

Mackay Guardian™ Solo
Operation and Maintenance Guide

Mackay Document Number: C11-0934
August 2011, Version 1.1 (draft)

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Mackay Guardian™ Solo

Operation and Maintenance Guide

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Prepared for Limited Release / PTCRB Certification.



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MacKay Guardian™ Solo Operation and Maintenance Guide

For meter application software version n.n and higher

MacKay Document Number: C11-0934 Version 1.1 (draft)

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- 2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This device has been designed to comply with safety requirements for exposure to radio waves (SAR) in accordance with RSS-102.

This device should be installed and operated with minimum distance 20cm between the equipment and your body.

Cet artifice a été conçu pour se plier à la sécurité les exigences pour l'exposition aux ondes radioélectriques (SAR) dans conformité avec RSS-102.

Cet artifice devrait être installé et fait marcher avec la distance minimale 20 centimètres entre l'équipement et votre corps.

Revision History

Version	Description of Changes	Initials	Date of Change
1.0	Initial Version (Draft)	GEC	June 2011
1.1	FCC & Industry Canada Statements added	GEC	Aug 15 2011

Take Note

Mackay has attempted to update pictures/screen shots to the most current revision, where there is a possibility that some confusion could result in describing a particular item/function/procedure.

To identify noteworthy changes/additions to the document, where possible/practical a yellow text box, as shown below, will appear next to the section that has been changed.

NEW!

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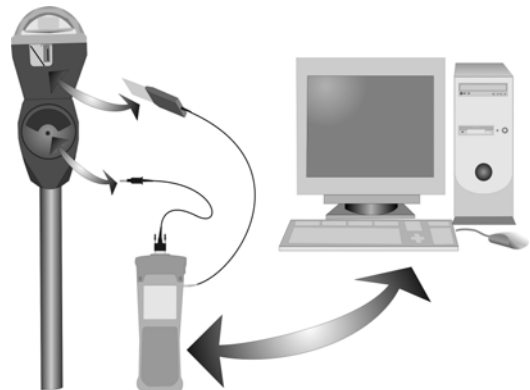
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1. Introduction

This document describes the basic operation, assembly and the maintenance procedures for the **Mackay Guardian™ Solo** (Solo) and assumes that meter application version [TBD] or higher is used. This document is intended for the installation and service personnel who will install and maintain the meters. It generally describes the meter hardware, which can be configured to accept payment by coins, client-approved smart cards, as well as credit cards. It will show the Solo parts and how they are interconnected, as well as the basic operational checks for normal operation. The complete system consists of the Solo parking meter, a complete housing assembly, an optional portable data terminal (PDT), and the web based Mackay Sentinel™ management software. (see Figure 1 and Figure 2).



• Figure 1 – Mackay Guardian™ Solo



• Figure 2 – Diagram Showing Complete System Components

1.1 List of Terms

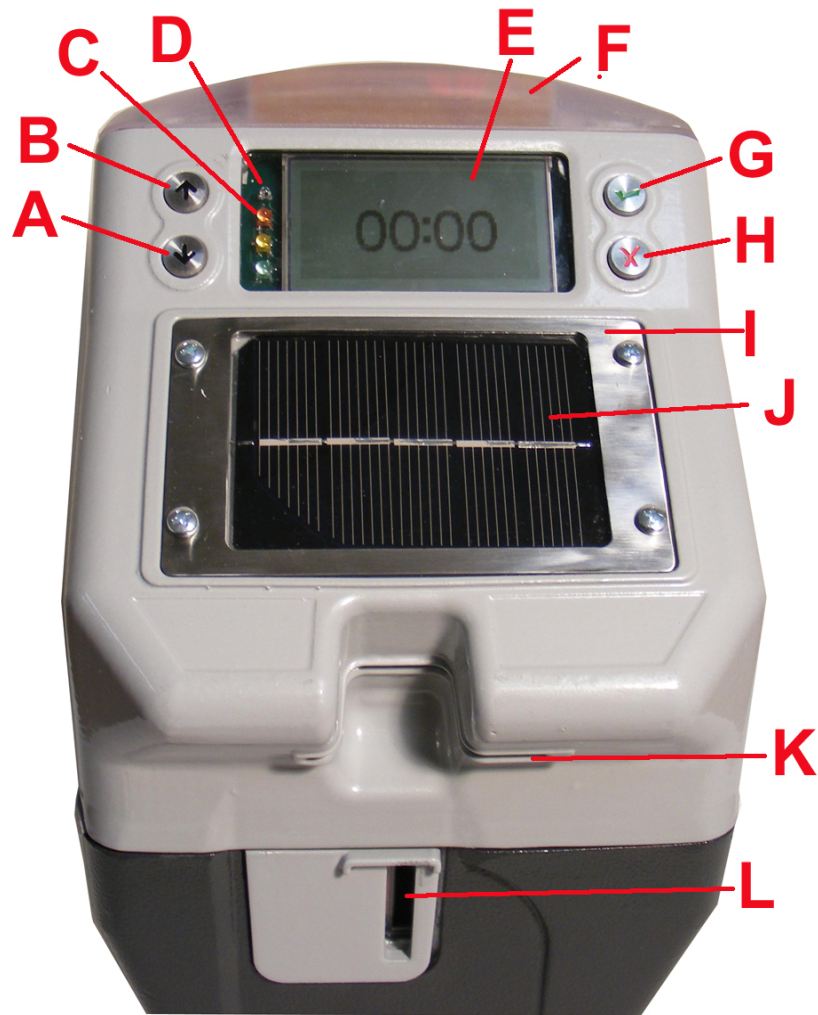
The following terms will be used extensively throughout this document. This section is provided for clarification purposes, and to save further explanation throughout the remainder of the manual.

- PDT: Portable Data Terminal.
- Solo or Meter: MacKay Guardian™ Solo parking meter mechanism.
- E-lock: electromechanical lock.
- LCD: Liquid Crystal Display.
- LED: Light Emitting Diode.
- SAM: Secure Access Module.
- AOD: Add-on device.
- Coin Chute: Refers specifically to the SmartChute™ Coin Discriminator.
- SCI: Smart Card Interface used for communication (also referred to as the Biberon).
- LKI: Lock Interface used for communication.
- Test Card: A valid smart card used for Solo testing purposes.
- Test Coin: A valid coin used for Solo testing purposes.
- Test Chute: A fully functional SmartChute™ coin discriminator used for Solo testing purposes.
- Test Card Reader: A fully functional card reader assembly used for Solo testing purposes.

2. MacKay Guardian™ Solo: General Description

The *MacKay Guardian™ Solo* consists of high strength zinc alloy metal covers and frame, consisting of an upper front cover assembly attached to a lower frame assembly, mated with a back cover assembly. All electronic components and sub-assemblies are held or mounted within the upper front cover assembly and the lower frame assembly. When placed into and secured into a traditional heavy duty meter housing, there is no longer a need for a traditional “cap” or cover as the metal front and back cover assemblies also provide the necessary strength and security previously provided by the old “cap”, while still offering the public a large user display, numerous payment options and a large rear enforcement display. The Solo is designed such that when unlocked, the front cover assembly with attached lower frame assembly can be easily detached and removed from the back cover assembly and meter housing. Alternatively the front cover assembly has a unique feature in that it can be detached from the back cover and hinged open leaving the lower frame assembly in the housing. This allows for the most common forms of service work such as inspecting/clearing coin chutes, card slots and battery replacement to be done with the meter held in place freeing up the technicians hands. The main controller board assembly containing the processor, program memory, and other circuits together with the rechargeable battery pack and many other electronic components are secured internally to the front cover assembly, while the coin chute, peripheral boards and main or non-rechargeable battery pack are secured in the lower frame assembly. All of these components are easily inspected and serviced when the meter front cover assembly is hinged forward into its open/service position. The lower frame assembly including the coin chute and backplane board plus any optional peripheral boards such as an RFID Reader Board is connected to the main controller board by way of a 20-pin ribbon cable. The coin chute is rigidly held in place without further screws when the lower front zinc frame member is attached to the lower back zinc frame member. A plastic card wiper is located between the back of the card guide slot opening and the front of the chip card reader board card slot. The card wiper should be replaced each time the card reader is removed for service. The large main non-rechargeable battery pack is attached to and powers the main board by way of its own 3-wire harness and is located in the lower frame assembly and is secured in place by its own weight in a large plastic battery holder attached to the back of the lower frame assembly. The appropriate stainless steel coin slot is dropped into place on the lower front frame member.

When viewed from the front, the separate coin and card slots are visible. Both are accessible to the user when the Solo is properly installed into a mechanism housing. Above and slightly back is the back-lit graphics LCD, visible through a rectangular opening on the front cover. To the left of the LCD, are the light sensor and three visual indicator LEDs for use by enforcement and maintenance staff. The red and green LEDs are used for enforcement or meter status indication, usually to indicate that the meter is OK/in a valid “time purchased” state or to indicate that the meter is in an expired state. The yellow LED is used primarily to indicate that service or maintenance is required. The card slot is for accepting either chip based smart cards, as well as traditional magnetic stripe type credit cards. The coin slot is used to accept coin payment as well as allow for communications between the portable data terminal (PDT) and the Solo using the RF probe interface.



• Figure 3 – Front of the MacKay Guardian™ Solo

- | | | | |
|---|----------------------------------|---|-------------------|
| A | Down (-) Button | B | Up (+) Button |
| C | Enforcement/Service LEDs (Front) | D | Light Sensor |
| E | Graphics LCD | F | Antenna Cap |
| G | Check (Confirm) Button | H | X (Cancel) Button |
| I | Solar Panel Bezel | J | Solar Panel |
| K | Chip / Credit Card Slot | L | Coin Slot |



• Figure 4 – Rear of the MacKay Guardian™ Solo

- | | | | |
|---|------------------|---|--------------|
| A | Back Cover | D | Rear Red LCD |
| B | Antenna Cover | E | |
| C | Enforcement LEDs | F | |



• Figure 5 – Right View of the MacKay Guardian™ Solo

- | | | |
|---|----------------------|---|
| A | Front Cover Assembly | D |
| B | Rear Cover Assembly | E |
| C | Lower Mech Housing | F |



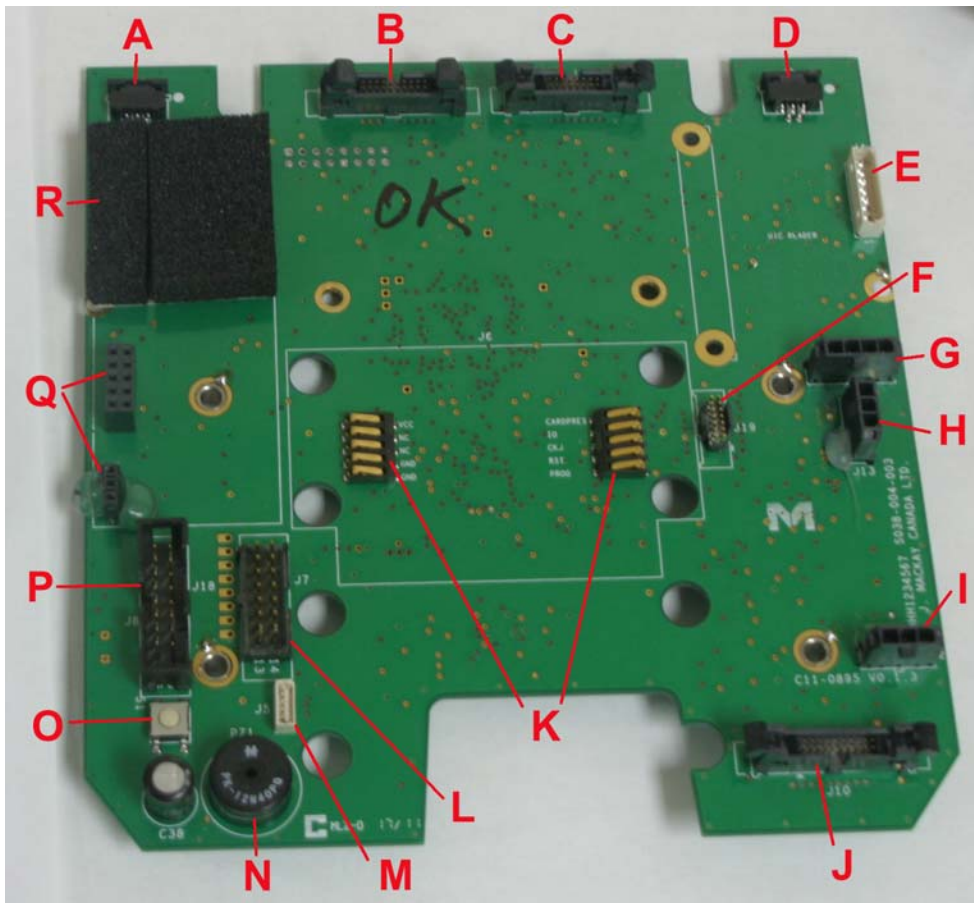
• Figure 6 – Left View of the MacKay Guardian™ Solo

