5.6.17 Datablock Selection Info	
	Added "The checksum is calculated as for datafiles. Refer to Section 7.1"	
	8. 5.7 Link Master Compulsory Features	
	"The Link Master must only grant a Datafile transfer request which is independent of the Vend Process when zero credit exists". Added: "except for filetype 17, maintenance request."	

## PRODUCT SPECIFICATION

Description: BDV 001

### CHANGE HISTORY continued

<u>Date</u>	<u>Alteration</u>	<u>Approved</u>
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#### 9. 6. Audit Details

"b. A general purpose file which is accessed by the VMC to audit data specific that that VMC and its vending environment."

Added:

"This is accessed by sending frames into audit addresses 24 to 243."

Filetype 21 the standard VMC audit file.  
124 machine specific audit bytes changed to 122.

#### 10. 7. Filetype Definitions

Checksum definition changed to:

"The checksum is 1 byte calculated such that the binary sum of the total Datafile, ignoring any overflow, has a value equal to 0. This single checksum byte is converted into two nibble significant bytes for retransmission".

#### 11. 7.2.2 Filetype 1: Status Block

Added to definition:

"If bit 0 is set then the Link Master should send the credit datafile, filetype 11.

If any of bits 1 to 3 are set, and the Link Master is a coin mechanism, then the coin mechanism dispenses the required coin.

If more than 1 coin is requested then the coin mechanism dispenses a coin from the highest value tube".

#### 12. 7.2.8 Filetype 7: Operation

Dataguard replaced by Audit Unit.

Definition of Link Master I.D. changed to "This value (3 byte packed BCD) is set to the Audit Unit as the Link Master identification code in response to the Audit Unit identify request.

## PRODUCT SPECIFICATION

Description: BDV 001

### CHANGE HISTORY continued

<u>Date</u>	<u>Alteration</u>	<u>Approved</u>
	13. 8.1.2.5 Checksum failure. 8.1.2.6 Sync Lost by Receiving Peripheral.	
	Change "Link Master returns to its peripheral polling routine without issuing a BLOCK ACK command to the Transmitting Peripheral" to: "Link Master issues a STATUS command instead of BLOCK ACK command to the Transmitting Peripheral".	
	14. 8.4 Requested Vend price  "Product classification" replaced by "Selection No."	
	15. 8.7 Audit Failure Modes  Correction made to schematic of 8.7.1 Transmitting Peripheral Sync Loss.	
	16. Figure 2 DC Power Requirements  Changed back to Edition 1 figure (erroneously changed in Edition 2).	
13.4.88	Edition 4 LM  1. Section 5.1.7. Added: Note: The timing parameters are recommendations, no Link Unit is constrained concerning timing.	

## PRODUCT SPECIFICATION

Description: BDV 001

### CHANGE HISTORY continued

<u>Date</u>	<u>Alteration</u>	<u>Approved</u>
	2. 5.1.10. The STATUS commands, and also the CREDIT command for a VMC, must be responded to quickly in order that the Link Master is not diverted from its business for too long. The maximum period between the beginning of a STATUS or CREDIT command character and the reply character should not be greater than 10mS. This is not compulsory; however, if the Link Master is a coin mechanism and this timing is not met then the coin acceptance rate may be severely degraded.	
	changed to:	
	The STATUS commands, and also the CREDIT command for a VMC, must be responded to quickly in order that the Link Master is not diverted from its business for too long. The maximum period between the beginning of a STATUS or CREDIT command character and the end of the reply character must not be greater than 20mSec.	
	3. 5.1.13 NOTE: All unused and reserved bits of command and replies must be set to zero.	
	changed to:	
	Note: All unused and reserved bits of command, replies and datafile bytes must be set to zero.	
	4. 5.2.7. Add: Link Unit A may even instruct Link Unit B to send a Datafile to Link Unit C.	
	5. 5.4. Audit Unit command HEX Code has been shown as the full HEX code.	

PRODUCT SPECIFICATION

Description: BDV 001

CHANGE HISTORY continued

<u>Date</u>	<u>Alteration</u>	<u>Approved</u>
	6. 5.4.5. To description of reply b, add:  Unless it was the first SEND DATA command after the command INITIATE DATA TRANSFER. In this case the receiving peripheral would not yet have been involved in the datafile transfer. The Link Master returns to its peripheral polling routine.	
	7. 5.4.7. To description of reply a, add:  Unless the DATA SYNC command resulted from reply b of the SEND DATA command (SYNC LOST/ABORT), or from a Link Master checksum failure. In these cases the Link Master returns to its peripheral polling routine.	
	8. 5.4.7. To description of reply b, add:  Unless the DATA SYNC command resulted from reply b of "SEND DATA" or from a Link Master checksum failure. In these cases reply b is the reply to be expected and the Link Master returns to the peripheral polling routine.	
	9. 5.4.13. Add:  Additionally the Audit Unit must be capable of handling the following Datafiles: 0,16.	
	10. Corrected: 5.1.15, 5.1.16 and 5.1.17 to 5.5.15, 5.5.16 and 5.5.17.	

