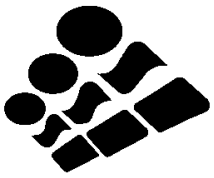

Money Controls

Specification and Adjustment Manual
ARDAC-5 Banknote Acceptor and Cassette System

ARDAC II Protocol / ID003 Protocol / Diagnostic Interface

Money Controls Manual Part Number 44X500

Revision 4 August 18, 2004

Specification and Adjustment Manual – ARDAC5
Document Number 44X500 Revision 4 – August 18, 2004

ARDAC-5 Banknote Acceptor and Cassette System
ARDAC II Protocol / ID003 Protocol / Diagnostic Interface

Manual Part Number 44x500

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Revision 3- June 2004 – Update to spare parts list.
Revision 4- August 2004 – Naming convention changed from WACS5 to ARDAC-5. Update to spare parts list.

Protocol Disclaimer

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Money Controls, Inc.
34099 Melinz Parkway
Eastlake, Ohio USA 44095
Phone: (440) 946-3000 Fax: (440) 946-9829

Money Controls, Inc.
6672 Spencer Street - Suite 400
Las Vegas, Nevada USA 89119
Phone: (702) 739-8263 Fax: (702) 739-1911

Money Controls Ltd
Royton, Oldham OL2 6JZ, England.
Phone: 44 (0) 161 678 0111
Fax: 44 (0) 161 626 7674

Money Controls Pty Ltd
Unit 1 / 2 Morton Street
Parramatta NSW 2150, Australia
Phone: 61(0)2 9683 5033 Fax: 61(0)2 9683 5055

CONVENTIONS USED IN THIS MANUAL

In this manual, certain information will be set off from the main text for special consideration:

NOTE

A **NOTE** identifies additional information or instructions, which may help, clarify an operation or procedure.

CAUTION

A **CAUTION** identifies additional information or instructions, which should be followed to avoid damage to the equipment.

WARNING

A **WARNING** identifies safety-related information or instructions, which should be followed to avoid personal injury.

Table of Contents

1
Description and Specifications

System Description – (ARDAC-5 Banknote Acceptor and Cassette System)

The Money Controls ARDAC-5 identifies, collects, and stacks banknote currency or the equivalent barcode ticket coupon into a secure, lockable, removable cassette stacker. The ARDAC-5 is a modular system consisting of a note acceptor, cassette stacker, and mounting chassis. These three modules and other system components are identified and illustrated in Figure 1-1.

The ARDAC-5 offers world capability and can be used for any country or currency set within the dimensional limits detailed in the Specifications in this chapter. Changing acceptance from one country or currency set to another is easily accomplished by updating the acceptor's EPROM / FLASH. The acceptor resident firmware determines system operating features and the bank notes accepted. Refer to Table 1-1 for firmware and bank note acceptance information.

Section 3, System Operation describes the functions and operations of the major System components.

This system can be ordered with a "Smart Cassette" option, which allows the cash box to record data about the quantity and denomination of notes accepted. This smart option also has an electronic serial number stored in the chassis that can be used to track where a cash box has been installed.

The smart system records the following information in the cassette:

1. Chassis Serial Number
2. Number of each denomination accepted
3. Reject Count for notes not recognized
4. Note Handling Reject Count
5. Tamper Count
6. Acceptor Jam Count
7. Time since memory last cleared

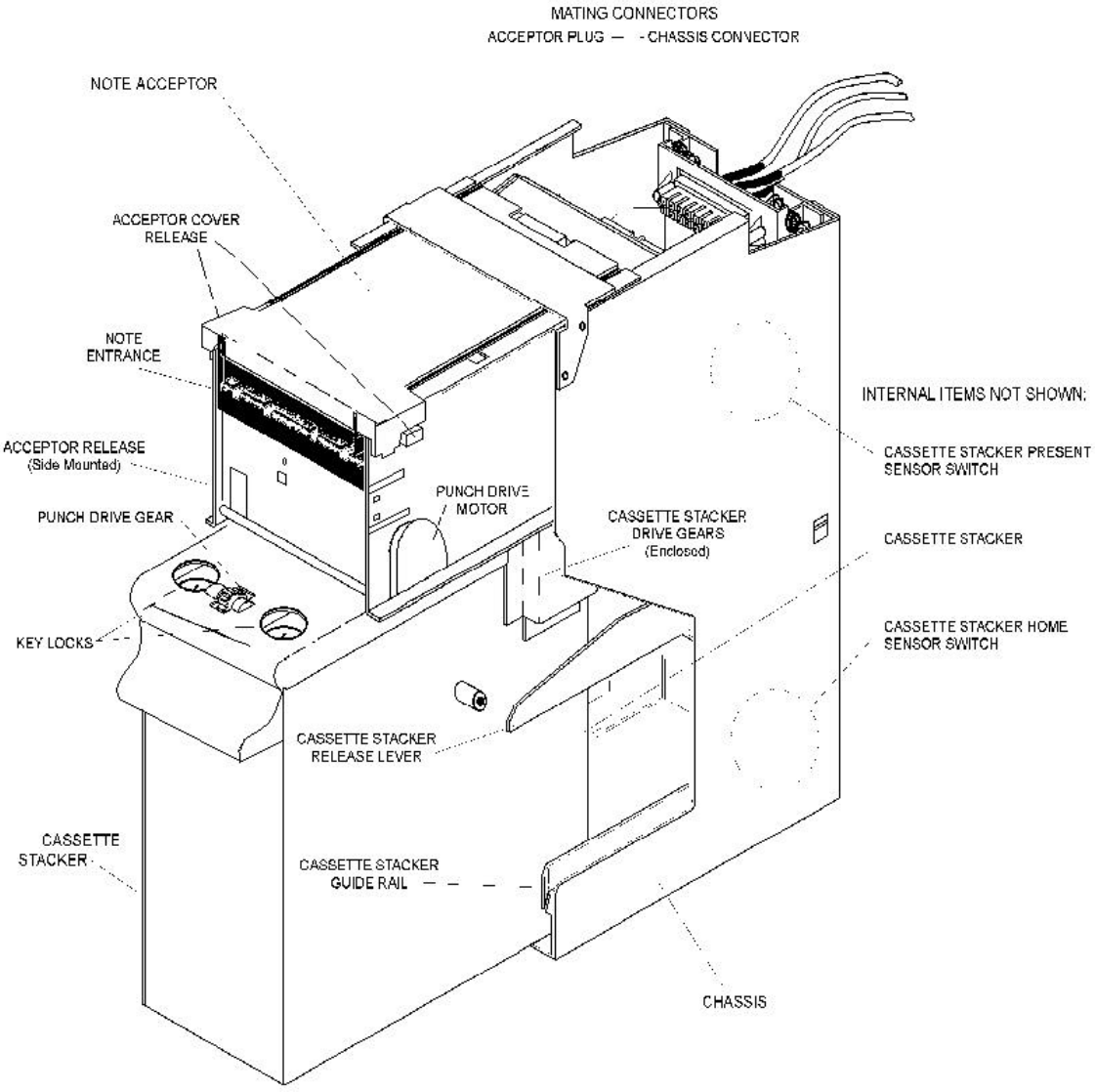


Figure 1-1
ARDAC-5 System Components

Terminology

For convenience and clarity several terms are used interchangeably throughout this manual. These and other system terms and components are illustrated in Figure 1-1.

- The terms Money Controls, ARDAC-5, and System describe the complete system, which includes all three modules (note acceptor, cassette stacker, and chassis).

- The terms Ardac-2 and Ardac II describe the primary communications protocol used in the Ardac-5 system.

- The chassis is the rectangular frame mounted permanently in the host equipment. The chassis secures the acceptor and stacker in precise alignment in the host. Smart cassette models contain a read only memory to store and communicate its specific chassis ID number. The stacker home sensor and system wiring harness are chassis components.

- The terms imbedded note acceptor, note acceptor and acceptor describe only the portion of the System, which actively transports and identifies the notes / barcode ticket coupon.

- The terms cassette, cassette stacker, cassette, and stacker refer to the removable, lockable box located in the bottom section of the system chassis. It contains the memory device to store acceptor data.

- The terms note, bank note, coupon and bill refer to paper currency or equivalent, which is inserted into the note acceptor and stored in the stacker.

- The terms Smart Cassette System, Smart System and Smart Cash box refer to an option that can be installed on new systems ordered that allow tracking of system data in a memory button located on the cash box.

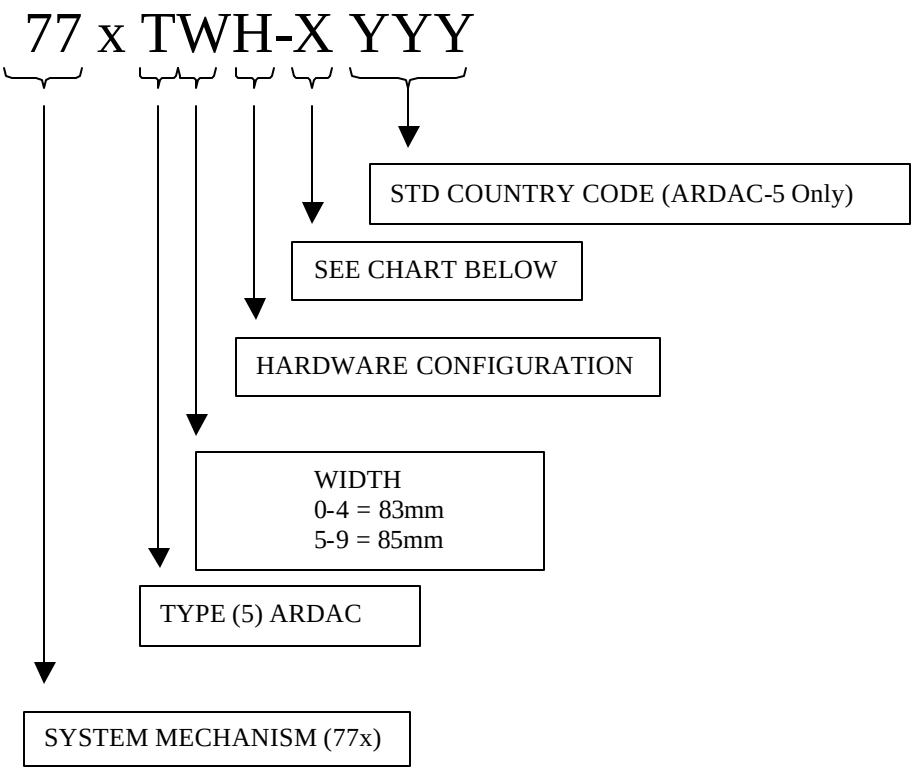
- The terms Escutcheon, Note guide and Mask refer to a plastic guide that mounts to the front of the bill acceptor and guides the note straight into the sensor path. Note guides are country specific.
  NOTE: The torque specification for the note guide inserts are **0.4 Nm**

Main Subassembly Part Numbers

The part numbers for the ARDAC-5 main modules are listed below. Figure 1-1 illustrates these modules and various other subassemblies of the System. Refer to Section 7, Diagrams and Parts Listings for more details parts information.

Hardware Config Number*	83mm or 85mm	Smart (S) or Non-Smart (NS)	Barcode (B) or Non-Barcode (NB)
77x500	*83*	*NS*	*B*
77x501	*83*	*S*	*B*
77x502	*83*	*NS*	*NB*
77x503	*83*	*S*	*NB*

*Note: All with International Sensor Sets, Plastic Cassettes, and all 12-24 Volt



Where X Equals:	PROTOCOL	PRGM IC	NOTE ESC.
0	Ardac II	Flash	Standard
A	ID003	Flash	None
B	ID003	Flash	Standard
C	ID003	Flash	Universal
D	ID003	Eprom	None

Chassis Mounting Recommendations

The chassis must be supported from underneath and be bolted to the host housing. The Dimension Drawing (Figure 1-3) shows the location of the chassis mounting hardware (notes 1 through 4).

As a minimum, secure the chassis to the host housing by doing the following:

a. Bolt one side and the bottom of the chassis to the housing.

b. Bolt one side and the back of the chassis to the housing. (Although the chassis must be supported from underneath, it is not necessary to bolt the bottom if the back is bolted to the host housing.)

c. Bolt both sides of the chassis to the housing. (Bottom support is not required.)

Features

The Money Controls ARDAC-5 has a number of features that minimize the need for maintenance, and simplify installation and operation:

- MODULAR DESIGN: The acceptor and cassette stacker are easily removed from the chassis. The acceptor provides all mechanical drive for itself and the cassette stacker. This simplified design makes the cassette stacker useful as an exchangeable, lockable cash box.

- FIRMWARE-CONTROLLED OPERATING SYSTEM: A microprocessor located in the acceptor controls: note identification, note handling, stacking, and communication with the host. Output signals indicate note denomination and acceptor status. Two drive motors in the acceptor drive the acceptor and the cassette stacker components.

- BENCH TEST DIAGNOSTICS: The ARDAC-5 firmware includes a Computer Analysis Program System (CAPS). When a CAPS Interface board connects the ARDAC-5 to a Personal Computer, the computer can access the CAPS software. The computer then monitors and operates some System components for diagnostic and bench test functions.

- LOCKABLE CASSETTE STACKER: The cassette stacker contains locations for two independent key locks for maximum security.

- STABLE, RELIABLE OPERATION: Note recognition devices are self-compensating and require no adjustments or maintenance. Systems are ready for immediate installation.

- 12-24VDC OPERATION: The ARDAC-5 System operates from a single, regulated DC source, which must be supplied by the host system.

- EASY ACCESS TO THE NOTE PATH FOR MAINTENANCE: The acceptor opens to fully expose the sensors and note transport mechanism. This facilitates inspection, cleaning, and servicing.

- SOLID CONSTRUCTION: Structural components of the acceptor and cassette stacker are made of ruggedized plastic. The chassis is made of welded steel construction for durability, strength, and security.

- STRING DETECTOR: This security system provides maximum protection against all types of stringing and numerous other intrusive cheating devices.

- Optional Smart Cassette data tracking system allows user to download data detailing the amount of money and the quantity of notes directly from the cash box without the need to unlock and open it.