- | | | |
|---|----------------------|---|
| A | Front Cover Assembly | D |
| B | Back Cover Assembly | E |
| C | Lower Mech Housing | |



• Figure 7 – Exploded Parts View of the Mackay Guardian™ Solo

A	Front Display Board	J	Main Controller Board
B	Antenna Assembly	K	6xD Alkaline Battery Pack
C	Front Cover	L	Lithium Ion Battery Pack
D	Rear Enforcement Display Assembly	M	SAM Board
E	RFID Reader Antenna	N	RFID Reader Board
F	Back Cover Assembly	O	Chip Card Reader Board
G	Battery Holder	P	Wireless Cellular Expansion Board
H	Backplane to MCB ribbon cable	Q	SmartChute Coin Validator
I	Front Display to MCB ribbon cable	R	Backplane Board
S	Lower Front frame member	T	Lower Rear frame member



• Figure 8 – MacKay Guardian™ Solo Main Board – (Connector Side)

- | | | | |
|---|---------------------------------|---|------------------------------------|
| A | Confirm/Cancel Button Connector | J | Backplane board connector |
| B | Enforcement Display Connector | K | Chip card reader connectors |
| C | Front Display Connector | L | peripheral port connector |
| D | Up/Down Button Connector | M | mag-head reader connector |
| E | RFID Reader connector | N | Piezo buzzer |
| F | SAM board connector | O | Reset button |
| G | Lithium-Ion Battery connector | P | X-Key programming connector |
| H | Solar Panel connector | Q | Wireless Cellular Board connectors |
| I | Alkaline 6xD battery connector | R | Foam spacer/support |

3. MacKay Guardian™ Solo: Detailed Description

3.1 General Specifications

- 1)** The *MacKay Guardian*™ Solo is a fully electronic parking meter mechanism, with solid-state semiconductor components.
- 2)** The Solo is designed to operate accurately and dependably within a wide temperature range and under varied environmental conditions, including wind blown grime, rain, fog, salt air and street vibrations.
- 3)** All electronic components and connections are fully weatherproofed where possible. The Solo has been designed to provide dependable operation when properly secured in its protective outer housing; however, the Solo is not waterproof, should never be immersed in water, and should not be left uncovered and fully exposed to driving rain and other elements for extended periods.
- 4)** The Solo fits into the MacKay MKH 4500 meter case, as well as others, without modification. All exposed Solo parts fit almost flush with the outside of the case.
- 5)** The only moving parts are those associated with the anti-tampering, anti-pullback features of the coin chute assembly.
- 6)** The Solo dome front detaches from the dome back, with one screw on the front and two screws on the back.
- 7)** The Solo has a tri-processor design. One low power microprocessor is dedicated to LCD and time-keeping functions, the second microprocessor is dedicated to run the main meter applications, and a third microprocessor is used in the coin chute assembly.
- 8)** The meter application is designed to support a smart card interface for data transfer and transaction data management.
- 9)** The Solo can support both coin and card operations and supports up to 16 different coins and/or tokens and up to three internal plug-in SAMs. It accepts coins through a coin interface module and card payments through a card interface module.
- 10)** The ISO compliant smart card interface supports both T=0 and T=1 protocols. The Solo can be programmed to accept both asynchronous and synchronous card types.
- 11)** The Solo has a 16 by 80 pixel front dot matrix LCD display capable of displaying alphanumeric messages and graphics.
- 12)** The Solo has over 1 megabyte (1 million bytes) of non-volatile memory.
- 13)** The Solo is powered by a 4.5V battery pack.

- 14) The Solo is activated by either the insertion of a coin or a card, if enabled, or insertion of a key into an attached operational e-lock.

3.2 Field Serviceability

- 1) The Solo is designed so that metallic and non-metallic foreign objects can be cleared from the coin chute and card reader slot under varied weather conditions within three minutes.
- 2) The Solo returns to full functionality after being cleared and reset. No special tools are required. It may be necessary to set the time of day clock using the PDT if the battery has been disconnected for an extended period.

3.3 Power Supply

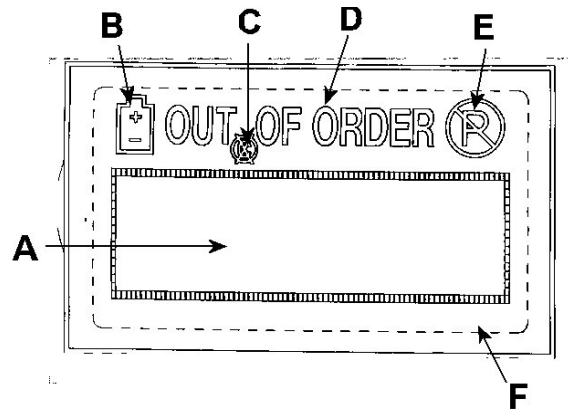
- 1) All 4.5-volt battery packs are shipped from the factory separately from the meters and without dielectric grease applied.
- 2) The battery pack is factory shrink-wrapped and supplied with a non-reversible plug-in connector. A label is found on one side of the battery pack. The label has the date of manufacture as well as a label to mark the battery pack installation date. The connector plug has a protective shrink-wrap insulator which must be removed prior to use.
- 3) The battery pack will provide an average operational service life of 12 months, if specific assumptions of power use are not surpassed. Replacement battery packs should always be new, and have been properly stored and handled according to the battery manufacturer's specifications prior to use. A new battery pack has a measured, unloaded (open terminal) battery voltage of 4.5 volts or slightly higher. Note that previously unused battery packs that have an older manufacture date, should be used first, before battery packs with a newer manufacture date. Note that packs that have been sitting on the shelf, unused for an extended period, will not give the same operational service life as fresh new batteries.
- 4) A "Low Battery" icon on the front LCD will be activated when the Solo detects that the battery voltage is near the end of its operational service life (3.0 volts). The amount of operational service life remaining, after the low battery icon is activated, is dependant on many factors including actual usage, and will vary between 5 and 30 days. If the battery is not replaced during this time, the Solo will shut down without further warning or indication when it detects that a specific absolute minimum battery threshold has been maintained for a 24-hour period. A battery pack is to be considered at or near its "low battery" threshold, and should not be used, if it has a measured, unloaded (open terminal) battery voltage of approximately 3.0 volts or below.
- 5) The Solo uses a switching power supply on the main board assembly, which supplies the necessary power to the various components when needed.
- 6) To conserve battery life, when the Solo is not in use by on-street users, many of the components are de-activated or powered down, however the graphic display and event

detection circuitry on the main board and coin reader assembly continue to be activated. In this mode the Solo can and will appear to almost instantaneously respond to the insertion of coins and cards and other events that wake it up. During non-enforcement hours, to conserve additional battery life, the Solo can be programmed to go into its “low power” mode. In this mode the coin chute assembly is deactivated, the graphics display is deactivated (appears blank), and an LED will blink to indicate that the Solo is “OK”.

Please note that any coins inserted in the Solo while it is in low power mode will not be detected or counted, and any card inserted at this point, will simply result in the meter displaying an “OFF” message – no funds will be extracted from the card.

- 7) The Solo battery pack consists of six standard alkaline D-size cell batteries (Duracell MN[TBD] (NEDA [TBD]) or an exact equivalent), arranged in two groups of three batteries connected in series, with each group of three batteries providing a nominal output voltage of 4.5 volts. Only high quality, industrial grade batteries such as the Duracell MN[TBD] should be used in replacement battery packs.

3.4 Indication Front



• Figure 9 – Front LCD

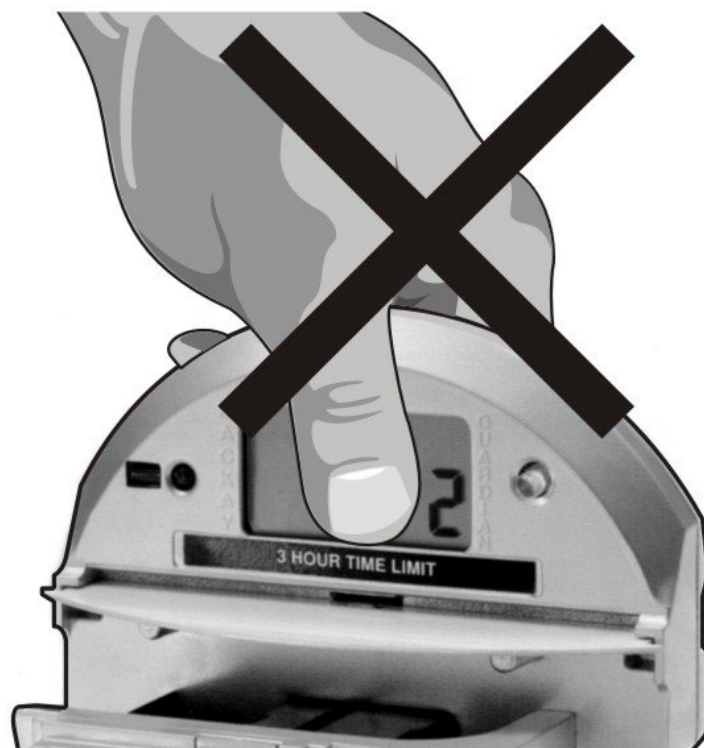
- | | | | |
|---|---------------------------------|---|--------------------------|
| A | 128 X 64 pixels Graphic Display | D | “OUT OF ORDER” Indicator |
| B | Low Battery Indicator | E | No Parking Indicator |
| C | Invalid Coin Indicator | F | Viewing Area |

- 1)** The Solo is capable of displaying the following:
 - Any symbol or pattern in a 16 high by 80 wide pixel graphics viewing area;
 - Five 16 by 16 pixel characters, full alphanumerical or graphic;
 - Six 16 by 12 pixel full height alphanumeric characters;
 - Two rows of 13, half-height characters (7 by 5 pixels each);
 - Negative sign or \$ symbol (or other symbol) located to the left of the left-most character;
 - Colon located between the second and third digits, when displaying time;
 - Decimal point located between the second and third digits for displaying cash values (\$0.01 - \$999.99);
 - International "No Parking" indicator;
 - "Low Battery" indicator;
 - "Out of Order" indicator;
 - "Last Coin Invalid" indicator.

- 2)** The Solo has three front mounted LED indicators, a red, green and a yellow LED. The normal configuration is to have the green LED flashing when the Solo is "OK" or when in a valid "time displayed" state. It flashes the red LED when in a "No Parking" or "Meter Expired" state and flashes the yellow LED to indicate to the service and maintenance staff that the Solo is in a "maintenance required" state.

