COIN MECHANISMS INC.

Where The Money Meets The Machine

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USER MANUAL
COMPARITOR TEST STATION P/N 00660009

00300009 REV. 05 2/13/2004

FRONT PANEL LAYOUT

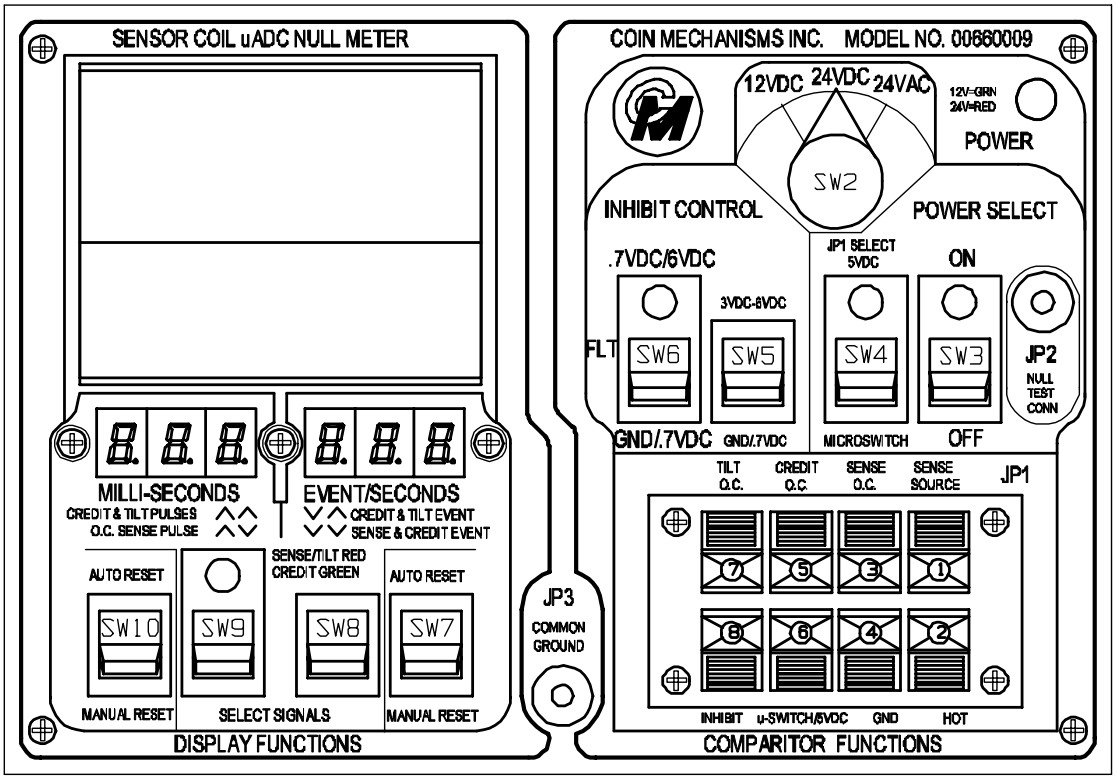


Fig 1

OVERVIEW

The Comparitor Test Station is used to test, adjust and troubleshoot all Coin Mechanisms and other coin validation products. The AC supply voltage is selectable, 110V, 120V, 220V, or 240VAC. The test station has three output voltages 12VDC, 24VDC and 24VAC. Switches can be toggled to simulate a machine's inhibit control lines. The two counters display output signals such as the sense, credit, tilt and A, B, C optic emulation outputs etc. A dual-color LED power indicator identifies which output voltage was selected. The sensor coil null meter is used to check or adjust the sensor coils null and eclipse adjustments. The "Quick connect" terminal block provides for easy hook-up for any I/O configuration.

Test Station Manual

CONTENTS

TOPICS	PAGE
Accessories and Display functions……	3
JP1 Hookup Functions, Switch Functions ……...	4 & 44
Sensor Coil Null Meter and Voltage Selection ……	5
CC and MC product Air Balance procedures using the Test Station……	6 – 8
CC and MC product Rail and Selectivity adjustment……..	8
CC and MC product Air Balance procedures using an Oscilloscope ……	9 & 10
IC product Air Balance procedures using the Test Station……..…	11 & 12
IC product Air Balance procedures using an Oscilloscope ……..…	13 & 14
Defender product Air Balance procedures using the Test Station……..…	15 – 17
Defender product Air Balance procedures using an Oscilloscope ……	18 – 20
Defender product Rail Adjustment……..	21
PCB Test Procedures……	22
Reference:	
• Coin Comparitor Identification…….	23 & 24
• Intelligent Comparitor Identification……	25
• Defender Comparitor Identification……	26
• Comparitor Pin Number Identification ……...	27 – 31
• Comparitor Test Point Identification …….	32 – 35, 40 & 41
• IC Test Point Identification and Test Stand …….	36 – 39
• Test Stand……..	41
• Damper Weight Recommendations ……..	42 & 43
• Test Station Set-up Switch configuration …….	44

ACCESSORIES

The following are accessories available from Coin Mechanisms Inc. or our authorized distributor for powering your unit or assist in testing and/or adjusting a Coin Comparitor.

PART NUMBER	DESCRIPTION
05000009	Test Stand (See page 29 of 32)
09280100	I/F, “A” ASSY, 6PIN, JST, BLK/ORG/YEL,/RED/ BLU/GRY
09280101	I/F, “B” ASSY, 3 PIN JST, BLK/VIO/ORG
09280102	I/F,”C” ASSY,6PIN MOLEX/AMP GRY/RED/BLU/YEL/ORG/BLK
09280103	I/F,”D” ASSY,7PIN MOLEX/AMP,CC-62 YEL/RED/BLU /ORG/GRN/BLK
09300247	VIDEO,VHS,COMPARITOR TRAINING
09300256	VIDEO,PAL,COMPARITOR TRAINING

DISPLAY FUNCTIONS

QUICK REFERENCE TABLE
POSITIONS FOR SIGNAL SELECT SWITCHES SW9 AND SW8

SW9	SW8	DISPLAY FUNCTIONS
UP⇧	UP⇧	CREDIT and LONG TILT PULSE WIDTHS
UP⇧	DOWN⇩	SENSE PULSE WIDTHS
DOWN⇩	UP⇧	SINGLE CREDIT PULSE WIDTHS and EVENT also UNWANTED TILT PULSES can be detected
DOWN⇩	DOWN⇩	SENSE and CREDIT EVENT

Table 1

Any output signals can be viewed individually by toggling the corresponding switches (see TABLE 1). A dual-colored LED flashes to indicate which signal or signals are being displayed, LED red = sense or tilt, LED green = credit. (above SW9)

The left 3-digit 7-segment display measures output signals such as the sense, credit, and tilt signals in milliseconds.

The right 3-digit 7-segment display measures longer output signals such as the tilt signal in seconds, the first counter overflows to the second counter and displays signals in seconds. Signals can be measured accurately up to 15 minutes.

The right display also doubles as a coin/event counter. It can help in detecting false crediting or numerous crediting.

Both counters utilize external reset switches (SW7, SW10) the 3-position switches can be set for manual reset, accumulating counter or the test station’s internal auto-reset mode that occurs in approximately 2 seconds after a signal has been generated. In auto-reset mode the next new incoming signal will reset the current signal displayed and display the new signal. Typically the manual reset (SW7) is used for coin counting (accumulating), The millisecond counter reset switch (SW10) can typically run in the auto-reset mode.

JP1-# I/O HOOKUP FUNCTIONS

For simplified choices regarding operation of the test station refer to TABLE 1 page 3.

Caution: Care must be taken to ensure that the proper voltage range is selected before connecting the unit to be tested.

FRONT PANEL HOOK-UP: JP1-#

JP1-1 = SENSE input; sourcing signals only. (From sense output of Comparitor)

JP1-2 = OUTPUT VOLTAGE (HOT); to Comparitor, SW2 voltage select, SW3 on/off.

JP1-3 = SENSE input; open collector (O.C.) signals only. (From sense output of Comparitor)

JP1-4 = COMMON; GROUND

JP1-5 = CREDIT input; open collector signals (O.C.) only. (From credit output of Comparitor)

JP1-6 = Dual function I/O; controlled by SW4, Micro-Switch input and a +5VDC output.

- Micro-Switch input; N.O. connection only, (with internal debounce circuit) used by mechanical Mechs. Micro-switch connection = N.O. tab to JP1-6 and switch COMM. tab to JP1-4.
- +5VDC output power supply; used for reject optics and any other 5V application.

JP1-7 = TILT input, open collector signals only. (From tilt output of Comparitor)

JP1-8 = INHIBIT control, applied by SW5 and SW6. (To inhibit pin of Comparitor interface)

SWITCH FUNCTIONS

SW1, main power switch in rear of test station.

SW2, output voltage select to Mech.

SW3, on/off power to Mech.

SW4, micro switch input or +5VDC output to JP1-6.

SW5, inhibit level emulation select, SW6 inhibit control emulation to Mech.

SW7, event/sec counter reset mode.

SW8 and SW9, select signal to view.

SW10, milli-sec. counter reset mode.

INHIBIT SWITCHES

SW5 and SW6 = INHIBIT LEVEL AND CONTROL

SW5 Configuration selects the proper inhibit level.

TOP POSITION = 3VDC or 6VDC

BOTTOM POSITION = GND.

SW6 Configuration sends the inhibit control level to JP1-8 and the Comparitor inhibit wire to disable it from accepting coins or enable it to accept coins. Both switches can be toggled to apply the proper inhibit level and control to the mech.

TOP POSITION = GND or 6VDC depending on SW5 position.

MIDDLE POSITION = OFF or OPEN (Floating connection).

BOTTOM POSITION = GND. or 3VDC depending on SW5 position.

Refer to the Comparitor Specification Sheet for inhibit control and level settings.

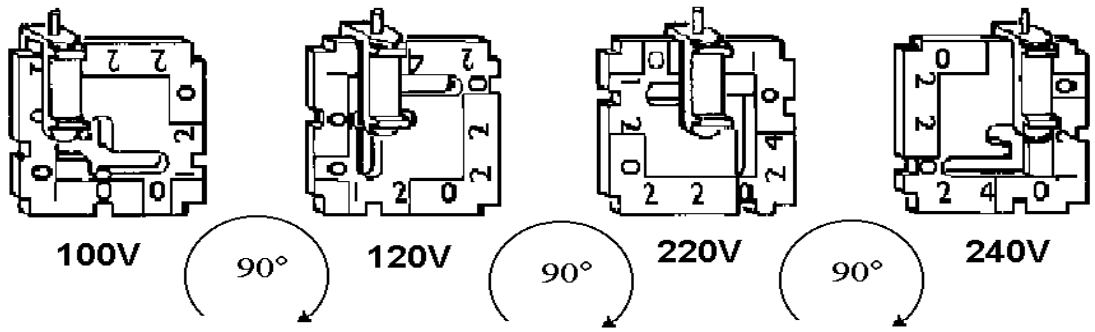
SENSOR COIL NULL METER

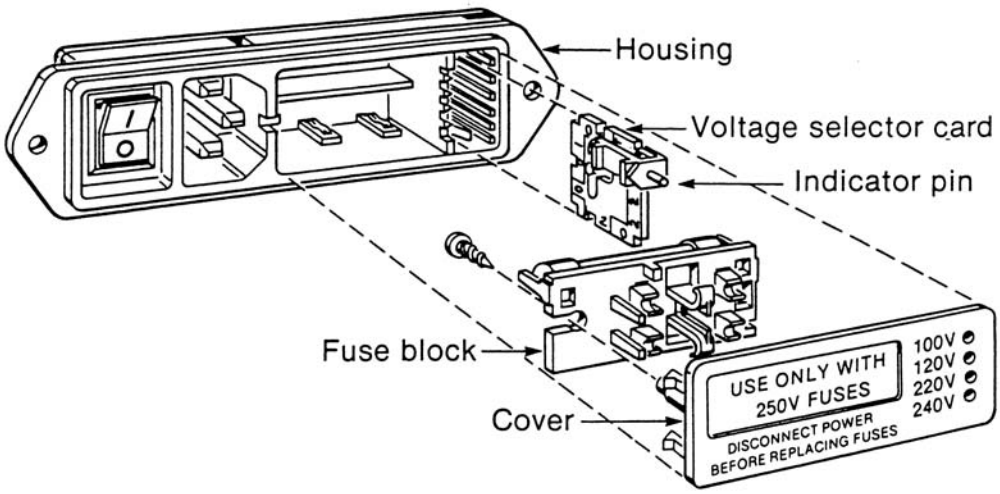
JP2 = Comparitor Null Test Point, use banana/mini-clip lead and connect to Comparitors Test Point, refer to schematic or Test Point identification at the end of this document. This test point is used to view the null and the coins eclipse adjustment in microamperes dc (uADC).

VOLTAGE SELECTION

To change voltage: open cover, using small blade screwdriver or similar tool: set aside cover/fuse block assembly: pull voltage selector card straight out of housing, using indicator pin; orient selector card so that desired voltage is readable at the bottom; orient indicator pin to point up when desired voltage is readable at bottom (note that when indicator pin is fixed, successive voltages are selected by rotating the card 90° clockwise); insert voltage selector card into housing, printed side of card facing toward IEC connector , and edge containing the desired voltage first; replace cover, and verify that indicator pin shows the desired voltage.

VOLTAGE SELECTOR CARD ORIENTATION





DETAILED PROCEDURE FOR AIR BALANCING THE SENSOR COILS USING THE COMPARITOR TEST STATION

INTRODUCTION:

Air balancing the sensor coils is one of the most important adjustments made to the coin Comparitor. Air balancing simply means to adjust the gap between the coils, to create an electrical field that is equal in both coin slots. It is important to adjust both coil sensor screws on the CC product line to an equal depth into the sensor coil body. By following this procedure, a uniform magnetic field will be maintained in the sensing area. Coin travel and sensing metal content of coins and tokens can be made more accurately. In addition, proper rail insert adjustment will complete the air balance procedure by providing a means to match the resident coin to the falling coin so they “eclipse” in the sensor coils. There is no rail adjustment on the Intelligent Comparitor product line. Another performance related adjustment is the selectivity potentiometer. Proper selectivity adjustment will improve coin / token acceptance vs. slug rejection. Pages 27– 31 illustrates the input/output pin assignments for the various Coin Comparitors that Coin Mechanisms Inc. manufactures.

WHY AIR BALANCE THE SENSOR COILS ?

1) After installing a new sensor coil assembly into a Comparitor.
2) After installing a rebuilt sensor coil assembly into a Comparitor.
3) Typical maintenance procedure for optimum performance.

TOOL LIST:

1) Various diameter, plastic tokens.
2) 1/16” hex allen head, adjusting screwdriver.
3) Coin sticks, or coins and scotch tape.
4) **Comparitor Test Station**, or power supply.
5) Oscilloscope, optional if using **the Comparitor Test Station.**

AIR BALANCING PROCEDURES FOR THE CC AND MICRO (MC) COMPARITOR PRODUCT USING THE COMPARITOR TEST STATION

Preliminary setup:

NOTE: Latest version MC product have a test header, refer to pages 36 & 37 for the correct pcb that matches your configuration.

1) Using pages 23 – 41 of this manual to determine which mechanism will be tested.
2) Acquire schematic and/or spec sheet that corresponds with the PCB/Comparitor to be tested from Coin Mechanisms Inc. or your local distributor.
3) Verify voltage (12VDC, 24VDC, or 24VAC) for the PCB being tested.
4) Turn voltage control knob (SW2) on test station to corresponding voltage.

Caution: Care must be taken to ensure that the proper voltage range is selected before connecting the unit to be tested.

5) Acquire correct interface for PCB (figures 10 – 18 pages 27 - 31).
6) Connect interface wires to test station terminals in accordance with appropriate schematic/spec sheet.
7) Attach interface to PCB.
8) Toggle “Power/Tilt Reset” switch (SW3) to the ON position.
9) Verify LED on PCB lights.
10) Connect a test lead from JP2 “NULL TEST CONN” on the test station to the test point on the PCB, (see pg. 32 – 35, 40 and 41). Illustrations show a CC-16, CC-40, CC-46 or MC equivalent, CC-62, CC-33/37, CC-32/36 Comparitors Refer to individual Comparitor control PCB documentation (Schematic Diagram or Comparitor specification sheet available from Coin Mechanisms Inc. or authorized distributor) for “Test Point” location and (Voltage Spec Sheet) for power input to Comparitor models.

Air Null Balance setup:

1) Use the plastic token chip provided with Comparitor (similar in diameter) to the actual coin or token to be used later as the sample coin and insert this chip into the sensor coils “Sample Holder”, indicated by the label “Slide To Replace Coin”. The plastic token positions the coils in their optimum location to simulate typical operating conditions. (see FIG. 2 page 23).

Air Null Balance adjustment :

1. Using the 1/16” allen head hex driver, back out the sensor coil screws counter-clockwise approximately ½ turn. Check the *Coil Mounting Screw* holding the sensor coils together for approximately 4-in. lb. of torque. Torque this screw to 4-in. lb.

2. Using the 1/16" allen head hex driver, turn the *Sensor Coil Adjusting Screws* (see FIG. 3) page 24, clockwise until the μA meter on the test station slightly decreases or until the screws **just** touch against the center coils metal plate stop. Make sure both screws are seated with equal depth into the sensor coil body.
3. Start with top screw first and alternate between top and bottom screws in short 5μA intervals, with inward (clockwise) rotation, until achieving the lowest μA reading on the μA meter.

Rail Insert adjustment setup:

1. Remove the plastic chip token from the "Sample Holder". Insert "Coin Sticks" into the coils insuring that the shafts of the sticks are perpendicular to the rail, using the allen screw driver turn the rail insert screw counter-clockwise until rail insert is against the rail body, remove any slack in the assembly by applying light pressure against the coils, towards the rail assembly (see FIG 4 & 5) page 24.
2. If "Coin Sticks" are unavailable use the coin and tape method, insert coin into the "Sample Holder", remove slack, apply tape to second identical coin and lower it into the other coil gap, position the taped coin in parallel to and "eclipse" the sample coin, observe the test station μA meter for lowest reading and tape coin in place onto the main plate.