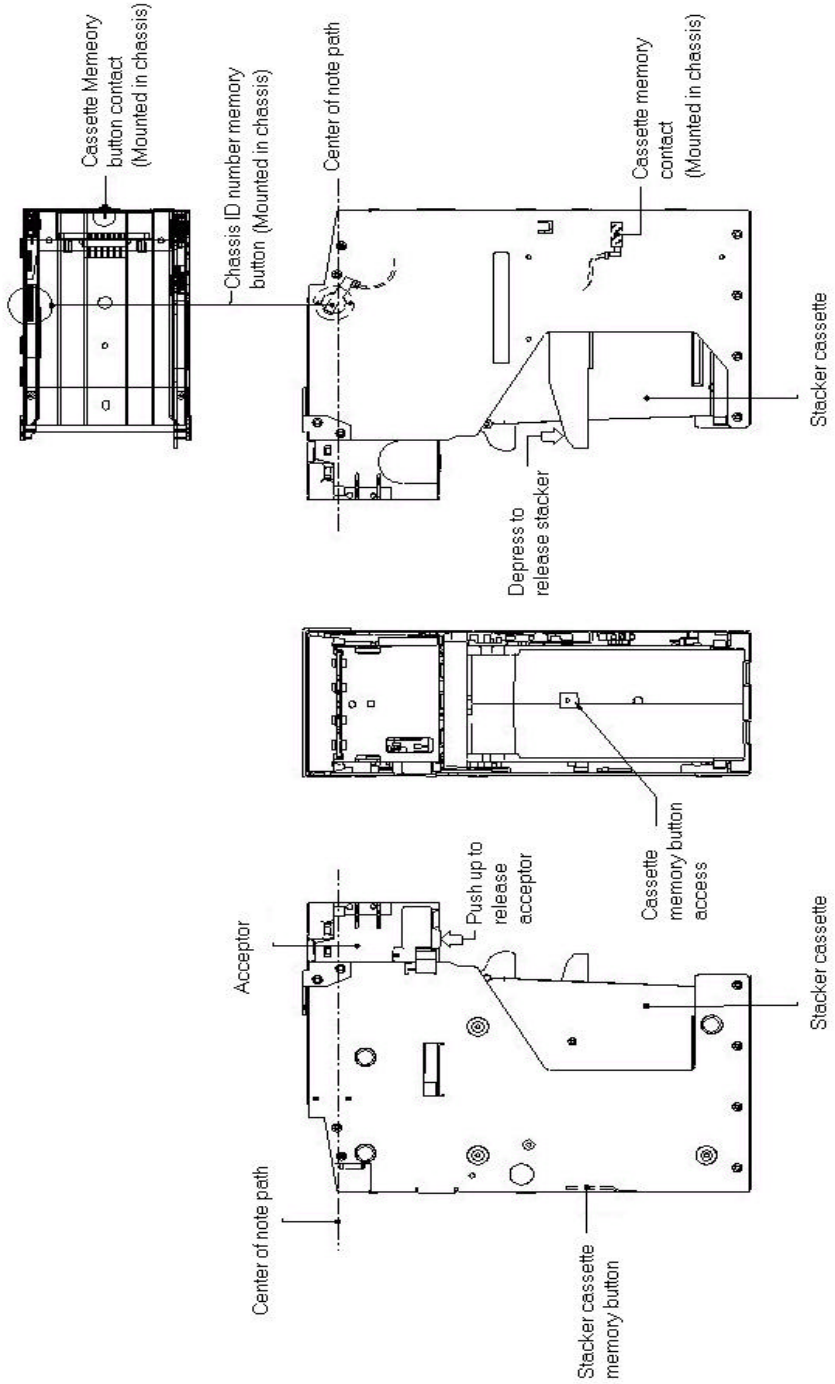


Figure 1-2
Phantom view: Top, Front And Sides

Specifications

NOTE SIZE RANGE:		62mm x 120mm to 85mm x 172mm
NOTE GUIDE MOUNTING INSERT TORQUE SPECIFICATIONS:		0.4 Nm
ACCEPTANCE RATE:		95% or better on first insertion with street-grade notes.
STACKER CAPACITY:		550 notes, minimum, in street-grade condition.
STACKER LOCKS:		Dual locks, 0.625" to 1.125" barrel length
CYCLE TIME, MAXIMUM:		1.5 seconds to note identification; 3.5 seconds total cycle time
POWER SUPPLY:		External to ARDAC-5
	Mounting Requirements:	Separate from System chassis
	Supply Voltage (Max):	12 Volts to 24 Volts DC
	Max Current	(Refer to Chart 1-1)
POWER SUPPLY CONNECTOR:		2-pin Molex Connector 35x552-2 with crimp terminals 35x435. Mating connector: 35x436-2 with 35x434 crimp terminals
POWER CONSUMPTION:		6 VA Idle, 48 VA maximum (With 12V input)
STATUS MONITOR:		Status is monitored through primary communications serial protocol
DIAGNOSTIC CONNECTION:		The 5-pin connector connects to a 2x7136-interface cable to allow P.C. based diagnostics.
DIAGNOSTICS COMMUNICATION		RS-232 ASCII, 19200,Odd Parity,8 Data Bits,1 Stop Bit. (For Use with Windows Hyper terminal™ or equivalent)
HOST COMMUNICATION:		ARDAC-2 Serial Protocol (RS-232) or ID003
HOST INTERFACE CONNECTOR:		DB-25 Female (Can plug directly to P.C. serial port)
SYSTEM DIMENSIONS:		(Standard 83mm system)
	Acceptor:	3.520"H x 4.210"W x 9.000"L
	Stacker:	8.042"H x 3.476"W x 7.940"L
	Overall:	12.442"H x 4.558"W x 7.100"L
	Mounting Arrangements:	Refer to Figure 1-3.
OPERATING ENVIRONMENT:		0° To 50° C, 15% To 90% Relative Humidity non-condinsending
FIRMWARE:	Version:	Refer To Table 1-1.
	Currency:	Refer To Table 1-1.
	Direction:	Refer To Table 1-1.
Optional smart system:		Will record data for up to 4 separate chassis in separate records in cash box memory button. Cash box data can be read and cleared either by using an optional docking station or through a bench type computer connection.

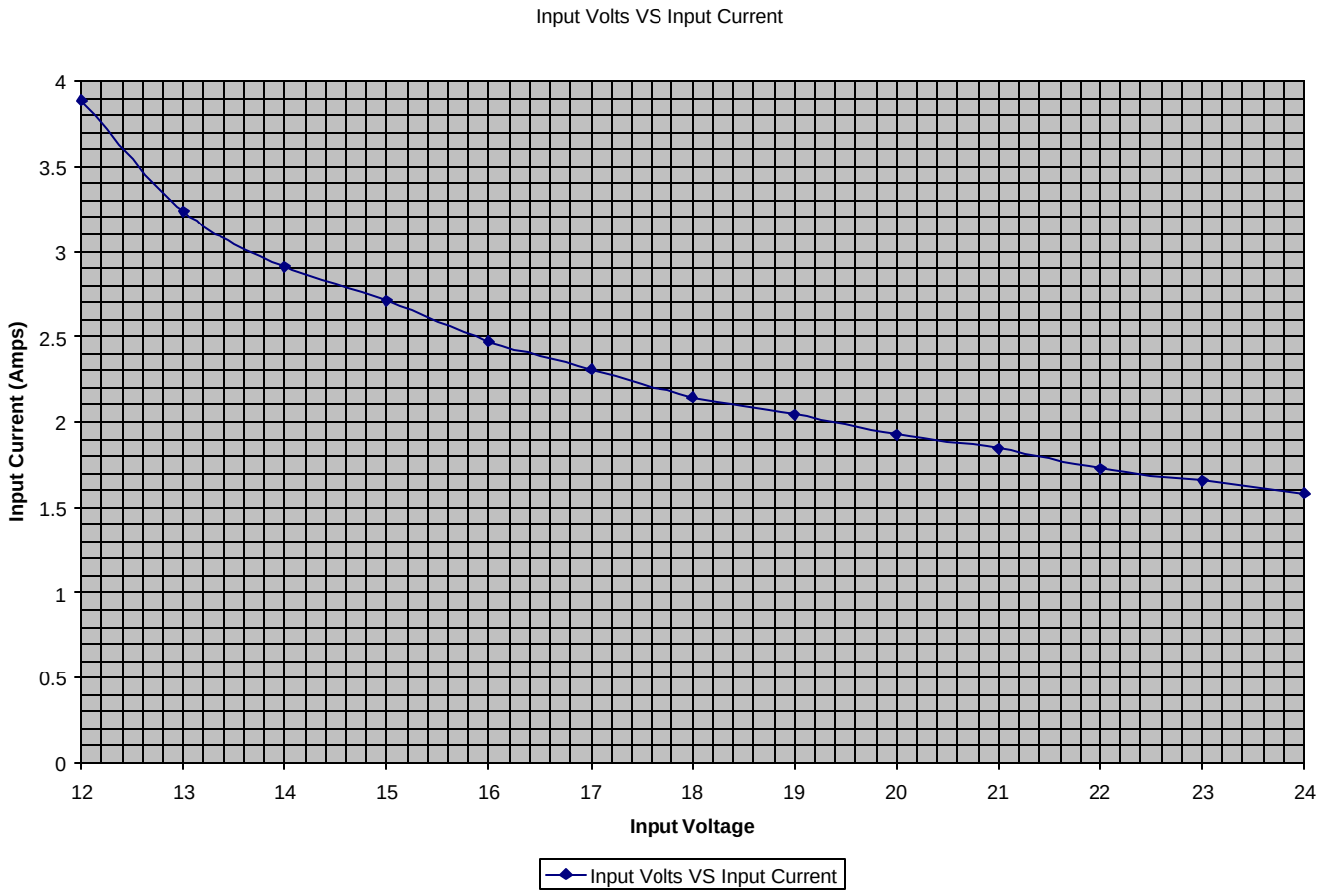

Input Volts VS Input Current
Input Current (Amps)
4
3.5
3
2.5
2
1.5
1
0.5
0
12
13
14
15
16
17
18
19
20
21
22
23
24
Input Voltage
Input Volts VS Input Current

Chart 1-1

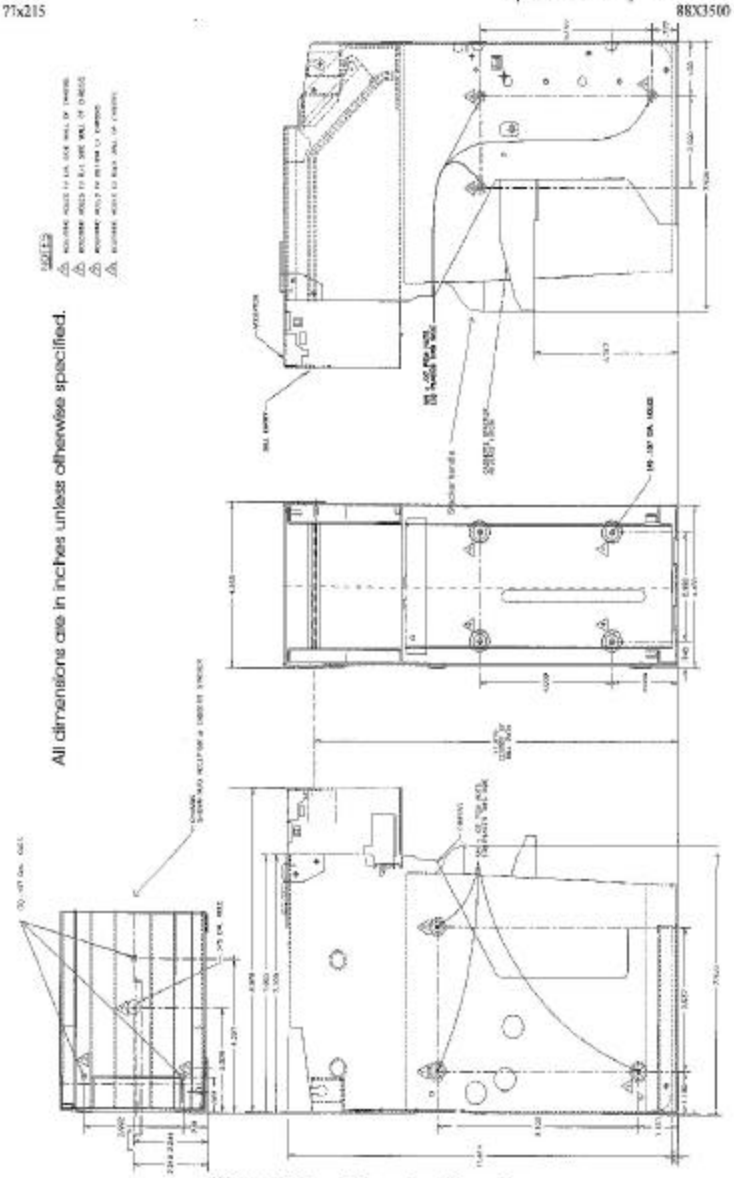


Figure 1-3 Dimension Drawing

Connector Description

Refer to Figure 1-4. Power and I/O connections to the system electronics are made through the main system internal wiring harness (not shown) to a single connector located at the top rear of the chassis. The acceptor unit makes or breaks all connections when the acceptor is installed or removed from the chassis. The external wiring harness is permanently mounted to the chassis connector, and provides cabling and termination for the power supply, and Host I/O or Money Controls Host Simulator connections.

Connector Specifications

Figure 1-5 shows the pin-outs of the main chassis to note acceptor connections. These connectors appear as viewed from the rear of the acceptor and the rear of the Main Chassis Connector.

Figures 1-5 through 1-9 show the pin-outs of the external harness connectors:

- The 2-pin power supply connector connects the ARDAC-5 to the host or bench power supply.
- The DB-25-pin host I/O connector passes control signals between the Host and ARDAC-5
- The 5-pin diagnostic connector allows access to the ARDAC-5 diagnostic system.

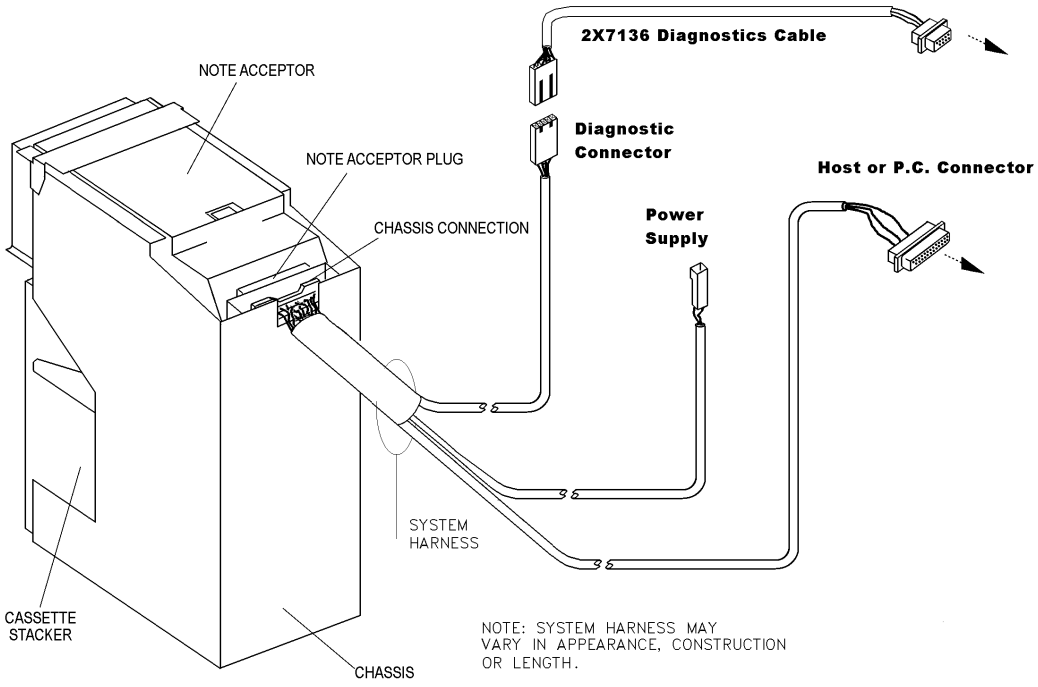


Figure 1-4
Diagnostic Bench Interface

MAIN CHASSIS CONNECTOR TO SYSTEM WIRING HARNESS

PIN #	FUNCTION	HARNESS COLOR
1		
2	Diagnostic RXD (RS232)	White / Blue
3	Stacker Present	White / Red
4		
5		
6	RS-232 RX	Violet
7	Ground	Green
8	Memory Button (Smart Only)	Blue (Smart only)
8	Ground (Non-Smart only)	Green (Non-Smart only)
9	RS-232 TX	Yellow
10	Stacker Home	Orange
11	+12 to 24V	White / Orange
12	Ground	Green
13		
14	Diagnostics TXD	White / Yellow

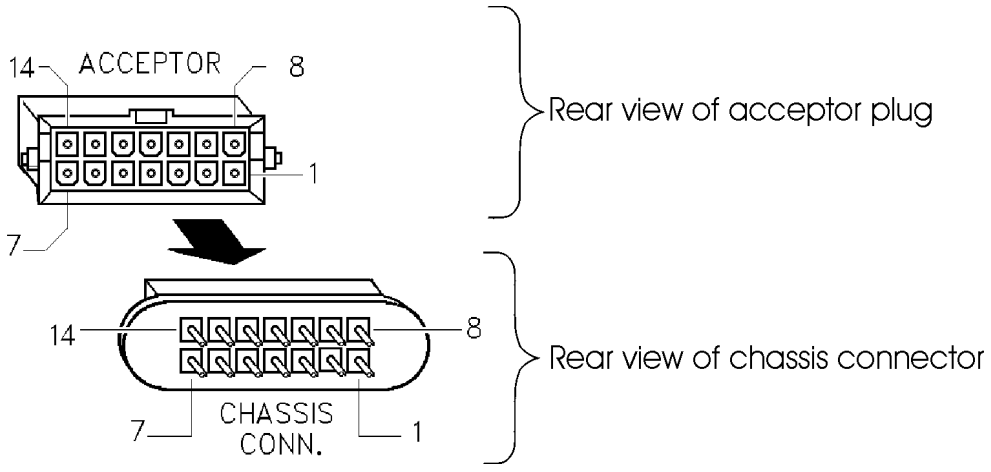


Figure 1-5
14 Pin Rear Connector

2-PIN POWER CONNECTOR (12-24VDC)

PIN #	FUNCTION	HARNESS COLOR
1	+12 to 24VDC	White / Orange
2	Ground	Green

Money Controls Part Numbers: 35x592 housing with 35x593 pins

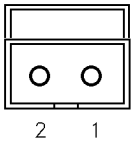


Figure 1-6
Two pin Power Connector

5-PIN DIAGNOSTIC CONNECTOR

PIN	FUNCTION	HARNESS COLOR
1	Diagnostic RXD (RS232)	White / Violet
2	Ground	Green
3	Diagnostic TXD (RS232)	White / Yellow
4		
5		

Money Controls Mate Part Numbers: 35x592-5 housing with 35x593 pins

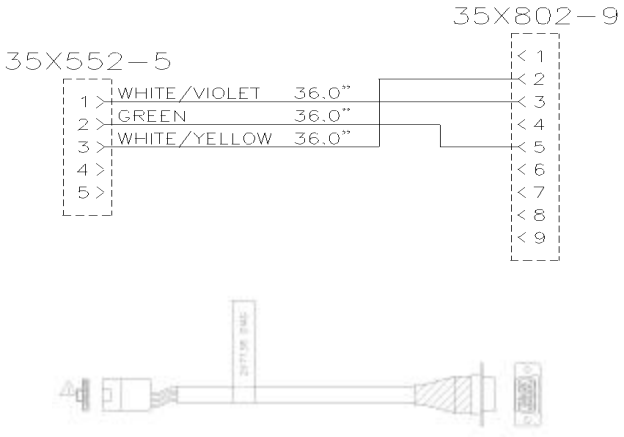


Figure 1-7
2x7136 Diagnostic Connector

Host Interface Connections

The DB-25 connector is used for communication with the host machine and can also be connected to a P.C. so that the acceptor can be run with a Host Simulator program. This also allows access to diagnostics.