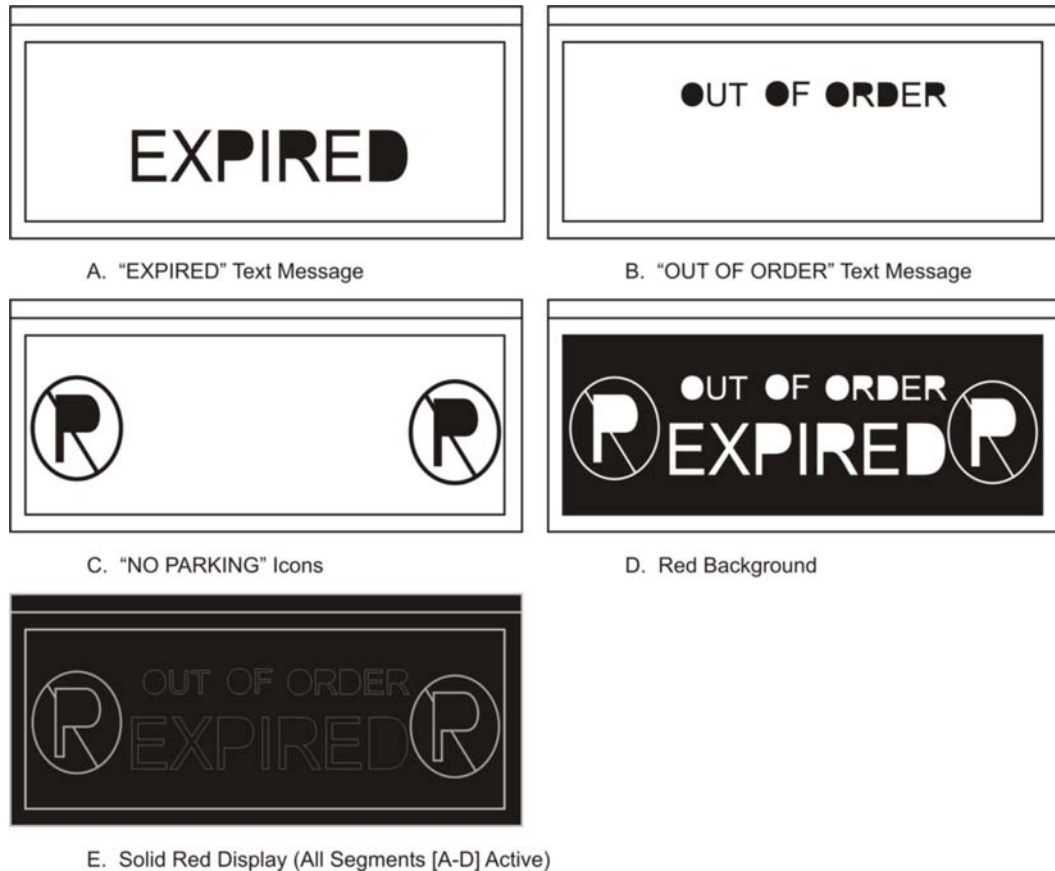
- 3)** The programmed behavior of the indicator LEDs can only be adjusted by replacing the Solo's factory profile file. This file is created by and supplied by the manufacturer. Note that the indicator LEDs on the rear of the Solo follow the exact same indicator behavior as the LEDs on the front of the Solo.

WARNING!



DO NOT
Handle the Parking Meter
by the Liquid Crystal Display
Breakage of the LCD can occur

3.5 Indication Rear



• Figure 10 – Rear Red LCD (Various Displays)

- 1) The Solo has a three square inch solid-state high contrast LCD on the back that is used to indicate paid status, expired status, and failed status. The LCD uses a red polarizer, which produces a high contrast, high visibility red color with a programmable variable flash rate.
- 2) The Solo can either statically display or flash the following information: "Out of Order", "Expired", 2 x International "No Parking" icons, and a solid red display. When the Solo is in normal operation and there is paid time remaining on the meter, the rear display will appear blank with the LCD's entire gray/silver background visible. When paid time has expired, the word EXPIRED, in RED on the LCD's gray/silver background will appear, and depending on the factory profile settings, this message may alternate with the reverse image equivalent, where the entire display is RED except for the word EXPIRED which will show on the LCD's gray/silver background.
- 3) The Solo has five rear mounted LED indicators, a left Red/Green led pair and a right Red/Green led pair as well as a single yellow LED. The normal configuration is to have the left hand green LED flashing when the meter is "OK" or when in a valid "time

displayed” state. It flashes the left hand red LED when in a “No Parking” or “Meter Expired” state and flashes the yellow LED to indicate to the service and maintenance staff that the Solo is in a “maintenance required” state. Note that the indicator LEDs on the rear of the Solo follow the exact same indicator behavior as the LEDs on the front of the Solo. The extra pair of red/green LEDs on the right side are only used when the Solo is configured for dual bay operation and are used to indicate the status of the right hand parking space while the left hand red/green led pair would be sued for the left hand parking space.



3.6 Rate and Hours of Operation Indication

- 1) UV-tolerant vinyl labels with the rate and hours of operation printed on them will be placed on a metal rate plate (D-plate) which is located on the Solo front below the front LCD. The rate plates can be changed by placing a new vinyl label over the old or by replacing the entire rate plate. The rate plate text should always match or correspond to the rate and maximum time limit installed on the Solo, which will match the Solo's profile group (zone).



• Figure 11 – Proper Rate Plate Removal Technique[TBD]

- 2) The rate plate can be removed by lifting the center of the rate plate, and pulling it forward. Installation of the replacement rate plate is the reverse.

3.7 Identification Label



• Figure 12 – Identification Label

Each Solo will have a unique serial identification number. This serial number is assigned by Mackay at the time of manufacture and is found on the identification label located on the rear of the Solo, on the top exterior of the meter battery compartment. The label also contains the Meter ID # as well as the zone (profile group) ID that was initially programmed into the Solo at the time of manufacture by Mackay.

Note that the serial number and the client assigned meter number found on the label are programmed into the Solo. They cannot be changed by the client.

The label information is also bar-coded (in code 39 format) for ease of retrieval/capture using appropriate bar code reading equipment/systems.

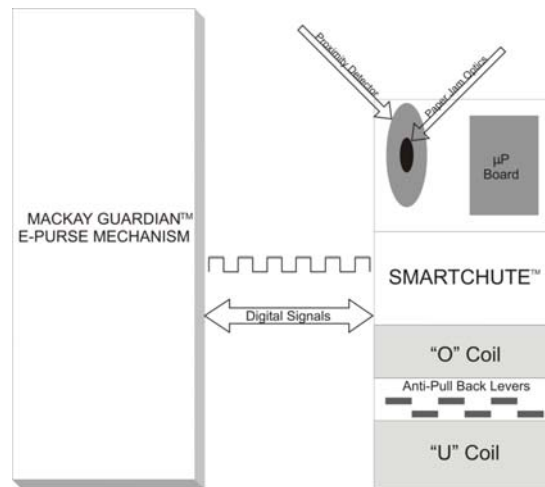
Other labels found on the Solo are the manufacture date label, patents notice label, QA/Inspection label.

3.8 SmartChute™ Coin Discriminator Assembly: General



• Figure 13 – SmartChute™ Coin Discriminator Assembly

- 1) The coin chute, using magnetic coils, registers the parameters of coins that pass through the chute and relays this information to the main electronics board. The main electronics board decides the award of purchase time.
- 2) The coin chute is a plug-in assembly and it can be replaced in the field without recalibration of the Solo or the use of special tools. There are no serviceable or replacement parts on the coin chute assembly.



• Figure 14 – SmartChute™ Coin Discriminator Internal Diagram

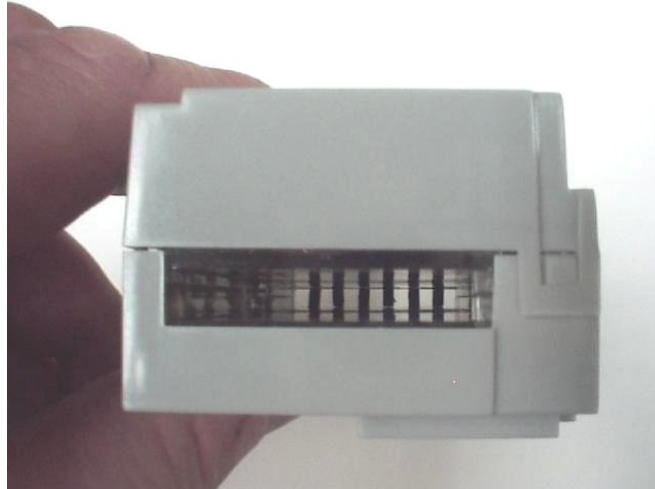
- 3) Subject to the actual location of the foreign object, the Solo can detect both metallic and non-metallic jams. When the coin chute detects a metallic or non-metallic jam, the Solo displays that it is inoperable. All detected jams are recorded in the maintenance log.

3.8.1 Coin Acceptance and Discrimination

- 1) The Solo is programmed to accept the following coins: the Sacagawea golden dollar, Susan B. Anthony dollar, Quarter, Dime and Nickel. The Solo is re-programmable to change/adjust the meter's coin recognition parameters of most accepted coins and tokens. The addition of most new coins can be accommodated in the future.
- 2) The *SmartChute* coin discriminator uses a proprietary inductive sensor design consisting of no less than three different coils to both activate and discriminate on coin insertion.
- 3) The Solo provides a count of all or most coin like metallic objects passing through the coin chute.
- 4) The coin chute provides a free-fall, almost straight drop coin channel. Coin jams can be cleared from either the top or bottom of the coin chute.

WARNING! SHARP METAL OBJECTS SHOULD NOT BE USED TO SERVICE OR CLEAR COIN JAMS FROM THE COIN CHUTE ASSEMBLY.

- 5) Significant build up of dirt/grime at the top of the coin chute may be sufficient to be detected as a non-metallic jam, and the Solo will go out of service. Replace the coin chute to correct this condition.

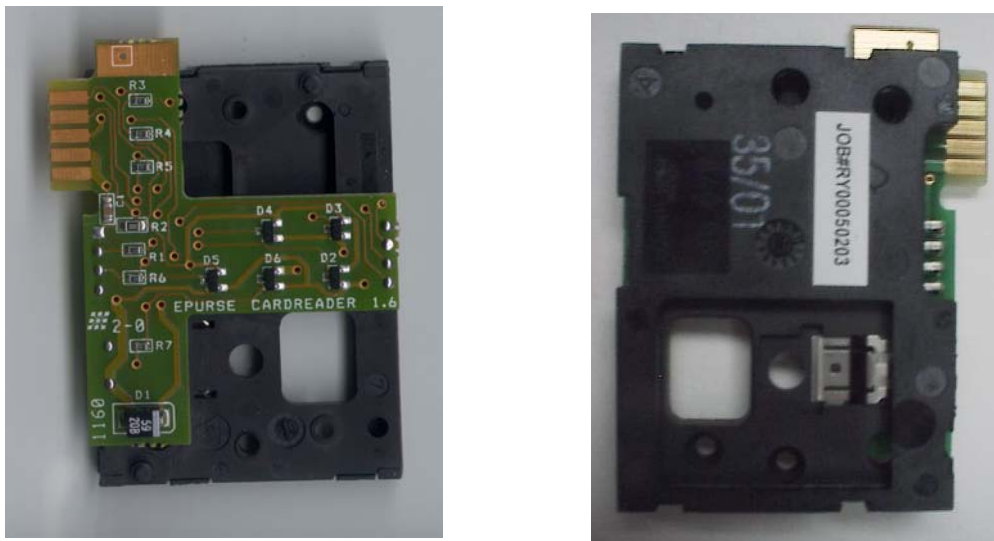


• Figure 15 – Top View, Close-Up Showing Anti-Pull Back Levers

- 6) The Solo has several independent mechanical anti-pull back levers, located at the lower part of the coin chute, which prevent the retrieval of deposited coins attached to strings, paddles, wires, etc. Coins should normally only be able to travel in one direction down through the coin chute. When clearing coin jams from the chute, the coins must not be forced in the opposite direction, as damage to the anti-pull back levers will occur and the product warranty will be voided.
- 7) The coin entrance has a replaceable stainless steel insert to provide some mechanical restriction of the maximum size (width/diameter) of the coins that can be inserted. To replace the coin slot insert, place the tip of a flat bladed screwdriver into the slot, and lift up on the slot.
- 8) Coins normally pass directly through the coin-chute into the sealed coin canister located in the vault. If jams are being recorded by the Solo, check for obstructions in the coin path.
- 9) In-shop coin testing of the Solo must always be carried out with the Solo placed in an upper mechanism housing assembly on a suitable stand. This will ensure that the in-shop testing being carried out is representative of how the Solo is actually used on-street. Coin testing should be done such that it is representative of on-street use. Coins should not be inserted in rapid succession or back-to-back without any pause between coins, nor should coins be flicked into the coin slot. This will result in missed coins and skewed test results.
- 10) The Solo's ability to discern and detect all inserted coins can be affected by a number of factors. They include the speed of the coin inserted, time between insertions, the angle of the Solo/post, and the presence of large amounts of water, dust, dirt and debris in the

coin chute. When investigating an Solo that has been reported as missing coins or having a large number of invalid coins, first inspect the post/housing to determine that it is not more than two (2) degrees of being plumb. A bent post will not allow the coin to free-fall through the coin chute, and the instances of invalid coins and jams will increase, with the severity of the bent post. Look down the coin chute and check for debris, water, dirt etc. Presence of enough of any of these substances that can slow down the coin as it free-falls through the coin chute may cause the coin (especially smaller lightweight coins like the dime) to not register correctly. Before placing the Solo back into the housing, always inspect inside the upper mechanism housing for evidence of coins or other debris that may have become caught in between the bottom of the chute and the housing.