Rail Insert adjustment:

1. The rail insert adjustment allows you to optimize the position of the resident coin to the falling coin. In order to get the best "comparison" of coins they need to "eclipse" each other when they are in the center of the sensor coil. The rail insert adjustment allows this exact match to occur. Performing this adjustment optimizes against fraud coins. The adjustment also allows compensation for worn parts to bring a highly used Comparitor back to optimum operating parameters.
2. Using the 1/16" allen hex driver, turn screw slowly clockwise (see FIG. 4 & 5) page 24, observe the μA meter, it should lower in amplitude, keep adjusting clockwise until lowest reading can be achieved. Remove sticks or taped coin after adjustment.

Selectivity adjustment:

1. The CC, MC and Defender products utilize a selectivity potentiometer to accommodate a wide range of coin alloys and distributions among each alloy. The selectivity adjustment allows the user to set the Comparitor to a more discriminative setting if a closely matching fraud is encountered or set to a more "open" setting to accept a wide range of poorly matching coins. Turning the potentiometer clockwise on the CC and MC product sets the product to a more discriminative setting (counterclockwise for Defender). Turning the potentiometer counterclockwise on the CC and MC products allows the mechanism to accept a wider range of a poorly matched coin alloy (clockwise on the Defender).

   The factory potentiometer setting is typically set at a "9:00 o'clock" position (arrow pointing straight left) for most coins. To set for the best performance/acceptance of good coins, (coins which match the sample / resident coin) start with the pot at its most discriminative setting. Turn the pot back, counter-clockwise (clockwise for Defender)

in short increments, dropping coins frequently between turns, until all coins are accepted repeatedly. Fine tune as necessary to accept all good coins or tokens and reject fraud coins.

AIR BALANCING PROCEDURES FOR THE CC AND MICRO (MC) COMPARITOR PRODUCT USING AN OSCILLOSCOPE

Preliminary setup:

1. Connect scope test probe to the "Mech Test Point", (see pg. 32 – 35, 40 and 41). Illustrations show a CC-16, CC-40, CC-46/MC, CC-62, CC-33/37, CC-32/36 Comparitors. Refer to individual Comparitor control PCB documentation (Schematic Diagram or Comparitor specification sheet available from Coin Mechanisms Inc. or authorized distributor) for "Test Point" location and (Voltage Spec Sheet) for power input to Comparitor models. Ground the scope ground connection to the ground input for common ground.
2. Set the Scope VOLT/DIV. to 500 mv. per division.
3. Set the Scope TIME/DIV. to 1 ms. per division. Depending on type of scope, some waveform positioning may be necessary to view the whole waveform.

Air Null Balance setup :

1. Use the plastic token chip provided with Comparitor (similar in diameter) to the actual coin or token to be used later as the sample coin and insert this chip into the sensor coils "Sample Holder", indicated by the label "Slide To Replace Coin". The plastic token positions the coils in their optimum location to simulate typical operating conditions. (see FIG. 2) page 23.

Air Null Balance adjustment :

1. Using the 1/16" allen head hex driver, back out the sensor coil screws counter-clockwise approximately ½ turn. Check the *Coil Mounting Screw* holding the sensor coils together for approximately 4-in. lb. of torque. Torque this screw to 4-in. lb. if necessary then seat the allen screws as indicated in step 3. (See FIG.5) page 24.
2. Using the 1/16" allen head hex driver, turn the *Sensor Coil Adjusting Screws* (see FIG. 3) page 24, clockwise until the wave form on the oscilloscope slightly decreases or until the screws **just** touch against the center coils metal plate stop. Make sure both screws are seated with equal depth into the sensor coil body.
3. Start with top screw first and alternate between top and bottom screws in short intervals, with inward (clockwise) rotation, until achieving the smallest amplitude of the waveform possible. Typically 80 to 200 mV is considered to be a proper null.

Rail Insert adjustment setup:

1. Remove the plastic chip token from the “Sample Holder”. Insert “Coin Sticks” into the coils insuring that the shafts of the sticks are perpendicular to the rail, using the allen screw driver turn the rail insert screw counter-clockwise until rail insert is against the rail body, remove any slack in the assembly by applying light pressure against the coils, towards the rail assembly (see FIG 4 & 5) page 24.
2. If “Coin Sticks” are unavailable use the coin and tape method, insert a coin into the “Sample Holder“, remove slack, apply tape to second identical coin and lower it into the other coil gap, position the taped coin in parallel to and “eclipse” the sample coin, observe the waveform for lowest amplitude and tape coin in place onto the mainplate.

Rail Insert adjustment:

1. The rail insert adjustment allows you to optimize the position of the resident coin to the falling coin. In order to get the best “comparison” of coins they need to “eclipse” each other when they are in the center of the sensor coil. The rail insert adjustment allows this exact match to occur. Performing this adjustment optimizes against fraud coins. The adjustment also allows compensation for worn parts to bring a highly used Comparitor back to optimum operating parameters.
2. Using the 1/16” allen hex driver, turn screw slowly clockwise (see FIG. 4 & 5) page 24, observe the oscilloscope, it should lower in amplitude, keep adjusting clockwise until lowest amplitude reading can be achieved. Remove sticks or taped coin after adjustment.

Selectivity adjustment:

1. The CC, MC and Defender products utilize a selectivity potentiometer to accommodate a wide range of coin alloys and distributions among each alloy. The selectivity adjustment allows the user to set the Comparitor to a more discriminative setting if a closely matching fraud is encountered or set to a more “open” setting to accept a wide range of poorly matching coins. Turning the potentiometer clockwise on the CC and MC product sets the product to a more discriminative setting (counterclockwise for Defender). Turning the potentiometer counterclockwise on the CC and MC products allows the mechanism to accept a wider range of a poorly matched coin alloy (clockwise on the Defender).

The factory potentiometer setting is typically set at a “9:00 o’clock” position (arrow pointing straight left) for most coins. To set for the best performance/acceptance of good coins, (coins which match the sample / resident coin) start with the pot at its most discriminative setting. Turn the pot back, counter-clockwise (clockwise for Defender) in short increments, dropping coins frequently between turns, until all coins are accepted repeatedly. Fine tune as necessary to accept all good coins or tokens and reject fraud coins.

AIR BALANCE PROCEDURES FOR THE (IC) INTELLIGENT COMPARITOR USING THE COMPARITOR TEST STATION

Preliminary setup:

1. Connect a test lead from the *Null Test Conn* (JP2) on the test station to the J4 *Mech Test Point* pin on the PCB (see pg. 36 - 39). Illustrations show IC-16, IC-40, IC-62, IC-33/37, IC-32/36 Comparitors. Refer to individual Comparitor control PCB documentation (Schematic Diagram or Comparitor specification sheet available from Coin Mechanisms Inc. or authorized distributor) for J4 location and (Voltage Spec Sheet) for power input to Comparitor models.

NOTE: THE IC PRODUCT AIR NULL IS PERFORMMED WITHOUT USING A PLASTIC CHIP IN THE RESIDENT COIN SIDE OF THE COILS. THE TOKEN HOLDER IS IN PLACE WITHOUT A RESIDENT COIN.

Air Null Balance setup :

1. Start with connecting power to J1 connector (Refer to individual Mech Control PCB documentation). Refer to Schematic Diagram and Voltage Spec Sheet for power input for the Intelligent Comparitor models and switch on power. If the led on the PCB doesn't light, turn power off and call Coin Mechanisms Inc or your local distributor.

Caution: Care must be taken to ensure that the proper voltage range is selected before connecting the unit to be tested.

2. Connect a test lead from the *JP2 Null Test Conn* on the test station to the Mech Test Point pin on the PCB. (see pg. 36 to 39)

Air Null Balance adjustment :

1. Using the 1/16" allen head hex driver, back out the *Coil Adjustment Screws* (see FIG. 6 & FIG. 7) page 25, counter- clockwise approximately ½ turn. Check the *Coil Mounting Screws* (see FIG. 6 page 25) holding the sensor coils together at approximately 3-1/2 in. lbs. of torque. Verify the torque on the two screws that hold the sensing coil stack together.

2. Using the 1/16" allen head hex driver, turn the *Coil Adjustment Screws* on the front coil clockwise until the needle on the μA meter **just** starts to move or until the screw **just** touchs against the center coil metal pin stop.

3. Install token holder (without sample token) in resident side of coils. Using token holder web as a thickness gauge, slide holder in and out of coil. If token holder binds in coil, adjust screw clockwise just until token holder clearance.

NOTE: DO NOT OVER ADJUST THIS SCREW AND CREATE AN EXCESSIVE GAP.

4. Insert the 1/16" allen wrench through the clearance hole in the spring retainer assy (see FIG. 7 page 25) and into the allen screw location on the number 3 (back) coil assembly. Turn the screw with the allen wrench clockwise until you get the lowest reading on the μA meter of the Comparitor Test Station (no greater than 7 microamperes).

NOTE: Once the allen screw on the back coil bottoms (the waveform begins to get smaller), it should not take more than a quarter turn before the lowest μA reading has been reached. If more than a quarter turn is required to balance, contact Coin Mechanism Inc or your local distributor.

5. Adjust the *Spring Retainer Adjustment Screw* clockwise until the screw ***just*** touches the main plate. This is to relieve strain on the #3 coil (see FIG. 7) page 25.
6. Verify the μA meter reading returns to the settings achieved in the previous steps when the coils are squeezed together and released. Adjust coil adjustment screw on number 3 (back) coil assembly if necessary.

AIR BALANCE PROCEDURES FOR THE (IC) INTELLIGENT COMPARITOR and PRODUCT LINE USING AN OSCILLOSCOPE

Preliminary setup:

1. Connect scope test probe to J4 "*Mech Test Point"* pin on the PCB (see pg. 36 to 39). Illustrations show IC-16, IC-40, IC-62, IC-33/37, IC-32/36 Comparitors. Refer to individual Comparitor control PCB documentation (Schematic Diagram or Comparitor specification sheet available from Coin Mechanisms Inc. or authorized distributor) for J4 location and (Voltage Spec Sheet) for power input to Comparitor models. Ground the scope ground connection to J4 PIN 6.
2. Set the Scope VOLT/DIV. to 500 mv. per division.
   Set the Scope TIME/DIV to 1 ms. per division. Depending on type of scope, some waveform positioning may be necessary to view the whole waveform.

Air Null Balance setup :

1. Start with connecting power to J1 connector (Refer to individual Mech Control PCB documentation. (Schematic Diagram) location and (Voltage Spec Sheet) for power input for the Intelligent Comparitor models and switch on power. If the led on the PCB doesn't light, turn power off and call Coin Mechanisms Inc or your local distributor.

Caution: Care must be taken to ensure that the proper voltage range is selected before connecting the unit to be tested.

2. Connect the scope probe to the Mech Test Point pin on the PCB (see pg. 36 to 39).

NOTE: THE IC PRODUCT AIR NULL IS PERFORMMED WITHOUT USING A PLASTIC CHIP IN THE RESIDENT COIN SIDE OF THE COILS. THE TOKEN HOLDER IS IN PLACE WITHOUT A RESIDENT COIN.

Air Null Balance adjustment :

1. Using the 1/16” allen head hex driver, back out the *Coil Adjustment Screws* (see FIG. 6 & FIG. 7) page 25, counter- clockwise approximately ½ turn. Check the *Coil Mounting Screws* (see FIG. 6 page 25) holding the sensor coils together at approximately 3-1/2 in. lbs. of torque. Verify the torque on the two screws that hold the sensing coil stack together.
2. Using the 1/16” allen head hex driver, turn the *Coil Adjustment Screws* on the front coil clockwise until the on the waveform **just** starts to move or until the screw **just** touchs against the center coil metal pin stop.
3. Install token holder (without sample token) in resident side of coils. Using token holder web as a thickness gauge, slide holder in and out of coil. If token holder binds in coil, adjust screw clockwise just until token holder clearance.

NOTE: DO NOT OVER ADJUST THIS SCREW AND CREATE AN EXCESSIVE GAP.

4. Insert the 1/16” allen wrench through the clearance hole in the spring retainer assy (see FIG. 7) page 25, and into the allen screw location on the number 3 (back) coil assembly. Turn the screw with the allen wrench clockwise until you get the lowest amplitude waveform on the oscilloscope (no greater than 500mV p-p).

Note: Once the allen screw on the back coil bottoms (the waveform begins to get smaller), it should not take more than a quarter turn before the smallest amplitude has been reached. If more than a quarter turn is required to balance, contact Coin Mechanism Inc or your local distributor.

5. Adjust the *Spring Retainer Adjustment Screw* clockwise until the screw ***just*** touches the main plate. This is to relieve strain on the #3 coil (see FIG. 7) page 25.
6. Verify the oscilloscope waveform returns to the same amplitude achieved in the previous steps when the coils are squeezed together and released. Adjust coil adjustment screw on number 3 (back) coil assembly if necessary.

AIR BALANCE PROCEDURES FOR THE DEFENDER COMPARITOR USING THE COMPARITOR TEST STATION

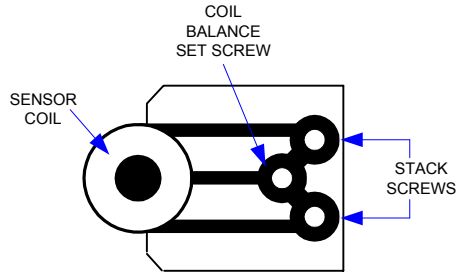
Preliminary setup:

1. Using pages 23 – 41 of this manual determine which mechanism will be tested.
2. Acquire spec sheet that corresponds with the Comparitor to be tested from Coin Mechanisms Inc. or your local distributor or on the web at www.coinmech.com.

Caution: Care must be taken that the correct interface is used to connect the mechanism

to the test station.

3. Choose the correct customer interface for the test station, 0928-000113 (8 pin JST connector to flying lead) for this test station.
4. Place the Mechanism in a test stand (CMI # 05000009).
5. Connect the interface cable to the test station and mechanism. (For connector pin outs refer to specific spec sheets).



There is a front (resident coin) coil balance set screw, and a back (drop slot) coil balance set screw. Use a 1/16 Inch Allen Wrench Adjustment tool (CMI # 05090004).

6. Remove the Resident Coin, if present.

Air Null Balance adjustment :

1. Using the 1/16" allen head hex driver, back out the *Coil Adjustment Screws* (see FIG. 8 & 9 page 26), counter- clockwise approximately ½ turn. Check the *Coil Mounting Screws* (see FIG. 9 page 26) holding the sensor coils together at approximately 3-1/2 in. lbs. of torque. Verify the torque on the two screws that hold the sensing coil stack together.

WITHOUT COIL GAGE BAR

2. Using the 1/16" Allen Wrench Adjustment tool, slowly tighten the front (resident coin) coil balance set screw just to the point it bottoms out and gets a little hard to turn. Do not over tighten this setscrew. If the coils are being balanced without using a gage bar proceed to step 9.

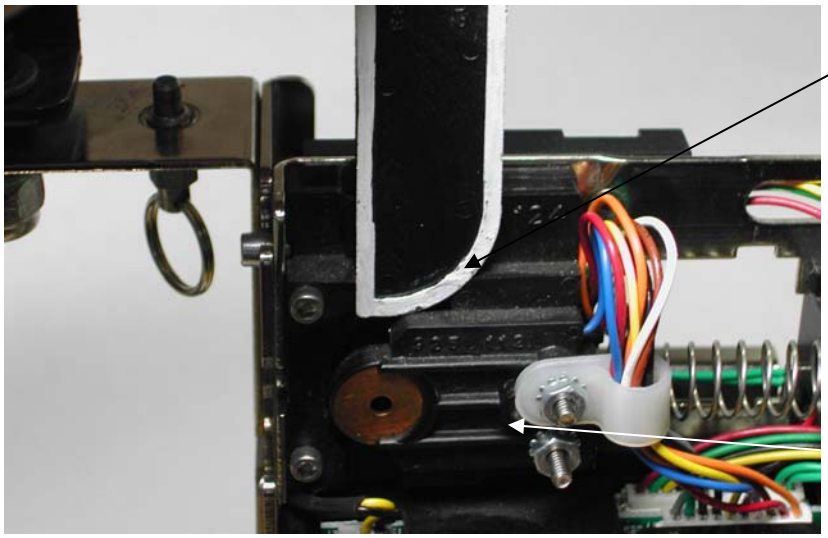
WITH COIL GAGE BAR

3. a. Insert coil gage bar, with the curve on the bottom right, (refer to table #2) between the first and second coil (resident coin gap). See picture on the next page for correct gage bar orientation.

   b. Using the 1/16" allen head hex driver, turn the *Coil Adjustment Screw* on the front coil clockwise until the gage bar just falls through the coils.

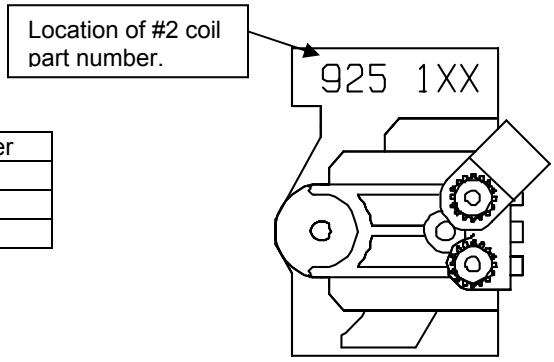
   NOTE: DO NOT OVER ADJUST THIS SCREW AND CREATE AN EXCESSIVE GAP.

   c. Remove coil balance gage bar.



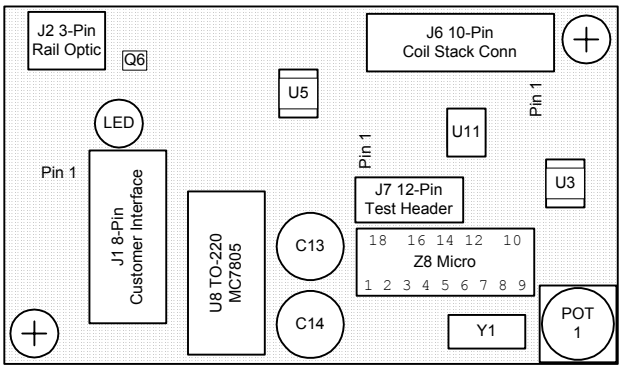
NOTE: The gage bar used for coil balancing is determined by the #2 coil part number.
See Table #2 on page21 for the correct gage bar for the different #2 coils.
See Fig 8 page 30 for the location of the #2 coil part number and format.

