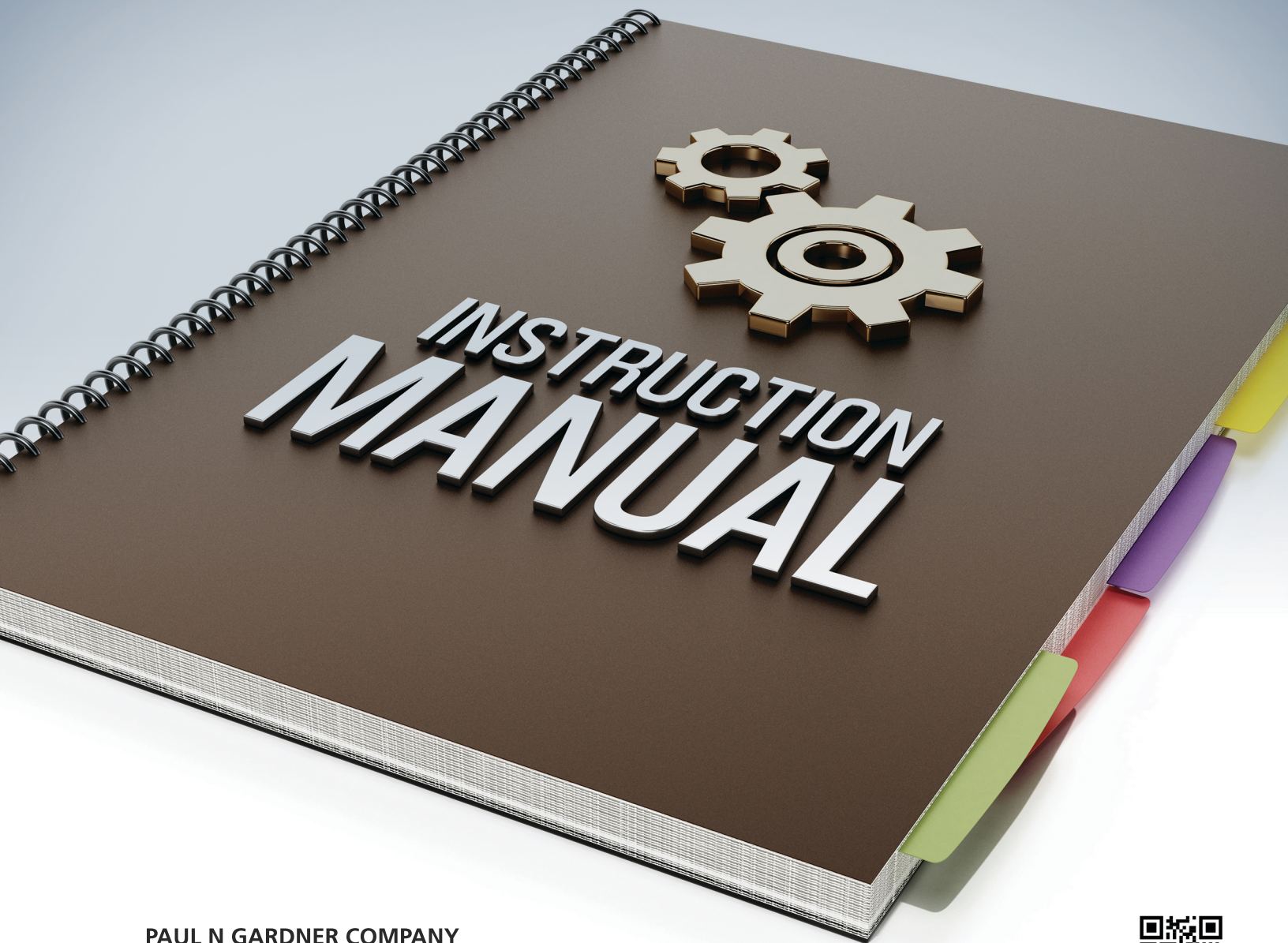




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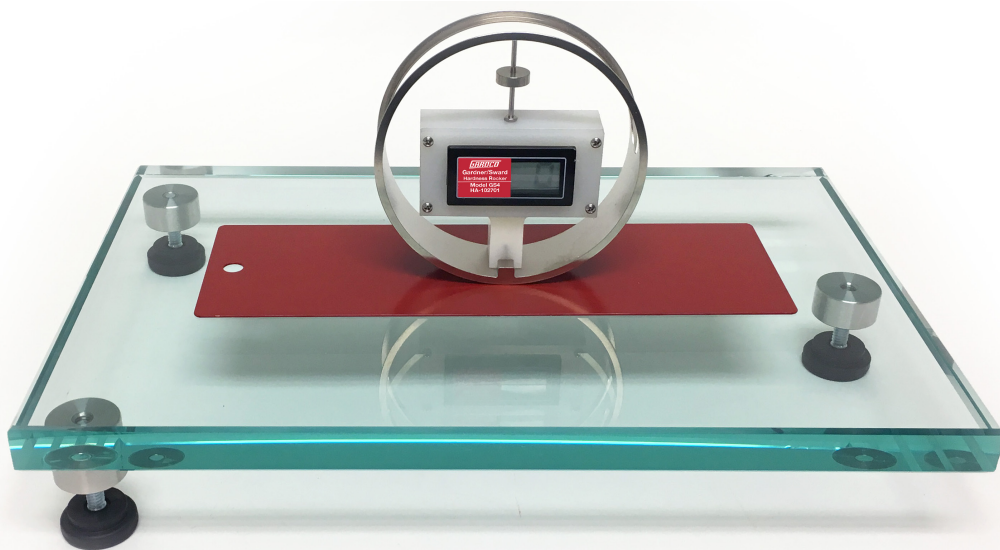
INSTRUCTIONS

GARDCO DISTRIBUTED PRODUCTS



Sward Hardness Rocker - GS4

User's Guide



GARDCO Sward Hardness Rocker

Model GS4

User's Guide

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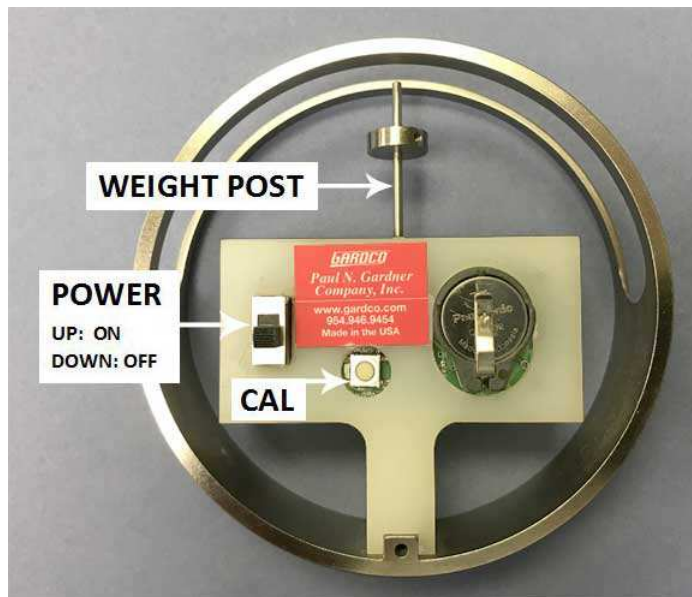


Figure 1 - Sward Hardness Rocker (Rear View)



Figure 2 - Preferred Starting Angle (22-degrees)

1.0 Introduction. The operation of the latest Sward Hardness Rocker design is based on the combination of a MEMS Accelerometer and a Microcontroller. In either its **Operation Mode** or **Calibration Mode**, this Rocker oscillates about its perpendicular axis and displays a total cycle count, representing the number of times it rocks inside a specific angular band—similar to previous Sward Hardness Rocker designs. To locate the **CAL** pushbutton switch, **POWER** slide switch and **WEIGHT POST**, needed to operate the Rocker, refer to the illustration shown in **Figure 1 – Sward Hardness Rocker (Rear View)**. All Calibration settings are stored and retained in **Non-Volatile Random Access Memory** or **NVRAM**.

