

# CAMBRIDGE

## SCALE WORKS INCORPORATED

### RUFF-WEIGH 50 HYDRAULIC WEIGHING SYSTEM FOR SKID STEERS, LOADERS & FORKLIFTS

### INSTALLATION, SET-UP & OPERATION



Cambridge Scale Works. • P O Box 670 • Honey Brook, PA 19344  
(800) 292-7640 • (610) 273-7040 • [www.cambridgescale.com](http://www.cambridgescale.com)

MANUAL P/N 5999-1029-00 (4/16)

# TABLE OF CONTENTS

|   |         |
|---|---------|
| Installation -----                        | 3 & 4   |
| Meter connections -----                   | 5       |
| Operation -----                           | 6 & 7   |
| 1.0 Scale Procedure-----                  | 8       |
| 1.1 Software Navigation Flowchart -----   | 8 & 9   |
| 1.2 Scale Menu Definitions -----          | 10 & 11 |
| 1.3 Numeric Entries -----                 | 12      |
| 1.4 Set Up Parameters -----               | 12      |
| 2.1 Calibration Procedures-----           | 13      |
| 2.2 Calibration Menu Definitions -----    | 13      |
| 2.3 Rough Calibration -----               | 14      |
| 2.3 Weight Repeatability -----            | 14 & 15 |
| 2.4 Weight Calibration -----              | 15      |
| 3.0 Communications Setup-----             | 16      |
| 3.1 Communications Menu Definitions ----- | 16 & 17 |
| 4.1 Testing Procedure -----               | 18      |
| 4.2 Testing Menu Definitions -----        | 18      |
| 5.0 Warranty -----                        | 19      |
| 6.0 Assistance -----                      | 19      |

## INSTALLATION:

### **CAUTION:**

*Hydraulic oil may be sprayed during installation. Please follow ALL Safety Procedures provided on the MSDS (Material Safety Data Sheet) intended for oil use.*

**NOTE:** Incorrect positioning of the sensor within the hydraulic system will affect the proper operation of your CSW-50 System.

The CSW-50 installation kit contains all the necessary parts/tools for tapping into various hydraulic systems. The method of tapping will depend upon the design of your particular system.

## INSTALLATION: "T"

- A. Tapping the existing "T" fitting requires drilling. The "T" fitting should be removed and tapped using the proper shop equipment when possible.

Locate the "T" fitting between the lift pressure hose and the pump. Tap the fitting using the 7/16" drill bit and 1/4 - 18 NPT tap provided with your CSW-50 installation kit.

Flush all metal shavings from the "T" fitting. Wrap teflon tape around 1/4 - 18 NPT fitting and install into the tapped hole.

Reinstall the "T" fitting. Connect hose to the fitting and route to sensor.

## INSTALLATION: Lollipop

- B. Lollipop Adapter: Optional, Kit not included with system.

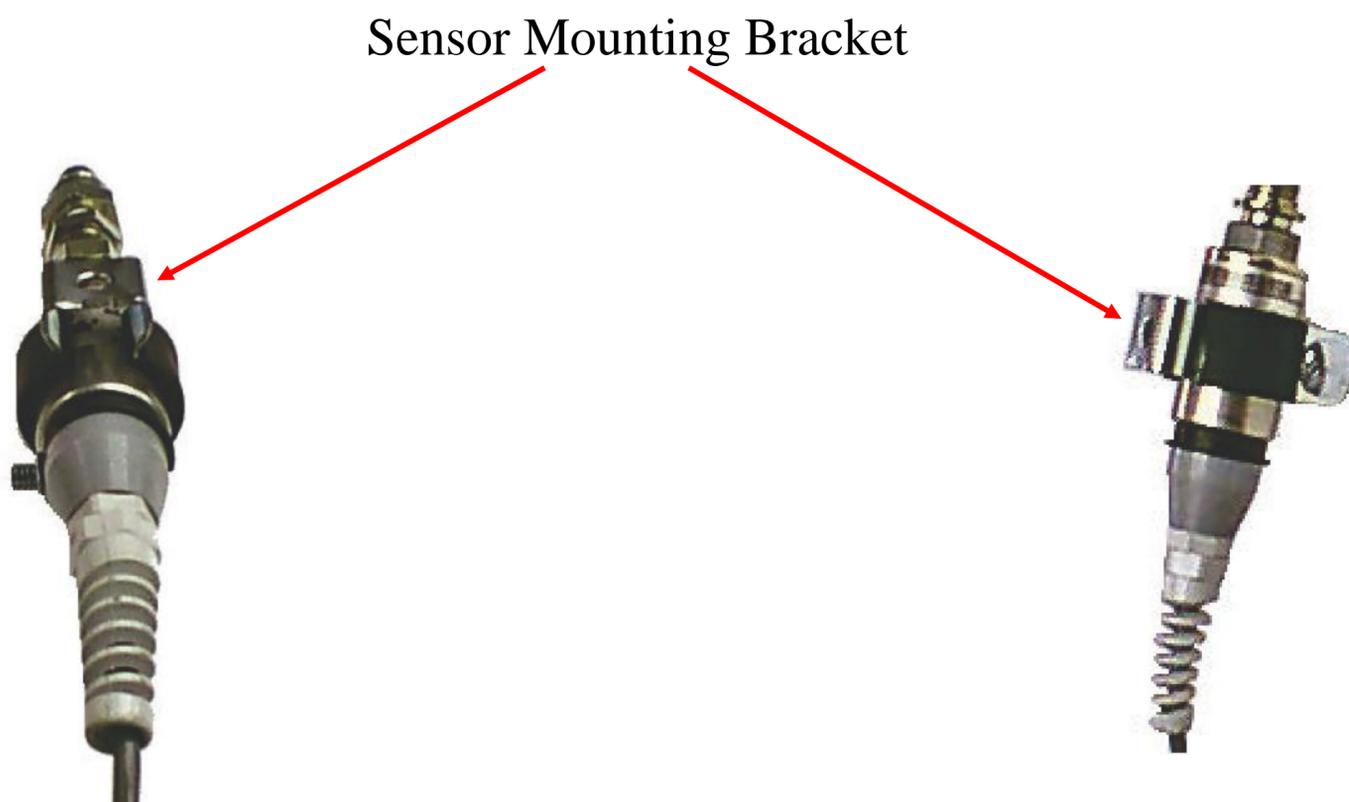
The lollipop is placed in-line with the lift pressure hose at the split flange. The lift pressure hose will be connected to the bottom of the lift cylinder (providing force to move the piston).

