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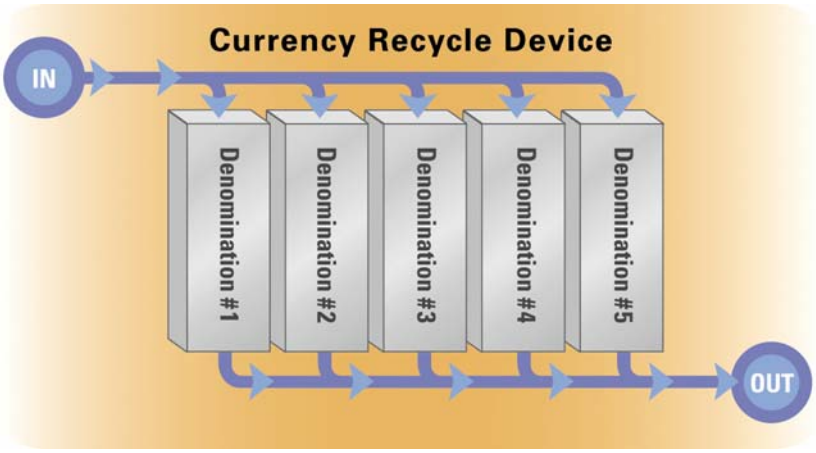
Trends and Considerations in Currency Recycle Devices

This white paper provides basic background on currency recycle devices as compared to the combined features of a currency acceptor device and a currency dispenser device.

What is a Currency Recycle Device?

A currency recycle mechanism is a device that accepts and stores currency for dispensing at a later time. Theoretically, the same physical piece of currency deposited into the recycle device by one customer could then be dispensed and received by a subsequent customer.

Here's a simple diagram of a currency recycle device:



Theoretically, if the number of deposits (IN) for each denomination is equal to the number of dispenses (OUT), there is never a need to replenish the device, as it will always maintain the same amount of available currency. Non-interrupted service can only be assured if the device never faulted or needed service. Unfortunately, very few applications have a situation where deposits are equal to dispense operations.

The same basic principle applies to devices that recycle multiple denominations. For example, a device may recycle $1, $5, $10, and $20 notes. For the device to operate indefinitely, each denomination ($1, $5, $10, & $20) must have an equal number of deposits compared to dispenses. A mismatch in the number of deposits versus dispenses for any given denomination will create a need to purge or replenish that particular denomination. The frequency for purging or replenishing currency is based on the device's storage capacity for the specific denomination.

What are the selection criteria for a Currency Recycle Device?

Priority and importance of the selection criteria will vary depending on the particular target application and project, but here are some of the basics:

Currency and denomination requirements: Definition of country-specific currency and denomination(s) are primary to defining the requirement for currency acceptance and dispense. It is common for requirements to include multiple denominations in a single country-specific currency. Definition of all currency types and denominations will determine the requirements for the currency acceptance portion of the recycle device. It is also common for a denomination to have multiple print years that must also be defined as required, i.e., the recycle device will only accept media that is defined and supported by the particular currency recognition technology.

Recycle all denominations: This feature support will allow all denomination types deposited to be recycled and dispensed. However, this feature is not currently supported by all currency recycle devices. For example, it is common for a recycle device to accept five different denominations and recycle only three denominations. Typically, the denominations not being recycled will go into a common storage area for non-recycled currency and cannot be dispensed.

Capacity requirements: Must be defined for each denomination type to be supported by the recycle device. The recycle device must be able to store a sufficient number of bills for each denomination to minimize the frequency of replenishing currency. For example, if the storage capacity is small, then too much currency in storage will create a need to remove some of the currency, and too little currency creates a need to replenish more frequently.

The capacity requirement for each denomination type can be calculated by determining how much currency will be deposited to the recycle device, and how much currency will be dispensed from the recycle device. This must be done for each denomination type, and one of the primary objectives / requirements for a recycle device is to provide extended operations without the need to purge or replenish currency. The basic calculation to determine how long the recycle device will operate without need for currency purge or replenishment is:

For denomination X,

Seed Qty + (Deposit Qty – Dispense Qty) = Not Empty or Not Full

- **Seed Qty** is the initial quantity of currency / starting quantity inventory
  - Some starting quantity will be required for each denomination
- **Deposit** is the projected quantity of currency deposited (added to **Seed Amount**)
- **Dispense** is the projected quantity of currency dispensed (removed from **Seed Amount**)
- **Not Empty** indicates there is some quantity of currency remaining to **Dispense**
- **Not Full** indicates there is storage space available to **Deposit** more currency

Note: The formula must be applied to each denomination recycled by the device. The first denomination to become full or empty will require the device to be replenished.

The ideal application is the case where the number of deposits equals the number of dispenses for each denomination supported. The starting amount (Seed Amount) of currency is then used to resolve any quantity differences in deposit versus dispense. The differences are limited to “storage full” or “storage empty” conditions.

Counterfeit detection: Various methods are used to determine currency validity. Counterfeit detection ability resides within the recycle device (typically firmware) and must be periodically updated to stay current with changes in new currency designs or series. Additionally, advances in the quality of counterfeit currency can be thwarted by changes in

the currency recycle device's ability to detect them. Depending on the product application using a currency recycle device, it can be highly desirable to be able to remotely update firmware. The more costly alternative is to visit each physical location and device and apply the new version of counterfeit detection firmware.