3.9 Card Reader Assembly: General



• Figure 16 – Card Reader Assembly Top and Bottom View

- 1) The card reader is a plug in assembly that can be serviced and replaced without recalibration of the Solo or the use of special tools. There are no replacement/serviceable parts on the card reader assembly, except for the metal support brackets.
- 2) The Solo main board makes the decision on the purchase of time from all valid cards.
- 3) The card reader has a sealed “card present switch” that activates when a card is fully inserted into the card reader. If the card is not removed after a purchase or if the switch is jammed “on”, the Solo will deem the card reader jammed, will indicate the appropriate message, and record the event in the maintenance log.
- 4) The card slot does not allow entry by currently minted U.S. coins and has clean outs to allow for removal of debris/paper during maintenance.
- 5) The Solo frame provides an embossed molded card contact symbol and arrow to indicate which way the card should be inserted.

- 6) A metal card reader support bracket is installed prior to assembly of the card reader assembly to the Solo by sliding the bracket over the outer edges of the card reader guides. The purpose of the card reader support bracket is to provide additional mechanical strength and support to the upper and lower plastic card guides on the card reader connector. There is a cutout in the support bracket so that the cleanouts of the card reader can still be cleared. Card readers that are replaced under warranty may also be supplied with integrated metal support brackets that serve this same purpose.

3.9.1 Card Acceptance

- 1) The Solo software controls the card acceptance. The inserted card is powered up, interrogated and validated using the appropriate command sequences and protocols associated with the card application in place to check the validity of the card. Once the validity of the card has been determined, the card purchasing cycle begins.
- 2) The card reader assembly does not lock the card in place, allowing the user to retrieve it at any time or after the purchase cycle ends.
- 3) The card reader assembly has a connector with internal card contacts. It is mated to a small circuit board to provide a rigid transition to the main board connector.
- 4) The card reader assembly has no electronic intelligence of its own. All of the driver and decision-making circuitry that establish communication with inserted cards is located on the main board.
- 5) The card reader assembly's card connector provides physical contacts to the inserted card as described by ISO 7816 specifications, Parts One to Four.
- 6) The card reader has over-voltage protection and current-limiting devices that provide it with protection against acts of vandalism, such as metal plates being inserted into the card reader or power being applied to the internal card contacts. The card reader will act as the sacrificial component in this regard and will "blow safe", protecting internal components on the main board.
- 7) The card slot has a plastic moisture wiper in the card path to minimize the amount of moisture on the card from entering the card reader. The wiper is held in place between the card reader and the coin-card front. It will bend out of the way when a card is inserted and snap back in place upon removal. Care is needed during disassembly and reassembly of the coin-card front as the card wiper can fall, or be knocked out of its cavity.

3.9.2 SAM Holders

- 1) The Solo meter has the ability to support up to three different SAMs and can be programmed to accept up to three (3) SAM-based smart card schemes.
- 2) The three SAM holders in the Solo can be accessed through either the removal of the battery cover or the removal of the coin-card front and coin chute.
- 3) The Solo has non-volatile flash memory which can be re-programmed at a future time, to meet the operational need to support cards and SAMs of customer selected card schemes.
- 4) The SAM is used to actively challenge and authenticate each card. Each card transaction is recorded in the Solo meter's memory. After card transactions are collected, they are stored as secondary records, which remain until the next data collection.
- 5) Any further discussion on SAM holders and SAM based card schemes is beyond the intended purpose of this manual.

3.10 Upgradeability and Peripheral Port

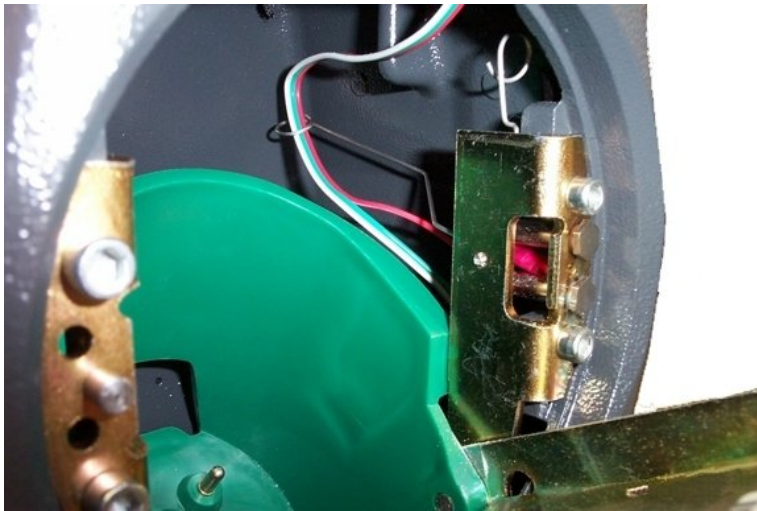


• Figure 17 – Solo Peripheral Port

- 1) The Solo peripheral port is an [TBD] that supports [TBD] control lines and is visible and accessible to the left of the card guide when the meter case is opened.
- 2) The peripheral port, is reserved for possible future use. This peripheral port connector has the necessary interface signals as well as industry standard serial communications interfaces, to support future add-on equipment.
- 3) The serial interface allows the meters to potentially communicate with MacKay support equipment to re-program the meters, change rates, etc., using a direct connection

process. Two-way data transfer is possible, initiated by either the Solo or the hardware attached to the peripheral port.

3.11 E-Lock Interface



• Figure 18 – E-lock Connector Plug

• Figure 19 – VaultDoor Interface Connector

When it is necessary to disconnect the Solo from the e-lock interface cable, care must be taken that both cable ends are grasped and then pulled apart. This will minimize stress and potential damage to the cable connection points at the Solo's main board and the housing right bracket lock contacts. Pulling the Solo away from the housing to force the separation of the cable will damage the cable wires and void the warranty on the Solo/e-lock interface.

The Solo is specifically designed to be connected to the optional e-lock harness.

- 1) The Solo has a dedicated interface connector on the backplane board that allows for [TBD].

3.12 Programmable Feature Options

- 1)** The following meter profile features are programmable on the Solo:
 - Standard rate operation (one rate, 24 hours a day, 7 days a week)
 - Time of day multi-rate operation (up to 8 rates in a 24 hour period)
 - Day of week multi-rate operation (up to 8 different rates and time limits per day)
 - Charge current rate if time purchased extends into the next rate period, or charge the current rate till the time purchased enters the next rate period, then charge that rate
 - Pre-payment period (purchase time is held in escrow until the Solo is in a scheduled enforcement period)
 - No-parking times with warning period
 - Power saver (low power) feature for non-enforced periods
 - Overtime or grace periods
 - Exception Dates/Holidays (free parking, no pay periods, no parking)

- 2)** The Solo is programmed with a specific profile to match the desired standard time and rate features for the City area/zone where the Solo will be located. The WinEMU device application software creates these profiles using the initial profiles provided as templates. Once created, the profiles are transferred to a PDT and uploaded to the Solo.

3.13 Internal Timekeeping

- 1)** The Solo has a 365-day calendar real-time clock with backup capacitor/circuit to retain the day/date/time clock settings during battery replacement. The back-up power held in the back-up capacitor/circuit provides the user with up to 5 minutes to change the batteries without losing the time-of-day/clock settings.

- 2)** The Solo must be programmed each year and in advance of any daylight savings dates. These are set in the WinEMU device application software, and are part of a given profile. These dates are normally pre-programmed into the meters for the year in which the meters are delivered.

- 3)** The time of day clock is accurate to +/-20 seconds per week.

- 4)** The time of day clock is unaffected by the selection of standard or multi-rate operation. It remains in continuous operation and is never adjusted or stopped once the time is set except for daylight savings time adjustments (if required), battery removal and while depressing and holding down the reset button.

- 5) The day of week is tracked in the Solo and is displayed on the LCD along with the time-of-day and other service information when the reset button is pressed. Sunday is considered day 1, and the time is displayed in 24 hour format.
- 6) The Solo uses the time of day clock to schedule many events, including but not limited to, rate changes, on/off periods, self-diagnostics, and no parking periods.
- 7) The Solo internal display timers are designed to ensure that a user never receives less than the paid parking time. The coin chute measurements and main board validation determine if the user receives paid parking time. If the display shows 20 minutes after the last coin has been inserted, the count down timer is designed such that the user will never get less than 20 minutes of purchase time.
- 8) The time on the internal clock will be reset to the PDT time when data is retrieved from the Solo, including but not limited to, during coin collections. It is important that the time/date set on the PDT is accurate as the PDT date and time is considered by the Solo as always being accurate and is uploaded to the Solo each time the PDT retrieves data and during coin collections.
- 9) All maintenance data and card transaction records stored within the primary audit data are time-stamped based on the calculated number of elapsed calendar seconds relative to a specific epoch date and standard time.

3.14 Memory

The Solo stores all required maintenance and card transaction data, keeping primary and secondary (redundant) records in memory. The redundant records are automatically replaced each time a primary record collection is completed. The secondary audit records can be collected/retrieved from the Solo in the event of the loss of primary audit data from a PDT, provided an additional primary audit has not been successfully completed on that meter prior to the collection of the secondary data.

3.15 Memory Retention at Power Failure

With the exception of the current time of day and the current purchase time (if any), stored data remains unaffected and is retained during power outages, such as a depleted or disconnected battery. The Solo memory stores programs and data for 10 years without degradation.

3.16 Revenue Audit Capabilities

- 1) The Solo maintains a count of each type of valid coin, invalid coins, token card transactions, and summary of electronic cash amounts, storing each type of information separately in memory. The coin count information, collected through the vault lock collection process, is referred to as Summary Audit Data.

- 2) The Solo incremental coin count totals will closely match the physical coin count total. The Solo continues to increment its coin counters until they are reset during a coin audit using the PDT. This counting/increment activity includes periods of Free Parking and No Parking. The Solo cannot count/increment counters in low power periods.

All financial audit data and all other card transaction data are retrieved via a PDT, either through the lock interface or through the smart card interface.

The Solo has two sets of coin count registers. One set of registers is reset to zero after each coin audit is completed, while the other set of registers retains a cumulative count of each coin type until it reaches 65,535 counts (2^{16} bits). Once it reaches this count limit, it will reset to zero and continue to increment upwards as coins of that type are inserted.

- 3) Viewing a coin log file is done through [TBD]. Usage details of this application are beyond the scope of this manual. For further details, consult your MacKay Customer Service Representative, or refer to the appropriate Coin Log Viewer documentation.