Loosen bolts to provide 3/8 to 1/2 inch clearance between the hose and flange. Place the adapter inside the clearance with the O-Ring against the flange. Insert new bolts provided (to compensate for the adapter between the hose and the flange).

Connect hose to the adapter and route to the sensor.

## INSTALLATING THE SENSOR

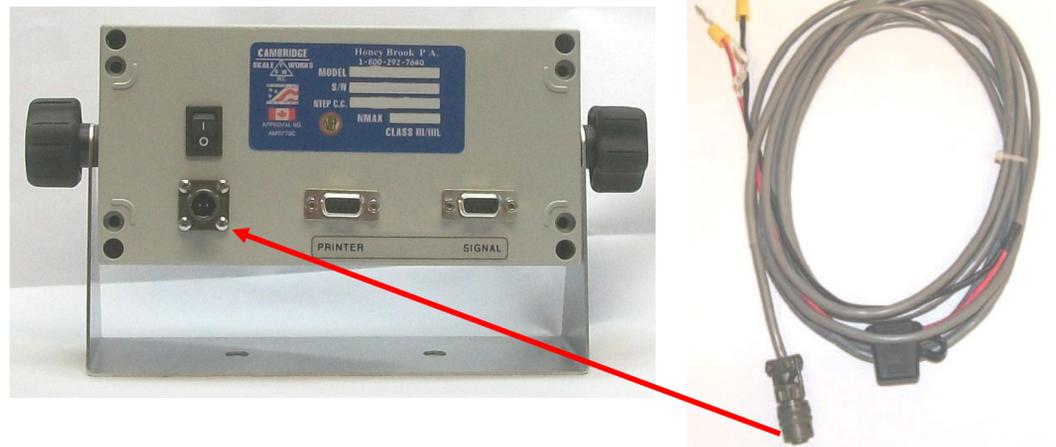
1. Locate the best place under the cab skirt to mount the sensor.
2. Screw the sensor mounting bracket to the skirt (using the self tapping screw provided with your sensor kit).
3. Attach the sensor and screw the bracket together until the sensor is secure.
4. Route the cable from the sensor directly to the CSW-50 indicator and attach to the rear of the indicator at the connector labeled "SIGNAL".



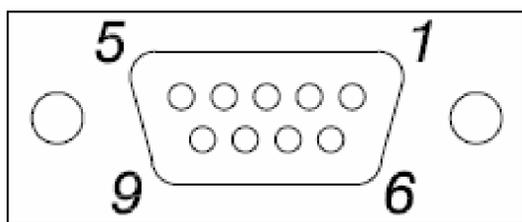
# Meter Connections

To connect power via fused DC power cable to the CSW-10 meter. First make sure the On/Off Switch on the rear of meter is in the **OFF** position. Connect the ring terminals *directly to the battery*.

Next, connect the other end of the cable to the rear of the meter for power.

