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**APPENDIX H  
OF  
TEST REPORT T31109\_F**

**TEST SAMPLE TECHNICAL(USER) MANUAL**

**FCC ID:** Q47-CID1D  
**Manufacturer:** ERG Ltd  
**Test Sample:** Card Interface Device (CID1B)  
**Model:** 18186  
**Serial No:** 03222860

**Date:** 13<sup>th</sup> November 2003



**ERG**

**GROUP**

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## Device Product Group

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### CID1B Field Maintenance Manual

**Document No:** DPG-00253

**Category:** 434

**Revision:** 1

<b>ERG Approvals</b>	<b>Author</b>	<b>Process Manager</b>	<b>Manager</b>
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## Document History

Revision	Revision Date	Description	Author
0.1	11 Nov 03	Initial Draft	William Rivera
1.0	13 Nov 03	Initial Release	William Rivera

## FCC Compliance Statement

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

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encourage to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The CID1B was submitted and a grant of authorisation received from the FCC under the intentional radiator requirements of part 15, Subpart C.

**Warning:** Any changes or modifications not expressively approved by ERG Transit Systems could void the user's authority to operate this equipment

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# 1 Introduction

## 1.1 Purpose

This manual describes the field maintenance procedures (refer to Section Maintenance Structures Overview) for the Card Interface Device (CID1b).

## 1.2 Scope

The manual provides a technical description of the removal, replacement and maintenance procedures for the CID1b. Information contained within this manual allows on site, first line maintenance only.

*Note: The maintenance procedures of the CID1b described in this manual may vary slightly between operators to cater for their individual requirements.*

## 1.3 Terminology

The following table contains a list of Equipment Terminology and their meanings.

**Table 1: Terminology**

Term	Definition
CID	Card Interface Device
CSC	Contactless Smart Card
DC	Driver Console
Hz	Hertz
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MTTR	Mean Time To Repair
Patron	Passenger or customer
PCB	Printed Circuit Board
PID	Patron Information Display
POST	Power On Selt-Test

## 2 Overview

The Card Interface Device (CID1B) is used when passengers board a vehicle in order to validate a contact-less smart card. Passengers are able to use their smart card to travel with various operators on all modes of public transport including train, light rail, bus, and ferry services.

Contact-less smart cards are credit-card sized, battery-less, encrypted, portable memory devices that have the facility to store patron information and a value of currency within their electronic "Purse". The operator can assess the value and deduct the payment for any trips electronic "Purse".



Figure 1: CID1B Card Interface Device

### 2.1 Maintenance Structure Overview

Maintenance activities for the CID1B are divided into two categories:

1. First Line Maintenance
2. Third Line Maintenance

**Note:** *Second Line Maintenance is not applicable to the CID1B. (Refer to 2.2.)*

Factors that distinguish the two categories include:

- The level of skill required.
- Complexity of test equipment and tools required.
- The need for workshop facilities.
- The feasibility of maintenance activities being performed on-site.

### 2.2 First Line Maintenance

As a rule, field maintenance is performed on-site and does not require workshop facilities, specialised test equipment or tools. Only basic technical knowledge is required, and work is performed according to set procedures. In most cases the Transit Operators will provide First Line maintenance.

Typical field maintenance activities include:

- Periodic and preventative maintenance, e.g. cleaning, lubricating, replacement of consumables.
- Removal and installation of equipment.
- Removal and installation of sub-assemblies using standard tools and methods.

- Low level commissioning of equipment, for example, loading of software, setting of equipment parameters (like time) and machine numbers. In short, any operation that does not require adjustments and calibrations based on measurements and technical judgement.
- Periodic monitoring, recording and reporting of equipment performance data.
- Identification and assessment of fault and damage indications and the preparation of fault reports.
- Completion of Equipment Service Reports and return of faulty equipment to the Service Bureau repair depot.

## 2.3 Second Line Maintenance

The Second Line maintenance is defined as any Service Bureau action necessary to diagnose and restore any out of service equipment where First Line maintenance and/or Transit Operator Telephone support was unsuccessful in resolving the problem. The Service Bureau will be responsible for providing local on-line and on-call maintenance support to the Transit Operators.

Typical Second Line maintenance activities include:

- On-line telephone support by technically trained Customer Service Representatives.
- On-call field support by the Service Bureau Field Service Team.
- Removal and installation of defective devices/modules.
- Commissioning of equipment, including adjustments, calibrations and the use of software diagnostic tools.