#2 Coil Part Number	Gage Bar part number
925 111	04700026
925 123	04700027
925 124	04700033



4. Insert a small plastic poker chip (CMI # 04090014) in the resident coin location.

5. Use a12-Pin Test Header Cable 0928-000151 (12 pin Molex connector to 3 wire flying lead) interface.



Main PC Board (0927-000570)

6. Connect the 0928-000132 interface from the Mechanism test header to JP3 “MECH TEST HEADER” of the test station.

7. Apply power to the Mechanism.

8. Monitor the µA meter on the Test Station.

9. Using the 1/16” Allen Wrench Adjustment tool, slowly tighten (clockwise), or adjust, the rear (drop slot) coil balance setscrew to achieve the smallest possible Raw Null signal level.

   A good null should achieve an air null balance of 0 to 6µA on the µA meter.

NOTE: Once the allen screw on the back coil bottoms (the waveform begins to get smaller), it should not take more than a quarter turn before the lowest µA meter reading has been reached. If more than a quarter turn is required to balance, contact Coin Mechanism Inc or your local distributor.

NOTE: On this Test Station, the Tilt display will continuously increment while balancing the coils.

If a good air coil balance cannot be achieved, then there could be a problem with the coil set or the main PC board. In most cases if a good coil air balance cannot be achieved then the coil set needs to be replaced.

10. Insert coil balance gage bar or your thickest coin for this model between the rear (drop slot) coil and middle coil and verify that the gage bar or coin fits. If it does not fit down the drop slot you will be required to readjust the rear coil balance setscrew until the gage bar or coin falls through.

11. If you had to readjust the rear (drop slot) coil balance setscrew again in order for the gage or coin to fit, you will be required to adjust the front (resident slot) coil balance adjustment screw again to produce the lowest possible null.

12. Verify the µA METER reading returns to the settings achieved in the previous steps when the coils are squeezed together and released. Adjust coil adjustment screw on number 3 (back) coil assembly if necessary.

AIR BALANCE PROCEDURES FOR THE DEFENDER COMPARITOR USING AN OSCILLOSCOPE

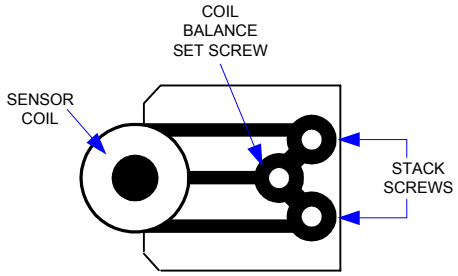
Preliminary setup:

Preliminary setup:

1. Using pages 23 – 41 of this manual determine which mechanism will be tested.
2. Acquire spec sheet that corresponds with the Comparitor to be tested from Coin Mechanisms Inc. or your local distributor or on the web at www.coinmech.com.

Caution: Care must be taken that the correct interface is used to connect the mechanism to the test station.

3. Choose the correct customer interface for the test station being used, 0928-000113 (8 pin JST connector to flying lead) for this test station.
4. Place the Mechanism in a test stand (CMI # 05000009).
5. Connect the interface cable to the test station and mechanism. (For connector pin outs refer to specific spec sheets).



There is a front (resident coin) coil balance set screw, and a back (drop slot) coil balance set screw. Use a 1/16 Inch Allen Wrench Adjustment tool (CMI # 05090004).

6. Remove the Resident Coin, if present.

Air Null Balance adjustment :

1. Using the 1/16" allen head hex driver, back out the *Coil Adjustment Screws* (see FIG. 8 & 9 page 26), counter- clockwise approximately ½ turn. Check the *Coil Mounting Screws* (see FIG. 9 page 26) holding the sensor coils together at approximately 3-1/2 in. lbs. of torque. Verify the torque on the two screws that hold the sensing coil stack together.

WITHOUT COIL GAGE BAR

2. Using the 1/16" Allen Wrench Adjustment tool, slowly tighten the front (resident coin) coil balance set screw just to the point it bottoms out and gets a little hard to turn. Do not over tighten this setscrew. If the coils are being balanced without using a gage bar proceed to step 9.

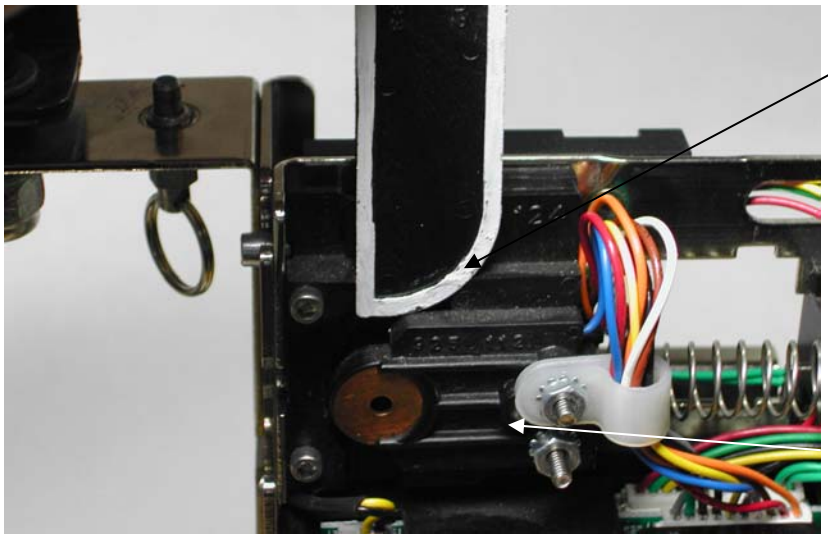
WITH COIL GAGE BAR

3. a. Insert coil gage bar, with the curve on the bottom right, (refer to table #2) between the first and second coil (resident coin gap). See picture on the next page for correct gage bar orientation.

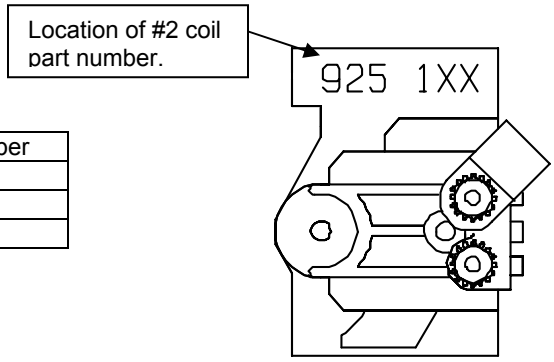
   b. Using the 1/16" allen head hex driver, turn the *Coil Adjustment Screw* on the front coil clockwise until the gage bar just falls through the coils.

   NOTE: DO NOT OVER ADJUST THIS SCREW AND CREATE AN EXCESSIVE GAP.

   c. Remove coil balance gage bar.



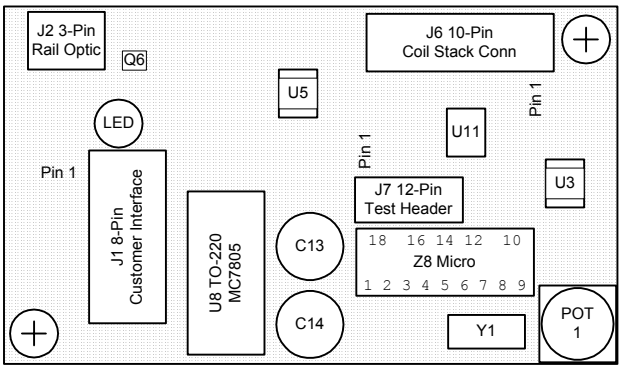
NOTE: The gage bar used for coil balancing is determined by the #2 coil part number.
See Table #2 on page21 for the correct gage bar for the different #2 coils.
See Fig 8 page 30 for the location of the #2 coil part number and format.



#2 Coil Part Number	Gage Bar part number
925 111	04700026
925 123	04700027
925 124	04700033

4. Insert a small plastic poker chip (CMI # 04090014) in the resident coin location.

5. Use a 12-Pin Test Header Cable (CMI #0928-000151).
   Connect an Oscilloscope to Pin 6 (Raw Null) of the test header or the GRN/YEL wire of the test header interface.
   Connect the Oscilloscope probe ground to Pin 11 (Ground) of the test header or Black wire of the test header interface.



Main PC Board (0927-000570)

6. Set the Oscilloscope to:
   Horizontal Time base to 100uS per Division.
   Vertical Display to 100 mV per Division.

7. Apply power to the Mechanism.

8. Look at the Oscilloscope display. It should be displaying the Raw Null Signal, a complex waveform that can oscillate between 7 and 9 KHz and can have an amplitude of about 9 volts Peak-to-Peak maximum, and go down to about 50 millivolts minimum. You may have to adjust your oscilloscope to properly view the waveform.

9. Using the 1/16" Allen Wrench Adjustment tool, slowly tighten (clockwise), or adjust, the rear (drop slot) coil balance setscrew to achieve the smallest possible Raw Null signal level.

   A good mechanism should achieve an air coil balance Raw Null signal level
   of less than 700 mV Peak-to-Peak,
   or less than 400 mV Positive Peak to Ground.

   If a good air coil balance cannot be achieved, then there could be a problem with the coil set or the main PC board. In most cases if a good coil air balance cannot be achieved then the coil set needs to be replaced.

10. Insert coil balance gage bar or your thickest coin for this model between the rear (drop slot) coil and middle coil and verify that the gage bar or coin fits. If it does not fit down the drop slot you will be required to readjust the rear coil balance setscrew until the gage bar or coin falls through the Sense coils.

11. If you had to readjust the rear (drop slot) coil balance setscrew again in order for the gage or coin to fit, you will be required to adjust the front (resident slot) coil balance adjustment screw again to produce the lowest possible null.

12. Verify the oscilloscope waveform returns to the same amplitude achieved in the previous steps when the coils are squeezed together and released. Adjust coil adjustment screw on number 3 (back) coil assembly if necessary.

DEFENDER RAIL ADJUSTMENT PROCEDURE

DROP SLOT DIAMETER CLEARANCE

1) Insert proper resident coin for the model to be adjusted.

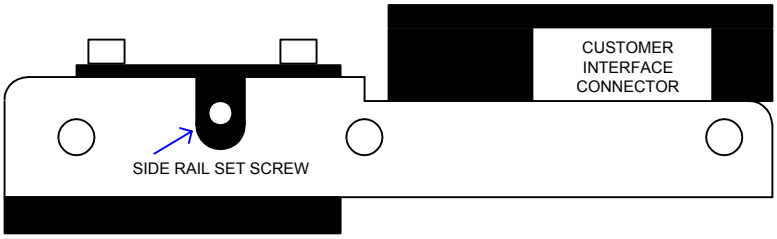
2) Turn the side rail set screw out (Counterclockwise) one full turn.

3) Drop a good coin into the drop slot, it should get stuck. If the coin does not get stuck, push the coil set (with the resident coin installed) toward the rail (left) (this should force the rail insert in). Drop another good coin into the drop slot, the coin should get stuck. If the coin still does not get stuck, contact Coin Mechanisms Inc.

NOTE: The unit may Tilt during the Drop Slot Diameter clearance adjustment procedure.

4) Turn the side rail set screw (using a .050" hex driver or CMI P/N 05090023) in (Clockwise) until the coin falls through the mechanism.
Drop more good coins and slightly adjust the side rail set screw until all the test coins fall freely through the mechanism.

5) Turn the side rail set screw an additional ¼ turn in (Clockwise) for some additional diameter clearance.



Side View of Unit

6) Drop good coins through the unit.
The unit should Accept 100% of the good coins.
Each coin should generate a Sense and Credit Pulse (if applicable) as the coin falls through the mechanism

The POT setting may need to be adjusted to achieve 100% acceptance if the test coins have a wide conductivity spread.

7) Check the Diameter Optics.
Drop 0.040 Inch shaved coins through the unit under test.
The unit should Reject 100% of the shaved coins.

PCB TEST PROCEDURES

1. Acquire spec sheet that corresponds with the PCB to be tested.
2. Acquire spec sheet that corresponds with the Comparitor to be tested from Coin Mechanisms Inc. or your local distributor or on the web at www.coinmech.com.

Caution: Care must be taken that the correct interface is used to connect the mechanism to the test station.

3. Attach PCB to appropriate test chassis (Green accept coil wires for 12VDC, Gray accept coils for 24VDC/24VAC).

Note: Test chassis should be a known good chassis.

4. Attach interface to PCB.
5. Toggle “INTERFACE POWER” switch to the ON position.
6. Verify LED on PCB lights.
7. Insert small Poker chip in resident coin location of coils.
8. If the mechanisms you are testing does not have a test header; connect the 0821-009080 to the BNC connector on the test station. Connect the 0821-009081 BNC to minigrabber clip to the 0821-009080 BNC cable and the RED minigrabber clip to the “TEST POINT”. See pg. 32 – 41 for “Test Point” location.
    a. If the mechanism you are testing has a test header, connect the correct interface (refer to spec sheet) to the “TEST HEADER” connection on the test station. Connect the other end of the interface to the test header on the PCB.
    b. Verify DC VOLT METER reading on test station is below 2.00VDC.

NOTE: If meter reading is above 2.00VDC, discontinue test – remove interface from PCB, remove PCB from chassis and trouble shoot PCB.

9. Remove Poker chip from resident coin coil location.
10. Insert a coin in resident coin coil location.
11. Verify INHIBIT state for PCB being tested.

NOTE: On the spec sheet, in the section titled INHIBIT CONTROL, explains at what level the PCB will INHIBIT or ENABLE. Using the new test station, the interface automatically connects the Inhibit line to the correct Inhibit logic level and the mechanism will always Inhibit when the Inhibit switch is placed in the up or INHIBIT position.

12. Verify INHIBIT Switch is in the correct position to ENABLE (down) (or to allow) the unit to accept coins.
13. Drop known good coins (same as resident coin) through the mechanism.
14. Refer to Page 6 and 7 of this document for “Display Functions” to monitor specific output pulse lengths.

NOTE: Pulse lengths may vary approximately 4mS from the documented lengths stated for your comparitor.

COIN COMPARITOR IDENTIFICATION REFERENCE

FIG. 1 AND FIG. 2

FIG #1

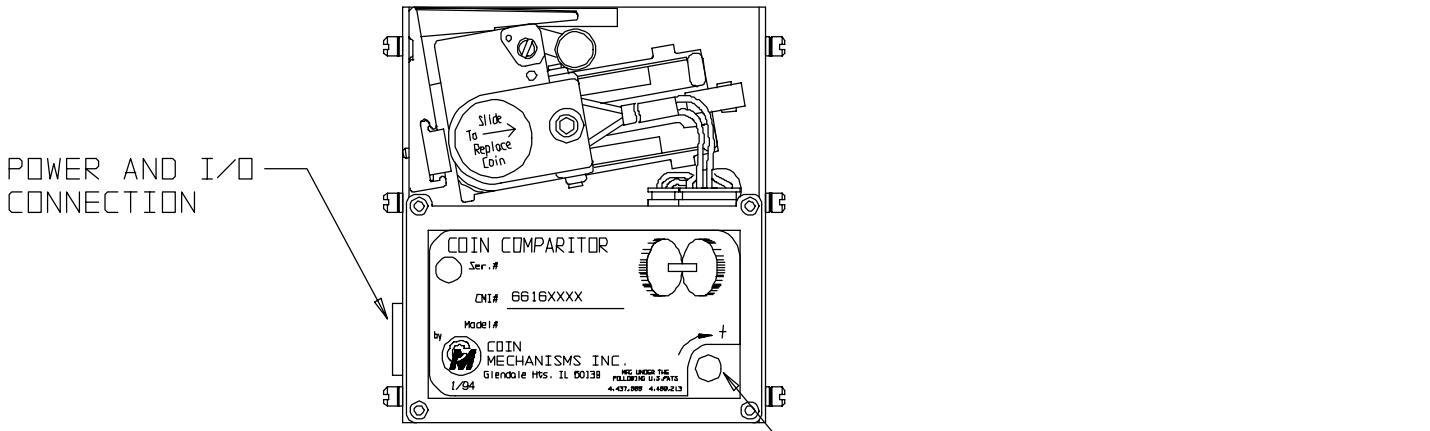
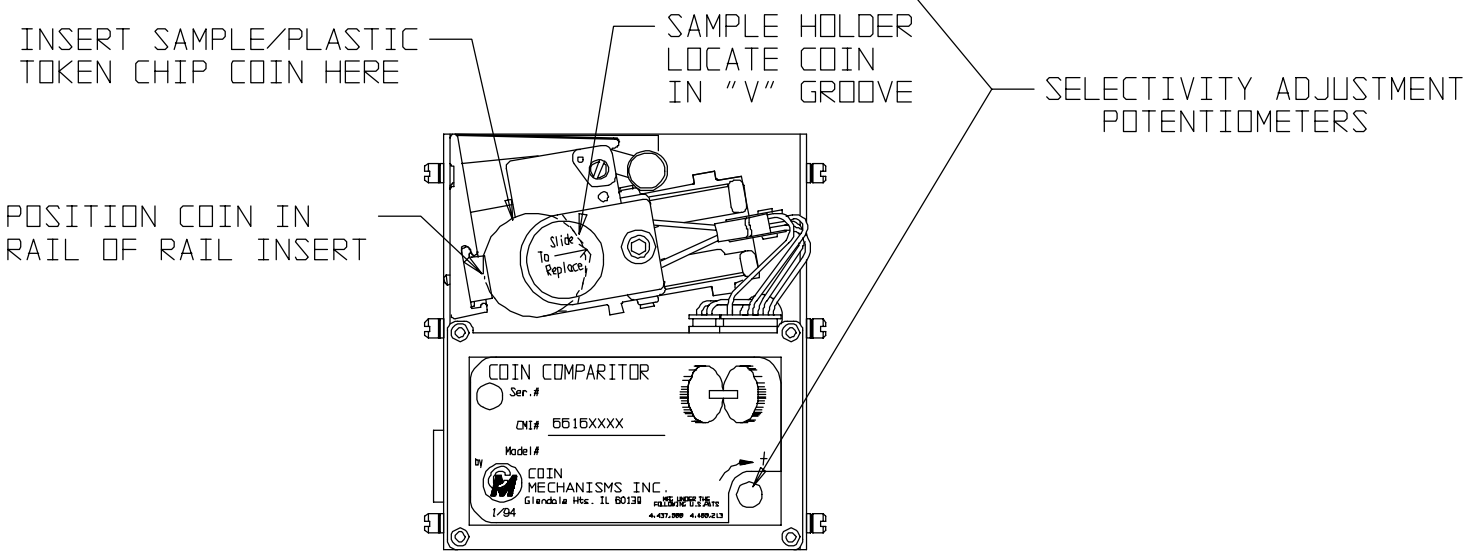


