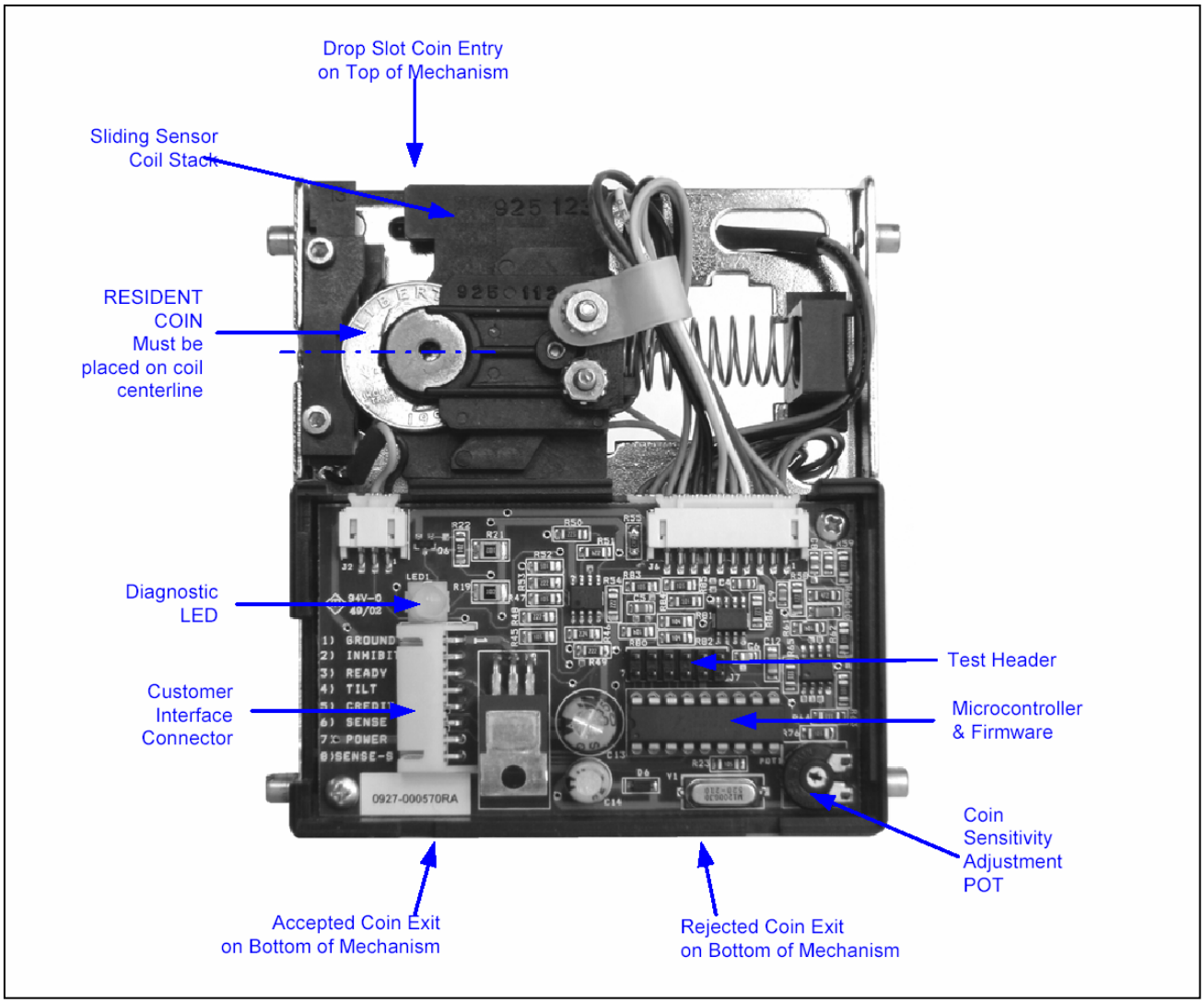
Defender
Product Training

Defender
Course Outline

- Defender Description
- Theory of Operation
- Calibration, Adjustment and Maintenance
- Mechanical and Interface Configurations
- Sub-Assembly Troubleshooting

Defender Description

The most technically advanced comparator technology for the highest available level of slot machine security.



Defender Theory of Operation

- Inhibit Control

- Validation Sequence
  - Coin Entry Sensors
  - Diameter Sensors
  - Sensor Coil Design
  - Comparitor ® Circuit and Null Definition
  - Accept Gate
  - Sense Pulse

- Exit Sequence
  - Exit Sensors
  - Credit Pulse

- Error Conditions

Defender
Inhibit Control

- In addition to supplying power to the Defender, the host machine must control the Defender to reject coins. This control line is called **Inhibit**.

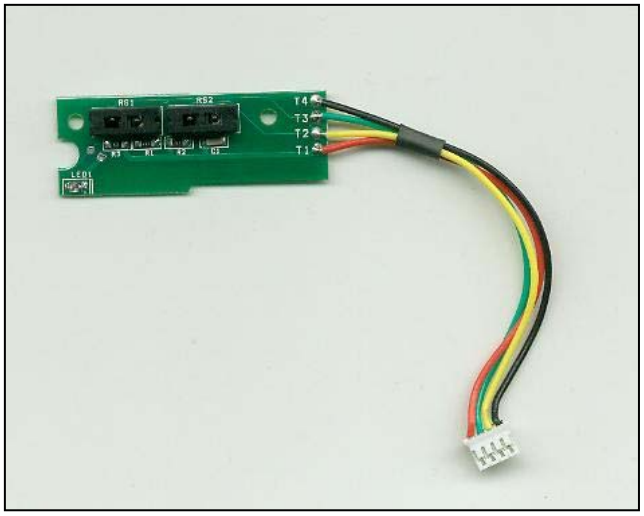
- Inhibit logic is determined by firmware. Some firmware will reject coins when the **inhibit** is supplied with a logic high and some will reject coins when the **inhibit** is supplied with a logic low.