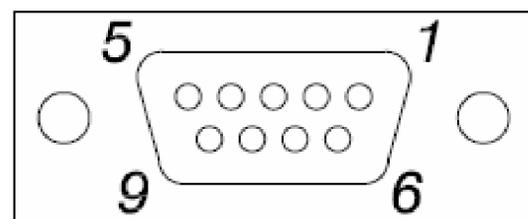


## Communications Port



| PIN # | DESCRIPTION |
|-------|-------------|
| 2     | ----- RXD   |
| 3     | ----- TXD   |
| 4     | ----- +5V   |
| 5     | ----- SGND  |

## Signal Connection



| PIN # | DESCRIPTION            |
|-------|------------------------|
| 1     | ----- +EXC             |
| 2     | ----- -SIG             |
| 5     | ----- SHIELD LOAD CELL |
| 6     | ----- -EXC             |
| 7     | ----- +SIG             |

# OPERATION

## Key Functions:

- ZERO** Brings the scale to a zero balance reading.  
If the zero key is pressed and held for 5 seconds the calibration zero value will be displayed.
- GRS/NET** -Toggles the display between gross weight and net weight.  
- Press and hold this key, until **Total** is displayed, to view totals.  
-This key is also used to enter setup mode. Begin by pressing and holding this key until the parameter and calibration event counters are displayed. Immediately after **code** is displayed, enter in sequence **Tare**, **lb/kg**, **GRS/NET**, and **Print/Enter**. The display will indicate **ScAIE**.  
*-P xxx and C xxx are Event Counters that will increment each time one or more changes are made to the Scale or Calibration Parameters.*
- TARE** Enters the gross weight value into the tare display and switches to the net display mode.  
If the **Tare** key is pressed and held for 5 seconds the current tare value will be displayed.
- lb/kg** Toggles the display between pounds and kilograms.  
Press and hold for 5 seconds to toggle peak hold. This allows the active weight to be viewed.
- PRINT** Outputs the displayed weight data to the RS-232 Port.

**Note:** All keys are disabled when the scale is in motion or overload.

## Error Messages

- oLD** The scale is in an overload condition.
- bAt LO** Will flash when the battery voltage falls to 10.8VDC and will be displayed constantly when the voltage falls to 10.2VDC.
- Err d** More than 20,000 scale divisions have been selected.

# OPERATION CONTINUED:

## ZEROING THE SCALE:

With the forks or bucket on the ground press **ZERO** and **Ready** will be displayed. Lift to the selected weighing point, when the locked empty system weight is displayed press **ZERO**. If your empty system weight is less than the zero band the display will stay at **ready**, in this case just lift to the selected weighing point and press **ZERO**.

### *Note: Select weighing point*

Select and mark a weighing point and lift to this point and stop each time to get the locked weight. On most equipment this should be around one foot high. On some front loaders the bucket should be around eye level from the operators view. The weighing point may need to be set higher or lower for the best repeatability on your equipment.

## TOTALIZING:

With the locked weight displayed press and hold the **Print** key until **Total** is displayed. The current weight will be printed and the new total will be displayed for 5 seconds, then the display will return to the current weight. The display must return to **ready** before the next weight can be totalized if not unload will be displayed.

## VIEWING THE CURRENT TOTAL:

Press and hold the **GRS/NET** key until **Total** is displayed. The current total will be displayed for 5 seconds.

## CLEARING THE TOTAL:

With the display at ready press and hold the **Print** key until **Total** is displayed. The total will be printed and total weight will be displayed for 5 seconds, then the display will return ready and the total will be cleared.

## EQUIPMENT WARM UP:

Warm up the equipment by extending and retracting the hydraulic cylinder piston several times to circulate warm oil through the hydraulic system. After the equipment is warmed up, the Weighing system is ready for operation.

## RECOMMENDED COUNT-BY:

Equipment lifting capacity: S3 under scale menu (20) default.