**Note:** *The CID1B does not require Second Line Maintenance. This section is included for information only.*

## 2.4 Third Line Maintenance

Activities of this category are normally performed in workshop facilities and require a degree of technical knowledge and some specialised tools. Valued judgement and decisions as to the usability and serviceability of equipment may be required.

Typical shop maintenance activities include:

- Periodic and preventive maintenance including the dismantling and re-assembly of subassemblies, soldering, crimping and assembly of connectors.
- Fault finding to functional block level, using electronic test equipment and standard fault finding methods.
- Identification and exchange of faulty PCBs.
- Functional testing and certification of equipment.
- Commissioning of equipment, including adjustments, calibrations and the use of software diagnostic tools.
- Monitoring, recording and reporting of equipment performance.
- Contributions to measures aimed at the improvement of the performance/reliability of equipment, e.g. Total Quality Management.

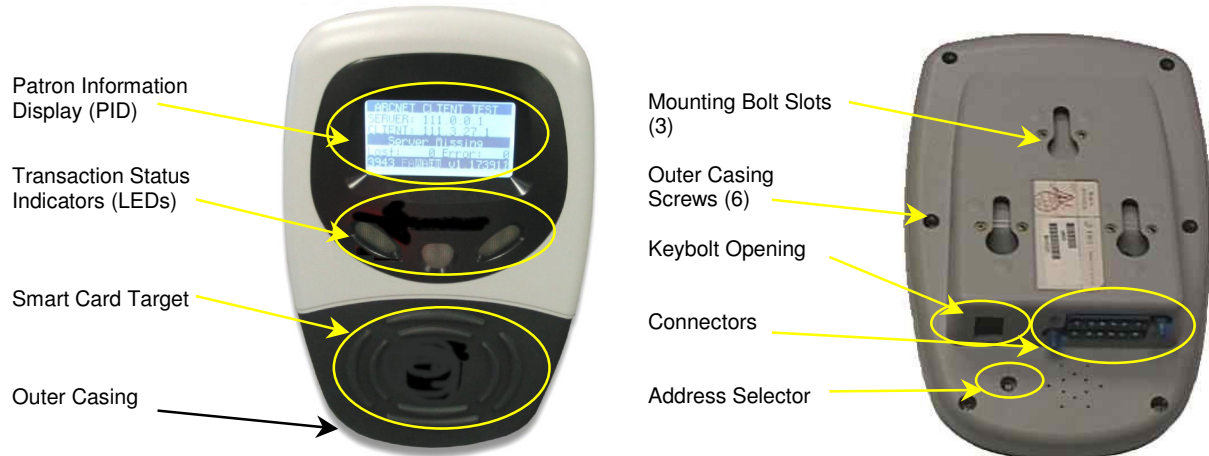


### 3 CID1B Device Description

The patron is required to present (tag) the smart card on both entry and exit via this device. The fare is deducted from the smart card on exit.

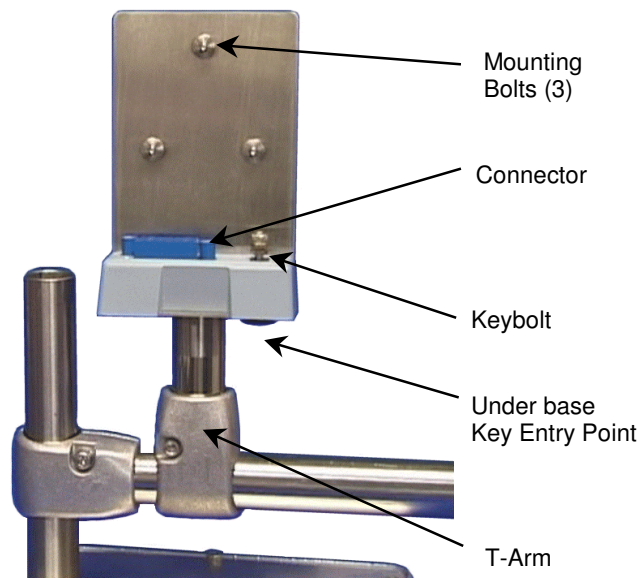
On a flat fare system, only one (tag) on entry is required.

A CID1B consists of the following components (Figure 2):



**Figure 2: CID1B front and rear view**

The CID1B is mounted on a dedicated mounting cradle located adjacent to entry and exit positions on each vehicle. The mounting cradle consists of:



**Figure 3: CID1B Mounting Cradle**

The CID1B consists of the following components.