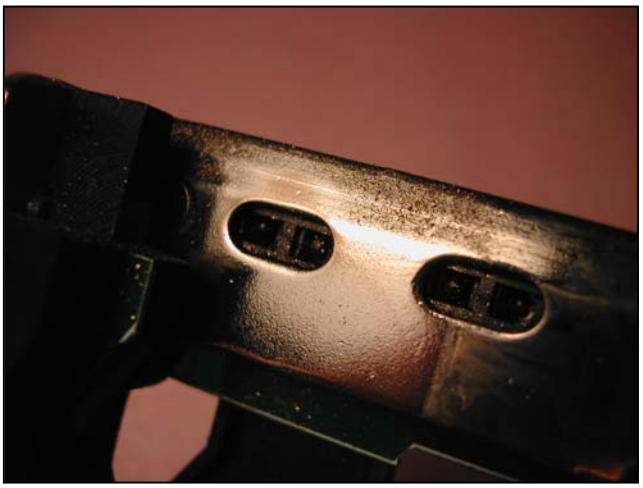
- When the Defender is inhibited, the diagnostic LED turns red.

Defender
Validation Sequence

- When a coin enters the DEFENDER Mechanism it passes:
  - Coin Entry Sensors
  - Diameter Sensors
  - Sensor Coils
- The microcontroller on the main PC board monitors the coin to ensure that it passes each sensor in the proper sequence for a proper length of time. If the coin passes all of the criteria only then is it determined to be a valid coin.
- When a coin is detected as valid, the microcontroller opens the **Accept Gate** and issues a pulse on the **Sense Output**.

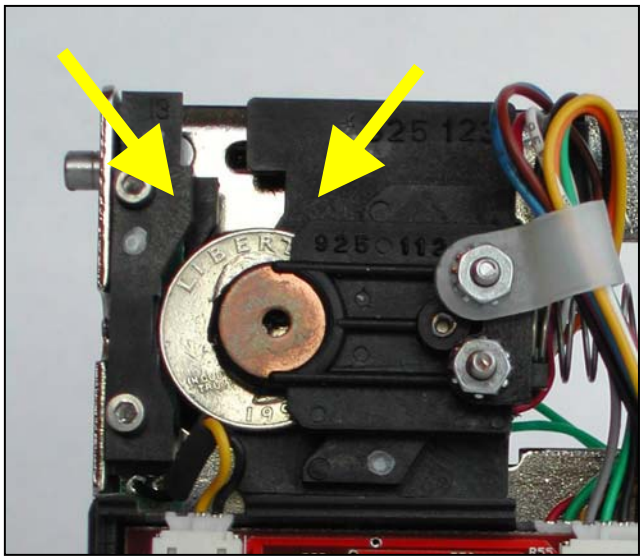
Defender
Coin Entry Sensors

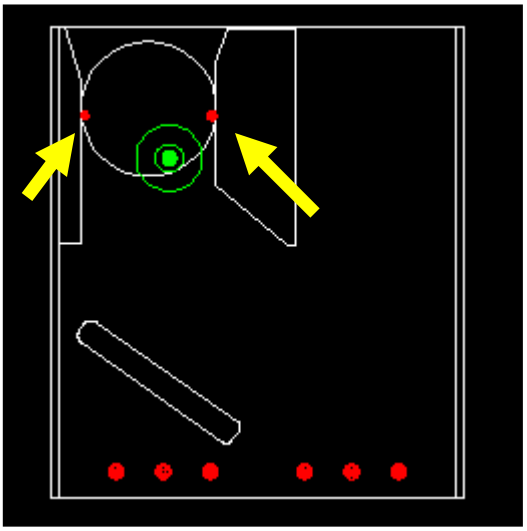




- The Coin Entry Sensors are positioned at the very top of the mechanism.
- They detect that something has entered the coin path and this starts an event timer in software.

