InSpec 9000-2005

ENCODED CARD TESTER
INSTALLATION AND OPERATION MANUAL

Manual Part Number 99875327 Rev 2

JUNE 2005

MAGTEK®

REGISTERED TO ISO 9001:2000
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REVISIONS

Rev Number	Date	Notes
1	04/01/2005	Initial Release
2	27 Jun 05	Reformatted

LIMITED WARRANTY

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SAFETY

This product has been evaluated, tested, and certified by the Canadian Standards Association (CSA 22.2), No. 950, and Underwriters Laboratories (UL1950). In order to insure that it maintains the safety integrity that was designed into the product, and for which it has been evaluated by the Safety Certification Agencies, compliance with all Installation Instructions and Safety Requirements is essential.

SAFETY REQUIREMENTS

Never do any of the following:

- Use a ground adapter plug to connect equipment to a power source receptacle that lacks a ground connection terminal.
- Attempt any maintenance function that is not specifically described in this Manual or any other MagTek InSpec 9000-2005 Manual.
- Remove any of the covers or guards that are fastened with screws. There are not operator-serviceable areas within these covers.
- Override or “cheat” electrical or mechanical interlock devices.
- Use supplies or cleaning materials for other than their intended purposes.
- Operate the equipment if unusual noises or odors are noticed.

Consider the following before operating the InSpec 9000-2005:

- Connect equipment to a properly grounded power source receptacle. If in doubt, have the receptacle checked by a qualified electrician.
- Improper connection of the equipment grounding conductor can result in risk of electrical shock.
- Locate equipment on a solid support surface with adequate strength for the weight of the machine.
- Be careful in moving or relocating the equipment. Use the proper lifting techniques.
- Use materials and supplies specifically designed for MagTek equipment. Use of unsuitable materials may result in poor performance and can possibly create a hazardous situation.

FCC WARNING STATEMENT

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC COMPLIANCE STATEMENT

This device complies with Part 15 of the FCC Rules. Operation of this device is subject to the following two conditions: (1) This device may not cause harmful interference. And (2) this device must accept any interference received, including interference that may cause undesired operation.

CANADIAN DOC STATEMENT

This digital apparatus does not exceed the Class A limits for radio noise for digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de las classe A prescrites dans le Réglement sur le brouillage radioélectrique édicté par les ministère des Communications du Canada.

CE STANDARDS

Testing for compliance to CE was performed by an independent laboratory. The unit under test was found compliant to Class A.

UL/CSA

This product is listed per Underwriter Laboratories and Canadian Underwriter Laboratories 1950.

Product Information

The InSpec 9000-2005 Encoded Card Tester is a real-time, continuous feedback, production line card tester. Because the parameters that appear on the screen are color coded, and warning screens advise when a card "MAY NOT BE READABLE IN THE FIELD," the tester is relatively easy to operate. The Tester is intended to be a reliable instrument of in-line testing that does not require a technician or an engineer to operate; nor does it require extensive technical knowledge of magnetics to operate and to interpret the parameters on the screen. The InSpec 9000-2005 Tester is designed to complement the more expensive, highly complex, precision, laboratory test equipment. MagTek recommends that out-of-spec cards from the Tester should be confirmed periodically by an independent laboratory.

Because the InSpec 9000-2005 is a cost-effective tradeoff compared with a precision laboratory test unit, some policy judgment is required to interpret ISO limits and the machine tolerances or "measurement uncertainty." ISO limits and measurement uncertainties are listed in Section 3, Figure 3-11, and examples are shown in Section 4, Figures 4-2 and 4-3. Measurement uncertainty for average amplitude, average bit size, and start sentinel are concerns of management for acceptance or rejection of cards. If these parameters are centered on the screen between minimum and maximum limits (centered in the green), the card will be acceptable even if the measurement uncertainty is worst case. If these parameters are near maximum or minimum limits when worst case measurement uncertainty is projected, the following precautions should be considered: the Tester should be checked; the sample may need to be expanded; or the cards may need to be physically checked to ensure they are clean and flat. Ultimately, judgment is required, and a policy decision should be in place for the operator.

The screen may also warn of two other parameters that concern noise detection: Added Pulse Detection and Wave Form Distortion. Tests of these parameters are critical in HiCo material testing. Exceeding the ISO limit by even a small percentage may affect read reliability. Since these two parameters are characteristic of the magnetic stripe and not encoding, issuers who have prequalified their stripes at a testing laboratory will rarely see this warning. If the warning appears frequently, sample cards should be sent to a testing laboratory for investigation and confirmation of the absolute values for the added pulse and waveform conditions.

For accurate card reading, normal preventive maintenance is the guideline. Consult the following:

Card size and thickness (Section 1, Specifications)
Card and Tester Cleaning (Section 2, Cleaning)
Calibration (Section 3, Calibration and Verification)

For corrective maintenance, consult Section 5, Troubleshooting and Appendix D, Error Messages.

TABLE OF CONTENTS

ILLUSTRATIONS

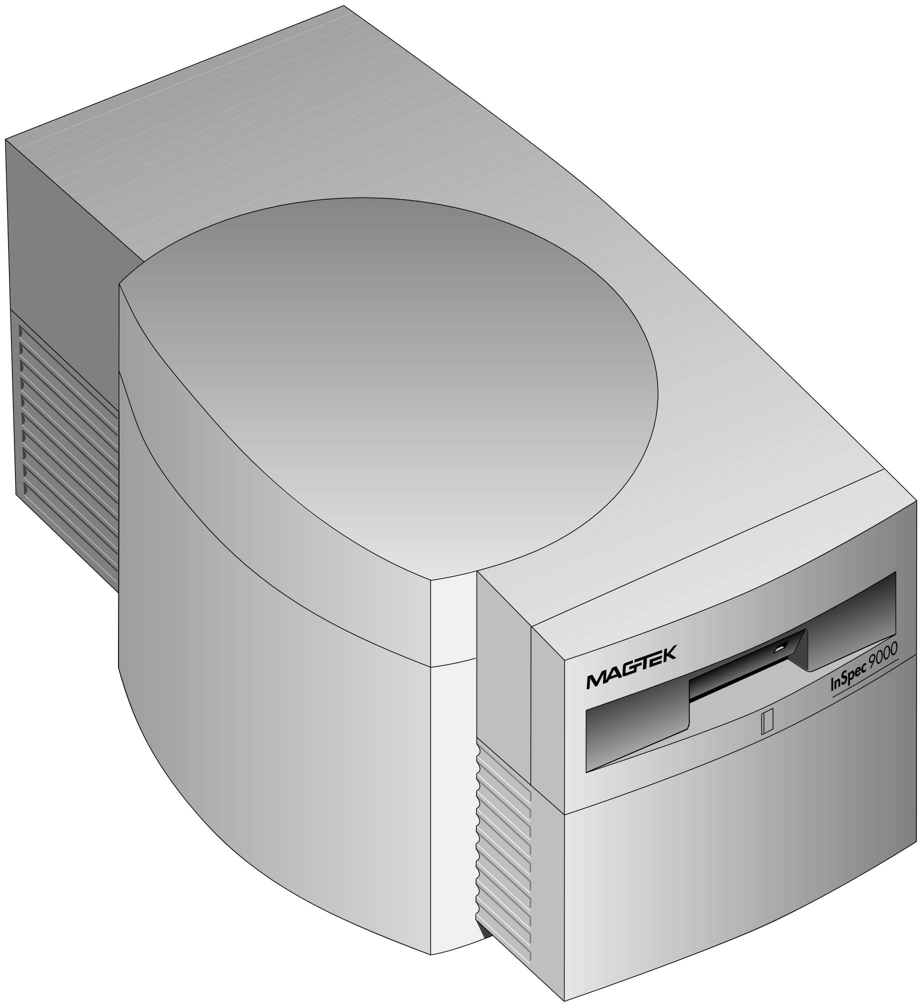


Figure 1-1. InSpec 9000-2005 Card Tester

SECTION 1. FEATURES AND SPECIFICATIONS

The InSpec 9000-2005™ Encoded Card Tester measures parameters of magnetic stripe encoding. The parameters are shown on a computer screen and compared with ISO (International Standards Organization) standards. Because the parameters are presented as graphic illustrations, they are easy to read and easy to understand. The Tester also provides performance trends based on a database of test results.

FEATURES

- Measures amplitude, bit size, and start sentinel, and compares results with ISO standards and presents data in various graphs, charts and tables
- Provides previous measurements of individual cards or daily summaries to establish trends
- Presents card profile graphs of each measured parameter
- Easily installed and easy to use Windows-based software
- Uses specially provided cards for easy head cleaning
- Maintains database files
- On-site calibration from user collected data on a test card compared to a factory-provided card
- Security password to restrict access or permit controlled use access to certain data

REQUIREMENTS

Equipment needed to operate the Tester is either supplied by MagTek or the customer. These items are listed below.

MagTek supplied

- InSpec 9000-2005 Card Tester hardware, P/N 39810003; Software-CD, Noise Detect, P/N 39810316
- Cable, 9 pin male Tester to 9-pin female PC Adapter, P/N 21015823
- Cable, power from Tester to wall receptacle, P/N 71100001
- Cleaning Cards, P/N 96700004
- Polishing Card, 0.5 micron (1), P/N 96700014
- Test Cards (2), P/N 96600033
- Setup Cards (2) - InSpec 9000-2005, unit specified, P/N 96600036
- Card Extraction Kit, P/N 39814801
- IntelliStripe 380 Encoder (optional)
- MCP Installation Software (required for IntelliStripe 380)

User supplied

The recommended minimum requirements are as follows:

- Pentium Computer System
- VGA color monitor (resolution 800 x 600 pixels or higher)
- 256 MB RAM
- 11MB of hard disk space
- 1 RS-232 Serial Port and 1 USB port for optional IntellliStripe 380
- Windows 98*, NT*, ME, 2000, or XP
- Adobe Acrobat Reader

* Windows 98 and NT can not be used with optional IntellliStripe 380

SPECIFICATIONS

Operational

Operating Voltage:	100 – 240 VAC
Operating Current	1.0 amp
Operating Temperature:	50°F to 122°F (+10°C to +50°C)
Humidity:	10% to 90% without condensing
Card Speed:	8 inches per second, typical
Resolution	10µ inches
Analysis Area	All three data tracks excluding 0.130 inch at each end
Measure Limits	Conform to ISO 7811 within Analysis Area

Mechanical

Depth:	13.3 inches
Width:	7.5 inches
Height:	7.1 inches
Weight:	8 lbs.

Card Parameters

Width and Length:	Per ISO/IEC Specification 7810:1995(E)
Thickness:	0.030 in ± 0.003 in (0.76 mm ± 0.08 mm)

Note

The InSpec 9000-2005 may not accurately read cards whose thickness and/or warpage exceed the ISO 7810 specification. In addition, cards that are not properly cleaned may give poor results along with contamination of the card path and head face.

SECTION 2. INSTALLATION

This section provides instructions for installing the Tester. There are five parts to the installation of the InSpec 9000-2005 Tester: unpacking, hardware installation, software installation, setup, and cleaning. Because card sampling is required for production, some examples are referenced in this section.

UNPACKING

Remove all material from the shipping carton and check the material with the shipping invoice to ensure everything on the invoice is contained in the carton. If there is damage to the unit or material on the invoice is missing, notify MagTek and the carrier.

Note

Retain the shipping carton and all packing material. The Tester may be packed and shipped back to the factory periodically for calibration or warranty service .

HARDWARE

Install the hardware as follows:

1. Place the Tester near the PC and a wall receptacle so that the cables can be installed.

Caution

Ensure power is off before plugging in cables, or damage to equipment or the program may result.

2. For RS-232 plug the cable with the 9-pin connector into the Tester and the other end to the PC Com Port. It may be necessary to use a DB9 to DB25 adapter for the Com port.

3. Plug the power cord into the Tester and the wall receptacle.

4. Power up the computer and press the power on (I) switch on the rear panel of the Tester.

5. The LED on the front of the Tester should be green. If the LED does not come on, check to ensure the cables are properly connected.

6. If the LED still does not light, press the power switch off, remove the cables, and check the fuse, located next to the power switch as shown in Figure 2-1.

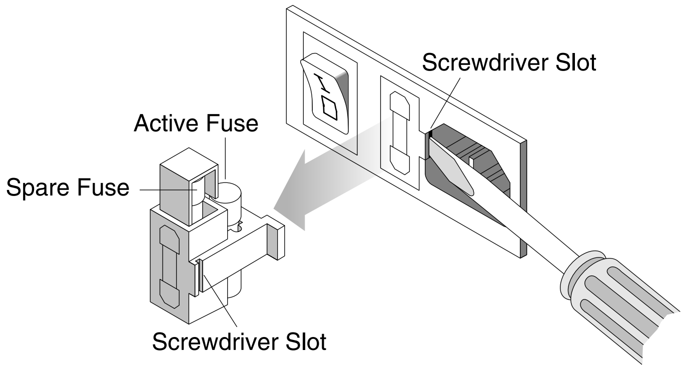


Figure 2-1. Fuse Holder

7. Replace the fuse if necessary, reconnect the cables, and power up. If the LED still does not light, call for technical or supervisory personnel.

SOFTWARE

Installation

1 Install MCP software. Insert the MCP CD into your CD drive. The setup program should start automaticly. Keep the default selection for all options during the installation.

2 Allow the setup program to restart the PC

3 Allow the setup program to finish after startup. This should be very brief.

4 Plug in the Intellistripe 380 to any USB port of the PC. Ensure the the Intellistripe 380 has power.

5 Allow the PC toinstall the new hardware. The ‘Found New Hardware’ message should appear in the lower right corner of the screen.

6 Instal Inspec 9000-2005 software. The setup program should start automaticly.

InSpec 9000-2005 (all users)

To begin the installation, insert the InSpec 9000-2005 CD into the appropriate drive. The installation program will automatically start. If the installation program does not start automatically, select Run from the Start menu. Within the open field, type x:\demo32, where x: is the drive letter of your CD ROM drive. Click OK to begin the installation. The installation program will guide you through the setup process.

MCP Software (only for use with the optional IntelliStripe 380)
To begin the installation, insert the MCP Installation CD into the appropriate drive. The installation program will automatically start. If the installation program does not start automatically, select Run from the Start menu. Within the open field, type x:\setuup, where x: is the drive letter of your CD ROM drive. Click OK to begin the installation. The installation program will guide you through the setup process.

Note for International Users

The InSpec 9000-2005 software requires regional settings be set to English (United States). Some features may not work correctly if other settings are used.

SETUP

To setup the unit for operation, perform the following steps:

1. From the Windows Program Manager, open the InSpec 9000-2005 program. (If more details are required for opening the program, refer to the next section, Operation.)

2. After the main menu appears, click on the Read Card button. If the unit is not set up, a dialog box will appear stating that the setup was not found. This is normal when ever the software starts up with a new InSpec 9000 reader. If the message states that the InSpec 9000 device was not found, there is no communications between the PC and the InSpec 9000 reader. Check the com cable and the power cable. Recheck the above instructions in the hardware section for proper hardware installation.

3. From the Main Menu select Setup, select Read Setup Card, and the follow the on screen instructions for inserting the setup card. Ensure that the Unit ID number on the card matches the number requested by the software.

   The Unit ID number is a unique number for that unit that also identifies the firmware. If a problem exists with the unit, this number will be needed by technical support personnel.

4. When the setup if finished, a message will notify the user that the setup was successful.

CLEANING

Accurate signal amplitude measurements (described in Section 3) depend on high quality contact between the Tester's magnetic head and the magnetic stripe under test. If the head does not make good contact by even a small amount, the resulting signal amplitude measurement value will be lower than it would have been with proper contact. A separation between the head and stripe of only 0.0005 inches (13µm) can lower the signal amplitude result by 50%.

Aside from surface distortions on the magnetic stripe or card, contamination is primarily responsible for poor head to stripe contact.

Offset powder sometimes used in card manufacture to prevent blocking (powder can cause a significant decrease in amplitude and can contaminate the read head giving false readings for many cards.)

- Packing materials; fibers from containers
- Hologram/Signature, Panel/Magnetic media particles "flash" not adhering to the card as intended
- Cards can also become statically charged making them attract airborne dust.

Card Cleaning

To optimize test results, MagTek recommends cleaning the magnetic stripe cards with ammonia-based glass cleaner before testing.

Caution

Do not clean magnetic stripe cards with alcohol or damage to the magnetic stripe may occur.

Head and Roller Cleaning - Standard Card, P/N 96700004

The Tester can only provide reliable results if it is clean. As a result, the Tester will issue a warning after 50 card read cycles. When the warning is received, the cleaning procedure should be performed. The warning will appear for each card tested until the cleaning procedure is performed.

Use the cleaning card and clean the head as follows:

1. From the Main Menu, select Tools and select Clean.

Note

Ensure the cleaning card is flat. If it is not flat, straighten it as required before using.

2. Follow the on screen instructions for inserting the cleaning card.

3. The cleaning card will move in and out of the Tester several times.

4. Remove and discard the card.

Caution

Wait approximately 2 minutes before performing card analysis. This will allow the unit to dry and thereby prevent damage to the magnetic stripe to the next cards to be analyzed.

TEST CARDS

Two test cards are shipped with each unit for the purpose of verifying that the Tester is within tolerance. Each card has a serial number on the face. The values that should appear when a test card is inserted into the Tester are also listed on the InSpec 9000-2005 Test Card Report that is shipped with each unit. The cards are listed on the Report by serial number. Use the cards as follows:

1. Insert a sample production card that is out of ISO specifications; that is, a card that shows yellow or red bars on the ISO Parameters screen when it is inserted into the Tester. (See Section 3, Operation and Section 4, Data presentations.)

2. Insert a MagTek test card into the Tester, and check the ISO Parameters screen. All the bars on the screen should be green for the test card. If there is any doubt about the validity of the test, check the values of the test card on the screen against the InSpec 9000-2005 Test Card Report. The values should be approximately the same*. Both should be within tolerance. Compare the production card with the Test Card.

*Tolerances for the test cards are as follows:

- Average Amplitude = ± 15%
- Start Sentinel = ± 0.007 inch
- Average Bit Size = ± 2%

3. If there is still some doubt about the accuracy of the Tester, run the other test card and check the values as described in step 2. If necessary, perform the 0.5-micron head polishing procedure below.

Head Polishing - 0.5-micron (Abrasive Card), P/N 96700014

If the Tester shows a change in amplitude of approximately 15% to 20% after the Test Card Procedure is run, use the 0.5 micron (abrasive) head-polishing card, P/N 96700014, and clean the head as follows:

1. With the abrasive stripe up and to the left, insert the card and click on Clean Unit.

2. The card will move in and out of the Tester several times.

Caution

Do not run the head-polishing card with abrasive stripe down, or damage to the roller surface and the Tester may result.

3. Remove the head-polishing card from the Tester, and run the cleaning card.

Note

Do not discard the head-polishing card after one use; this card is for multiple use.

