IBM 4777 Magnetic Reader/Encoder
Product Attachment Information
Version 1.0

IBM Corporation

Preface

> **Notice**
>
> The solution described by this document may undergo revision in function and/or scope at any time. The information contained herein does not imply a commitment on IBM's part to produce or deliver any of the functionality described.

Contents

Magnetics Model Configurations

Models with the following configurations are provided.

MODEL 1   CARD READER

Read track 1 at 210 BPI.
Read track 2 at 75 BPI.
Read track 2 at 210 BPI.

MODEL 2   PASSBOOK ENCODER

Read track 2 at 75 BPI.
Read track 2 at 210 BPI.
Read track 3 at 210 BPI.
Encodes across tracks 2 and 3 location with single .260" head
(6.5mm) at 210 BPI.

MODEL 3   ID CARD READER

Read and encode track 1 at 210 BPI.
Read and encode track 2 at 75 BPI.
Read track 2 at 210 BPI.

MODEL 4   CARD READER

Read track 2 at 210 BPI.
Read track 2 at 75 BPI.
Read track 3 at 210 BPI.

MODEL 5   JUCC CARD AND PASSBOOK READER

Read track 1 at 210 BPI.
Read track 2 at 75 BPI.
Read JUCC Track (Track 2) at 210 BPI.
Read Passbook (Track 3) at 210 BPI

Chapter 1. Communications Interface

Dual electrical interfaces are included, to support both the
Serial RS232 or Mouse interfaces.

These devices will attach to members of PS/2, PS/VP or equivalent
computers via the RS232 Serial port at 9600 Baud, and PS/2 equivalent
auxilliary(mouse)port.

For all communications modes, the data will be one start bit,
8 data bits, 1 parity bit (odd) and 1 stop bit.Each byte transmission
consists of 11 bits transmitted serially on the data line.

1st bit:	Start bit
2nd bit:	Data bit 0 (Least Significant Bit)
3rd bit:	Data bit 1
4th bit:	Data bit 2
5th bit:	Data bit 3
6th bit:	Data bit 4
7th bit:	Data bit 5
8th bit:	Data bit 6
9th bit:	Data bit 7 (Most Significant Bit)
10th bit:	Parity bit (odd parity)
11th bit:	Stop bit

The Serial and Mouse Interfaces allow the Magnetics Device to
co-exist with a 4718/4778 PIN Pad device on a single host port.
The interconnection cabling, together with logic within the assemblies,
uses either the busy line (Mouse) or RTS/CTS lines (Serial) to control
which device has ownership of the interface.

The 4777 communication mechanism allows sharing a common port. Each
device requires a unique Activate ID, and must be deactivated when not
in use to allow the sharing device(4778) to gain access to the
communication link.

The host issues a command selecting one device for communication
or an I/O device that requires attention may request control of
the interface, then issue an attention, requesting service from the host.

Each I/O device connected to a single port requires the unique Activate
Command, this distinguishs the device to the Host from the other
devices. Each I/O device type is assigned a permanent Activate ID.
Once activated, an I/O device will assert the control line(-Busy/RTS)
indicating to other devices sharing the link to remain inactive.

Host Communication Interface Cable

The Host attachment cable consists of an 8 wire interface, including six signals, 5 V and ground. The cable is 150mm long (approximately 6") and terminates in an 8 pin locking female mini-DIN plug. The host personality cable plugs into this cable, as does the multidrop configurations.

Unique cables for RS232 and Auxilliary(mouse) port connection are necessary.

Serial Communication Interface

The communications implemented in the 4777 devices include the RS232 Serial interface. The output and inputs are defined by RS232C. The 'ON' (logic high) is +3V to +15V while the 'OFF' (logic Low) is defined as -3V to -15V. The RS 232 serial port will only run at 9600 Baud in 11-bit start stop mode.

RXD and TXD Data Signals

The 'RXD' line is a uni-directional signal used to transfer data between the Host and the 4777 and other I/O device on a common communication link. The 'TXD' line is a uni-directional signal used to transfer data between the 4777 or other I/O device on a common link to the Host. To allow more than one device on the interface the 'TXD' signal is active only when the I/O device has been activated and will switch 'TXD' in the connection state only during transmission sequences. This 'TXD' switch interface allows the 4777 Magnetics to co-exist with a I/O device (4778 PIN pad) on a single RS-232C port.

Device Contention

The 'CTS' and 'RTS' signals are used to allow the 4777 or other I/O device to gain control of the interface and to indicate when the interface is in use. This function is necessary to allow inactive devices to differentiate between communications between the Host and the active I/O Device.

When both the 4777 device and another I/O device are connected to one serial port special connector cables are required, allowing the communications interfaced to be shared at a single serial port. This cabling supports connection of the 'CTS' signal of the first device to the 'RTS' of the second device and the 'CTS' signal of the second device to the 'RTS' of the first device allowing for a "Busy" interface state management between the two devices.

```
 _____                       _____
|          'CTS'  |7 <---------------- 8|  'RTS'           |
|DEVICE 1         |                     |        DEVICE 2 |
|          'RTS'  |8 ----------------> 7|  'CTS'           |
|_____|                     |_____|
             Control Line Configuration
```
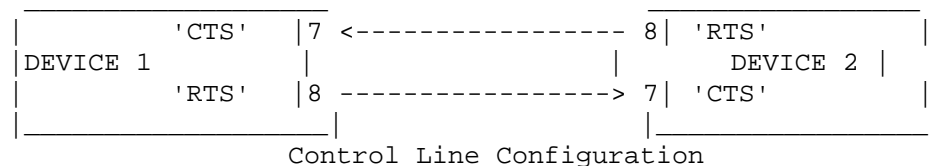
Mouse Communications Interface

The Mouse interface supports 3 interface signal lines, as described below, 5 volts and ground. Please refer to the PS/2 Keyboard/Auxilliary controller port specification for further connector definition.

+Data

Pin 1

The '+Data' line is a bi-directional signal used to transfer data between the device and the Host. A logical '1' is defined as a high level on the interface. This signal is driven and received by the Host and all devices attached to the Host. Contention over which I/O device in a multi-device configuration can drive this line is resolved by the '-Busy' line.

+Clock

Pin 5

The '+Clock' line is a bi-directional signal used to synchronize the data transfer between I/O devices and Host. This signal is driven and received by the Host all I/O devices attached to the Host. The Host can hold this line low to inhibit all I/O devices from communicating. For data transfers (both transmit and receive) this line is driven by the I/O device controlling the interface. Contention over which I/O device in a multi-device configuration can drive this line is resolved by the '-Busy' line.

-Busy

Pin 2

The '-Busy' line is a bi-directional signal that allows the I/O device to gain control of the interface and to indicate when the interface is in use. This function is necessary to allow inactive devices to differentiate between communications between the Host and the active device and the Host transmission of 'ACTIVATE' commands that all I/O devices must receive. A low voltage level on this line indicates a request is being made or that the interface is busy. A high level indicates that the interface is not busy and all I/O devices should monitor interface activity. This line can be driven and received by all I/O devices attached to the Host. The I/O device can drive this line to request the interface or when it has control.

Device Contention

The definition of the '+Data' and '+Clock' signals requires that one I/O device always has control of the interface and will drive the '+Clock' line for communications. An I/O device must first gain control of the interface before a communication sequence can occur. The '-Busy' line allows for an I/O device to request and gain control of the interface. The request sequence can be initiated in two ways:

1. Device Initiated

The I/O device requesting service will initiate a request for control of the interface by sending an 'ATTENTION' command to the Host. After the device has acquired control of the interface, set the busy mode and sent the 'ATTENTION', the device will return to the interface mode (monitor or busy) that it was in prior to sending the 'ATTENTION'. If a host transmission is started ('Request to Send' on the clock and data lines) after the device has set the '-Busy' line to send an 'ATTENTION', the device will return to the monitor mode and clock in data bits from the host. If the host aborts the transmission of the 'ATTENTION' by holding the clock line low, the device will return to the monitor

mode and prepare to clock in a transmission from the host. The device will also initiate a request for the interface when it has completed power-on initialization. The unit will execute its initialization routines in response to the 'STEST' and 'RESTART' commands and therefore request control of the interface.

