

# COXMATE

ADVANCED ELECTRONICS FOR ROWING

## Coxmate SC and SC-R Manual

### Contents

1. Introduction
2. Components
3. Operation
  - 3.1 Charging and Battery Management
  - 3.2 Power On/Off
  - 3.3 Speed Sensor
  - 3.4 Display and Menu Selection
    - 3.4.1 Battery
    - 3.4.2 Backlight
    - 3.4.3 Volume
    - 3.4.3 Status
    - 3.4.5 Radio
    - 3.4.6 Recall
    - 3.4.7 Metronome
    - 3.4.8 Calibration
    - 3.4.9 Memory/Computer Link
4. Installation
  - 4.1 Speakers
  - 4.2 Cable Harness
  - 4.3 Seat/Stroke Sensor
  - 4.4 Speed Sensor
5. Maintenance and Fault Finding



### 1. Introduction

The **Coxmate SC** (and **SC-R**) are sophisticated instruments for both coxes and coaches. They provides an array of 'in boat' functions for the cox, and, the ability to capture detailed information on the crew's performance, transfer it to a PC and analyse it. The following summarises the features:-

- Audio amplifier for communication from cox to crew
- Optional built in radio receiver for communication from coach to crew for **SC-R**.
- Stroke rate sensor
- Stroke rate logging and recall (does not require PC)
- Stroke counter
- Timer/Stopwatch
- Storage and recall of timed intervals (does not require PC)
- Metronome
- Speed Sensor
- Display of:-
  - Speed
  - Cover (distance covered per stroke)

- Ratio of minimum to maximum velocity through each stroke
  - Rating
  - Time (stop watch)
  - Distance covered
  - Total strokes
- 'Microrecord' of up to approx one hour of rowing -only accessible through PC. A detailed record of boat performance is stored. **SCPCComateSC** analysis software enables everything from an individual stroke to a 2000 metre race, to be graphically analysed. The following variables can be graphed against time, distance or stroke count:-
    - Rating
    - Speed
    - Cover(distance between strokes)
    - Speed ratio

The cable harness, speakers, stroke sensor, microphone and battery charger used on the **Coxmate SC** maintain compatibility with those used on the **Coxmate AA** and **Coxmate SR**. All the **Coxmate** control units can be connected to an existing Nielsen Kellerman® Cox-Box™ or Cox-Vox™ cable harness, stroke sensor and speakers.

Many improved features have been incorporated into the **Coxmate SC**:

- Sophisticated battery management with indication of charge level.
- Increased battery capacity and voltage – increasing audio power, reducing distortion, increasing efficiency and increasing battery operating time.
- Automatic power down if speakers are not connected and there is no pulse from seat/stroke sensor – avoids accidental flattening of batteries.
- Stroke rate displayed to 0.1 strokes per minute.
- Speed sensor, which does not require any holes to be drilled in shell and has negligible drag on boat
- Storage of detailed data (Microrecord) on over 2,000 strokes. This can be transferred to and analysed on a PC
- Automatic retention of volume setting when turned off/on.
- Large versatile 2 x 16 digit alpha numeric display with backlight. Backlight can be turned on/off.
- Integrated stop watch/timer.
- Metronome function provides audible pulse at preset rate.
- Short circuit protection of speaker output
- Easy replacement of rechargeable batteries.
- A permanent connection of microphone to control box – removing problems associated with unreliable BNC connector.
- **Coxmate** harness accommodates up to 4 speakers – providing even sound level through boat, and enabling cox to communicate with crew but not the competing crew alongside.
- The **Coxmate** units are supplied with a special mounting plate. This can be permanently mounted in boat or strapped to cox's arm or leg with Velcro™ strap. The **Coxmate** unit is easily attached/detached to/from this plate.

In addition to the **Coxmate SC** control box features detailed above, the cable harness has also been improved:

- All connectors are fitted with strain relief to protect against damage during connection/disconnection.
- All cables are double insulated to provide additional mechanical protection.
- All copper wires are tinned to reduce corrosion.
- All connectors are fitted with visual markers to assist in aligning of two halves during connection.
- The connectors which are left disconnected, i.e. the one connecting to control unit and the section connector are fitted with protective caps.