- Patron Information Display (PID)
- Light Emitting Diode (LED) indicators and loudspeaker
- Smart card target and reader/writer
- Outer casing
- Communication and diagnostic ports (not shown)

- Internal electronic printed circuit boards (not shown)
- The CID 1B is mounted on a dedicated mounting cradle located adjacent to entry and exit positions on each vehicle.

## 3.1 Operational Modes

The CID1B can operate in one of the following five operational modes:

- Start-up Mode.
- In-service Mode.
- Employee Logon Mode.
- Maintenance Mode.
- Out-of-service Modes.

## 4 Troubleshooting and Diagnostic Testing

### 4.1 Troubleshooting Guide

If a problem is detected during the operation of the CID1B, turn the device off and on. If after rebooting the problem still exists, remove and replace the CID1B.

In general, the following problems are possible during the operation of a CID1B:

**Table 2: Troubleshooting Chart**

<b>Problem Description</b>	<b>Repair Procedure</b>	<b>Successful Repair</b>	<b>Unsuccessful Repair</b>
No display	Perform Start-up	Proceed with normal operation	Remove and replace CID1B ( <i>see 7 Mounting</i> ).
Displays incorrect information ( <i>see Appendix A</i> )	Perform Start-up	Proceed with normal operation	Remove and replace CID1B ( <i>see 7 Mounting</i> ).
LEDs do not illuminate	Perform Start-up	Proceed with normal operation	Remove and replace CID1B ( <i>see 7 Mounting</i> ).
LEDs illuminate incorrectly ( <i>see Appendix A</i> )	Perform Start-up	Proceed with normal operation	Remove and replace CID1B ( <i>see 7 Mounting</i> ).
Speaker does not sound	Perform Start-up	Proceed with normal operation	Remove and replace CID1B ( <i>see 7 Mounting</i> ).
Speaker sounds incorrectly ( <i>see Appendix A</i> )	Perform Start-up	Proceed with normal operation	Remove and replace CID1B ( <i>see 7 Mounting</i> ).
CSC reader/writer does not respond to card tag	Perform Start-up	Proceed with normal operation	Remove and replace CID1B ( <i>see 7 Mounting</i> ).

### 4.2 Diagnostic Testing

The diagnostic testing consists of two testing methods:

- Power on self-test performed at start-up.
- Maintenance mode testing.

The following sections describe the diagnostic testing procedures of the CID1B.

## 4.2.1 Start-up

Start-up diagnostic testing is performed whenever power is applied to the CID1B.

The purpose of the start-up diagnostic testing is to confirm the correct operation of the CID1B Main board and its peripheral devices before the CID1B is placed In Service. On Start-up the CID1B will cycle through operating the LCD, speakers, LEDs and CSC reader/writer. The diagnostic messages are displayed on the screen.

The CID1B performs the following actions whenever it is powered up or is reset:

1. Power is applied to the CID1B and the CPU commences operation.
2. The CID1B performs a Power on Self-Test. See Section 4.2.1.1.

**Note:** *The CID1B enters the Out of Service (permanent) mode if any of self-tests fails.*

3. If the CID1B has been powered off or reset for less than a configurable period of time, it enters into the mode of active operation before being reset or turned off, otherwise it enters the Out Of Service temporary mode.

### 4.2.1.1 Power on Self-Test

Self-Test is performed whenever the CID1B is powered up, or reset.

The Self-test sequence is as follows:

1. Main PCB checks.
2. Memory checks.
3. CSC Reader checks.
4. If the CID1B internal tests fail the following sequence of events will occur:
  - The CID1B goes into Out Of Service (Permanent) Mode.
  - The CID1B logs the relevant error code.
5. If the CID1B internal tests pass the following sequence of events will occur:
  - The CID1B sounds the O.K. tone.
  - The CID1B enters into Out Of Service (Temporary) Mode.

The Out-of-service Modes are:

- Permanent - when a CID fails its Power on Self-Test (POST), it can not be operated and requires maintenance.
- Temporary – when a CID passes its Power on Self-Test (POST), it goes into standby mode ready for operation.

## 4.2.2 Maintenance Mode Testing

Maintenance mode enables maintenance personnel to perform routine self test functions. This mode can be entered and exited by tagging a special maintenance smart card on the card reader.