Reading maintenance data or resetting the Solo for other purposes will not affect financial audit data held in memory by the Solo.

3.17 Transfer of Data

- 1) The average time to download Summary Audit Data will normally not exceed 3 seconds. All other data transfer times will vary by the amount of data being held in the Solo.
- 2) The average time of field programming of Solo profiles will normally not exceed 10 seconds.
- 3) The transfer time associated with the collection of card transaction data will depend on the selected card scheme, as well as the number of card transaction records held in the Solo.

3.18 Coin and Card Check during Maintenance

- 1) The Solo has a feature that temporarily disables the recording of cash totals to allow test purchases to be made on the meter without those test purchases being recorded in the audit data. The feature is invoked by pressing the reset button.

After the Solo displays its reset sequence, the internal counting of any subsequently inserted coins or card transactions is immediately disabled to allow for testing. Any test coins or cards inserted will cause the Solo to operate (and display purchased time as usual) however these test transactions will not register in the internal coin count registers or primary audit until there has been no coin or card transaction activity for at least 60 seconds, after which time the registering of coins in the count registers and card transactions in the primary audit is enabled automatically.

- 2) Once the testing is completed, the Solo will revert to normal operation without further operator intervention or commands.

3.19 Modular Components

- 1)** The Solo consists of modular components that can be separated for repair and/or replacement.
- 2)** The main wear and tear components can be accessed by removing the three screws, one located on the front and two located on the back of the meter casing, using a common Philips screwdriver. All screws remain attached to the zinc frame and will not fall out after disassembly.
- 3)** While the wear and tear components can be easily replaced with the coin-card front removed, the main board electronics remain covered and protected in the zinc shell.

4. Portable Data Terminal: Description

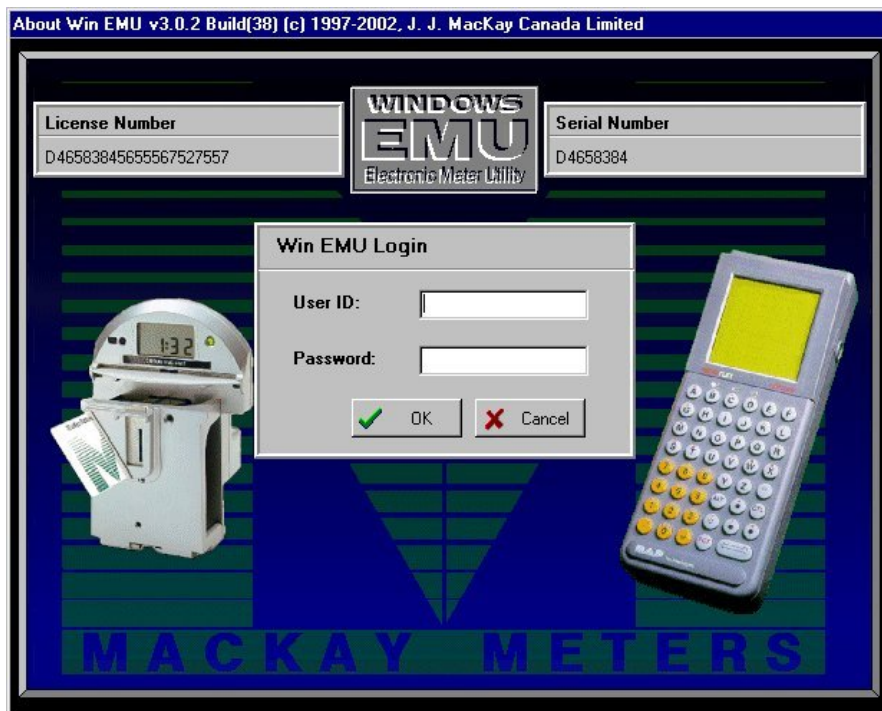
The meter, once installed into the field, can be programmed and communicated with, by a portable data terminal (PDT), configured with the appropriate interface device and running suitable software to allow communications. The handheld devices employed are Microsoft® Windows® CE based computers, small, lightweight and rugged in design. The typical activities carried out in the field with the handheld devices are to change rates (or other programmable meter features), read and save the individual meter coin totals (audit) and transaction data, as well as recording meter status/maintenance activities. At the end of the day's maintenance or data collection activities, the PDT is returned to its cradle for battery charging and data transfer. Use of the PDT is beyond the scope of this manual, and additional information can be found in the appropriate PDT documentation.



• Figure 20 – PDT in Charger/Communications Cradle with Attached LKI

5. Web Based Management Software: Sentinel

The MacKay Sentinel web based meter management software is used for organizing meter system data, generating reports, and managing the entire meter system. This web based software can be accessed using any web browser and using the provided user access information. Use of Sentinel is beyond the scope of this manual, and additional information can be found in the appropriate Sentinel documentation.



• Figure 21 – MacKay Sentinel Web Application

6. MacKay Guardian™ Solo: “How does it work?”

This section describes the basic coin and card operation of the *MacKay Guardian*™ Solo meter, use of the Smart Card Interface (SCI) and the meter’s display sequence following reset (Lamp Test).

6.1 Coin Operation

The *SmartChute*™ coin discriminator (coin chute) uses patented sensor technology. The term "SmartChute" is derived from the fact that a dedicated microprocessor is used inside the coin chute assembly (the part that all coins fall through). There are a number of advantages of doing this, but the primary goal is to have consistently good coin validation performance. There are actually three inductive sense coils in the *SmartChute* coin discriminator assembly, in addition to an optical sensor pair that is used to detect non-metallic jams in the upper part of the chute. The upper most sense coil is used to detect and signal that a coin is passing through the chute, while the remaining two sense coils provide a series of distinctive signatures that are captured and converted to a digital form. The series of captured signatures are usually unique for a given metallic object. Since both the US and Canadian Mints will usually control (within specified limits) the weight/metal content of each coin type, the insertion of identical coins will give approximately the same series of distinctive signatures. The *SmartChute* coin discriminator will provide a series of measured signatures from an inserted coin and the meter will compare those signatures with a table of known valid coins. When a match is found in the table, meter time is awarded to the user based on the value of the coin and the current rate structure. Otherwise, the coin is considered invalid, recorded as such, but no time awarded.

The Solo operates in the following manner when a coin is inserted:

All inserted coins pass down a common coin path, through the same coin slot. In the brief time it takes the coin to travel through the coin slot and exit out the bottom of the coin chute, the meter has activated its electronic circuits and analyzed the coin. For all metal objects inserted, the meter completes a number of measurements on the object using MacKay’s patented coin discrimination technology. The measurements of the inserted coin are compared with known values of valid coins in a look-up table stored in the meter. Based on proper matching within the table the coin is determined to be valid or invalid.

If the coin is Invalid (i.e. not on the list of valid coins):

- The invalid coin symbol is turned on, if configured (see Figure 9, Item C).
- The meter's internal invalid coin counter¹ is increased by one.
- The meter increments the e-lock's invalid coin-count register by one.

If the coin is Valid:

- The meter's internal coin counter¹ for the valid coin type is increased by one.
- The meter increments the e-lock's valid coin type count register by one.
- If, for example the inserted coin was to result in a purchase of 20 minutes of time, the meter's display would register 0:20, indicating zero hours, and twenty minutes of countdown time remaining. The internal timer counts down for each minute shown on the display. The meter display is decreased by one minute every time the internal timer passes zero.
- If there is no time on the meter or it is in an overtime period, the appropriate amount of time is added from zero and shown on the display. If the backlight is enabled it will turn on at this time (if a minimum purchase is enabled, subsequent coin insertions may be required before time is displayed).
- If there is time on the meter, the appropriate amount of time for the valid coin is added to the time shown on the display up to the meter's maximum time and this new time is displayed. If the meter has a scheduled OFF (low power) period immediately following the regular enforced time, the meter will only display the purchased time up to the next scheduled OFF period (e.g. if the enforced period which ends at 6:00pm, is followed by an OFF (low power) period, and the user inserts coins into the meter at 5:45pm, the most time that the meter can display (or the user can purchase) is 15 minutes).
- **NEW!** If the meter is on, but is functioning in a non-enforcement period (i.e. one hour before enforcement begins), and a coin is inserted to make a purchase, the time remaining between the time of purchase and the enforcement period is automatically added to the desired purchase time at no cost to the end user. For example, if enforcement begins at 9:00am, and a customer wishes to purchase one hour of time (value of \$1.00) at 8:15am, insertion of a \$1.00 coin would result in 1:45 being displayed.
- If the maximum time limit is reached (or attempted to be exceeded by excess coin payment), only the maximum amount of time allowed by the meter is displayed. Please note, the time limit sticker, if used, is normally located below each display, indicating the maximum time limit for the meter.

¹ The meter's internal coin counter is an actual internal register or reserved memory located in the meter's memory that keeps track of the coins inserted into the meter and tokens removed from valid cards. This is non-volatile memory and will not get lost in the event of complete battery failure.

- When the display on the meter changes to 0:01, there is one minute of purchase time remaining. The display remains like this until the internal timer counts to zero, purchase time is now used up and the display either goes into a predetermined overtime period (Grace or Penalty) or shows the EXPIRED message (Violation).

6.2 Card Operation

NEW!

All cards inserted activate the meter through the mechanical activation of a small, sealed, contact switch at the back of the card reader assembly. The card must be fully inserted to activate the switch. When activated, the meter provides power to the card, and determines whether the card is a valid client smart card. If the card is not identified as a valid client card, or if the card is found on the internal blacklist held in the meter, the meter will reject the card and indicate an appropriate error message.

The Solo's card blacklist file is a file that is loaded into each Solo that actually contains both a whitelist and a blacklist. The currently approved/accepted card manufacturer code(s) (also known as a whitelist) is found in this blacklist file. The blacklist file can also contain a reject list of individual card serial numbers, a range of card serial numbers, a list of individual card batches, a range of card batches, or any combination of these criteria up to the pre-determined file size limit of the blacklist. Cards that are found on the whitelist (i.e. they have the correct manufacturer code) but then subsequently found on the blacklist will always be rejected by the meter. The blacklist data placed into a meter's blacklist file data can be created/edited using a standard text editor, and following a specific record format. The blacklist data is then encoded using a conversion utility provided by MacKay to produce the file that can be loaded onto a meter. Blacklist record format and use of this utility is beyond the scope of this manual. Once the complete blacklist file is uploaded to the Solo, the meter will reject any card that is listed in the blacklist section of the file, in addition to rejecting all cards not approved for use on the whitelist section of the blacklist file.

A valid card normally contains stored value for parking, which is organized on the card as a count of full tokens, plus any additional value currently held in a partial token counter or register on the card. Each card token has a predetermined value, for example \$0.25 (token value). The partial token counter or register has a resolution of \$0.01 (partial token value). These values are determined up front, and then are set by the manufacturer during the manufacturing of the card. This is an irreversible process. That is, once the card token values have been set by the manufacturer, you cannot change the token values of the card because the "fuse" has been blown.

The token value is known by the meter, and based on the number of tokens counted the meter multiplies this total by the token value assigned by the customer. An example of this is if the meter counted 200 tokens on the card and the value assigned by the issuer is \$0.25 (200 x \$0.25), and there is zero in the partial token count, the value shown on the display is \$50.00. This means the customer has \$50 parking dollars on their card.

However, certain criteria, such as Card Initial Purchase Increment, Card Initial Increment Count and Card Purchase Increment, can be changed through profiles created and edited with WinEMU. Use of WinEMU is beyond the scope of this manual. Please consult new supplemental WinEMU documentation regarding the creation of card profiles, or your MacKay Customer Service Representative for further details.

Certain card schemes can use either re-loadable or disposable cards, and are customizable within the meter application, created and provided by MacKay. Please contact your MacKay Customer Service Representative for further details on supporting other cards on the Solo.

Zero cash value remaining will be indicated with a display of zero or an appropriate message appearing on the meter's LCD. Under normal circumstances, the card is only removed once the desired amount of parking time has been purchased.