## 2. Components

The **Coxmate SC** system comprises a number of components :

- **Coxmate SC-Kit**. Includes microphone, manual, charger, carry case, mounting plate, silicone grease and **SCPCComateSC** analysis software.
- **Coxmate SC-R-Kit** Above plus a built in radio receiver for coach to crew communication.
- **Cable harness** for four(**CH4-SR/SC-Kit**) or eight(**CH8-SR/SC-Kit**). Kit includes seat sensor.
- **Coxmate SC-XP Speed Sensor Kit**. There are 3 versions SC-XP-2m, SC-XP-7m and SC-XP-14m. These have different cable lengths and are for bow coxed four, stern coxed four and eight, respectively.

## 3. Operation

This section will cover the following topics:

- 3.1 Charging/Battery Management**
- 3.2 Power On/Off**
- 3.3 Speed Sensor**
- 3.4 Display and Menu Selection**
  - 3.4.1 Battery**
  - 3.4.2 Backlight**
  - 3.4.3 Volume**
  - 3.4.4 Status and Timer/Stopwatch**
  - 3.4.5 Radio**
  - 3.4.6 Recall**

**3.4.7 Metronome**  
**3.4.8 Calibrate**  
**3.4.9 Memory(Connect to PC)**

### **3.1 Charging and Battery Management**

To maximize battery life, it is recommended that the battery be fully charged and discharged for its first two cycles. To charge the unit, connect the Coxmate charger to the small jack socket on side of control box. It will take around 8 hours for a full charge. Once charged, the charge current will be reduced to a trickle. The unit can be left permanently connected to charger without degrading batteries. Even if unit is **Off**, batteries will slowly discharge. It will take 2-3 weeks to fully discharge.

The battery monitoring system provides a number of functions:

- Monitors and displays charge level
- Controls charging regime, to maximize battery life
- Provides warning if battery charge falls below 10% and 5%. It will also provide warning if charge is below 15% when unit is turned on
- Turns backlight off if battery level is below 10% - to preserve battery.

In normal operation the batteries will run for approx 9 hours without backlight and approx 4.5hours with backlight.

Over time it is possible for the battery % figure to accumulate an error. To reset reading, it is necessary to fully discharge batteries. A special function is included to facilitate this – it has to override the automatic powerdown – see section **3.4.1**. Once this is initiated, system will stay on until batteries are fully discharged. The battery % value will then be reset to zero.

### **3.2 Power ON/OFF**

**ON:** The power is turned on to the unit by pressing and holding down the **[Menu]** key until display turns on. This key has an adjacent marking **[On/Off]** indicating this function. On power up the system will display “Welcome to Coxmate” for 1 second then “Firmware VX.XX, 15<sup>th</sup> Nov 04 14:19hr” for 2 seconds, and then default to **status display** described in section **3.3.4**, .

**OFF:** The unit is turned OFF either by holding the **[Menu]** key down for 2 seconds, or, the loudspeakers are not connected and no seat/stroke sensor pulse or keystroke is received for 5 minutes.

If the unit is being charged it will display ‘**Charging**’ and ‘**Battery %**’.

### **3.3Speed Sensor**

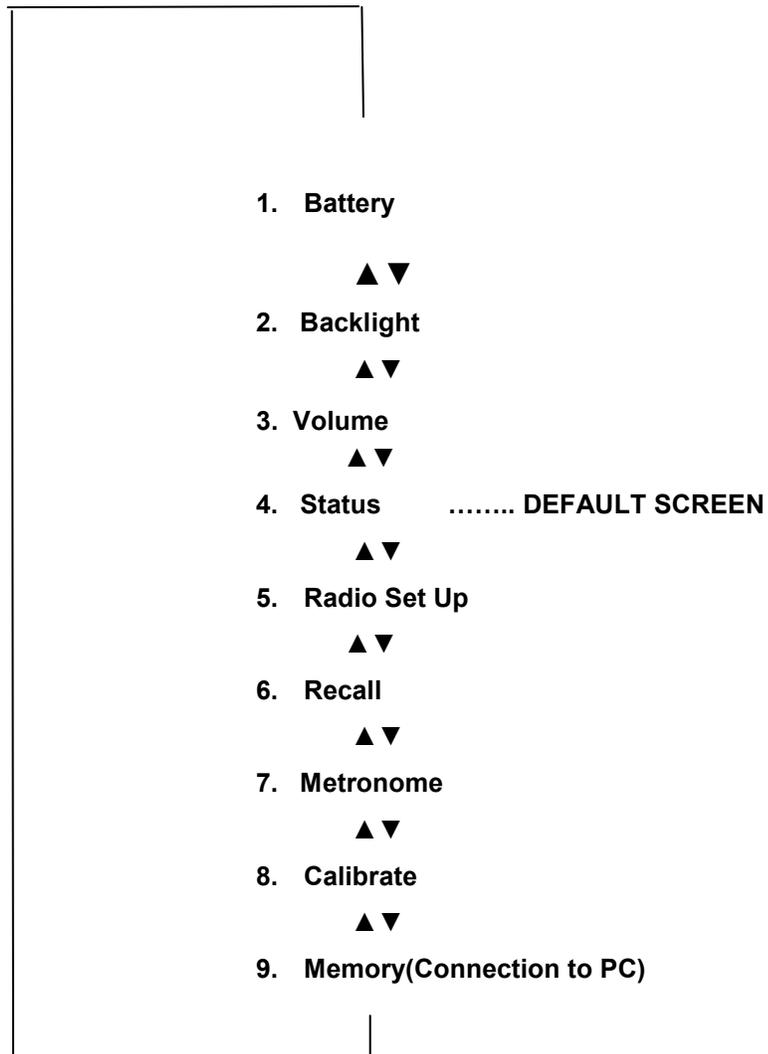
The speed sensor comprises a small impeller attached to the bottom of the shell with double sided tape, and an electronics pick up, mounted inside the shell. The electronic pick