All Sward Hardness Rockers, bearing firmware Version 3.3 and higher, can be adjusted using a new Calibration Technique described in paragraph **2.4 Finding the Trigger Point**; which, shows how to tilt the Rocker to find the Preferred Starting Angle's trigger point. Refer to **Figure 2 – Preferred Starting Angle (22-degrees)** to ascertain the Rocker's preferred starting angle.

NOTE: Before any Rocker calibration attempts, practice sessions, aimed at mastering this new Calibration Technique, are recommended.

System Messages are codified in **Table-1 - Sward Hardness Rocker (GS4) - System Messages**. In the event of a system malfunction or after installing a fresh coin cell battery, enable the Rocker's **Master Reset**, described in paragraph **3.0 Enabling the Master Reset**.

CAUTION: To obtain repeatable counts from the Rocker during calibration, it is imperative that the glass calibration surface be **absolutely clean** and **free of vibrations**. Also, gently wipe the Rocker's rings before any calibration.

2.0 Operation. This Rocker is equipped with an **Operation Mode** and a **Calibration Mode**. The **Operation Mode** is the Rocker's standard measuring mode, where it oscillates on the desired surface to achieve an expected count. In contrast, the **Calibration Mode** is a measuring mode where the Rocker oscillates on the calibration surface to make adjustments to the lower angular reference stored in NVRAM.

2.1 Enabling the Operation Mode. To enable the **Operation Mode**, slide the **POWER** switch to the OFF position; then, to the ON position, without pressing the **CAL** pushbutton. Note that on start up, the Rocker's display briefly shows the current Firmware Version as illustrated in **Figure 3**.

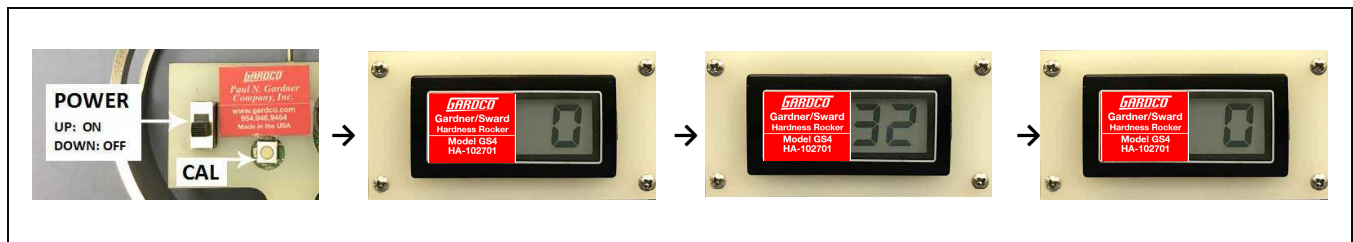


Figure 3 – Operation Mode, Current Firmware Version

For example, the Rocker's display can show a count-up from 0 to 32, where the number 32 represents Firmware Version 3.2.

2.2 Assisted Automatic Calibration. The self contained **Assisted Automatic Calibration** has been implemented to simplify the Rocker's calibration process. **Assisted Automatic Calibration** is a two-point calibration process, where the Rocker adjusts its **Calibration Angle** while it oscillates on the calibration surface through several cycle sets, to obtain the desired 50 (± 1) counts in a period of 60 (± 5) seconds, using Angle References and Cycle Count Settings saved in NVRAM before shipment. The Rocker's firmware algorithm automatically adjusts the lower Angle Reference during the **Assisted Automatic Calibration**.

NOTE: The Rocker's **Calibration Angle** is only adjustable when its **Calibration Mode** has been enabled.

During the calibration process and depending on the context, messages in the form of a count up from 0 to 2, from 0 to 3, and from 0 to 4, will appear on the Rocker's DISPLAY. Their associated codes are: (2-0) *Calibration Complete*, (3-0) *Calibration Mode Selected*, and (4-0) *Calibration Required*. For a list of all System Messages, refer to *Table-1 - Sward Hardness Rocker (GS4) - System Messages*.