FIG #2



COIN COMPARITOR IDENTIFICATION REFERENCE

FIG. 3, FIG. 4 AND FIG. 5

FIG #3

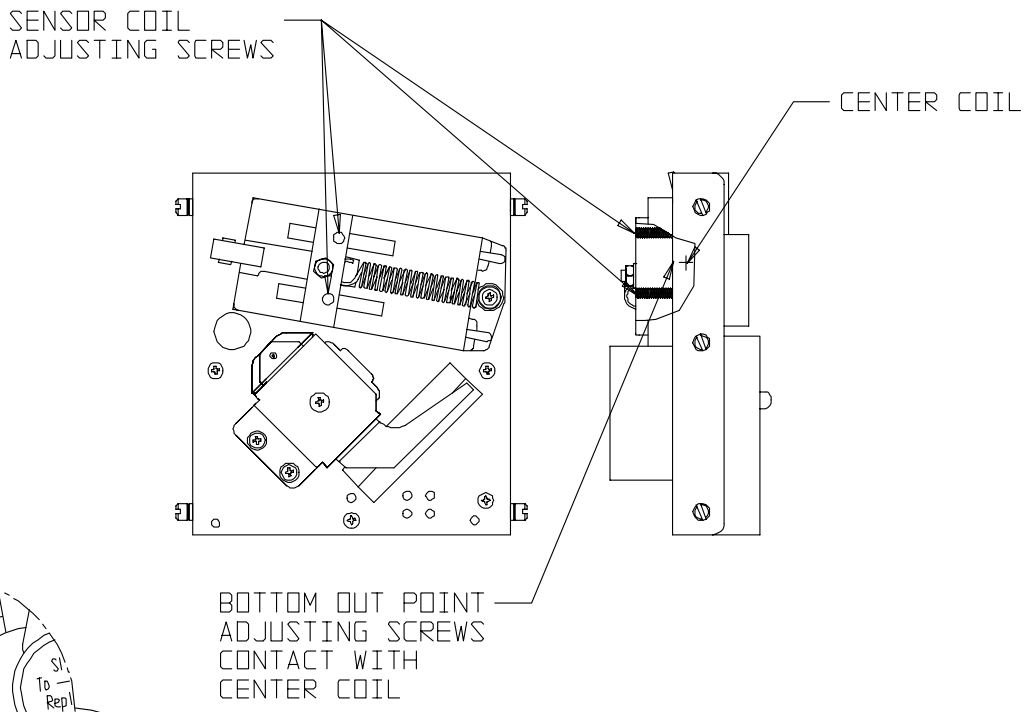


FIG #4

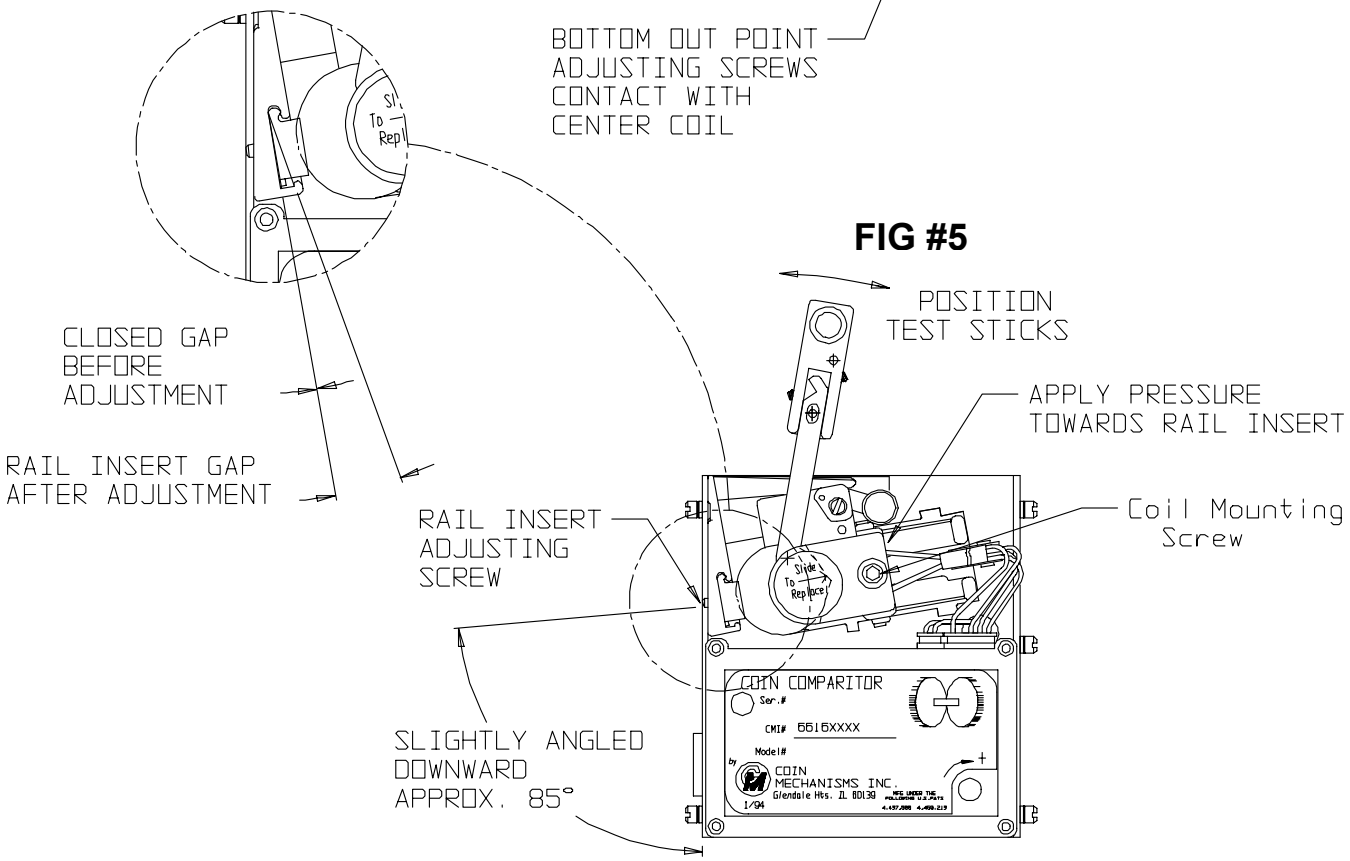


FIG #5

INTELLIGENT COMPARITOR IDENTIFICATION REFERENCE

FIG. 6 AND FIG. 7

FIG #6

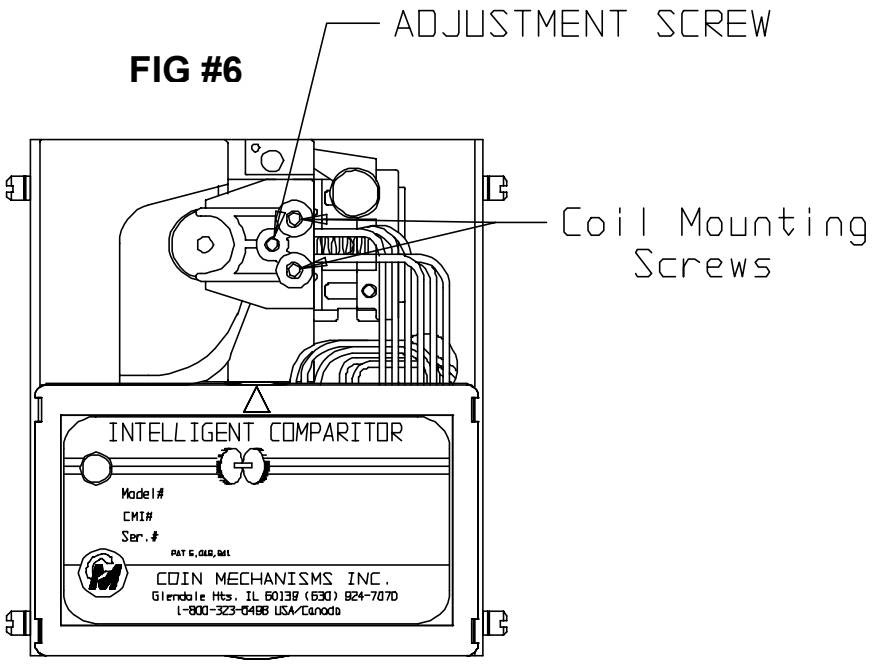
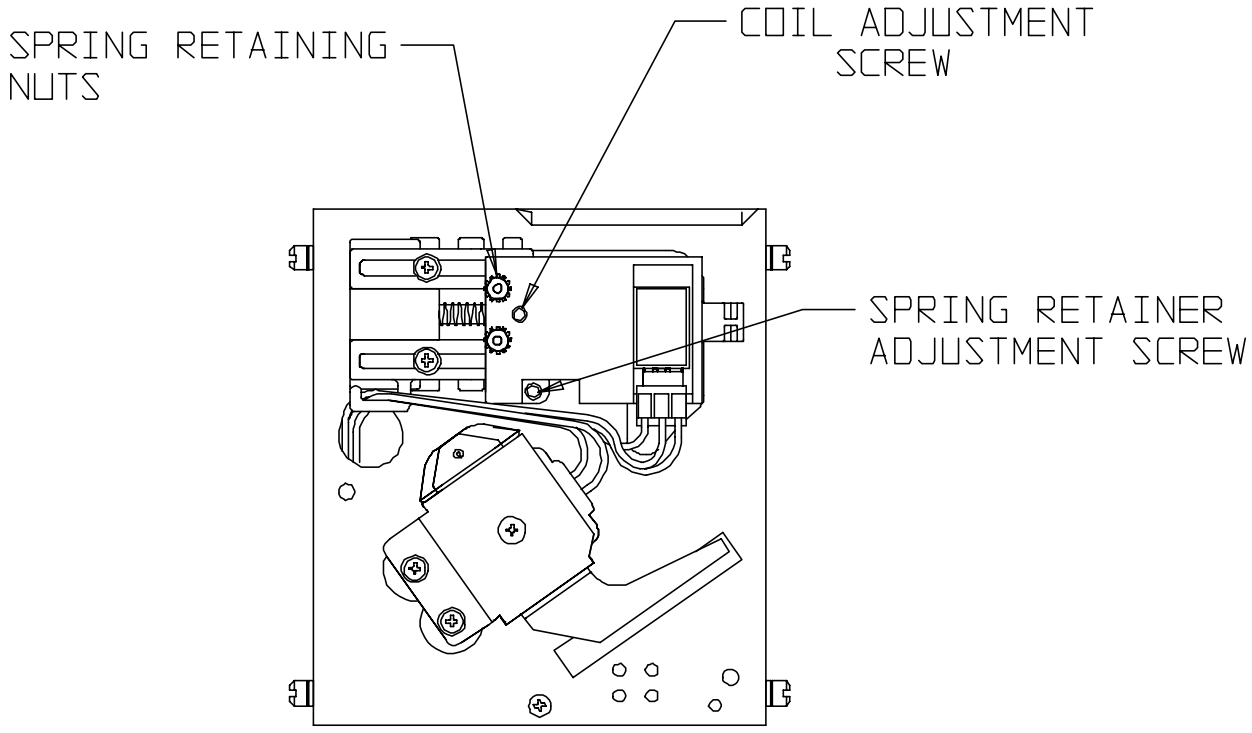


FIG #7



DEFENDER IDENTIFICATION REFERENCE

FIG. 8 AND FIG. 9

FIG #8

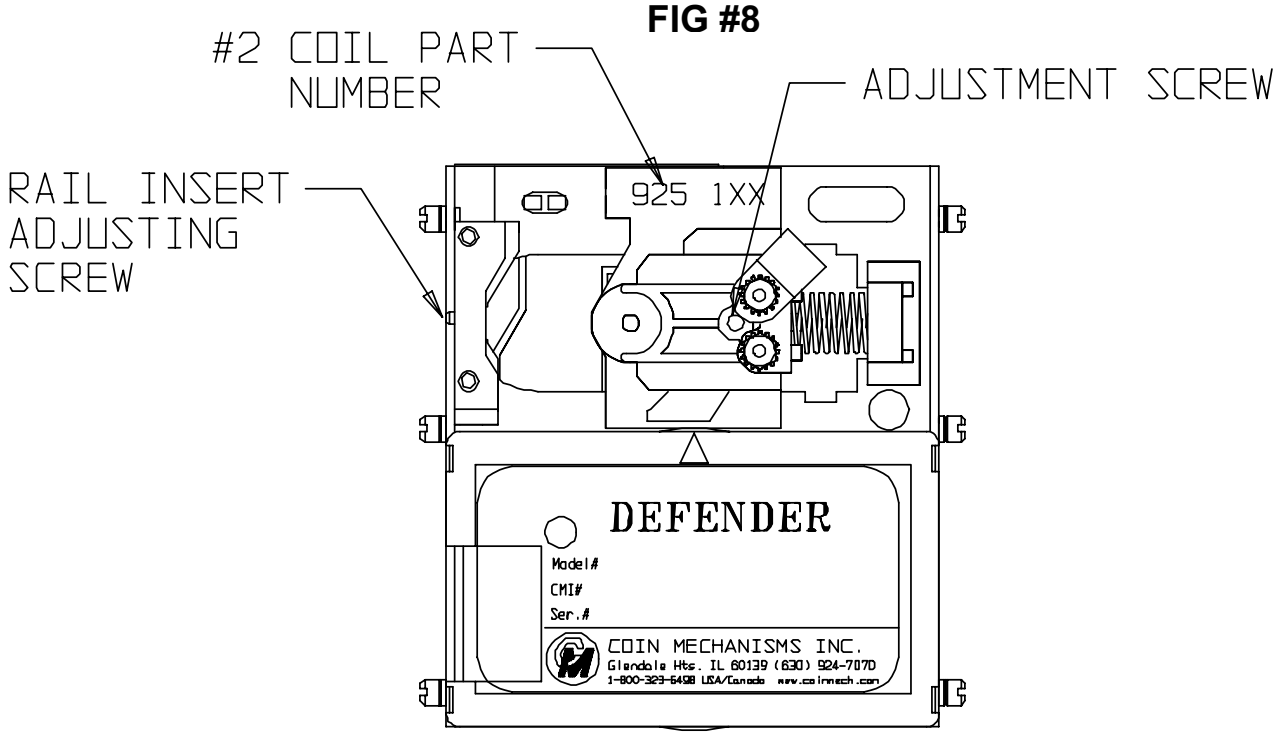
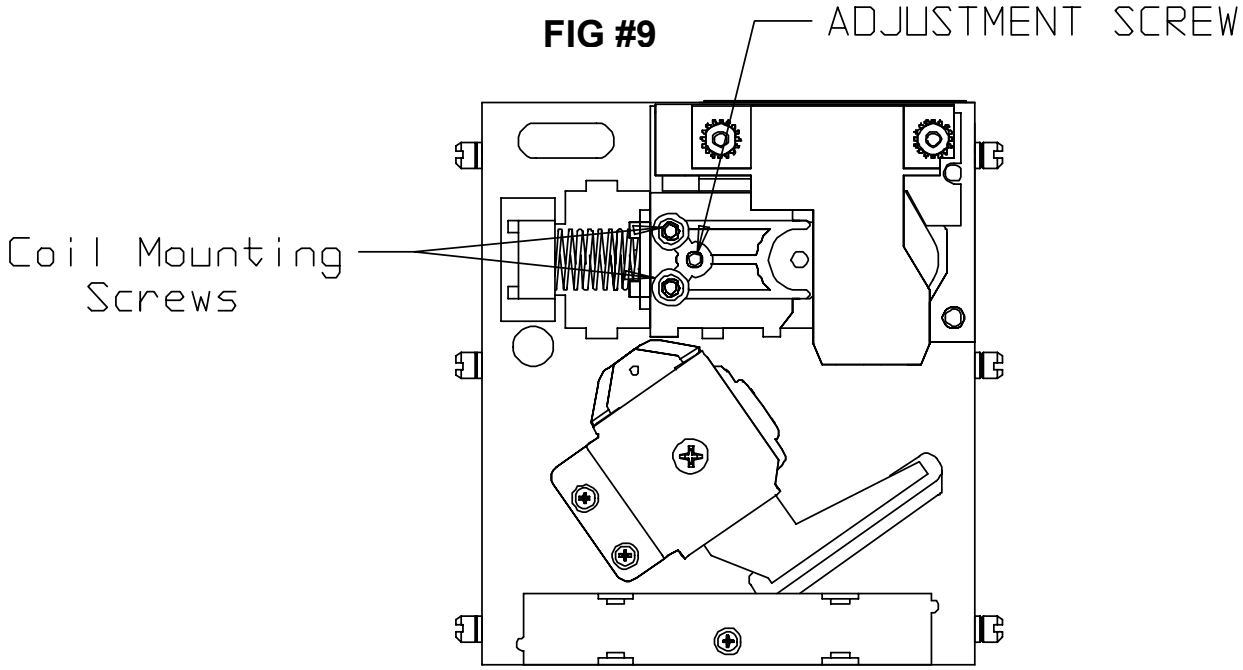