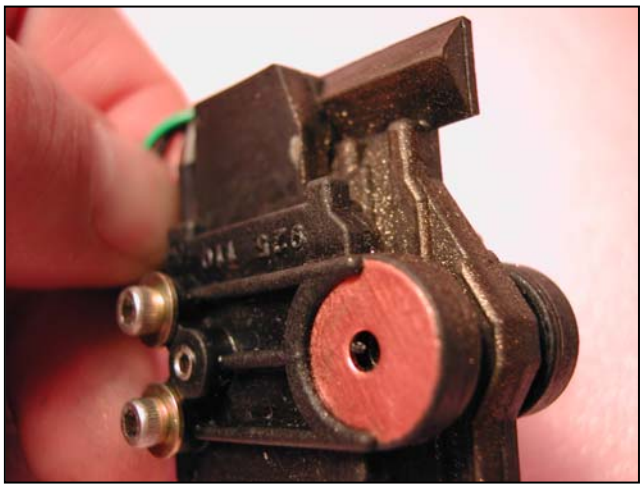
Defender
Diameter Sensors

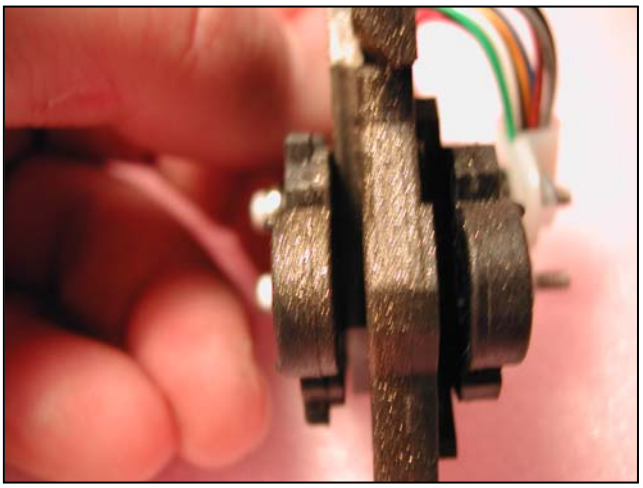




- The Diameter Sensors are positioned on both sides of the coin path. One sensor is located in the rail assembly and the other is embedded in the sensor coil assembly.
- If the coin reaches the diameter sensors in the proper amount of time and the diameter is within the proper tolerances, the validation event continues.

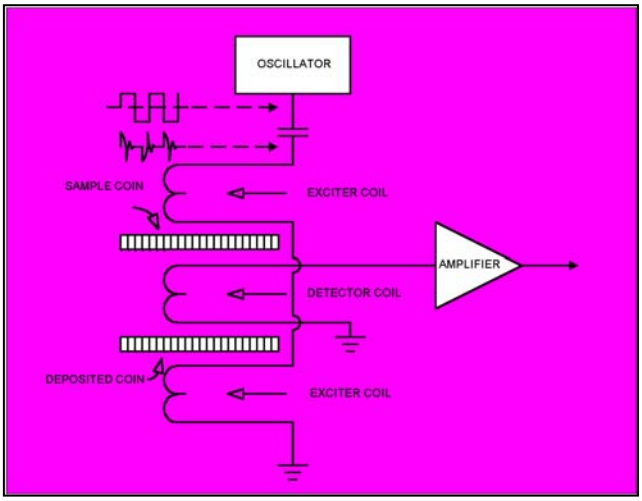
Defender
Sensor Coil Assembly Design

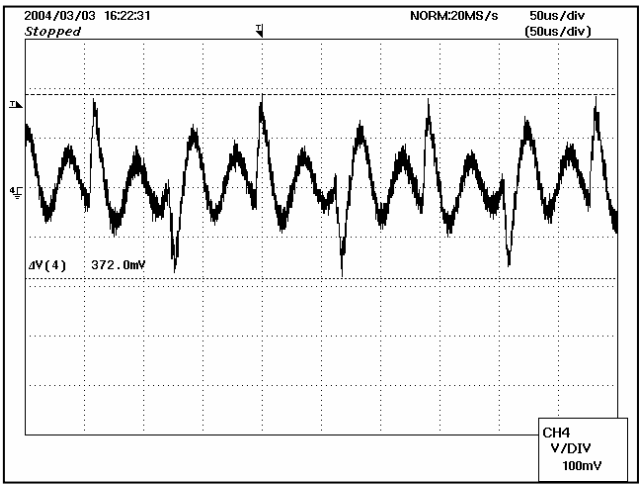




- Coin Comparitor ® technology uses a system of three coils spaced and stacked such that the diameters of each of the cylindrical coil bobbins are parallel to each other. There are two gaps created between the three coils. In one gap a reference sample coin is held. The other gap is positioned in the validation path below the coin entry. As the deposited coin passes through this gap, it is compared to the reference sample coin.

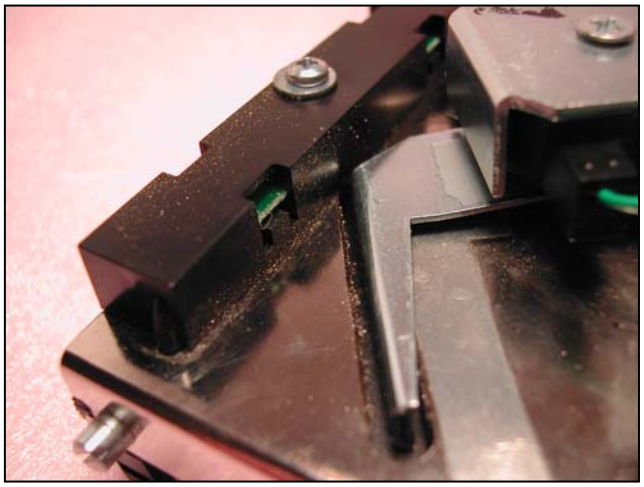
Defender
Comparitor ® Circuit and Null Definition

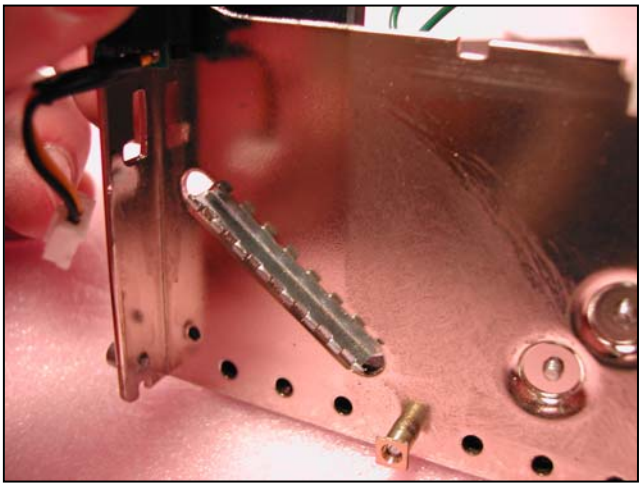




- An oscillating current is passed through the exciter coil. The detector coils are magnetically coupled to the exciter coil via the magnetic fields in the gaps. The detector coils serve to sense the difference in magnetic field strength between the gaps. When this difference is at its smallest (balanced coil gaps), the resultant waveform is identified as a “null”.