To initiate the calibration process, enable the Rocker's **Calibration Mode** (paragraph **2.3 Enabling the Calibration Mode**).

2.3 Enabling the Calibration Mode.

The following process enables the Rocker's **Calibration Mode**.

*Step-1 If the Rocker is ON, slide the **POWER** switch to the OFF position.*

*Step-2 **Press-and-hold** the **CAL** pushbutton switch.*

*Step-3 While monitoring the Rocker's display, slide the **POWER** switch to the ON position. Wait about 4 seconds or until the single digit on the Rocker's DISPLAY begins a count up from 0 to 3, before releasing the **CAL** pushbutton switch, as illustrated in **Figure 4**.*

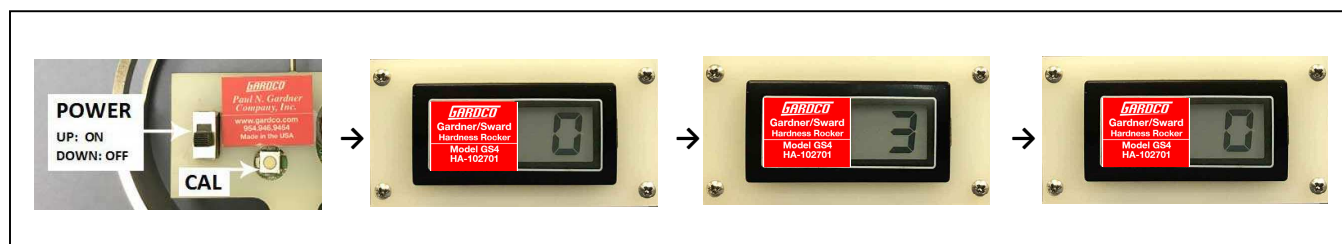


Figure 4 – Enabling the Calibration Mode

NOTE: The LCD will count up to [3] and reset to [0] during this process.

*Step-4 Upon releasing the **CAL** pushbutton, the Rocker enters the **Calibration Mode**.*

*Step-5 If the **CAL** pushbutton is released before the Calibration Mode Selected, Code (3-0), is displayed, go back to Step-1 and re-start the process. The Rocker will not enter the **Calibration Mode** if the **CAL** pushbutton is released before it displays the Calibration Mode Selected, Code (3-0).*

2.4 Finding the Trigger Point for the Starting Angle. To observe this effect, where the software triggers a Count Reset to zero [0], the Rocker must have a count GREATER THAN ZERO [e.g.; 1, 2, ..., 51] on its DISPLAY. So, to find the Start Angle when the Rocker displays , go to Step-1.

Step-1 Place the Rocker on the glass calibration surface.

*Step-2 Tilt the Rocker clockwise to the "1-o'clock" position (similar to the position shown in **Figure 5**), using the WEIGHT POST as a reference; then, let the Rocker oscillate freely on the glass calibration surface. **Stop the Rocker immediately** after it displays a count GREATER THAN ZERO (refer to **Figure 6**).*