FIG #9



COIN COMPARITOR
PIN NUMBER IDENTIFICATION

FIG #10
CC-16 , MC-16

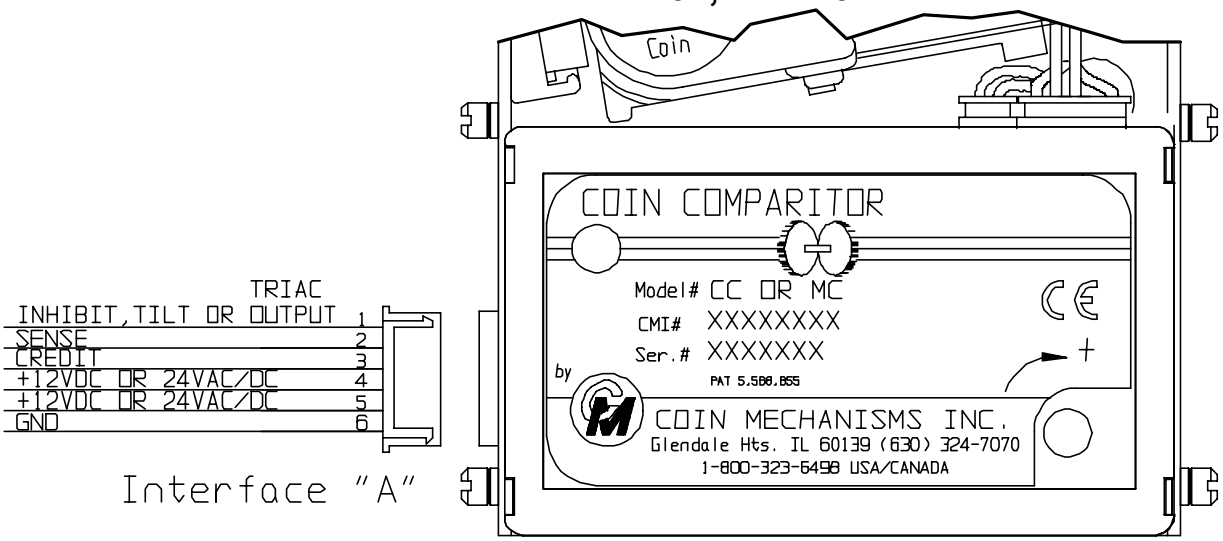
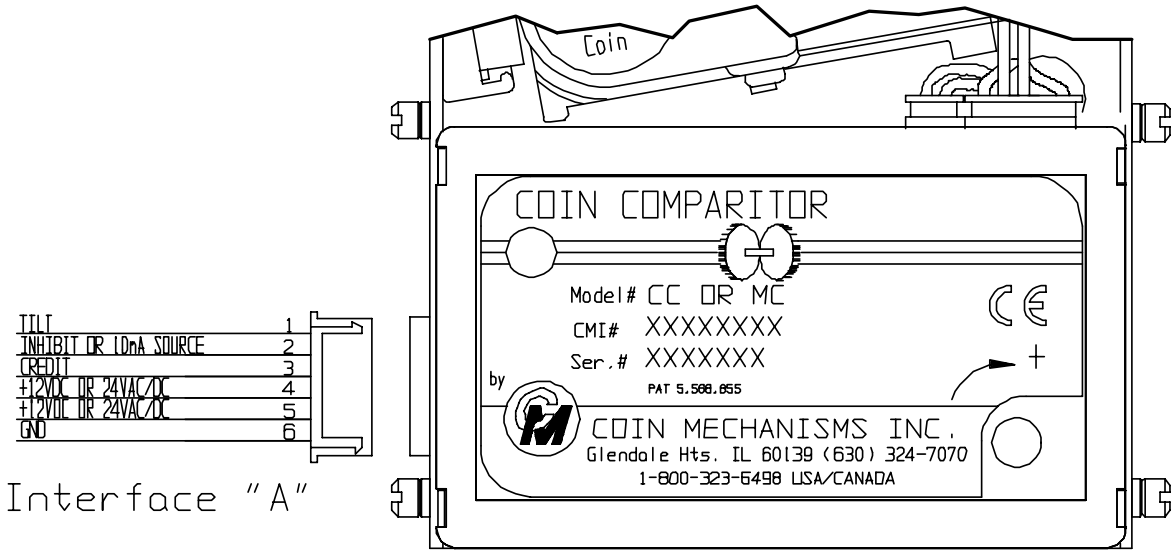


FIG #11
CC-40 , MC-40



COIN COMPARITOR
PIN NUMBER IDENTIFICATION

FIG #12
CC-33 , CC-37

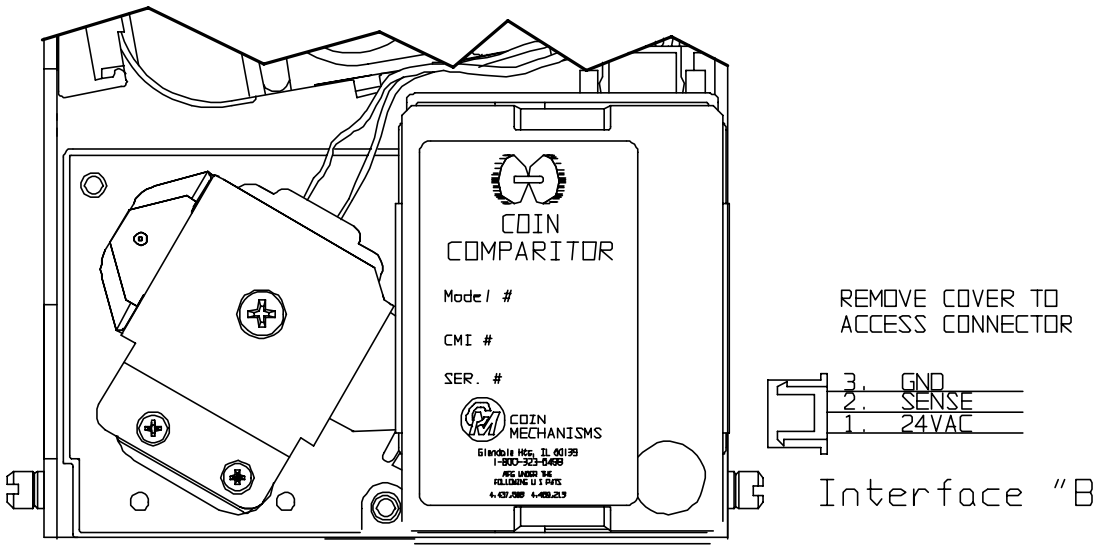
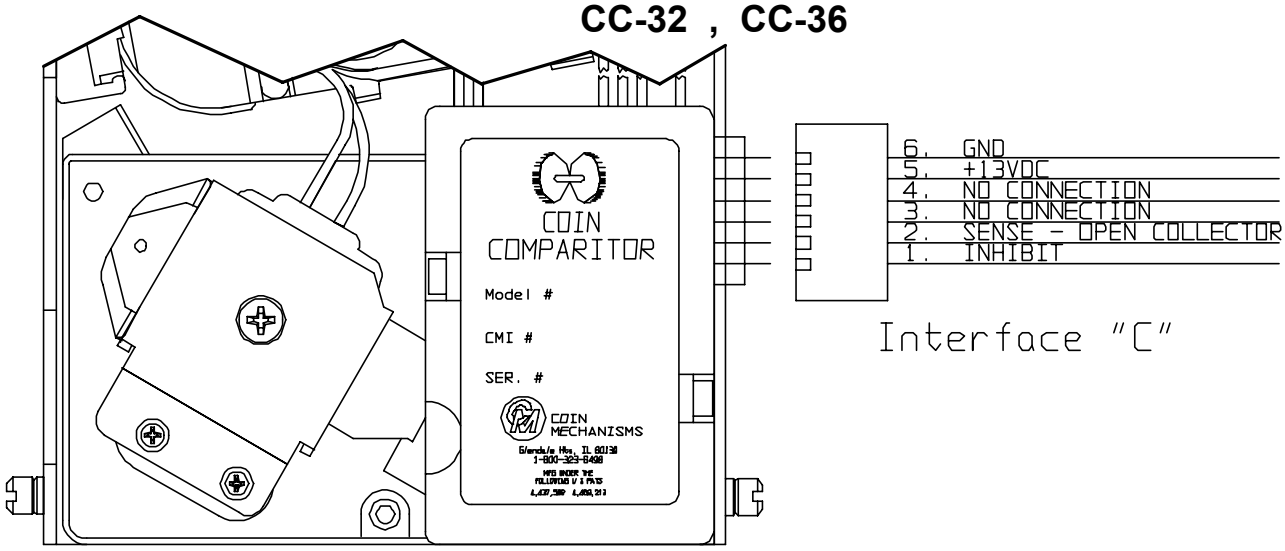


FIG #13
CC-32 , CC-36



COIN COMPARITOR
PIN NUMBER IDENTIFICATION

FIG #14
MC-62 , CC-62 , IC-62

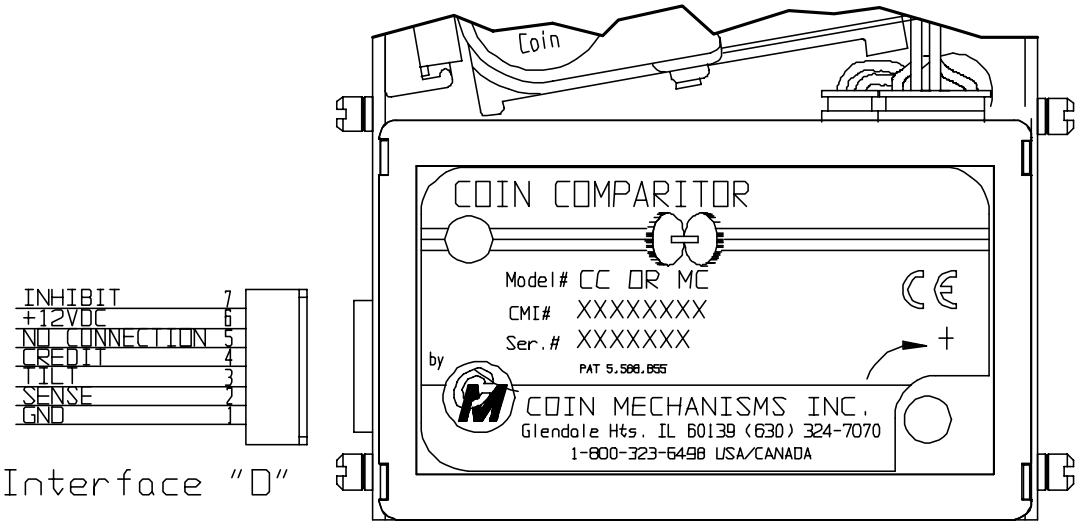
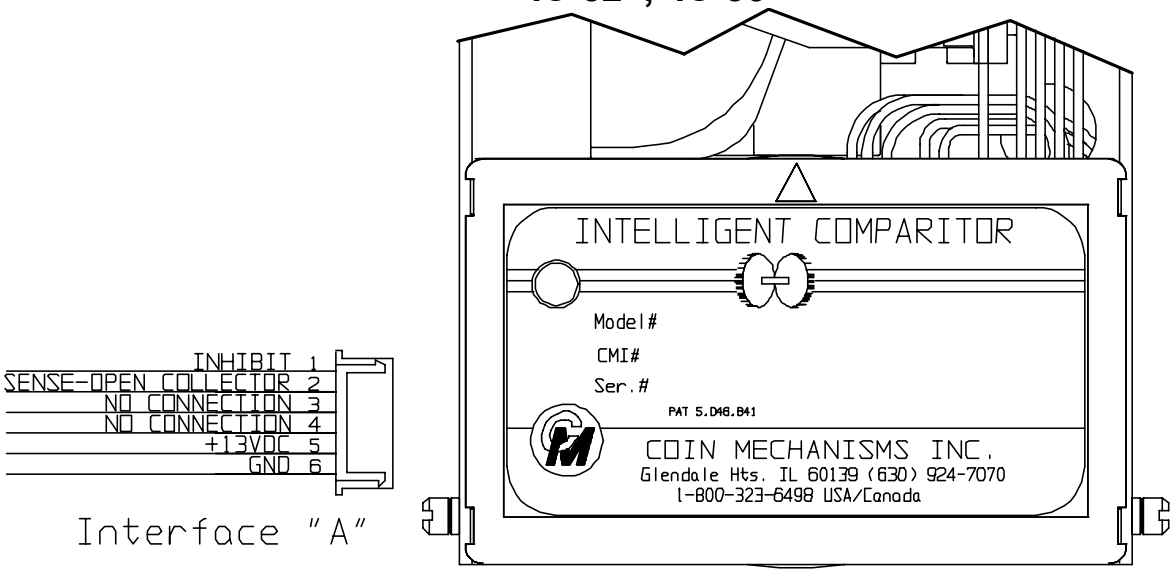


FIG #15
IC-32 , IC-36



COIN COMPARITOR
PIN NUMBER IDENTIFICATION

FIG #16
IC-33 , IC-37

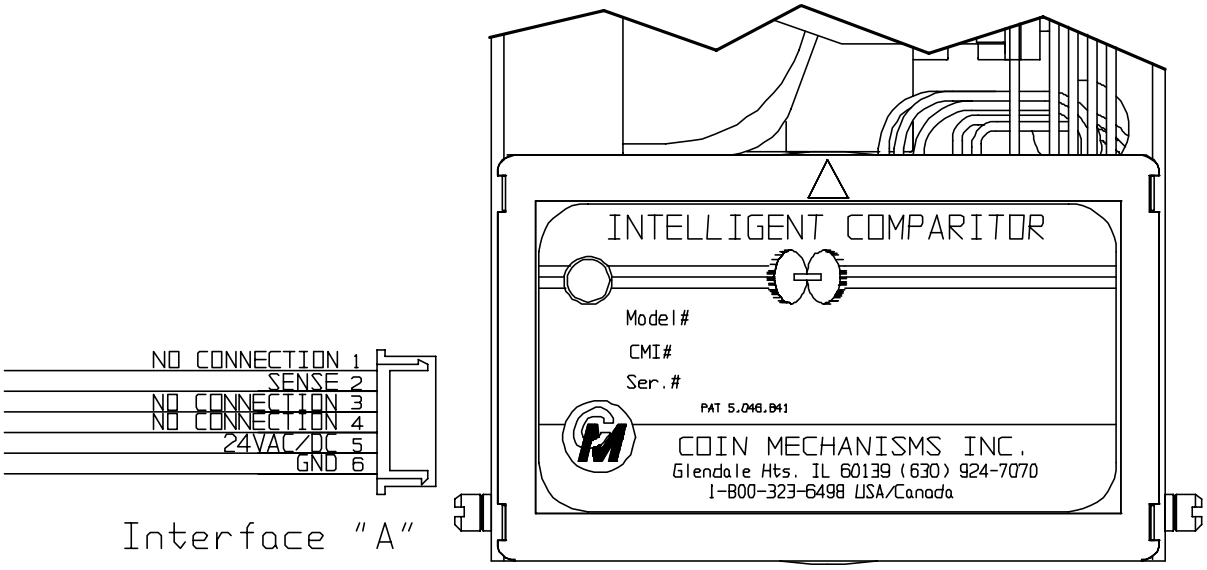
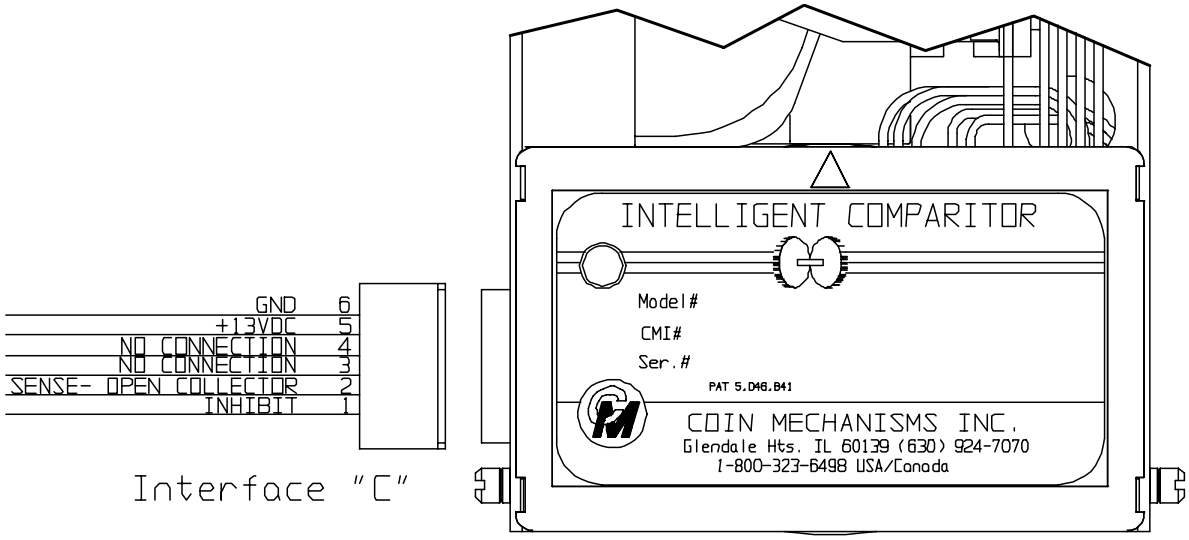
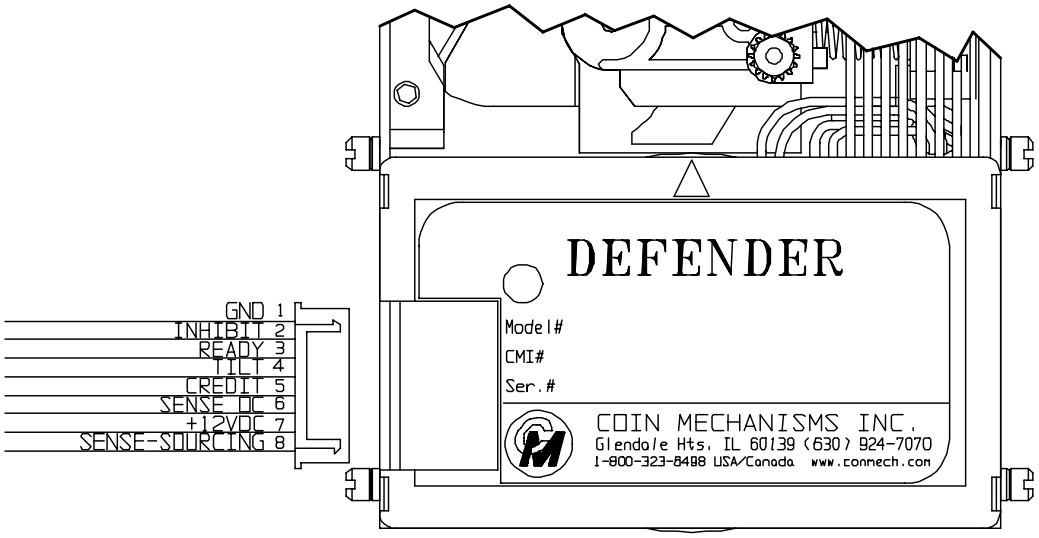