2. Host Initiated

When the Host has a command to issue to a device, it must be assured control of the interface. The Host will issue an 'ACTIVATE' command identifying the device. All I/O devices monitor 'ACTIVATE' commands. The device will respond to receiving its ID by requesting and gaining control of the interface and sending an 'ACTIVE' command identifying itself back to the Host.

Once the device has been selected by the 'ACTIVATE' command and has gained control of the interface, it will remain in control of the interface with the '-Busy' line active (busy mode) until receiving a 'DEACTIVATE' command from the Host. When this command is received the device will deactivate the '-Busy' line (monitor mode) to allow other devices to gain control of the interface.

Chapter 2. Functional Description Magnetics

The 4777 magnetics device allows data from two adjacent tracks to be read and stored on a single pass of a credit card or other magnetic media. When the 4777 has detected that a card or other magnetic media has been slotted, the 4777 will request attention from the Host. The Host can issue commands to read the stored data and re-enable the 4777. Once a card has been slotted, the 4777 will remain disabled until re-enabled by the Host.

The 4777 magnetics device can buffer data sent from the Host that is to be encoded when media is slotted. Two adjacent tracks can be encoded with independent data and read back on a single pass of a credit card or other magnetic media. An encoder model is also defined with a wide encode head to allow encode of a single data stream over an area covering two adjacent tracks. Verification of the data read back to the 4777 storage must be performed by the Host.

Read Functions

Track 1

Track 1 characters comprise 6 bits + parity.

1. Is capable of reading Track-1 at 210 BPI, in accordance to ISO Standards 7811/2 and /4.

2. All data read will be stored until requested, or until cleard by command.

3. Storage may be cleared on command.

Track 2

Track 2 characters comprise 4 bits + parity.

1. Is capable of reading Track-2 at either 75 or 210 BPI with no conditioning, in accordance with ISO Standards 7811/2 and /4.

2. All data read will be stored until requested, or until cleard by command.

3. Storage may be cleared on command.

Track 3

Track 3 characters comprise 4 bits + parity.

1. Is capable of reading Track 3 at 210 BPI, in accordance to ISO Standards 7811/2, /4, and /5.

2. All data read will be stored until requested, or until cleard by command.

3. Storage may be cleared on command.

JUCC Support

The Model 5 4777 will support read of the JUCC stripe on the front of a card, track 1 and 2 ISO tracks on the back of a card, and the passbook stripe of a thick passbook.

Encode Functions

Passbook Encoder

1. Is capable of encoding data at 210 BPI, in accordance with IBM Format, DIN 32744, or ISO Standard 8484.

2. Data to be encoded O.260"(6.5 mm) wide, in an area on the magnetic stripe defined as Track 2 and Track 3.

3. Data to be encoded will be received from the Host, then stored in the 4777.

Card Encoder

1. Is capable of encoding Track 1 at 210 BPI and Track 2 at 75 bpi, in accordance with ISO Standards 7811/2 and /4.

2. Data to be encoded will be received from the Host, then stored in the 4777.

Multi Track

Is capable of simultaneously encoding(writing) on two tracks with independent data streams.

Read Verify

When encoding Track 1, 2 or 3, the data encoded will be read during the same pass of the media. The data read will be stored until requested. Storage may be cleared on command.

Media Detect

Provides means for detecting the presence of media in the slot and provides a status byte on command through the external interface.

Indicator LED's

Ready (Green)

1. On command will come on, steady, to indicate ready to read.

2. On command will come on, blinking at approximately 2.5 cycles per second indicating ready to encode.

3. Will be held on, steady or blinking,until media is detected.

In Process (Amber)

1. Turned on and off by command.

2. Turned on by 4777 when read or encode pass has completed

Check (Red)

Turned on and off by command.

Note: See " WRIND - Hex Code X'DF'" on page 3-16 for command to control 'In Process" and 'Check' indicators.

Chapter 3. Device Commands

The Magnetics group are the commands necessary to support the functions of the 4777. All commands that are used to transfer data or status or set device operating parameters or modes are in this group.

Issuing Commands

A transaction between the Host and the 4777 consists of three parts;

1) Device Selection
2) Execution of a magnetics command sequence or sequences
3) Termination

The Host initiates a transaction by first selecting the 4777 using the 'ACTIVATE' command and waiting for it to be acknowledged by the 'ACTIVE' status. The Host can then send a magnetics command. Magnetics command sequences are completed when the 4777 sends the 'OPCOMP' command to the Host. Upon receiving the 'OPCOMP' the Host can issue another magnetics command or terminate the transaction by issuing the 'DEACTIVATE' command. After receiving the 'DEACTIVATE' command the 4777 will release the control line and return to the monitor mode.

If the 4777 requires service from the Host it must first gain control of the interface then send an 'ATTENTION' to the Host. After sending the 'ATTENTION', the 4777 will return to the interface mode (busy or monitor) that it was in prior to the 'ATTENTION' transmission. Upon receiving the 'ATTENTION' the Host will activate the 4777 (if not active) and issue a 'SENSE' command to determine the reason for the 'ATTENTION'. At the completion of the 'SENSE' command sequence the Host my issue another magnetics command or terminate the transaction with the 'DEACTIVATE' command.

The magnetics command sequence consists of a command issued by the Host and concluded by the 'OPCOMP' response from the 4777. If execution of the command requires additional data be sent from the Host, the 4777 will send the 'NEXT' status when it is ready for each data byte. Upon receiving the 'NEXT' status the Host will send one additional byte of data. This byte-by-byte handshaking will continue until all data has been transferred. The Host will indicate to the 4777 that all data has been transferred by sending an 'EOP' in response to the 'NEXT' status. For all magnetics command sequences transferring data to the 4777, the 4777 will calculate an LRC for the data field and send it to the Host in response to the 'EOP'. The sequence will be completed with another 'EOP' from the Host and the 'OPCOMP' response. Data transferred to the 4777 can have 1 to 7 valid bits per character. The high order bit (bit 7) must always be '0' for data bytes and '1' for command bytes sent to the 4777.

If execution of the magnetics command sequence requires data to be transferred to the Host, the 4777 will respond to the command with a 1-byte header indicating that data follows. The 4777 will wait for the 'NEXT' status from the Host before sending each data byte. The Host will indicate when all data has been received by sending an 'EOP' instead of the 'NEXT'. The 4777 will then send a one byte LRC character. The sequence is completed with another 'EOP' from the Host and the 'OPCOMP' response.

Initialization

Immediately after a reset (i.e., after power-up) the 4777 will execute a self-test routine. This routine is the same routine used to service the 'STEST' command. Thus the reset implies a 'STEST' command. After completion of the self-test, if the 4777 is capable of responding, the 4777 will request control of the interface, go to the monitor mode and wait for the 'ACTIVATE' command from the Host. Once the 'ACTIVATE' command sequence has been completed the 4777 will enter the 'ECHO' mode (see 'ECHO' Command). If the 4777 completes the self-test routine successfully it can accept the 'ACTIVATE' command

Device Selection Commands

The following commands are used to control which I/O device is in control of the interface. A brief description of each command is given in this section.

Activate Magnetics:

ACTIVATE - Hex Code X'B0'

This command is issued by the host to select the 4777 for execution of a communication sequence. The host terminal will not issue this command if there are any commands in progress (I/O devices must be in the monitor mode). After receiving this command, the 4777 will gain control of the interface, set the busy mode and respond with the status 'MAG ACTIVE'. After sending the 'MAG ACTIVE' the Magnetic Device will then be ready to accept any magnetics commands from the host. The 4777 will remain active until receiving 'DEACTIVATE' from the host.