DB-25 HOST CONNECTOR

PIN #	FUNCTION	HARNESS COLOR
1	-----	-----
2	ARDAC-5 Receive Data (RS232)	Violet
3	ARDAC-5 Transmit Data (RS232)	Yellow
4	-----	-----
5	-----	-----
6	-----	-----
7	Ground	Green
8-25	-----	-----

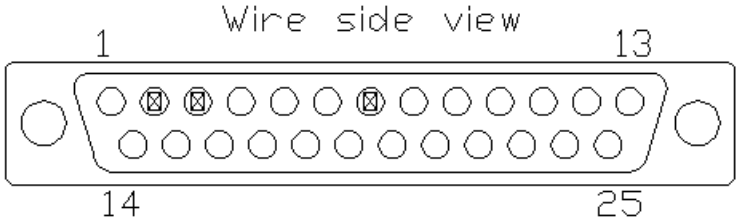


Figure 1-9
DB-25 Host Interface

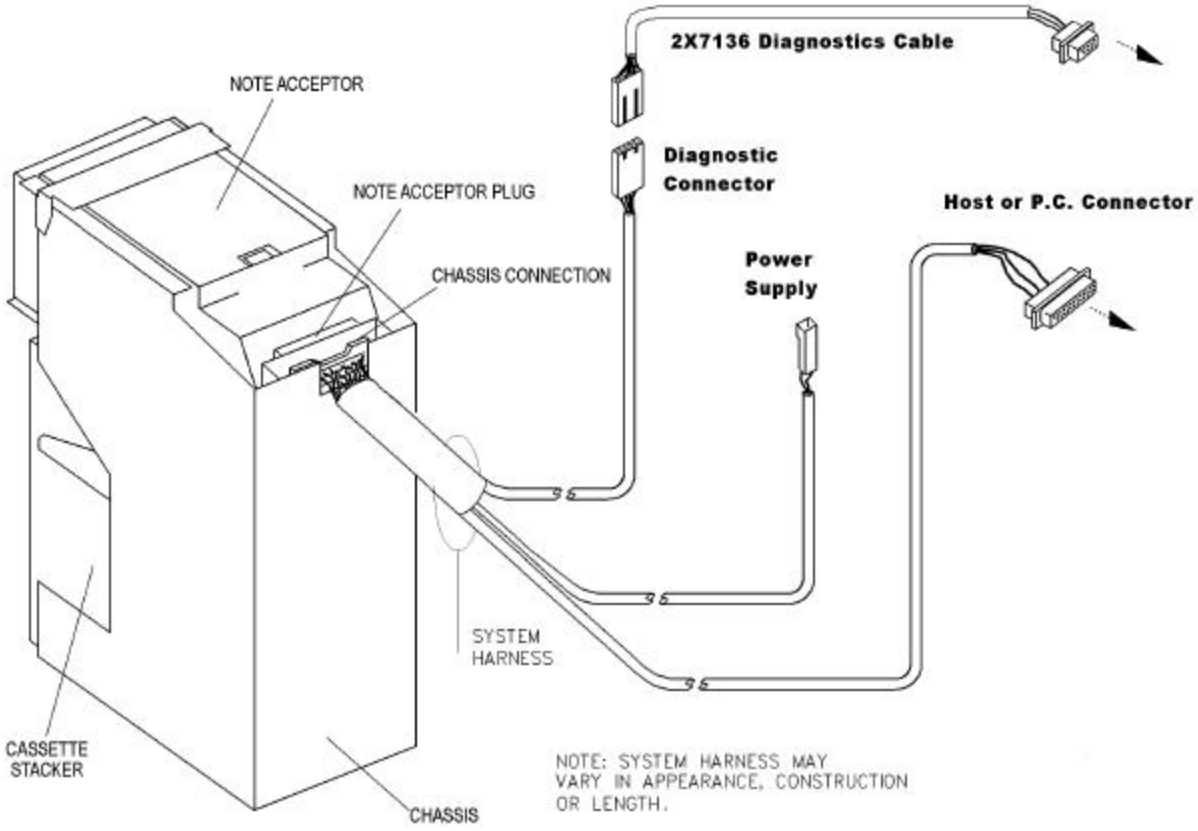


Figure 1-10
ARDAC-5
Diagnostic Interface

DIP Switch Settings and Functions

The microprocessor board used in the System note acceptor has 2 banks of eight DIPswitches. These switches set the System's operating mode and enable or inhibit acceptance of certain notes. For the location of these DIPswitches, refer to Figure 1-1. Table 1-1 describes the DIPswitch functions. DIPswitch settings may vary from table 1-1 depending on specific firmware version installed in machine.

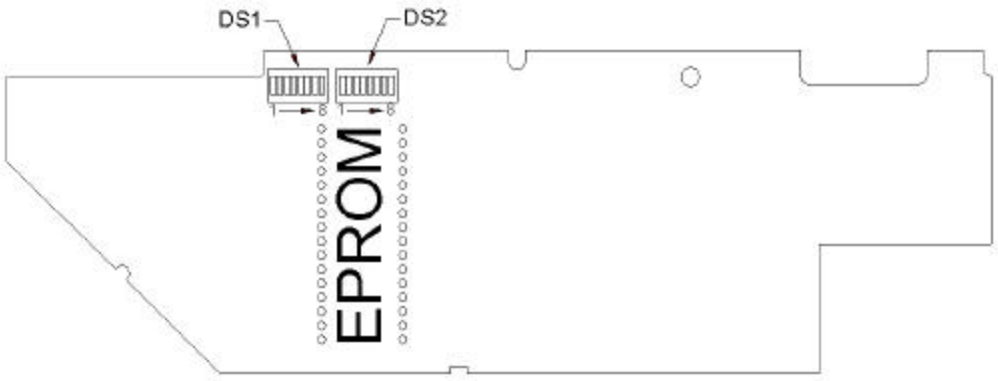


Figure 1-11
EPROM / FLASH and Dip Switch Location
(Micro) board

SWITCH BANK 1		**SWITCH OFF (Enable)**	**SWITCH ON (Inhibit)**
SWITCH 1-1	NOTE 1 (Lowest Value)	ACCEPT NOTE 1	INHIBIT NOTE 1
SWITCH 1-2	NOTE 2	ACCEPT NOTE 2	INHIBIT NOTE 2
SWITCH 1-3	NOTE 3	ACCEPT NOTE 3	INHIBIT NOTE 3
SWITCH 1-4	NOTE 4	ACCEPT NOTE 4	INHIBIT NOTE 4
SWITCH 1-5	NOTE 5	ACCEPT NOTE 5	INHIBIT NOTE 5
SWITCH 1-6	NOTE 6	ACCEPT NOTE 6	INHIBIT NOTE 6
SWITCH 1-7	NOTE 7	ACCEPT NOTE 7	INHIBIT NOTE 7
SWITCH 1-8	NOTE 8 (Highest Value)	ACCEPT NOTE 8	INHIBIT NOTE 8

SWITCH BANK 2		**SWITCH OFF**	**SWITCH ON**
SWITCH 2-1	RESERVED	N/A	N/A
SWITCH 2-2	CASSETTE STACKER MODE	ENABLE	DISABLE
SWITCH 2-3	MAG SENSOR	DISABLED	ENABLED
SWITCH 2-4	STRING SENSOR	ENABLE	DISABLE
SWITCH 2-5	SMART CASSETTE	DISABLE	ENABLE
SWITCH 2-6	FIRMWARE DEVICE	EPROM	FLASH

SWITCH BANK 2-7 AND 2-8	**FUNCTION**
SW2-7 = OFF, SW2-8 = OFF	NORMAL OPERATION
SW2-7 = OFF, SW2-8 = ON	CALIBRATION CARD MODE
SW2-7 = ON, SW2-8 = OFF	CLEANING CARD MODE
SW2-7 = ON, SW2-8 = ON	UNDEFINED

Table 1-1

2
Host Machine Installation

Host Installation & Setup

When the ARDAC-5 is connected to the host, the 2-pin connector attaches to the host power supply and the DB-9 or DB-25 connector is used for communications.

Installation Overview

The ARDAC-5 is to be installed only in equipment built in accordance with the application data and specifications provided in Section 1, Description and Specifications. The basic ARDAC-5 installation consists of mounting the chassis in the host and securing the acceptor and stacker into the chassis. Because the ARDAC-5 systems are modular, the modules of any ARDAC-5 systems are interchangeable with the modules of any other ARDAC-5 systems of the same type.

To install Money Controls ARDAC-5 unit into the host equipment:

- Fit the chassis into the host equipment and secure it in place by the mounting nuts captive in the chassis body. Refer to Chassis Mounting Requirements in Chapter 1.
- Connect the DB-25 or DB-9 pin, and two pin connectors on the chassis wiring harness to the matching connectors of the host equipment.
- If necessary install a new or up-graded EPROM / FLASH. Ordinarily this is done at the factory before shipment.
- Verify the proper DIP Switch settings and reset as required.
- Install the cassette stacker module into the chassis.
- Install the note acceptor module into the chassis.
- Apply power to the assembled System through the host equipment.

Power Supply and Voltage Requirements

The ARDAC-5 operates from an external regulated 12 to 24 Volt DC power supply.
Section 1, Description and specifications, has details on the recommended power requirements.

Connection of the ARDAC-5 System to the Host

ARDAC-5 units connect to the host equipment through the DB-25 or DB-9 connector on the chassis. The specifications for each of these connectors are provided in Section 1, Description and Specifications.

- RS-232 ARDAC-2 protocol serial communications pass through the DB-25 I/O connector.

- The 2-pin power connector must be connected to a host (or bench test) power supply meeting the specifications of Section 1, Description and Specifications.

- The 5-pin black connector is not used when installed in host machine.

Install New or Up-Graded EPROM / FLASH on Microprocessor Board (Optional)

It may become necessary to install or change the EPROM / FLASH on an acceptor's Microprocessor board. The ARDAC-5 units are shipped from the factory with the latest version of the firmware for the specified country, currency and application.

An EPROM / FLASH change may be required to:

- Adapt the System to a new country, currency or application.
- Change or increase the type of notes or currency handled by the System.
- Up-grade an already installed acceptor with the latest firmware version.

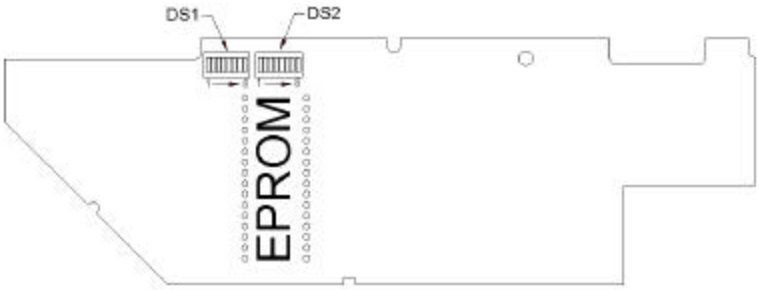


Figure 2-1 EPROM / FLASH Location

Programming New Firmware into an EPROM / FLASH

New firmware can be ordered already programmed into an EPROM / FLASH, or delivered by E-Mail. If new firmware is required, it must be programmed into a suitable 4 Meg EPROM or FLASH device. Money Controls recommends using the parts listed below.

Source	MFG Part Number	Money Controls Part Number
National Semiconductor	27C040 (EPROM)	56x764
AMD	29F040 (FLASH)	56x713

EPROM / FLASH Removal and Replacement

WARNING

The EPROM / FLASH on the acceptor's microprocessor board should be changed only by personnel experienced with proper ESD Static Protection procedures.

Refer to Figure 2-1 and replace the old EPROM / FLASH with the new one:

1. Make sure all power is disconnected from the bill acceptor.
2. Note the orientation of the EPROM / FLASH and pin-1 notch.
3. Using a small needle nose pliers, loosen one end of the EPROM / FLASH and then the other. Pull the EPROM / FLASH from its socket. **(Observe proper ESD protection procedures)**
4. Position the new EPROM / FLASH over the socket with the notch in the EPROM / FLASH at the pin 1 end of the socket. This is the end of the socket closest to the top of the acceptor.
5. Make sure all of the pins are straight and aligned with their respective sockets.
6. Be careful to prevent bending the pins or damaging the EPROM / FLASH, press the EPROM / FLASH into its socket until it seats firmly.

Check the DIP Switch Settings And Re-set As Required

The microprocessor board used in the ARDAC-5 note acceptor has two banks of eight DIP switches. These switches set the System's operating mode and enable or inhibit acceptance of certain notes. They are located on the Microprocessor Board as shown in Figure 2-1. Refer to Table 1-1 and verify that the DIP switches are set properly for the required mode of operation and currency combination. If changes are required, use a small non-conductive screwdriver or plastic switch setting wand to toggle the switches. Do not use a conductive probe of any kind.

Insert Stacker Module into the Chassis

To assure proper operation of the ARDAC-5, the stacker cassette must be fully installed and locked into position before the System is powered up.

When inserting the stacker cassette into the chassis:

1. Position the back of the cassette between the guide rails at the bottom of the chassis. (Fig. 2-2)
2. Make sure the latch pin on the right side of the stacker is under the stacker retaining latch on the right side of the chassis.
3. If the note acceptor has already been inserted into the chassis, note the stacker punch gear at the top front corner of the cassette. Also note the punch drive gear at the bottom front corner of the note acceptor. Make sure these gears mesh properly and without damage as the stacker cassette slides into the chassis.
4. Carefully push the cassette into the chassis until it seats against the back of the chassis, and the stacker-retaining latch catches the latch pin.

Insert Note Acceptor Module

To assure proper operation of the ARDAC-5, the note acceptor module must be properly positioned, locked in place, and the main harness connector of the acceptor must be fully inserted into its mating connector in the chassis. The acceptor unit makes or breaks all connections when the acceptor is installed or removed from the chassis.

When inserting the note acceptor into the chassis:

1. Position the back of the acceptor so the support rails at the top of the acceptor fit above the guide rails at the top of the chassis.
2. If the cassette stacker has already been inserted into the chassis, note the stacker punch gear at the top front corner of the cassette. Also note the punch drive gear at the bottom front corner of the note acceptor. Make sure these gears mesh properly and without damage as the acceptor slides into the chassis.
3. Carefully push the cassette into the chassis until the connector at the back of the acceptor seats properly into the connector at the back of the chassis, and the acceptor retaining latch on the left side of the acceptor catches the latch on the left side of the chassis.

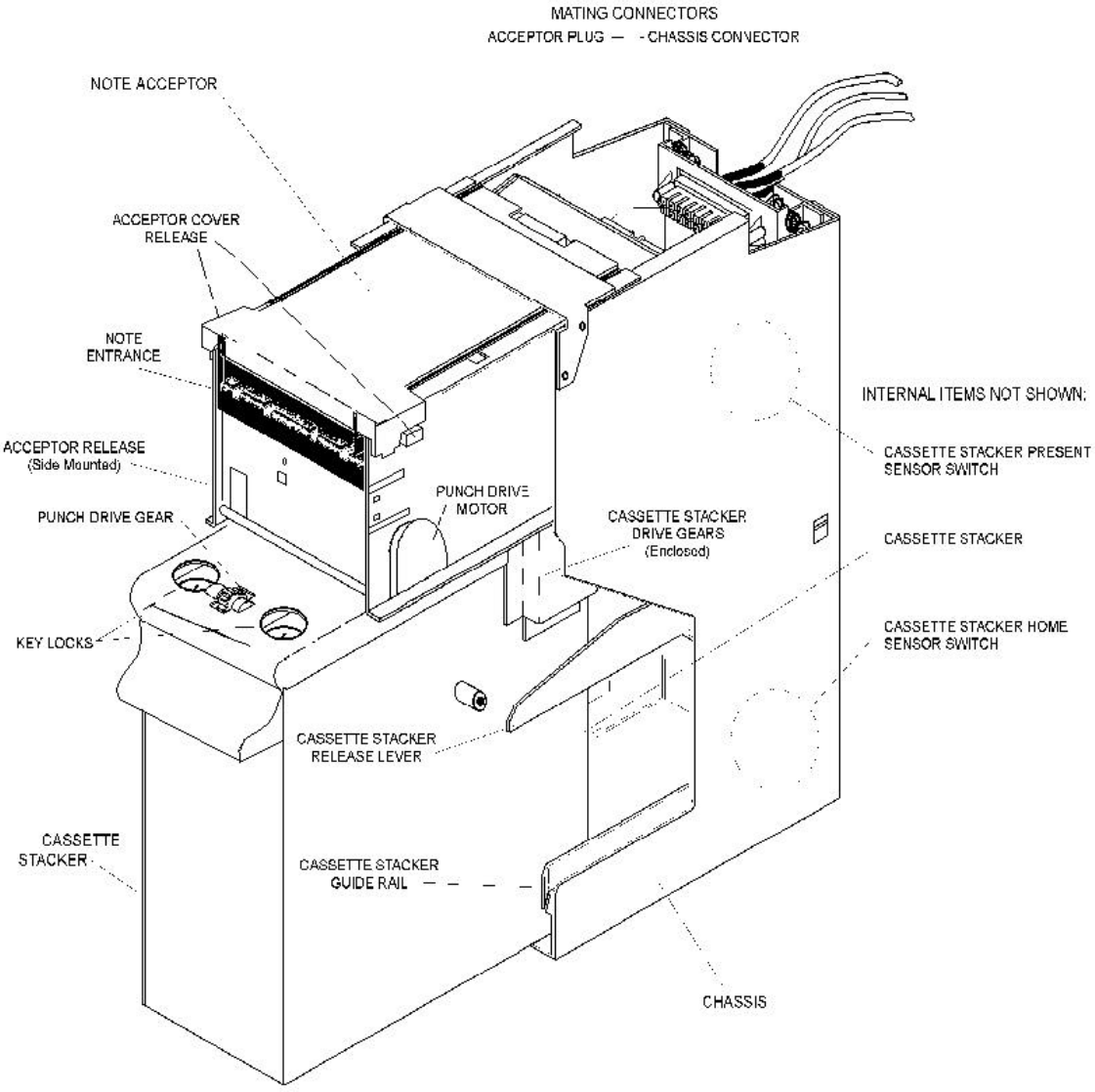


Figure 2-2
ARDAC-5 System Components

System Power-up

NOTE

Before applying power to the system, check that there are no notes in the acceptor. Wait until the stacker cycles twice before inserting notes.