4. Perform the Test Card procedure to ensure the Tester is within tolerance. If the results are not within spec, call service personnel.

SAMPLING TECHNIQUES

The InSpec 9000-2005 Encoded Card Tester is designed for a production environment; that is, samples are taken from a large production run and tested on the InSpec 9000-2005. The samples tested represent a lot or batch. The lot or batch is accepted or rejected on the basis of these samples.

More than sampling lots for acceptance or rejection, the Tester also reveals problem trends with the processes of producing, encoding, or testing cards. Because of the data presentations and database in the Tester, problem trends are easier to identify. (See Section 4, Data presentations, Interpreting Performance Charts.)

There are many techniques for sampling, and the example below is commonly used in industry. The example is taken from the following publication:

ANSI/ASQC Z1.4 - 1993, American National Standard, Sampling Procedures and Tables for Inspection by Attributes, American Society for Quality Control.

In the following table, the "Single Normal Plan, General Inspection Level I, AQL .010" designates the criteria used in sampling. In the Table, the Lot Size is equivalent to the card production run; the Sample Size is the number of randomly selected cards to be run on the Tester; the Accept and Reject columns are the number of samples for rejecting or accepting the Lot. If, for example, Accept is 1 and Reject is 2, the Lot will be accepted if there is 1 card out of spec, but rejected if there are 2 cards out of spec. If the Lot is rejected, the process is repeated. If rejected again, 100% evaluation is required.

Example of Single Normal Plan, General Inspection Level I, AQL .010

Lot or Batch Size	Sample Size	Accept	Reject
2 to 8	All	0	1
9 to 15	All	0	1
16 to 25	All	0	1
. . .			
151 to 280	13	0	1
281 to 500	20	0	1
501 to 1200	32	0	1

The following procedure is only an example using ANSI/ASQC Z1.4 - 1993 as a guideline for sampling:

1. Determine the Lot size, and remove the number of samples listed in the table.

2. For a Lot size of 501 to 1200, remove 32 samples and run them on the Tester.

3. If all 32 cards are within spec, accept the Lot.

4. If 1 card is out of spec, repeat steps 2 and 3.

5. If 1 card is out of spec, test the entire Lot.

Consult *ANSI/ASQC Z1.4 - 1993*, for actual techniques and values for sampling.

SECTION 3. OPERATION

The operation of the Tester includes the main screen, cleaning, reading cards and interpreting the results, obtaining performance charts and interpreting trends. Also included in this section are descriptions of Windows-style buttons and Tester icons on the main screen.

MAIN SCREEN

At the top of the main screen, shown in Figure 3-1, the buttons are similar to Windows buttons but are specific to the Tester. The screens selected from the main screen are shown in this section and in "Section 4. Data Presentations."

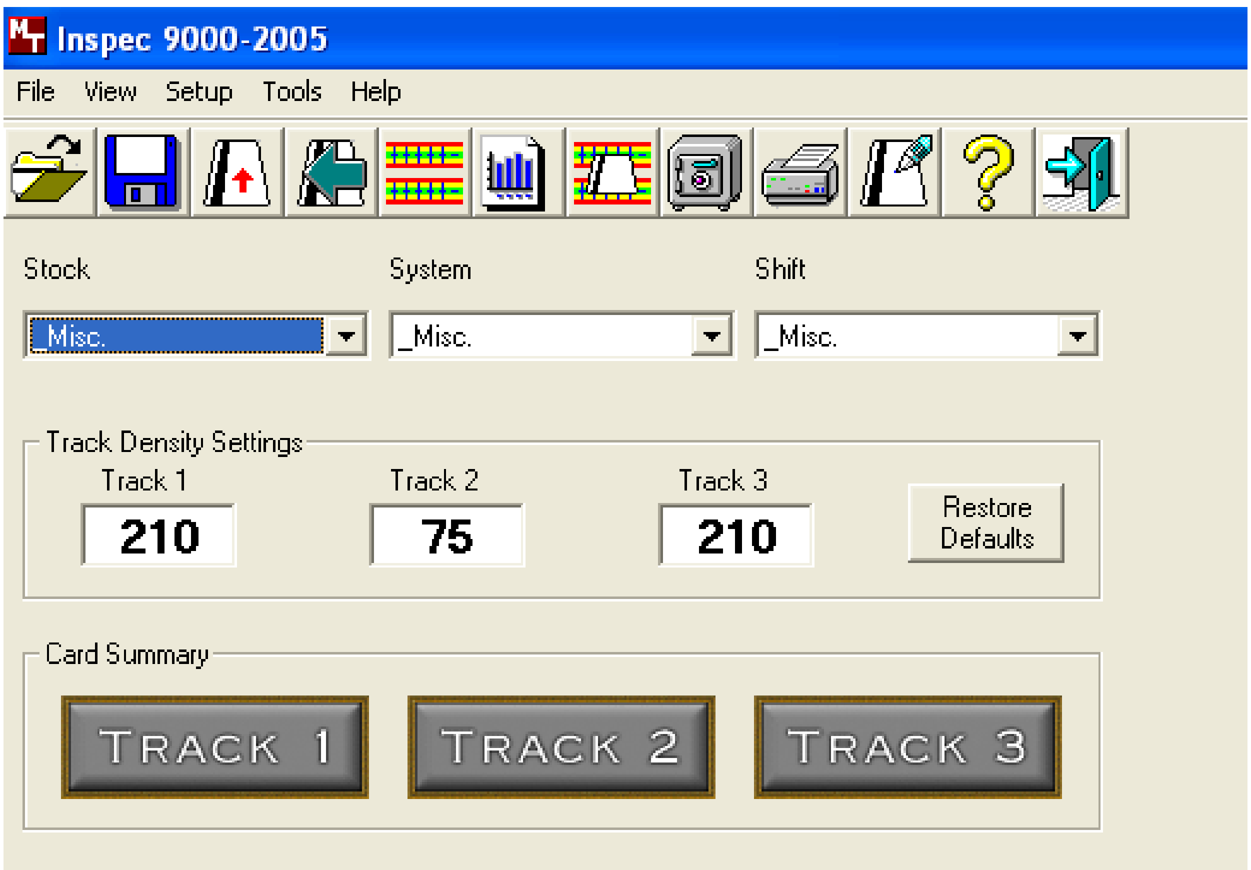


Figure 3-1. Main Screen

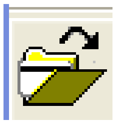
Windows Screen

Brief descriptions of the routines that are presented by the Windows menu bar are as follows:

FILE

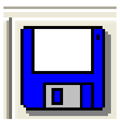
The file menu is shown and described below.

Open:



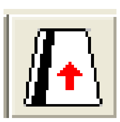
The Open button or menu item loads an InSpec 9000 saved card file (.I9K). The card data can then be viewed as if the card had just been read.

Save:



The Save Button or menu item writes all the card data from a single card read to a file (.I9K). Saving a card read has no effect on the card database used for the performance charts.

Read Card:



The Read Card button or menu item initializes the InSpec 9000 reader to read a card. Ensure that the proper Keywords are select for each of the three lists. This will ensure that the read is properly sorted within the card database. Follow the on screen prompts as to when and how to insert the card into the reader. Inserting the card before the reader is ready will cause the reader to not to pull the card in. If this happens, cancel the read and click Read Card again.

Archive Data:

The Archive menu item allows the operator to move all database records before a selected date to an archive database file. Removing older data from the card database will allow the performance charts to operate quicker. Archived records can be viewed from the View Database menu item. When to archive data will depend on each operator's usage. The screen is shown in Figure 3-2. An example of the date for 2 Jan 05 is written as 01 02 05.

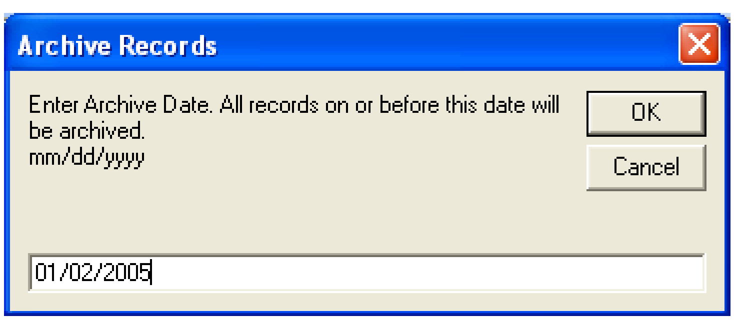
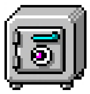
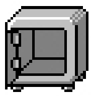
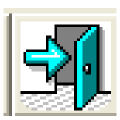


Figure 3-2. Archive Screen

Reset Security:

  The Reset Security button or menu item starts and ends a security override. Security override is a password protect setting that is design to give a supervisor temporary access to restricted features for the purpose of trouble shooting a failed card read. The button icon will indicate the current security condition. An “open safe” icon indicates the security override is active. The “closed safe” indicates that the standard security settings are active. The security override is also ended when the software is shutdown. The features that are restricted and password controlled are handled with the Setup Security menu item.

Exit:



Standard Windows exit from this program.

VIEW

The View screen shown at the right is described below.

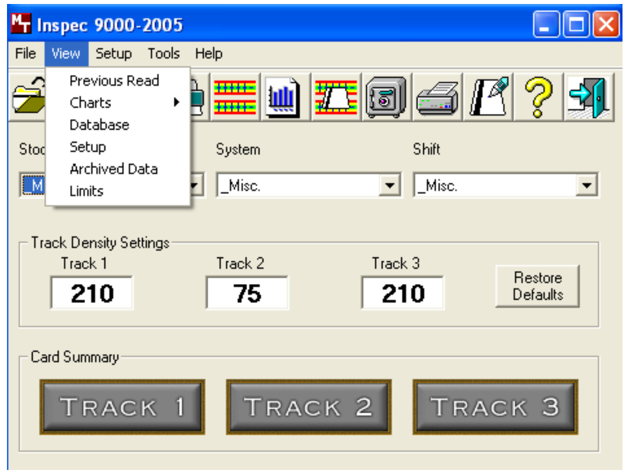
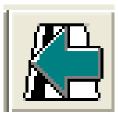


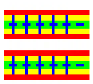
Figure 3-3. View Screen

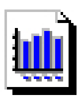
Previous Read:



The Previous Read button or menu item allows the operator to switch between two card reads without having to reread the cards.

Charts:





The ISO Compliance and Performance buttons and menu items give access to the different charts that show individual card quality and over all performance. See Section 4, Data Presentations for more information on these charts.

Database:

The Database menu item allows the operator view the individual records in the card database and the archived databases.

Setup:

The Setup menu item allows the operator to view the current setup values. The Setup screen is shown in Figure 3-4.

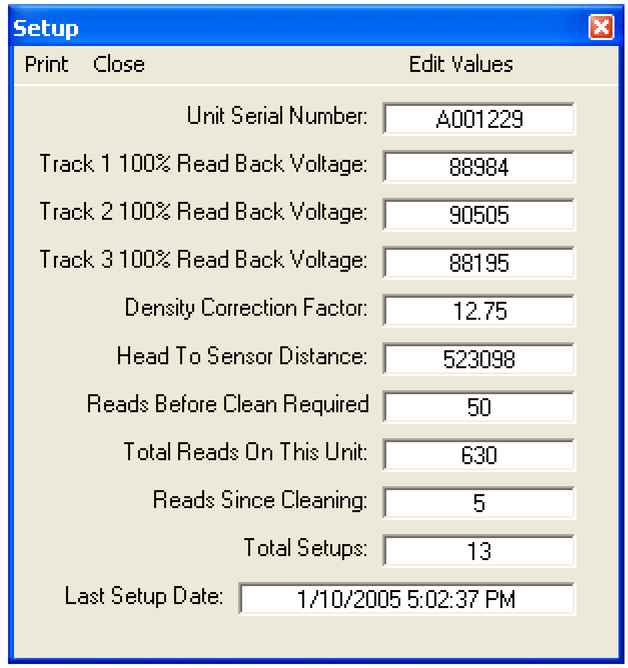


Figure 3-4. Setup Screen

Limits:

The limits for unused and returned cards are shown in Figure 3-5.

Editing limit values will affect card result displays. The limits are described in Section 4, Data presentations.

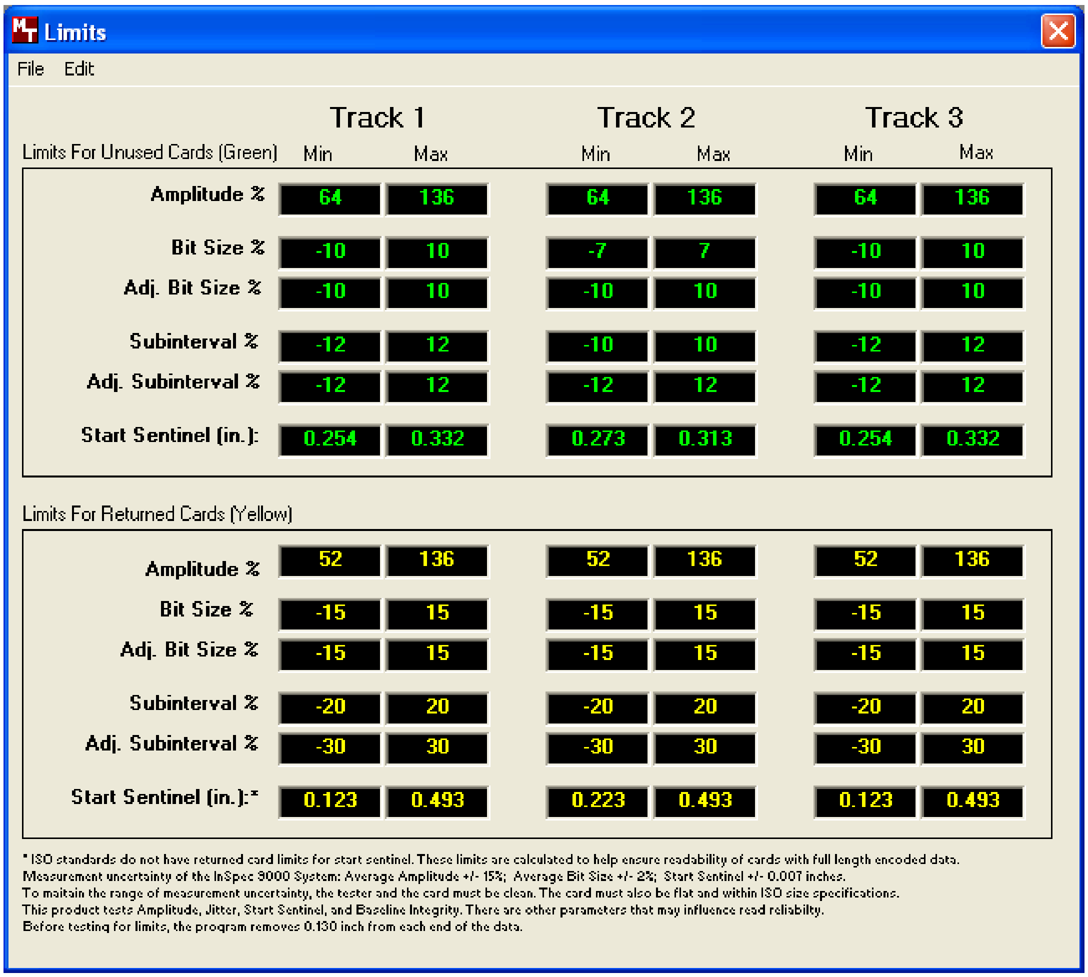
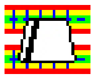
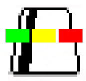


Figure 3-5. Limits for Unused and Returned Cards.

SETUP

Mode:

The mode button and menu items toggle between the two modes, Normal and Quick. The Normal Mode reads a card and displays the compliance charts. The Quick mode automatically resets the reader for another read and only displays the card summary. At any time while in quick mode, the operator may cancel the read and view the overview and related charts for the last read card.

Edit Keywords

The Edit Keywords menu item allows the operator to add and remove keywords and change the keyword labels. Keywords are used to sort the database records. The keywords could identify different encoders, operators, shifts, or card stock. The keyword labels are only used to identify what each list of keywords represents and do not affect the database. There will be two keywords that appear in all three lists that can not be removed, "_DoNotAdd" and "_Misc". "_DoNotAdd" will cause the following card read NOT to be added to the database. _Misc is for card reads that do not belong under any of the other keywords, such as reading InSpec test cards. See Keywords below for information on how keywords are used.

Example: You decide that keyword 1 will represent the operator. You would enter "Operator" as the keyword 1 label. Then you would enter the names of each your operators under "Keyword 1" and click Add to add each name to the list. When an operator is about to read a card, he would select his name from the list of operators on the main screen. This selection would then be saved in the database record. At a later time you could use the performance charts to view all of the cards read by a certain operator.

Communications:

The Communication menu item is used to set the communications for the InSpec reader and the IntelliStripe 380 Encoder (optional). Under Com Ports, select the com port that the InSpec reader is connected to. Usually this will be "Com1". If an IntelliStripe 380 Encoder is present, select "IntelliStripe 380 USB" under Device Names. Click, "OK" to keep these settings

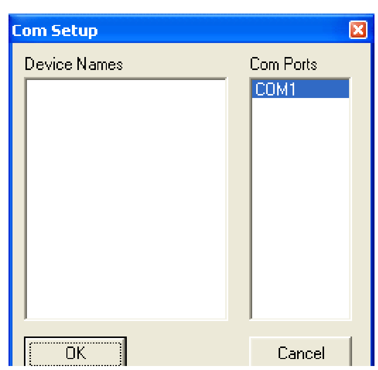


Figure 3-6. Com Setup

Read Setup Card:

The Read Setup Card menu item is used to read the setup card that comes with each InSpec 9000 reader. Every time an InSpec reader is connected to a PC for the first time, the setup card must be read.

Security:

The Security menu item gives the user access to the security features of the InSpec 9000 software. The default password is “password”. To change the password, enter the current password, then enter the new password. Passwords must be 4 to 12 characters long, using only 0-9, a-z, and A-Z. Retype the new password and click “Change Password” button. Forgotten passwords can NOT be retrieved. There are eight different features that can be restricted. Hide Card Data ensures that the operator can not see or print the data encoded on the cards being tested. Disable Save Card ensures that the operator can not create save files of the cards tested. Disable Profile Charts keeps the operator from viewing the profile charts. Hide LRC Character strips off the LRC character from the end of the decoded data display. The LRC is still checked for accuracy. Hide Card Data will hide all card data. This supersedes the Hide LRC Character. Hide Numerical Display keeps the operator from seeing the numerical results. Hide Performance Charts will keep the operator from using the performance charts. Disable Printing will not allow any printouts from the InSpec software. Disable Editing will not allow the operator to edit the limits or setup values. Allow Override will allow a supervisor with the password to temporarily disable the security setting for the purpose of troubleshooting a failed read. The security level is reset by clicking the reset security button or menu item or by shutting down the software. While the override is active, the reset security button icon will show an open safe.