When entering Maintenance mode, the CID1B display indicates that it is in Maintenance mode.

The CID1B can be placed into Maintenance Mode by tagging a Maintenance card.

The CID1B performs a set of self-tests and displays the result of these tests.

The following self-tests are:

1. The CID1B displays a Maintenance Mode text message and turns off all LEDs. You have 5 seconds to tag your card again to EXIT maintenance mode.
2. The CID1B displays software version and date.
3. The CID1B displays system information, i.e. fare information etc.
4. The CID1B tests the CSC reader/writer.
5. The CID1B tests the LCD screen by turning the pixels on then off.
6. The CID1B tests the background contrast of the LCD.
7. The CID1B tests the brightness of the LCD.
8. The CID1B tests the LEDs by turning them on one at a time then all three at the same time; the LEDs test is repeated a second time.
9. The CID1B tests the Speaker by sending beeps to the speaker. These beeps will last for 15 seconds and the level will gradually increase from (0 to 260).
10. At the completion of the Maintenance Mode self tests the CID1B will exit to Out-Of-Service mode.

**Note:** *During a self-test, if a Maintenance card is placed over the CSC reader/writer the CID1B will exit to Out-Of-Service mode.*

## 5 Preventative Maintenance

The Daily Maintenance checks described below are easily carried out in-situ and are recommended for the continued efficient operation of the CID1B. Daily checks are best carried out at the end of the last shift of the day. Weekly and monthly checks are not required.

### 5.1 Safety

All maintenance work is to be performed to recognised industry standards, using appropriate protective clothing where necessary and tools suitable for the task.

When a bus is in service, cradles must not be left empty and should have a device mounted at all times.

Personnel attempting to diagnose or repair faults in the electrical wiring are to be trained and qualified in the appropriate electrical codes of practice and are to work in accordance with those codes.

### 5.2 Retrieving Data from Devices

The CID1B carries data recorded during each bus trip that has commercial value to the bus service provider. It is important that this information is retrieved from the device before any maintenance is carried out which may destroy the data.

### 5.3 Daily Maintenance

The daily maintenance procedure is as follows:

- 1) Check the exterior of the CID1B and cables for any signs of physical damage.
- 2) Check the security of the equipment in the cradle and the lock.
- 3) Power up the On-Board equipment and check the operation of the LCD display, LEDs and loudspeaker.
- 4) Check the CID1B is positioned correctly to allow the patron to see the PID clearly.
- 5) Remove any dirt or dust from the surface of the equipment with a damp cloth.

**Warning:** *Use of abrasive cloths, cleansers and concentrated cleaning solvents will cause permanent damage to the exterior surfaces of the unit.*

### 5.4 Weekly Maintenance

There is no requirement for weekly maintenance.

### 5.5 Monthly Maintenance

There is no requirement for monthly maintenance.

### 5.6 Yearly Maintenance

There is no requirement for yearly maintenance.

## 5.7 Special Maintenance

Every two years the CID1B must be removed and returned to a Repair Depot for internal maintenance including battery replacement. The cradle can be checked and cleaned at this time.

1. Remove the CID1B from its mounting cradle (see Section 7.2).
2. Pack the CID1B for shipping to a Repair Depot.
3. Check the cleanliness of the cradle. Clean if required with a damp cloth. Dry completely before replacing a unit.
4. Inspect the contacts in the connector for dirt and/or damage. Clean contacts with a soft brush.
5. Install replacement CID1B unit (see Section 7.1).
6. Power up the On-Board equipment and check the operation of the LCD display, LEDs and loudspeaker.
7. Check that the CID1B is positioned correctly to allow the patron to see the PID clearly.
8. Remove any dirt or dust from the surface of the equipment with a damp cloth.

**Warning:** *Use of abrasive cloths, cleansers and concentrated cleaning solvents will cause permanent damage to the exterior surfaces of the unit.*

## 6 Line Repair Procedures

This section describes the various test, maintenance and service procedures to ensure the CID1B operates correctly and at optimum performance.

### 6.1 General

In order to maintain a very low Mean Time to Repair (MTTR), faults should be quickly investigated and a course of action undertaken.

Minor faults can be rectified onsite with the help of the Trouble Shooting Guide (see Section 4.1). If the problem cannot be rectified onsite, the CID1B should be replaced immediately with an operational spare. The defective CID1B should be returned to a Repair Depot for servicing. This allows the user to continue operation with the minimum of delay and inconvenience.