The stacker punch cycles once at the beginning and once at the end of the power-up self-calibration sequence. The second cycling of the stacker punch marks the end of the power-up sequence.

The power-up sequence takes approximately 10 to 15 seconds. Refer to Figure 2-3. The System should not be disturbed until the sequence is completed. During this sequence, the System firmware does the following:

- Checks for objects in the note path and if necessary clears the note path.
- Cycles the stacker punch once.
- Calibrates the front sensors.
- Calibrates the dual-density sensor.
- Calibrates the top and bottom TNT sensors.
- Calibrates the String Sensor.
- Checks the DIP switch settings.
- Checks for stacker present. If present, the stacker is cycled and checked for proper rest position.
- Reads chassis and cash box memory buttons (If optional smart system is installed)

Section 3, System Operation explains in detail the System Power-up Sequence, including calibration and storage of calibration values.

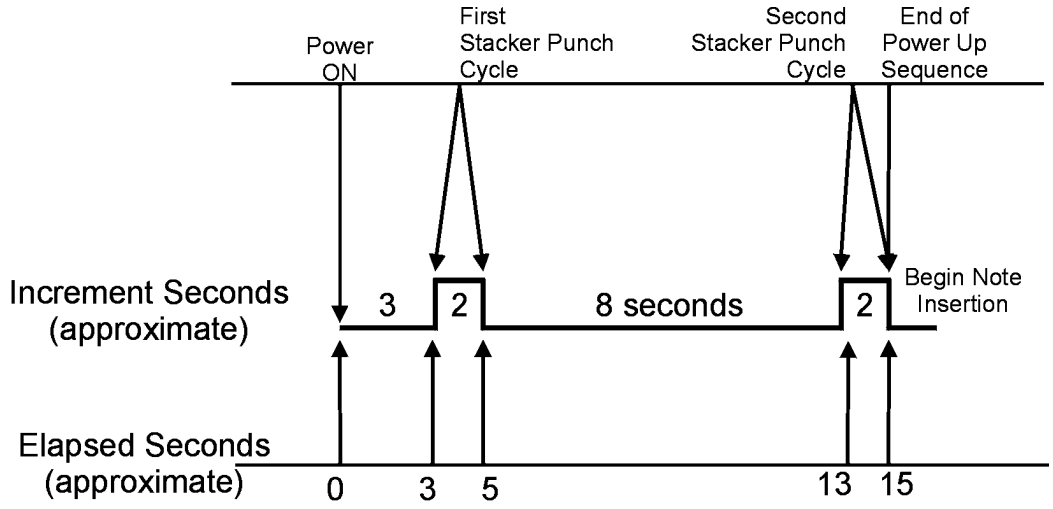


Figure 2-3
Power-Up Timing

3
System Operation

Functional Description of System Modules

Section 1, Description and Specifications provides a general System description and a list of major system subassemblies including part numbers. This section of the manual describes operation of the three system modules and subassemblies. The Money Controls ARDAC-5 consists of the following three modules, which are mounted and interconnected as shown Figure 3-l and in Section 1, Description and Specifications:

NOTE ACCEPTOR:

- Processes an incoming note/ barcode coupon and passes or rejects the note based on sensor data.
- Acts as the System controller.
- Provides protection against all types of stringing and numerous other intrusive fraud devices.
- Monitors the presence and status of the cassette stacker via sensors in the chassis.
- Provides all mechanical drive for itself and the cassette stacker.
- Communicates with the host.

CASSETTE STACKER:

- Receives notes/coupons exiting the note acceptor through a drive-down mechanism, which is propelled by the note acceptor.
- Stacks notes through action of a punch mechanism, which is driven by the note acceptor.
- Acts as an interchangeable, locking note cassette (2 locks).
- Contains memory device to store acceptor data. (On system with Smart option.)

CHASSIS:

- Provides proper alignment of the note acceptor and cassette stacker.
- Provides fastener points for mounting the ARDAC-5 to the host.
- Contains the main System power and communication connector.
- Contains a mechanical switch sensor, which enables the acceptor to detect the presence of the cassette.
- Contains an optical sensor, which enables the acceptor to detect when the stacker punch is in the home (rest) position.
- Contains the chassis ID number memory (read only) for the cassette tracking system. (Smart systems only)

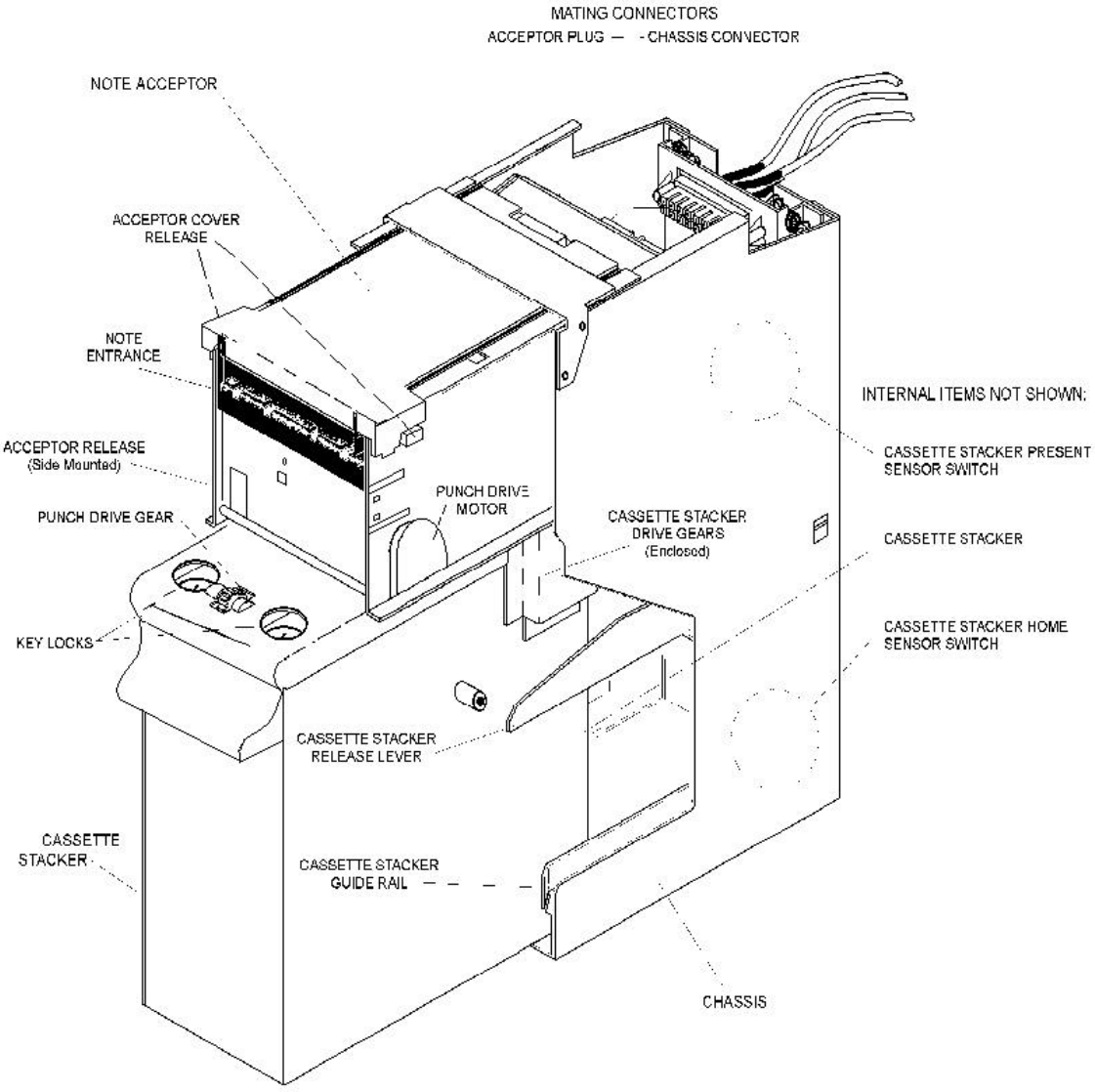

MATING CONNECTORS
ACCEPTOR PLUG — - CHASSIS CONNECTOR
NOTE ACCEPTOR
ACCEPTOR COVER RELEASE
NOTE ENTRANCE
ACCEPTOR RELEASE (Side Mounted)
PUNCH DRIVE GEAR
KEY LOCKS
CASSETTE STACKER
CASSETTE STACKER GUIDE RAIL
CASSETTE STACKER RELEASE LEVER
PUNCH DRIVE MOTOR
CASSETTE STACKER DRIVE GEARS (Enclosed)
INTERNAL ITEMS NOT SHOWN:
CASSETTE STACKER PRESENT SENSOR SWITCH
CASSETTE STACKER
CASSETTE STACKER HOME SENSOR SWITCH
CHASSIS

Figure 3-1

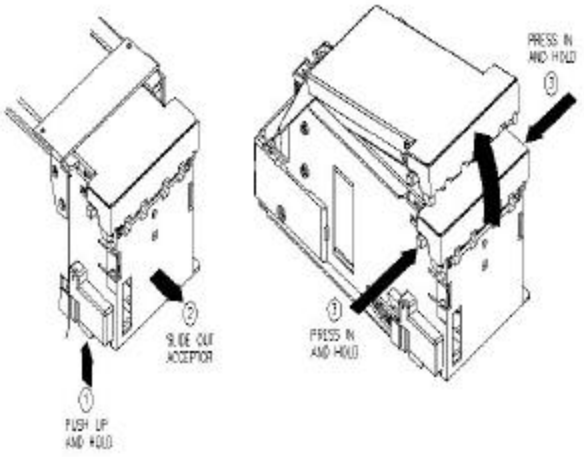


Figure 3-2

Operational Notes - Acceptor

The note acceptor used in the ARDAC-5 System is a belt-driven, horizontal note acceptor. The acceptor identifies notes through the use of a DSP-based, self-calibrating sensing system. Sensors located above and below the note path scan both sides of the note. A sensor at the opening of the note path monitors for a variety of stringing and other intrusive fraud devices.

- When the acceptor verifies that the note/coupon is a valid, applicable currency and the cassette stacker can receive it, the acceptor drives the note out of a slot at the bottom rear of the acceptor, into the stacker.

- The note is returned to the customer through the note entrance when the acceptor detects that:
    1. The note is not a valid, applicable currency
    2. An intrusive fraud device is being used
    3. The stacker is jammed or full
    4. The host instructs the acceptor to return the note.

The note acceptor contains two drive motors. One motor, located toward the rear of the acceptor, operates the drive belts inside the acceptor. These belts transport the note past the acceptor's sensor systems. This motor also operates gears, which propel a drive-down mechanism in the cassette stacker. This mechanism actively drives an accepted note into the stacker as the note leaves the acceptor, thus assisting in the initial stages of note stacking.

The second drive motor operates the punch mechanism in the cassette stacker. This bi-directional motor is located toward the front of the acceptor, and can be seen on the right side plate of the acceptor. After a note has been driven fully into the stacker, the punch mechanism pushes the note toward the front of the stacker, into the existing note stack. After the note is stacked, the motor reverses to return the punch to the home position. Optical sensors located in the lower rear corners of the chassis detect this home position.

Removal of the Note Acceptor

The note acceptor positively locks into the System chassis. A spring-loaded release on the left side of the acceptor engages a tab on the chassis to lock the acceptor in place. All connections between the note acceptor and the rest of the System are made or broken automatically through a 14-pin connector on the back of the note acceptor and its mate on the chassis.

To remove the acceptor:

1. Locate the spring release tab on the left side of the acceptor (Figure 3-2 Item 1).
2. Press the tab upward, toward the top of the acceptor and hold.
3. While maintaining pressure on the tab, pull the acceptor from the chassis.

To open the acceptor (after acceptor is removed from the chassis): Refer to Figure 3-2

1. Grasp and push inward on both acceptor cover release tabs at the front corners of the acceptor cover, and hold.
2. While maintaining pressure on the release tabs, lift the acceptor cover.

Before replacing the acceptor, open the acceptor and check that no notes or other materials remain in the note path. When inserting the acceptor into the chassis refer to the instructions: Insert Acceptor Module into the chassis in Section 2, Installation.

Operational Notes - Cassette Stacker

The cassette stacker is a single-compartment unit, which can hold up to approximately 550 notes in average, circulated condition. The cassette stacker does not contain any electronics or active drive components. The acceptor provides drive to the stacker through gears located at the front and rear of the stacker. See the previous sections, which describe these drive systems.

The internal drive mechanisms in the cassette stacker consist of a pinch roller set in the rear top of the stacker, on either side of the note inlet, and a belt mechanism located inside the front of the stacker and along the bottom left of the stacker. Both mechanisms are driven through gears by motors in the acceptor. The pinch rollers act as a drive-down for incoming notes. The belt system operates the stacker punch. See Figure 3-3.

The cassette stacker contains two positions for key locks. Keys can be removed only if both locks are in the locked position. Both keys must be removed before the stacker can be seated in the chassis. The locks must both be unlocked before the stacker top cover can be opened for emptying of notes. There is a screw inside the cassette stacker that must be removed to disassemble the stacker. If this screw is not removed, it is not possible to dismantle or open the cash box without serious damage.

Removal of the Cassette Stacker

The cassette stacker positively locks into the system chassis through the action of a spring-loaded release lever located on the right side of the chassis (Figure 3-1). To remove the stacker, depress the lever, and then pull the stacker out of the chassis.

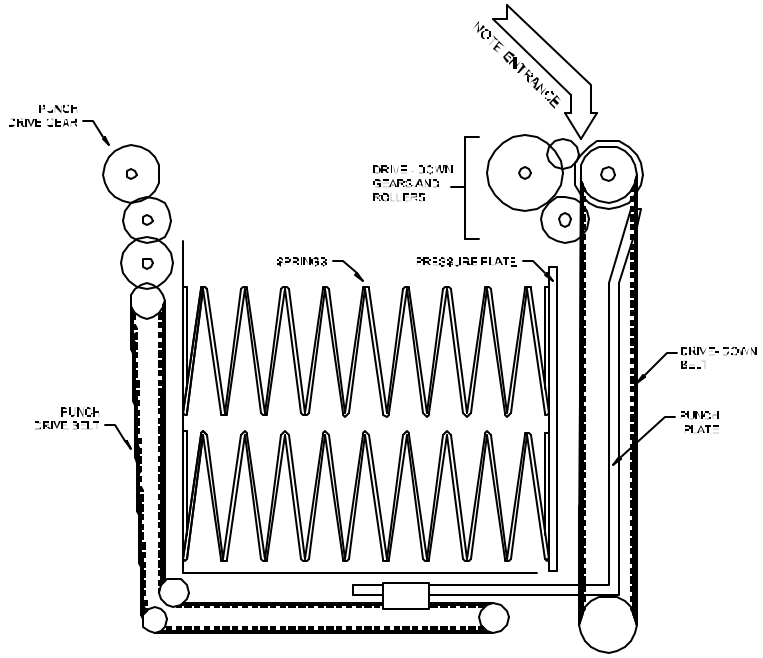


Figure 3-3
Cassette Drive-Down and Punch Mechanisms

Opening The Cassette Stacker

CAUTION

DO NOT FORCE THE STACKER COVER WIDE OPEN.

Refer to Figure 3-4. Open the stacker cover by lifting the front edge only until the cover is perpendicular to the top of the stacker. Mishandling of the stacker cover can cause permanent damage to the cover and hinge. When opening the cassette stacker:

- **DO NOT** force the cover back into the areas of dark shading in Figure 3-4.
- **DO NOT** hold or suspend the stacker by the front edge or by the key lock holes in the cover.
- **DO NOT** flip the cover open by holding the cassette handle and snapping the cassette down and forward.