Clean Unit

The Clean Unit menu item starts the cleaning process. For more information on cleaning the InSpec 9000 reader, see Section 2, Cleaning.

Eject Card:

The Eject Card menu item will send an eject command to the InSpec reader. If the reader detects any of its sensors to be block, it will attempt to eject the card. If the sensors are not blocked or the eject failed to remove the card, the card extraction tool will have to be used. See Section 5, Card Extraction.

Encode Card:

The Encode Card menu item will activate the IntelliStripe 380 encoder to encode a preset test message on blank cards. The test message can not be altered and the IntelliStripe 380 can not be used with the InSpec 900-2005 software to copy cards read by the InSpec reader. IntelliStripe 380 is an optional addition to the InSpec 9000 to allow testing of cards at a point before they would normally be encoded.

HELP

Contents:

This button and menu item opens this manual.

About:

This menu item gives the user version information for the InSpec 9000 software and connected hardware.

Keywords

Keywords are used to enable sorting of data in the database. A single InSpec 9000 reader may be used by multiple users, for multiple encoders, with multiple card stock, during multiple shifts. Without a way to sort this data, the database would be nearly useless. The keywords allow the user to look at only the data that is needed. Ensure that the three selected keywords properly represent the card that is about to be read. After the card has been read, the keyword for that read can not be altered. See Section 4, Data Charts.

Card Summary

The card summary shows the worst result from the overview chart for each track. If the indicator for a track is green, then all parameters for that track are within the new card limits. If one or more parameters exceed the new card limits, but none exceed the returned card limits, then the indicator will be yellow. A red indicator means that one or more parameters have exceeded the returned card limits. The card summary is updated for every read, but is most useful in quick mode where the overview chart is not automatically displayed.

PARAMETERS

When a card is read, the Tester checks six important ISO parameters, which are presented graphically, and color coded as green, yellow, and red. There are two sets parameter limits: one for new cards and one for returned cards. New cards are cards that have been encoded but have not been used. Returned cards are cards that have been encoded and issued, and usually used in practical applications, and returned for testing.

ISO Limits and Measurement Uncertainty

The ISO Limits specified under the View menu are a composite of two ISO specifications: 7811-2 and 7811-6. These values are the widest ISO limits of both specifications. They were selected because LoCo and HiCo values are different, and Readers in the field read reliably with cards encoded within these combined limits.

As with any machine, there are also tolerances, or measurement uncertainties, ascribed to the Tester. Measurement uncertainty limits may be found on the “ISO Limits” screen that is accessed from the Limits Menu. The measurement uncertainty is at the bottom of the screen.

Amplitude

The signal amplitude is the resulting voltage as the read head passes over the flux transitions on a track. The measure of signal amplitude is stated as a percentage of the Reference Signal Amplitude.

The value of the reference signal amplitude is traceable to the Primary Standard as established by the United States National Institute for Standards and Technology (NITS), formerly the National Bureau of Standards. Figure 3-7 shows the reference amplitude and the related boundaries for within spec, marginal, or out of spec. These values as well as the values for the other parameters below are listed in Appendix C (from 7811). Composite values (from 7811-2 and 7811-6) are listed in the ISO Limits under the View Menu.

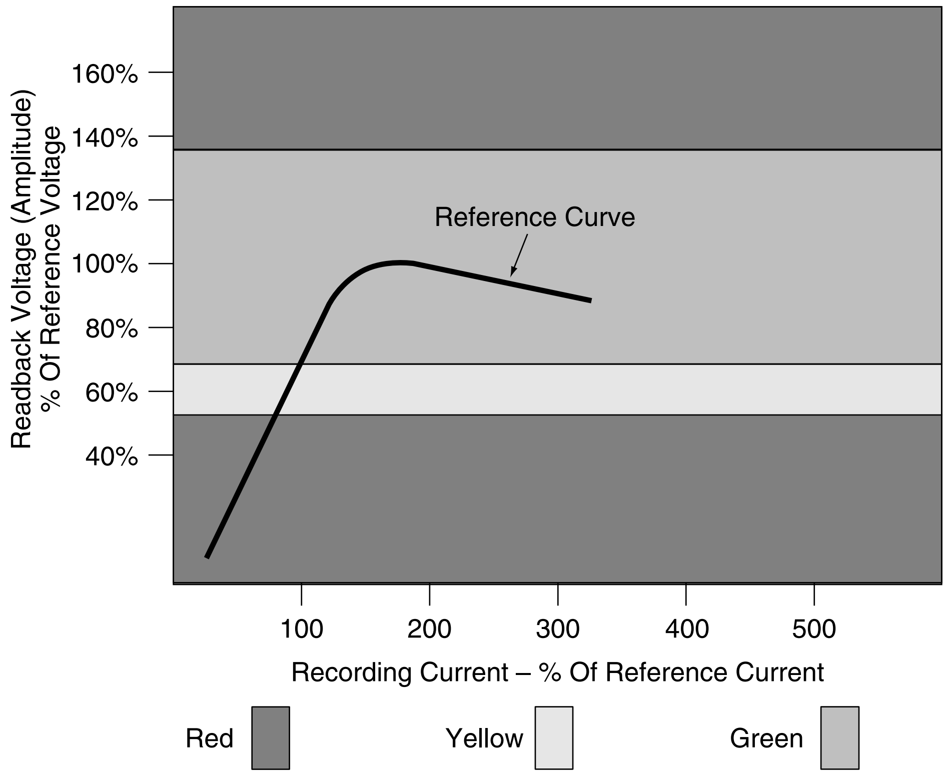


Figure 3-7. Reference Amplitude

Bit Size

The bit size, or bit cell, is the distance between two clocking flux transitions. This distance is the "zero" bit. The ISO standard abbreviates the bit size as **Bin** and calls it **Individual Flux Transitions Spacing Variation**. Figure 3-8 shows the bit size, the subinterval, the adjacent bit and the adjacent subinterval.

Adj. Bit

The Adj. Bit, or adjacent bit, is the distance between the "zero" bit flux transition and the previous bit cell, shown as Bin + 1. The ISO standard abbreviates the adjacent bit as **Bin + 1** and calls it **Adjacent Bit Cell Spacing Variation.**

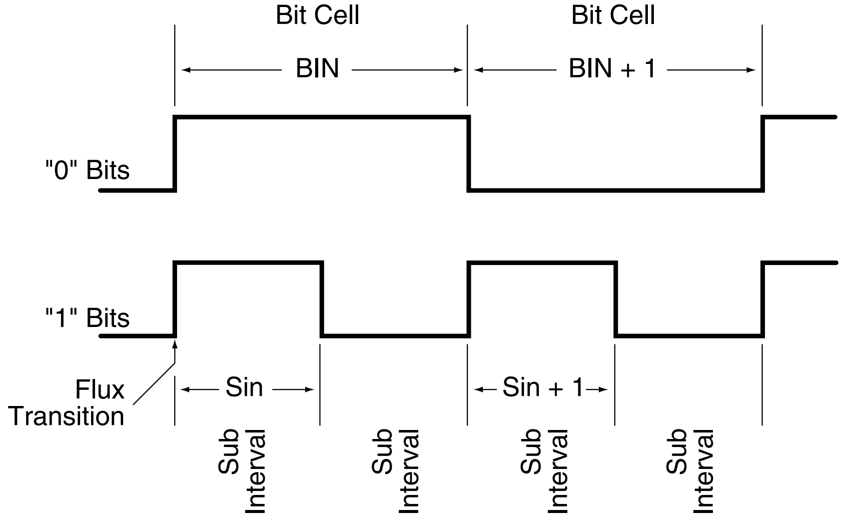


Figure 3-8. Bit Size

Sub. Int.

The Sub Int., or subinterval, is simply the distance of the bit cell divided by two. The ISO standard abbreviates the subinterval as **Sin** and calls it **Subinterval Spacing Variation**.

Adj. Sub.

The Adj. Sub., or adjacent subinterval, is the distance between a subinterval transition and the previous subinterval. The ISO abbreviates the adjacent subinterval as **Sin + 1** and calls it **Adjacent Subinterval Spacing Variation**.

Start Sent.

Start Sentinel, is the distance from the leading edge of the card to the first subinterval flux transition (the first one bit) encountered for each track.

CALIBRATION

The InSpec 9000-2005 is calibrated at the factory. This calibration should last several months with normal use. The data on the setup card that was received with the unit transfers the calibration information to the InSpec calibration database. However, the calibration of the unit should be periodically verified.

CALIBRATION VERIFICATION

Calibration may be verified by using one of the test cards Supplied with the InSpec 9000-2005. This may be done as follows:

1. From the Main Screen select ‘Do_Not_Add’ from the list of keywords. It is important to do this so that the database only contains data on your production cards.

2. Click on the read card button to read the test card.

3. From the ISO Parameters bar chart screen, click on “Numerical”, then compare the average amplitude, average bit size and start sentinel values, for all three tracks, from the numerical screen to the values for on the Test Card Results form included with the test cards. Check to see if the readings are within the measurement uncertainty found below.

   Measurement uncertainty of the InSpec 9000 System: Average Amplitude +/- 15%; Average Bit Size +/- 2%; Start Sentinel +/- 0.007 inches. To maintain the range of measurement uncertainty, the tester and the card must be clean. The card must also be flat and within ISO size specifications. This product tests Amplitude, Jitter, Start Sentinel, and Baseline Integrity. There are other parameters that may influence read reliability. Before testing for limits, the program removes 0.130 inch from each end of the data.

RE-CALIBRATION PROCEDURE

Following procedure should be used to obtain the required information to see if calibration is required:

1. From the Main Screen select ‘Do_Not_Add’ from the list of keywords. It is important to do this so that the database only contains data on your production cards.

2. Select one of the two test cards that were sent with the InSpec 9000-2005 to perform this test. The card you select must be sent in with the printed results, so keep track of which one you use. Click on the read card button to read the test card.

3. From the ISO compliance overview chart screen, click on “Numerical Results” to obtain the numerical screen, and then click on “Print”. If a printer is not available, the Average

Amplitude, Average Bit Size, and Start Sentinel values must be manually transcribed for all three tracks.

4. Repeat the above until 10 reads of the selected test card are completed.

5. From the “View” menu, click on “setup”. Click on “Print”, and then click on “Close”. Again, if a printer is not available, transcribe the information manually.

6. You will need to send in the results of the10 reads of the selected test card, either in the printout form or in the manually transcribed form, the “setup” information obtained in # 5 above , and the test card that was read.

Contact your local sales representative for the proper procedure for obtaining MagTek Technical Support. If calibration is required, MagTek will use the above information to either produce a new setup card for “in-field” calibration or to recommend service options.

SECTION 4. DATA PRESENTATIONS

The data presentation is divided into two groups, ISO compliance charts and performance charts. ISO compliance charts display information regarding a single card read as it relates to the various ISO specifications. The performance charts display information regarding multiples reads over a period of time to show changes or trends in the encoding quality.

The ISO compliance charts provide the operator with a quick and easy to understand “Go, No Go” test of individual card reads. Amplitude, interval size, and start sentinel location are all measured and displayed in several charts. The encoded data is also checked for parity, LCR, and several other factors that may affect the ability to read the card in the field.

The performance charts are a useful tool for detecting problems with card encoding before the cards are out of ISO specifications. The trend chart shows individual cards or daily averages over a period of time. With the proper use of the keywords, the operator can view data on individual encoders, different card stock, or other factors that might differentiate the encoded cards. The histogram chart will provide statistical information on the same data that can be displayed in the trend charts.

OVERVIEW

The Overview Chart Figure 4-1 is displayed after the card is read. The green region represents the new card limits. The yellow region represents the used card limits. The red region represents exceeding all limits. All of the other compliance charts can be accessed from this screen. If one of the three tracks is not encoded on a card, no chart will be displayed for that track.

Note

Only the green region, new card limits, represents proportional data. Data in the yellow or red regions will always be shown at the same location on the chart, no matter how close or far the data is from the limit. See the numerical results or profile charts for more detailed results.

Figure 4-1. Overview Chart

PROFILE CHARTS

The Profile Charts, Figure 4-2, give the operator a detailed view of a single parameter. The chart for each parameter can be accessed from the profile chart menu and from the buttons below each track's overview chart. Most of the profile charts display data for only a single track, but the start sentinel chart displays the start sentinel locations for all three track.

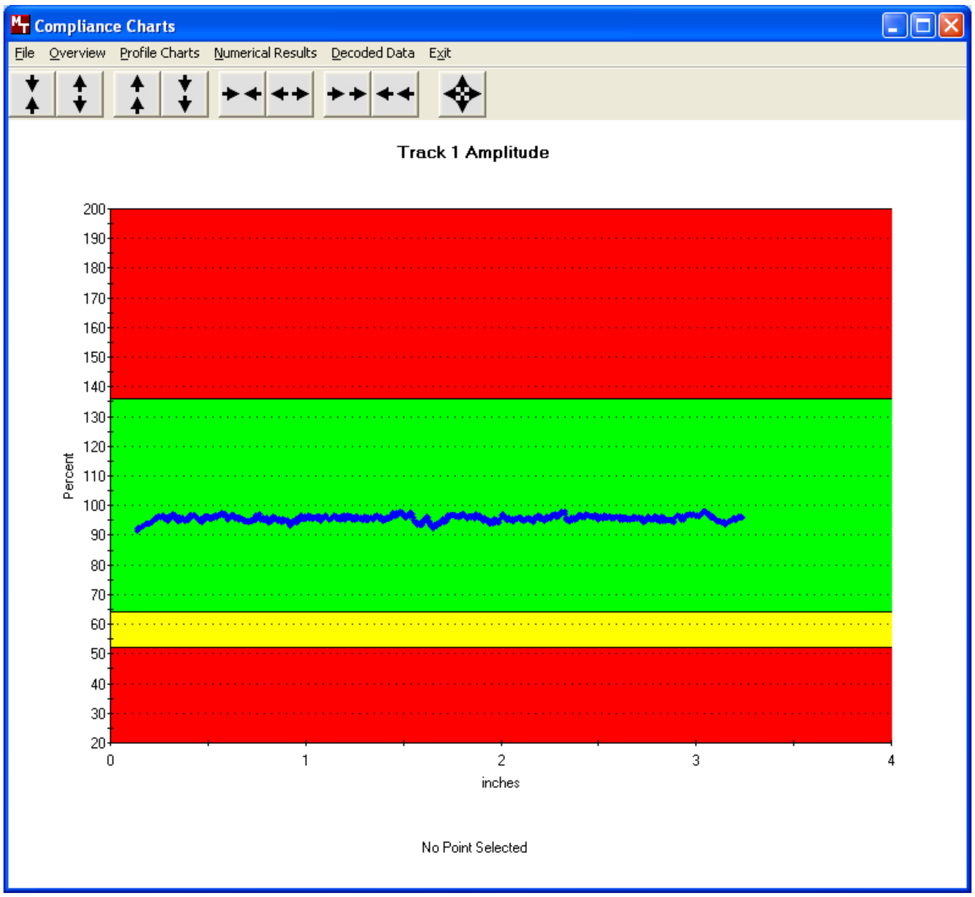
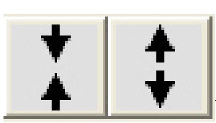
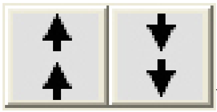
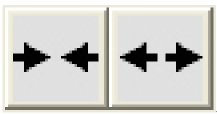


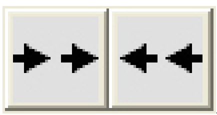
Figure 4-2. Profile Chart

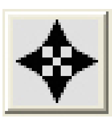
The amplitude and size profile charts have zoom controls buttons above the chart.

Y Axis Zoom buttons allow the operator to zoom the graph in or out vertically. Once the zoom limit has been reached, clicking the button will not have any more affect on the graph.

Y Axis Shift buttons allow the operator to shift the chart up or down. Once one side of the chart has reached a zoom limit, clicking the button will act like a zoom in until both side have reached a zoom limit.

X Axis Zoom buttons allow the operator to zoom the graph in or out horizontally. Once the zoom limit has been reached, clicking the button will not have any more affect on the graph.

X Axis Shift buttons allow the operator to shift the chart left or right. Once one side of the chart has reached a zoom limit, clicking the button will act like a zoom in until both side have reached a zoom limit.

Zoom all will zoom out to show the entire chart. To view the chart in the default condition, select that profile chart from the menu list.

NUMERICAL RESULTS

The Numerical Results, Figure 4-3, are the actual values of the overview charts, and they are color coded on the screen accordingly.

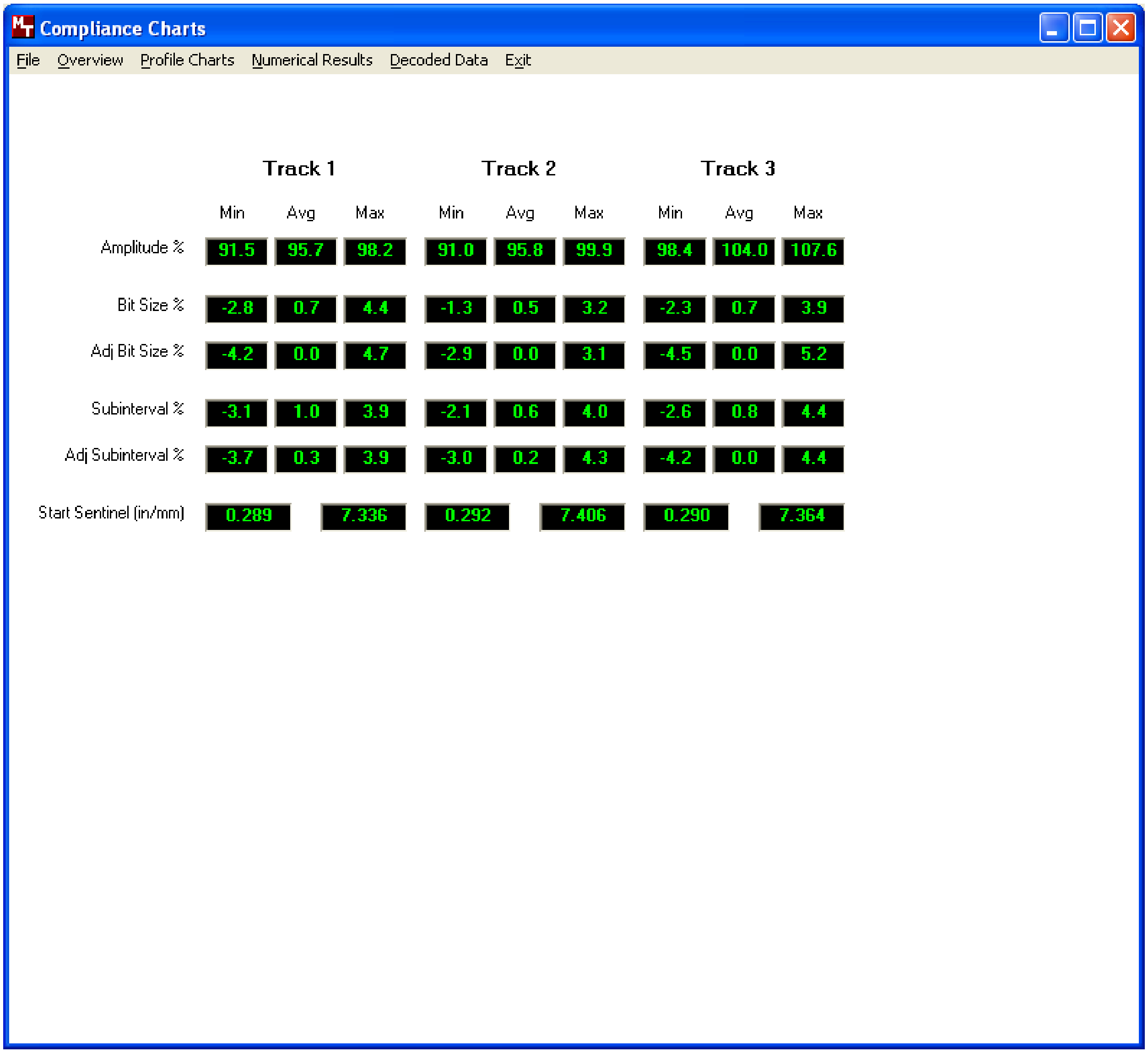


Figure 4-3. Numerical Results

DECODED DATA

The Decoded Data, Figure 4-4, displays the decoded data from all three tracks, if present. The status indicator will be green if there are no problems with the decoded data for that track. If any problem were detected with the decoded data, the indicator will be red. The drop down list next to the status indicator will display a list of the condition of the decoded data.