0 -20K ----- 20

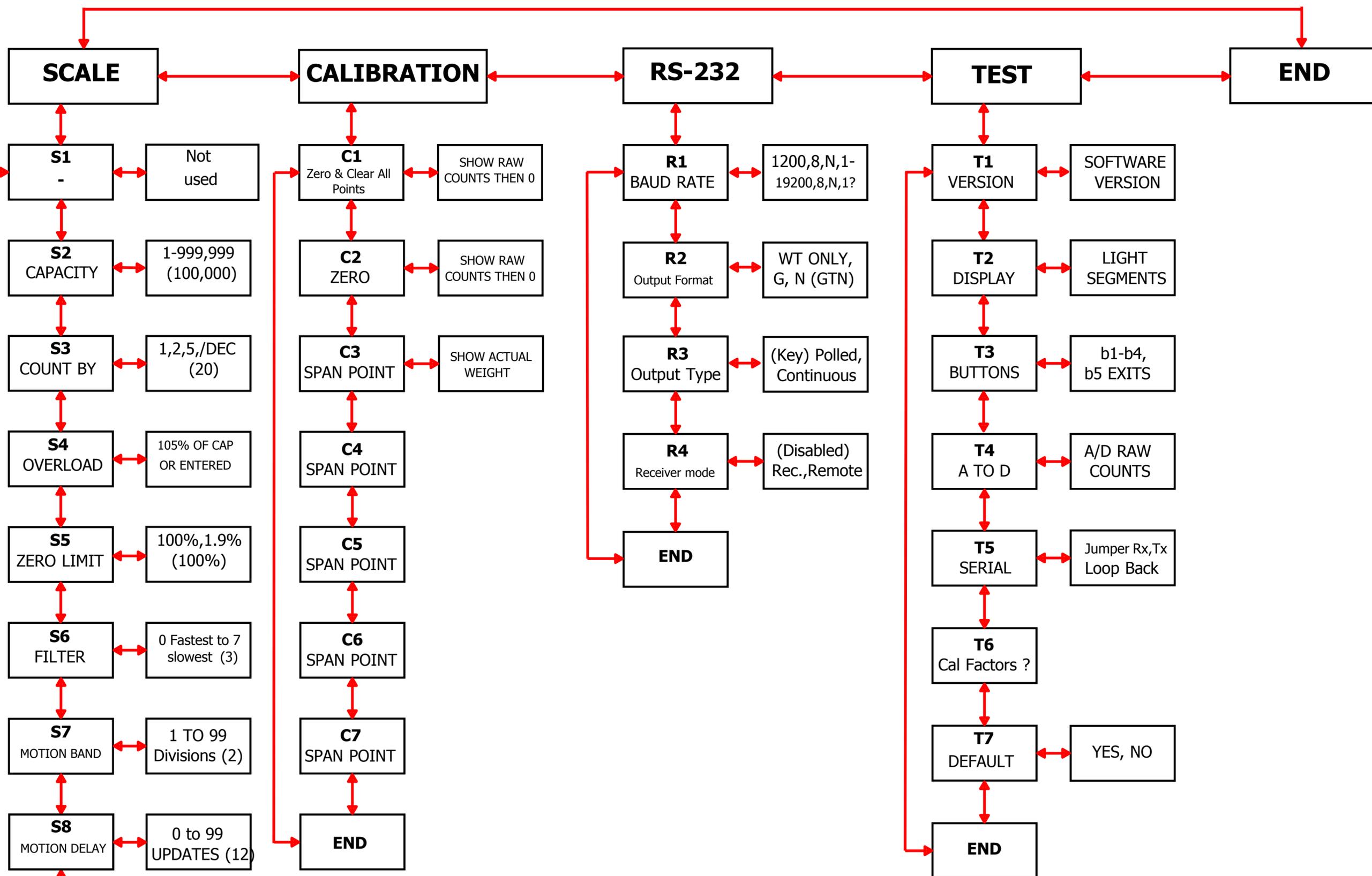
20-50K ----- 50

50k & up----- 100

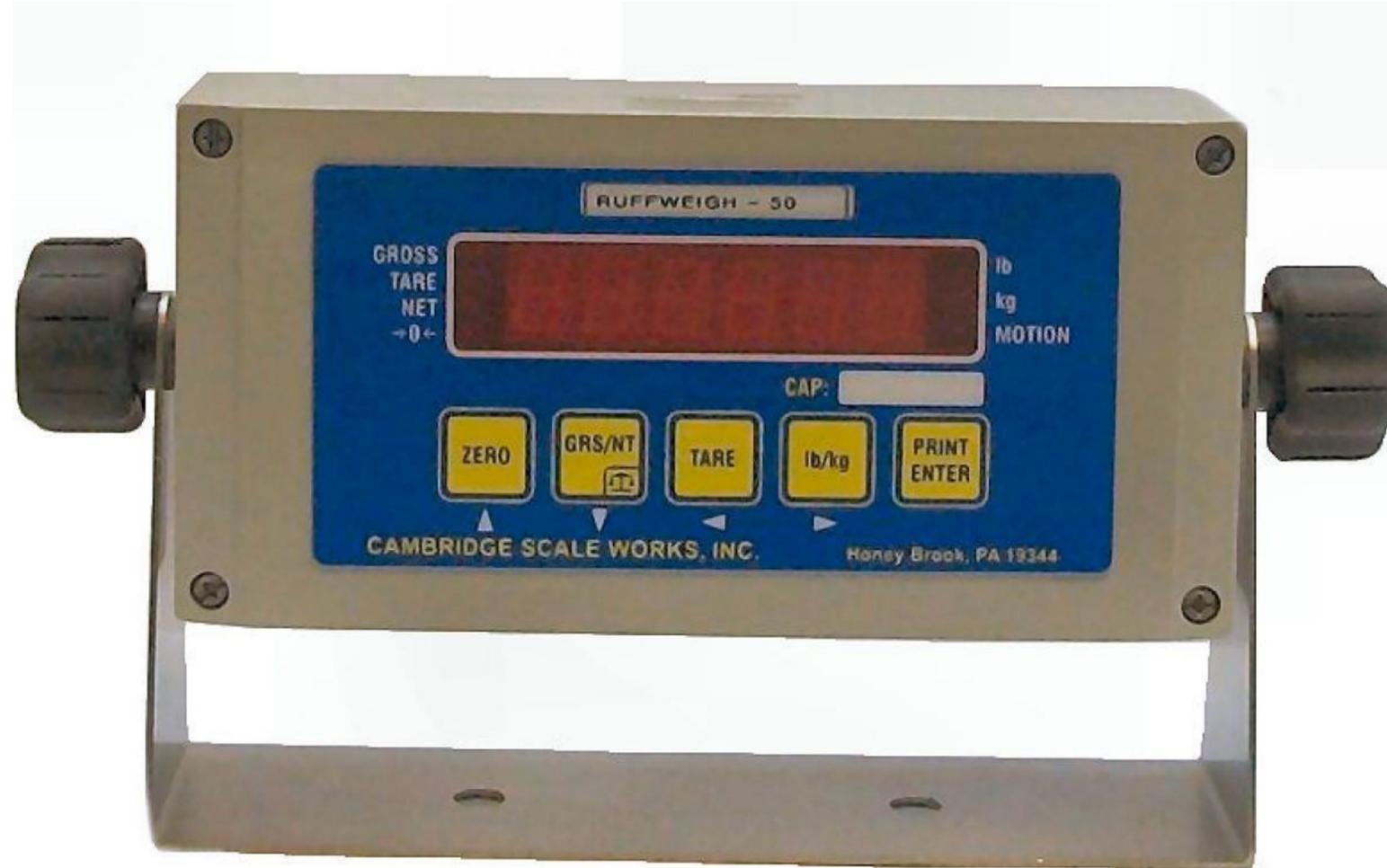
