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Magnetic Stripe Systems – A Primer

The magnetic stripe systems addressed in this document are the kind found on plastic identification cards. Magnetic stripe (magstripe) technology is also utilized on card and paper stock, usually for parking control. Such systems are beyond the scope of this document and are not normally sold or supported by AURORA.

Readers and Reader/Encoders

There are two basic types of magstripe devices available on the market today: readers and reader/encoders. The names should be rather self-explanatory. Readers just read magstripes, while reader/encoders both read and write magnetic stripes. The main reason for including a reader in a reader/encoder system is to verify the accuracy of data encoded on a particular magstripe card.

Magnetic Stripe Tracks

Data can be encoded on magstripe cards using a proprietary methodology or by employing an "open" or "standard" encoding pattern. There are common standards by which magstripe cards are encoded. Such standards are created by organizations such as ANSI (American National Standards Institute), IATA (International Air Transportation Association) and the ABA (American Banking Association). Virtually all magstripe cards, with the exception of those used for security or proprietary reasons, utilize these standards. Therefore, assuming a card has been encoded to the typical standard, any brand or model of reader should be capable of reading (decoding) the magnetic stripe.

Standards have been developed for encoding three "tracks" on a magstripe card. A track is basically just a single physical line on the magnetic stripe where data are encoded. The tracks are referred to as Track 1, Track 2 and Track 3. How logical, eh? What are laid-down on the tracks are, essentially, bits—the off or on switches (zeroes and ones) that make up computer binary language. The density to which the bits are recorded are logically referred to as BPS, or bits-per-inch.

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What follows is an explanation of what makes up each track and what it normally encodes. Keep in mind that these are as per the accepted standards and anything is possible when going beyond.

Track 1 is an alphanumeric track, recorded at 210 BPS at 7 bits per character. Its limit is 79 characters. In the case of a credit card, this track normally encodes the cardholder's name, card number and card expiry date. Included in the 79 characters are a number of delimiter and placeholder characters found on the track.

Track 2 is a numeric-only track, recorded at 75 BPI at 5 bits per character. It's limit is 40 characters. Track 2 on credit cards contains the cardholder's card number and expiry date. While these two pieces of data are also found on Track 1, the reasons for placing them on Track 2 are twofold. Firstly, it provides an extra degree of redundancy on the card, should one of the tracks be erased or become unreadable. The second reason is that, rumour has it, a number of US states and other constituencies don't allow for the non-discretionary recording of a person's name during a financial transaction.

Track 3 is seldom used at all, numeric-only in nature, recorded at 210 BPI, 5 bits per character. It is termed the "thrift track." Up to 107 characters can be placed on Track 3.

Readers and encoders can be purchased as single track, dual track and triple track. In the case of dual track, it could be tracks 1 & 2, or 2 & 3.

On-line Magstripe Readers

As the name implies, magstripe readers only read already-encoded magnetic stripes and they are almost used exclusively on-line (attached to a PC, terminal or cash register). They are normally interfaced with a computer device either through an RS-232 serial connection, or via a keyboard wedge. This latter interface is most common in PC applications. In this case, the reader shares the PC's keyboard port and all scanned data are accepted by the PC as if they were keyed in. Serial readers almost always require an external AC/DC power supply. Keyboard wedge readers "borrow" power from the keyboard port.

On-line magstripe reader systems come in two basic styles: integrated decoder and non-integrated decoder. A decoder is fundamentally the electronic circuitry that decodes the "raw" signals generated by the reader. The main advantage of the integrated, one-piece systems are their low cost. Their main disadvantage is that "all of your eggs are in one basket" and, should one of the components (reader or decoder) fail, the entire system will probably need replacing.

Most magstripe readers are of the “swipe” type, where the card is manually drawn through a slot in the reader. Insertion readers, common on ATM machines, automated gas pumps and kiosks, are also available from AURORA. These type of readers are seldom in “finished” form right out of the box. More typically, they are integrated into other equipment, like a kiosk.

High and Low Coercivity

One of the biggest disadvantages with magstripe technology is the volatility of the data encoded on the stripe. Magnetic or electromagnetic interference (found everywhere on earth, especially nearby electricity) can wipe out a low coercivity magstripe card in no time flat.

High coercivity cards and encoders, on the other hand, use special materials and technology to make the magnetic bits “stick” better to the stripe, making them harder to erase. Note that both the type of magstripe card and the magstripe encoder must be of the high coercivity type to make this technology work properly.

Virtually all banking and credit cards, by the way, are low coercivity. This is probably due to the cost factor (hi-co costs more) and the need to only have a card remain readable for a couple of years.

Magstripe Encoders

In some instances (for example, a local heath club), it may be necessary to both read and encode magstripe cards with member’s names, number, etc. A light-duty magstripe encoder would best be used for such a job.

Magstripe encoders almost invariably use an RS-232 serial interface. Unlike readers, which are a one-way transmission device, reader/encoders are involved in a two-way interface with an attached computer. Special circuitry in the encoder interprets incoming characters from an attached device, usually a PC. The first of these characters will typically be “command” or “escape” characters. (People familiar with writing software code for changing fonts on a computer printer will no doubt relate to these terms.) Contained in the command string are both instructions to the reader regarding which track(s) to encode and actual data to write to the stripe. The data are actually written to the stripe as it is swiped across the write head.

Off-the-shelf software is available from AURORA for encoding magstripes. Alternately, a programmer with basic abilities should be able to integrate magnetic stripe encoding into most any computer software program.