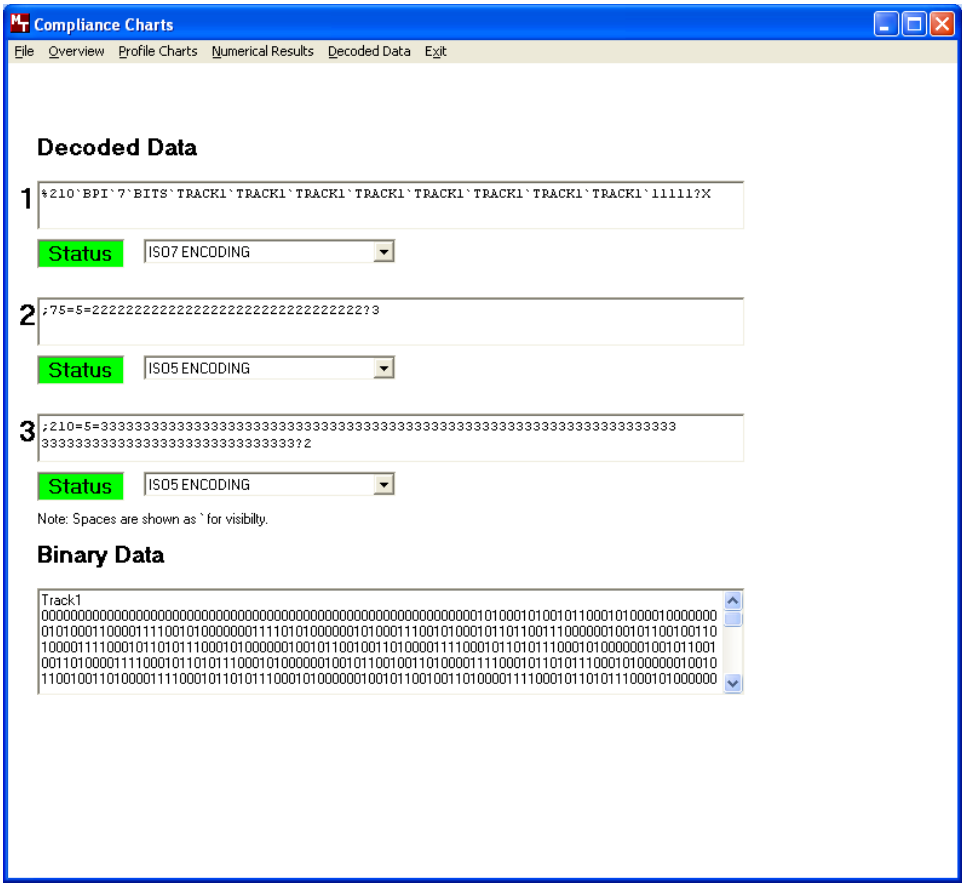


Figure 4-4. Decoded Data

The top item will be the encoding format. There are four different encoding types that may be listed. ISO7 and ISO5 are the standard encoding methods specified in the ISO specification, 7 bit for track 1, and 5 bit for tracks 2 and 3. The InSpec software will decode either of these formats on any of the three tracks.

JIS2 is displayed when Japanese Industrial Standard Type 2 encoding is detected. JIS2 is a wide track encoding, and will be displayed as track 2. JIS Type 1 is very similar to standard ISO encoding, and will be identified as ISO7 and ISO5.

Parity and LRC will be checked, and displayed as ‘Pass’ or ‘Fail’. For more information on parity or LRC, see appendix A Magnetic Encoding.

The number of leading and trailing zero bits are added to the list. Although there is no specification on how many zeros there should be, this information can be helpful in determining the reason for some cards not reading well.

If a start sentinel or end sentinel could not found, a message will be added to the list. No message is added if both are found.

‘One bit in leading zeros’, ‘data after end sentinel’, and ‘first one bit too close to leading edge’ are all problem that can be found in the leading and trailing zeros. These problems may affect reading in only one direction.

‘Added pulse detected’ is displayed when there are indications that there may be a problem with background noise. The InSpec 9000 is NOT a media tester and can not accurately test background noise. If this problem is consistently displayed, the cards should be tested using the proper equipment. There are several independent labs that can do this type of testing. Magtek Inc. does not do this kind of testing.

The binary data displays the encoded data as it is encoded on the card, as 1s and 0s. All three tracks are listed, if they are present on the card. Use the scroll bar the view the entire binary data.

START SENTINEL

The Start Sentinel chart, Figure 4-5, displays the location of the start sentinel for all three tracks. The bar shows the location of the start sentinel in relationship to the limits. Beside each bar will be the measured location. The optimum location for all three tracks is .293 inch. The allowable deviation differs between the tracks.

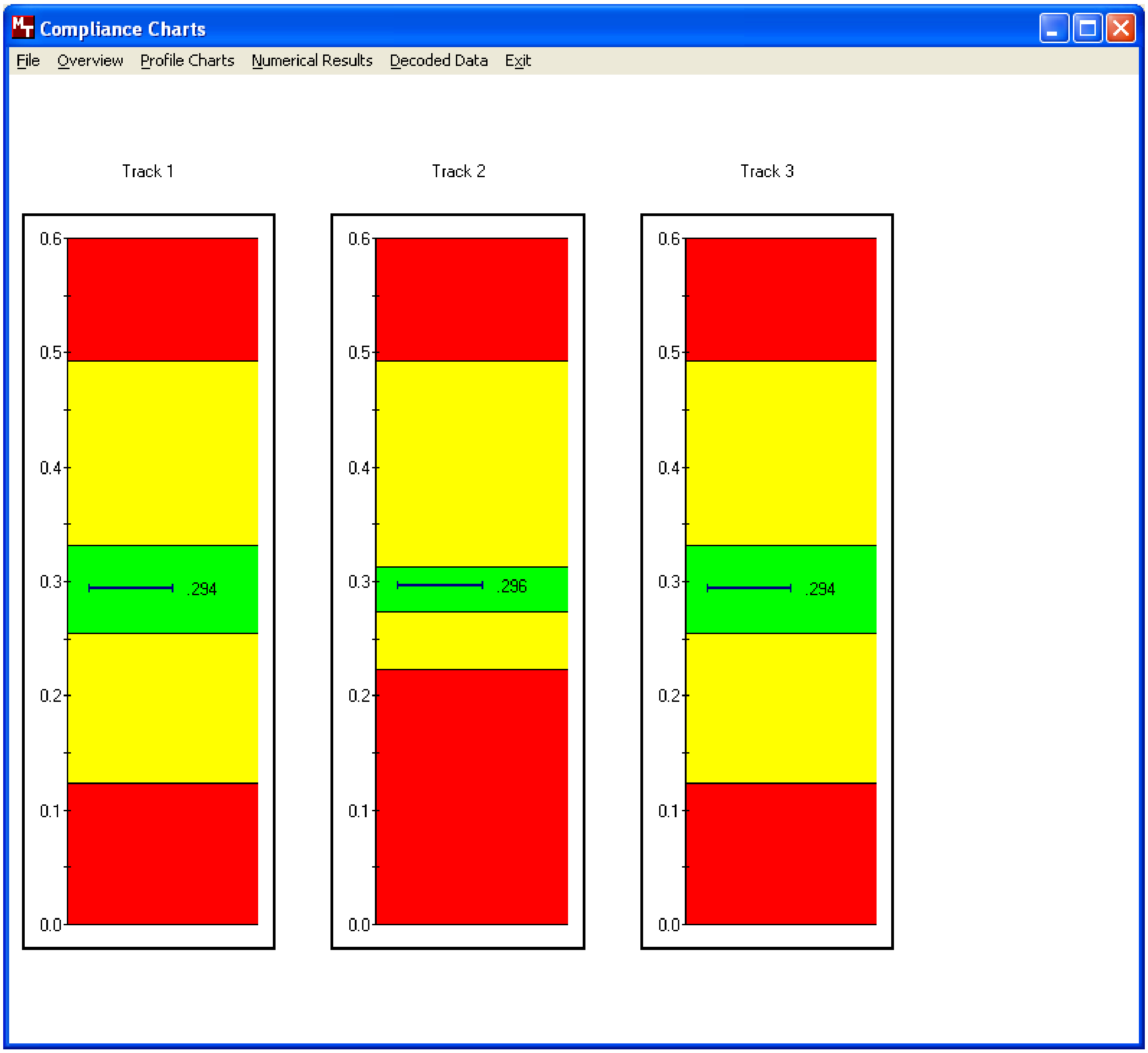


Figure 4-5. Start Sentinel

All of the profile charts can be displayed using millimeters instead of inches. The operator can toggle between the two measurements using the Profile Charts menu.

PERFORMANCE CHARTS

The performance charts allow the operator to view data collect from multiple cards over multiple days. Data can be selected from the database using eight different criteria, including the three keywords selected before each card was read. The selected data is then displayed in one of two charts, trend chart or histogram. These charts are used to detect problems before the encoding is out of specification.

The trend chart can display maximum, minimum, average, maximum and minimum, or all three. The trend chart will display the red/yellow/green limits as the profile charts did, but instead of data from one card, the data is cards reads during a certain date with certain criteria. The data points can also be an average of all the cards read on each day within the selected period with the selected criteria.

The histogram chart can display maximum, minimum, or average. The histogram displays the same data as the trend chart, but sorts the data by how many times each value occurs.

INTERPRETING PERFORMANCE CHARTS

When interpreting performance charts, the observer looks for trends. Compilations of daily summaries or individual cards may reveal problems with the process of producing cards, or encoding them, or the card stock, or the encoder, or even the Tester itself (cleaning for example). The operator should report these trends to the supervisor, the technician or other appropriate personnel. It may be helpful to print the chart to illustrate the trend.

SELECTING RECORDS

The Select Records toolbox displays the current selection and allows the operator any of the eight criteria. Track allows the selection of one of the three tracks. Only one track can be displayed at a time. Field allows the selection of one of the six measured attributes, amplitude, bit size, start sentinel, etc. There are two formats to select from, individual cards and daily average. Individual cards displays data for every card selected. Daily average displays one data point for each day that cards were read on. The keywords are the selection that were made on the main screen before each read. Not all keywords will be available for selections, only those keywords that have been used to for at least one read. The date selection has several predetermined periods along with the ability to select any starting and ending dates.

The same data was used to display the following two charts and statistical display, Figures 4-6, 4-7 and 4-8. In the trend chart, Figure 4-6, the minimum amplitude for each card selected is plotted on the chart. The background zones indicate the specifications limits.

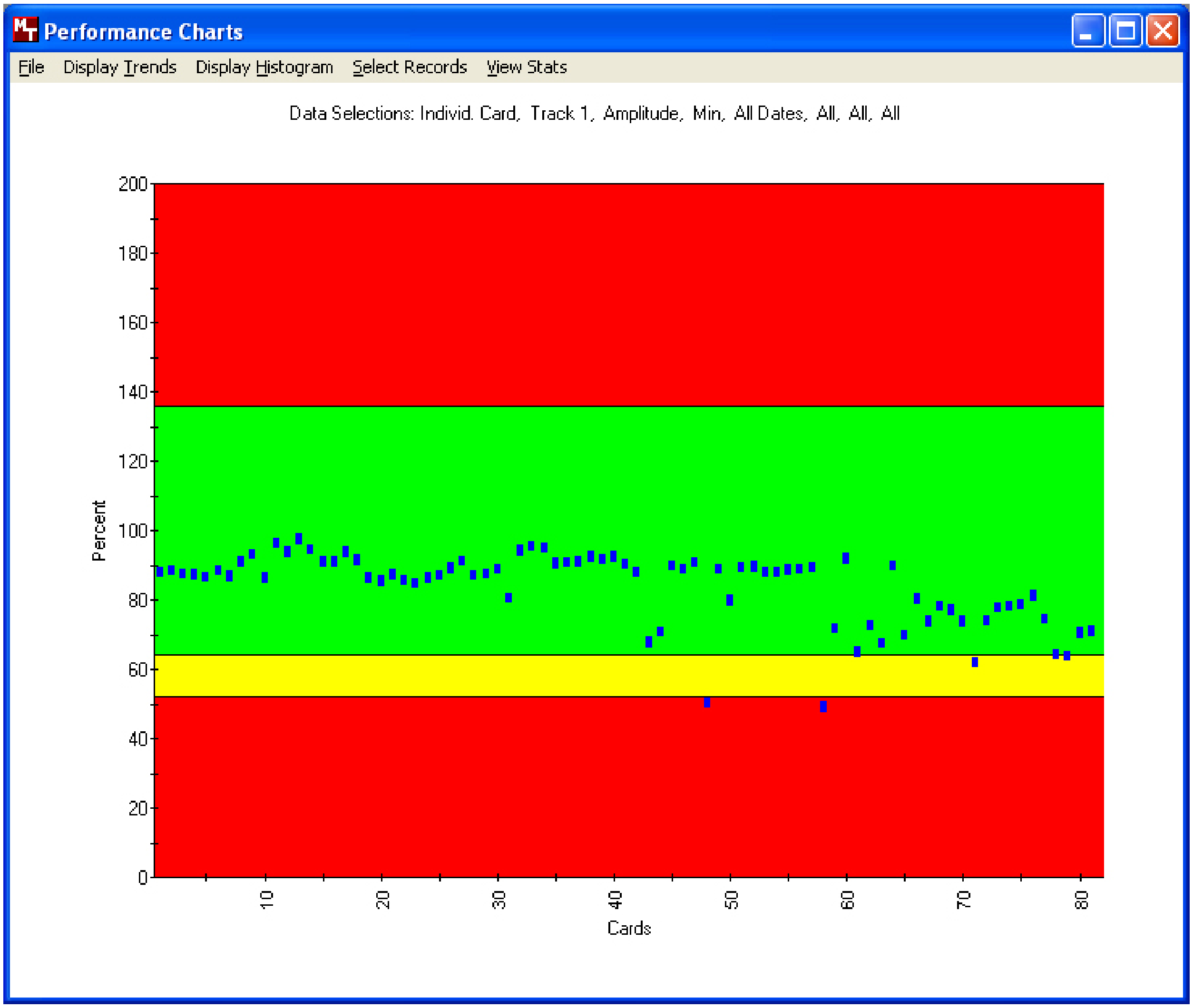


Figure 4-6. Performance Trend Chart- Amplitude

In Figure 4-7, the same data is displayed in a histogram chart. The two data points shown in the red zone in Figure 4-6 are shown here in the first two bins, each with a frequency of one. The two yellow bins with a frequency total of 4, but the trend chart only showed two points. This is because if any single point exceeds a limit, the color of that bin will be changed to indicate the presence of that point. This will only happen for bins that straddle limit boundaries.

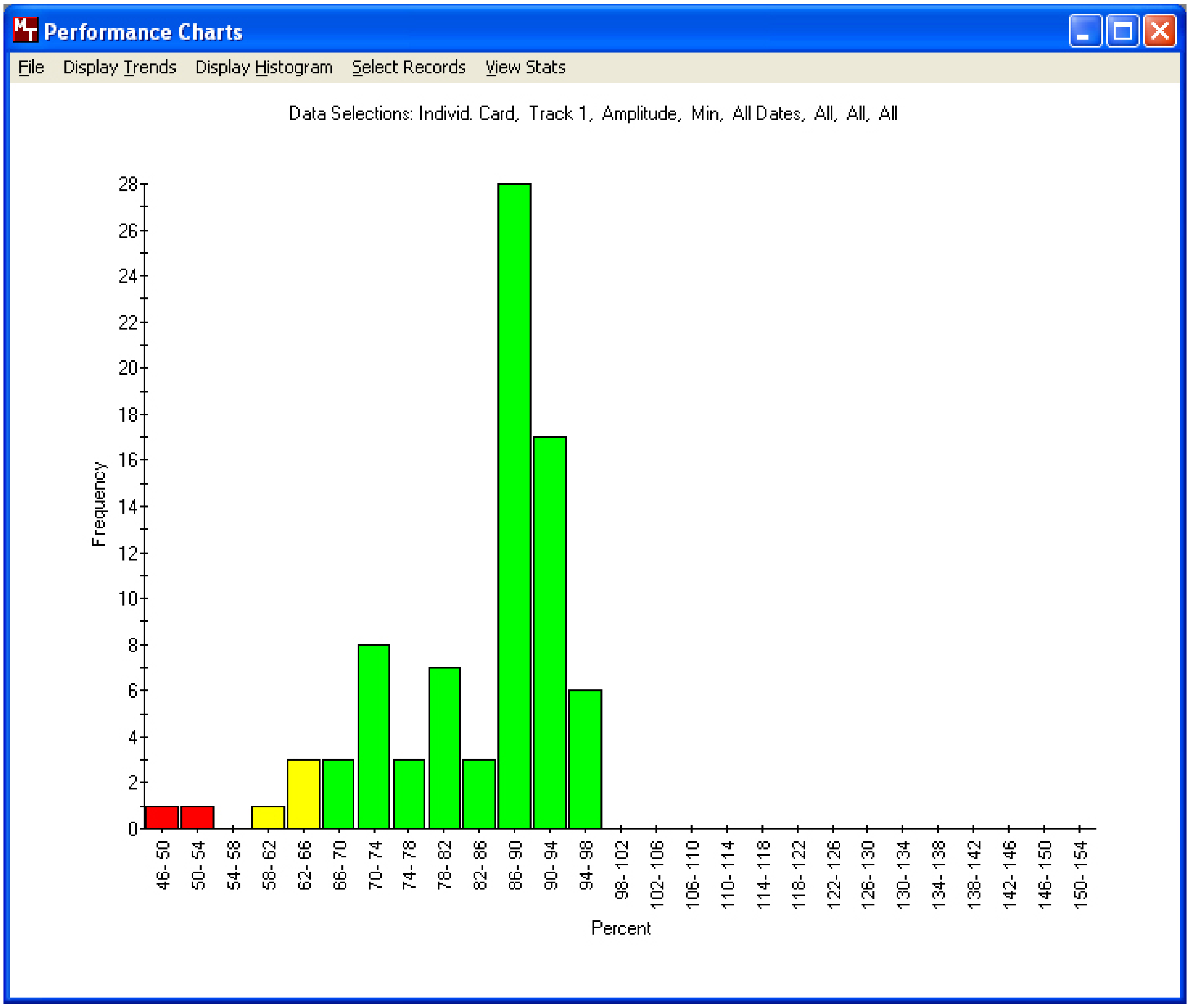


Figure 4-7. Performance Histogram Chart - Amplitude

The Statistics toolbox, Figure 4-8, displays information on the select data. Maximum, minimum, and average data can be viewed without reselecting the data by using the pull down list box.