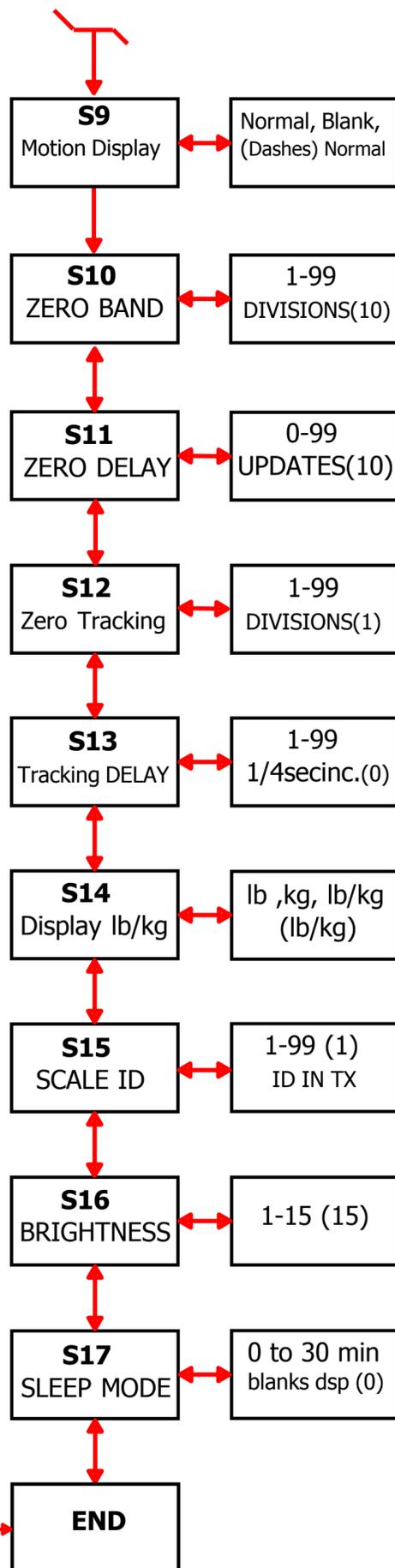
Choosing a count-by smaller than the recommended count-by may decrease the Accuracy of the system.