Figure 5

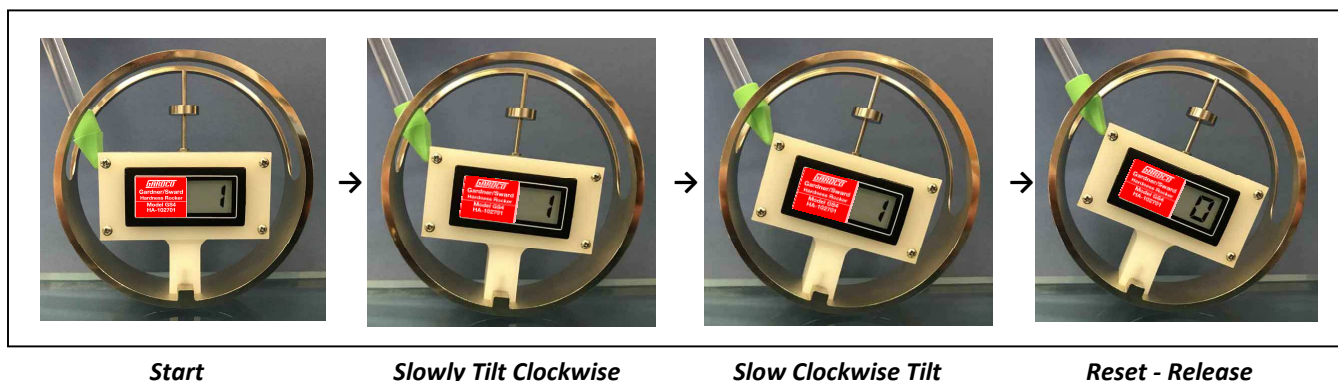
Step-3 After stopping the Rocker, keep the WEIGHT POST perpendicular to the glass calibration surface. Should the count displayed increase while settling the Rocker, there's no harm to this process.

*Step-4 Using the rubber tipped tool provided, slowly tilt the Rocker clockwise on the surface until the displayed count resets—in this example from one [1] to zero [0]—then let the Rocker oscillate freely on the surface to start a count cycle. Refer to **FIND THE STARTING ANGLE** illustration below.*



Figure 6

FIND THE STARTING ANGLE



Start

Slowly Tilt Clockwise

Slow Clockwise Tilt

Reset - Release

Note: All things being equal, after gently triggering a Count Reset, the cycle counting may typically start anywhere between 10 to 18 cycle swings.

*Step-5 To continue practicing, reset the count displayed, then, go back to Step-1; otherwise, proceed to paragraph **2.5 Calibration Procedure** to continue the Rocker's calibration process.*

2.5 Calibration Procedure. Use this procedure to *adjust* the Rocker's **Calibration Angle**, then verify the desired 50 (± 1) counts in a period of 60 (± 5) seconds on the calibration surface.

Step-1 Thoroughly clean the glass calibration surface and gently wipe the Rocker's rings.

*Step-2 Pick up the Rocker and enable the Rocker's **Calibration Mode** (**POWER** switch to OFF position, press-and-hold **CAL** pushbutton, **POWER** switch to ON position, wait about 4 seconds for Code [3-0], release **CAL** pushbutton).*

*Step-3 Place the Rocker on the glass calibration surface, **FIND THE STARTING ANGLE** (get number on display, slow tilt to "1-o'clock" position until number resets to zero), then let the Rocker oscillate freely on the glass calibration surface. If the Rocker's DISPLAY shows Code (2-0), go to Step-5; otherwise, go to Step-8.*

*Step-4 If the count is LESS than 49 or GREATER than 51, do NOT reset the count shown; instead, stop the Rocker's oscillations, holding it on the calibration surface with the **WEIGHT POST** tilted to the "11-o'clock" position, slide the **POWER** switch to the OFF position, then go back to Step-2.*

*Step-5 When the Rocker's DISPLAY shows the Calibration Complete, Code (2-0)—see **Figure 7**—every two seconds, pick up the Rocker, then go to Step-6.*

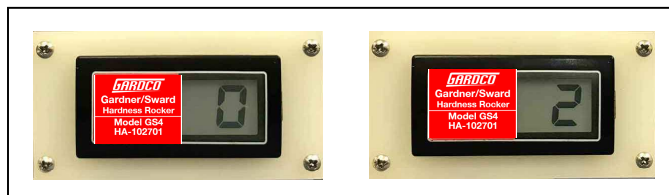


Figure 7

*Step-6 Enable the **Operation Mode** (**POWER** switch to OFF position, **POWER** switch to ON position without pressing the **CAL** pushbutton), then place the Rocker on the glass calibration surface.*

*Step-7 To start a count cycle, **FIND THE STARTING ANGLE**, then let the Rocker oscillate freely on the glass calibration surface.*