FIG #17
CC-16 , IC-16
13VDC INH



COIN COMPARITOR
PIN NUMBER IDENTIFICATION

FIG #18
DEFENDER



COIN COMPARITOR
TEST POINT IDENTIFICATION

FIG #19

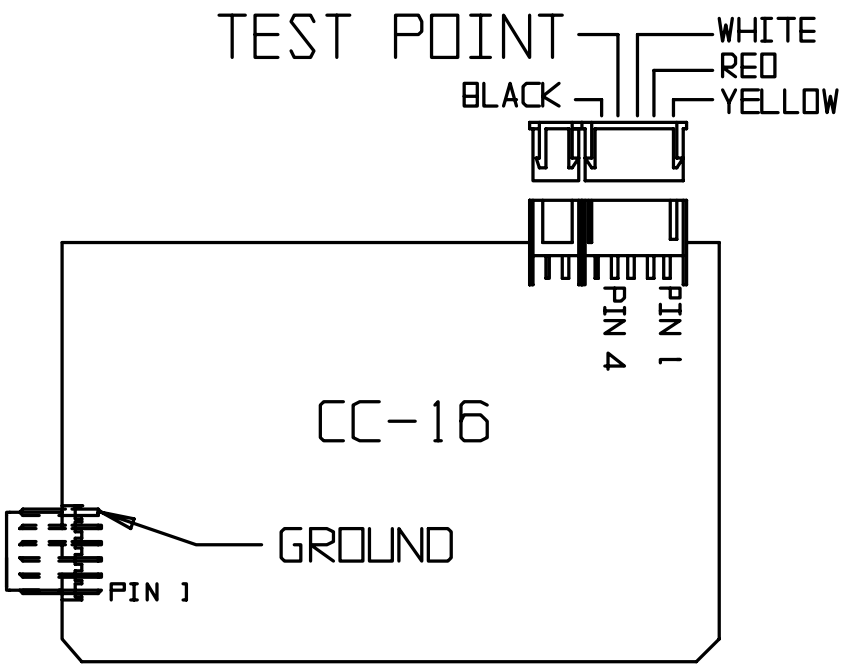
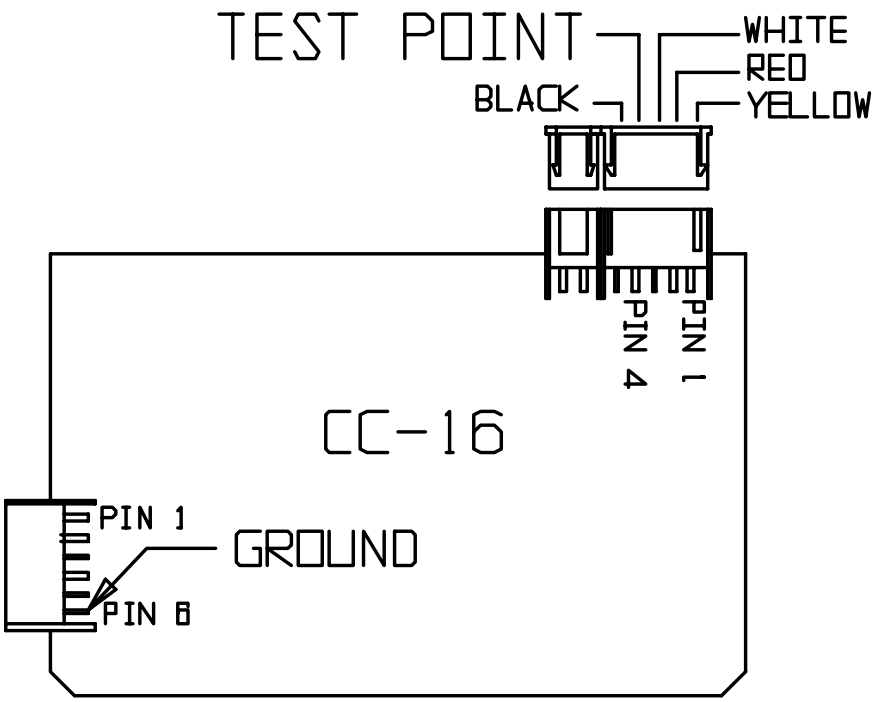


FIG #20



COIN COMPARITOR
TEST POINT IDENTIFICATION

FIG #21

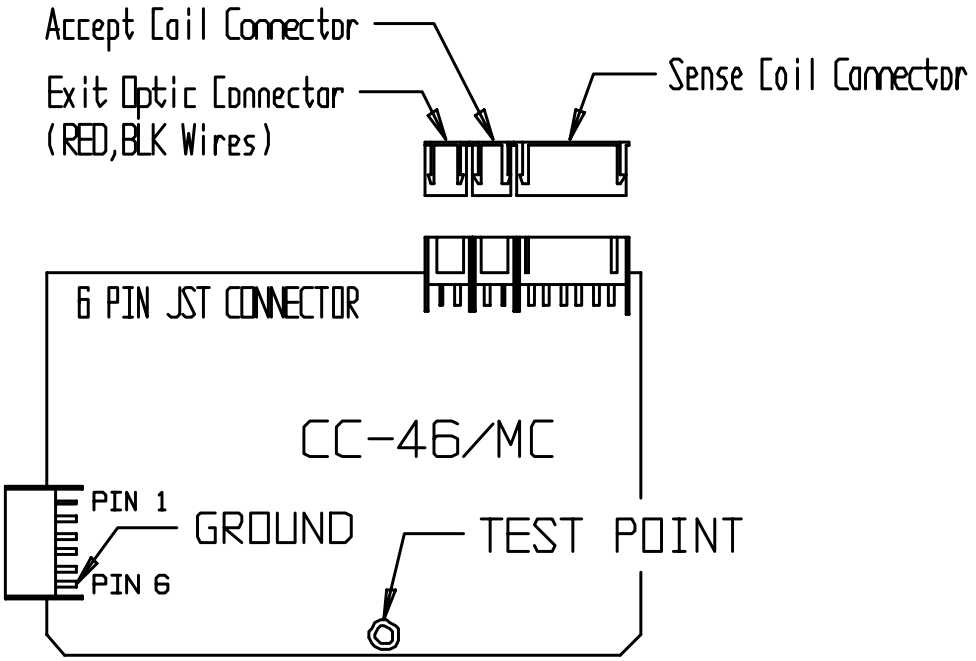
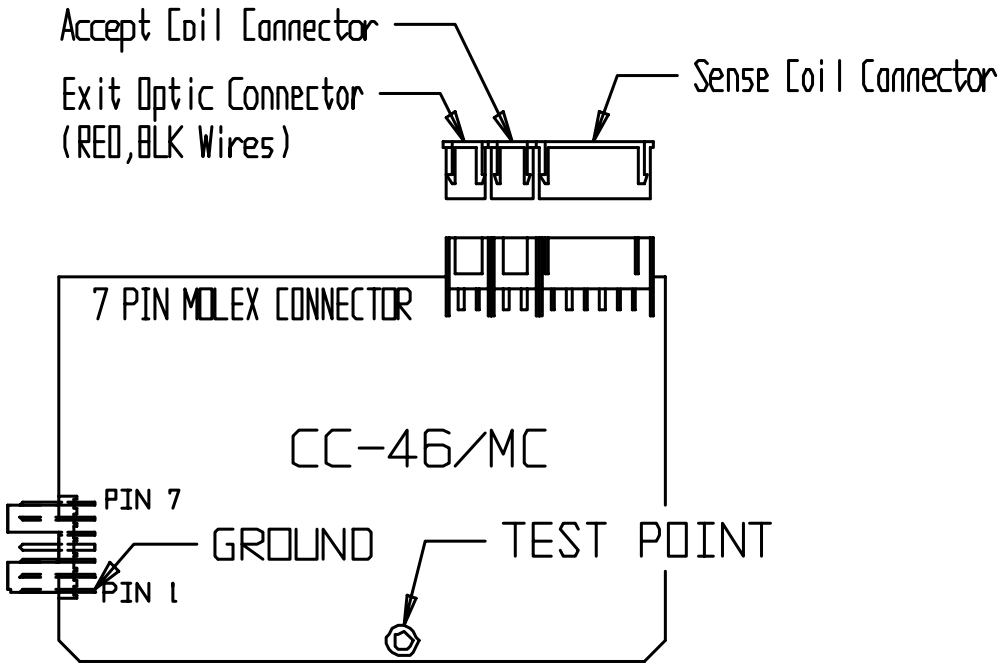


FIG #22



COIN COMPARITOR
TEST POINT IDENTIFICATION

FIG #23

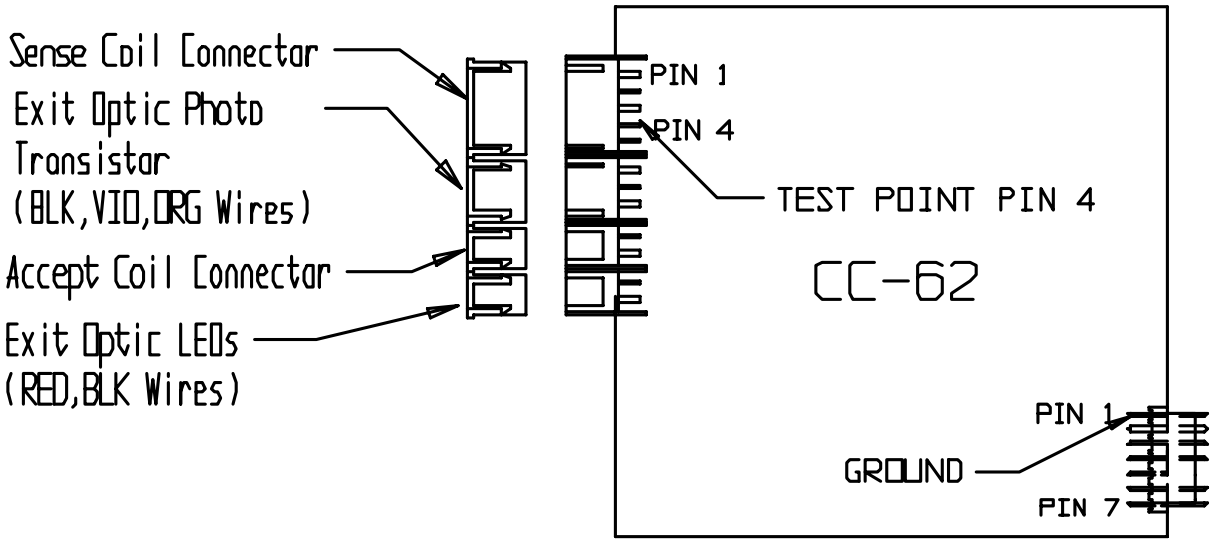
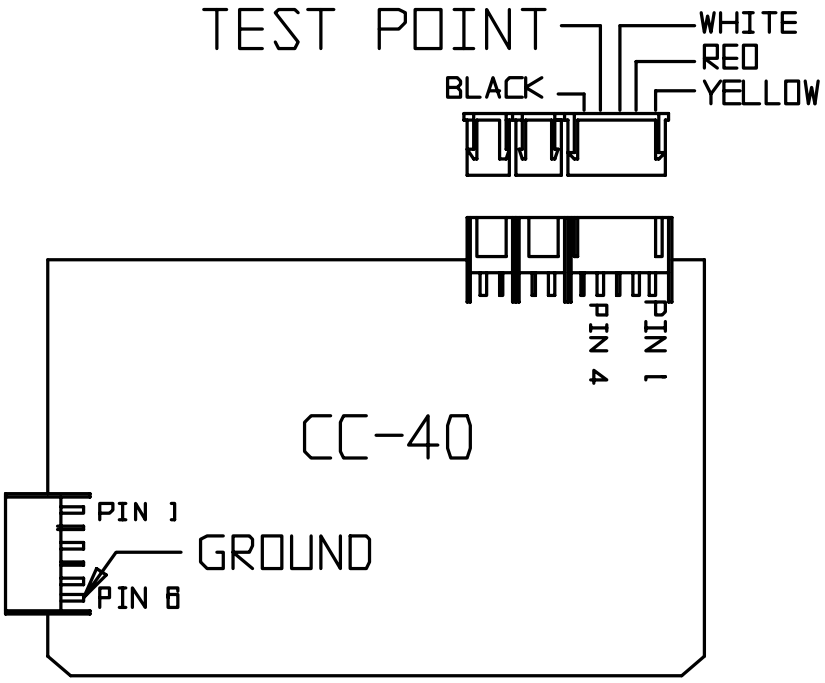


FIG #24



COIN COMPARITOR
TEST POINT IDENTIFICATION

FIG #25

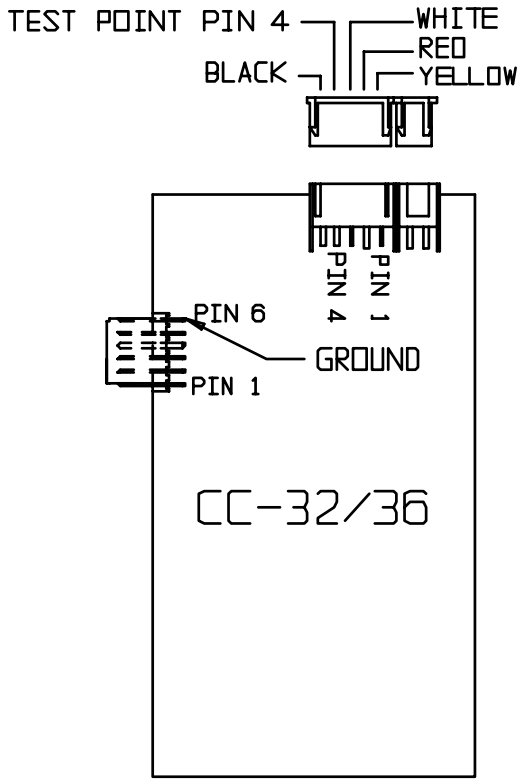
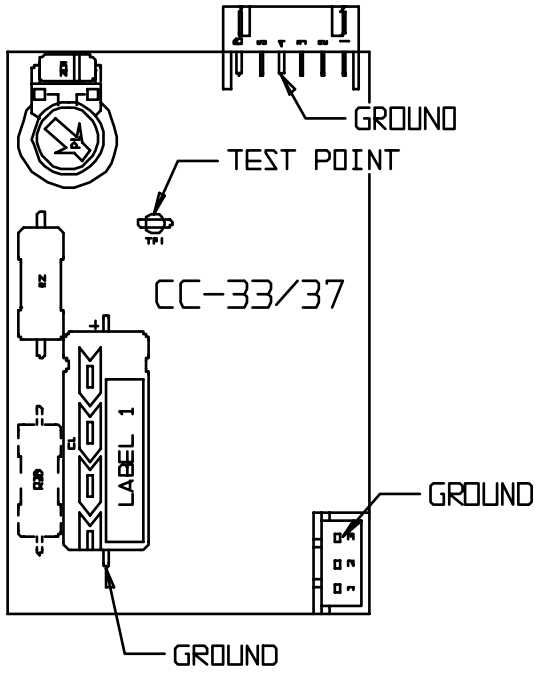


FIG #26



COIN COMPARITOR
TEST POINT IDENTIFICATION

FIG #27

200 Series IC boards (e.g. 092702xx)

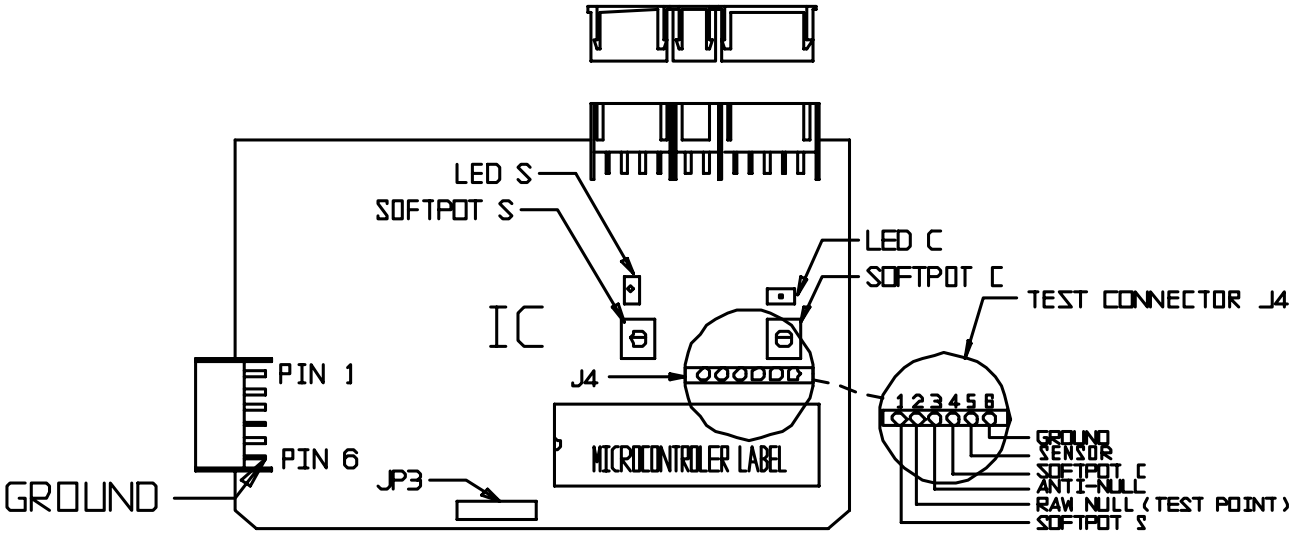
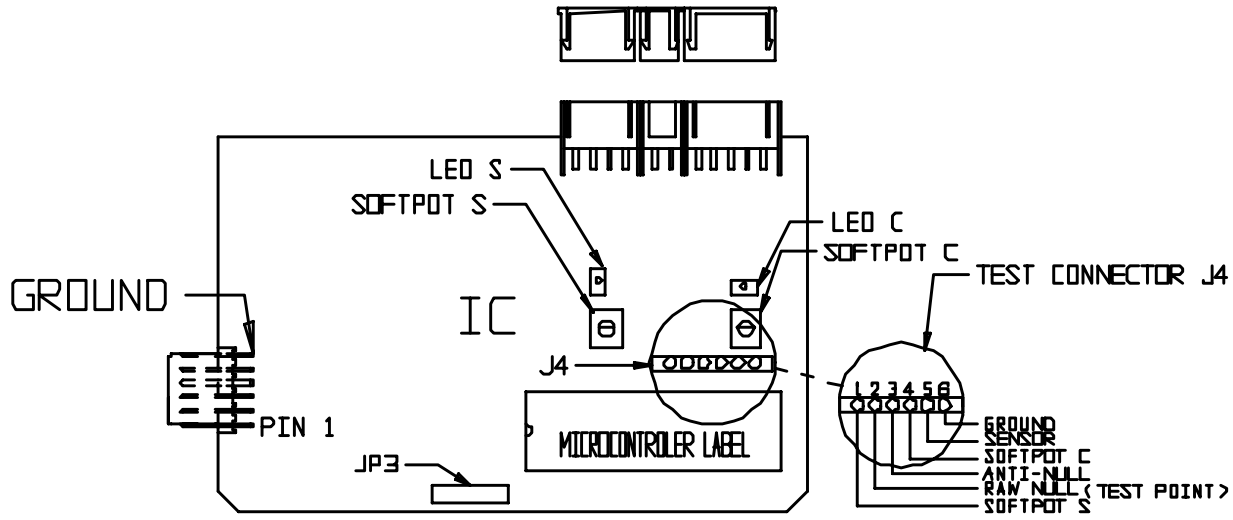