Whether counterfeit detection is required is very subjective. Perhaps the best way to determine the answer is to ask the question relative to your application. For example, is it acceptable if the currency recycle device accepts and then dispenses counterfeit currency? Perhaps the currency is pre-screened and counterfeit detection is not a concern.

Speed of currency acceptance: Speed is usually determined by the recycle device's processing power, counterfeit detection support, available memory, and number of different type currencies accepted. It is common to have restrictions on the number of different currency denominations (and versions). As a general rule, the currency acceptance features of a recycle currency device are very similar to those commonly found in gaming and vending applications.

Bunch versus single currency (item) acceptor: When available, this feature enables the recycle currency device to accept a deposit containing more than one currency note at a time. Most currency acceptor devices accept only one note at a time, e.g., the commonly accepted process of inserting a single dollar bill in a vending machine. Bulk currency acceptance can save considerable time with applications that involve multiple deposits for a single transaction / operation.

Cost Analysis (Initial Costs & Recurring Costs)

Initial cost considerations: Initial costs are primarily viewed as the purchase price of the device. Currently, currency recycle devices are three to five times more expensive than the combined cost of a currency acceptor device and a currency dispenser device. However, it is reasonable to assume that the high cost of currency recycle devices will be reduced as technology advances and competition grows.

Recurring cost considerations: These costs will vary greatly depending on the market and specific application. However, some of the common recurring costs to consider are:

- **Currency purging / replenishment cost**: There is a significant cost associated with purging and or replenishment of currency in the device. An application that has a balance of deposits and dispenses will have a much reduced currency servicing frequency. However, if the application has a significant difference between deposits and dispenses for any denomination supported, the cost savings in using a currency recycle device will be lost.

- **Maintenance costs**: Ongoing maintenance costs include all the activities required to keep the device running properly. They are generally categorized as "first line" that can be completed by non-technical employees and "second line," which require a trained technician. As a general rule, first line maintenance costs are much less expensive than second line. Moreover, the more complex the device, the lower is the likelihood that maintenance can be performed by first line personnel.

- **Anticipated or Annual Failure Rate (AFR)**: Projections of how often a device will fail are commonly based on engineering design projections or actual field failure data. Most service / maintenance organizations consider the anticipated failure rate of each component in the target product to determine the costs for an annual maintenance contract, i.e., the more often something is expected to

break, the more expensive the maintenance service costs. The currency recycle device is a more complex mechanism and most often has a higher anticipated failure rate when compared to the combined equivalent of a separate currency acceptor device and currency dispenser device.

Arguments in Favor of Currency Recycle Devices

Physical size: The physical size of a recycle device is typically smaller than the combined size of a currency acceptor device and a currency dispenser device. This assumes similar capacities of the recycle devices versus separate / discrete devices.

Labor savings: Costs associated with currency purging and currency replenishment are greatly reduced, but these savings are upheld only when the number of deposits for each denomination supported is equal or nearly equal the number of dispenses.

Machine Up-Time: Assuming the number of deposits for each denomination supported is equal or nearly equal to the number of dispenses, the device could operate for an indefinite period. Again, however, this assumes other factors such as zero machine failures or need for periodic scheduled servicing of the recycle device.

Reduced amount of currency: The amount of currency dedicated to most applications can be reduced. A recycle device will have initial “seed inventory” plus the quantity of currency that has been deposited (recycled). The seed inventory of a non-recycle dispenser is determined by the anticipated dispense demand only.

Simplified currency handling: There are fewer container bins / cassettes to handle when using a recycle device. The same storage bins are typically used for deposit and dispense operation.

Single device: Currency recycle reduces the number of devices being supported in an application, thereby reducing the number of communication ports required to control the device(s).

Arguments Against Currency Recycle Devices

Higher costs: The initial purchase price for a currency recycle device is approximately three to five times more expensive. In addition, the cost associated with recurring / maintenance cost is higher over the life of the product.

Slower speed: Currency deposit speed is typically slower on single-note currency acceptor devices that must transport the currency to a storage area in preparation for later dispensing.

Reduced machine reliability: The action associated with transportation and storage of currency increases opportunity for transport jam.

Technically more difficult: The currency recycle device is inherently more complex and reduces the amount of servicing that can be accomplished by first line personnel. There is often special training that is required for second line service personnel.

Typical False Perceptions

Cost Savings: Initial discussions in favor of a currency recycle device can be very exciting. However, only careful examination of the target application will prove or void the benefits. A review of the items included in the cost analysis section of this document should be included when considering a currency recycle device.

Balancing / Reconciliation: The process of balancing and reconciliation is required regardless of the technology being used, (i.e., recycle versus separate currency acceptor and currency dispenser devices). There is often a perception that a currency recycle device will provide some advantage when it comes to end-of-day balancing / settlement. Regardless of whether you use recycling technology or a combined solution using currency acceptor and dispenser, the solution should always be able to determine the amount of currency dispensed to the customer and how much has been accepted.

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