*Step-8 If at the end of the count cycle the Rocker displays the **Calibration Required**, Code (4-0), as shown in **Figure 8**, pick up the Rocker, enable the **Calibration Mode**, then go back Step-3; otherwise, go to Step-9.*

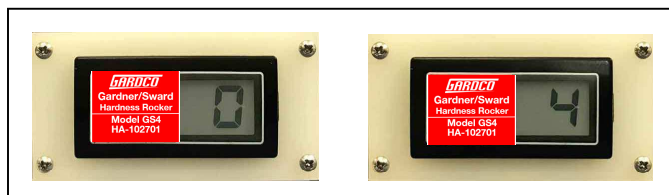


Figure 8

Step-9 If the desired 50 (± 1) counts in a period of 60 (± 5) seconds has been attained, repeat Step-3, to obtain 3 consecutive, 50 (± 1) counts in a period of 60 (± 5) seconds to complete the calibration. Otherwise, go to Step-4.

3.0 Enabling the Master Reset.

In the event of a system malfunction, a new calibration, or after installing a fresh battery, enable the Rocker's **Master Reset**. Following this process.

*Step-1 Pick up the Rocker. If the Rocker is ON, slide the **POWER** switch to the OFF position.*

*Step-2 **Press-and-hold** the **CAL** pushbutton switch. While monitoring the Rocker's display, slide the **POWER** switch to the ON position.*

*Step-3 Wait about 13 seconds—the LCD will count up to 3 and reset to 0 during this process—until the Rocker's DISPLAY shows the Master Reset Selected, Code (10-0), before releasing the **CAL** pushbutton switch.*

*Step-4 Slide the **POWER** switch to the OFF position, then slide the **POWER** switch to ON position.*

Step-5 Proceed to paragraph 2.5 Calibration Procedure, Step-3.

4.0 System Messages.

Descriptions for messages that may appear on the Rocker's display are shown in **Table-1 - Sward Hardness Rocker (GS4) - System Messages**.

Table-1 - Sward Hardness Rocker (GS4) - System Messages

Code	Description
(0-0)	No message
(1-0)	Low Battery – Install a new battery
(2-0)	Calibration Complete – Cycle Power Switch (see Figure 1)
(3-0)	Calibration Mode Selected – Place Rocker on calibration surface: Start oscillations
(4-0)	Calibration Required – Proceed to paragraph 2.5 Calibration Procedure (Step-8)
(5-0)	Calibration Error – Error enabling Calibration Mode – Cycle Power Switch (optional)
(6-0)	Setup Required – Setup Angle References
(7-0)	Setup Complete – (optional)
(8-0)	Zero Degrees Set – (optional)
(9-0)	22-Degrees Set – (optional)
(10-0)	Master Reset Selected – Proceed to paragraph 2.5 Calibration Procedure (Step-6)

5.0 Troubleshooting.

5.1 Low Battery. The **Low Battery** Code (1-0) will invariably trigger when the battery's voltage falls below approximately 2.65 Volts. When the **Low Battery** condition happens, do the following:

Step-1 Remove the depleted coin cell battery from the rocker's battery holder.

Step-2 Install a fresh coin cell battery into the rocker's battery holder.

*Step-3 Perform a **Master Reset** (proceed to paragraph 3.0 **Enabling the Master Reset**).*

5.2 Count of "52" in Operation Mode. During **Operation Mode**, immediately after a calibration cycle where counts have been increasing towards 50 counts, a count of "52" may appear on screen as the final count. This provides the opportunity to tweak the rocker's calibration band towards obtaining the desired 50($\pm$ 1) counts. When this happens, proceed to paragraph 2.5 **Calibration Procedure, Step-4**.

6.0 Glossary.

"1-o'clock" Position - Rocker's **WEIGHT POST**, tilted clockwise, points to 1-o'clock.

"11-o'clock" Position - Rocker's **WEIGHT POST**, tilted counter-clockwise, points to 11-o'clock.

"12-o'clock" Position - Rocker's **WEIGHT POST** is perpendicular to the calibration surface and points to 12-o'clock.