FIG #28

200 Series IC boards (e.g. 092702xx)



COIN COMPARITOR
TEST POINT IDENTIFICATION

FIG #29

300 Series IC boards (e.g. 092703xx)

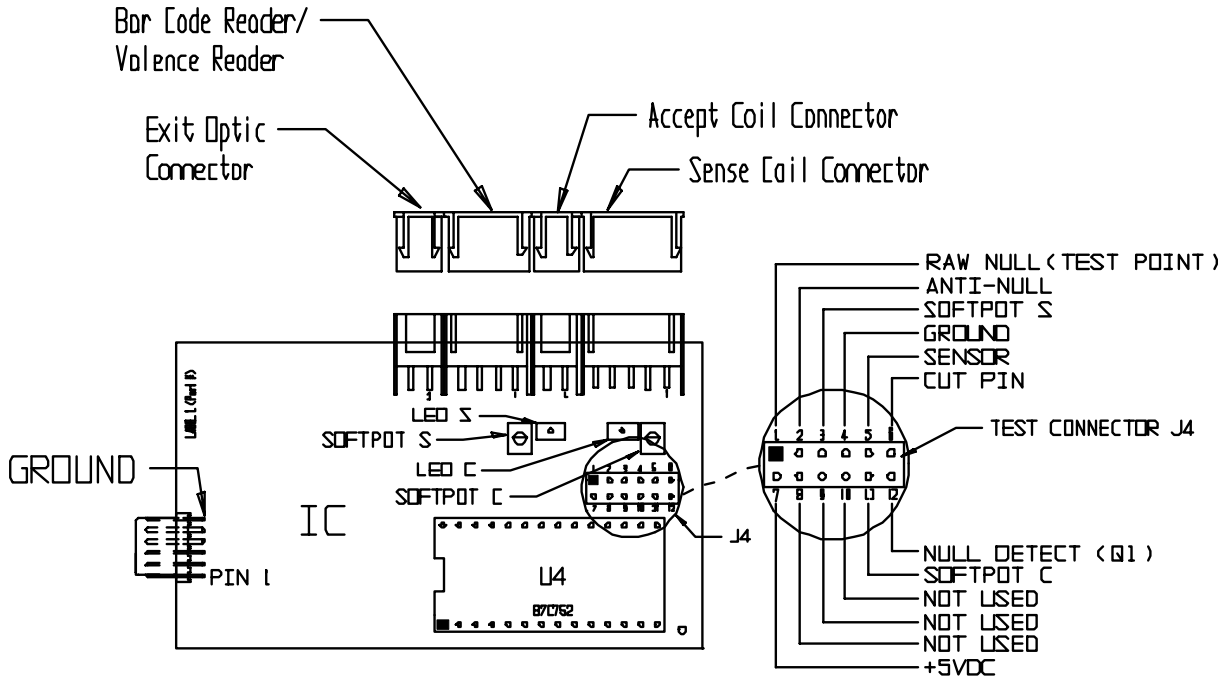
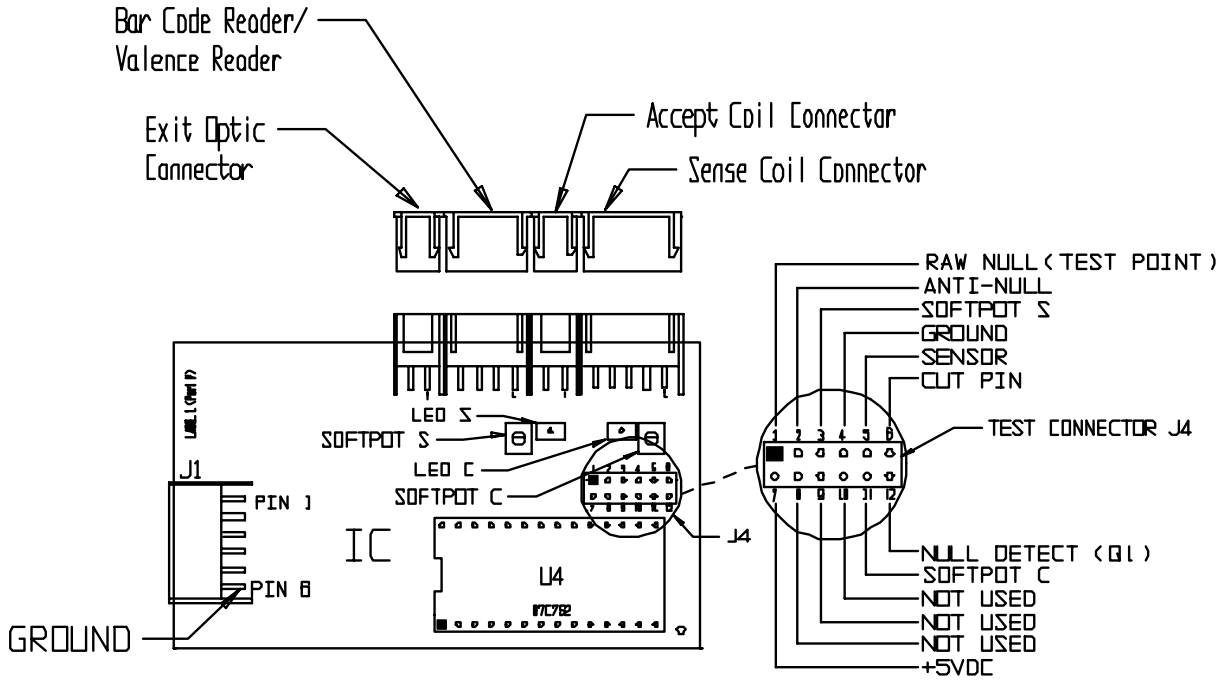


FIG #30

300 Series IC boards (e.g. 092703xx)



COIN COMPARITOR
TEST POINT IDENTIFICATION

FIG #31

400 Series IC boards (e.g. 092704xx)

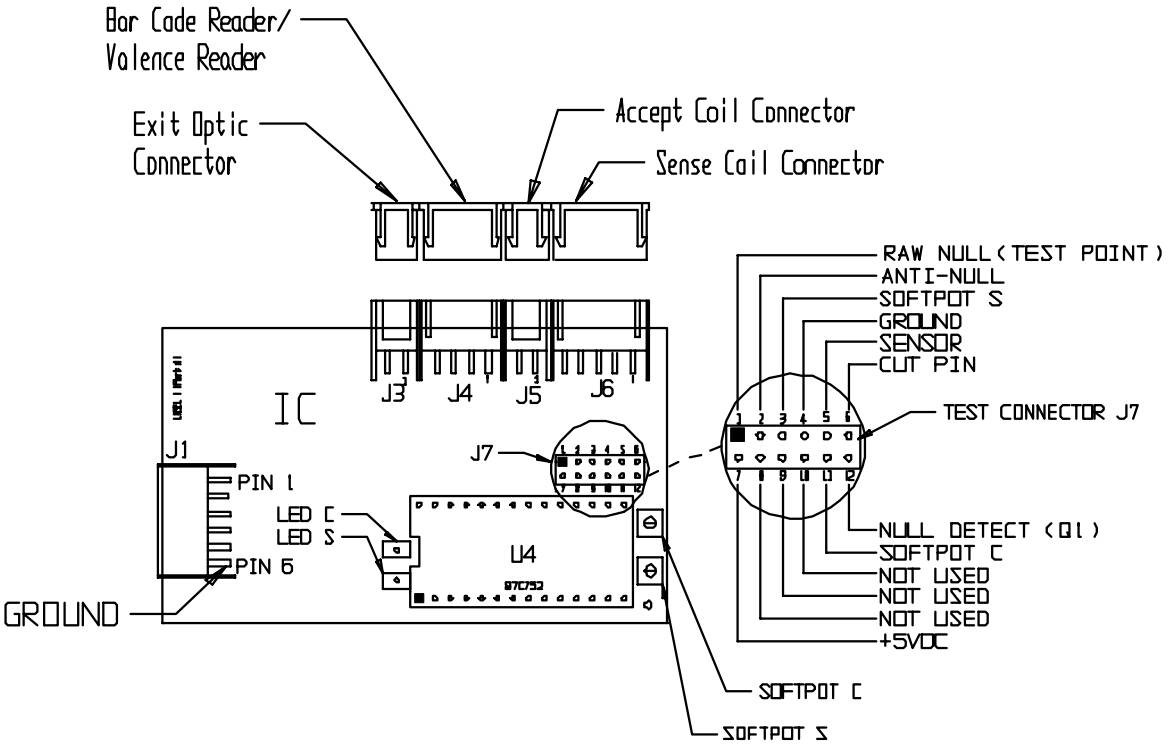
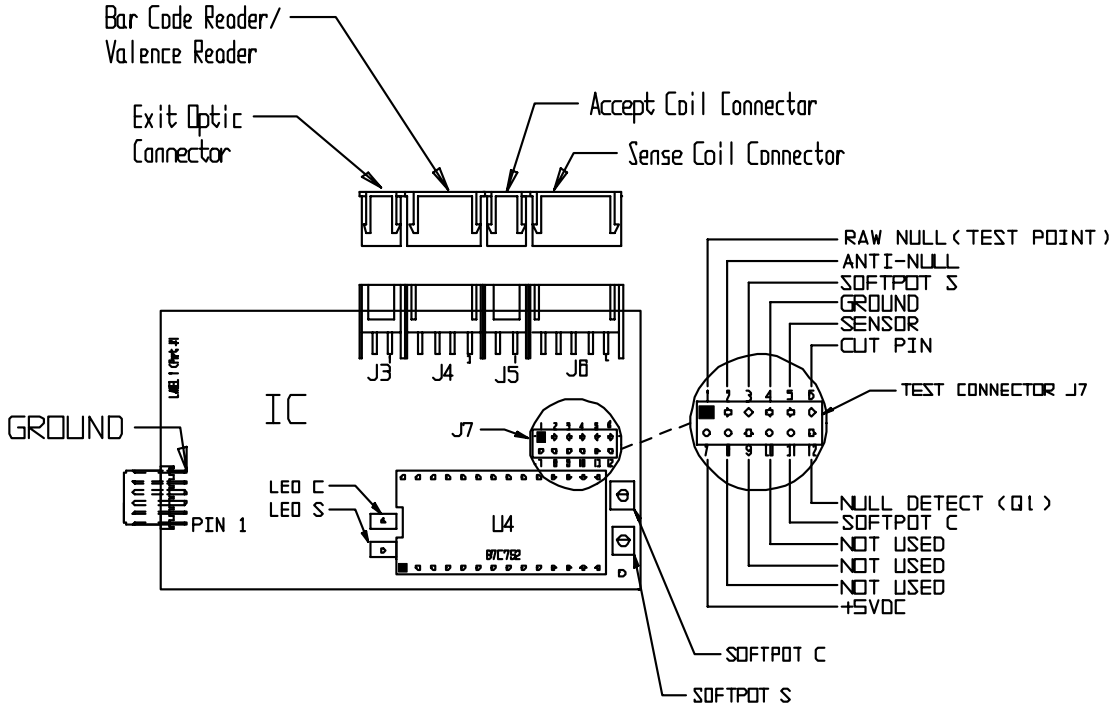


FIG #32

400 Series IC boards (e.g. 092704xx)



COIN COMPARITOR
TEST POINT IDENTIFICATION

FIG #33

7000 Series IC boards (e.g. 0927-007xxxx)

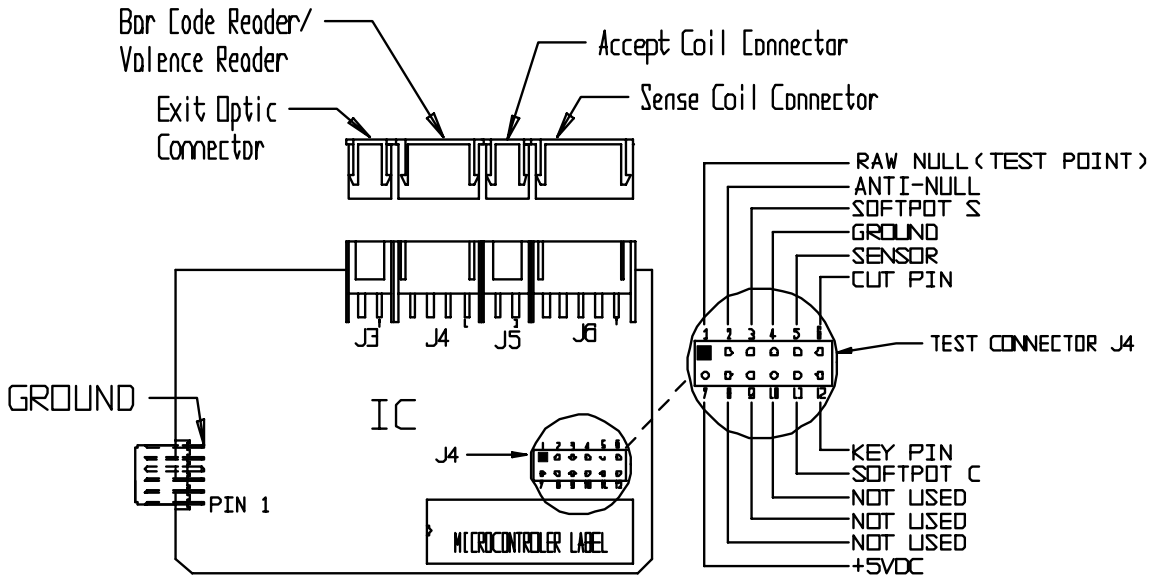
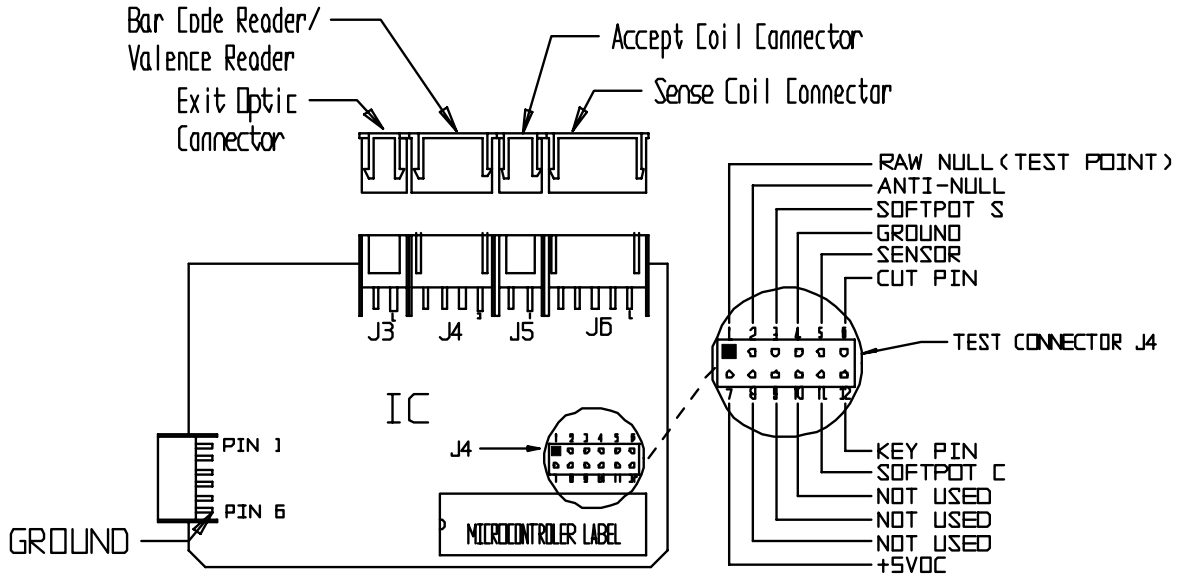