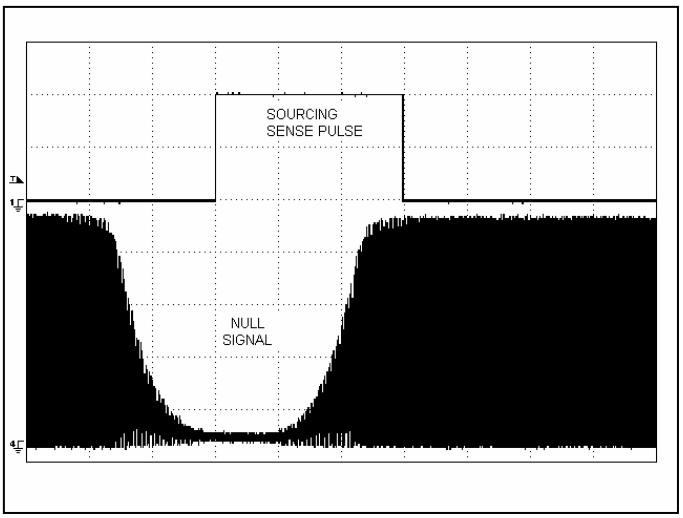
Defender
Accept Gate

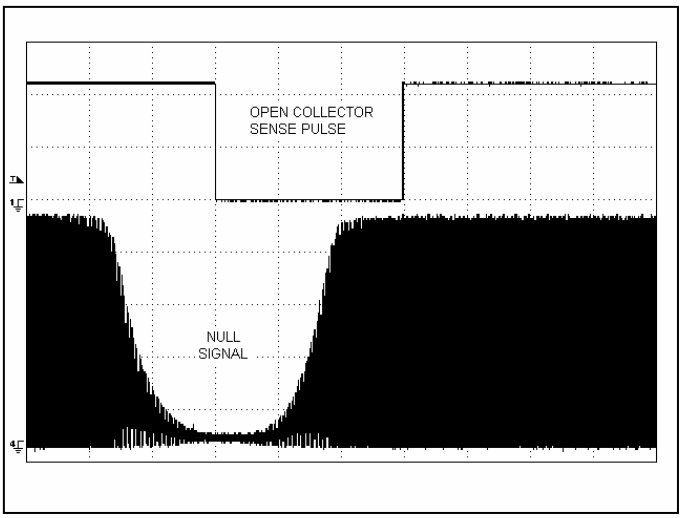




- The Accept Gate is located below the Sensor Coil Assembly and above the Exit Optics. If a valid coin is detected, the Accept Gate is opened allowing the coin to fall out the bottom of the unit on the accept side. In reject mode, a bad coin is deflected by the Accept Gate and falls out of the bottom of the mechanism on the reject side.

Defender
Sense Pulse





- When the microcontroller on the main pcb determines that all of the criteria for a valid coin has been met, it outputs a **Sense Pulse**.

- The **Sense Pulse** is output as both current source and open collector

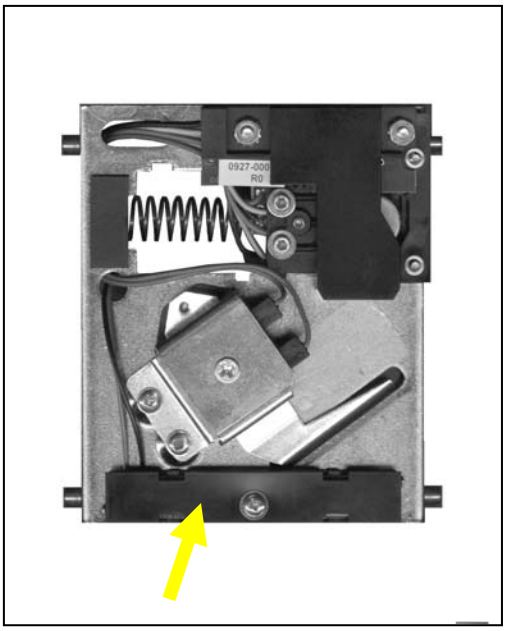
- When optic emulation firmware is used, this convention may not be followed.

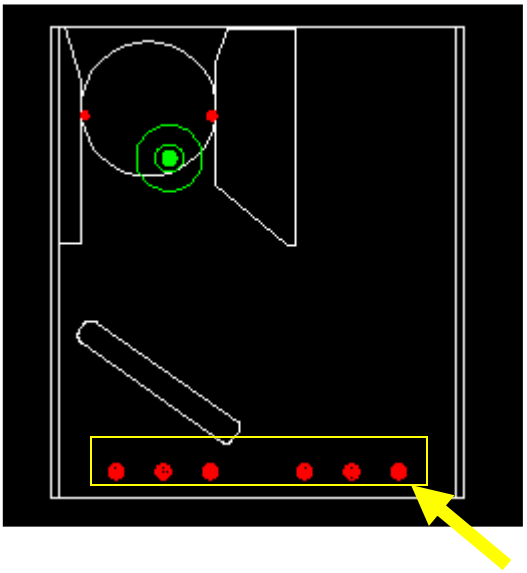
Defender
Exit Sequence

- When a valid coin passes the Accept Gate and exits the mechanism, the microcontroller checks the following criteria:
  - The coin reaches the Exit Sensors in the proper amount of time.
  - The coin passing the Exit Sensors is preceded by a valid coin sequence

- If the exit sequence meets the above criteria, the microcontroller closes the Accept Gate. The microcontroller also issues a pulse on the **Credit Output**.