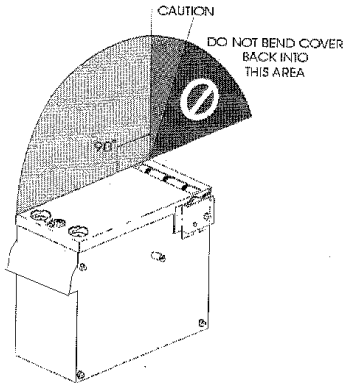


Figure 3-4

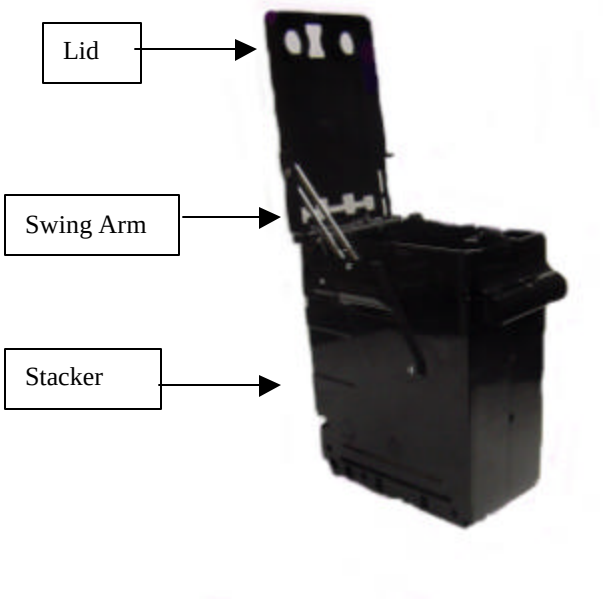


Figure 3-5

Closing and Locking The Cassette Stacker

While firmly supporting the cassette stacker, use only fingers to move the front edge of the cover from its open position above the stacker, to its closed position at the top front edge of the stacker. Mishandling of the stacker cover can cause permanent damage to the cover and hinge. When closing the cassette stacker:

- **DO NOT** close the cover by hitting it against another object such as a table top or chair back.
- **DO NOT** flip the cover closed by holding the cassette handle and snapping the cassette up and inward.
- **DO NOT** close the cover by pushing the open stacker cassette into the System Chassis. The stacker cassette must be closed completely before insertion into the chassis.

If locks are installed, the keys can be removed only if both locks are in the locked position. Both keys must be removed before the stacker can be seated in the chassis.

* NOTE: Even though the swing arm of the stacker (Figure 3-5) prevents lid over travel; observe the precautions outlined above for proper handling of stackers.

Replacement of the Cassette Stacker

To assure proper operation of the ARDAC-5, the stacker cassette must be fully installed and locked into position before the System is powered up. When inserting the stacker cassette into the chassis refer to the instructions: Insert Stacker Module into the chassis in Section 2, Installation.

Operational Notes - Chassis

Like the cassette stacker, the chassis is an electronically passive device. Its main function is to provide alignment and a mounting shell for the acceptor and cassette inside the host. The acceptor and cassette should smoothly slide into the chassis, and easily lock into position. If the acceptor or cassette require excessive force to engage the latches, the acceptor, cassette, or chassis may be bent or damaged.

Sensors in the chassis detect the presence of the cassette stacker, and also when the stacker punch is the home position. The "Stacker Present" sensor is a normally closed mechanical switch. When the stacker is fully seated, this switch is set to the open position.

The "Stacker Home" sensor is an LED-photo sensor pair. One element of this pair is mounted on either side of the chassis, in the lower inside rear corners of the chassis. When the stacker punch moves out of the home position, the photo sensor sees the LED through access holes in the sides of the stacker cassette. When the stacker punch is in the home position, the punch plate mechanism breaks the light beam between the LED and photo sensor.

If the optional Smart function is installed, there is a read-only memory device installed in the chassis that stores a unique electronic serial number for that chassis.

Operational Notes - System Power-up Sequence

The power-up sequence takes approximately 10 to 15 seconds. The System should not be disturbed until the sequence is completed. During this sequence, the System firmware checks the note path, calibrates the sensors, checks for stacker present, and checks the DIP switch settings. The stacker punch cycles once at the beginning and once at the end of the power-up sequence.

Before Applying Power To The System

1. If possible, check that there are no notes in the acceptor's note path. In some cases this may not be possible. For example: When power is momentarily lost to the host equipment, and then restored. To address these cases, the acceptor firmware includes routines to automatically clear the note path and reset the stacker. These are explained below.
2. For proper completion of the Power-up Sequence, the stacker cassette must be fully installed and locked into position before the System is powered up.

Power-up Sequence

During the power-up sequence, the following occur:

1. Unit checks RAM and ROM for accuracy.
2. The acceptor checks the note path for covered sensors. If a note was stopped in the note path when the system was powered-down, it will cover some of the sensors. Depending on the position of the stopped note and the condition of the stacker, the acceptor will either:
   - Drive the note into the stacker cassette.
   - Return the note.
3. The acceptor cycles the stacker punch once. This completes the stacking of any note that was partially stacked when power was removed from the system.
4. The front sensors are calibrated.
5. The mid-density sensors are calibrated.
6. The TNT sensors are calibrated.
7. The String Sensor is calibrated. This occurs only if the string sensor DIP switch is set to enable the sensor. For details, refer to Section 1, Description and Specifications, Figure 1-10 and Table 1-2.
8. The presence of the stacker cassette is checked. If present, the stacker is cycled and checked for proper rest position.
9. The DIP switch settings are checked for note inhibits.

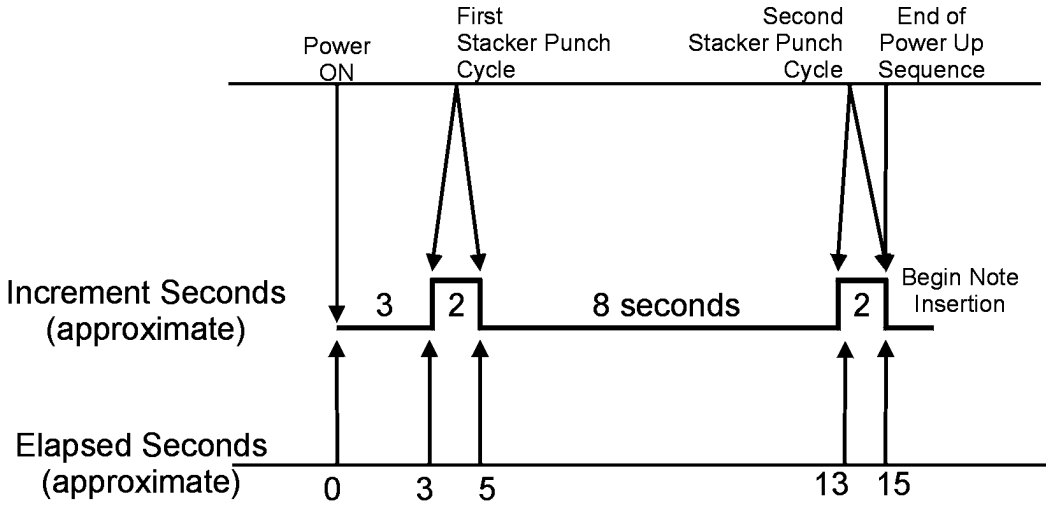


Figure 3-6
Power-Up Timing

Storage of Calibration Values

Except for dual density values, all calibration values are stored in volatile RAM on the Microprocessor Board. Each time power is removed from the System the old values are discarded. New values are established through re-calibration when the System is power-up again.

Dual Density Values

Dual density calibration values are stored on the Microprocessor board. It is not necessary to recalibrate the optical density values unless:

- The Microprocessor Board has been replaced.
- Major service or repair replacement has been performed on the dual density sensor or emitter.
- Testing on the bench in diagnostics mode indicates a high rate of "C0" errors related to the "Density Sum". The "C0" error will have a message indicating "Dual Density Sum Over Limit". If the "C0" error is not associated with a "Density Sum Over Limit" error, Density Calibration will not correct the problem.

Re-calibration of the optical density values is explained in Section 4, System Diagnostics, under the heading Dual Density Calibration.

System Stalls and Incomplete Power-up

For the calibration process to work properly, the System must be powered up without any notes or obstructions in the note path.

- If any object is present in the note path during calibration, the process will not complete properly, resulting in such problems as erratic performance or poor acceptance.
- If an obstruction is present in the note path during subsequent power-ups, the acceptor will try to clear the note path and complete the power-up sequence. If the acceptor cannot clear the note path, the power-up sequence will be halted, and the stacker punch will not cycle.
- If the System has been improperly powered up and stalls, power down the System, and check the note path. Correct the problem as necessary and re-energize the System.

Dip Switch Note Inhibits And String Sensor

The DIP switches on the microprocessor board are read during power-up to check the communications mode, whether any notes have been inhibited and whether the string sensor is enabled or disabled. The EPROM / FLASH on the acceptor Microprocessor Board must support the protocol selected or the System will not operate properly. The DIP switches are located on the Microprocessor Board as shown in Figure 1-10 of Section 1, Description and Specifications. Table 1-1 of the same section lists the switch functions.

4
System Diagnostics

Introduction

The ARDAC-5 System can be removed from the host machine and connected to an IBM-compatible personal computer (PC) in two different ways for maintenance and diagnostic testing.

Figure 4-1 shows the ARDAC-5 connected to the PC through its host interface cable. This interface allows the unit to be operated from a P.C. running a "Host Simulator". When connected in this manner, the PC simulates a host machine and allows the user to insert notes and monitor acceptance.

Figure 4-2 shows the ARDAC-5 connected to the PC through the flat 5-pin diagnostics connector and a 2x7136 Diagnostic interface cable. This type of connection allows the user to access more detailed diagnostic information, monitor acceptance, gather data and calibrate the unit. This diagnostics mode can be used by itself or at the same time as the ARDAC-2 communications to monitor the system. Using both modes at the same time will require the use of two serial ports or 2 computers.

Equipment and Software Required for ARDAC-2 Protocol Host Simulator

To operate the ARDAC-5 Banknote Acceptor in ARDAC II protocol mode, you will need the following items:

1. IBM-compatible personal computer (PC), 80286, or better, running at 16MHz (minimum).
2. This PC must have one available serial (COM) port capable of running at 19,200 baud.
3. Money Controls ARDAC-2 Host Simulator Software.
4. An extension or adapter cable may be required to connect the 25-pin connector on the chassis to the PC serial port (9-pin or 25-pin).

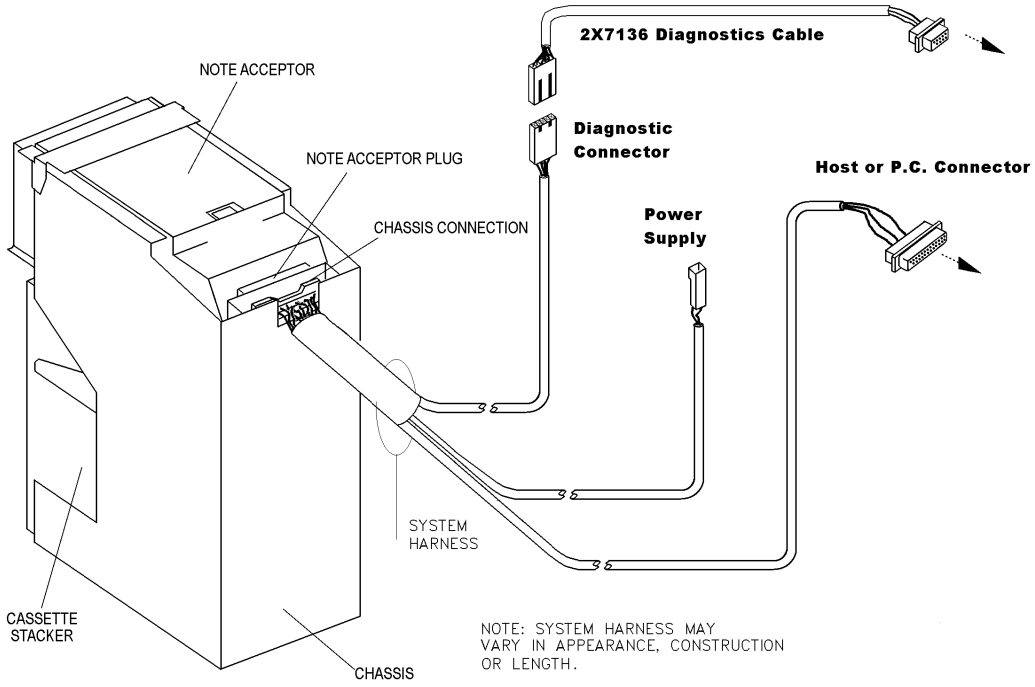


Fig. 4-1
Simulator Connection
CAPS Connection for diagnostics

ARDAC-2 Simulator Connections

To connect the ARDAC-5 to a PC for simulator operation, refer to Figure 4-1.

1. Turn off the ARDAC-5 System.
2. Connect the ARDAC-5 DB-25 connector to the computer serial port.

Host Software Installation

Money Controls will provide a copy of the Money Controls ARDAC II Host Simulator software 59x105-3 on 3.5" floppy diskette, CD-ROM or through E-Mail to individuals or organizations authorized by Money Controls. Before installation or operation of the Host Simulator, set aside a master copy of the package.

- If you receive the software on floppy diskette, copy the diskette and store the original (master) in a safe place.

- If you receive the package by way of E-Mail, copy the files to a floppy diskette and store this master in a safe place.

Fixed Disk Or Floppy Diskette

For maximum convenience and speed, run HOST.EXE from a fixed disk. Although it is not recommended, it is possible to run HOST.EXE from a floppy diskette.

- If you intend to run the host simulator from a floppy diskette:
  1. Never run HOST.exe from the master diskette. Use only a copy of the master diskette.
  2. If the copy is damaged or fails, make another copy of the original (master) program diskette and use this copy to run the Host Simulator program.

- If you intend to run the host simulator from a fixed disk, install the host simulator software in a directory of its own.

  1. Create a directory for the program files on the fixed disk (ARDAC is suggested).
  2. Copy all the files from the distribution diskette to this new directory. Refer to Host Setup files below and make sure these files are in the new directory.

Host Setup Files

The files **COMM.HST,** and **DEFAULT.HST** should be in the same directory as the executable HOST.EXE. If present, they change the initial set up of the program.

The **COMM.HST** file contains the communications set-up parameters. The only parameter that should be modified is the default communication port number. This is the very first character in the file. Care must be taken to keep all the strings in the same order and of the same general format (punctuation, etc.) as the originals.

Running the Host Software

Communication Port Settings

While the computer's serial port may support a variety of parameters, the Money Controls ARDAC II Host software supports only those parameters detailed as the Diagnostic Communications Parameters in the Specifications table of Section 1, Description and Specifications.

To change the COM port settings, Hit <F3> when the host is running then select the communications option on the list. It is also possible to edit the file COMM.HST and manually change the port by entering the correct port number in the first position in the file.

Simulator Start-up Command

To run the Host Simulator software, move to the directory containing the software and type HOST at the DOS command line. For example:

```
C:\cd\ARDAC
C:\HOST
```

This program can also be executed by creating a shortcut placed on the Windows™ desktop.

Host Software Main Screen Display

NOTE

The Host Simulator software is based on a program, which is used for several Money Controls products. Some commands and setup options may not pertain to the ARDAC-5.

A screen resembling Figure 4-2 appears on your monitor when the simulator software starts. This is the Host Simulator Main Screen Display:

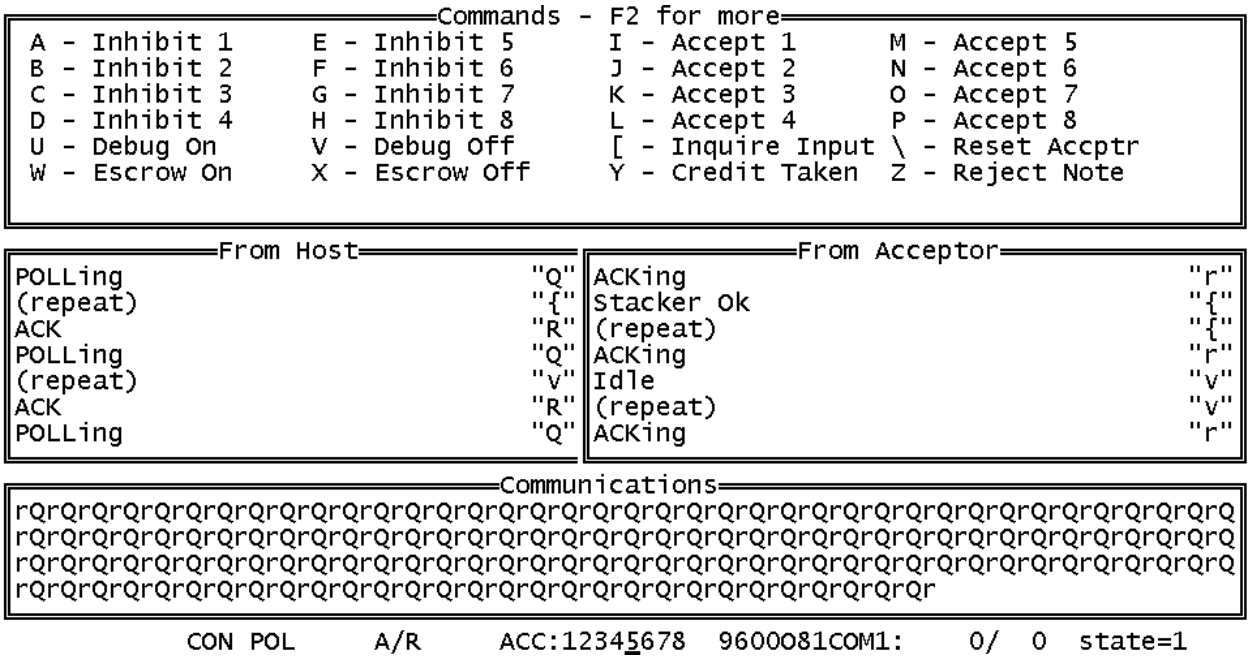


Figure 4-2
ARDAC-2 Protocol Host Main Display

Commands

The Commands window shows the characters, which can be sent to the acceptor. Not all the characters are valid at all times.