There is not a retry command defined for the 'ACTIVATE MAGNETICS' command or 'MAG ACTIVE' response. Any errors will result in the host re-initiating the sequence from the beginning. The 4777 or other I/O device will not return the 'MAG ACTIVE' status if a parity error was detected on the transmission of the 'ACTIVATE DEVICE' command. If no I/O device detects its valid ID, the status of the interface will not change and the 'MAG ACTIVE' status will not be returned by any device. After a 25 milli-second timeout the host may reissue the 'ACTIVATE DEVICE' command. If the host detects an error in the 'MAG ACTIVE' response or receives and invalid ID in the response, the host will send the 'DEACTIVATE COMMAND' to force all devices to the monitor mode and reissue the 'ACTIVATE MAGNETICS' command.

Activate Reserved:

Hex Code X'B1' to Hex Code x'BF'

These commands are reserved for activate functions of other I/O devices. These commands could be received by the 4777 when in the monitor mode.

Magnetics Attention:

ATTENTION - Hex Code X'C0'

The 'MAGNETICS ATTENTION' command is issued by the 4777 when service is required. The 4777 must first gain control of the interface and assert the control line before issuing this command. This command identifies the 4777 as the device requiring service. Following transmission of the 'ATTENTION' the 4777 will return to interface mode (busy or monitor) that it was in prior to the cause of the 'ATTENTION'. The 4777 will then wait to be activated (if not active) and receive the 'SENSE'command.

Reserved Attention:

Hex Code X'C1' to Hex Code x'CF'

These 'ATTENTION' commands are reserved for other I/O devices.

Deactivate:

Hex Code X'FF'

This command is issued by the Host to cause the active I/O device to halt communications and return to the monitor mode. This command is used for normal command sequence completion. No response is defined of the 'DEACTIVATE' command. For communications with the 4777, it will normally be issued following the 'OPCOMP' command at the completion of the magnetics command sequence.

Magnetics Commands

The following commands are unique 4777 commands required to implement the magnetics functions. A brief description of each command is given in this section.

Commands: Auxilliary(Mouse) versus Serial(RS232C)

The command sequence is different when the 4777 is connected to the Auxilliary port then when connected to the Serial port. The 4777 will request a command to be resent for verification when connected to the auxilliary port. The Serial port requires the command be sent only once.

Auxilliary(Mouse)port

```
Host:    <Mag Cmd>        <Mag Cmd>       .....
4777:            <RESEND>          <NEXT> ......
```

 This representation for the auxilliary port connected 4777 is abbreviated
in all the command descriptions as '<COMMAND>'.

Serial(RS232C)port

```
Host:    <Mag Cmd>   .....
4777:            <NEXT> ......
```

 This representation for the serial port connected 4777 is abbreviated in all the command descriptions as '<COMMAND>'.

Arm Encoder- Track 1

ARM1 - Hex Code X'E1'

This command indicates the data in the internal storage buffer associated with the track 1 encode head is to be written to the magnetic stripe. The 4777 will not encode the data until the 'ENABLE MAGNETICS' command is received. The 4777 responds to the command by returning 'OPCOMP' status and setting an internal bit indicating that track 1 encode is pending.

After the 'ENABLE MAGNETICS' command is received the 4777 will enable the reader and track 1 encode hardware, then blink the 'Ready' indicator at a rate of approximately 2.5 times per second, with approximately 50% duty cycle.

Swiping a card after the 4777 enables the slot will cause the data in the internal storage associated with the track 1 encode head to be written onto the magnetic stripe. The data encoded on the stripe will be read back with the same swipe used to encode. The data will be read into the same internal storage used for the normal read function (see " RDRB1A - Hex Code X'F6'" on page 3-7 and " RDRB1S - Hex Code X'FA'" on page 3-9).

When a card is detected, the 4777 waits sufficient time for the card to exit the slot. It then takes control of the internal storage, disables the magnetic encoder, resets the track 1 encode pending indicator bit, turns the 'Ready' indicator off and turns the 'In Process' indicator on.   After taking control of the internal storage the 4777 sends an 'ATTENTION' to the Host. The Host will then issue a 'SENSE' command and the 4777 will respond with the 'MDR' status bit set to indicate that magnetic data is available (see " WRIND - Hex Code X'DF'" on page 3-16).

The Track 1 encode pending bit will be reset whenever a 'DISABLE MAGNETICS', 'STEST' or 'RESTART' command is received or a card is slotted.

```
Host:     <COMMAND>
4777:            <OPCOMP>
```

Arm Encoder- Track 2

ARM2 - Hex Code X'F3'

This command indicates the data in the internal storage buffer associated with the track 2 encode head is to be written to the magnetic stripe. The 4777 will not encode the data until the 'ENABLE MAGNETICS' command is received. The 4777 responds to the command by returning 'OPCOMP' status and setting an internal bit indicating that track 2 encode is pending.

After the 'ENABLE MAGNETICS' command is received the 4777 will enable the reader and track 2 encode hardware, then blink the 'Ready' indicator at a rate of approximately 2.5 times per second, with approximately 50% duty cycle.

Swiping a card after the 4777 enables the slot will cause the data in the internal storage associated with the track 2 encode head to be written onto the magnetic stripe. The data will be encoded at the density (75 BPI or 210 BPI) defined for track 2 encode by the model identification. The data encoded on the stripe will be read back with the same swipe used to encode. The data will be read into the same internal storage used for the

normal read function (see " RDRB2A - Hex Code X'F7'" on page 3-8 and " RDRB2S - Hex Code X'FB'" on page 3-10).

When a card is detected, the 4777 waits sufficient time for the card to exit the slot. It then takes control of the internal storage, disables the magnetic encoder, resets the track 2 encode pending indicator bit, turns the 'Ready' indicator off and turns the 'In Process' indicator on. After taking control of the internal storage the 4777 sends an 'ATTENTION' to the Host. The Host will then issue a 'SENSE' command and the 4777 will respond with the 'MDR' status bit set to indicate that magnetic data is available (see " WRIND - Hex Code X'DF'" on page 3-16).

The Track 2 encode pending bit will be reset whenever a 'DISABLE MAGNETICS', 'STEST' or 'RESTART' command is received or a card slotted.

Host: <COMMAND>
4777:   <OPCOMP>

Arm Encoder- Track 3

ARM3 - Hex Code X'F4'

This command indicates the data in the internal storage buffer associated with the track 3 encode head is to be written to the magnetic stripe. The 4777 will not encode the data until the 'ENABLE MAGNETICS' command is received. The 4777 responds to the command by returning 'OPCOMP' status and setting an internal bit indicating that track 3 encode is pending.

After the 'ENABLE MAGNETICS' command is received the 4777 will enable the reader and track 3 encode hardware, then blink the 'Ready' indicator at a rate of approximately 2.5 times per second, with approximately 50% duty cycle.

Swiping a card after the 4777 enables the slot will cause the data in the internal storage associated with the track 3 encode head to be written onto the magnetic stripe. The data encoded on the stripe will be read back with the same swipe used to encode. The data will be read into the same internal storage used for the normal read function (see " RDRB3A - Hex Code X'F9'" on page 3-8 and " RDRB3S - Hex Code X'FD'" on page 3-10).

When a card is detected, the 4777 waits sufficient time for the card to exit the slot. It then takes control of the internal storage, disables the magnetic encoder, resets the track 3 encode pending indicator bit, turns the 'Ready' indicator off and turns the 'In Process' indicator on. After taking control of the internal storage the 4777 sends an 'ATTENTION' to the Host. The Host will then issue a 'SENSE' command and the 4777 will respond with the 'MDR' status bit set to indicate that magnetic data is available (see " WRIND - Hex Code X'DF'" on page 3-16).