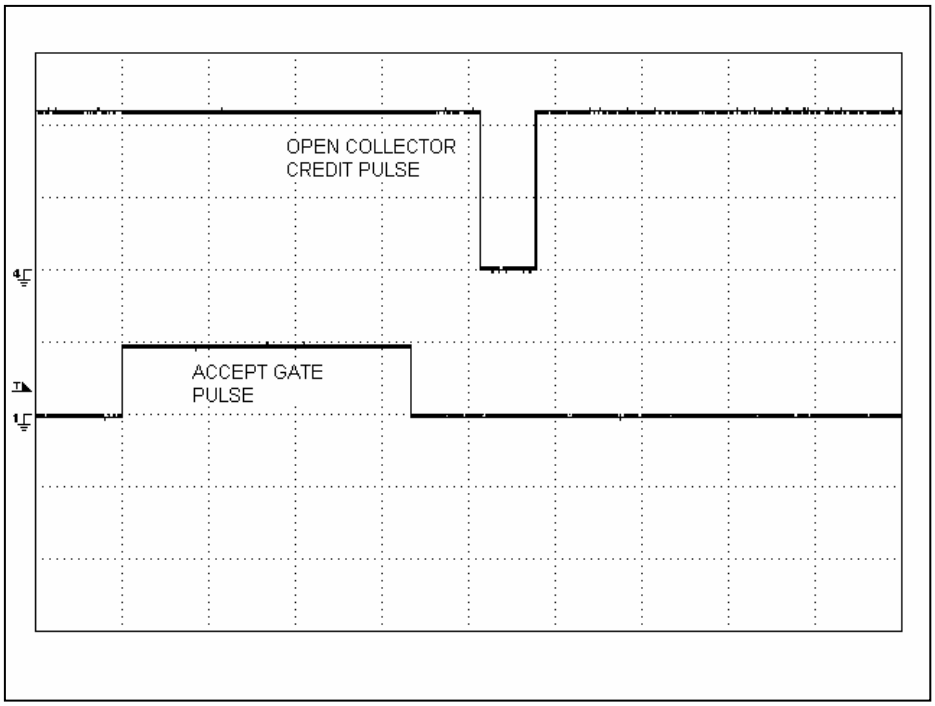
Defender
Exit Sensors





- A row of sensors are positioned across the entire bottom edge of the mechanism.
- These sensors detect a coin exiting on either the accept side or the reject side of the mechanism.

Defender
Credit Pulse



- When the microcontroller on the main pcb determines that a valid coin has exited the mech, it outputs a pulse on the **Credit Output**
- When optic emulation firmware is used, this convention may not be followed.

Defender
Error Conditions

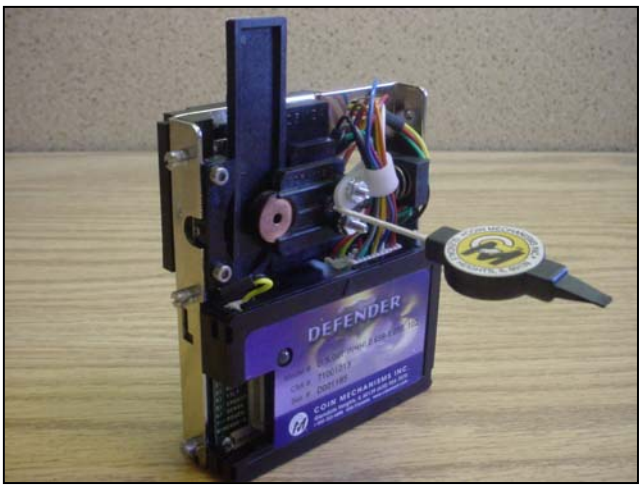
- The microcontroller will issue a signal on the **Tilt Output:**
  - If the reference sample coin is removed from the Defender
  - If the Defender detects a cheat condition (sensor active out of sequence, or elapsed time)
  - If the Defender detects a failed sensor
- When a **Tilt Signal** is issued, the Defender self inhibits and will reject coins for a period of time, or until the error condition is removed.

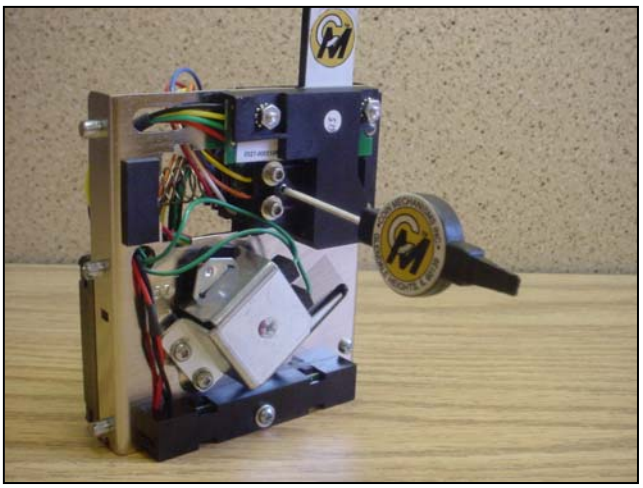
- When the Defender is in Tilt mode, the diagnostic LED turns red.