### 6.2 Diagnostic Testing

Start-up diagnostic testing is performed whenever power is applied to the CID1B. The purpose of the start-up diagnostic testing is to confirm the correct operation of the CID1B Main board and its peripheral devices before the CID1B is placed in service. On Start-up the CID1B will cycle through operating the LCD, speakers, LEDs and CSC reader/writer. The diagnostic messages are displayed on the screen.



## 7 Mounting and Removing the CID1B

This section describes the method of mounting and removing the CID1B.

### 7.1 CID1B Mounting

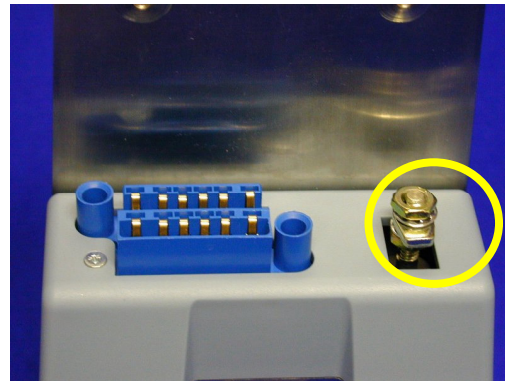
This section describes the method of mounting the CID1B.

The CID1B is mounted on a cradle secured by a locking device. The following diagrams detail the components of the CID1B.

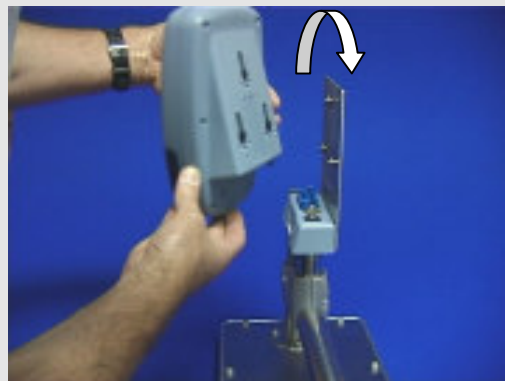
1. Turn off the CID1B.

2. Ensure the keybolt on the cradle is pointing forward to fit the Keybolt Opening.

**Note:** The correct height of the locking bolt is  $17/64$ " ( $6.7\text{mm} \pm 0.1$ ). This should be checked prior to installation.



3. Align the CID1B slots with the Mounting Bolts on the front of the Cradle.



4. Check the CID1B is aligned with the Cradle Serial Contacts.



5. Seat the unit by pushing back and down until it clicks in place.



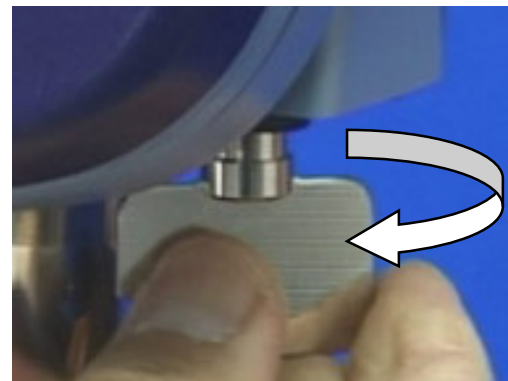
The Keybolt on the cradle will now be fully enclosed by the CID1B. Place the Device Action Lock Key into the key entry point.



Key Entry Point.



6. Turn the key firmly in a clockwise direction. The CID1B is now securely on the cradle.



7. Power up the On-Board equipment and check the operation of the LCD

display, LEDs and loudspeaker.

8. Check the CID1B is positioned correctly to allow the patron to see the PID clearly.



9. Remove any dirt or dust from the surface of the equipment with a damp cloth.

**Note:** Prolonged use of concentrated cleaning solvents will lead to permanent damage to the outer casing.



## 7.2 Removal of CID1B

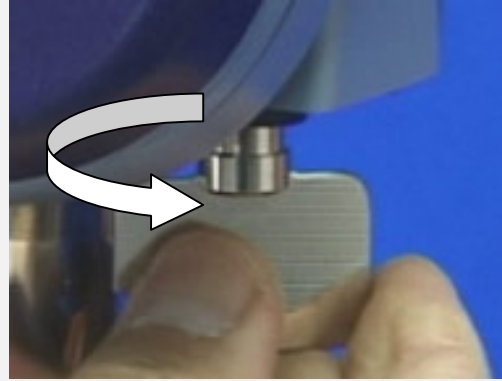
This section describes the method of removal for the CID1B.