The Track 3 encode pending bit will be reset whenever a 'DISABLE MAGNETICS', 'STEST' or 'RESTART' command is received or a card slotted.

Host: <COMMAND>
4777:   <OPCOMP>

Disable Magnetics:

DISMAG - Hex Code X'F1'

This command causes the 4777 to turn off the 'Ready' indicator, take control of and clear the internal storage associated with the encode heads. The command is acknowledged by sending an 'OPCOMP' to the Host.

If a card is swiped while the slot is disabled, the 4777 will ignore the action and the 'ATTENTION' status will not be issued.

Host: <COMMAND>
4777:   <OPCOMP>

Echo Data:

ECHO - Hex Code X'E8'

The 'ECHO' command causes the 4777 to echo data bytes back to the Host. Upon receiving 'ECHO' the 4777 sends a header, 'DAV', to the Host and then waits for the Host to send a data byte. The data byte is sent back to the Host as soon as it is received. If the data was received in error, the byte will be echoed as it was received (parity regenerated). The Host must wait until it receives the previous byte before sending another. The 4777 echoes every data byte until the Host terminates the command by sending an 'EOP' (the data byte cannot equal a command). Upon receiving the 'EOP' the 4777 then responds with an 'OPCOMP').

Host: <COMMAND>   <DATA>   ...<DATA>   <EOP>
4777:   <HEADER>   <DATA>   <DATA>   <OPCOMP>

Enable Magnetics:

ENMAG - Hex Code X'F0'

This command 'ENABLE MAGNETICS' causes the 4777 to take control of and clear the internal storage associated with the read heads. The command is acknowledged by sending an 'OPCOMP' to the Host.

The 4777 will turn the 'Ready' indicator on. At this time swiping a card will load the internal storage with the data read from the magnetic media.

After acknowledging the command the 4777 waits for a card to be swiped. When a card is detected the 4777 waits for the card. Then takes control of the internal storage, turns the 'Ready' indicator off and turns the 'In Process' indicator on. After taking control of the internal storage the 4777 sends an 'ATTENTION' to the Host. The Host then issues a 'SENSE' command and the 4777 responds with the 'MDR' status bit set to indicate that magnetic data is available.

If a card is in the slot when 'ENMAG' is received, the 4777 will acknowledge the command with 'OPCOMP' but not enable the slot or turn on the 'Ready' indicator. When the card is removed from the slot, the 4777 will set the 'illgl' status bit, turn off the 'Ready' indicator, turn on the 'in process' indicator and send an 'ATTENTION' to the Host.

Host: <COMMAND>
4777:   <OPCOMP>

End of Operation:

EOP - Hex Code X'F2'

This command should be used to terminate the 'RDRBX', 'RDWBX', 'WRRDX' 'WRWBX', 'ECHO', 'SENSE', and 'WRIND' commands. If no command is pending when the 'EOP' is received it is acknowledged by the 4777 with an 'OPCOMP'.

Host: <COMMAND>
4777:   <OPCOMP>

Read Magnetics Read Buffer 1:

RDRB1A - Hex Code X'F6'

This command causes the 4777 to take control of the internal storage associated with the track 1 read hardware. It will then start assembling data from internal storage (track 1 read buffer) into 8-bit characters starting with the first bit in the storage. Data in the storage is assumed to be arranged so that the least significant bit of a character is the first bit read.

Before sending any data, the 4777 will respond with a header, 'DAV'. The Host will then send a 'NEXT'. Upon receiving the 'NEXT', the 4777 will start assembling characters from storage. When a byte is assembled, the 4777 will send it to the Host. The Host will then respond with either a 'NEXT', 'RESEND' or an 'EOP'. The 4777 will assemble data from the internal storage associated with track 1 read hardware until the Host sends an 'EOP'. Upon receiving the 'EOP', the 4777 will send an LRC to the Host. The 4777 calculates this LRC from the data that it sent to the Host. This LRC is added by the 4777 and is not necessarily the same as the LRC read from the stripe. After receiving the LRC, the Host should send an 'EOP' to which the 4777 will respond with an 'OPCOMP'.

Note: If the 4777 is expecting a 'NEXT', 'RESEND' or an 'EOP' but the byte received is neither then the 4777 will treat it as a 'NEXT'.

Reading from internal storage does not clear the internal storage.

Note: If the Host issues this command to a model of the 4777 which does not have track 1 read capability (see 'SENSE') then the 4777 will send a header of 'OPCOMP' and automatically terminate the command.

Host: <COMMAND>   <NEXT>   ...<EOP>   <EOP>
4777:   <HEADER>   <DATA>   <LRC> <OPCOMP>

Read Magnetics Read Buffer 2:

RDRB2A - Hex Code X'F7'

This command causes the 4777 to take control of the internal storage associated with the track 2 read hardware. It will then start assembling data from internal storage (track 2 read buffer) into 8-bit characters starting with the first bit in the storage. Data in the storage is assumed to be arranged so that the least significant bit of a character is the first bit read.

Before sending any data the 4777 will respond with a header, 'DAV'. The Host will then send a 'NEXT'. Upon receiving the 'NEXT', the 4777 will start assembling characters from storage. When a byte is assembled, the 4777 will send it to the Host. The Host will then respond with either a 'NEXT', 'RESEND' or an 'EOP'. The 4777 will assemble data from the internal storage associated with track 2 read hardware until the Host sends an 'EOP'. Upon receiving the 'EOP', the 4777 will send an LRC to the Host. The 4777 calculates this LRC from the data that it sent to the Host. This LRC is added by the 4777 and is not necessarily the same as the LRC read from the stripe. After receiving the LRC, the Host should send an 'EOP' to which the 4777 will respond with an 'OPCOMP'.

> Note: If the 4777 is expecting a 'NEXT', 'RESEND' or an 'EOP' but the byte received is neither then the 4777 will treat it as a 'NEXT'.

Reading from internal storage does not clear the internal storage.

> Note: If the Host issues this command to a model of the 4777 which does not have track 2 read capability (see 'SENSE') then the 4777 will send a header of 'OPCOMP' and automatically terminate the command.

```
Host: <COMMAND>      <NEXT>    ...<EOP>   <EOP>
4777:           <HEADER>   <DATA>      <LRC>   <OPCOMP>
```

Read Magnetics Read Buffer 3:

RDRB3A - Hex Code X'F9'

This command causes the 4777 to take control of the internal storage associated with the track 3 read hardware. It will then start assembling data from internal storage (track 3 read buffer) into 8-bit characters starting with the first bit in the storage. Data in the storage is assumed to be arranged so that the least significant bit of a character is the first bit read.

Before sending any data, the 4777 will respond with a header, 'DAV'. The Host will then send a 'NEXT'. Upon receiving the 'NEXT' the 4777 will start assembling characters from storage. When a byte is assembled, the 4777 will send it to the Host. The Host will then respond with either a 'NEXT', 'RESEND' or an 'EOP'. The 4777 will assemble data from internal storage '3' until the Host sends an 'EOP'. Upon receiving the 'EOP', the 4777 will send an LRC to the Host. The 4777 calculates this LRC from the data that it sent to the Host. This LRC is added by the 4777 and is not necessarily the same as the LRC read from the stripe. After receiving the LRC, the Host should send an 'EOP' to which the 4777 will respond with an 'OPCOMP'.

> Note: If the 4777 is expecting a 'NEXT', 'RESEND' or an 'EOP' but the byte received is neither then the 4777 will treat it as a 'NEXT'.

Reading from internal storage does not clear the internal storage.