Defender
Calibration, Adjustment, and Maintenance

- Balancing the Sensor Coils
- Adjusting the Coin Path Diameter
- Adjusting the Selectivity Potentiometer
- Cleaning the Defender

Defender
Balancing the Sensor Coils



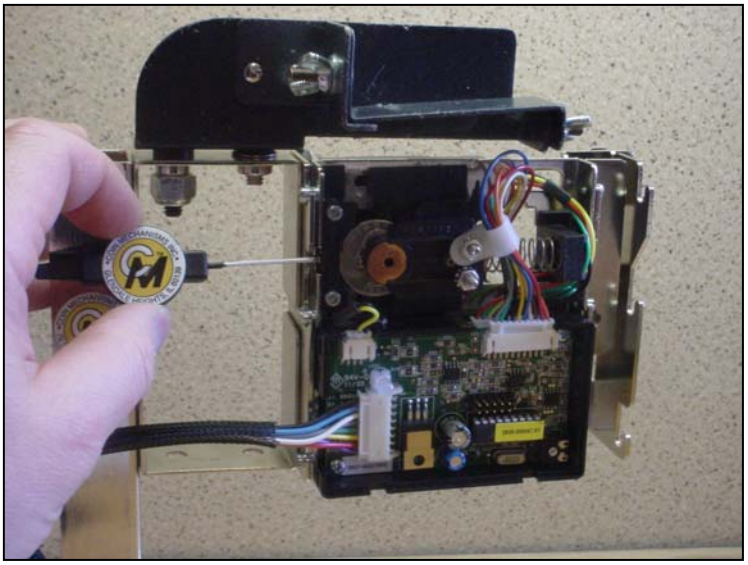


- Air balancing the Sensor Coils is an important adjustment and is done to every mechanism. When you adjust the coil balance set screws you are adjusting the physical spacing between the magnetic coils. It is important to space the coils an equal distance apart to create equal magnetic fields in both gaps.

- Using the coil gap gauge bar (available from Coin Mechanisms) insures that both gaps are the proper dimension.

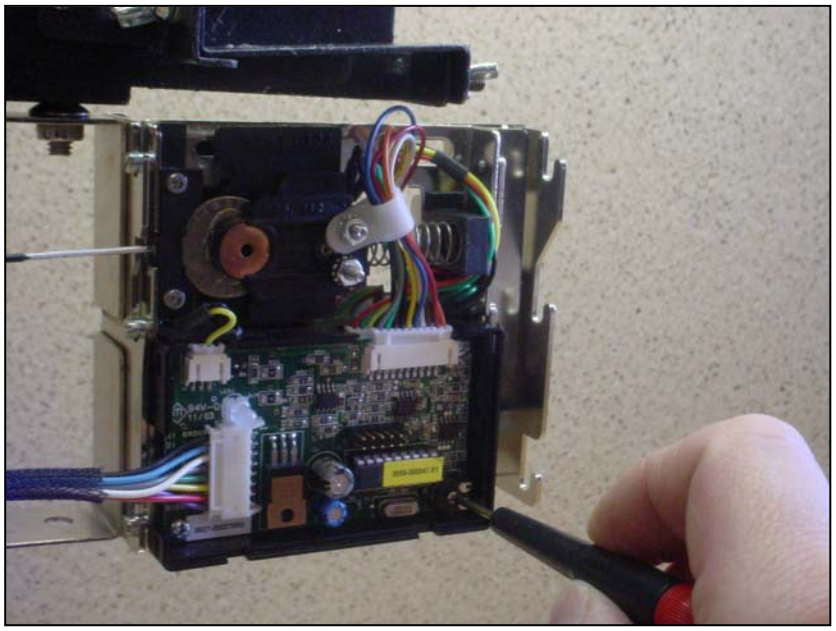
- Use a 1/16 in. hex wrench to adjust the Sensor Coil adjustment screws. (The tool shown is available from Coin Mechanisms)

Defender
Adjusting the Coin Path Diameter



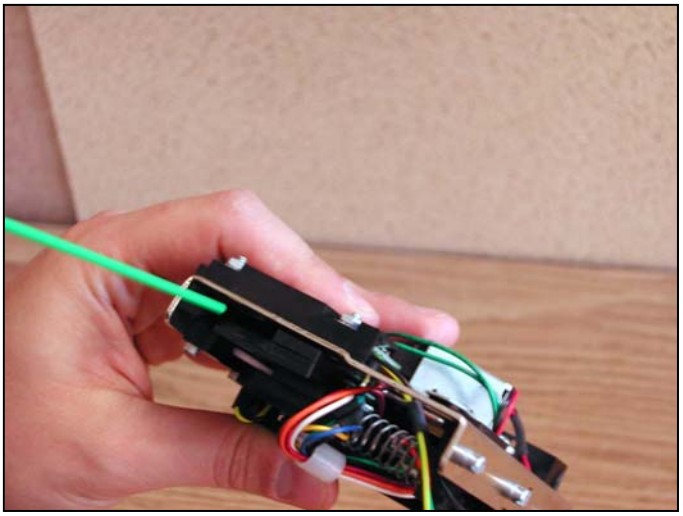
- The rail adjustment screw configures the coin path diameter:
  - To pass the largest diameter from the coin population
  - To reject coins that are more than .040” / 1.016mm smaller in diameter than the largest diameter from the coin population
- Use a 0.050” hex wrench to adjust the side rail set screw. (The tool shown is available from Coin Mechanisms)

Defender
Adjusting the Selectivity Potentiometer



- The Selectivity Potentiometer allows for the adjustment of good coin acceptance and at the same time the rejection of unwanted coins or frauds.
- Use a 2mm standard screwdriver to adjust the Selectivity Potentiometer.