FIG #34

7000 Series IC boards (e.g. 0927-007xxxx)



COIN COMPARITOR
TEST POINT IDENTIFICATION

FIG #35

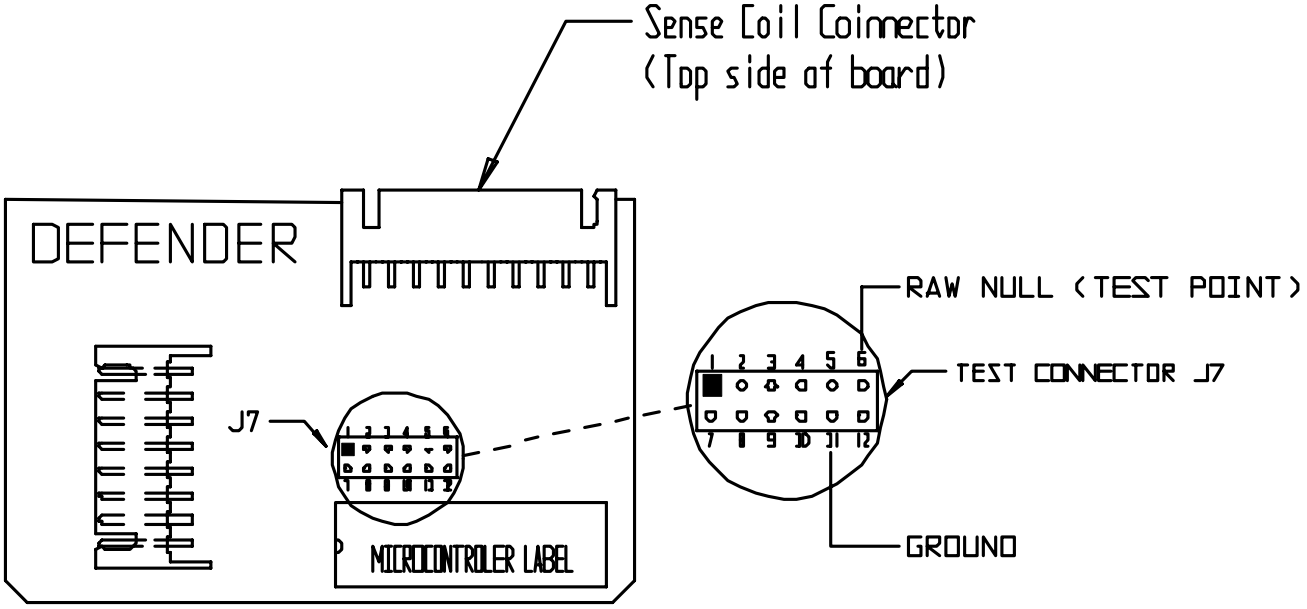
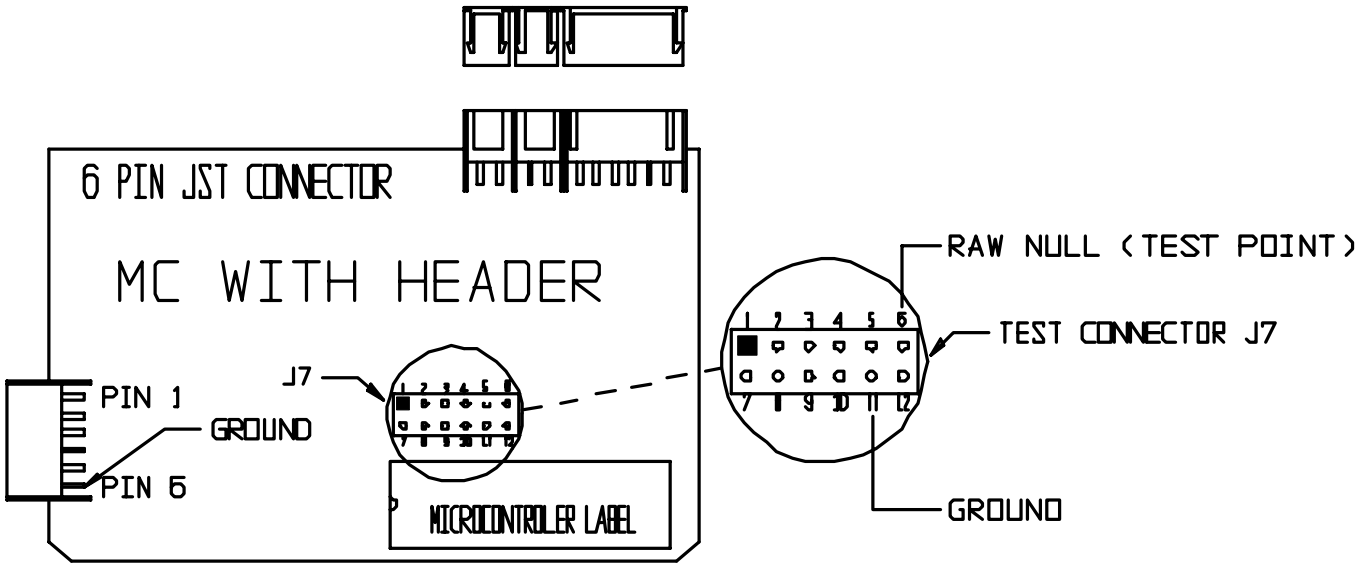
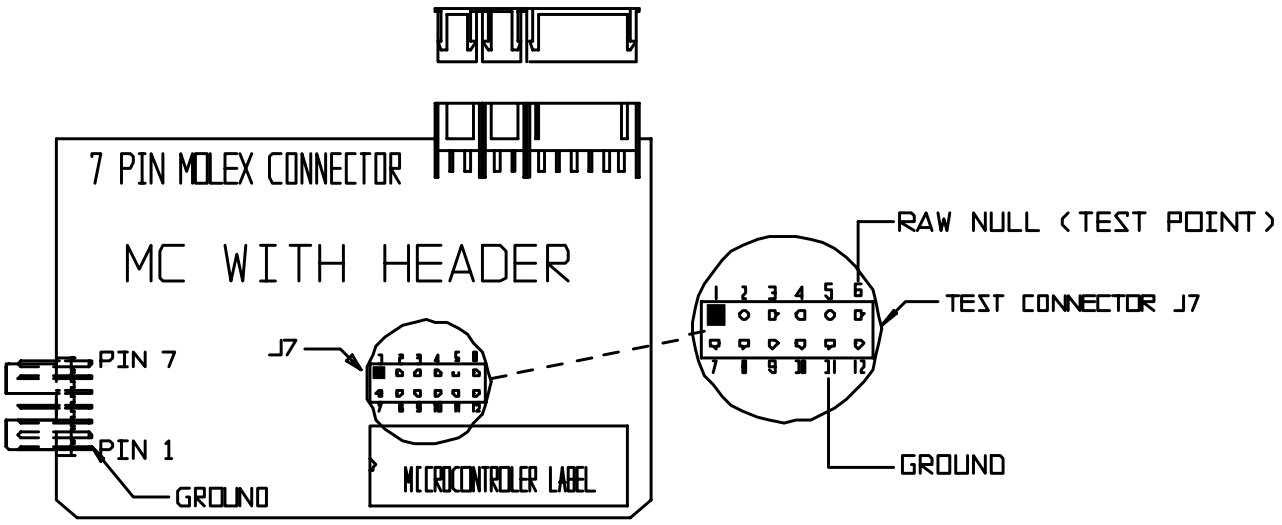


FIG #36

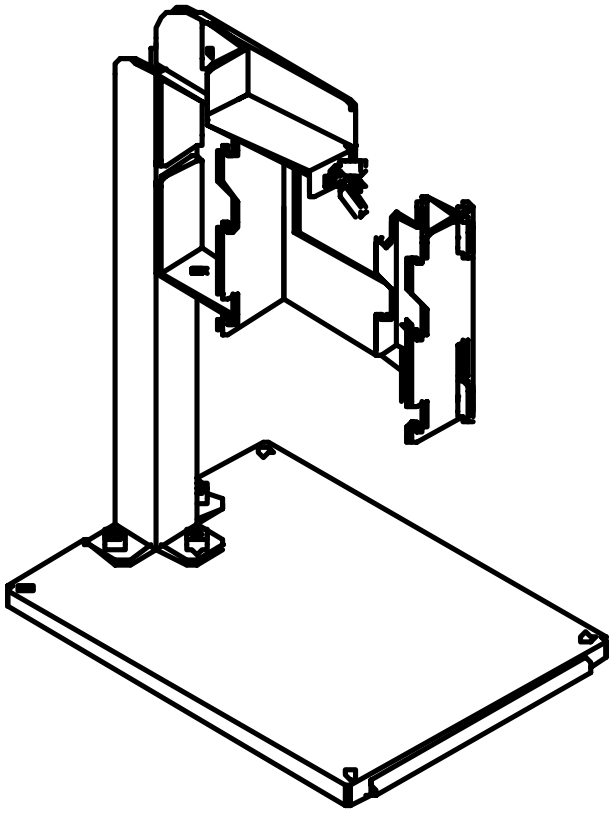


COIN COMPARITOR
TEST POINT IDENTIFICATION

FIG #37



<u>Test Stand</u>
<u>Part number 05000009</u>



DAMPER WEIGHT RECOMMENDATION
For Coin Comparitor®

Coin Weight vs. Damper Weight

When dealing with small, lightweight coins, which have copper compositions in them, like the US dime, it is recommended that a small mounting stud weight be used such as the mounting stud from the mainplate assembly. This small stud weight versus no weight will prevent other somewhat larger copper composition coins to be accepted as dimes. This condition can be applied to other unwanted coins, which have similar metal alloys and are slightly larger in diameter.

Coin Weight Range in grams	**Typical coin used**	Damper Weight Assembly No.
1.5 to 1.9	Small coins / tokens	06660024 = "No Weight"
2.0 to 2.9	1¢,10	06660051 = 0.7 grams
3.0 to 4.4	5¢ , 25¢	06660012 = 2.6 grams
4.5 to 5.0	Canadian 25¢	06660101 = 4.0 grams
5.0 to 8.5	25¢, Token	06660013 = 6.0 grams
8.5 to 10.0	Canadian $1	06660102 = 9.0 grams
10.0 to 10.5	Special coins	06660056 = 10.6 grams
10.5 to 11.0	Australian Dollar	06660046 = 12.0 grams
11.0 to and up	50¢ / $ Game Tokens	06660014 = 14.2 grams
11.0 to and up	1.47" and up dia. only	06660076 = 14.2 grams

The damper weight is utilized in conjunction with a lever arm in the Comparitor coin chute to bias the falling coin against a reference surface (the rail) in order to closely align the coin with the resident coin so that an accurate comparison can be made by the sensor coils and associated electronics.

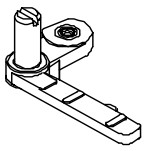
To establish a repeatable test for damper weight specifications, the chart above was determined dropping coins from a "static" position at the coin entry. A minimum weight coin was determined to overcome and pivot the damper lever when let go from this static position. This minimum weight established the coin weight range for each damper weight.

In real in-situ applications the initial height of the falling coin, and therefore its speed and striking force on the lever, will have differing consequences on the Comparitor's performance for accepting valid coins and rejecting fraud coins. In some cases, excessive rejection of valid coins may be remedied by using the next higher damper weight. However, using too heavy of a weight can slow the coin significantly to where it will be rejected because of a time out.
This chart was established as a guideline only and may be deviated from for special coin / token and machine circumstances.

DAMPER LEVER WEIGHT AND HARDWARE CHART

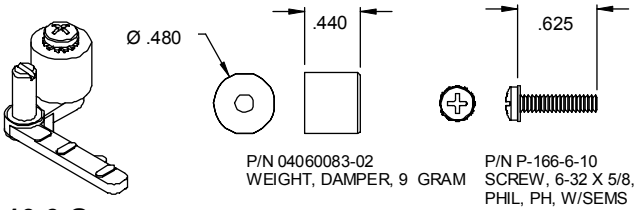
NO WEIGHT

P/N 06660024



9 G

P/N 06660102

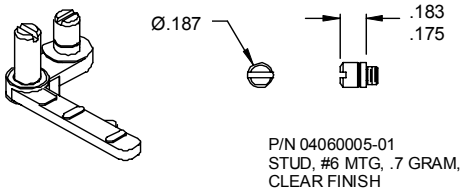


P/N 04060083-02
WEIGHT, DAMPER, 9 GRAM

P/N P-166-6-10
SCREW, 6-32 X 5/8,
PHIL, PH, W/SEMS

.7G

P/N 06660051

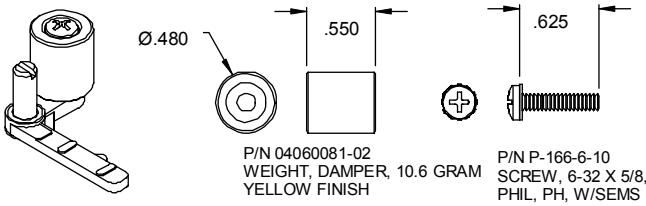


P/N 04060005-01
STUD, #6 MTG, .7 GRAM,
CLEAR FINISH

10.6 G

Ø.480

P/N 06660056

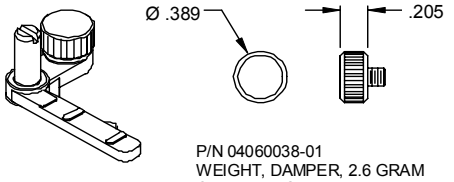


P/N 04060081-02
WEIGHT, DAMPER, 10.6 GRAM
YELLOW FINISH

P/N P-166-6-10
SCREW, 6-32 X 5/8,
PHIL, PH, W/SEMS

2.6 G

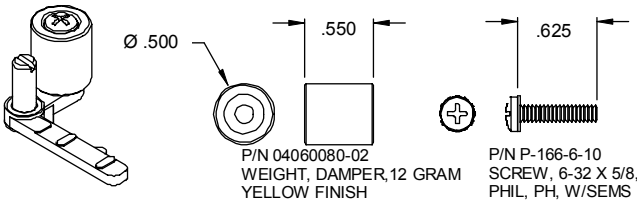
P/N 06660012



P/N 04060038-01
WEIGHT, DAMPER, 2.6 GRAM
CLEAR FINISH

12 G

P/N 06660046

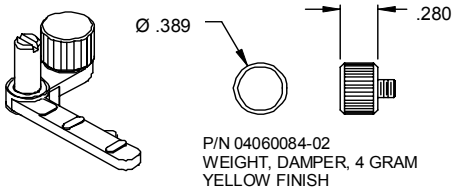


P/N 04060080-02
WEIGHT, DAMPER,12 GRAM
YELLOW FINISH

P/N P-166-6-10
SCREW, 6-32 X 5/8,
PHIL, PH, W/SEMS

4 G

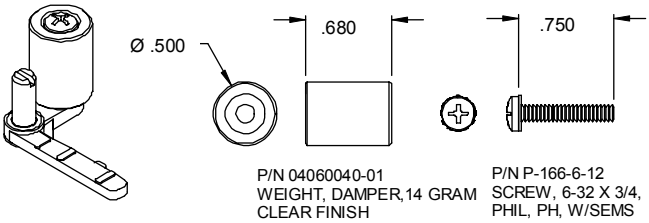
P/N 06660101



P/N 04060084-02
WEIGHT, DAMPER, 4 GRAM
YELLOW FINISH

14 G

P/N 06660014

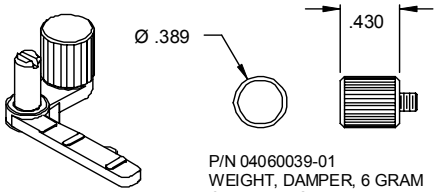


P/N 04060040-01
WEIGHT, DAMPER,14 GRAM
CLEAR FINISH

P/N P-166-6-12
SCREW, 6-32 X 3/4,
PHIL, PH, W/SEMS

6 G

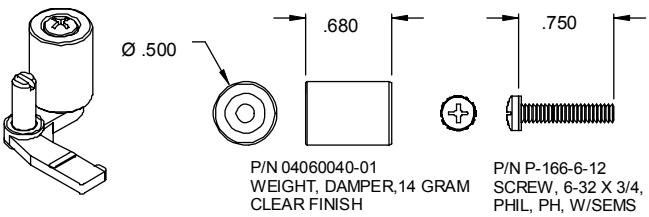
P/N 06660013



P/N 04060039-01
WEIGHT, DAMPER, 6 GRAM
CLEAR FINISH

14 G

P/N 06660076



P/N 04060040-01
WEIGHT, DAMPER,14 GRAM
CLEAR FINISH

P/N P-166-6-12
SCREW, 6-32 X 3/4,
PHIL, PH, W/SEMS

TABLE 1 MATRIX	CC16,IC16	CC32,CC33,CC36 ,CC37	CC40,MC	MC SERIES	CC62,IC62	IC33,IC37	IC-32,IC36
SW3	Power ON/OFF	Power ON/OFF	Power / Tilt reset	Power / Tilt reset	Power / Tilt reset	Power ON/OFF	Power ON/OFF
SW6	SEE PAGE 3 Refer to Spec Sheet	N/A	SEE PAGE 3 Refer to Spec Sheet	SEE PAGE 3 Refer to Spec Sheet	SEE PAGE 3 Refer to Spec Sheet	N/A	SEE PAGE 3 Refer to Spec Sheet
SW2	VOLTAGE Refer to Spec Sheet	VOLTAGE Refer to Spec Sheet	VOLTAGE Refer to Spec Sheet	VOLTAGE Refer to Spec Sheet	VOLTAGE Refer to Spec Sheet	VOLTAGE Refer to Spec Sheet	VOLTAGE Refer to Spec Sheet
SW7	User preference	User preference	User preference	User preference	User preference	User preference	User preference
SW8 Sense	NO SETTING REQUIRED	NO SETTING REQUIRED	n/a	SENSE = (Refer to Spec Sheet)	SENSE = JP1 #3 (bottom position)	SENSE= (bottom position)	SENSE= (bottom position)
SW8 Credit	n/a	n/a	CREDIT = JP1 #5 (top position)	CREDIT = (Refer to Spec Sheet)	CREDIT = JP1 #5 (top position)	N/A	N/A
SW8 Tilt	n/a	n/a	TILT = JP1 #7 (top position) For long Tilts also set SW8 (top position)	TILT = (Refer to Spec Sheet)	TILT = JP1 #7 (top position)	N/A	N/A
SW9 Coin	EVENT (bottom position)	EVENT (bottom position)	EVENT (bottom position)	EVENT (Refer to Spec Sheet)	EVENT (bottom position)	EVENT (bottom position)	EVENT (bottom position)
SW9 Sense	EVENT (bottom position)	EVENT (bottom position)		EVENT (Refer to Spec Sheet)	EVENT (bottom position)	EVENT (bottom position)	EVENT (bottom position)
SW9 Credit	n/a	n/a	EVENT (bottom position)	EVENT (Refer to Spec Sheet)	EVENT (bottom position)	N/A	N/A
SW9 Tilt	n/a	n/a	(top position)	High going tilts to JP1#1 Low tilts are set same as CC40 or CC/IC62	(top position)	N/A	N/A
SW10	User preference	User preference	User preference	User preference	User preference	User preference	User preference
JP2 to MECH	SEE PAGES 23-29	SEE PAGES 23-29	SEE PAGES 23-29	SEE PAGES 23-29	SEE PAGES 23-29	SEE PAGES 23-29	SEE PAGES 23-29
JP1	1 = SENSE, Sourcing 2 = +Input Voltage 3 = n/a 4 = Ground, common 5 = n/a 6 = n/a 7 = n/a 8 = Inhibit, see SW2	1 = SENSE, Sourcing 2 = +Input Voltage 3 = n/a 4 = Ground, common 5 = n/a 6 = n/a 7 = n/a 8 = n/a	1 = n/a 2 = + Input Voltage 3 = n/a 4 = Ground, common 5 = Credit, low 6 = n/a 7 = Tilt, low 8 = Inhibit, see SW2	1 = Sense, see Specs 2 = + Input Voltage 3 = Sense, see Specs 4 = Ground, common 5 = Credit, see Specs 6 = n/a 7 = Tilt, see Specs 8 = Inhibit, see Specs	1 = Sense, see Specs 2 = +Input Voltage 3 = Sense, see Specs 4 = Ground, common 5 = Credit, see Specs 6 = n/a 7 = Tilt, see Specs 8 = Inhibit, see Specs	1 = Sense, see Specs 2 = +Input Voltage 3 = Sense, see Specs 4 = Ground, common 5 = N/A 6 = N/A 7 = N/A 8 = Inhibit, see Specs	1 = Sense, see Specs 2 = +Input Voltage 3 = Sense, see Specs 4 = Ground, common 5 = N/A 6 = N/A 7 = N/A 8 = Inhibit, see Specs