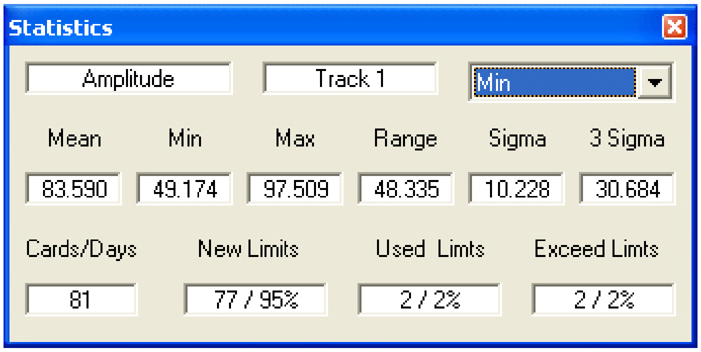


Figure 4-8. Performance Statistics- Amplitude

The Trend chart, Figure 4-9, can display maximum, minimum, and average data together. Figure 4-9 shows bit size data for both maximum and minimum.

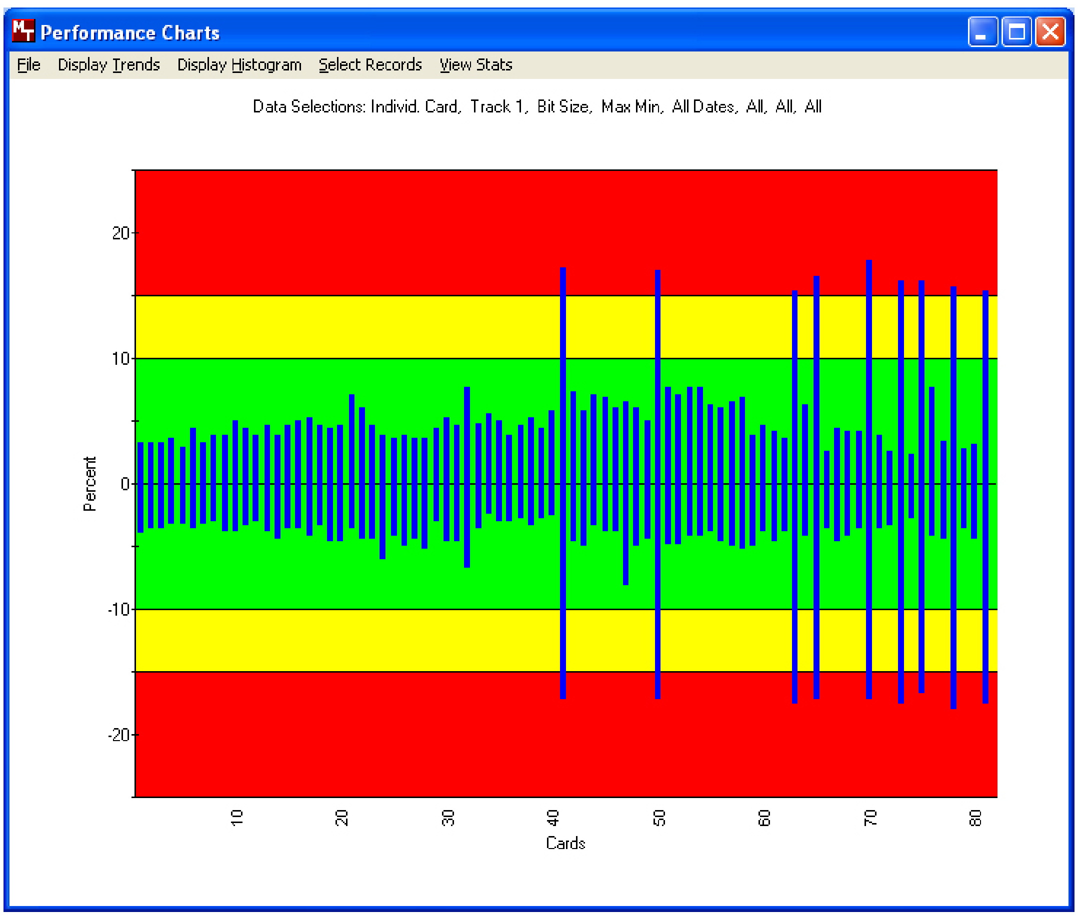


Figure 4-9. Performance Trend Chart- Bit Size

The Histogram chart, Figure 4-10, will always be centered at the optimum measurement for the selected parameter, 100% for amplitude, 0% the size parameters, and .293 for start sentinel. Figure 4-10 shows how the data may be skewed to one side, but the chart is still centered about 0%. Maximum and minimum data will tend to be skewed to one side.

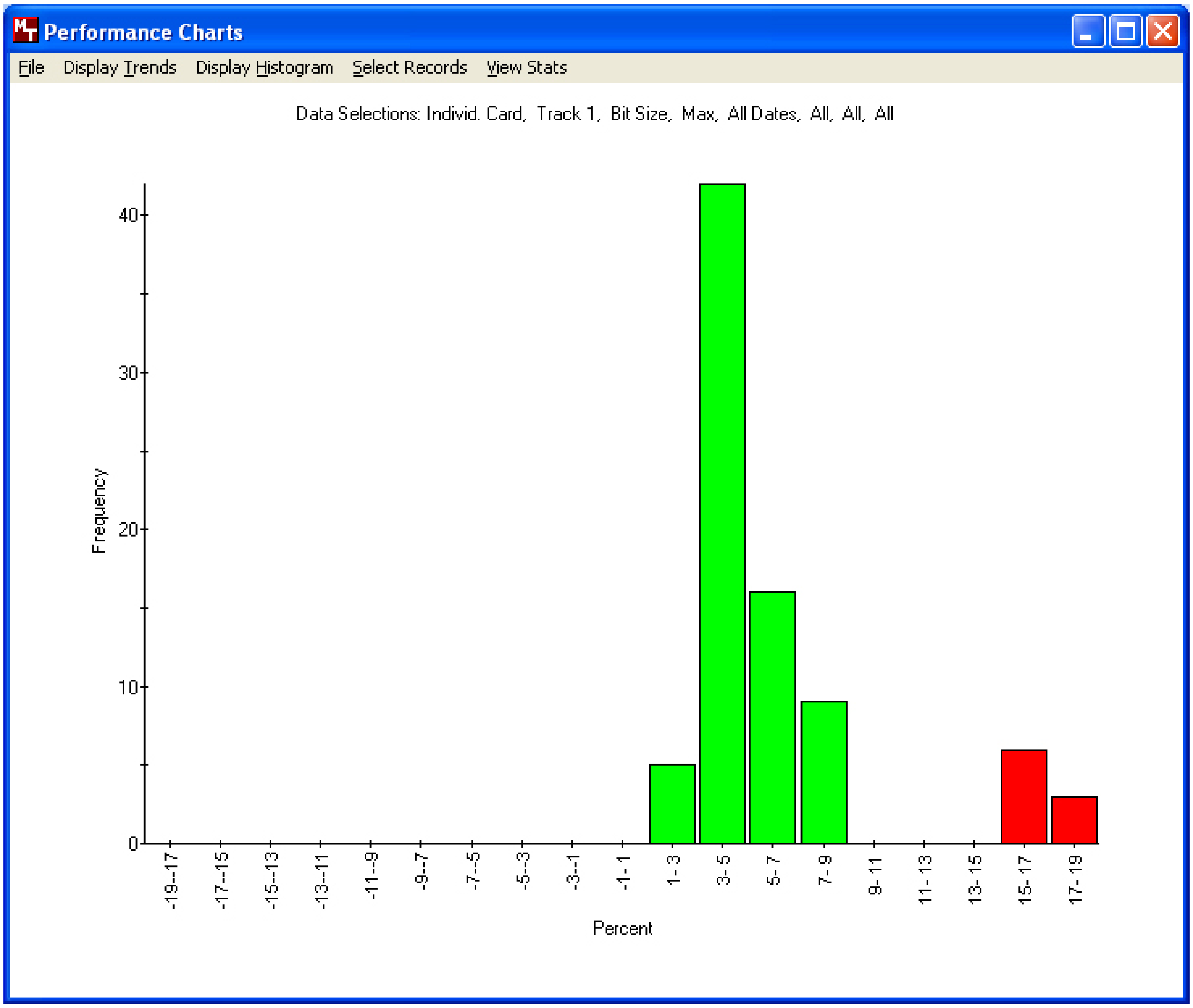


Figure 4-10. Performance Histogram Chart - Bit Size

The Performance Trend Chart for the Start Sentinel (Figure 4-11) shows the start sentinel is centered at .293 inch.

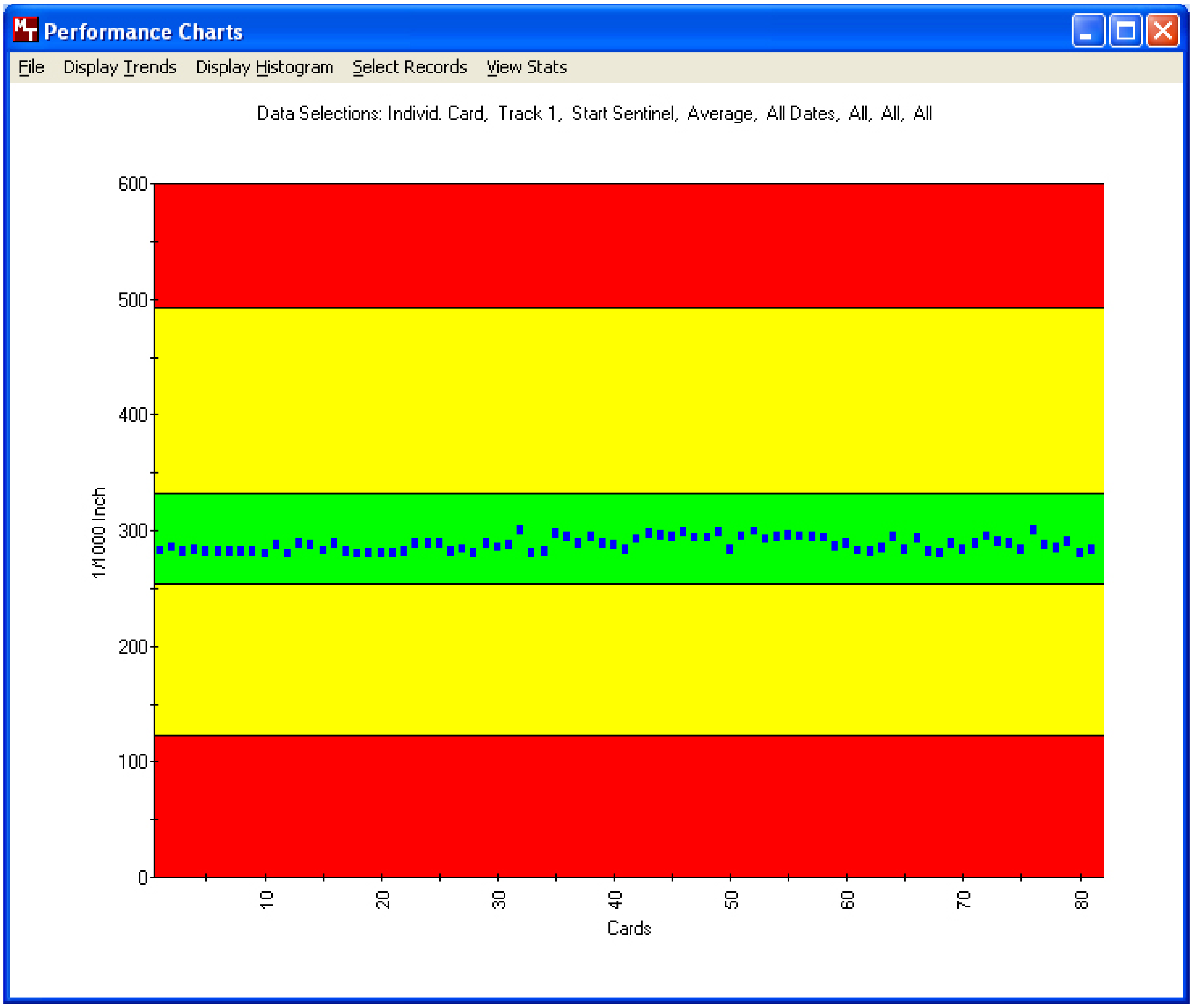


Figure 4-11. Performance Trend Chart- Start Sentinel

The Performance Histogram Chart for the Start Sentinel (Figure 4-12) shows the bars skewed to the left.

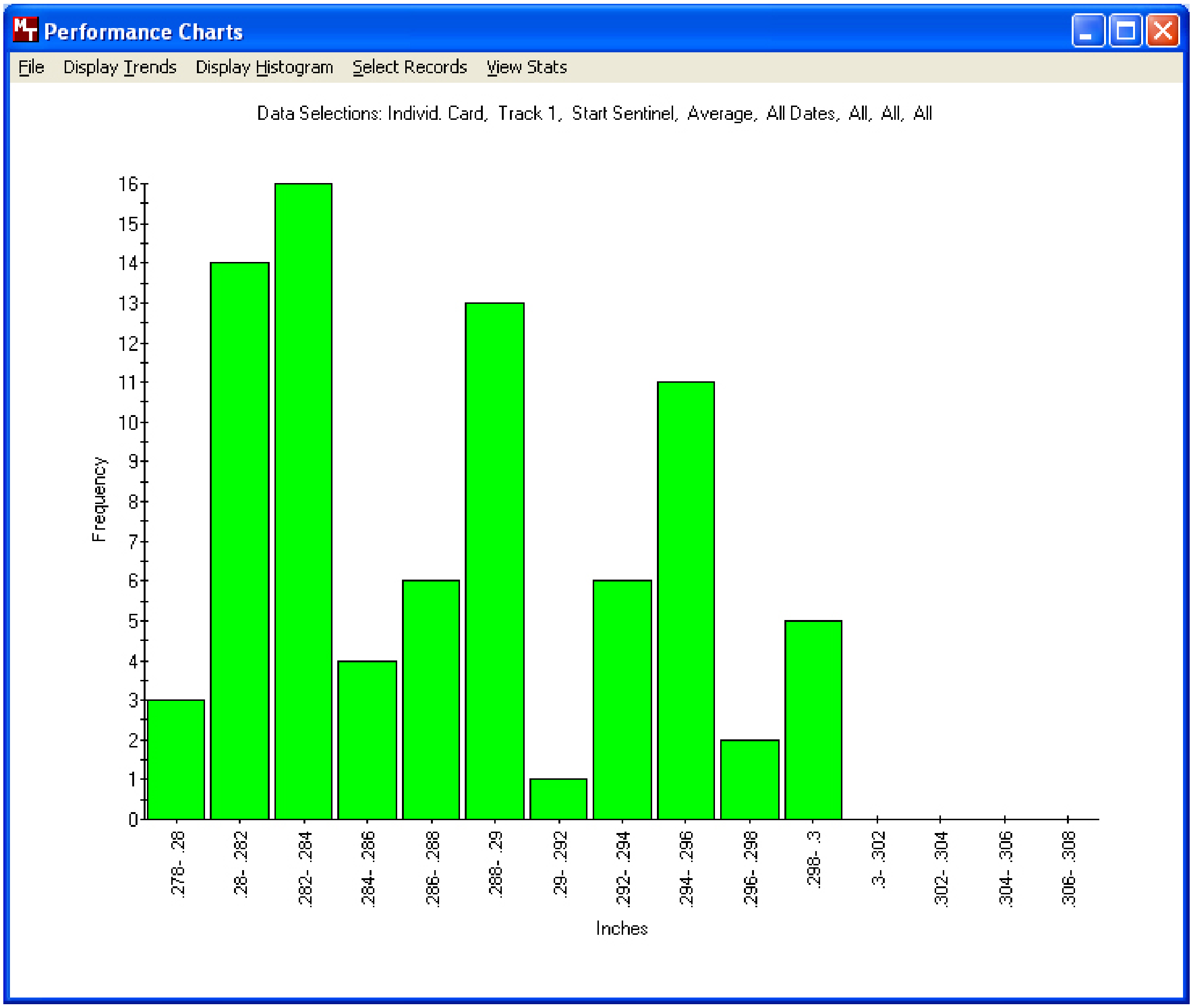


Figure 4-12. Performance Histogram Chart - Start Sentinel

Trends to observe and report are when the bars begin to drift. When this occurs, the technician may want to investigate the process for encoding the card stock, the encoder, or may send the card or cards to a test laboratory for analysis. Cleaning and calibration of the Tester may be in order.

DATABASE

The database contains records of cards read. The view database screen will allow the operator browse through the records of the main database and the archived databases. Records can be deleted if allowed by the current security settings.