Cleaning the Defender



- Cleaning of the Defender optic sensors is recommended for proper performance.
- The coin path must be kept clean and dry.
- Refer to the Defender Users Manual for cleaning instructions.

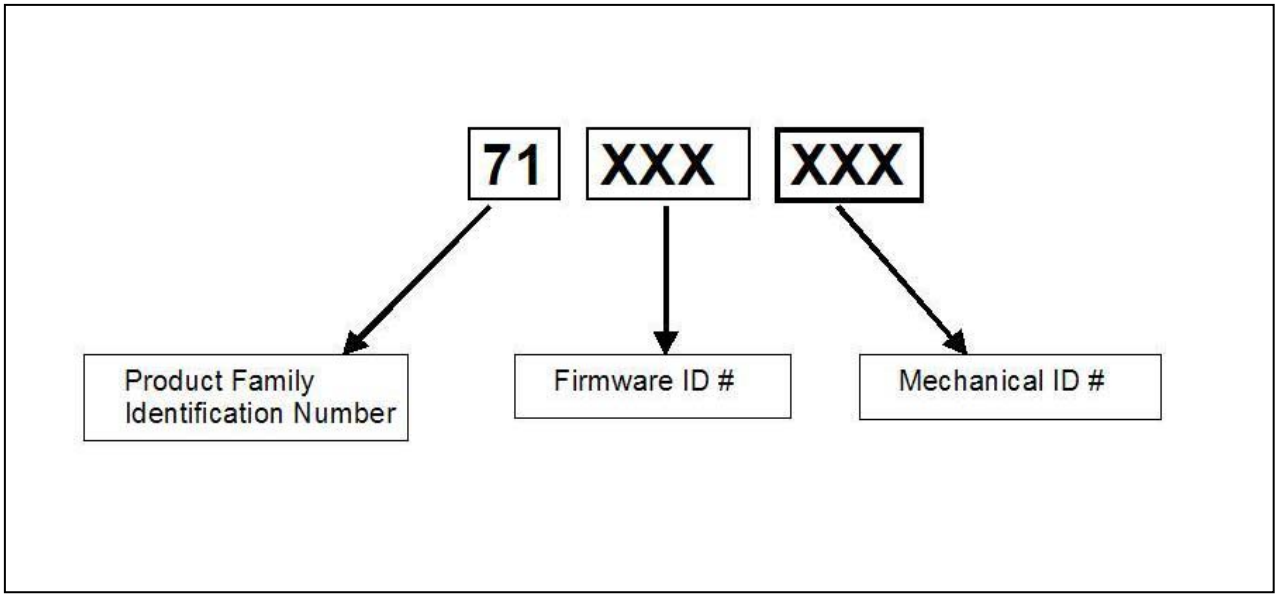
Defender
Mechanical and Interface Configurations

- Defender Part Number Format

- Mechanical Configurations
  - Coin Path Thickness
  - Coin Diameter Ranges
  - Reverse Logic and Wide-body

- Interface Configurations

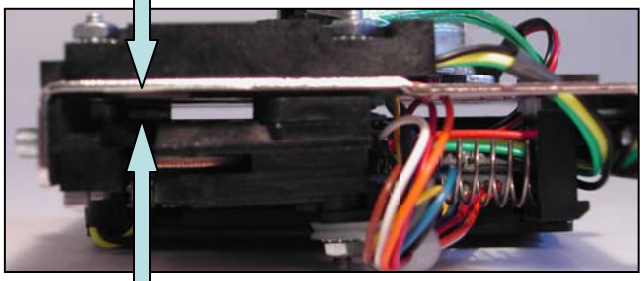
Defender
Part Number Format



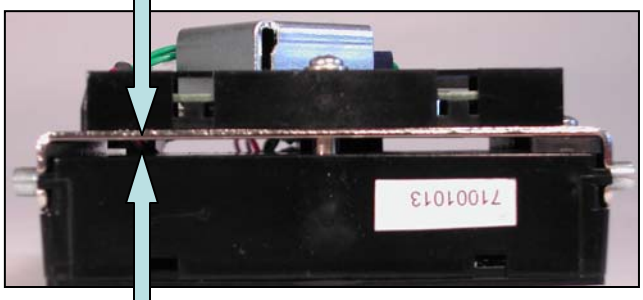
- The Defender part number is formatted with the firmware and mechanical configurations coded into the number
- The firmware ID# defines the inhibit logic and output pulse specifications.
- The mechanical ID# defines the coin diameter and thickness ranges