Note: If the Host issues this command to a model of the 4777 which does not have track 3 read capability (see 'SENSE') then the 4777 will send a header of 'OPCOMP' and automatically terminate the command.

```
Host: <COMMAND>      <NEXT>    ...<EOP>  <EOP>
4777:          <HEADER>  <DATA>      <LRC>  <OPCOMP>
```

Read Magnetics Read Buffer 1 SOM:

RDRB1S - Hex Code X'FA'

Upon receiving this command, the 4777 takes control of the internal storage associated with track 1 read hardware. The 4777 then searches the data in the (track 1) internal storage for the IATA 'SOM' character. The 4777 sends a header to the Host to indicate whether the 'SOM' was found or the end of the internal storage was reached,

If the 4777 reaches the end of the internal storage before finding the 'SOM' it will automatically terminate the command, indicated by the 'OPCOMP' being sent to the Host.

After the Host receives the 'DAV' header, it will then send a 'NEXT', 'EOP' or a 'RESEND'. Upon receiving the 'NEXT', the 4777 will start assembling and transmitting 7-bit characters (starting with the SOM). The 4777 will transmit one character at a time waiting for a 'NEXT' before sending another. The 4777 will continue to send data to the Host until the Host sends an 'EOP' (in place of the 'NEXT'). Upon receiving the 'EOP' the 4777 will send to the Host an LRC which the 4777 calculated from the data bytes sent to the Host. This LRC is added by the 4777 and is not necessarily the same as the LRC read from the stripe. After receiving the LRC the Host should send a 'EOP' to which the 4777 will respond with an 'OPCOMP'.

Note: If the 4777 is expecting a 'NEXT', 'RESEND' or an 'EOP' but the byte received is neither then the 4777 will treat it as a 'NEXT'.

Reading from internal storage does not clear the internal storage.

Figure 3-1. Track 1 with SOM		
Track	**Valid SOM(s)**	**Data Type**
1	100 0101	IATA

Note: If the Host issues this command to a model of the 4777 which does not have track 1 read capability (see 'SENSE') then the 4777 will send a header of 'OPCOMP' and automatically terminate the command.

```
Host: <COMMAND>      <NEXT>    ...<EOP>  <EOP>
4777:          <HEADER>  <DATA>      <LRC>  <OPCOMP>
```

Read Magnetics Read Buffer 2 SOM:

RDRB2S - Hex Code X'FB'

Upon receiving this command the 4777 takes control of the internal storage associated with track 2 read hardware. The 4777 then searches the data in (track 2) internal storage for the ABA 'SOM' character. The 4777 sends a header to the Host to indicate whether the 'SOM' was found or the end of the internal storage was reached,

If the 4777 reaches the end of the internal storage before finding the 'SOM' it will automatically terminate the command, indicated by the 'OPCOMP' being sent to the Host.

After the Host receives the 'DAV' header it will then send a 'NEXT', 'EOP' or a 'RESEND'. Upon receiving the 'NEXT', the 4777 will start assembling and transmitting 5-bit characters (starting with the SOM). The 4777 will transmit one character at a time waiting for a 'NEXT' before sending another. The 4777 will continue to send data to the Host until the Host sends an 'EOP' (in place of the 'NEXT'). Upon receiving the 'EOP' the 4777 will send, to the Host, an LRC which the 4777 calculated from the data bytes sent to the Host. This LRC is added by the 4777 and is not necessarily the same as the LRC read from the stripe. After receiving the LRC the Host should send an 'EOP' to which the 4777 will respond with an 'OPCOMP'.

> Note: If the 4777 is expecting a 'NEXT', 'RESEND' or an 'EOP' but the byte received is neither then the 4777 will treat it as a 'NEXT'.

Reading from internal storage does not clear the internal storage.

Figure 3-2. Track 2 with SOM		
Track	**Valid SOM(s)**	**Data Type**
2	0 1011	ABA

Note: If the Host issues this command to a model of the 4777 which does not have track 2 read capability (see 'SENSE') then the 4777 will send a header of 'OPCOMP' and automatically terminate the command.

Host: <COMMAND>   <NEXT>   ...<EOP>   <EOP>
4777:   <HEADER>   <DATA>   <LRC>   <OPCOMP>

Read Magnetics Read Buffer 3 SOM:

RDRB3S - Hex Code X'FD'

Upon receiving this command the 4777 takes control of the internal storage associated with the track 3 read hardware. The 4777 then searches the data in (track 3) internal storage for an ABA or DIN 'SOM' character. The 4777 sends a header to the Host to indicate whether a 'SOM' was found or the end of the internal storage was reached,

If the 4777 reaches the end of the internal storage before finding the 'SOM' it will automatically terminate the command, indicated by the 'OPCOMP' being sent to the Host.

After the Host receives the 'DAV' header it will then send a 'NEXT', 'EOP' or a 'RESEND'. Upon receiving the 'NEXT' the 4777 will start assembling and transmitting 5-bit characters (starting with the SOM). The 4777 will transmit one character at a time waiting for a 'NEXT' before sending another. The 4777 will continue to send data to the Host until the Host sends an 'EOP' (in place of the 'NEXT'). Upon receiving the 'EOP' the 4777 will send to the Host an LRC which the 4777 calculated from the data bytes sent to the Host. This LRC is added by the 4777 and is not necessarily the same as The LRC read from the stripe. After receiving the LRC the Host should send an 'EOP' to which the 4777 will respond with an 'OPCOMP'.

> Note: If the 4777 is expecting a 'NEXT', 'RESEND' or an 'EOP' but the byte received is neither then the 4777 will treat it as a 'NEXT'.

Reading from internal storage does not clear the internal storage.

Figure 3-3. Track 3 with SOM		
Track	**Valid SOM(s)**	**Data Type**
3	0 1101	Din
3	0 1011	Thrift

Note: If the Host issues this command to a model of the 4777 which does not have track 3 read capability (see 'SENSE') then the 4777 will send a header of 'OPCOMP' and automatically terminate the command.

Host: <COMMAND>   <NEXT>   ...<EOP>   <EOP>
4777:   <HEADER>   <DATA>   <LRC>   <OPCOMP>

Read Magnetics Write Buffer 1:

RDWB1 - Hex Code X'E2'

This command causes the 4777 to take control of the internal storage associated with the track 1 encode hardware. It will then start assembling data from internal storage (track 1 write buffer) into 8-bit characters starting with the first bit in the storage. Data in the storage is assumed to be arranged so that the least significant bit of a character is the first bit read.

Before sending any data the 4777 will respond with a header, 'DAV'. The Host will then send a 'NEXT'. Upon receiving the 'NEXT,' the 4777 will start assembling characters from storage. When a byte is assembled, the 4777 will send it to the Host. The Host will then respond with either a 'NEXT', 'RESEND' or an 'EOP'. The 4777 will assemble data from the internal storage associated with track 1 encode hardware until the Host sends an 'EOP'. Upon receiving the 'EOP', the 4777 will send an LRC to the Host. The 4777 calculates this LRC from the data that it sent to the Host. This LRC is added by the 4777 and is not read from the shift register. After receiving the LRC, the Host should send an 'EOP' to which the 4777 will respond with an 'OPCOMP'.

> Note: If the 4777 is expecting a 'NEXT', 'RESEND' or an 'EOP' but the byte received is neither then the 4777 will treat it as a 'NEXT'.

Note: The buffer data cannot be read after issuing the "ENABLE MAGNETICS" command.

Reading from internal storage does not clear the internal storage.

Note: If the Host issues this command to a model of the 4777 which does not have track 1 encode capability (see 'SENSE') then the 4777 will send a header of 'OPCOMP' and automatically terminate the command.

```
Host: <COMMAND>      <NEXT>     ...<EOP>   <EOP>
4777:          <HEADER>   <DATA>       <LRC>   <OPCOMP>
```

Read Magnetics Write Buffer 2:

RDWB2 - Hex Code X'E3'

This command causes the 4777 to take control of the internal storage associated with the track 2 encode hardware. It will then start assembling data from internal storage (track 2 write buffer) into 8-bit characters starting with the first bit in the storage. Data in the storage is assumed to be arranged so that the least significant bit of a character is the first bit read.