up stores the calibration data for speed sensor. This pick up would normally reside in the boat. This means different **SC** units can be used in the same boat, without the need to recalibrate speed sensor. The speed information is transmitted back to **SC** unit. Details of installation and operation are covered in Section 4. The speed sensor is supplied with a nominal calibration. To provide a greater accuracy it is recommended the sensor be calibrated in the boat –see section 3.4.8.

### 3.4 Display and Menu Selection

#### Display Summary – Menu

▲ ▼ to scroll  
through menu



The default on **POWER UP** is the **status display** as shown in Display 4.3. This display is the one the cox would use in normal operation of the unit.

If the **[Menu]** key is pressed, the display will show:

Display 4.0

M	E	N	U					1	3	:	0	5	:	4	5
4	.	S	T	A	T	U	S								

The **[▲]** and **[▼]** keys will scroll through the menu options – as shown in section 3.4. If the **[Menu]** key is pressed repeatedly the display will return to the **status display** (Display 4.3). The 13:05:45(hour:min:sec) is the current time. This time alternates with the date.

Each of the menu options will now be described:-

### 3.4.1 Battery

Display 1.0

M	E	N	U					1	3	:	0	5	:	4	5
1		B	A	T	T	E	R	Y					X	X	%

Note: 'XX %' shows how much charge is in batteries.

**[Ent]** is held down for 4 seconds

Display 1.1



B	A	T	T	E	R	Y									
D	I	S	C	H	A	R	G	I	N	G					

The unit will stay **ON** with backlight on until battery is fully discharged. This process can not be operated with the battery charger being connected. The discharging will stop if unit is turned **[Off]**.

### 3.4.2 Backlight

*Display 2.0*

M	E	N	U				2	4	-	N	O	V	-	0	4
2		B	A	C	K	L	I	G	H	T					



[Ent]



*Display 2.1*

B	A	C	K	L	I	G	H	T		X	X		O	F	F
+		0	N							-			O	F	F



[Menu]



Note: '**OFF**' defines current state of backlight and will change to '**ON**' when backlight is on. If the backlight is set to '**OFF**', it will still come on when a key is pressed, but will turn '**OFF**' 20 seconds after last key is pressed. To preserve battery, the backlight will turn off if the '**battery**' level drops below 10%.

The '**XX**' value is for adjusting the contrast setting of this display with the [▲] and [▼] buttons. This should not normally require adjusting.

### 3.4.3 Volume

*Display 3.0*

M	E	N	U												
3		V	O	L	U	M	E								



[Ent]



*Display 3.1*

V	O	L	U	M	E							X	X	%
+		U	P						-		D	O	W	N

Note: '**XX**' denotes volume.