# 1.0 SCALE PROCEDURE

## 1.1 SOFTWARE NAVIGATION FLOWCHART



## 1.1 SOFTWARE NAVIGATION FLOWCHART (CONTINUED)



## 1.2 NAVIGATION KEYS

During setup you will be required to make numeric entries. (Ex: Capacity, Zero Band, etc...) The following table outlines the keys used to perform these entries along with their function.

ZERO-----KEY IS USED TO NAVIGATE UP.  
 GRS/NET---KEY IS USED TO NAVIGATE DOWN.  
 TARE-----KEY IS USED TO NAVIGATE LEFT.  
 lb/kg-----KEY IS USED TO NAVIGATE RIGHT.  
 PRINT-----KEY IS USED TO ENTER DATA AND RETURNS.

## 1.2 Scale Menu Definitions:

|            |                |  |
|------------|----------------|--|
| <b>S1</b>  | Reserved       | Not used. If entered S2 will be displayed  |
| <b>S2</b>  | Capacity       | 1 to 950,000 pounds (100,000).   |
| <b>S3</b>  | Count By       | .001, .01, .1, 1, 10, 100,<br>.002, .02, .2, 2, (20), 200<br>.005, .05, .5, 5, 50, 500   |
| <b>S4</b>  | Over load      | (105%) of scale capacity or user entered value.  |
| <b>S5</b>  | Zero Limit     | (100%) or 1.9% of scale capacity.  |
| <b>S6</b>  | Filter         | 0 - 7 (3) 0 is the fastest response or least filtering and 7 is the slowest response or most filtering   |
| <b>S7</b>  | Motion Band    | 1 to 99 divisions (2) the weight display must be stable within the selected number of divisions for the motion indicator to be turned off.   |
| <b>S8</b>  | Motion Delay   | 0 to 99 updates (12) the weight display must be within the motion band for the selected number of updates for the motion indicator to be turned off.   |
| <b>S9</b>  | Motion Display | Normal: When the scale is in motion the motion LED will light.<br>Blank: When the scale is in motion the display will be blanked out.<br>(Dashes): When the scale is in motion the display will show all Dashes. |
| <b>S10</b> | Zero Band      | 1 to 99 divisions (10) the weight display must return to zero within the selected number of divisions to be considered zero.   |
| <b>S11</b> | Zero Delay     | 0 to 99 updates (10) the weight display must be within the zero band for the selected number of updates to be considered zero.   |
| <b>S12</b> | Zero Tracking  | 1 to 99 divisions (2) the number of graduations allowed to be automatically zeroed off.  |

## 1.2 Scale Menu Definitions Continued:

- S13** Tracking Delay    0 to 99 updates (0) the amount of time the display must be within the allowed graduations before it will be automatically zeroed.  
(0) disables zero tracking.
- S14** Lb/Kg (Lb/KG): Allows the indicator to be switched between pounds and kilograms by pressing the *lb/kg* key.  
LB: This sets the display to pounds only.  
Kg: This sets the display to kilograms only.
- S15** Scale ID            (1) to 99 scale ID used in RF link output.
- S16** Brightness        0 to (15) adjusts the LED display intensity 15 is the brightest.
- S17** Sleep Mode        (0) to 30 minutes. The display will turn off after the the set amount of time elapses with no scale activity.
- END**                    Exits back to the main menu.

( ) indicates factory set defaults.

### 1.3 Numeric Entries

When entering a numeric value, first press and release the **lb/kg** key to move right into the menu where the numeric value will be entered. Then press and release the **ZERO** key, the first digit in the value will flash. Press and release the **ZERO** and **GRS/NET** keys to increase or decrease the digits value. Press and release the **TARE** key to move to the next digit. Repeat the steps above to adjust the digits value. Repeat all steps until the numeric value is correct, then press and release the **PRINT** key to enter the data. The display will return to the menu.

### 1.4 Set Up Parameters

To begin press and hold the **GRS/NET** key until the parameter and calibration event counters are displayed. Immediately after code is displayed, enter in sequence **Tare**, **lb/kg**, **GRS/NET**, and **Print/Enter**, The display will indicate **ScALE**.

*-P xxx and C xxx are event counters that will increment each time one or more changes are made to the Scale or Calibration Parameters.*

With the display indicating **ScALE**, press the **GRS/NET** key to move down. This allows the operator to change any of the scale parameters **S1** thru **S17**. For example, press the **GRS/NET** key to move down until **S2** is displayed, **S2** is used to set the capacity of the scale. Press the **lb/kg** key to move right in the **S2** parameter. The current capacity will be displayed. Press the **ZERO** key, the first digit will flash. Enter the capacity using the steps described in section 1.3. When the capacity is correct, press the **Print** key to enter the value. The display will return to **S2**.