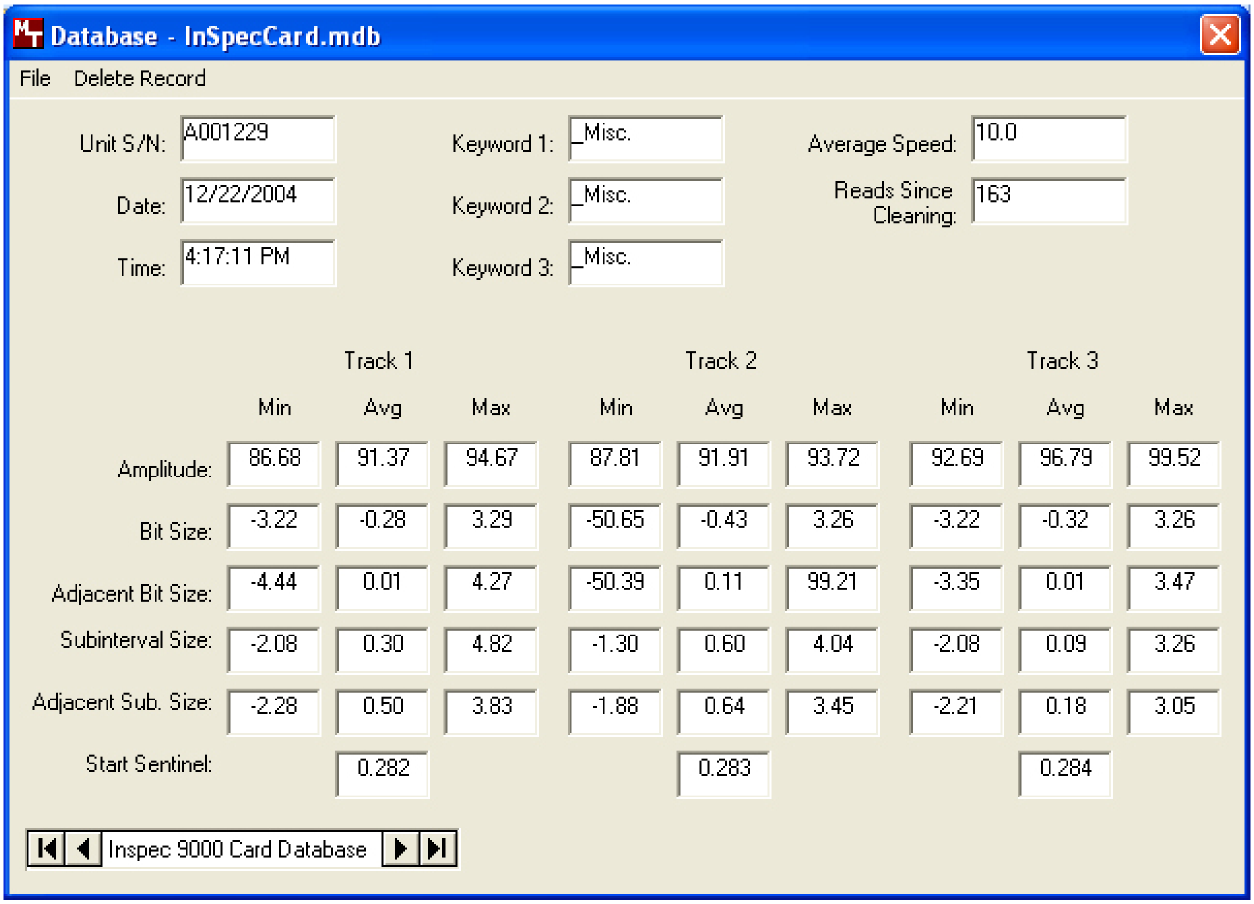


Figure 4-13. Database of Cards Read

SECTION 5. TROUBLESHOOTING

The Troubleshooting table below lists problems and corrective actions. When a problem occurs, take the corrective actions listed, and if the problem still persists, notify the responsible technical or supervisory personnel. If the problem still persists or reoccurs, call MagTek Technical Support.

The steps for corrective action are not necessarily sequential. Try each step and if one works, the action is complete. Reset the unit by switching the power switch in the rear of the unit off then on.

TROUBLESHOOTING TABLE

PROBLEM	CORRECTIVE ACTION
Power -No power to Tester -No green LED	1 Ensure power cord is plugged into a live AC (110-220V) outlet. 2 Ensure power switch in the rear of the unit is on (I). 3 Check Fuse on rear panel (See Section 2). 4 Reset the unit by switching power off then on.
Communication Failure -"Unit Not Responding". -InSpec 900 Device Was Not Detected	1 Ensure unit is powered up. 2 Ensure the serial cable shipped with the unit is plugged into the back of the unit and an available Com Port on the PC is used. 3 Reset the unit by switching power off then on.
Communication Port Messages appear: -"Communication Port not assigned". -"The hardware is not available (locked by another device)"	1 From the Setup menu select Communications and choose the available Com Port on your system. 2 If the problem persists, a conflict might exist with the Com Port devices. Refer to the PC manual and relevant documentation.
Hardware Failure -Red LED. Messages appear: -"FPGA failure". -"External RAM failure".	1 Reset the unit by switching power off then on. 2. If problem persists, notify supervisory or technical personnel then MagTek Technical Support.
Card does not eject - Card remains in Tester after reading a card or calibrating Tester.	1 Check to ensure power and signal cables are properly connected. 2 From the Options menu select Eject Card several times. 3. If still no ejection, reset by switching power on and off several times. 4. If still no ejection, ensure power is off, and use the card extraction tool as described below. 5 Reset the unit by switching power off then on. 6 Make sure that the card stock is not infrared transparent.
	Notify supervisory or technical personnel then call MagTek Technical Support.

CARD EXTRACTION

The card extraction tool (CET) is a slim rod with a handle on one end and a hook on the other. The handle and the hook are oriented in the same plane.

Remove the card as follows:

1. Perform the other "Card does not eject" procedures in the Troubleshooting Table before using the extraction tool.

Caution

Ensure power is off before inserting the tool or the unit may become damaged.

2. Press the power switch off (O).

3. Orient the Card Extraction Tool so the hook and handle are in a parallel plane with the card as indicated in Figure 5-1.

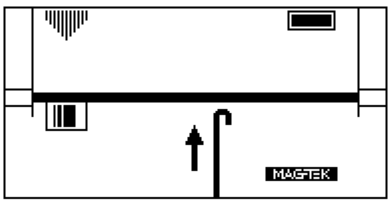


Figure 5-1. CET Orientation

4. Insert the tool up to the handle as shown in Figure 5-2.

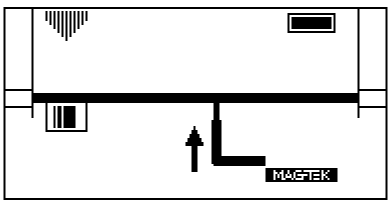


Figure 5-2. CET Insertion

5. Rotate the tool 90° *downward* as indicated in Figure 5-3

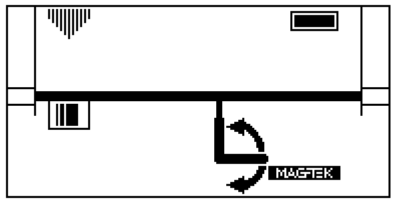


Figure 5-3. CET Rotation

6. Pull the tool until the card can be removed as indicated in Figure 5-4. If tool does not capture the card edge, the tool may be under instead of above the card. Reinsert the tool and rotate the handle 90^0 *upward*.

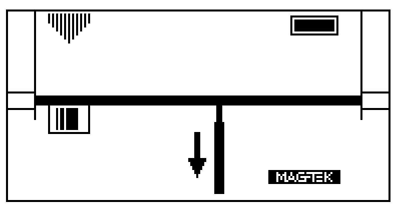


Figure 5-4. CET Extraction

7 Repeat 3 through 7 until card edge is captured. Pull the tool out until the card can be removed. Remove the card before removing the tool.

Caution

The card and tool can not be removed together and if forced, damage may occur to the card, the unit, or the tool.

8. Rotate the tool to the horizontal position and remove it from unit.

9. Turn the power on.

APPENDIX A. MAGNETIC ENCODING

This Magnetic Encoding Primer is intended to provide the reader with a basic understanding of magnetic stripe cards and magnetic encoding. The subject of magnetic stripe encoding involves many technical parameters that are often complicated and confusing. We will attempt to bring these parameters into perspective as we discuss basic magnetism, how encoding and reading heads work and the important aspects of magnetic media construction. First, we'll start with a brief history lesson.

HISTORICAL BACKGROUND

Magnetic recording technology began in the late 1800's. Many scientists, throughout the next half century, whose field involved electricity or magnetism, discovered the fundamentals that magnetic stripe cards rely on today.

At the Paris Worlds Fair in 1900, Valdemar Poulsen demonstrated a magnetic wire recording device. This device permitted voices to be recorded on an iron wire for later playback. Similar devices were used aboard German submarines during the first World War as a means to transmit secret voice information by recording the message at normal speed and then transmitting the play back recording in reverse at higher speeds.

In 1928, a German patent was filed on a coating of iron particles on a strip of paper as a recording medium and a machine that used such a strip. The German Magnetophone was exhibited in Berlin in 1935.

After World War II, rapid growth in magnetic tape and recording occurred. Minnesota Mining & Manufacturing (3M) started delivering iron oxide tapes in 1947, while Ampex began delivering sound or "audio" recorders in 1948.

Meanwhile, a breakthrough in calculating machines came in 1944 when at Harvard University an electromechanical calculator was developed that utilized binary arithmetic. "Binary" refers to a counting method that only has two states; ON and OFF or in terms of numbers ONE and ZERO. In 1951, the first commercial computer, UNIVAC I, was produced. Computers soon began to utilize the memory storage ability of magnetic tape. Since computers function by manipulating ONE bits and ZERO bits, only these two states needed to be stored. The technology of "digital" recording was born. While the digital method of recording was similar to audio recording, it differed in the amount of drive current used in the recording head. Audio recording relies on varying the amplitude of the desired "signal", in order to reproduce both loud and quiet passages as occurs in music. Digital recording relies on an even amount of signal amplitude. By "saturating" the magnetic tape, the resulting signal amplitude remains fairly constant. This is a key concept for our later discussion of how cards are recorded and read back.

The key interchange parameters, that card readers rely upon, are Signal Amplitude and Jitter. These parameters are measured by the Encoded Card Quality Tester and are defined and explained in the pages that follow. First, some basic concepts are presented.

BASICS OF MAGNETIC RECORDING

Digital magnetic recording requires three basic components for the technology to be worthwhile: the Recorder (or Encoder), the Magnetic Tape, the Reader. We will first focus our attention on the Magnetic tape as it is the fundamental component from which the Encoder and Reader are designed to work.

Magnetic Tape

A discussion of magnetic tape must first start with the tape's most basic ingredient: Iron. Modern magnetic tapes are made with various types of iron (ferrites) or metal oxides. However, before we complicate matters further, an understanding of iron, the basic element in any magnetics discussion, is needed.

The fundamental characteristic of iron is its ability to become magnetized when subjected to a magnetic field. As you know, a direction finding compass works because the Earth has magnetic fields directed toward the North Pole. Magnetic fields can also be created by the flow of electric current. Electric current is the fundamental way that magnetic fields are controlled and directed in billions of products. A coil of wire, wrapped around an iron rod, will produce a magnetic field when a DC (Direct Current) current flows through the wire, as illustrated in Figure A-1.

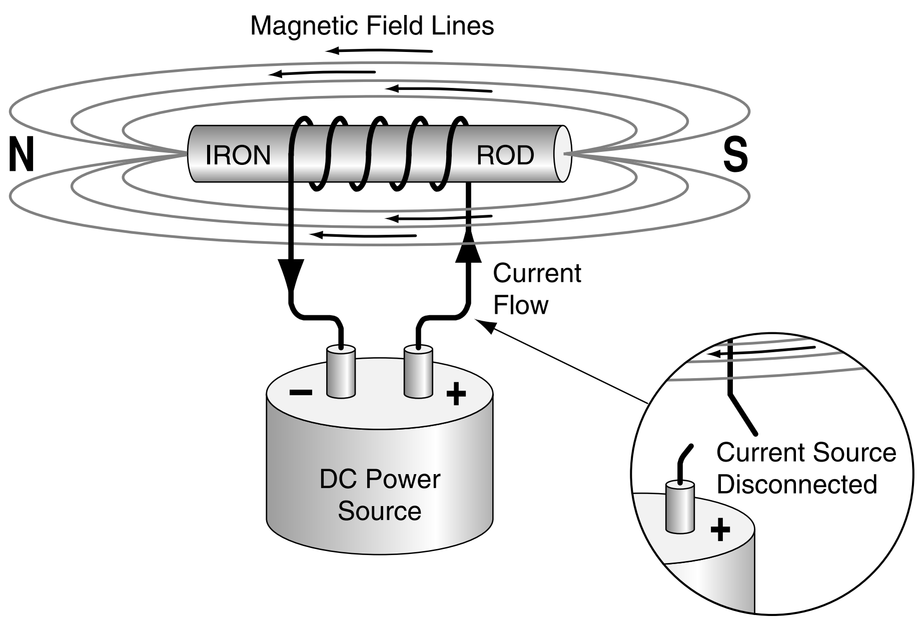


Figure A-1. Magnetic Field

The magnetic field is directional like a DC current is directional. The convention for describing the direction of DC current flow is for electrons to flow from the positive (+) terminal to the negative (-) terminal. Similarly it is also conventional to describe magnetic field lines as going from the "South Pole" to the "North Pole".

Now, back to our iron rod and wire coil. Disconnecting the current source will not stop the magnetic field, since the iron itself has become magnetized. The magnetic field lines will be the same as shown in Figure A-1.

This ability of iron to retain the magnetic field created by the wire coil and electric current is the fundamental element in any magnetic media's ability to store information. The key concept here is the ability of iron to keep or retain the magnetic field after the electric current has been removed.

We can reverse the magnetic field direction by reconnecting the DC power source so that the current in the wire coil flows in the opposite direction, as shown in Figure A-2.

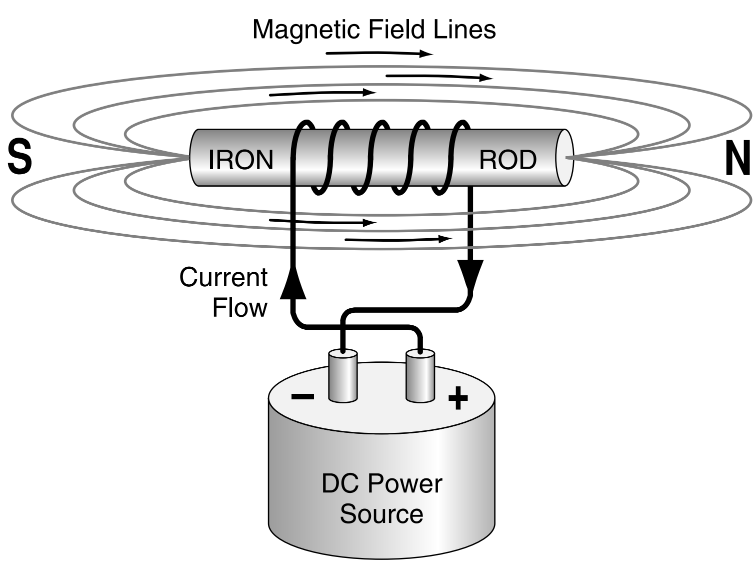


Figure A-2. Reverse Polarity

Again, disconnecting the DC current source will not stop the magnetic field since the iron itself has become magnetized, now in the opposite direction.

Think of the iron rod as a "bit". We can define the left to right direction of magnetization as a ONE bit and right to left direction as a ZERO bit. In order to make this iron rod useful as a storage device, we need to sense the magnetic field direction in order to determine whether the bit is a ONE or ZERO. This single bit, iron rod storage device is far from practical in today's world where hundreds of megabytes (a million bits) of disk storage is common place and relatively inexpensive. However, we do want to take this iron rod concept further.

Modern Magnetic Tape

A means to compact or compress a bunch of iron rods is necessary for magnetic recording to be practical. This is done by grinding up the iron rod into a powder. This iron (or ferric) powder forms the basic magnetic component of all magnetic media. The magnetic powder goes through a complex process of oxidation resulting in an iron oxide called gamma ferric oxide (γFe_2O_3). Gamma ferric oxide is the most commonly used magnetic particles for "low coercivity" magnetic tape. ("Coercivity" is described later.) When mixed with a liquid "binder", the iron oxide can then be coated onto a number of "substrates". Typically, for plastic card manufacture, the substrate is a polyester film which is later slit to narrow widths for transference to cards or for direct application on cards.

Encoding Process

The electric current used to produce a magnetic field in the iron rod is also used with an encoding "head" to generate a magnetic field to magnetize the magnetic tape in order to store ONES and ZEROES. Figure A-3 shows the internal workings of a typical encoding head.

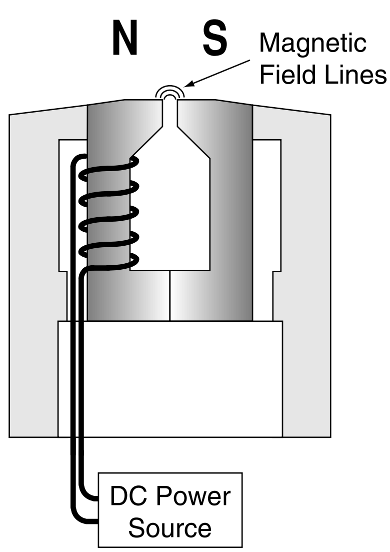


Figure A-3. Encoding Head Model

Notice in the figure that a coil of wire is wrapped around an iron core and that the iron core is shaped much like a "horse shoe" magnet with the North and South Poles close together. The gap between the North and South Poles is where the magnetic field lines are produced (when electric current flows) and thus, it is the area of the head that touches the magnetic tape. When the power source changes the direction of the electric current, the magnetic field lines also change directions. This change of magnetic field direction produces a flux transition on the magnetic tape.

To illustrate this point, refer to Figure A-4, an idealized model for magnetic tape:

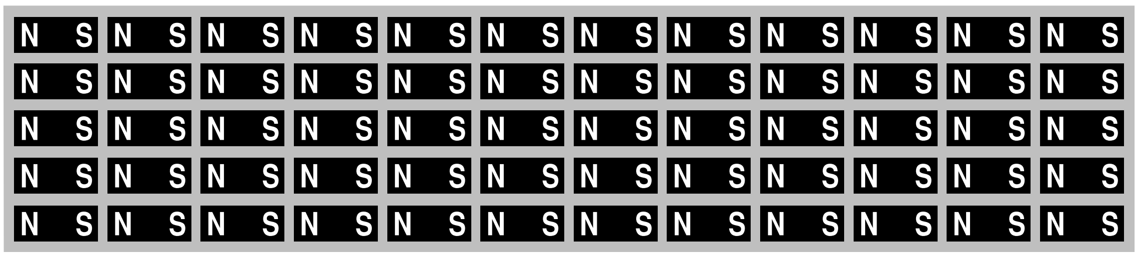


Figure A-4. Magnetic Tape Model

This idealized model shows the iron oxide particles, all uniformly shaped as tiny bar magnetics and all perfectly aligned.

Now, consider that an encode head has passed over the magnetic tape and the direction of the electric current in the encode head coil has changed as indicated in Figure A-5.

Notice the change in the magnetic polarity on the magnetic tape where the change in encode current occurred. This change in polarity is called a flux transition and it is what a READ head will detect as it passes over the magnetic tape.

So, imagine a READ head passing over the magnetic tape. A READ head is basically constructed in the same way as an encode head - “horse shoe” shaped iron with a coil of wire. However, instead of a current being sent through the coil by a power source, an electric current is created in the coil as the gap of the READ head passes over the flux transitions. A read back signal is generated as illustrated in the figure above. This read back signal forms the basis for the measurement of the position precision of the flux transitions (jitter).

