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**MAGNETIC CARD BASICS**

**Track 1 (IATA)**  
This track was developed by the International Air Transport Association for automation of airline ticketing and reservations systems. It is typically used in credit card applications as well.

**Track 2 (ABA)**  
Developed by the American Bankers Association for automation of financial transactions, this track is often used for security access and applications that require an ID code only.

**Track 3 (THRIFT)**  
The Thrift Industry (Savings and Loans, Credit Unions, etc.) developed this track for applications which require rewriting information during each transaction. Typical applications include cash dispensers, prepaid cards, and debit cards.

**JIS II**  
Japanese Industrial Standard. This track is nearly identical to ISO Track 2, only on the reverse side of the card.

**HiCo**  
All Omron magnetic card readers can read HiCo cards. Only designated models can write HiCo cards.

**Applicable Standards for Magnetic Cards**

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**IC CARD BASICS**

**Omron IC Card Contact Nomenclature**

When “J,” “B,” “U,” or “X” is used in a part number for an IC card-capable reader/writer, it has the following meaning:

**J**  
This is the ISO 7816 contact location used most frequently in the world today. Includes 8 surface pins.

**B**  
Location defined by Bull Corporation. Contacts are rotated 180° from “J” style. It is used predominantly in France and is also known as CP8. Includes 8 surface pins.

**U**  
Original contact location defined in the US, with IC on the same side as the magnetic-stripe. It is rarely used today. Includes 8 surface pins.

**X**  
An OMRON contact that includes 16 surface contacts mating with cards conforming to either the “J” or “B” locations. The corresponding “J” and “B” pins are electrically tied together in the contact, resulting in eight output pins. Used for applications in which both “J” and “B” card types are in circulation.

**Applicable Standards for IC Cards**

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Answer-to-Reset
The data string a Processor Card sends to the reader immediately after being powered up and reset, which identifies the chip type and details the type of protocol used.

Authentication
Any of a variety of techniques to confirm the identity of a card or computer system. Techniques include PIN numbers and data encryption (for processing cards).

Biometrics
The technique of studying and digitizing physical characteristics of a person such as finger prints, hand geometry, eye structure, or voice patterns to uniquely identify them.

Bit Density
The number of bits encoded per unit length on the magnetic stripe, expressed in bits-per-inch (BPI).

BPI
Bits per inch. See Bit Density.

CMOS
Complementary Metal Oxide Semiconductor Logic: logic zero = <1.5 VDC, logic one = >3.5 VDC, and very low current.

Coercivity
The ability of various ferrous oxide materials to retain their energy value, measured in oersteds (Oe). “Low coercivity,” or “LoCo,” typically means 300-650 Oe. “High coercivity,” or “HiCo,” is typically 2750-4000 Oe. Cards using a HiCo magnetic stripe are more resistant to accidental erasure or degaussing, but are not any more “secure” than cards using LoCo stripes. All Omron magnetic stripe card readers can read both LoCo and HiCo cards. However, only designated models can write HiCo cards.

Compensation
The ability of a reader decode circuit to automatically correct for jitter.

Contactless Cards
IC cards that contain no surface contacts. These cards use either Radio Frequency Identification (RFID) technology, which uses an antennae and power source inside the card, or an inductive technology where metallic plates inside the card are used to receive power and transmit data. Read ranges vary by technology, from a few inches to a few feet. Currently, contactless cards are often used in access control, personal ID, vehicle ID, manufacturing, and animal ID.

Credit Card
A magnetic stripe or IC card used with a PIN number to authorize electronic credit of funds from an account.

Cryptography
The science of communicating in secret. Secret Key Cryptography is one common technique in which, for instance, John encodes a message using a secret key “K” (similar to a password), sends it to Jane (via internet, etc.), and Jane uses the same secret key “K” to decode it. John and Jane must devise a method of sharing this secret key prior to sending messages. Data Encryption Standard (DES) is the best-known example of secret-key cryptography, and is easily computed. Public Key Cryptography differs somewhat in that it uses a matched pair of unique keys, one public “Kp” and one secret “Ks.” Here, Jane publishes her public key “Kp” (on her business card, for example) and John uses “Kp” to encode a message and sends it to her. To decode John’s message, Jane applies the other half of the key pair “Ks,” which only she knows. Once a message is encrypted, not even John can decode it without knowing “Ks.” RSA cryptography is perhaps the best known example of public-key cryptography, but is computationally slow.

Debit Card
(a) A card with value encoded on the magnetic stripe or IC, which is rewritten with a lower value at each use; (b) A magnetic stripe or IC card used with a PIN number to authorize electronic debit funds from an account.

Embosed
Raised letters and numbers on a plastic card, such as the name and account number of the card holder, created by mechanical pressure from the back side.