Defender
Coin Path Thickness Gap

Top View



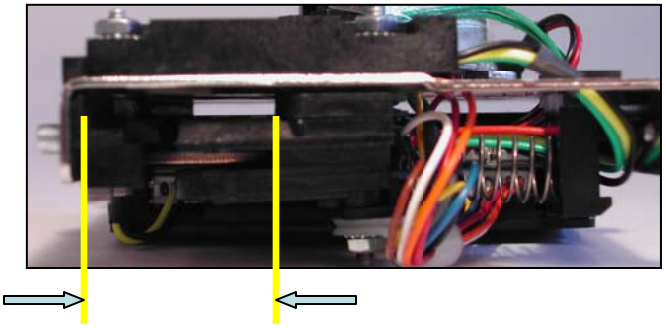
Bottom View



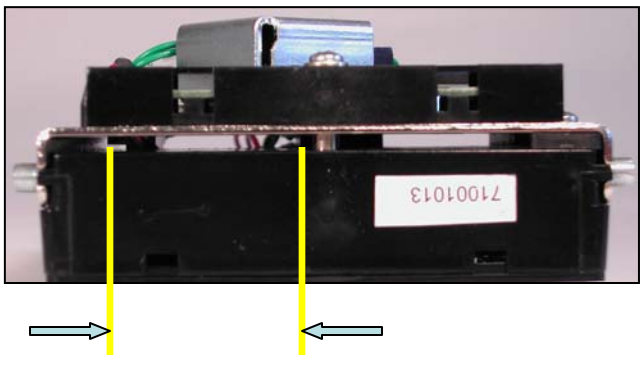
- To alleviate shingling inside the mechanism, Defender offers three coin path thickness configurations in the standard chassis size.
- These three configurations accommodate coin thicknesses from .050”/1.27mm to .125”/3.17mm.
- Defender is also available in a reverse logic and wide-body model for thicker tokens.

Defender
Coin Diameter Ranges

Top View



Bottom View



- Defender can accommodate coin diameters from 0.698in./17.7mm to 1.500in./38.1mm in three configurations of the standard chassis size.
- Defender is also available in a reverse logic and wide-body model for larger diameter tokens.

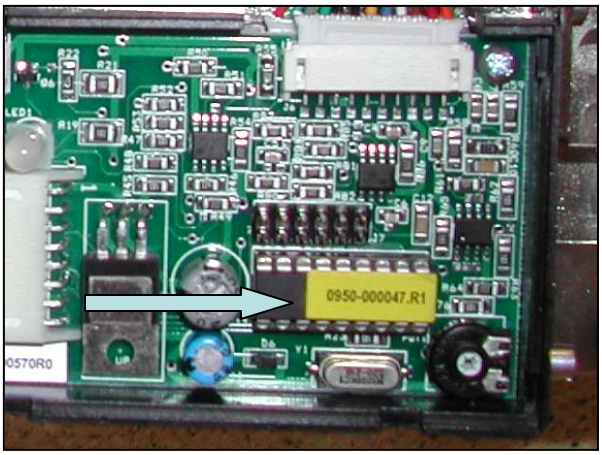
Defender
Reverse Logic and Wide-body

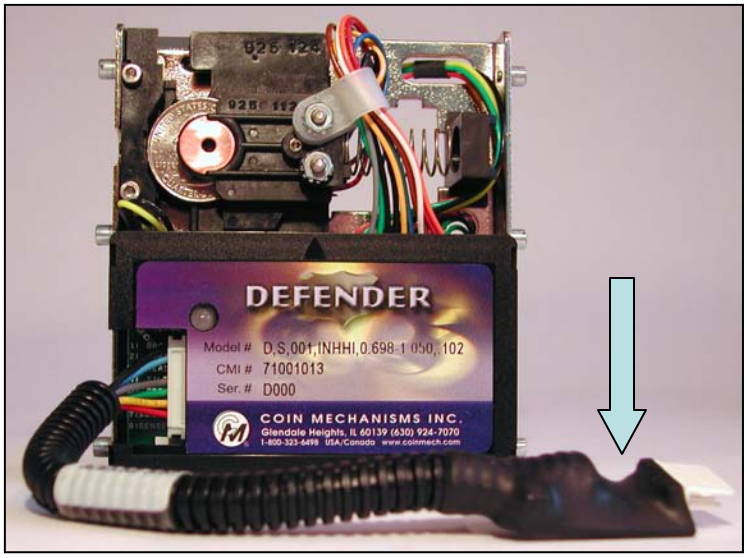
Defender Wide Body

Defender Reverse Logic

- Defender Reverse Logic and Wide-body models accommodate:
  - Diameters from 1.501”/38.12mm – 1.875”/47.63mm
  - Thicknesses from .080”/2.03mm – .145”/3.68mm

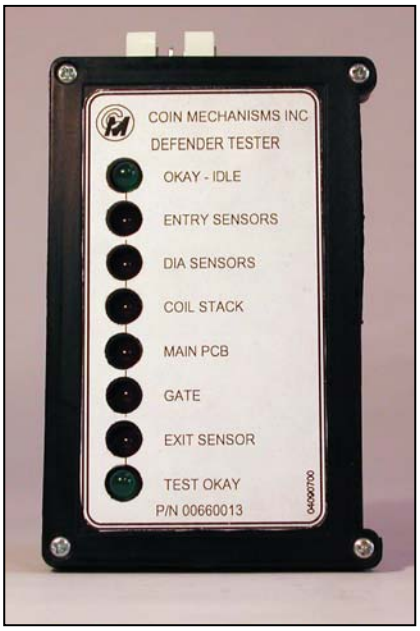
Defender
Interface Configurations





- To reconfigure the Defender for a different manufacturer's machine:
  - Replace the firmware (socketed microcontroller) with the appropriate part.
  - Replace the Interface Harness (if required).
- For Firmware and Interface part numbers call Coin Mechanisms customer service.

Defender
Sub-Assembly Troubleshooting



Defender Tester

- If the Defender has been properly calibrated, and does not accept coins, use the Defender Tester to determine what sub-assembly may have failed.

- The Defender Tester is designed to test and troubleshoot the Defender down to the sub-assembly level using LED indicators.