From Host

The "From Host" window shows and interprets the characters that are being sent to the acceptor. In addition to characters that the protocol part of the program generates, any character that is typed on the keyboard will be sent to the acceptor.

From Acceptor

The "From Acceptor" window shows and interprets the characters that are being received from the acceptor.

Communications

The Communications window shows the characters being transferred in both directions on the serial link, interlaced with each other. This is useful for understanding the communications protocol between the acceptor and host.

Status Line

The bottom line of the display line shows the values of the various flags, communication parameters, and state of the host simulator.

Message Window

The Message window allows access to the diagnostics functions once the acceptor has been put into "Set-up mode" The other way to access diagnostics is by using the 2x7136 interface cable plugged into the flat 5-pin connector on the chassis. Using windows Hyperterminal.

Options Menu

The communication parameters and protocol timing should not be changed. To call up the options menu press the F3 key. Then use the arrow keys to select the desired option and press the “enter” or return key. Some items on the main menu have sub-menus associated with them. These are displayed when the main menu option is selected. Some of the items (such as the protocol timing constants) have fill-in-the-blanks spaces. To change this option use the arrow keys to get to the option, key in the new value and hit return. To choose none of the items on the main menu or any sub-menu, the user may back out of the menu by pressing the left arrow key or the <ESC> key.

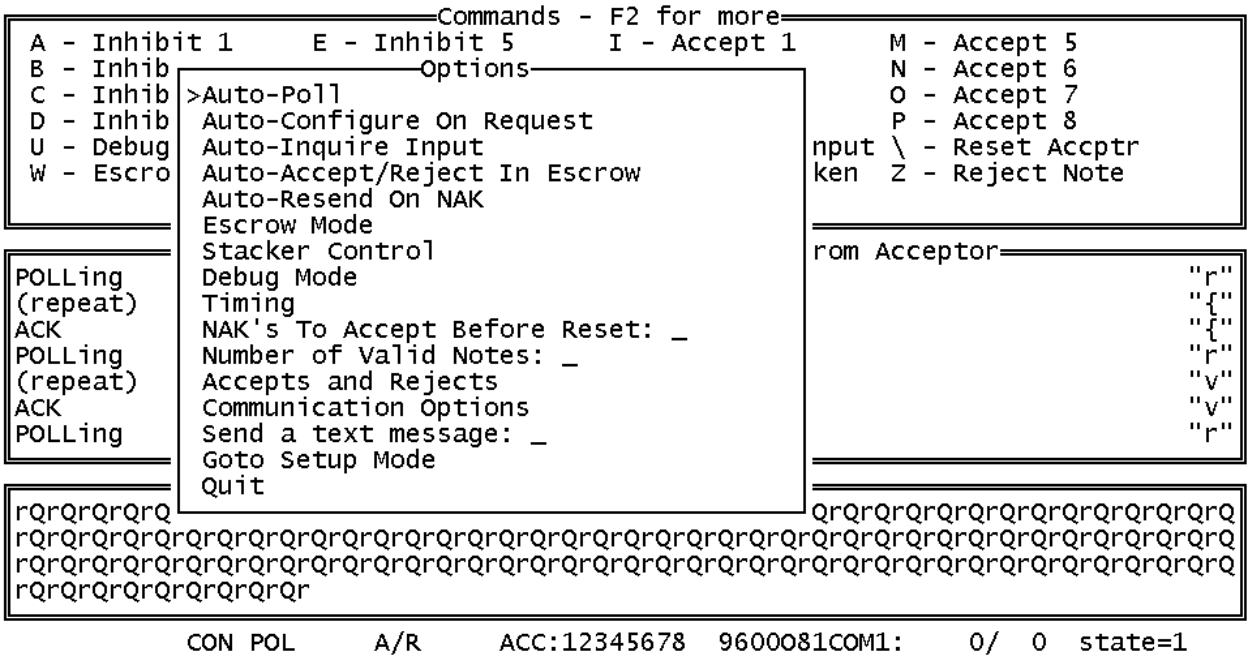


Figure 4-3

Options Menu

```
                              Commands - F2 for more
A - Inhibit 1     E - Inhibit 5      I - Accept 1      M - Accept 5
B - Inhibit 2     F - Inhibit 6      J - Accept 2      N - Accept 6
C - Inhibit 3     G - Inhibit 7      K - Accept 3      O - Accept 7
D - Inhibit 4     H - Inhibit 8      L - Accept 4      P - Accept 8
U - Debug On      V - Debug Off      [ - Inquire Input \ - Reset Accptr
W - Escrow On     X - Escrow Off     Y - Credit Taken  Z - Reject Note
```

```
                              Commands - F2 for more
@ - Sleep
1 - Motor On      2 - Motor Off      3 - Motor Forward 4 - Motor Reverse
5 - TNT Lamps On  6 - TNT Lamps Off  < - Calibrate     : - Setup Voltages
7 - Stacker For   8 - Stacker Rev    9 - Stacker Off   0 - Stacker Cycle

F1 - Help         F3 - Options       F4 - Show Message Window
```

```
                              Commands - F2 for more
1 - Motor On      2 - Motor Off      3 - Motor Forward 4 - Motor Reverse
5 - TNT Lamps On  6 - TNT Lamps Off  < - Calibrate     : - Setup Voltages
7 - Stacker For   8 - Stacker Rev    9 - Stacker Off   0 - Stacker Cycle

F1 - Help         F3 - Options       F4 - Show Message Window
F5 - Quit         F6 - Reset Host    F7 - Transparent/Host Sim Mode
```

Figure 4-4
“F2 for more” Screens

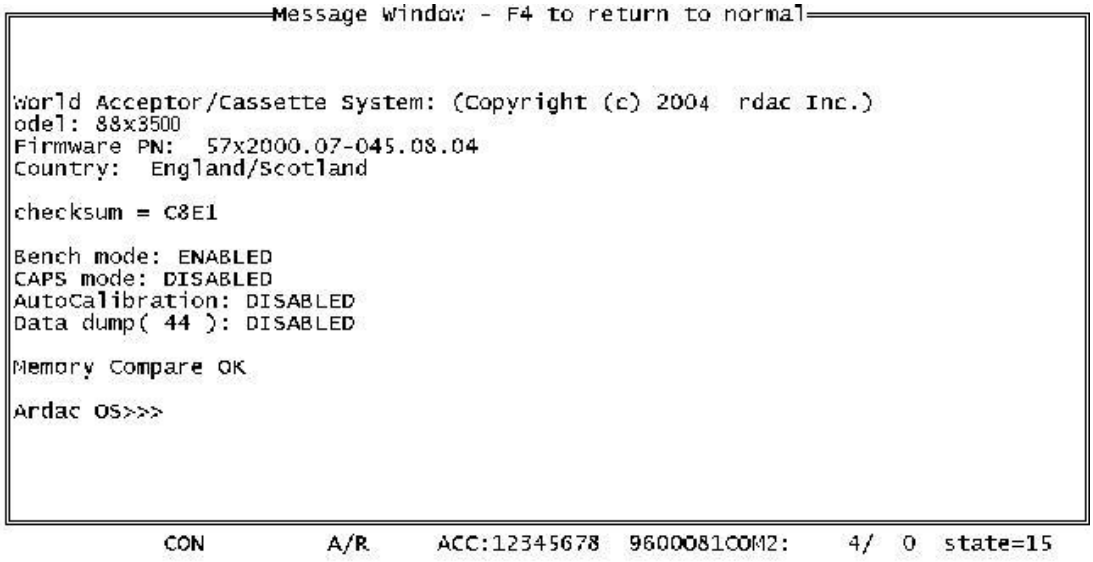


Figure 4-5
"Message Window" screen

STATUS ELEMENT	MEANING
STK	The stacker is under control of the acceptor.
ESC	The acceptor is in escrow mode.
DEB	The acceptor is in debug mode.
CON	The host will automatically reconfigure the acceptor on receipt of a request for reconfigure.
POL *	The host will periodically poll the acceptor.
INQ *	The host will automatically perform an inquire input at a certain time.
A/R	The host, when in escrow mode, will automatically accept or reject a note in for a credit signal was received.
SIM	The host is in host simulation mode (as opposed to transparent mode).
ACC:12345678	This shows which notes are acceptable.
9600O81COM1:	(9600/O/8/1/COM1) The baud rate, parity, bits per byte, stop bits, and com port for the serial communications.
2/3	The present value of the system clock (in 1/18 sec) and the time at which it will time-out waiting for some event.
state = 1	The state of the host simulation.

* The POL and INQ flags in HOST.EXE Version 1.0 have no function and are included for future releases.

Table 4-1
Description of Host Messages

ARDAC-2 Host Simulator Set-up

After the connections have been made, ensure that the note acceptor and cassette are installed and fully seated in the chassis. Then proceed with the following steps:

1. Apply power to the computer. Allow the computer to boot and load operating system.

2. Start the Host Simulator by running the HOST.EXE file from the DOS prompt or by creating and using a shortcut on your Windows™ desktop. Configure the software for the serial port where the note acceptor is connected.

3. The software will start in Auto-Polling Mode unless this mode was disabled during a previous operating session. The "From Host", "From Computer", and "Communications" windows will show the polling activity.

   - If Auto-Polling is ON, proceed to step 4.

   - If Auto-Polling is OFF, press the F3 function key to access the Options Menu. Select Auto-Polling from the menu options and press the Enter key. When Auto-Polling starts, proceed to step 4.

4. Apply power to the ARDAC-5, and wait for the stacker punch twice indicating completion of the power-up sequence.

Diagnostic (Bench) Mode

1. The diagnostics or "Bench" mode on a ARDAC-5 can be accessed by using the ARDAC-2 Host simulator and placing the acceptor into setup mode or by using the diagnostic cable and interfacing to a computer using Windows Hyper Terminal™

   A serial communications program such as Windows Hyper Terminal™ set to 19,200 baud, odd parity, 8 data bits and one stop bit can be used to access the diagnostics mode if using the 5 pin diagnostics port. After the ARDAC-5 completes power-up, start Diagnostic (Bench) mode by hitting <ESC> <ESC> <ESC> <B>

2. Hitting the <ENTER> key by itself while in diagnostics will display a block of information containing the following information:

Model	88x35xx	
FIRMWARE NO:	57xVVV-RR	(VVV = Version, RR = Revision)
CHECKSUM:	CCCC	(CCCC = hex checksum)
Country		

Bench mode: ENABLED
CAPS mode: DISABLED
Auto calibration: DISABLED
Data dump(44): DISABLED

Diagnostic (Bench) Mode Operations

With Diagnostics mode enabled, the technician can operate the System directly from the P.C. keyboard. The Host software will monitor and control:

- Monitoring Note Acceptance
- Calling Up Calibration Voltages
- Controlling the Note Transport Motor
- Controlling the Stacker Drive Motor
- Data gathering
- Auto Calibrate Mode
- Read and clear data from Smart Cassette system (If installed)

The CAPS and data dump modes are for factory use.

The available commands are shown below:

Valid Commands:

ACAL = auto calibration mode
B = toggle Bench mode
C = caps dump
D = data dump
E = Easy-quick note caps dump
J = Real Time Sensors Debug
K = Verbose Vend Mode
M = Mag calibration
NOW = clear smart cassette data
P = previous note caps dump
R = register dump
q = quick dump (use lower case q)
SB = barcode test card process
SI = total number of notes inserted
SS = number of points per note
SN = get unit serial number
SWnnnnnnnn = write serial number nnnnnnn
V = auto zero voltage dump
Y = smart cassette data dump
1 = toggle transport forward
2 = toggle transport reverse
5 = stacker 1 cycle
6 = toggle TNT act/deact
? = This display

Table 4-2. Diagnostic Control Keys

To Monitor Note Acceptance:

Each time a note / barcode is inserted in the note acceptor, the computer display will return one of two message strings.

- If the note / barcode is accepted, the display responds in the following format (actual messages or numbers may differ):

  Note = Denomination: (EURO) 10 EURO (f u t l)

  Barcode = BARCODE:000000000000000392

  Time to ESCROW: tttt sec.
  Time to credit: tttt sec.
  Time to irretrievable: tttt sec.
  Time to IDLE: tttt sec.

If a note / barcode is inserted and then rejected, the display shows:

Diagnostic Code = 00C0 Correlation error
Note .
Table 0

frtl f0 0000
frtr f2 0000
tv/i 64 0000
ti/1 65 0000
bv/i 63 0000
bi/1 66 0000
dden 00 0000
magma 80 0000
1st 0000
2nd 0000
Total 0000

FrtSum = 0000 TopSum = ffff BotSum = ffff

mag delta sum = 1559
note length = 0186, 6.212399 in
Denomination: No Correlation
Barcode scan error

Number of notes inserted so far is 3
Percentage of notes accepted is 100%
no correlation

The number following “Diagnostic Code” will be most useful in determining the cause of the error condition or reason for note rejection. Table 4-3 shows a collection of error codes and their meaning.

To Control The Transport Motors:

To toggle the acceptor motors forward or reverse, and ON or OFF, press the numeral keys 1 or 2 as shown below. The cassette must be left in place to enable these operations. If the cassette is removed, the actuator lever on the top of the Stacker Present switch must be taped down to simulate the presence of the cassette. No specific printout information will appear on the computer display.

1 (Toggle transport motor forward ON/OFF)
2 (Toggle transport motor reverse ON/OFF)

To Cycle The Cassette Stacker:

To run the stacker motor through one cycle, press the numeral key 5. No specific printout information will appear on the PC display.

5 (Cycle stacker motor)

To Control The TNT Lamps:

To toggle the TNT lamps ON or OFF, press the letter key T. To avoid unnecessary heating of the sensors, keep lamp ON-time to a minimum during such checks (a few seconds).

6 (Toggle TNT lamps ON/OFF)

ERROR	MEANING
01	Transport trigger note reached in time.
02	Note Handling Error (improper transportation of note)
03	Stalled motor
04	2nd note in transport
05	Transport jammed
06	Note position error
07	Long note
08	Short note
09	Tampering Error (possible String Sensor problem)
10	Host disabled
11	Host has disabled acceptor or has inhibited a note denomination
20	Cassette stacker full or missing
21	Cassette stacker not in the home position
22	Error while cassette stacker was attempting to punch a note.
30	Message sent to host, but no response received.
31	Error occurred when acceptor head was attempting to drive note into cassette stacker
32	Error occurred during protocol exchange between host and ARDAC-5.
A0	TNT EEPOT is out of range
A1	Top TNT VIS channel EEPOT is out of range
A2	Top TNT IR channel EEPOT is out of range
A4	Bottom TNT VIS channel EEPOT is out of range
A8	Bottom TNT IR channel EEPOT is out of range
B0	Barcode scan error
B1	Barcode invalid start pattern
B2	Barcode invalid stop pattern
B3	Barcode invalid code pattern
B4	Ticket density over limit
7D	DAC at High Rail
7E	DAC at Low Rail
7F	Calibration unstable
80	EPROM checksum error
81	Microprocessor internal RAM problem
82	Microprocessor board (external) RAM problem
B0	String detector calibration error
C0	Inability to identify note based on stored note data
C1	Density calibration failed to complete within 10 sec time-out
C2	TNT calibration failed to complete within 10 sec time-out
C3	String sensor covered or detected an obstruction
C4	Touch memory read/write error (smart cassette system only)

Table 4-3. Error Codes

To Show Calibration Voltages:

After communications are established and the acceptor has been enabled, press the V key. A display similar to the one below will appear on the computer display.

Top Vis Voltage = 1.99 Volts (102) ee pot: 12/31
Top IR Voltage = 1.97 Volts (101) ee pot: 09/31
Bottom Vis Voltage = 1.97 Volts (101) ee pot: 16/31
Bottom IR Voltage = 1.99 Volts (102) ee pot: 19/31
Left Front Voltage = 4.70 Volts (target=4.72 V) DAC Setup = 107/255
Right Front Voltage = 4.70 Volts (target=4.72 V) DAC Setup = 125/255
IR Density Voltage = 4.70 Volts (target=4.72 V) DAC Setup = 73/255
Red Density Voltage = 4.72 Volts (target=4.72 V) DAC Setup = 170/255
String Detect Voltage = 2.34 Volts (target=2.34 V) DAC Setup = 94/255
IR Density Calibration: Slope=058, Diffusion Offset=+0.46, Cal Open V=4.72
Red Density Calibration: Slope=109, Diffusion Offset=-0.27, Cal Open V=4.70

********* CALIBRATION PASSED *********

PRESS <ENTER> TO CONTINUE...