Before sending any data, the 4777 will respond with a header, 'DAV'. The Host will then send a 'NEXT'. Upon receiving the 'NEXT', the 4777 will start assembling characters from storage. When a byte is assembled, the 4777 will send it to the Host. The Host will then respond with either a 'NEXT', 'RESEND' or an 'EOP'. The 4777 will assemble data from the internal storage associated with track 2 encode hardware until the Host sends an 'EOP'. Upon receiving the 'EOP', the 4777 will send an LRC to the Host. The 4777 calculates this LRC from the data that it sent to the Host. This LRC is added by the 4777 and is not read from the shift register. After receiving the LRC, the Host should send an 'EOP' to which the 4777 will respond with an 'OPCOMP'.

Note: If the 4777 is expecting a 'NEXT', 'RESEND' or an 'EOP' but the byte received is neither then the 4777 will treat it as a 'NEXT'.

Reading from internal storage does not clear the internal storage.

Note: If the Host issues this command to a model of the 4777 which does not have track 2 encode capability (see 'SENSE') then the 4777 will send a header of 'OPCOMP' and automatically terminate the command.

Note: The buffer data cannot be read after issuing the "ENABLE MAGNETICS" command.

```
Host: <COMMAND>      <NEXT>     ...<EOP>   <EOP>
4777:          <HEADER>   <DATA>       <LRC>   <OPCOMP>
```

Read Magnetics Write Buffer 3:

RDWB3 - Hex Code X'E4'

This command causes the 4777 to take control of the internal storage associated with the track 3 encode hardware. It will then start assembling data from internal storage (track 3 write buffer) into 8-bit characters starting with the first bit in the storage. Data in the storage is assumed to be arranged so that the least significant bit of a character is the first bit read.

Before sending any data, the 4777 will respond with a header, 'DAV'. The Host will then send a 'NEXT'. Upon receiving the 'NEXT', the 4777 will start assembling characters from storage. When a byte is assembled, the 4777 will send it to the Host. The Host will then respond with either a 'NEXT', 'RESEND' or an 'EOP'. The 4777 will assemble data from internal storage '3' until the Host sends an 'EOP'. Upon receiving the 'EOP,' the 4777 will send an LRC to the Host. The 4777 calculates this LRC from the data that it sent to the Host. This LRC is added by the 4777 and is not read from the shift register. After receiving the LRC, the Host should send an 'EOP' to which the 4777 will respond with an 'OPCOMP'.

Note: If the 4777 is expecting a 'NEXT', 'RESEND' or an 'EOP' but the byte received is neither then the 4777 will treat it as a 'NEXT'.

Reading from internal storage does not clear the internal storage.

Note: If the Host issues this command to a model of the 4777 which does not have track 3 encode capability (see 'SENSE') then the 4777 will send a header of 'OPCOMP' and automatically terminate the command.

Note: The buffer data cannot be read after issuing the "ENABLE MAGNETICS" command.

```
Host: <COMMAND>    <NEXT>   ...<EOP>  <EOP>
4777:         <HEADER>   <DATA>      <LRC>  <OPCOMP>
```

Resend:

RESEND - Hex Code X'F5'

'RESEND' can be used in place of any transmission, by the Host or the 4777, except a data byte sent from the 4777. It will cause the receiver to repeat the last byte that is transmitted. Data bytes resent in response to this command are not used in the LRC calculation.

```
Host: ...<REQUEST>    ... or ...      <DATA> ...
4777:          <DATA>          <REQUEST>
```

Restart Magnetics:

RESTART - Hex Code X'EE'

The 'RESTART' command causes the 4777 to return to it's initial state. The interface is re-initialized using the same procedure as a power-on reset.

'RESTART' is similar to 'STEST' in that it is a software reset but 'RESTART' does not perform a self-test. The test results of the previous self-test are retained.

```
Host: <COMMAND>  ... <DATA(I)>        ... <EOP>
4777:                    <DATA(I)>        <OPCOMP>
```

Sense Attention:

SENSE - Hex Code X'E9'

The 'SENSE' command is used to determine the reason for an 'ATTENTION' or to read the results of a self-test. The 4777 will respond with a header, 'DAV'. The Host then sends a 'NEXT' and the 4777 responds with the status byte. Upon receiving the status byte the Host sends an 'EOP'. The Host then sends an 'EOP' and the 4777 returns an 'OPCOMP'.

If instead of the first 'EOP' the Host sends a 'NEXT' then the 4777 will respond with the extended status byte.

Figure 3-4. Sense Status Byte							
BIT7	**BIT6**	**BIT5**	**BIT4**	**BIT3**	**BIT2**	**BIT1**	**BIT0**
ID Bit 7	ID Bit 6	ID Bit 5	Test Results Bit 4	Test Results Bit 3	Illegal (ILLGL)	Magnetic Data Read (MDR)	Request (REQ)

REQ = 1 An 'ATTENTION' was sent since the last 'SENSE' command was received.
 Reset by 'SENSE'

MDR = 1 Valid card data is in the internal storage. Reset by a power-on reset, 'STEST', 'RESTART', 'ENMAG', or 'DISMAG'.

ILLGL = 1 Card swipe was started before the slot was enabled. Reset by 'SENSE'.

TEST RESULTS

01 = Test Passed
10 = Test Failed

Figure 3-5. Identification Bit Definitions	
ID BITS	**Functions**
0 0 0	Extended Status Indicator
0 0 1	Track 1 Reader
	Track 2 Reader
0 1 0	Track 2 Reader
	Track 3 Reader
	Track 2 210 BPI Encoder
	Track 3 210 BPI Encoder
0 1 1	Track 1 Reader
	Track 2 Reader
	Track 1 210 BPI Encoder
	Track 2 75 BPI Encoder
1 0 0	Track 2 Reader
	Track 3 Reader

Note: Model '010' has one encode circuit and head that will encode both track 2 and track 3 with the same data stream. Only one write buffer is implemented in hardware but can be accessed by track 2 and track 3 three commands ('RDWB2', 'WRWB2', 'RDWB3', 'WRWB3'). 'ARM2' or 'ARM3' can be used to enable the model '010' encoder. The encoded data can be read back from either the track 2 or track 3 read buffer.

Note: ID = 000 is reserved as an extended status indicator. The extended status is used to provide additional information about the device capabilities. The extended status is in the form of an additional byte of data sent in response to the 'SENSE' command. Refer to the following figure for bit definitions of the extended status byte.

Figure 3-6. Extended Status Byte							
BIT7	**BIT6**	**BIT5**	**BIT4**	**BIT3**	**BIT2**	**BIT1**	**BIT0**
Not Defined	Read Track 1 (R1)	Read Track 2 (R2)	Read Track 3 (R3)	Not Defined	Encode Track 1 (E1)	Encode Track 2 (E2)	Encode Track 3 (E3)

A '1' indicates the device has the ability perform the corresponding function.

```
Host: <COMMAND>    <NEXT>    <EOP>  <EOP>
4777:         <HEADER>  <STATUS>  <LRC>  <OPCOMP>
```

. . . OR . . .

```
Host: <COMMAND>    <NEXT>    <NEXT>    <EOP>  <EOP>
4777:         <HEADER>  <STATUS>  <X-STAT>  <LRC>  <OPCOMP>
```

Self Test:

STEST - Hex Code X'EF'

This command is equivalent to a software reset. Upon receiving the 'STEST' command the 4777 then goes into a self-test routine. After the completion of this command The 4777 enters the 'ECHO' mode, see section 'ECHO' command. If the 4777 is capable of responding it will be in 'ECHO' mode within 0.5 seconds after the 'STEST' command is received.