The Solo electronic parking meter normally operates in the following manner when a standard, authorized, token card is inserted (actual behavior is dependent upon the specifications of the token card scheme deployed):

- The meter attempts to validate the inserted card. This process is indicated to the user through the message "Processing" on the display.

If the card is Invalid:

- The meter will display a message indicating a card error and to pay using coins (for example, "Card Error, Use Coins").
- If the card is left in the card reader device after the meter has displayed this message, the meter will in almost all cases display a "Coins Only" message until the card has been removed.

If the card is Valid:

- The meter takes a count of how much stored value is on the card. As money is removed from the card, the token count value becomes smaller.
- If the user would simply like to check the balance of his or her card, removal of the card can take place after the balance is displayed, and no value is deducted from the card.
- If there are tokens remaining on the card, and the card is left in the meter after the card balance has been displayed, the meter will attempt to initiate a purchase cycle.

Token Card Purchase Cycle

- If there is no time on the meter or it is in an overtime period (grace or penalty period), the appropriate amount of time is added from zero and shown on the display. Several token extractions may be required to complete a minimum purchase (if defined in the meter rate profile) before time is displayed.
- If, for example the inserted card was to result in a purchase of 20 minutes of time, the meter's display would register 0:20, indicating zero hours, and twenty minutes of countdown time remaining. The internal timer counts down for each minute shown on the display. The meter display is decreased by one minute every time the internal timer passes zero.

- If there is time on the meter, the appropriate amount of time for each token is added to the time shown on the display up to the meter's maximum time and this new time is displayed. If the meter has a scheduled OFF (low power) period immediately following the regular enforced time, the meter will only display the purchased time up to the next scheduled OFF period (e.g. if the enforced period which ends at 6:00pm, is followed by an OFF (low power) period, and the user inserts a card into the meter at 5:45pm, the most time that the meter can display (or the user can purchase) is 15 minutes).
- If the Solo is on, but is functioning in a non-enforcement period (e.g. one hour before enforcement begins), and a card is inserted to make a purchase, the time remaining between the time of purchase and the enforcement period is automatically added to the desired purchase time at no cost to the end user. For example, if enforcement begins at 9:00am, and a customer wishes to purchase one hour of time (value of \$1.00) at 8:15am, insertion of a card (after validation and display of the card balance) would result in the starting time of 0:45, then permitting the user to continue purchasing time up until the desired purchase has been made, resulting in a display of 1:45. Alternatively, the user may purchase up until the maximum time on the Solo has been reached or the card is depleted of funds.
- If the inserted card does not have sufficient funds to complete a purchase, the meter will display the message "No Funds, Use Coins". If the card remains in the card reader, the meter will display a "Coins Only" message until the card has been removed. The card user may always insert coins before or after a card transaction to buy additional time until the maximum time has been reached.
- If the maximum time limit is reached (or attempted to be exceeded by excess card payment), only the maximum amount of time allowed by the meter is displayed. Please note that the time limit sticker, if used, is normally located below each display, indicating the maximum time limit for the meter, along with a message indicating that the meter has reached its maximum purchase time. The one exception to this is if a purchase is made prior to an enforced period, where the remaining time between non-enforcement and enforcement is added to the purchase, and subsequently the display.
- Card purchases will only compound in standard increments (i.e. card initial purchase increment and card purchase increment as specified in the profile). There are two exceptions to this rule: one is if a purchase is initiated with residual time left on the meter. In this scenario, partial tokens will be extracted (i.e. in \$0.03 increments if so programmed in the meter's profile) to bring the purchase to maximum time. The other exception is if a maximum time purchase is completed before the meter begins enforcement period. In this case, there may be an "odd" time remaining before enforcement begins. Therefore, the meter will take partial tokens (increments that may be less than the standard token value) to bring the meter to maximum time.

Solo Memory

- The meter increments the e-lock's token register by the total number of tokens and partial tokens extracted from the card.
- The meter's internal token counter² is increased by the number of tokens extracted from the card, which increases as long as the card remains in the card reader device up until the maximum time has been purchased.

Post-Purchase Solo Behavior

- If the card is left in the card reader device after the meter has reached its maximum time, and the meter has indicated that the transaction has ended and to remove the card, the meter will indicate to use coins only until the card has been removed.
- When the display on the meter changes to 0:01, there is one minute of purchase time remaining. The display remains like this until the internal timer counts to zero, purchase time is now used up and the display either goes into a predetermined overtime period (Grace or Penalty) or shows the EXPIRED message (Violation).

6.3 Maintenance/Data Collection Using the RF Probe Interface (RFI)

The Solo electronic parking meter operates in the following manner when a device called the RF Probe Interface (RFI) is inserted into the coin slot:

- All inserted devices will cause an interrupt to the main processor, which in turn will activate the appropriate circuits to initiate the interrogation of the card/device that was inserted into the card slot. If a very specific challenge and acknowledge sequence is successful then the meter determines that it is communicating with the PDT through the RF probe interface device.
- The meter then receives the appropriate commands from the PDT such as send audit data, set date/time, etc.
- Once the meter has responded to the commands issued, the link is terminated and the RFI device can be removed.

² The E-Purse's internal token counter is actually an internal register or reserved memory located in the meter's memory that keeps track of the coins inserted into the meter and tokens removed from valid cards. This is non-volatile memory and will not get lost in the event of complete battery failure.

Note:

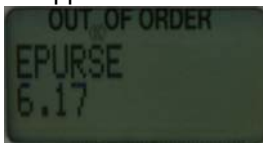
6.4 Meter & LCD Display Activity During & Following Reset

When the reset button is pressed and released, the primary time of day clock is shortly halted and started. Any previously purchased time is lost and the meter display time is reset to zero. The graphics display will be cleared while the reset button is depressed. When the reset switch is released, the meter carries out an internal health test/diagnostic, and if no problems are detected, it goes into normal service. During the reset cycle, the meter carries out what is referred to as its "LAMP TEST" and the following actions occur:

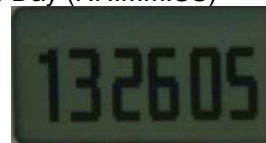
Once the meter initialization/start-up process and lamp test is started, it should be allowed to run to completion without interruption.

- 1) When the reset button is pressed, there will be an initial display pattern presented, then the display on the LCD will display the following information:

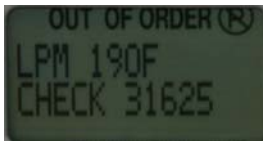
- a. Main Meter Application Version



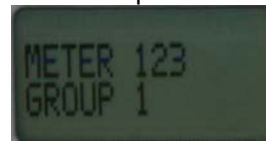
- d. Time of Day (HH:MM:SS)



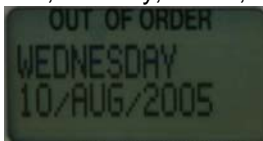
- b. LPM Firmware Revision and Checksum



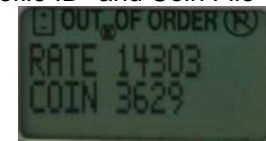
- e. Meter ID and Group ID



- c. Day of Week, and Day, Month, Year



- f. Rate Profile ID³ and Coin File



• Figure 22 – Display Samples

³ For the Rate Profile ID, the first set of numbers represents the Profile Group currently installed in the meter and the second set of numbers, following the slash, represents the Profile Number of the rate profile installed in the meter. Profile group and profile numbers are created and associated in WinEMU. The association is maintained automatically when using the **Update Profile**, **Reload Profile** or **Install Meter** functions of PDT-CE. It is possible to override the association by forcing a different profile into the meter by using the **Transfer Data Item** function.

Note that it is normal that other icons/symbols appear during the above display sequence, as is shown in the various figures.

- 2) The above display sequences will also have flashed all the LEDs, and available LCD ICONS, and will have exercised all LCD pixels in the graphic display area.
- 3) The meter will pause at the last display, with the backlight momentarily active, while it does the following additional internal tests:
 - (a) Check communications with lock and coin chute
 - (b) Check data integrity of downloadable data items
- 4) Once the above internal tests are complete, the LCD will display on the LCD the meter's health status (meter status and extended status) as exemplified below:



• Figure 23 – Health Status Display Sample

NEW!

- 5) Following the display of the health status information, the meter will go into service if it is able. The last two operations performed are the suppression of the counting of coins and card transactions for a period of 60 seconds, reset by a coin or card insertion, and it will log a reset maintenance event when the lamp test is complete. The counting of coins and card transactions will resume automatically after 60 seconds has elapsed since a coin or card was inserted.

Pressing the reset button is discouraged except for the following circumstances:

- 1) To access the coin/card test feature.
- 2) In cases where the meter is apparently non-responsive to normal stimuli, including an attempt to connect via SCI.
- 3) Where requested to do so by MacKay originating operating procedures, or customer service representative, obeying all documented timing restrictions.

Note: For the period that the reset button is depressed, the primary clock circuit is halted. This introduces a time difference between the meter's primary and backup (secondary) clocks. Since the reset button typically is depressed for less than a second, this normally has no operational impact. However, if the reset button is held or depressed many times during a one day period, the time difference between the primary and secondary clock could become sufficiently large (greater than 15 seconds). If so, the meter will generate a false "clock unreliable" event and go out of order. If this occurs, the meter can be put back into operation by resetting the meter's clock using PDT-CE.

6.5 Requirement for Periodic Primary Audits

While there is substantial memory in the Solo meters to store maintenance activities and card transactions, this memory is finite and will eventually fill up over time. When this happens, the meter is currently configured to go out of service. The meter will provide a warning by flashing the yellow (amber) LED when the memory reserved for maintenance records and card transactions is more than 80% full. The meter is currently configured to hold 850 maintenance event records and 350 card transaction records. While this may seem like a significant number, some intermittent or repeating faults will generate many duplicate maintenance records and fill up the available space in a relatively short period. In addition, many maintenance records are generated because of normal street activity such as lock openings, meter checks and other inspections.

As such, MacKay recommends that the meter primary audit be collected periodically or at least once every month. Depending on current configuration, primary audit data collections can be combined with meter coin audit collections in the "Audit" function of PDT-CE. Alternatively, this data collection activity can be automated by using the "routine" function of PDT-CE. In this way, maintenance staff simply has to insert the SCI into the meter and the data will automatically be collected.

The behavior of whether the meter goes out of service or not when the maintenance and card transaction memory fills up is configurable in the factory profile provided by MacKay. MacKay does not recommend changing this behavior. The meter will continue to provide error/status warnings that the audit memory is near or at capacity, but once it is filled, the meter will stop recording transaction events. Since a meter's maintenance transaction memory typically fills up most quickly when there is a problem with the meter, the opportunity to collect and review valuable data that can help troubleshoot the problem will be lost if the primary audit is not regularly collected.

7. Meter Installation and Removal from Housing

7.1 MacKay Guardian™ Solo Installation

The *MacKay Guardian*™ Solo meter will display the “Out of Order” message until it has been configured using a proper INSTALL procedure, described below, and will display a flashing amber LED until it has been connected to an e-lock. Knowledge in the proper use of the PDT is required to do all meter installations and removals. The steps to carry out meter installation are:

- 1)** Connect a fresh, new battery to the meter, and let the meter complete its lamp test.
- 2)** Using the PDT, set the proper date and time on the meter.
- 3)** Connect the meter’s e-lock interface cable to the mating connector found inside the upper housing. This cable passes through an access hole in the upper mechanism housing.
- 4)** Using the PDT, carry out the INSTALL procedure which sets the post ID and zone where the meter is being installed. The meter should now be in service.
- 5)** Briefly press and then release the reset button, let the meter do a complete diagnostic, and once the lamp test has completed, insert coins of each accepted denomination and a test card to test for normal/expected behavior (rate and max time).

Remember that for 60 seconds after the last coin or card insertion, the meter will not add coin or card transactions to the respective counter or data log. It is recommended to wait for 60 seconds with the meter before returning it to its housing or allowing the public to use the meter.