[Menu]



The volume can also be adjusted from **status display** (*Display4.1.*)

### 3.4.4 Status

*Display 4.0*

M	E	N	U				2	4	-	N	O	V	-	0	4
4		S	T	A	T	U	S								

↓  
**[Ent]** or on **POWER UP**  
 ↓

*Display 4.1*

STROKES/MIN				SPEED				RATIO				COUNT		
X	X	.	X	X	:	X	X	X	X		X	X	X	
X	X	:	X	X	X	X	.	X	X	X	X	X	<b>R</b>	
TIME				COVER				DISTANCE				REC		

↓  
**[Menu]**

Notes:

- **Display 4.1** is the default display, i.e. it comes up on power up, or repeated pushing of **[Menu]** key.
- The timer displays stop watch value. When the timer is running, the time is displayed in seconds. When the timer is stopped the time is displayed to 0.1 second. The **start**, **stop** and **lap/reset** operate in a similar way to a conventional stop watch. The **stroke count** and **distance** displays are reset and run at the same time as the timer. The start of the stopwatch requires either two presses of the **start** button, or one press of the **start** button and a pulse from the **seat/stroke** sensor. When the **start** button has been pressed once, '**SET**' will be displayed. This reverts to time once timer starts running. When the **LAP** is on, '**LAP**' will be displayed adjacent to time, in place of **Cover**. When **Timer/Counter** is '**SET**', ready to start, **Strokes/min**, **Ratio**, **Count**, **Speed**, **Cover** and **Distance** displays will be blank. The **RECORD** functions operate whenever the timer is running and an '**R**' is displayed in bottom right of display. The '**R**' will change to a flashing '**F**' if memory is full, and recording will stop. The menu system can not be entered whilst the timer is running.
- **RECORD:** There are two **RECORD** functions. The first operates in the same way as the **SR** model, section 3.4.6 explains how this operates and how data can be recalled. This stores limited data on rating and timer intervals. Data will be stored, and is only overwritten if timer is restarted after having been **reset**. The second is the **MICRORECORD**. This records boat speed approximately every 25 milliseconds. Approx one hour of data can be stored. This data can only be accessed through a PC, using **Coxmate PC Link** and **Coxmate Analysis Software**. This software enables rowing records to be annotated eg with crew list and weather conditions. The **SC** also has a real time clock, so all records are time and date stamped. The software enables the rowing data to be graphed and compared. Rating, cover, speed ratio and speed can be graphed against distance time or stroke count. The fine time resolution means the velocity profile from individual strokes can be analysed, and a number of strokes overlayed on same graph. Alternatively the same variables can be displayed over 2000 metres or more. More detail is available from [www.coxmate.com.au](http://www.coxmate.com.au). A demonstration version of software will be available. If

the **Timer** is running and no stroke is sensed for 12 seconds, the '**RECORD**' will be suspended – as if **stop** button had been pressed. If **start** button is pressed **Timer** and '**RECORD**' will resume.

- **Cover** (distance travelled in a single stroke) will be displayed to two decimal places, i.e. X.XX m if **timer** value is less than 10 minutes. If time exceeds 10 minutes, cover will be displayed to one decimal place i.e. XX.X. **Cover** is updated every stroke.
- Display will go to Display 3.1 if either [▲] or [▼] is pressed- this enables volume to be adjusted. Display will revert to Display 4.1 after 2 seconds from last adjustment.
- [Ent] key will mute audio when display is on **status** screen .
- **RATIO** is the % speed ratio during a stroke - the minimum velocity divided by the maximum velocity multiplied by 100. It is updated every stroke.
- **SPEED** is displayed in either metres per second (m/s) or time per 500 metres (mm:ss). The user can select their preference when the **SC** is connected to PC. The speed reading is updated each stroke and is the average speed of the stroke.
- The **ratio** and **stroke count** display can be replaced with **average speed**. This is the average speed since the **timer** was started. The display will show eg 'A4.32' – if speed is selected to metres per second. This display can be toggled between **ratio** and **stroke count** and **average speed** by pushing the **start** button. The default display state for either **ratio** and **stroke count**, or, **average speed** can be selected in PC.
- **Splits**: The **SC** can have a split distance (50,100,200,250,500 or 1000 metres) programmed – when it is connected to PC. If this distance was set to 500 metres, then when each 500 metre interval had been completed, the display would flash '**split**' in place of cover. The **rating**, **ratio** and **speed** would then display the average value for the 500 metres. The '**split**' details will be displayed for 10 seconds, or until **start** button is pressed.

### 3.4.5 Radio

The radio controls are for setting up the radio. It is used for the internal radio with the **SC-R**, and for the external radio in the case of the **SC**. This provides the ability to turn the external radio On/Off, and to set the volume independently of the cox's microphone. If there is an internal radio, it also provides a means of selecting channel. All settings will be retained if unit is turned Off/On.