Current Mag Gain Value = 23

DIP Switch1: 1 2 3 4 5 6 7 8
off off off off off off off off
DIP Switch2: 1 2 3 4 5 6 7 8
off off on off off on off off

Table 4-4. Diagnostic (Bench) Mode Voltage Printout

To Show Smart Cassette Data:

After communications are established and the acceptor has been enabled, press the "Y" key. A display similar to the one below will appear on the computer display.

```
Y
Chassis SN = 01 3e 1b 52 07 00 00 6a

Record 1 -- Chassis SN in Cassette = 01 8f be 87 02 00 00 0e
VEND[1-16] = 0 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0
Correlation Reject Count = 0   Note Handling Reject Count = 0
Tamper Count = 0   Acceptor Jam Count = 0
TIME since record 1 started = 8 days, 1 hours, 21 minutes, 11 seconds
Cassette RAM CRC = 57 78

Record 2 -- Chassis SN in Cassette = 01 3e 1b 52 07 00 00 6a
VEND[1-16] = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Correlation Reject Count = 0   Note Handling Reject Count = 0
Tamper Count = 0   Acceptor Jam Count = 0
TIME since record 2 started = 0 days, 2 hours, 30 minutes, 15 seconds
Cassette RAM CRC = d7 3a
```

There can be as many as 4 records stored in the cassette memory. The data displayed above can be broken down as follows:

1. The first line showing the chassis SN is the electronic serial number stored in the chassis memory button.

2. The VEND [1-16] will show how many of each denomination has been stacked in the cash box since the last time the memory was cleared. The first character is the lowest denomination; the second character is the second lowest denomination. This is repeated up to the highest denomination. 16 locations are allocated but generally, not all locations are required since most countries do not have 16 denominations.

3. The Correlation reject count shows how many notes were rejected because they could not be recognized.

4. The note handling reject count shows how many notes were rejected due to poor insertion or handling.

5. The tamper count shows how many times the acceptor saw a condition that appeared to be attempted tampering with the note acceptor.

6. The Acceptor jam count shows how many times the acceptor detected a note jam.

7. The Time since record started shows how long it has been since that cassette was either:

   A. Cleared by docking station or computer

   B. Installed into a chassis with a different serial number

Dual Density Calibration

Dual Density Calibration Card (Money Controls part number 49x307) is required to perform this calibration procedure. If this card is not available, obtain one from Money Controls before starting this procedure. Please note that the unit is calibrated at the factory and should not need routine re-calibration by the end user. The probability that poor acceptor operation is caused by improper calibration is very low. Calibration should only need to be performed after a unit has had a circuit board changed or an optical part was changed in the density circuit. **THE CALIBRATION CARD ONLY AFFECTS THE DENSITY CIRCUIT AND WILL NOT CORRECT ANY OTHER PROBLEMS.**

CAUTION

Calibrating the acceptor with anything other than the calibration card specified will cause poor or no note acceptance.

Calibration Procedure

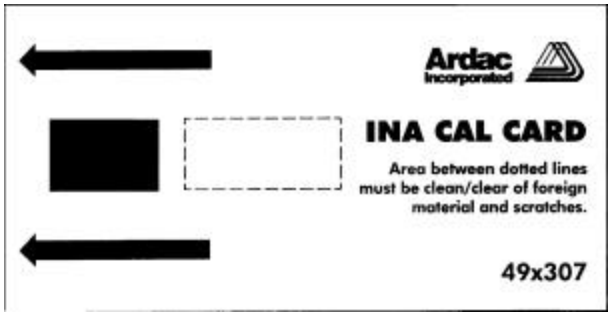
1. Follow the instructions in the Diagnostics section of this manual to:
   - Install and set-up the equipment for bench mode operations.
   - Set up the Windows Hyper Terminal™ software for bench mode operations.
   - Start bench mode as described in the Diagnostics section above.

2. Once bench mode is active, access the Message Window. The screen display includes an auto calibration status line that reads:

   Autocalibrate: DISABLED

3. With the Message Screen displayed, start the Auto Calibration sequence by typing ACAL. The CAPS software responds with the message:

   Insert the calibration card



4. Using only a Money Controls 49x307 Calibration Card, insert the card into the acceptor. As shown below:

5. The card is drawn into the acceptor and returned after a second.

6. The message “Calibration Passed” and the new calibration values display on the monitor. The unit is calibrated.

7. At the end of its calibration sequence, the acceptor automatically leaves Auto Calibrate Mode. When the Message Screen displays again, the Auto Calibration status line will read:

Autocalibrate: DISABLED

5
Maintenance

Introduction

The Money Controls ARDAC-5 provides maximum performance with a minimum of service and maintenance. Typical maintenance consists of periodic inspection and cleaning of:

- Sensor Surfaces
- Drive Components
- Note Path Components

Adjustments

The ARDAC-5 sensors are self-adjusting and do not require routine electronic calibration.

Calibration Card

If the performance of the machine indicates that calibration is required, the user can enter a "Quick Calibrate" mode through the use of a dip switch. This procedure is listed below. Use of the calibration card will only correct calibration errors in the dual density (Center round) sensor. The original calibration is done at the factory. The unit should not need to be calibrated again unless the microprocessor, top sensor board or bottom sensor board have been changed. Also, if a part in the dual density has been changed, calibration is suggested.

"Quick Calibration"

Dip Switch 8 on switch bank #2 will be used to enable and disable “Quick Calibration”. Setting the switch to ON will enable the calibration. Setting the switch to OFF will disable the calibration.

1. Beginning Calibration
   a. Place Switch 2-8 to the ON position.
   b. Supply power to the unit.
   c. Wait until the stacker cycles twice before inserting the calibration card. (The unit needs to complete its power up calibration before the Calibration Card is inserted. The presence of anything on the front sensors before power up calibration is finished will cause a delay in the power up calibration.)
   d. The cycling of the stacker is the signal that power up calibration is complete.

2. Ending Calibration (Within Limits)

   a. If the unit passes the calibration test, the Calibration Card will be returned, the stacker will cycle once, and the unit will be disabled.
   b. It will not take any more note insertions until Switch 2-8 is set to OFF and the power is cycled.

3. Ending Calibration (Outside of Limits)

   a. If the unit fails the calibration test, the Calibration Card will be returned, but the unit will not be disabled.
   b. The Calibration Card can be reinserted until the calibration passes.

3. Power up Hardware Tests
   a. To minimize the time needed to perform the "Quick Calibration", none of the power up hardware tests will be executed.
   b. The Power Up Calibration still needs to be performed. (Stacker cycles twice at power up)

4. Operation without a stacker
   a. The "Quick Calibration" can be performed without a stacker.
   b. All of the steps to perform the calibration are the same, with or without a stacker.
   c. The stacker motor will still run to signal the user if a stacker is not installed.

Cleaning

Banknote handling devices normally build up a film of oil and dirt from the banknotes themselves. The ARDAC-5 has been designed to operate for extended periods of time between cleanings. If excessive dirt builds up on the transport drive mechanism or sensors, poor acceptance may result. The note path should be cleaned at least once a year. More frequent cleaning may be required depending on the location, frequency of usage, and condition of the banknotes taken in.

Cleaning Materials

CAUTION

OIL-BASED SOLVENTS WILL ATTACK RUBBER PARTS, CAUSING PREMATURE FAILURE. AGGRESSIVE AROMATIC SOLVENTS WILL ATTACK OR MELT PLASTIC COMPONENTS AND PAINT

When cleaning the ARDAC-5, use the following materials:

- Clean, soft lint-free clothes
- 99% Isopropyl Alcohol

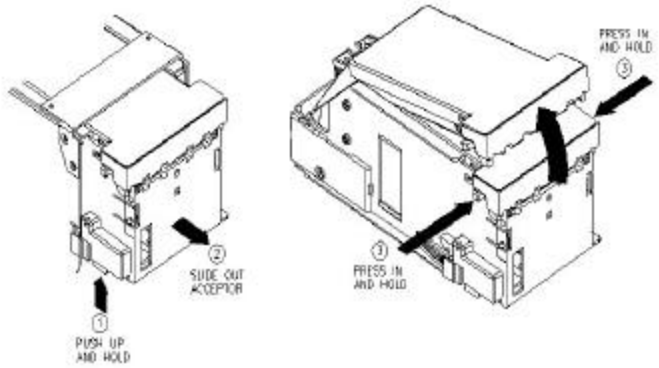


Figure 5-1 Removing and Opening Acceptor

Cleaning Instructions

Clean the acceptor and note path as follows:

1. Turn off power to the System.
2. Locate the release tab on the left side the acceptor. Press the tab upward, and while maintaining pressure on the tab, slide the note acceptor out of the chassis (Figure 5-1).
3. Open the acceptor by simultaneously pushing the acceptor cover releases on either side of the acceptor top inward. While maintaining pressure on the releases, swing the top cover open to expose the note path and sensors.
4. Inspect the condition of the belts, gears and sensor surfaces in the bottom sensor plate. The belts should not be frayed, glazed, nicked, or worn. Also inspect the rollers in the top sensor plate. Rollers should be smooth and not show signs of wear, abrasion, or other damage.
5. Check the condition of the sensor windows and grays scales in the top and bottom sensor plates. These surfaces should not be worn, scratched, or discolored.
6. Dampen a lint-free cloth with 99% isopropyl alcohol. Make sure the cloth is not soaked so much that alcohol will drip from it into the acceptor. Wipe the inside of the note path. Make sure to clean pressure wheels on top, belts, windows and gray-scale plastic. After exposed portion of belts are cleaned, rotate large white gear on rear of acceptor to expose the portion of the belts that have not been cleaned and repeat cleaning until all of belts are clean.
7. Locate the other note sensor sets in the top and bottom sensor plates. Use a cotton swab moistened with alcohol the sensors if required.
8. Routine lubrication of this product is not required.

NOTE:
Do not clean small round sensors unless a film or dirt is visible on the lens

Using Cleaning Card Mode

A cleaning card can be used for a quick cleaning where only the belts and pressure wheels need to be cleaned. There is a special mode set using dipswitches and a 49x315 pre-soaked cleaning card. It is recommended that the acceptor be inspected for dirty or damaged components in the note path. Use of a cleaning card should not replace routine inspection of the note path by opening acceptor and inspecting the belts, wheels, windows and levers for proper operation.

1. Setting switches on the micro board enters the cleaning card mode. (See switch setting table in section 1)
2. Set unit into cleaning card mode according to switch settings in section 1.
3. Install unit into host machine and apply power.
4. Wait for stacker to cycle out and back two times.
5. Insert Money Controls 49X315 cleaning card while holding end of cleaning card firmly.
6. The motors should run for approximately 6 seconds.
7. Do not allow the entire card to be pulled inside machine.
   (The belts should be moving while card is held stationary)
8. If the cleaning card does accidentally slip into the machine, it will be returned to you.
9. The card should be inserted in all four directions to assure adequate cleaning of belts.
   (It is normal to see black marks on the cleaning card from the dirt on the acceptor belts.)
10. After running the cleaning card, open the unit and wipe the note path with a cloth to clear any remaining debris from the note path. (Dampen cloth with alcohol if required to remove foreign material)
11. After cleaning, turn cleaning card mode off with the DIPswitches.
12. Discard cleaning card

6
ARDAC-5 Diagnostic Interface

Introduction

The DB-25 interface connector provides interface to the ARDAC-5 system communication lines. This interface is used by the host machine and can also be used to run the acceptor on a test bench with a computer running a host simulator program.

Description

The ARDAC-5 system should be connected as illustrated below for bench operation:

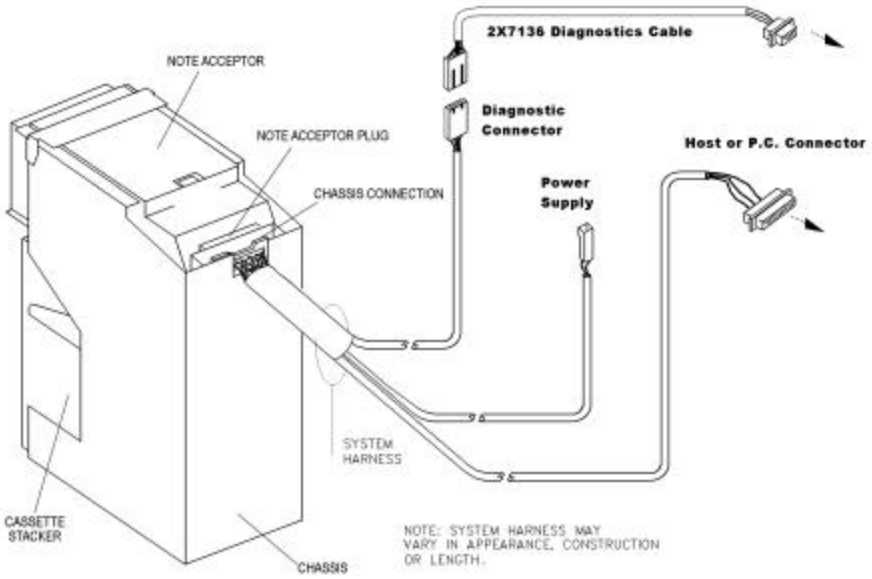


Figure 6-1
Host Simulator Connections

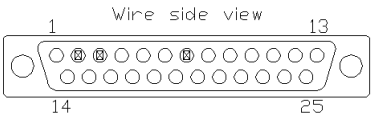


Figure 6-2
DB-25F Communications connector pin-out

Communications Parameters

The 5 pin diagnostic connector connects the ARDAC-5 and the computer using a special 2x7136 diagnostics cable as illustrated below:

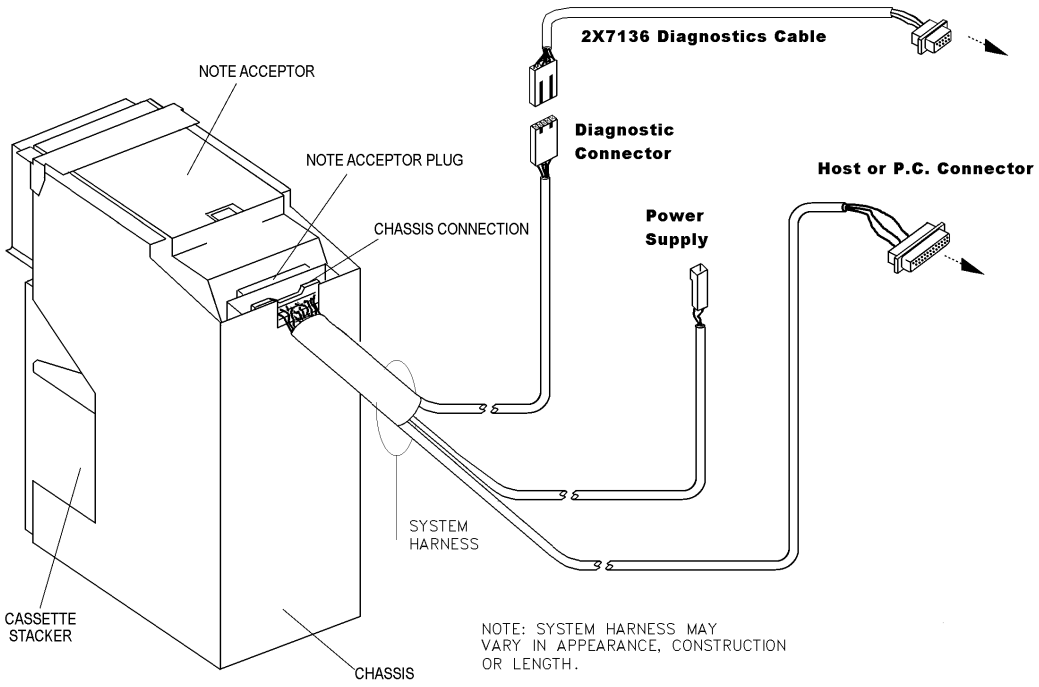


Figure 6-3
Diagnostics Interface

Bench Mode using Diagnostic Connector

1. The diagnostics or "Bench" mode on a ARDAC-5 can only be accessed by connecting a 2X7136 interface cable to the black 5 pin connector on the chassis as shown in Fig. 4-2.

2. A serial communications program such as Windows Hyper Terminal™ set to 19,200 baud, odd parity, 8 data bits and one stop bit should be used to access the diagnostics mode. After the ARDAC-5 completes power-up, start Diagnostic (Bench) mode by hitting <ESC> <ESC> <ESC> <B>
A screen similar to the following should appear:

```
World Acceptor/Cassette System: (Copyright (c) 2004 Money Controls Inc.)
Model: 88x35xx
Firmware PN:  57x2000.07-045.08.04
Country:  England/Scotland

checksum = C8E1

Bench mode: ENABLED
CAPS mode: DISABLED
AutoCalibration: DISABLED
Data dump( 44 ): DISABLED

Memory Compare OK

Ardac OS>>>
```

Bench Mode Operations using Diagnostic Connector

With Diagnostics mode enabled, the technician can operate the System directly from the P.C. keyboard. The Host software will monitor and control:

- Monitoring Note Acceptance
- Calling Up Calibration Voltages
- Controlling the note transport motor
- Controlling the stacker drive motor
- Data gathering
- Auto Calibrate Mode
- Read and clear Smart Cassette data (If smart option is installed.)

The CAPS and data dump modes are for factory use.