7.2 MacKay Guardian™ Solo Removal

A meter will need to be removed if, after normal on-street inspection and troubleshooting, the meter will still not operate reliably. A record of each meter removal **MUST** be made on the PDT to ensure that the meter/post database is kept accurate. This record can be done manually if the meter is non-responsive (dead battery, etc.) or using the Solo and SCI or LKI if the Solo is still able to communicate in this manner. The steps to carry this out are:

- 1)** Using the PDT, carry out the REMOVE (or SWAP) METER procedure which identifies the meter being removed and the post affected. If the meter is non-responsive and communications with the meter is not possible the PDT keyboard is used to make the manual meter removal data entries.

- 2)** Disconnect the Solo's e-lock interface cable from the mating connector.

When it is necessary to disconnect the Solo from the e-lock cable, care must be taken that both cable ends are grasped and then pulled apart. This will minimize stress and potential damage to the cable connection points at the meter's main board and the housing right bracket lock contacts. Pulling the meter away from the housing to force the separation of the cable may void the warranty.

- 3)** Disconnect the battery from the meter.

- 4)** Complete and attach a meter fault label to the meter or in the battery compartment so that the City's repair staff at their meter repair depot will know what the original fault was and what repair attempts have already been made.

- 5)** If the meter cannot be repaired, and if it is still covered by warranty, return the meter to MacKay in accordance with prescribed warranty return procedures.

8. Troubleshooting

This section deals with basic troubleshooting. It is assumed that the user/reader of this guide has received adequate PDT training and knows how to use the MacKay PDT-CE Handheld Application. Use discretion when determining which procedures can be carried out on-street and which require the meter to be taken to the meter repair depot for servicing.

8.1 Repair Guide

Materials Required:

- Bench test card reader;
- Bench test coin chute;
- Bench test battery pack;
- JETT handheld running MacKay MT-CE Handheld Application Version [TBD] or greater;
- RF Probe Interface device ;
- # 2 Philips screw driver;
- Decoding sheet for reset messages;
- Masking tape (blue);
- Marker.

Required Setup for In-Shop Repairs/Testing:

- [TBD]
-

Please Note: It is assumed that a stock of replacement card readers and coin chutes are on hand for repair and that all faulty components will get swapped for good ones with the designated service technician.

8.2 Final Test

Before the Solo can be considered ready for the street, it must be [TBD]

- 1) TBD

8.3 Common Faults

The following outlines the more common faults and most likely repairs.

8.3.1 TBD

Problem TBD

Solution

- 1) TBD

9. Maintenance and Repair

This section deals with: testing a new battery pack, replacing meter battery packs on-street, in-shop repairs, replacing a coin chute and card readers, testing a reassembled meter, annual, monthly and weekly maintenance, handling, storage and transportation of meters and how to read and interpret the meter status message of the *MacKay Guardian™* Solo.

9.1 Testing a New Battery Pack

- 1)** Using a digital multi-meter (DMM) set to the proper voltage range (10V DC) test the terminal voltage of the new battery pack. Insert the positive and negative leads of the multi-meter into the battery connector. A fresh unused battery pack has a measured voltage of 4.5V DC or higher.
- 2)** The Solo will signal a low battery condition when the battery pack voltage is at approximately 3.0 volts DC. It is recommended that a battery pack be considered at or near its “low battery” threshold, and should not be used, if it has a measured, unloaded (open terminal) battery voltage of approximately 3.0 volts or below.

9.2 Replacing Meter Battery Pack

To replace the battery on a meter that has indicated that it is in a low battery condition (If the display is not blank, i.e. showing time/out of order/zeros) or the battery pack installation date is more than 12 months old, do the following:

Note: Avoid replacing the battery pack when it is active (i.e. during a reset sequence).

- 1)** Unlock and remove the top from the upper housing, and carefully lift the meter out of the housing. Use caution, as the meter is connected to the e-lock located in the lower vault housing via the meter e-lock interface cable, and any sudden pulls on the wire harness may damage the connection and void the warranty. There is no need to disconnect the meter/e-lock interface cable during Solo battery changes.
- 2)** Remove the black plastic Solo battery compartment cover by placing your fingertip into the access hole located on the cover and gently pull down until the cover pops clear of the dome back.



• Figure 24 – Rear View of the MacKay Guardian™ Solo

- 3) Holding the meter and one end of the battery plug in one hand, disconnect the battery by pulling the mating ends of the battery plug apart from each other. Take due care when doing so as the mating battery connector ends may be initially quite stiff/firmly attached and may release quite suddenly. Applying a twisting motion to both connector halves while pulling is an effective way to disconnect the battery connector halves (see guidelines for proper battery disposal). Once the battery pack is disconnected, it normally takes 2-5 seconds for the removal to be detected, and the meter display to go blank. **DO NOT DISCONNECT AND THEN IMMEDIATELY RECONNECT THE BATTERY PACK!** Wait at least 5 seconds before replacing or reconnecting a battery pack to the meter.
- 4) Remove the protective insulating tape around the end of the new replacement battery pack connector. Apply a very small amount of dielectric grease to the exposed metal contacts on both exposed mating ends of the battery connectors (Dow Corning 4 Electrical Insulating Compound).

• Figure 25 – MacKay Guardian™ Solo Battery Pack (Part Number 30EP000010)



- 5) Attach the new, previously tested, replacement battery pack by connecting the mating battery connector halves firmly and deliberately together, using the same twisting motion as above, so that there is no exposed metal contact visible. **DO**

NOT CONNECT AND THEN IMMEDIATELY DISCONNECT THE BATTERY PACK!

Wait until the meter lamp test has completed (if replacing a dead battery) or at least 5 seconds before disconnecting a newly replaced battery pack from the meter. For battery testing procedures, see Section 9.1.



• Figure 26 – MacKay Guardian™ Solo Battery Plug

- 6) Place the battery pack back into the meter battery compartment, ensuring that the mating battery connectors and excess wire are also placed into the battery compartment cavity, such that they will not be pinched by the battery cover. The “INSTALLED DATE” label on the battery pack should be facing outwards and the repairperson replacing the battery should write the current date on the label using either a pencil or waterproof permanent marker.
- 7) Replace the plastic battery compartment cover, by first locating the lower part of the cover into the zinc frame detents and then hinging the cover closed until it snaps into place at the upper end. If the battery connector wires are not properly tucked into the battery compartment cavity, the battery cover will pop off. If this is the case, place the wires inside the battery compartment properly and then re-install the battery cover.
- 8) Press and release the reset button located on the left hand side of the meter next to the card reader. If the meter was in operation prior to the battery replacement, and the new replacement battery was replaced within 3 to 5 minutes of the old battery being disconnected, the meter should be operational after completion of the meter’s reset sequence (in most cases this is noted by the graphics display indicating “EXPIRED”). If the previous battery was fully discharged or the new battery replacement took longer than 3 to 5 minutes, the meter will not be operational (will normally indicate “OUT OF ORDER”) until the correct time/date have been set in the meter by using the handheld/PDT.
- 9) Once the meter is operational, after pressing reset, a coin and card test should be conducted to ensure that the meter is operating properly. Insert cards and sufficient coins in various denominations to bring the meter to its maximum time. Note that this coin and card testing will not register in the meter’s audit memory if the coins and cards used for testing are inserted into the meter within 60 seconds of pressing reset. The meter will automatically revert to registering all coin and card transactions in its audit

memory after more than 60 seconds have elapsed since the last coin or card was inserted into the meter.

- 10)** Insert the meter back into its housing ensuring that the meter's e-lock interface cable is not being pinched or blocking the coin path. Replace and lock the upper housing top.

Note: When a battery is changed in the meter, a Battery Event is recorded in the meter's maintenance record. However, the meter is designed so that any abnormal change in battery voltage since the meter's last health check is interpreted as a Battery Event. If a review of the meter's maintenance records indicates repeated unexplained Battery Events, the meter should be returned to MacKay for evaluation and repair.

9.3 Meters Returned to Meter Repair Depot for Repair

- 1)** Remove the faulty meter from its transit case/carton. Review the fault sticker/label and begin to trouble shoot the problem. Carefully inspect the meter for physical damage or any obvious reason for the failure. Check the battery pack for proper voltage and secure connection. Check the card reader assembly, coin chute and reset button for jams, foreign material or a stuck condition. Connect the meter under repair to a test e-lock and housing setup. Using the PDT and SCI tools, install the meter into this test setup using the proper procedures (see Section 8), and ensure that the meter date and time are set.
- 2)** If the meter cannot be fixed at your workshop, arrange a return merchandise authorization, "R.M.A." number with the local repair depot or MacKay. Package the meter carefully and return as instructed. The entire meter, less the battery, should be returned. Do not return partially dismantled or loose parts to the repair depot.
- 3)** Once the meter has been repaired by MacKay and returned, coin check and check with a test card (if used) and return it to stock for future use.

9.4 Disassembly

The following are step-by-step instructions for the disassembly of the Solo. Depending on the component being replaced, not all steps of the disassembly procedure will need to be performed. As the disassembly involves electronic components, the work area must be clean and have appropriate anti-static measures in place with anti-static mats, pads, wrist-straps, and any other appropriate anti-static equipment. A Phillips screwdriver is the primary tool required for disassembly and re-assembly of the Solo.

Note: All disassembly and reassembly should be performed with the battery pack removed (see Section 9.2, "Replacing Meter Battery Pack"). Please refer to Figure 7 of this manual showing the exploded view of all meter components.

- 1)** Separate the coin-card front from the main meter frame.
 - i)** Remove the rate plate by lifting the center of it up and clear of the retaining tab and pulling the rate plate forward.
 - ii)** Unscrew the long front screw from the face of the Solo coin-card front, until it is no longer connected to the dome front. Note that the screw will not actually fall free as it is retained by a small plastic retaining washer that prevents the screw from falling away from the zinc frame and becoming lost.
 - iii)** Unscrew the lower two captive screws found at the lower back of the meter. Note that these screws are self-retaining and will remain on the main frame when unscrewed from the coin-card front.
 - iv)** Pull the coin-card front forward and clear of the main meter frame. This will fully expose the card reader (if installed) and the coin chute.
 - v)** Note that the card wiper may still be lodged in the cavity for the card reader and slot.
 - vi)** To remove the coin slot from the coin-card front, insert the tip of a flat bladed screwdriver into the coin slot and lift up on the coin slot.
 - 2)** Remove the card reader assembly (if card reader is present).
 - i)** Gently pull the card reader assembly straight away from the meter frame. You will note that there is a mating card edge connector. It may be necessary to rock the card reader assembly slightly while pulling the card reader assembly away from the meter frame.
 - 3)** Remove the SmartChute™ coin discriminator (coin chute).
 - i)** Gently pull the coin chute straight and away from the meter frame. You will note that on the main frame there is a male header connector for connection with a female connector on the coin discriminator. It may be necessary to rock the coin discriminator assembly slightly while pulling the coin discriminator away from the meter frame.
 - 4)** Remove the RJ cap found at the lower right corner of the dome front.
 - 5)** Remove the rear battery cover and battery pack (if not previously done).
 - 6)** Remove the dome back.
 - i)** Unscrew the three dome back captive screws; one found above the rear display opening, and the remaining two screws found just below the battery opening at the lower rear of the dome back.
 - ii)** Separate and lift the dome back clear of the meter assembly.
 - iii)** Remove the service bracket.
 - 7)** Remove the main board assembly.
-

- i) Unscrew the three small chute board screws that hold the main board in place.
- ii) Lift the main board assembly clear of the dome front piece that remains and place the board into a protective antistatic container or pouch.
- iii) Note the location of and remove the reset button from the cavity in the dome front piece.