*Display 5.0*

M	E	N	U					1	3	:	0	5	:	4	5
5		R	A	D	I	O									



[Ent]



*Display 5.1*

R	A	D	I	O							O	N	/	O	F	F
S	C	R	O	L	L			+			-					



[Ent] [▲] and [▼] will scroll through:

**ON/OFF**  
**VOLUME**  
**CHANNEL SELECT**

If **ON/OFF** selected from scrolling on *Display 5.1*



*Display 5.2*

R	A	D	I	O											O	F	F
+		O	N								-				O	F	F

**OFF** shows the status of RADIO.  
[▲] and [▼] are used to turn it ON and OFF.

[Menu] or [Ent]



To *Display 5.1*

If **CHANNEL SELECT** selected from scrolling on Display 5.1

Display5.3

R	A	D	I	O		C	H	A	N	N	E	L		X	X
S	E	L	E	C	T			+			-				

Channels 1 through to 40 are available. A channel with minimum voice traffic on it should be selected. This channel must be synchronised with coach's radio. 'XX' shows the selected channel. A default channel can be set from PC.

↓  
[Menu] or [Ent]



To Display 5.1

If **VOLUME** is selected from scrolling on Display5.1

Display5.4

R	A	D	I	O		V	O	L	U	M	E		X	X	%
+		U	P							-		D	O	W	N

'XX' shows the volume setting.



[Menu] or [Ent]



To Display 5.1

### 3.4.6 Recall

The **Recall** function is a similar way as the **SR** model. The SR can only store one record, but the SC can store up to eight. The volume of data stored in this function is limited, but can be accessed without connecting unit to a PC. The **MICORECORD** data can only be accessed via a PC.

Display 6.0

M	E	N	U					1	3	:	0	5	:	4	5
5		R	E	C	A	L	L								

↓  
[Ent]

*Display 6.1*

R	E	C	O	R	D		N	O		0	1				
+		N	E	W	E	R				-	O	L	D	E	R

↓  
[Ent]

Up to 12 records can be stored.  
Recovering the data to display will take a few seconds.

[Menu]

R	E	C	A	L	L					R	A	T	I	N	G
+		R	T	N	G					-		I	N	T	

↓

[Menu]

[Ent]

The ▲ (+) and ▼ (-) keys enable **RATING** or **INTERVAL** details to be selected. The one selected eg **RATING** in above sample will be displayed on top line. *Display 6.2* shows **RATING** and *Display 6.3* shows **INTERVAL**

*Display 6.2*

R	A	T	I	N	G		X	X	.	X		F	R	O	M
Y	Y	:	Y	Y		t	O		Z	Z	:	Z	Z		

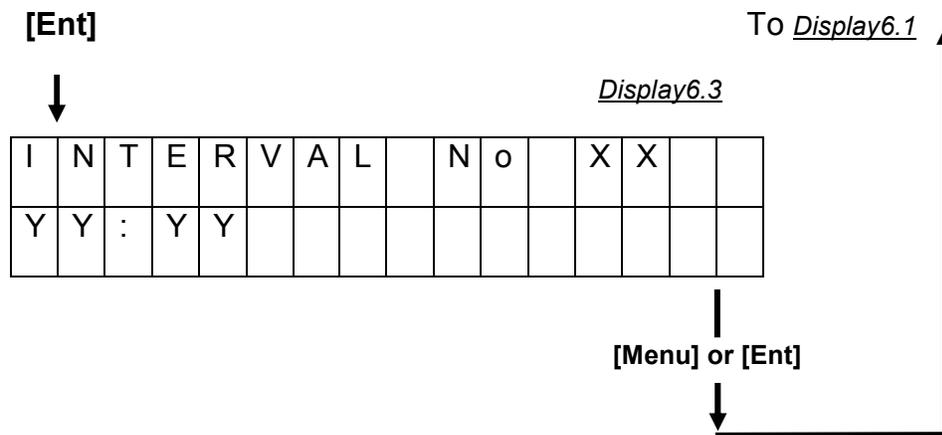
**Note:** This recall feature should not be confused with the **RECORD** function. The recall always stores rating for the last period the timer run. This feature is the same as that available on **SR** model:

[Menu] or [Ent]