EMV
Europay®/Mastercard®/VISA®.* These three companies are cooperatively developing specifications to facilitate the use of smart cards for payments worldwide. EMV is built on ISO 7816 for smart cards with electrical contacts.

Encoder
An electromechanical device which can measure distance traveled along a magnetic stripe and produce flux reversals (indicating data) at specified locations along the stripe.

Forward Read
Reading the magnetic stripe starting at the end containing the Start Sentinel. See Reverse Read.

Fricton IC Contact
IC contacts on the card reader are stationary and drag across the card. This method has a somewhat lower cost, but may result in scratching of the IC contacts on the card itself. See Landing IC Contact.

HiCo
See Coercivity.

IC Card
Any of a series of card-shaped devices that contain one or more IC chips. IC cards include both memory-only cards and processor-based “smart” cards.

ISO
International Standards Organization.

Jitter
The variation in flux reversal spacing on a magnetic stripe. It can result from incorrect encoding of the flux reversals on the stripe, speed changes during the read operation, and read circuit changes with amplitude or frequency.

*Trademarks are the property of Europay, Mastercard, and Visa.
Landing IC Contact
IC contacts on the card reader are raised until the card is fully inserted, then “lands” on the card. This prevents scratching the IC contacts on the card itself.

Lifting IC Contact
IC contacts on the card reader are stationary and the card is lifted into position at the end of the insertion. Usually involves a small “ramp” inside the card reader.

LoCo
See Coercivity.

Memory IC Card
An IC card that is used primarily in decremented value systems such as prepaid phone cards, parking meters, and newsstands. They use a write-once memory so that when a bit representing value is burned, it cannot be reused.

Multi-Application Card
A card which can function for more than a single purpose. The EMV specification is the most recent attempt to define multi-application protocols for IC cards.

Oe(Oersted)
See Coercivity.

Paper Card
Standard dimensions for paper cards are 85.6 mm x 58.83 mm x 0.2 mm (up to 0.3 mm thick).

Personalization
The modification of a card to reflect information about a single person, such as name, account number, or picture, and the corresponding electrical information stored on the card.

PET Card
Polyethylene terephthalate. A thin plastic card covered entirely with a HiCo magnetic coating. Standard dimensions for PET cards are 85.8 mm x 53.9 mm x 0.2 mm.

PIN
Personal Identification Number. A three- to six-digit number encrypted in the magnetic stripe encoding of a financial card, which the card holder must enter on a keyboard before the card reader system will process the transaction.

Self-Clocking Data
The encoding format that allows magnetic stripes to be read at different speeds without a special track to clock data.

Smart Card
See Processor Card.

Track
A strip of specified width and location running the length of the magnetic stripe on which data is encoded. ANSI/ISO standards define three track locations for the magnetic stripe on credit/financial cards, called Tracks 1, 2, and 3. The tracks are 0.110” wide, with Track 1 closest to the card edge.

Transmission Protocols
There are currently two primary transmission protocols for IC cards: T=0 and T=1. T=0 defines a character by character protocol and is used when small amounts of data are exchanged. T=1 is a newer block protocol and has higher transmission error resilience than T=0 and is used when larger amounts of data must be exchanged.

TTL
Transistor-Transistor-Logic. Logic zero = <0.8 VDC, logic one = >2.4 VDC, and will source 1.6 mA.

Wiegand
Essentially a “magnetic barcode,” these cards utilize embedded magnetic wires to generate a binary machine-readable code and are read by contact. It is an older, low-cost and secure technology with limited data capacity used primarily in security and access control. Omron does not supply Wiegand-compatible card readers.

Pre-Paid Card
A magnetic or IC card in which monetary value is stored and then decreased as services or products are purchased. Typical applications are cash cards, phone cards, highway toll cards, photocopier cards, vending cards, laundry cards, and any other application where small cash value is involved. Also referred to as an Electronic Purse. Typically PVC, PET, or IC cards are used.

Processor IC Card
An IC card that contains an embedded microprocessor, operating system, and several types of memory (ROM for storage of operating instructions, RAM for storage of temporary data during processing, and EEPROM for nonvolatile storage of data). Processor cards are extremely difficult to counterfeit and are highly secure compared to magnetic stripe technology due to the elaborate password authentication and encryption schemes that can be employed to control who can access the data.

PVC Card
Polyvinyl chloride, the plastic most commonly used for credit/debit cards. Standard ID-1 dimensions are 54 mm x 85.6 mm x 0.76 mm.

Reverse Read
Reading the magnetic stripe starting at the end containing the End Sentinel. See Forward Read.

RS-232C
An EIA Recommended Standard Interface defining data and control circuits, for use between data terminal equipment (e.g., computers) and data communication equipment (e.g., modems) using serial binary data interchange; a subset of the standard is widely used for communication between any two types of data processing equipment.