## PRODUCT SPECIFICATION

Description: BDV 001

### CHANGE HISTORY continued

<u>Date</u>	<u>Alteration</u>	<u>Approved</u>
11. 5.6.3	This command is used during each poll of the VMC provided vending has not been inhibited and the Link Master has credit or a Free Vend has been requested as described above.	
	Add:	
	or there is a cashless token present in the system, i.e. bit 1 of the CPC reply to a STATUS command is set.	
12. 5.6.4	The Vend Succeeded reply will cause the remaining credit value to be returned if the Link Master is operating in single vend mode. The Link Master will then return to its normal peripheral polling routine.	
	Modified to:	
	The Vend Succeeded reply will cause the Link Master to send Datafile 9, Actual Vend Price, to the VMC and the remaining credit value to be returned if the Link Master is operating in single vend mode. The Link Master will then return to its normal polling routine.	
13. 5.6.10	To description of reply a, add:	
	Unless the DATA SYNC command resulted from reply b, of the SEND DATA command (sync lost/abort), or from a Link Master checksum failure. In these cases the Link Master returns to its peripheral polling routine.	
	To description of reply b, add:	
	Unless the DATA SYNC command resulted from reply b of "SEND DATA" or from a Link Master checksum failure. In these cases reply b is the reply to be expected and the Link Master returns to its peripheral polling routine.	

PRODUCT SPECIFICATION

Description: BDV 001

CHANGE HISTORY continued

<u>Date</u>	<u>Alteration</u>	<u>Approved</u>
	14. 5.6.11. Add:	
	Unless it was the first SEND DATA command after the command INITIATE DATA TRANSFER. In this case the receiving peripheral would not yet have been involved in the Datafile transfer. The Link Master returns to its peripheral polling routine.	
	In the case a DATA SYNC command has been issued to the receiving peripheral the reply "checksum failed/sync lost" would be the most appropriate.	
	15. 5.6.18	
	Any device performing the BDV VMC role must be capable of handling the 'Selection Info' datablock and Filetype 16.	
	Changed to:	
	Any device performing the BDV VMC role must be capable of handling the 'Selection Info' datablock, Filetypes 16 and 9.	
	16. 5.7	
	Added that the Link Master must be capable of handling Filetype 9.	
	17. 6. Audit Details.	
	Added another audit address to the Standard Audit file.	
	Address 25, manual fill money, 5 BCD Real Currency Units. Transmitted value: 0-99999.	
	The VMC audit address now goes from 26 to 243.	
	18. 7.2.1. Added:	
	Link Unit A (transmitting peripheral ident) instructs Link Unit B (receiving peripheral ident) to send a file (requested filetype) to Link Unit C (send to peripheral ident). Link Unit A and C may be the same peripheral.	

## PRODUCT SPECIFICATION

Description: BDV 001

### CHANGE HISTORY continued

<u>Date</u>	<u>Alteration</u>	<u>Approved</u>
19.	7.2.10 filetype 9 now defined as Actual Vend Price.	
20.	7.2.17. Filetype 16. Added: Byte 1 (sourced from peripheral ident) is redundant and identical to the sourcing device (transmitting peripheral ident).	
21.	7.2.18. Filetype 17. Added: Bit 1. When set, cancel credit and send credit to audit address, value of overpay.  Bit 2. When set, cancel credit and send credit to audit address "manual fill money".  Bit 2 is required when the Link Master is a coin mechanism for manually filling the tubes.  NOTE: For integrity of audit information no money should be taken from the cashbox during manual filling of tubes without being audited as collected.	
22.	8.4. Added: The reader should not assume that every successfully transferred selection info will be followed by the VEND command; there might be a file transfer first or no VEND command at all (if the Link Master refuses the vend).  The VMC <u>MUST NOT REPEAT</u> the selection info in an endless loop (until a VEND command is issued by the Link Master) because such behaviour could lead to a situation where a following customer could be forced to buy the product, which was selected by the previous customer (but which was not granted, e.g. by veto).	

## PRODUCT SPECIFICATION

Description: BDV 001

### CHANGE HISTORY continued

<u>Date</u>	<u>Alteration</u>	<u>Approved</u>
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23. 8.5. Cashless Payment Credit Vend.  
In the diagram depicting the vend cycle, the DECREMENT command has been moved to before the VEND command and the transfer of Datafile 9, actual vend price, has been added.
24. Figure 3, current profile at 24V DC has been modified.
25. Figures 4 and 5, mechanical envelope, have been modified.
26. 4.2.1.  
Stated AMP TYPE 350720-1 is a universal number  
Stated AMP TYPE 350699-1 is a U.K. number  
Stated AMP TYPE 926886-1 is a German number  
Stated AMP TYPE 350828-1 is a U.K. part number  
Stated AMP TYPE 927231-3 is a German number

21 September 1988 : Issue 0.5

27. 7.2.18 Added :

under NOTE section  
"If the coin mechanism contains a keyboard to dispense coins then this function must be inactive after power up/reset. The keyboard may be activated by setting bit 3 of databyte 0.

If a coin manufacturer desires, activation may also be carried out with a tool operated switch."

Added to Data-byte Index under Data heading  
"; dispense buttons"

Added under bit 3  
"0 deactivate dispense buttons  
1 activate dispense buttons"

PRODUCT SPECIFICATION

Description: BDV 001

CHANGE HISTORY continued

<u>Date</u>	<u>Alteration</u>	<u>Approved</u>
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28. Section 8.4.1

delete VEND

Insert

"OK" (Hex FD) <-----> BLOCK ACK

"OK" (Hex FD) <-----> ACCEPT BLOCK

<-----> FILE TYPE ID  
(System Credit)

"Checksum passed"  
(Hex FD) <-----> DATA SYNC

'Vend Pass/Fail' <-----> VEND

etc.

Insert "block (plus block acknowledge)"  
in penultimate para in section 8.4.1.

29. Section 8.5

Insert "BLOCK ACK" ----->

<----- "O.K." (HEX FD)

Amend 18 ms to 21 ms

30. Section 8.5.1. Timing Summary

amend 231ms to 234ms.

31. Section 5.6.17

Delete "and BLOCK ACK acknowledgement"