1. Turn off the CID1B

2. Locate the Device Action Lock Key Keybolt on the CID1B.



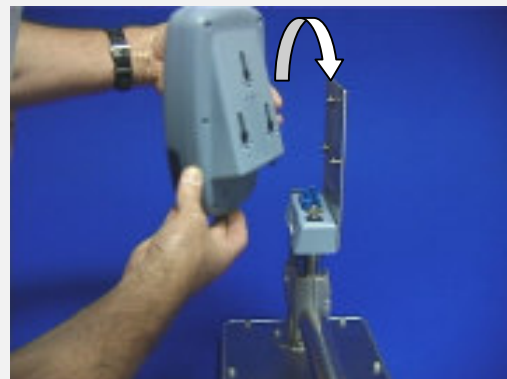
3. Turn the key firmly in an anti-clockwise direction until the CID1B is released from the cradle.



4. Gently lift the casing directly upwards until it disengages with a click from the cradle.



5. Unhook the CID1B from the Mounting Bolts on the front of the Cradle



6. Pack the CID1B into the packaging from the replacement CID1B.

## 8 CID1B Audio/Visual Indicators

The CID1B has audible and visual indicators to speed up patron throughput.

These indicators inform both the driver and patron of the status of the current smart card transaction. This reduces the need for the patron to read the LCD and thus increases patron throughput. For example, viewing a green LED and hearing a valid audible tone from the loudspeaker is faster than reading "VALID TRANSACTION".

The typical values for the various tones and LED displays, along with the PID display, are shown below in Table 3.

The CID1B audio indicators are three types of tones:

- **Valid transaction** – a single tone of 1000Hz for 200ms.
- **Invalid transaction** – three tones of 1400Hz for 100ms with a 50ms delay between tones .
- **Low value transaction** – two tones, first tone 1000Hz for 200ms, and second tone 1200Hz for 200ms with a 50ms delay between tones.

The CID1B visual indicators are red, green and amber LEDs:

- **Red** – represents invalid transactions, (Out Of Service) or closed, all LEDs will be on.
- **Green** – a represents valid transactions.
- **Amber** – a warning to the patron that e.g. funds have automatically been added through the auto load facility. Travel is allowed for this transaction and therefore the green LED is also on.

**Table 3: Audio/Visual Indicators Typical Values**

Transaction	Screen Display	LED Display	Freq. (Hz)	Duration (ms)	Pause	Sequence
Valid card used, \$0.70 fare deducted	TRAVEL OK FARE \$0.70 BAL \$25.30	Green	1000	200	None	One Single Tone
Valid card One ride used	TRAVEL OK RIDE USED BAL 8 RIDES	Green	1000	200	None	One Single Tone
Valid card upgrade	UPGRADE OK FARE \$0.00 BAL \$35.00	Green	1000	200	None	One Single Tone
Valid Senior	TRAVEL OK FAST PASS RENEWED OK TO FEB 28	Green	1000	200	None	One Single Tone
Low Value	TRAVEL OK FARE \$0.70 BALANCE \$0.70	Green Amber	1000 then 1200	200	50	Two Ascending Tones
Low Funds	TRAVEL DENIED LOW FUNDS BALANCE: \$0.XX	Red	1400	100	50	Three Single Tones

Transaction	Screen Display	LED Display	Freq. (Hz)	Duration (ms)	Pause	Sequence
Invalid	TRAVEL DENIED CARD INVALID	Red	1400	100	50	Three Single Tones
Passback	TRAVEL DENIED CARD ALREADY PROCESSED	Red	1400	100	50	Three Single Tones
Expired	TRAVEL DENIED CARD EXPIRED	Red	1400	100	50	Three Single Tones
Not Permitted	TRAVEL NOT PERMITTED	Red	1400	100	50	Three Single Tones
Hotlisted	TRAVEL DENIED CARD BLOCKED	Red	1400	100	50	Three Single Tones

**Table 4: LED Functionality**

Function	Red	Amber	Green
OUT OF SERVICE (Equipment Fault, not processing smart cards – end of day, etc.)	ON	ON	ON
IDLE	-----	-----	-----
LAST TRANSACTION	-----	ON	-----
Valid card or transaction	ON	-----	-----
Invalid card or transaction	-----	-----	ON