The Host initializes the magnetics interface and the 4777 by using the same procedure as in the power-on reset.

```
Host: <COMMAND> ... <DATA>      ... <EOP>
4777:              <DATA>       <OPCOMP>
```

Write Indicators:

WRIND - Hex Code X'DF'

This command causes the 4777 to take bits 6 and 5 of the data byte sent by the Host and output them to the indicator drivers. The 4777 will request the byte of the command by sending a 'NEXT' to the Host. The 4777 continues to request data and output it to the indicators until an 'EOP' is received. The 4777 responds to the 'EOP' with an LRC (calculated from the data). Upon receiving the LRC the Host sends an 'EOP' and the 4777 returns an 'OPCOMP'.

The form of the second byte is 0AB0 0000, where A and B are the levels to be output to the drivers (a 1 turns the indicator on).

Bit 6 is used to set or reset the In Process indicator and bit 5 is used to set or reset the Check indicator.

```
Host: <COMMAND>   <DATA>  <EOP>  <EOP>
4777:          <NEXT>  <NEXT>  <LRC>  <OPCOMP>
```

Write Magnetics Read Buffer 1:

WRRB1 - Hex Code X'E5'

This command is used to write data to the internal storage associated with the track 1 read hardware. The Host must provide a second byte which specifies the number of bits per character (0000 0101 ==> 5 bits per character). The number of bits per character must be between 1 and 7, inclusive. Bit 7 of data transmitted to the 4777 must always be '0'. The Host must provide all leading zeros in addition to the data. The data is to be right justified, with bit 0 containing the least significant bit.

Upon receiving this command the 4777 will take control of the internal storage. It will then start writing the data provided by the Host to the internal storage (track 1 read buffer).

After all data has been accepted by the 4777 the Host must terminate the operation by sending an 'EOP' to the 4777.

The 4777 will request all bytes of data from the Host (after the command) by sending a 'NEXT' to the Host. The first byte after the command will be the number of bits per character. The command is terminated when the Host sends an 'EOP' to the 4777. When the 'EOP' is received the 4777 adds the trailing zeros to fill the shift register and then acknowledges the command. The command is acknowledged by sending an LRC which the 4777 calculated from the data (including the byte which specified the number of bits per character). After receiving the LRC the Host should respond with an 'EOP'. upon receiving the 'EOP' the 4777 will send an 'OPCOMP' to the Host.

> Note: Data which is in error when the 4777 receives it, i.e., the 4777 responds with a 'RESEND', is not used in calculating the LRC.

> Note: The buffer data cannot be read after issuing the "ENABLE MAGNETICS" command.

The 4777 does not limit the number of bits that it will accept from the Host, but only the first 1024 bits will get written to internal storage. If 1024 or more bits are sent to the 4777 no trailing zeros will be added.

```
Host: <COMMAND>   <DATA>      ... <EOP>   <EOP>
4777:           <NEXT>   <NEXT>        <LRC>   <OPCOMP>
```

Write Magnetics Read Buffer 2:

WRRB2 - Hex Code X'E6'

This command is used to write data to the internal storage associated with track 2 read hardware. The Host must provide a second byte which specifies the number of bits per character (0000 0101 ==> 5 bits per character). The number of bits per character must be between 1 and 7, inclusive. Bit 7 of data transmitted to the 4777 must always be '0'. The Host must provide all leading zeros in addition to the data. The data is to be right justified, with bit 0 containing the least significant bit.

Upon receiving this command the 4777 will take control of the internal storage. It will then start writing the data provided by the Host to the internal storage (track 2 read buffer).

After all data has been accepted by the 4777 the Host must terminate the operation by sending an 'EOP' to the 4777.

The 4777 will request all bytes of data from the Host (after the command) by sending a 'NEXT' to the Host. The first byte after the command will be the number of bits per character. The command is terminated when the Host sends an 'EOP' to the 4777. When the 'EOP' is received the 4777 adds the trailing zeros to fill the shift register and then acknowledges the command. The command is acknowledged by sending an LRC which the 4777 calculated from the data (including the byte which specified the number of bits per character). After receiving the LRC the Host should respond with an 'EOP'. Upon receiving the 'EOP' the 4777 will send an 'OPCOMP' to the Host.

> Note: Data which is in error when the 4777 receives it, i.e., the 4777 responds with a 'RESEND', is not used in calculating the LRC.

> Note: The buffer data cannot be read after issuing the "ENABLE MAGNETICS" command.

The 4777 does not limit the number of bits that it will accept from the Host, but only the first 1024 bits will get written to internal storage. If 1024 or more bits are sent to the 4777 no trailing zeros will be added.

```
Host: <COMMAND>   <DATA>      ... <EOP>   <EOP>
4777:            <NEXT>   <NEXT>        <LRC>   <OPCOMP>
```

Write Magnetics Read Buffer 3:

WRRB3 - Hex Code X'E7'

This command is used to write data to the internal storage associated with the track 3 read hardware. The Host must provide a second byte which specifies the number of bits per character (0000 0101 ==> 5 bits per character). The number of bits per character must be between 1 and 7, inclusive. Bit 7 of data transmitted to the 4777 must always be '0'. The Host must provide all leading zeros in addition to the data. The data is to be right justified, with bit 0 containing the least significant bit.

Upon receiving this command the 4777 will take control of the internal storage. It will then start writing the data provided by the Host to the internal storage (track 3 read buffer).

After all data has been accepted by the 4777 the Host must terminate the operation by sending an 'EOP' to the 4777.

The 4777 will request all bytes of data from the Host (after the command) by sending a 'NEXT' to the Host. The first byte after the command will be the number of bits per character. The command is terminated when the Host sends an 'EOP' to the 4777. When the 'EOP' is received the 4777 adds the trailing zeros to fill the shift register and then acknowledges the command. The command is acknowledged by sending an LRC which the 4777 calculated from the data (including the byte which specified the number of bits per character). After receiving the LRC the Host should respond with an 'EOP'. Upon receiving the 'EOP' the 4777 will send an 'OPCOMP' to the Host.

> Note: Data which is in error when the 4777 receives it, i.e., the 4777 responds with a 'RESEND', is not used in calculating the LRC.

The 4777 does not limit the number of bits that it will accept from the Host, but only the first 1024 bits will get written to internal storage. If 1024 or more bits are sent to the 4777 no trailing zeros will be added.

```
Host: <COMMAND>   <DATA>      ... <EOP>   <EOP>
4777:            <NEXT>   <NEXT>          <LRC>   <OPCOMP>
```

Write Magnetics Encode Buffer 1:

WRWB1 - Hex Code X'EA'

This command is used to write data to the internal storage associated with the track 1 encode hardware. The Host must provide a second byte which specifies the number of bits per character (0000 0101 ==> 5 bits per character). The number of bits per character must be between 1 and 7, inclusive. Bit 7 of data transmitted to the 4777 must always be '0'. The Host must provide all leading zeros in addition to the data. The data is to be right justified, with bit 0 containing the least significant bit.

Upon receiving this command the 4777 will take control of the internal storage. It will then start writing the data provided by the Host to the internal storage (track 1 write buffer).

After all data has been accepted by the 4777 the Host must terminate the operation by sending an 'EOP' to the 4777.

The 4777 will request all bytes of data from the Host (after the command) by sending a 'NEXT' to the Host. The first byte after the command will be the number of bits per character. The command is terminated when the Host sends an 'EOP' to the 4777. When the 'EOP' is received the 4777 adds the trailing zeros to fill the shift register and then acknowledges the command. The command is acknowledged by sending an LRC which the 4777 calculated from the data (including the byte which specified the number of bits per character). After receiving the LRC the Host should respond with an 'EOP'. upon receiving the 'EOP' the 4777 will send an 'OPCOMP' to the Host.

> Note: Data which is in error when the 4777 receives it, i.e., the 4777 responds with a 'RESEND', is not used in calculating the LRC.