To enter the count by press the **GRS/NET** to move down, **S3** will be displayed. Press the **lb/kg** key to move right into this parameter. The current "Count by" will be displayed. Press the **ZERO** and **GRS/NET** keys to adjust the divisions. Press the **Tare** and **lb/kg** keys to adjust the decimal point. Press the **PRINT** key ,when finished, to enter the data. The display will return to **S3**. Exit set up mode by pressing the **Tare** Key, **End** will be displayed, then press **Print/Enter**.

## 2.0 CALIBRATION PROCEDURES

### 2.1 Calibration Menu Definitions:

- C1 Zero All** Raw counts, (pitch and roll if in angle mode) will be displayed. When **ZERO** is pressed an analog zero is done and all calibration span points will be cleared. If in angle mode the pitch and roll offsets will also be zeroed.
- C2 Zero** Zeroed Raw counts, (pitch and roll if in angle mode will be displayed. When **ZERO** is pressed an analog zero is done and all calibration span points will NOT be cleared. If in angle mode the pitch and roll offsets will also be zeroed.
- C3 Span Point** The last calibration weight will be displayed then the actual weight on the scale will be displayed.  
*If you do not wish to change the span point, press the TARE key to exit without making any changes.*  
If the displayed weight does not match the known test weight, press the **ZERO** key to enter the correct weight. Use the steps described in section 1.4 for numeric entry. When the weight is correct press the **Print** key to enter the new value.
- C4 to C7 Span points** C4 to C7 are for linearity correction, they can be used in any order and in any quantity or not at all if no correction is necessary.  
You may also return to C4 to C7 later and add a new correction point without effecting any original calibration points.  
The last calibration weight will be displayed then the actual weight on the scale will be displayed. If no calibration weight has been entered at this span point "notset" will be displayed then the actual weight on the scale is displayed. If the displayed weight does not match the known test weight, follow the steps described for C3 span point on adjusting the weight and entering the value.
- END** Exits back to the main menu.

## 2.2 Rough Calibration

Warm up the equipment as described in the operation section of the manual. After the warm up and the forks or bucket are on the ground, press the **ZERO** key and **ready** will be displayed. Lift to the selected weighing point, as described in the operation section, when the locked system weight is displayed press the **ZERO** key. If your empty system weight is less than the zero band the display will stay at **ready**. In this case just lift to the selected weighing point and press the **ZERO** key.

With the forks or bucket still at the weighing point, enter calibration by pressing and holding the **GRS/NET** key until the parameter and calibration event counters are displayed. Immediately after (waiting 5 seconds) enter in sequence **Tare**, **lb/kg**, **GRS/NET** and **Print/Enter**, the display will indicate **ScALE**. Next press the **lb/kg** key, the display will indicate **CALib**. Press the **GRS/NET** key to move down to **C1**, then press the **lb/kg** key. The raw counts will be displayed for 5 seconds. Press the **ZERO** key, "0" will be displayed. Press the **Print/Enter** key to enter the data. "0" is now entered and the display returns to **C1**. Press **Tare** then **Print/Enter** to exit Calibration.

Lift a know weight to the selected weighing point, after the locked weight is displayed, enter calibration, as described in the previous paragraph. At **CALib**, press the **GRS/NET** key until **C3** is displayed. Press **lb/kg** to enter **C3**. The last Calibrated weight will flash then the current weight on the forks or in the bucket will be displayed. Press the **ZERO** key, the first digit of the weight will flash. Use the **Zero** and **GRS/NET** keys to increase and decrease the digits value until correct. Press the **Tare** key to move to the next digit and repeat until the correct weight has been entered. Press the **Print/Enter** key to record the data. The display will return to **C3**. At **C3** press the **Tare** key, **End** will be displayed, then press **Print/Enter** to exit calibration mode and return to operation mode.

## 2.3 Weight Repeatability

After calibrating, perform a weight repeatability test by lifting a known weight to the selected weighing point, taking note of the displayed weight, then lower to the ground. Lift this known weight 5 times waiting 15 to 20 seconds between lifts. if the weight readings do not repeat adjust the following parameters one at a time making only small changes to the values. The perform the repeatability test again.

**S6** Filter, (3) is the default

0 is the fastest response or least filtering and 7 is the slowest response or most filtering.

- A larger value may work better for equipment that lifts the weight with little oscillating or bouncing.
- A lower value may work better for equipment that lifts the weight with oscillating or bouncing.

## 2.3 Weight Repeatability Continued

### **S7** Motion Band (2) is the default

The weight must be stable within this amount of scale divisions before it will be displayed.

- This number may need increased if the weight is not locked within 5 to 10 seconds.

### **S8** Motion Delay (12) is the default

The weight must be within the motion band for the selected number of updates before it will be displayed.