9.5 Replacing Coin Discriminator

If a coin discriminator cannot be cleaned out or becomes damaged it will be necessary to replace the coin discriminator. Use the following procedure to replace the coin discriminator:

- 1)** Separate the coin-card front from the main meter frame.
 - i) Remove the rate plate by lifting the center of it up and clear of the retaining tab and pulling the rate plate forward.
 - ii) Using a Phillips #2 screwdriver, unscrew the long front screw from the face of the Solo coin-card front, until it is no longer connected to the dome front. Note that the screw will not actually fall free as it is retained by a small plastic retaining washer that prevents the screw from falling away from the zinc frame and becoming lost.
 - iii) Unscrew the lower two captive screws found at the lower back of the meter. Note that these screws are self-retaining and will remain on the main frame when unscrewed from the coin-card front.
 - iv) Pull the coin-card front forward and clear of the main meter frame. This will fully expose the card reader (if installed) and the coin discriminator.
 - v) Note that the card wiper may still be lodged in the cavity for the card reader and slot.
 - vi) To remove the coin slot from the coin-card front, insert the tip of a flat bladed screwdriver into the coin slot and lift up on the coin slot.
- 2)** Remove the coin discriminator from the plug to which it is attached.
- 3)** Spray a squirt of ProGold™ XPG5 conditioning treatment on the connectors and re-install a coin discriminator into the mating header.
- 4)** Replace the front onto the meter housing (inverse step 1).
- 5)** Press the reset button and ensure that the meter is in service. Drop a coin 10 or more times through the meter and observe for proper acceptance.

WARNING! SHARP METAL OBJECTS SHOULD NOT BE USED AT ANY TIME TO SERVICE OR CLEAR COIN JAMS FROM THE COIN DISCRIMINATOR ASSEMBLY.

9.6 Replacing a Card Reader

If a card reader cannot be cleaned out or becomes damaged it will be necessary to replace the card reader. Use the following procedure to replace the card reader:

- 1) Separate the coin-card front from the main meter frame.
 - i) Remove the rate plate by lifting the center of it up and clear of the retaining tab and pulling the rate plate forward.
 - ii) Using a Philips #2 screwdriver, unscrew the long front screw from the face of the Solo coin-card front, until it is no longer connected to the dome front. Note that the screw will not actually fall free as it is retained by a small plastic retaining washer that prevents the screw from falling away from the zinc frame and becoming lost.
 - iii) Unscrew the lower two captive screws found at the lower back of the meter. Note that these screws are self-retaining and will remain on the main frame when unscrewed from the coin-card front.
 - iv) Pull the coin-card front forward and clear of the main meter frame. This will fully expose the card reader and the coin discriminator.
 - v) Note that the card wiper may still be lodged in the cavity for the card reader and slot.
 - vi) To remove the coin slot from the coin-card front, insert the tip of a flat bladed screwdriver into the coin slot and lift up on the coin slot.
- 2) Remove the card reader from the plug to which it is attached.
- 3) Spray a squirt of ProGold™ XPG5 conditioning treatment on the connectors and re-install a new card reader into the mating card socket.
- 4) Replace the front onto the meter housing (inverse step 1).
- 5) Press the reset button and ensure that the meter is in service. Insert the SCI or test card to verify that the card reader is in operation.

9.7 Reassembly

The reassembly instructions are essentially the reverse of the disassembly steps. As the reassembly involves electronic components, the work area must be clean and have appropriate anti-static measures in place with anti-static mats, pads, wrist-straps, and any other appropriate anti-static equipment. The following are step-by-step instructions for reassembly.

- 1) Place the dome front on a clean work surface front side down.
- 2) Install the reset button.
- 3) Place the RJ cap into the RJ 45 peripheral port at the lower left of the dome front.
- 4) Install the main board assembly using the three ¼" long Phillips self-tapping screws.
- 5) Ensure that the e-lock interface cable is located through the e-lock cable slot in the dome front.
- 6) Place the housing service bracket into its slot on the side of the dome back.
- 7) Place the dome rear piece onto the assembly ensuring that the battery connector protrudes through the rear of the dome piece, and that the e-lock cable is not pinched between the two mating dome pieces.
- 8) Tighten the three captive screws to secure the rear dome back to the dome front.
- 9) Turn the meter assembly over so that the two front connectors are visible from the front.
- 10) Spray a squirt of ProGold™ XPG5 conditioning treatment on the connectors and carefully insert the card reader assembly into the card edge connector.
- 11) Align the mating connectors from the meter's main board to the coin chute and carefully spray a squirt of ProGold™ XPG5 conditioning treatment on the connectors. Once aligned, join the two connectors by pressing the coin chute onto the meter assembly.
- 12) Place a coin-card front facedown on a working surface, and insert the card wiper into the coin-card front card reader cavity.
- 13) Pick up the meter assembly with the card reader and coin discriminator attached, and while aligning both card and coin assemblies into their respective cavities on the inside of the coin-card front, bring the meter assembly and the coin-card front together. There should not be any gaps between the legs of the coin-card front and the dome front when the two parts are brought together correctly. Tighten the two lower captive screws to secure the coin-card front to the dome front. Tighten the long front screw.
- 14) Install the coin slot into the slot.
- 15) Install the rate plate.
- 16) Install the battery.

- 17)** Install the battery cover ensuring that the battery connector wires are properly tucked into the battery compartment cavity.
- 18)** Press reset, ensure the meter is operational, and coin test the meter. See Section 9.8 for testing instructions.

9.8 Testing a Reassembled Meter

- 1)** Press the "Reset" button and check that the LCD displays the correct information (see Section 6.4).
- 2)** Using several coins of each type accepted, check that all coins pass freely through the meter and register correctly. Using a test card, check that the meter operates correctly.

9.9 Annual Maintenance

A general inspection of all components should be carried out yearly. This inspection should include the following:

- 1)** The display is to be checked for any damaged segments or abnormalities.
- 2)** The coin chute is to be checked for any foreign substances such as glue, any sticky sugary substances, spider webs, insect larva and jammed material (i.e. paper, wood, etc.).
- 3)** Overall appearance of rate plate, decals and any other instruction plates. Replace as needed.
- 4)** Inspect the LCD/LED's to insure display is highly visible without excessive dust or dirt build up. Clean as required.
- 5)** Check card reader for debris and/or damage. Clear debris or replace if necessary.
- 6)** Check for corrosion on battery leads. Replace if necessary.
- 7)** The battery should be replaced if the battery pack installation date is more than 12 months old.

9.10 Monthly Maintenance

If the card reader is accessed frequently (high usage), they should be cleaned at a minimum of once per month, even with the benefit from a "self cleaning" action created every time a card is inserted into the card reader. Neglect of proper card reader cleaning can result in card reader

failure, inconsistent card functionality and premature card failure. Maintenance records must be maintained to preserve warranty.

The following is a recommended procedure for card reader maintenance using a PRESAT™ *Smart Card Reader Double-Sided Cleaning Card* which can be purchased from MackKay. The card reader cleaner is long enough so that both ends of the card reader can be used for cleaning.

- 1) Remove the card reader cleaner from its wrapper, holding it by its edges. The cleaner should feel wet when it comes out of the package.
- 2) Quickly insert and remove the card reader cleaner in the meter three times to provide maximum cleaning action.
- 3) Generally, up to eight card readers can be cleaned effectively with one card, alternating each end of the card reader as each meter is completed (clean one meter then flip the cleaner around, clean another meter then flip the cleaner around again). The precise number of readers that can be cleaned by a single card before it dries out and needs to be remoistened with the cleaning solution is dependent on the condition of the card readers in the field.
- 4) The cleaning solution from the card cleaner manufacturer (PRESAT) can be purchased in volume. It should be put into a spray bottle and applied to the end of the card reader cleaner as required to keep them moist and effective. Normal isopropyl alcohol should not be used as it contains a large percentage of water and will damage the card readers with extended use.
- 5) Service technicians must pay close attention to the cleaners and their condition as they work. If excessive dirt and grime build-up is present, the card reader can be cleaned with a rag and more cleaning solution applied. If the card reader cleaner card is extremely dirty or worn, it should be discarded and a new cleaner used.

Equally effective is the LPS® CFC Free Electro Contact Cleaner. The LPS® brand contact cleaner is sold in an aerosol format and can be sprayed onto a dry cleaner card. LPS® products are widely available.

9.11 Weekly Maintenance

Meters that have a high card usage benefit from a “self cleaning” action created every time a card is inserted into the card reader. However, lack of card use allows dust, dirt, moisture and other environmental elements to build on the cards readers causing premature corrosion. This corrosion can cause serious card reader as well as card system problems.

High card usage failures can be expected on meters equipped with card readers that have been in service for an extended period without cards being used. Meters that utilize cards and are located in areas where usage is very low or non-existent should have the card readers checked and cleaned weekly.

9.12 Handling, Transportation and Storage of Meters

While the meter is designed to withstand many of the day-to-day situations that may arise, precaution should be taken when transporting meters from one area to another. Damage can result from improper handling, and when not transported and/or stored properly.

- Care should be taken while handling the meter once outside of the protective housing. The meter should never be held or grabbed by the LCD display. Grabbing the meter by the LCD display may result in damage to the numerical display and will void the product warranty. Segments on the display can be damaged causing confusing messages from the display. ***Always avoid contact with the LCD when handling a meter.***
- Avoid dropping the meter while handling. Dropping onto a hard surface may cause damage to both the main board and the coin chute.
- When removing parking meters from a post, or when removing the post/parking space, never leave the complete housing/meter combination attached to the post. Doing so could result in serious damage to the Solo and the housing itself. If a parking space is eliminated or removed, first remove the Solo from the housing, placing it in a safe container for transport. Next, remove the housing from the post, placing the housing in a secure container for transport keeping the Solo and the housing separate.
- It is recommended that the meter be transported from one area to another using the meter boxes supplied or a container of equal or better quality. Meters should never be permitted to roll around in the back of a utility vehicle or piled one on top of the other in a shop environment.
- Spare meters should be stored safely on shelves where they are easily accessible and placed in secure containers for transporting.

• Figure 27 – MacKay Guardian™ Solo "Exploded View"

Note: Some parts are not exactly as shown above.



9.13 MacKay Guardian™ Solo Meter Parts List

MacKay Part No.	Qty.	Item Description
10EP0010020	1	Solo Coin Card Front - Silver
10EP0010050	1	Solo Dome Front - Silver
10EP0010060	1	Solo Dome Back - Silver
15EP0500000	1	Solo Main Board
20GD0000010	1	SmartChute Coin Discriminator
25UE0000020		Card Reader Protector
30EP0000010	1	Solo Battery Pack
32GD0000005	1	Acetate Card Wiper
25EP0000005	1	Card Reader Assembly
32GD0000040	1	RJ Cap
32UE0000XXX	1	Coin Slot
35EP0000025	1	Retaining Washer for Front Screw
35GD0000035	5	Captive Screws
35K80000425	1	Front Screw
35K80000420	3	Chute Board Screw
37EP0000020	1	Solo Battery Cover
37UE0000005	1	Reset Button
39UE0000005	1	Rate Plate Decal

39UE0000XXX	2	Time Limit Decals
45EP0000020	1	Service Bracket
45EP0000025	1	Rate Plate

• Table 1 – Mackay Guardian™ Solo Parts List

10. Returning a Meter to MacKay

- 1)** Contact the Product Support Technician at MacKay for a 'Return Merchandise Authorization Number (RMA#)';

Phone: (888) 462-2529

Fax: (902) 752-5955

- 2)** Send the meter(s), noting the RMA# clearly on the packing slip, to the following address:

[TBD]

- 3)** Please help us get your product back to you as soon as possible by including a detailed description of the problem. If possible, please provide the following information:
 - The PDT date and time the incident occurred.
 - The meter ID number, location ID number, profile group, profile and meter software version.
 - A description of what was being done with the meter when the problem occurred, or what state the meter was found in. This includes a description of what was showing on the display, if anything, and if any LED were lit or flashing.
 - The status of the meter, obtained using the Check Meter function in PDT CE. If a connection cannot be made using the SCI or LKI, the status can be obtained by pressing reset and watching the status displayed on the meter display screen.
 - A copy of the primary audit file (AAB file).