The 4777 does not limit the number of bits that it will accept from the Host, but only the first 1024 bits will get written to internal storage. If 1024 or more bits are sent to the 4777 no trailing zeros will be added.

```
Host: <COMMAND>   <DATA>      ... <EOP>   <EOP>
4777:            <NEXT>   <NEXT>          <LRC>   <OPCOMP>
```

Write Magnetics Encode Buffer 2:

WRWB2 - Hex Code X'EB'

This command is used to write data to the internal storage associated with track 2 encode hardware. The Host must provide a second byte which specifies the number of bits per character (0000 0101 ==> 5 bits per character). The number of bits per character must be between 1 and 7, inclusive. Bit 7 of data transmitted to the 4777 must always be '0'. The Host must provide all leading zeros in addition to the data. The data is to be right justified, with bit 0 containing the least significant bit.

Upon receiving this command the 4777 will take control of the internal storage. It will then start writing the data provided by the Host to the internal storage (track 2 write buffer).

After all data has been accepted by the 4777 the Host must terminate the operation by sending an 'EOP' to the 4777.

The 4777 will request all bytes of data from the Host (after the command) by sending a 'NEXT' to the Host. The first byte after the command will be the number of bits per character. The command is terminated when the Host sends an 'EOP' to the 4777. When the 'EOP' is received the 4777 adds the trailing zeros to fill the shift register and then acknowledges the command. The command is acknowledged by sending an LRC which the 4777 calculated from the data (including the byte which specified the number of bits per character). After receiving the LRC the Host should respond with an 'EOP'. Upon receiving the 'EOP' the 4777 will send an 'OPCOMP' to the Host.

> Note: Data which is in error when the 4777 receives it, i.e., the 4777 responds with a 'RESEND', is not used in calculating the LRC.

The 4777 does not limit the number of bits that it will accept from the Host, but only the first 1024 bits will get written to internal storage. If 1024 or more bits are sent to the 4777 no trailing zeros will be added.

```
Host: <COMMAND>   <DATA>      ... <EOP>   <EOP>
4777:          <NEXT>   <NEXT>         <LRC>   <OPCOMP>
```

Write Magnetics Encode Buffer 3:

WRWB3 - Hex Code X'ED'

This command is used to write data to the internal storage associated with the track 3 encode hardware. The Host must provide a second byte which specifies the number of bits per character (0000 0101 ==> 5 bits per character). The number of bits per character must be between 1 and 7, inclusive. Bit 7 of data transmitted to the 4777 must always be '0'. The Host must provide all leading zeros in addition to the data. The data is to be right justified, with bit 0 containing the least significant bit.

Upon receiving this command the 4777 will take control of the internal storage. It will then start writing the data provided by the Host to the internal storage (track 3 write buffer).

After all data has been accepted by the 4777 the Host must terminate the operation by sending an 'EOP' to the 4777.

The 4777 will request all bytes of data from the Host (after the command) by sending a 'NEXT' to the Host. The first byte after the command will be the number of bits per character. The command is terminated when the Host sends an 'EOP' to the 4777. When the 'EOP' is received the 4777 adds the trailing zeros to fill the shift register and then acknowledges the command. The command is acknowledged by sending an LRC which the 4777 calculated from the data (including the byte which specified the number of bits per character). After receiving the LRC the Host should respond with an 'EOP'. Upon receiving the 'EOP' the 4777 will send an 'OPCOMP' to the Host.

Note: Data which is in error when the 4777 receives it, i.e., the 4777 responds with a 'RESEND', is not used in calculating the LRC.

The 4777 does not limit the number of bits that it will accept from the Host, but only the first 1024 bits will get written to internal storage. If 1024 or more bits are sent to the 4777 no trailing zeros will be added.

Host: <COMMAND>   <DATA>   ... <EOP>   <EOP>
4777:   <NEXT>   <NEXT>   <LRC>   <OPCOMP>

Figure 3-7. Device Select Commands

Reference	Hex Code	Type	Originator
" ACTIVATE - Hex Code X'B0'" on page 3-2	X'B0'	COMMAND	Host
" Hex Code X'B1' to Hex Code x'BF'" on page 3-2	X'B1'-X'BF'	COMMAND	Host
MAGNETICS ACTIVE	X'B0'	STATUS	4777
" Hex Code X'B1' to Hex Code x'BF'" on page 3-2	X'B1'-X'BF'	STATUS	I/O DEVICE
" ATTENTION - Hex Code X'C0'" on page 3-3	X'C0'	COMMAND	4777
" Hex Code X'C1' to Hex Code x'CF'" on page 3-3	X'C1'-'CF'	COMMAND	I/O DEVICE
" Hex Code X'FF'" on page 3-3	X'FF'	COMMAND	Host

Figure 3-8 (Page 1 of 2). Magnetics Device Commands, Status, Headers

Reference	Hex Code	Type	Originator
DAV	X'85'	HEADER	4777
RESERVED	X'8E'	HEADER	4777
OPCOMP	X'E0'	STATUS	4777
NEXT	X'FE'	STATUS	Host/4777
" RESEND - Hex Code X'F5'" on page 3-13	X'F5'	COMMAND	Host/4777
" DISMAG - Hex Code X'F1'" on page 3-6	X'F1'	COMMAND	Host
" ECHO - Hex Code X'E8'" on page 3-6	X'E8'	COMMAND	Host
" ENMAG - Hex Code X'F0'" on page 3-6	X'F0'	COMMAND	Host
" EOP - Hex Code X'F2'" on page 3-7	X'F2'	COMMAND	Host
" RESTART - Hex Code X'EE'" on page 3-13	X'EE'	COMMAND	Host
" SENSE - Hex Code X'E9'" on page 3-14	X'E9'	COMMAND	Host

Figure 3-8 (Page 2 of 2). Magnetics Device Commands, Status, Headers			
Reference	**Hex Code**	**Type**	**Originator**
" STEST - Hex Code X'EF'" on page 3-16	X'EF'	COMMAND	Host
" WRIND - Hex Code X'DF'" on page 3-16	X'DF'	COMMAND	Host
" ARM1 - Hex Code X'E1'" on page 3-4	X'E1'	COMMAND	Host
" ARM2 - Hex Code X'F3'" on page 3-4	X'F3'	COMMAND	Host
" ARM3 - Hex Code X'F4'" on page 3-5	X'F4'	COMMAND	Host
" RDRB1A - Hex Code X'F6'" on page 3-7	X'F6'	COMMAND	Host
" RDRB2A - Hex Code X'F7'" on page 3-8	X'F7'	COMMAND	Host
" RDRB3A - Hex Code X'F9'" on page 3-8	X'F9'	COMMAND	Host
" RDRB1S - Hex Code X'FA'" on page 3-9	X'FA'	COMMAND	Host
" RDRB2S - Hex Code X'FB'" on page 3-10	X'FB'	COMMAND	Host
" RDRB3S - Hex Code X'FD'" on page 3-10	X'FD'	COMMAND	Host
" RDWB1 - Hex Code X'E2'" on page 3-11	X'E2'	COMMAND	Host
" RDWB2 - Hex Code X'E3'" on page 3-12	X'E3'	COMMAND	Host
" RDWB3 - Hex Code X'E4'" on page 3-13	X'E4'	COMMAND	Host
" WRRB1 - Hex Code X'E5'" on page 3-17	X'E5'	COMMAND	Host
" WRRB2 - Hex Code X'E6'" on page 3-17	X'E6'	COMMAND	Host
" WRRB3 - Hex Code X'E7'" on page 3-18	X'E7'	COMMAND	Host
" WRWB1 - Hex Code X'EA'" on page 3-19	X'EA'	COMMAND	Host
" WRWB2 - Hex Code X'EB'" on page 3-19	X'EB'	COMMAND	Host
" WRWB3 - Hex Code X'ED'" on page 3-20	X'ED'	COMMAND	Host
RESERVED	X'FC'	COMMAND	Host