Valid Commands:
ACAL = autocalibration mode
B = toggle Bench mode
C = caps dump
D = data dump
E = Easy-quick note caps dump
J = Real Time Sensors Debug
K = Verbose Vend Mode
M = Mag calibration
NOW = clear smart cassette data
P = previous note caps dump
R = register dump
q = quick dump (use lower case q)
S = number of points per note
SB = barcode test card process
SI = total number of notes inserted
SS = number of points per note
SN = get unit serial number
SWnnnnnnnn = write serial number nnnnnnn
V = auto_zero voltage dump
Y = smart cassette data dump
1 = toggle transport forward
2 = toggle transport reverse
5 = stacker 1 cycle
6 = toggle TNT act/deact
? = this menu display

Table 4-2
Diagnostic Control Keys

To Show Calibration Voltages:

After communications are established and the acceptor has been enabled, press the V key. A display similar to the one below will appear on the computer display.

Top Vis Voltage = 1.99 Volts (102) ee pot: 12/31
Top IR Voltage = 1.97 Volts (101) ee pot: 09/31
Bottom Vis Voltage = 1.97 Volts (101) ee pot: 16/31
Bottom IR Voltage = 1.99 Volts (102) ee pot: 19/31
Left Front Voltage = 4.70 Volts (target=4.72 V) DAC Setup = 107/255
Right Front Voltage = 4.70 Volts (target=4.72 V) DAC Setup = 125/255
IR Density Voltage = 4.70 Volts (target=4.72 V) DAC Setup = 73/255
Red Density Voltage = 4.72 Volts (target=4.72 V) DAC Setup = 170/255
String Detect Voltage = 2.34 Volts (target=2.34 V) DAC Setup = 94/255
IR Density Calibration: Slope=058, Diffusion Offset=+0.46, Cal Open V=4.72
Red Density Calibration: Slope=109, Diffusion Offset=-0.27, Cal Open V=4.70

******** CALIBRATION PASSED ********

PRESS <ENTER> TO CONTINUE...

Current Mag Gain Value = 23

DIP Switch1: 1 2 3 4 5 6 7 8
off off off off off off off off
DIP Switch2: 1 2 3 4 5 6 7 8
off off on off off on off off

Table 4-3
Acceptor Voltage display

To Show Smart Cassette Data:

After communications are established and the acceptor has been enabled, press the "Y" key. A display similar to the one below will appear on the computer display.

```
Y
Chassis SN = 01 3e 1b 52 07 00 00 6a

Record 1 -- Chassis SN in Cassette = 01 8f be 87 02 00 00 0e
VEND[1-16] = 0 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0
Correlation Reject Count = 0   Note Handling Reject Count = 0
Tamper Count = 0   Acceptor Jam Count = 0
TIME since record 1 started = 8 days, 1 hours, 21 minutes, 11 seconds
Cassette RAM CRC = 57 78

Record 2 -- Chassis SN in Cassette = 01 3e 1b 52 07 00 00 6a
VEND[1-16] = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Correlation Reject Count = 0   Note Handling Reject Count = 0
Tamper Count = 0   Acceptor Jam Count = 0
TIME since record 2 started = 0 days, 2 hours, 30 minutes, 15 seconds
Cassette RAM CRC = d7 3a
```

There can be as many as 4 records stored in the cassette memory. The data displayed above can be broken down as follows:

1. The first line showing the chassis SN is the electronic serial number stored in the chassis memory button.

2. The VEND [1-16] will show how many of each denomination has been stacked in the cash box since the last time the memory was cleared. The first character is the lowest denomination. The second character is the second lowest denomination. This is repeated up to the highest denomination. 16 locations are allocated but generally, not all locations are required since most countries do not have 16 denominations.

3. The Correlation reject count shows how many notes were rejected because they could not be recognized.

4. The note handling reject count shows how many notes were rejected due to poor insertion or handling.

5. The tamper count shows how many times the acceptor saw a condition that appeared to be attempted tampering with the note acceptor.

6. The Acceptor jam count shows how many times the acceptor detected a note jam.

7. The Time since record started shows how long it has been since that cassette was either:

   A. Cleared by docking station or computer

   B. Installed into a chassis with a different serial number

7
Recommended Spare Parts And Diagrams

Introduction

This section provides service, repair, and recommended spare parts information. The parts diagrams listed in Table 7-1 may be ordered from the Money Controls. The Money Controls address, phone, and fax numbers are provided in the front of this manual.

Service and Replacement Parts Manual

The comprehensive Service And Replacement Parts Manual covers all models of ARDAC-5 systems. The manual is a supplement to this Specification and Adjustment Manual. Refer to it when ordering service and replacement parts. The diagrams and parts lists of the manual cover:

- ARDAC-5 Acceptor Parts
- ARDAC-5 Stacker Parts
- ARDAC-5 Chassis Parts

To order this manual, contact the Money Controls.

Spare Parts Recommendation

A list of recommended spare parts is provided in Table 7-1. This list includes only the spares for the System listed. To obtain quantity recommendations and current pricing, contact the Money Controls.

Board Locations

The printed circuit boards, which control the system, are located in the acceptor. The board locations are illustrated in Figure 7-1.

Bottom Sensor Board

The bottom sensor board is located in the inside of the note acceptor, immediately beneath and parallel to the note path.

Top Sensor Board

The top sensor board is located within the lid of the acceptor. The top cover must be removed to gain access to this board.

Microprocessor Board

The microprocessor board is located inside the note acceptor, on the left side of the acceptor.

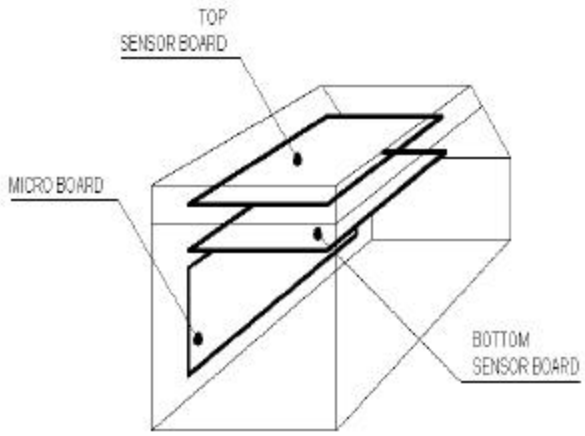


Figure 7-1 Circuit board Locations

Major Components Part Description	Part Number	Spare Parts Ordering Number
Ardac-5 System (Complete)	77X500	77X500
Acceptor Head Transport Assembly	883505, 883510	883505, 883510
- Internal Harness, Acceptor Head	WMH/443	SACSDEXX00082
- Micro PCB	0272970002	SACSDEXX00014
- Top Sensor PCB	027295	SACSDEXX00002
- Bottom Sensor PCB	027296	SACSDEXX00012
- Top TNT Head	0225870030	T0225870030
- Bottom TNT Head	0225870031	T0225870031
- Main Drive Belt Assembly	SUB/4434	SACSDEXX00087
- Stacker Drive Gearbox Assembly	SUB/4435	SACSDEXX00086
- Stacker Drive Motor	MOT/039	SACSDEXX00024
- Transport Motor Assembly	027294	SACSDEXX00089
- Transport Motor	500046	T500046
- Drive Belts	290172	T290172
- Dual Density LED	SOT/076	SACSDEXX00088
- Rear Position Sensor Transmitter Assy.	WMH/476	SACSDEXX00084
- Rear Position Sensor Receiver Assy.	WMH/477	SACSDEXX00085
Chassis	027096	T027096
- Chassis Harness	027095	T027095
- Stacker Home Sensor (PS5042)	560544	T560544
- Stacker Home L.E.D. P.C. BD.	206232	T206232
Cassette Stacker (Plastic)	480862	480862
Cassette Stacker (Metal)	480827	480827

Table 7-1
Major Components Spare Parts List

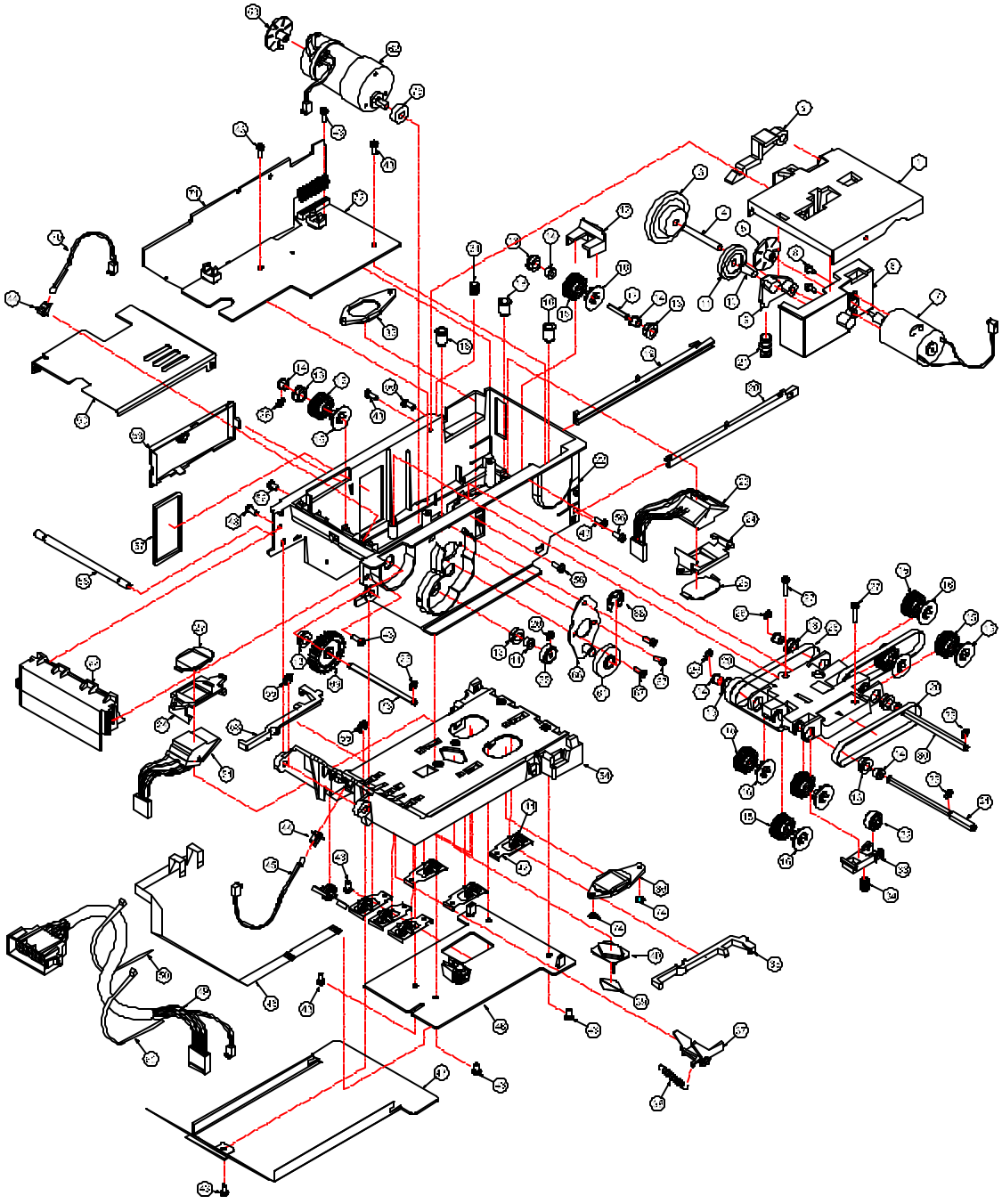


Figure 7-2
Exploded view

Acceptor Head Transport Assembly
88X3505, 88X3510 PARTS LIST

PARTS LIST 88X3505, 88X3510 – Acceptor Head Transport Assembly

ITEM	PART NO.	PART DESCRIPTION	SPARE PARTS ORDERING NUMBER
#1	PBL/1536	PLATE PUNCH DRIVE	SACSDEXX00011
#2	PBL/1542	LATCH ACCEPTOR	SACSDEXX00020
#3	180113	COMBINATION GEAR	T180113
#4	MET/962	SHAFT COMBINATION GEAR	SACSDEXX00021
#5	PBL/1558	TACH WHEEL	SACSDEXX00022
#6	PBL/1530	MOUNT PUNCH DRIVE	SACSDEXX00023
#7	MOT/039	STACKER MOTOR	SACSDEXX00024
#8	HSC/754	M2.6 X 5 POZI PAN SCREW	SACSDEXX00025
#9	PBL/1534	LEVER PUNCH COUPLER GEAR	SACSDEXX00026
#10	MET/963	SHAFT COUPLER GEAR	SACSDEXX00027
#11	PMC/814	PUNCH COUPLER GEAR	SACSDEXX00028
#12	PBL/1535	FRONT PULLEY MOUNT	SACSDEXX00029
#13	PBL/1547	DRIVE SHAFT BEARING	SACSDEXX00030
#14	PBL/1538	BUSHING SQUARE SHAFT	SACSDEXX00031
#15	PBL/1557	PULLEY 080P 28T	SACSDEXX00045
#16	PBL/1562	PULLEY 080 28T	SACSDEXX00046
#17	MET/955	SHAFT FRONT DRIVE	SACSDEXX00047
#18	PBL/1533	LED COVER	SACSDEXX00048
#19	PBL/1527	NOTE CHANNEL L.H.	SACSDEXX00049
#20	PBL/1528	NOTE CHANNEL R.H.	SACSDEXX00050
#21	SPR/133	SPRING, LEVER	SACSDEXX00051
#22	PBL/1525	BOTTOM SENSOR PLATE	SACSDEXX00052
#23	0225870031	TNT (BOTTOM)	T0225870031
#24	171351	TNT SNAP MOUNT	T171351
#25	171349	CLEAR WINDOW	T171349
#26	HCR/206	E-RING	SACSDEXX00053
#27	HCS/336	NO. 4 X 7/16 PH Z/P SCREW	SACSDEXX00054
#28	290172	BELT 93T	T290172
#29	PBL/1541	MOUNT BELTS & PULLEYS	SACSDEXX00007
#30	MET/960	SECOND AXLE	SACSDEXX00055
#31	MET/968	THIRD AXLE	SACSDEXX00056
#32	PBL/1537	WHEEL MAG PRESSURE	SACSDEXX00057
#33	PBL/1532	MAG PRESSURE LEVER	SACSDEXX00058
#34	SPR/134	SPRING, MAG PRESSURE	SACSDEXX00059

#35	PBL/1540	TOP LATCH R.H.	SACSDEXX00060
#36	171350	GREY SCALE	T171350
#37	PBL/1531	REAR CLEAR ACTUATOR	SACSDEXX00061
#38	SPR/130	SPRING, REAR CLEAR	SACSDEXX00062
#39	MET/969	BARCODE MASK	SACSDEXX00063
#40	PBL/1561	WINDOW, BARCODE SENSOR	SACSDEXX00006
#41	PBL/1543	IDLER WHEEL	SACSDEXX00064
#42	SPR/129	IDLER SPRING	SACSDEXX00065
#43	HSC/149	SCREW 4.20 X 5/16 POZI PAN	SACSDEXX00066
#44	PBL/1545	OPTO MOUNT	SACSDEXX00067
#45	WMH/477	HARNESS, PHOTOTRANSISTOR	SACSDEXX00043
#46	027295	TOP SENSOR BOARD	SACSDEXX00002
#47	MET/953	UPPER LID	SACSDEXX00068
#48	WMH/474	CABLE- FFC 16 WAY 270MM	SACSDEXX00069
#49	WMH/443	HARNESS ARDAC-5 INTERNAL	SACSDEXX00082
#50	HCT/001	CABLE TIE	SACSDEXX00070
#51	0225870030	TNT HEAD –TOP	T0225870030
#52	PBL/1529	REAR TOP SENSOR PLATE	SACSDEXX00010
#53	PBL/1539	TOP LATCH L.H.	SACSDEXX00071
#54	PBL/1526	TOP SENSOR PLATE	SACSDEXX00008
#55	HCT/207	E-RING	SACSDEXX00072
#56	HSC/079	M3 X 6 ZINC + PAS	SACSDEXX00073
#57	171792	E-PROM COVER	T171792
#58	MET/952	ARDAC-5 ROD PIVOT	SACSDEXX00074
#59	PBL/1544	WIRE COVER	SACSDEXX00075
#60	MET/274	LOWER LID	SACSDEXX00076
#61	180112	INTERMEDIATE IDLER GEAR	T180112
#62	027294	TRANSPORT DRIVE GEAR	T027294
#63	PBL/1651	TRANSPORT TACH WHEEL	SACSDEXX00077
#64	SPR/131	SPRING, LATCH	SACSDEXX00078
#65	180111	DRIVE GEAR	T180111
#66	MET/967	AXLE PLATE	SACSDEXX00079
#67	HSC/083	M3 X 12 P/PAN M/S	SACSDEXX00080
#68	310091	CIRCLIP	T310091
#69	PBL/1552	GEAR DRIVE DOWN COUPLER	SACSDEXX00081
#70	WMH//476	HARNESS (LED)	SACSDEXX00044
#71	0272970002	ARDAC5 MICRO BOARD	SACSDEXX00014
#72	027296	BOTTOM SENSOR BOARD	SACSDEXX00012
#74	MET/954	SHAFT, REAR DRIVE	SACSDEXX00091
#75	180114	MOTOR OUTPUT GEAR	T180114
#76	310091	RETAINING RING, MOTOR GEAR	T310091