- A lower number may work better for equipment that lifts the weight with little oscillating or bouncing.
- A larger number may work better for equipment that lifts the weight with oscillating or bouncing.

After the weight readings repeat and are displayed within 5 to 10 seconds move on to the weight calibration.

## 2.4 Weight Calibration

With the forks or bucket on the ground press **ZERO**, ready will be displayed. Lift to the selected weighing point, when the locked empty system weight is displayed press **ZERO**. If your empty system weight is less than the zero band the display will stay at ready, in this case just lift to the selected weighing point and press **ZERO**.

Next lift a known weight to the selected weighing point, after the weight is displayed enter calibration mode by pressing and holding the **GRS/NET** key until the parameter and calibration event counters are displayed. Immediately after (within 5 sec.) enter in sequence **Tare**, **lb/kg**, **GRS/NET**, and **Print/Enter**, the display will indicate **ScAlE**. Press the **lb/kg** key until **CAlib** is displayed, then press **GRS/NET** until C3 is displayed. Now press **lb/kg** to enter the current known weight as described in Section 2.2. After the weight is entered correctly, press **Print/Enter** to record the data. The display will return to C3. At C3 press the **Tare** key, **End** will be displayed, then press **Print/Enter** to exit calibration mode and return to operation mode.

Additional weights can also be calibrated. While still in operation mode, lift the next known weight to the selected weighing point. After the weight is displayed, enter calibration mode by pressing and holding the **GRS/NET** key as described previously, then enter the known weight value into the next available calibration point C4-C7.



## 3.0 COMMUNICATIONS SETUP

### 3.1 Communications Menu Definitions Continued:

- R4 Receiver**      0 - Disabled - normal scale mode.
- 1 - Standard Receiver.  
Receives R3.3 RF link output string displaying data as it appears on the scale. All keys are disabled except the ***PRINT*** key.
- 2 - Remote control.  
Receives R3.3 RF link output string displaying data as it appears on the scale and allows full control of all scale meter functions.
- END**                      Exits back to the main menu.

( ) indicates factory default setting

## 4.0 TESTING PROCEDURES

### 4.1 Testing Menu Definitions:

- T1** Version                      Displays Software Version.
- T2** Display                      Lights all display segments and indicating LED's
- T3** Buttons                      Press the **ZERO** key, b1 will be displayed.  
Press the **GRS/NET** key, b2 will be displayed.  
Press the **Tare** key, b3 will be displayed.  
Press the **lb/kg** key, b4 will be displayed.  
Pressing the **Print** key will exit back to the menu T3.
- T4** A to D                      Displays raw counts where a 1mV/V signal from the scale  
will display 25,000 counts.  
When in angle mode down **GRS/NET** will cycle Pitch, Roll  
and Raw counts.
- T5** Serial                      Serial communications can be verified by connecting pins  
2 and 3 on the serial port. A single character will be echoed  
and pass or fail will be displayed.
- T6** Setup data                      Setup data will be sent out on the printer port.
- T7** Default                      Resets the meter back to factory defaults clearing all  
calibration and setup data. "r you sure?" will be displayed  
then press the **Tare** key to exit without defaulting, or press  
the **Print** key to reset the meter to factory default.
- END**                      Exits back to the main menu.

## 5.0 WARRANTY

**CAMBRIDGE** warrants the **CSW-50** to be free of defects in workmanship and/or materials for 12 months from the date of shipment. This warranty of workmanship and/or materials is valid, if in the opinion of **CAMBRIDGE** the equipment has not been mechanically, environmentally, or electrically abused.

This warranty is limited, at the option of **CAMBRIDGE**, to repair, replace or an appropriate credit adjustment, not to exceed the original equipment sale price paid to **CAMBRIDGE**. **CAMBRIDGE** assumes no liability in connection with the sales of its products beyond that stated above.

Warranty replacement parts and or repair services are performed at the factory in Cumberland, Maryland or by an authorized service group approved by **CAMBRIDGE**.

Warranty does not include travel expense if a factory technician is requested to perform repairs at a location other than the factory.

It is the user's responsibility to follow the proper set-up, calibration and operating procedures of the **CSW-50** as described in this manual. If the operator has difficulty using their **CSW-50** properly, please contact **CAMBRIDGE** at 1-301-724-4082. Any one of our Technicians will be happy to work with the user via telephone.

## 6.0 ASSISTANCE:

If at any time and you require assistance with your **Model: CSW-50** Indicator:

End User please contact your servicing scale dealer.

Authorized Cambridge Dealer/ Distributor please contact:

### **CAMBRIDGE SCALE WORKS, INC.**

115 West Mary Street  
Cumberland, MD 21502

Phone: (301) 724-4082

Fax: (301) 724-4964