This point needs to be emphasized. It is the basis for all the measurements taken by the Encoded Card Tester: The flux transitions recorded by the encode head, on the magnetic tape, causes a read back signal to be generated by the read head. This signal possesses amplitude whose peaks define the position of flux transitions.

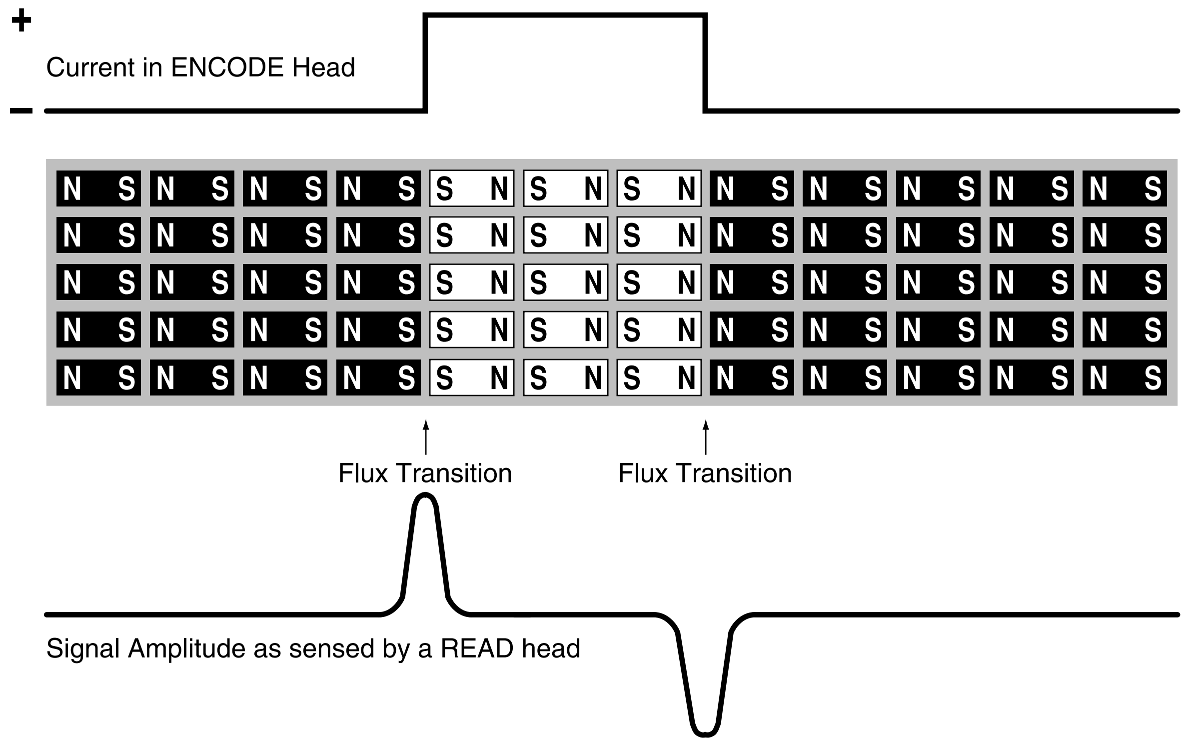


Figure A-5. Flux Transitions

It is important to understand the basic characteristics of magnetic tape and how they relate to recording and readback.

Magnetic Tape Characteristics

Imagine an encode head, as it passes over a length of magnetic tape, having current "driven" into the head wires which changes at a rate of 200 times per inch (200 flux transitions per inch -200 ftpi) at ever increasing current levels. Figure A-6 illustrates this current:

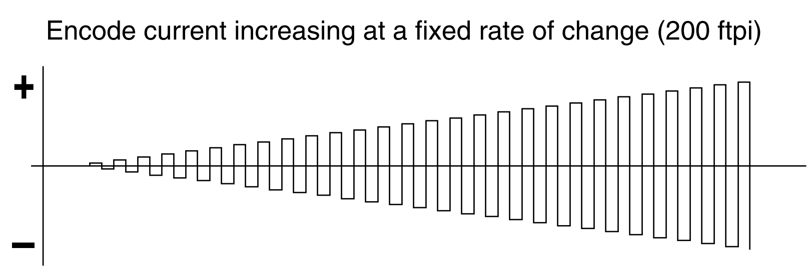


Figure A-6. Encode Current Level

After recording a magnetic tape with this increasing current, as shown above, we can then Read the signal amplitude peaks and plot the peak values as a function of the encode current level. The resulting plot is shown in Figure A-7.

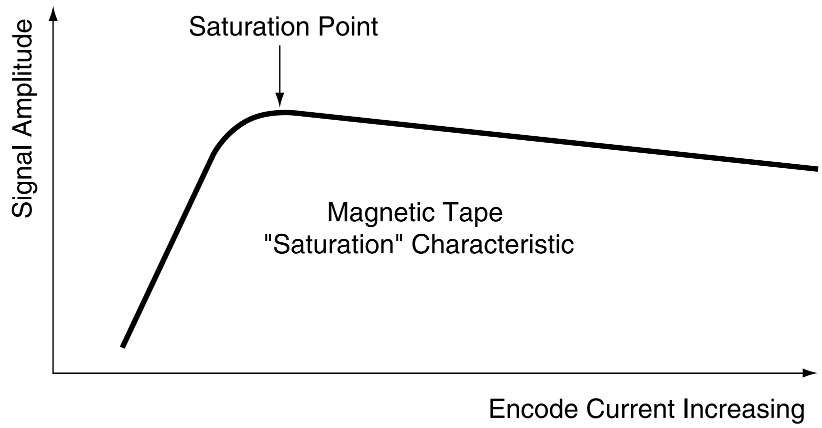


Figure A-7. Signal Amplitude

This plot is known as the magnetic tape's saturation characteristic. Notice that the Signal Amplitude increases linearly as the encode current increases until it reaches a maximum value where afterwards the Signal Amplitude decreases slowly with ever increasing encode current. The maximum value of Signal Amplitude on this plot is called the saturation point of the magnetic tape.

As a point of interest, the region of the magnetic tape's saturation characteristic, before saturation is the region where audio or sound recordings take place. That is, audio recorders limit the amount of recording current so that when loud passages are recorded, the playback signal amplitude is the greatest while quiet passages generate small currents and yield small levels of signal amplitude. Digital recordings utilize the region after the saturation point. We will continue this discussion in the next section on Digital Magnetic Recording.

DIGITAL MAGNETIC RECORDING

Digital recording utilizes the region of the magnetic tapes characteristic past the saturation point where the signal amplitude does not change much with encode current. This is important, not because encode currents vary, but because encode heads and magnetic tape are not always in perfect, intimate contact during the encoding process. The magnetic field strength from the encode head gap decreases significantly as the distance increases from the gap. Thus, digital recording can withstand small "spacing losses" between the encoding head and magnetic tape. Saturation recording (digital recording) also produces fast, sharp rise times in the read back signal, making detection of the positions of the flux transitions more accurate.

Spacing losses occur when the encoding head leaves contact with the magnetic tape. Contamination on the magnetic tape surface or the encoding head can produce spacing losses. Contamination can be classified in two categories. One is loose debris (dust, plastic shavings), which resides on the surface of the magnetic stripe causing the head to bounce or otherwise lose contact with the magnetic stripe surface. The second type is deposits of oil, plasticizer or other film type deposits which create a surface that causes the encoding or reading head to stick then slip across the magnetic stripe. These oily film deposits can be thick enough to cause spacing losses and thus can cause read or encode failures.

F2F Encoding

There are several schemes used to record or encode ones and zeros in the computer industry. (We use the term record and encode synonymously.) In the card industry the International Standards Organization (ISO) has defined F2F as the encoding scheme for cards. F2F stands for frequency - double frequency, or for the purist - two frequency coherent phase recording. F2F encoding provides for self-clocking data. That is, the serial data stream consisting of one and zero bits provides the timing information for the reader to determine which bit is which.

The key feature of self-clocking data is that the data bits can be extracted from the serial data stream without the need to control the speed of the magnetic media past the encoding head. Thus, card swipe readers, where a human hand is passing the card through the read slot can work regardless of how fast or slow the card is passing through the slot. Serial data merely means that the one and zero bits, that form the desired characters, are stored on the same track, one bit after the next bit.

F2F is an encoding technique which places flux transitions on the magnetic stripe separated by a defined distance for zero bits and one half that distance for one bits.

The defined distance for Track 1 is 0.0047619 inches for zero bits. This value is the reciprocal of the bit density of Track 1 - 210 bits per inch. For one bits - 0.0023809 (1/2 the zero bit distance.)

The defined distance for Track 2 is 0.013333 inches for zero bits. This value is the reciprocal of the bit density of Track 2 - 75 bits per inch. for one bits - 0.0066665 inches (1/2 the zero bit density.)

Figure A-8 illustrates this concept.

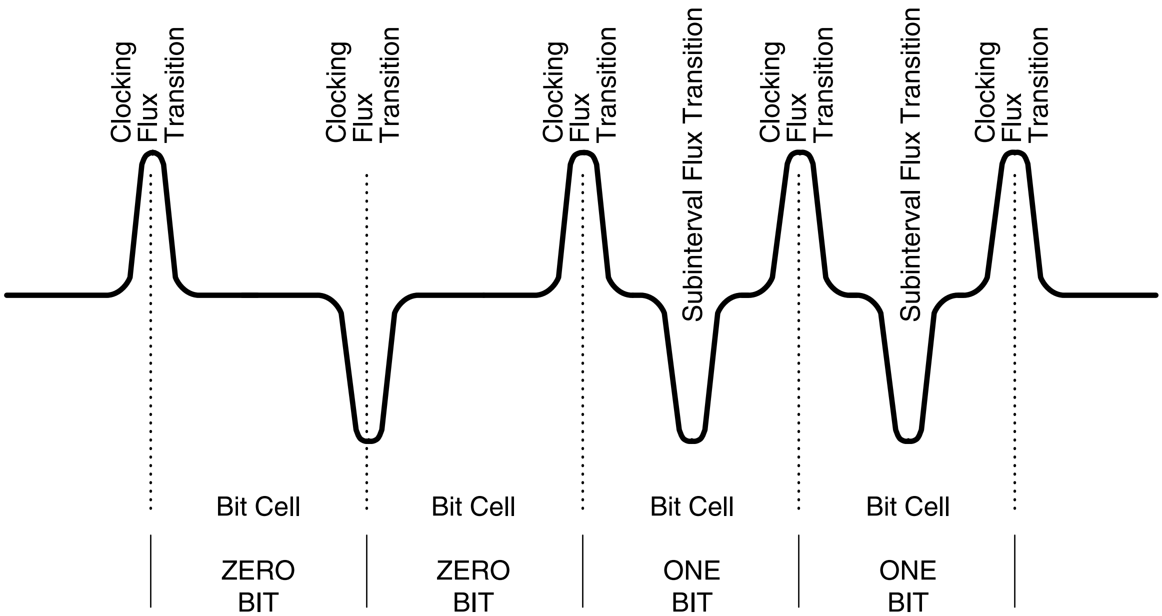


Figure A-8. Bit Cell - Flux Transition

The encoding device has the responsibility to separate the flux transitions at the proper distance. Variations in the proper distance between flux transitions is what is commonly referred to as jitter. Jitter is described later in this section; but first, the following is a description of the general encoding format on each of the ISO tracks.

Before the desired information can be stored (encoded) on the card, many things must happen. The information itself (the alphanumeric characters for Track 1 and the numeric characters for Tracks 2 and 3) needs to be coded. That is, the information must be converted to one and zero bits. The one and zero bit code for each character can be found in the Coded Character Set tables in ISO/IEC 7811-2. These tables define the pattern of the one and zero bits for each character. There is a special bit that is added to each character code for the purpose of error detection. This special bit is called a parity bit. The parity bit is either a zero bit or a one bit depending on whether the number of one bits in the character is an even number or and odd number. The ISO standard has defined that for all tracks odd parity is maintained on each character.

This means that if the character has an odd number of one bits in the character code for that character, the parity bit is then a zero bit. On the other hand, if the character has an even number of one bits in the character code for that character, the parity bit is a one bit causing the total number of one bits to be odd. Thus the term odd parity.

Before the first character (or more specifically, the first series of bits that define the desired first character) can be encoded, a Start Sentinel character needs to be encoded. The Start Sentinel is a defined series of bits which signal the start of the data bits. Track 1 Start Sentinel consists of seven bits (as all characters on Track 1). Track 2 Start Sentinel consists of five bits (as all characters on Track 2). As an example, the Track 2 Start Sentinel code is: 11010.
After the last data character is encoded, an End Sentinel must be encoded. The End Sentinel is a defined series of bits which signal the end of the data bits. Immediately after the End Sentinel, a special error checking character is also encoded. This error checking character is called the LRC - Longitudinal Redundancy Check character. For further details of the LRC see Appendix B, Glossary of Terms.

Before the Start Sentinel character and after the LRC character, "clocking bits" are encoded. These clocking bits provide card readers with timing to start their synchronization process before encountering the start sentinel (or end sentinel for reverse reading). Figure A-9 illustrates the relative location of all the characters previously discussed.

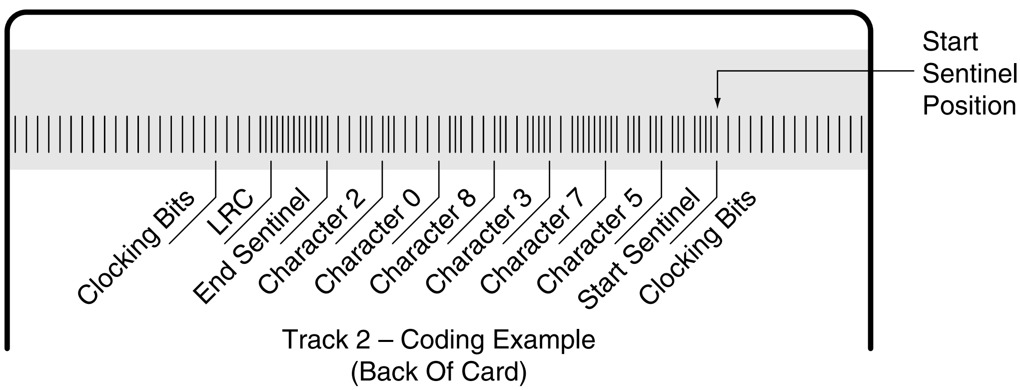


Figure A-9. Card Coding

Note that as you look at the diagram, while not to scale, the encoded information does travel from right to left along the length of the magnetic stripe.

There is one more important parameter that the Tester measures. It deals with the position of the Start Sentinel from the physical right hand edge of the card. The ISO standard requires that the "center line" of the first bit in the start sentinel on either Track 1 or 2 to be 0.293 inches ± 0.020" from the right hand edge of the card. The ISO standard allows the tolerance for the Start Sentinel position on Track 3 to be ± 0.040". The reason the start sentinel position is important is because it provides the reader with enough leading clocking bits for synchronization and an expectation for where valid data starts from the physical edge of the card.

The F2F encoding technique also permits reading in reverse. That is, instead of passing the card across a read head with the start sentinel first, it is possible to pass the card across the read head with the LRC and end sentinel first. Whether any particular reader can function in reverse depends on whether it was designed to do so.

Next, the parameter "jitter" and why it is an important parameter to measure and control. The Tester measures jitter and reports values for each of the jitter terms described below.

Jitter

Jitter is a term used as a short version for: Variations in Flux Transition positions. Jitter is more precisely stated in the ISO standard as Flux Transition Spacing Variation, Subinterval Spacing Variation, Adjacent Bit Cell Variation, and Adjacent Subinterval Spacing Variation, Bin+1 for Adjacent Bit Cell Variation and Sin+1 for Adjacent Subinterval Spacing Variation. We will use the ISO shortened terms (Bin, Sin, Bin + 1, and Sin +1) in this section. All four parameters have one thing in common. They are all distance measurements between flux transitions. While all four parameters are distance measurements, it is common to state the measured value in terms of a percent.

Average Flux Transition Spacing Variation - Ba

This term means a measurement of the overall or average bit density for the encode track.

Individual Flux Transition Spacing Variation - Bin.

Flux Transition Spacing Variation is the distance measurement between clocking flux transitions or Zero Bit flux transitions over the bit density for the track.

For example, if the distance between the flux transitions for a Zero bit on Track 1 measured to be 0.004350, the Flux Transition Spacing Variation would be stated as -8.7% meaning that the flux transition that made a zero bit were 8.7% too close together.

Note that a positive value indicates that the flux transitions were farther apart than the ideal bit density value. A negative value indicates that the flux transitions were closer together that the ideal bit density value.

The mathematical formula for this parameter is shown below along with the quantities for this specific example:

$$\left[\frac{\text{Clocking or Zero Bit Distance between Flux Transitions}}{\text{1/Bit Density}} - 1\right] \times 100 = \% \quad \text{flux transition spacing variation (Bin)}$$

For this example:

$$\left[\frac{0.004350''}{0.004762''} - 1\right] \times 100 = -8.7\% \quad \text{flux transition spacing variation (Bin)}$$

Graphically, the definitions for Bin, Bin + 1, Sin, and Sin +1 are shown in Figure A-10.

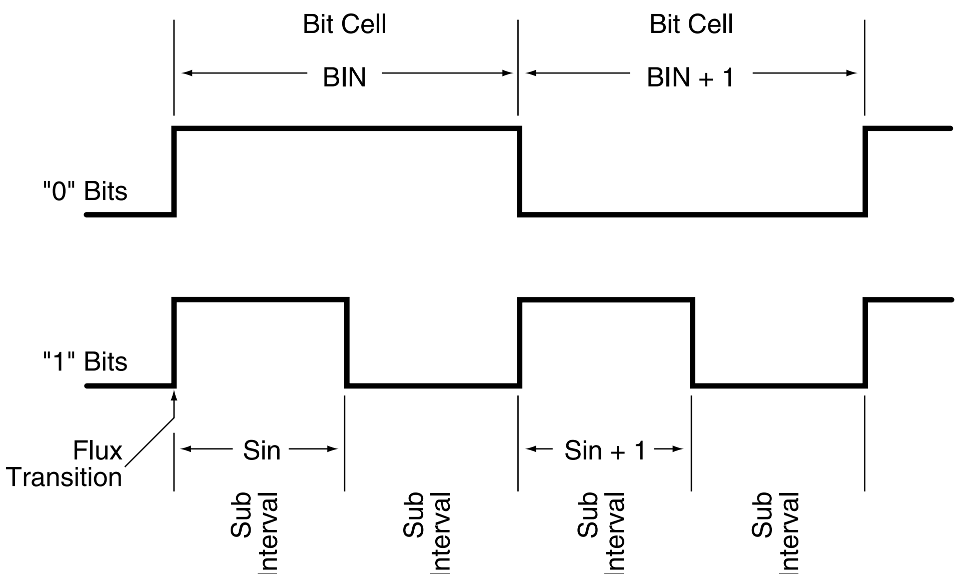


Figure A-10. Bit Cells for 0 and 1 Bits

Subinterval Spacing Variation -Sin

Subinterval Spacing Variation is the distance measurement between a subinterval transition over one half the bit density for the track.

The mathematical formula for Sin is as follows:

$$\left[\frac{\text{Distance between a Flux Transition and Subinterval}}{1/(\text{Bit Density} \times 2)} - 1\right] \times 100 = \%\ \text{Subinterval spacing variation}$$

Adjacent Bit Cell Spacing Variation - Bin + 1

Adjacent Bit Cell Spacing Variation* is the distance measurement between Zero Bit flux Transitions over the previous bit cell for the track.

$$\left[\frac{\text{Clocking or Zero Bit Distance between Flux Transitions}}{\text{Previous Clocking or Zero Bit Distance between Flux Transitions}} - 1\right] \times 100 = \%\ \text{Adjacent Bit Cell variation (Bin + 1)}$$

*Adjacent bit cell spacing variation is also called Bit-to-Bit Jitter or BBJ

Adjacent Subinterval Spacing Variation - Sin + 1

Adjacent Subinterval Spacing Variation is the distance measurement between a subinterval transitions over the previous subinterval.

$$\left[\frac{\text{Distance between a Flux Transition and Subinterval}}{\text{One Half of Previous Bit}} - 1\right] \times 100 = \%\ \text{Adjacent Subinterval variation (Sin + 1)}$$

APPENDIX B. CARD STANDARDS

In 1973, the first American National Standards Institute (ANSI) card standard was issued which established a Reference Standard for the magnetic stripe's signal amplitude along with other card requirements, all directed toward defining minimum parameters for card based information interchange.

The ANSI committee responsible for Financial Transaction Card Interchange, in 1985, agreed to accept the International Standards Organization (ISO) Card Interchange Standards as the U.S. standards and to send an American delegation to ISO meetings to participate in future standardization work.

In 1993, ISO completed a lengthy review of the card standards and released an updated version of ISO 78xx series standards. In 2001 the standards were updated again. The 2001 edition is the current set of specifications referred to in this document. The most notable change was to remove most of the differences between ISO 7811-2, for low coercivity cards, and ISO 7811-6, for high coercivity cards.

ISO SPECIFICATIONS

ISO 7811-2, and -6 parameters for cards that the InSpec 9000-2005 Card Tester measures are as follows:

Note

The ISO Standard uses the terminology of Unused Encoded cards and Returned Cards for New cards and Used cards respectively.

TRACK 1

Parameter	**ISO Term**	**Unused Card Limit**	**Returned Card Limit**
Signal Amplitude*	Ui	126% ≥ Ui ≥ 64%	126% ≥Ui ≥ 52%
Average Bit Density	Ba	± 8%	± 8%
Flux Transition Spacing Variation	Bin	± 10%	± 15%
Subinterval Spacing Variation	Sin	± 12%	± 20%
Adjacent Bit Cell Variation	Bin+1	± 10%	± 15%
Adjacent Subinterval Variation	Sin+1	± 12%	± 30%

Start Sentinel Position   0.293" ± 0.039" (7.44 ± 1.00 mm)

TRACK 2

Parameter	ISO Term	Unused Card Limit	Returned Card Limit
Signal Amplitude*	Ui	126% ≥ Ui ≥ 64%	126% ≥ Ui ≥ 52%
Average Bit Density	Ba	± 5%	± 8%
Flux Transition Spacing Variation	Bin	± 7%	± 15%
Subinterval Spacing Variation	Sin	± 10%	± 20%
Adjacent Bit Cell Variation	Bin+1	± 10%	± 15%
Adjacent Subinterval Variation	Sin+1	± 12%	± 30%

Start Sentinel Position 0.293" ± 0.020" (7.44 ± 0.50 mm)

TRACK 3

Parameter	ISO Term	Unused Card Limit	Returned Card Limit
Signal Amplitude*	Ui	126% ≥ Ui ≥ 64%	126% ≥Ui ≥ 52%
Average Bit Density	Ba	± 8%	± 8%
Flux Transition Spacing Variation	Bin	± 10%	± 15%
Subinterval Spacing Variation	Sin	± 12%	± 20%
Adjacent Bit Cell Variation	Bin+1	± 10%	± 15%
Adjacent Subinterval Variation	Sin+1	± 12%	± 30%

Start Sentinel Position 0.293" ± 0.039" (7.44 ± 1.00 mm)

* as a percent of Reference Signal Amplitude

It should be noted that there are no unused and returned card specifications for Start Sentinel. The ISO specifications for start sentinel are used as unused limits. The returned card limits were calculated to ensure that there would be enough zero bits on each end of the card for most read circuitry to synchronize before the first one bit.

HIGH COERCIVITY MAGNETIC MEDIA

The term "Coercivity" refers to the amount of magnetic field strength necessary to change the direction of the magnetic field lines. In our discussion of magnetic field lines with the iron rod, we did not discuss the amount of force that the magnetic field lines generate. The amount of force is referred to as the Magnetic Field Strength. It is the result of the properties of the metal (in the iron rod) and the amount of electric current that flows through the wire coil that caused the rod to be magnetized.

Other metals can produce stronger magnetic fields than iron or gamma ferric oxide. Barium (or Strontium) Ferrite, for example, is a material from which magnetic tape can be constructed that requires substantially stronger magnetic fields than gamma ferric oxide to create flux transitions. Barium (or Strontium) ferrite is one of the materials used to construct "High Coercivity" magnetic stripes for cards.

Basically, magnetic tape whose coercivity is between 250 to 800 Oersted (typically 250 to 600 for ISO 7811-2 compliance) is considered to be "Low Coercivity". (Oersted is the unit of measure of coercivity). Gamma ferric oxide magnetic media typically measures around 300 Oersted and is the most commonly used low coercivity magnetic stripe material. Barium (or Strontium) ferrite magnetic media can possess coercivities between 2500 to 5000 Oersted (typically 2500 to 4000 for ISO 7811-6 compliance), which is the range considered to be "High Coercivity".

While High Coercivity magnetic tape requires greater magnetic field strength to encode, the resulting signal amplitude of the flux transitions can be equivalent to the signal amplitude on Low Coercivity magnetic tape. This is a key point, as it is at the heart of the ISO High Coercivity standardization efforts. All existing readers that are designed to read ISO Standard cards will be able to read ISO Standard High Coercivity cards. The difference is in the amount of magnetic field strength generated by the encode head necessary to properly encode the chosen magnetic tape coercivity. Since it makes no difference, to ISO compatible readers, what the coercivity of the magnetic tape is, the Encoded Card Tester is likewise ambivalent to the coercivity of the magnetic tape.

CARD STANDARDS LISTING

International Standards Organization (ISO) documents are available for purchase though the American National Standards Institute (ANSI) in New York. Their phone number is: (212) 642-4900.

The following is a listing:

Document	Description
ISO/IEC 7810	Identification Cards - Physical Characteristics Scope: This International Standard specifies the physical characteristics of identification cards including cad materials, construction, characteristics and dimensions for three sizes of cards.
ISO/IEC 7811-1	Identification Cards - Recording technique - Part 1: Embossing Scope: This part of ISO/IEC 7811 specifies the requirements for embossed characters for either machine or human readable characters.
ISO/IEC 7811-2	Identification Cards - Recording technique - Part 2: Magnetic Stripe Scope: This part of ISO/IEC 7811 specifies the requirements for low coercivity magnetic media used on identification cards. The requirements include recording technique, density, signal amplitude and coded character set.
ISO/IEC 7811-3	Identification Cards - Recording technique - Part 3: Location of embossed characters on ID-1 cards Scope: This part of ISO/IEC 7811 specifies the location of embossed characters for ID-1 cards.
ISO/IEC 7811-4	Identification Cards - Recording technique - Part 4: Location of read-only magnetic tracks - Tracks 1 & 2. Scope: This part of ISO/IEC 7811 specifies the location of the magnetic stripe Tracks 1 & 2.
ISO/IEC 7811-5	Identification Cards - Recording technique - Part 5: Location of read-write magnetic tracks - Track 3. Scope: This part of ISO/IEC 7811 specifies the location of the magnetic stripe Track 3.
ISO CD 7811-6	Identification Cards - Recording technique - Part 6: High Coercivity Magnetic Stripe Scope: This part of ISO/IEC 7811 specifies the requirements for high coercivity magnetic media used on identification cards. The requirements include recording technique, density, signal amplitude and coded character set.

ISO/IEC 7813	Identification Cards - Financial transaction cards Scope: This International Standard specifies directly or by reference the requirements for cards used in financial transactions. It contains numbering systems, magnetic stripe track data formats and registration procedures.
ISO/IEC 7816	Identification Cards - Integrated circuit cards with contacts. Scope: These series of International Standards specify IC card requirements of position of contacts, minimum environmental characteristics and protocol.
ISO/IEC 10373	Identification Cards - Test Methods Scope: This International Standard describes test methods for testing the characteristics of identification cards specified in all ISO card standards.
ISO/IEC 10536	Identification Cards - Contactless Integrated circuit cards. Scope: These series of International Standards specify contactless IC card requirements of minimum environmental characteristics and protocol.

APPENDIX C. ERROR MESSAGES

The following is a list of error messages and descriptions:

Added Pulse Detected!
CARD MAY NOT BE READABLE IN THE FIELD!

This message indicates that the card media may have background noise or waveform condition in excess of ISO specifications.

Amplitude Speed Compensation Failure on Track (1,2,3)
Please Reread Card

This message indicates that there was a problem aligning speed and amplitude data. Performing a cleaning cycle may eliminate the problem.

Blank card or card inserted incorrectly!

The tester did not detect any magnetic encoding.

Could Not Setup Unit, Track 1 data is missing or Invalid Setup Card!
or
Could Not Setup Unit, Invalid Setup Card!
or
Could Not Setup Unit, Density Factor out of range!
or
Could Not Setup Unit, SS Sensor out of range!

This group of errors indicates a problem with the setup card. Repeat setup. If problem continues contact technical support to have a new setup card made.

CRC Check has Failed.
CARD MAY NOT BE READABLE IN THE FIELD!

Some encoding formats contain CRCs. This error indicates that the CRC or the data is incorrect. The purpose of CRCs is similar to LRCs.

Data Fault On Track (1,2,3)
Please Read Card Again.

Error detected in size data. Reread card. If problem continues, cycle tester power.

Encoded Card Tester help not available.

The InSpec 9000-2005 software was unable to find the help file in the correct location.

External RAM Failure!
or
FPGA Failure!

These messages indicate a failure in the tester electronics. Switch off the tester power. Wait several seconds before reapplying power to the unit.

File Exists, Choose Different Date!

The user may not create two different archives using the same date. Select another date.

Incomplete Data Transmission!
or
Invalid STX byte!
or
Invalid ETX byte!
or
Invalid LRC byte

These messages indicate that the data transmitted from the tester was corrupted or incomplete. If problem continues, cycle tester power and reread card.

Invalid File Format!

The file is not a valid saved card file. Only .CQT files can be opened by this software. If the file was a CQT, the file may be corrupted.

Invalid 'From' Date!
or
Invalid 'To' Date!
or
Not A Valid Date, Please Choose New Date.
or
Illegal Date, Please Change Date.
or
Invalid Date or Time Expression!

The date/time entry does not convert to a date or time. Reenter the date or time.

Non-Standard Encoding Detected on Track (1,2,3)

The encoding for the specified track was not ISO format.

No Records in Database!

No records were found in the card database. If an archive has been performed recently, all records were archived. Read one or more cards before attempting to graph data again.

No Records meet current criteria

There were no records in the card database that met all of the graph parameters. Change one or more graph parameters to include more records. Graph must be displayed before it can be printed.

No Records Were Found Before This Date!

There were no database records found before the date that was entered. Enter a later date.

Please Clean Tester!
If tester is not cleaned results may not be reliable.

Good contact between the card and the read head is essential for accurate reading. This message indicates that the number of reads since the last cleaning cycle was performed has exceeded the recommended amount. Performing a cleaning cycle will remove this error message.

Please complete the Card Parameters Selection!

A selection must be made in all three card parameters.

Please enter Data for all graph parameters

The graph requires that all graph parameters have valid data. This message indicates that one or more graph parameters have not been selected.

Setup Unit before use!

Each tester must be setup before first use on each PC. See Setup in this manual for information on how to setup the tester.

Start Sentinel Not Found On Track (1,2,3)
Card May Not Be Readable In Field.

Start Sentinel Character was not found at the start of the binary data on the specified track. This has no effect on Start Sentinel location, which is determined by the first one-bit detected.

Start Sentinel On Track (1,2,3) Is Excessively Close To The Leading Edge.
Card May Not Be Readable In Field.

Start Sentinel is close enough to the leading edge of the card as to make the track unreadable in some readers.

The Password You Have Entered Is Not Correct.
Please Renter The Password.

The user has mistyped the password or entered the incorrect password. Technical support can decrypt passwords if necessary.

The password you type does not match the password in the Confirm box!
The passwords in each box must match.

To change the password, the user must enter the same password in NEW and CONFIRM. This ensures that the password does not contain a typing error.

Track (1,23) LRC check has Failed
and/or
Track (1,2,3) Parity check has Failed
CARD MAY NOT BE READABLE IN THE FIELD!

LRC and Parity are used to detect data errors. This message indicates that an error in the data, Parity, or LRC was detected.

Unit attached is not setup!

Each tester must be set up on each PC that it is used on.

Unit Not Responding!

There is no communications between the PC and the tester. Ensure that the communications cable is plugged into the PC and the tester and the correct Com Port has been selected.

Unit Time up, Start Trans!

Communications between the PC and the Tester were interrupted.

Unit Time Out, …

The tester did not respond to the PC software. Check power and communication cables on the tester.

APPENDIX D. GLOSSARY

Adjacent Bit Cell Variation

See "Jitter"

American National Standards Institute (ANSI)

The United States national standards organization. ANSI also serves as member body to the International Standards Organization (ISO).

BBJ

See "Jitter"

Bit-to-Bit Jitter

See "Jitter"

Bpi

Bits per inch - a measure of the number of bits (bit-cells) per inch on the magnetic stripe track. This parameter is not the same as ftpi since, for example, ISO Track 1 possesses 210 bpi encoding density. The number of flux transitions per inch for ONE bit is 420 ftpi.

Bpmm

Bits per millimeter - measure of the number of bits (bit-cells) per millimeter on the magnetic stripe track. This parameter is not the same as ftpmm since, for example, ISO Track 1 possesses 8.27 bpmm encoding density. The number of flux transitions per millimeter for ONE bits is 16.54 ftpmm.

Character code

The information to be recorded or encoded on the magnetic stripe are a series of characters (for Track 1, alphabet characters and numerals are accommodated where as on Track 2 & 3 only numerals are permitted). These characters are reduced to ONES and ZERO bits by the track's character code. For Track 1, a 7-bit code is defined (6 data bits and one parity bit) For Track 2 & 3 a 5-bit code is defined (4 data bits and one parity bit). The specific codes for each character can be found in ISO/IEC 7811-2.

Clock transition

A flux transition marking a bit-cell boundary.

Coercivity

A measure of magnetic field strength necessary to effect a change in the magnetic field direction of the magnetic material.

Density

The number of bits encoded per unit length usually expressed in bits per inch, Bpi or bits per millimeter, Bpmm.

End sentinel

The character which signals the end of the data field on an encoded track.

Flux transition

A reversal of magnetic field direction (polarity) on a magnetic stripe track. The flux transition on the stripe is caused by reversal of current flow in the encoding head during the process of encoding.

Flux transition spacing variation

See "Jitter"

Ftpmm

Flux transitions per millimeter - a measure of the density of recording on a magnetic stripe track.

Ftpi

Flux transitions per inch - a measure of the density of recording on a magnetic stripe track.

High-Co or HiCo

Colloquial term for high coercivity magnetic recording material. Typically, the value of high coercivity media is considered to be between 2500 to 5000 oersted (typically 2500 to 4000 for ISO 7811-6 compliance).

International Standards Organization (ISO)

The international organization made up of national standards bodies and under whose auspices international standards are developed and published.

Jitter

Term used to describe a variation in the perfect placement of flux transitions. There are two general categories of " jitter" where the value of flux transition variation is stated as a percent of the idealized position and where the value of flux transition variation is stated as a percent of the previous flux transition. These two parameters have several names associated with them. The first category is referred to as:

Flux Transition Spacing Variation
Long Term Jitter - LTJ
Bin - (Zeroes bit jitter)
Sin - (Ones bit jitter)

The second category is referred to as:

Adjacent Bit-Cell Variation
Bit to Bit Jitter - BBJ
Bin+1 - (Bit Cell to Bit Cell jitter)
Sin+1 - (Subinterval to Subinterval jitter)

Long Term Jitter
See "Jitter"

Low-Co or LoCo
Colloquial term for low coercivity magnetic recording material. Typically, the value of low coercivity media is considered to be between 250 to 800 oersted (typically 250 to 600 for ISO 7811-2 compliance).

LTJ
See "Jitter"

Magnetic Field
A physical phenomenon in which a force is created either from the flow of electric current in a conductor or from the presence of magnetic poles of a permanent magnet.

Oersted
Unit of measure of coercivity.

Parity Bit
An extra bit included on each character code to provide a means to test for correct read back. The ISO defined tracks include an ODD parity bit for each character. For example: Track 1 character "A" has the following serial 6-bit data code: 100001 This code has an even number on ONE bits. Therefore the parity bit added after the last data bit is a ONE bit in order to have the entire character code possess an ODD number of ONES bits. The entire 7-bit character code for the character "A" (Track 1) is: 1000011.

PTB - Physikalisch-Technische Bundesanstalt
PTB certifies Reference cards for signal amplitude and maintains traceability to the Primary Standard.

Reference Card
This card provides the Signal Amplitude reference for comparison of all cards used in the ISO interchange. The Reference Card is certified at a PTB (Physikalisch-Technische Bundesanstalt) which maintains traceability to the Primary Standard as established by the United States National Institute for Standards and Technology (NIST) - formerly National Bureau of Standards (NBS).

Signal Amplitude

This parameter is the result of a read head passing over an encoded track. When a read head passes over a flux transition, a voltage is induced in the read head. This voltage is referred to as Signal Amplitude. The measure of Signal Amplitude is stated as a percent of the Reference Signal Amplitude as provided by the Reference Card. The peak value of the signal amplitude is the value reported and is either an AVERAGE of all the PEAKS on the track or the MINIMUM or MAXIMUM value of the PEAKS. The minimum and maximum values are also referred to as INDIVIDUAL Signal Amplitude. The position of the PEAKS of signal amplitude defines the position of the flux transitions for jitter measurements.

Spacing loss

A reduction of signal amplitude as a result of the read head not in intimate contact with the magnetic media.

Two-Frequency Recording (F2F)

The encoding method used for ISO tracks. This method defines a ONE bit as a bit with a flux transition between two clock transitions. A ZERO bit is defined as no flux transition between two clock transitions

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