The first display for **RATING** recall is the average rating(XX.X) over the total time period(ZZ:ZZ). The start time (YY:YY) will be zero. If the ▼ button is repeatedly

pressed the display will then step through and display the rating for each recorded period. The first four periods are 15 seconds, and subsequent ones are 30 seconds. For the first 15 second interval, Y:YY will be 0:00 and Z:ZZ will be 0:15; X.XX will be the average rating over this period. The second would be 0:16 for Y:YY and 0:30 for Z:ZZ. The maximum number of intervals is 80, the last being 38:30 for Y:YY and 39:00 for Z:ZZ.. The ▲ and ▼ keys will scroll through these intervals. It is unlikely the last interval will be the full 15 or 30 seconds. In this case the actual time value will be displayed. The RECALL recording function always operates when the timer is operating. The recalled information is only cleared when the record becomes the oldest i.e. more than eight. The eighth record will be cleared when timer is next started. All data is kept, even if unit is powered down. The RECALL function can only be accessed once timer has been stopped.

From Display 6.1 if **INTERVAL** is selected:



Each time the **LAP** is initiated when the timer is on, the unit will record the time interval which has elapsed since the last time the **LAP** was initiated. Up to 20 elapsed interval times can then be recalled as shown above. The ▼ and ▲ buttons can be used to scroll through the recorded times. Interval No1 is the time between the timer starting and the first time the **LAP** is pressed.

If the cox wanted to record the times for the eight 250 metre segments of a 2000 metre, then he would press **LAP** at the end of each of the 250 metre segments. When the **LAP** is pressed the time display will freeze. To release this freeze, the cox must push the **LAP** a second time. It is only the initiating of the **LAP** which will define the start and end of the timed interval.

### 3.4.7 Metronome

*Display 7.0*

M	E	N	U					1	3	:	0	5	:	4	5
5		M	E	T	R	O	N	O	M	E					

↓  
[Ent]

*Display 7.1*

M	E	T	R	O	N	O	M	E		X	X		O	F	F	
▲		U	P							▼			D	O	W	N

Note: [▲] and [▼] adjust the rate – in pulses per minute. 'XX' will flash.

↓  
[Ent]

*Display 7.2*

M	E	T	R	O	N	O	M	E		X	X		O	F	F
+		O	N							-			O	F	F

↓  
[Ent] or [Menu]

Note: 'OFF' on top line indicates status of the Metronome. This status will flash. ▲ and ▼ turn metronome ON and OFF.

The volume of the metronome pulse is deliberately kept low, and is unaffected by volume control.

### 3.4.8 Calibrate

Whilst the **speed sensor** is provided with a nominal calibration, this will be affected by hull shape, and location on the boat. To achieve a high degree of accuracy, it is necessary to perform an 'in boat' calibration. The **Coxmate speed sensor** is an intelligent device and once calibrated, will remember the value. This means that this calibration information stays with the sensor in the boat. If a different SC unit is used, no recalibration will be required.

The calibration requires the boat to be rowed over a known *Measured Distance*, eg 1000 metres. It is better if a running start is used i.e. the boat is at speed as it starts the 1000 metres. It is also recommended that the boat be rowed at a reasonable pace i.e. at least firm pressure. The cox starts the **timer** as he/she starts the 1000 metres, and stops the **timer** as he/she reaches the 1000 metre mark.

If there is a current in the water, then it is recommended the calibration be conducted in both directions over the same stretch of water. This will minimise any error caused by the current. The timer can be stopped after 500 metres and restarted (without **resetting**) for the second 500 metres. Provided the *Measured Distance* is 1000 metres, be it a single stretch of 1000 metres or two at 500 metres, then the calibration can be updated by using the **AUTO CALIBRATION** detailed on the next page - *Display 8.1 and 8.2*. In this case the **timer** must **not** be used or reset until calibration has been completed.

If the *Measured Distance* is not 1000 metres then the new **calibration constant** has to be calculated and entered manually.

In theory any distance could be used for the *Measured Distance*. However between 200 and 2000 metres is recommended. The following example demonstrates how the new **calibration constant** is calculated:

If the *Measured Distance* was 500 and the *Distance Recorded* as shown on display was 530 metres. The actual and the recorded distance are then used to determine the adjustment required to the **calibration constant (K)**.

$$\text{New calibration constant, K} = \frac{(\text{Old K value}) \times (\text{Measured Distance})}{(\text{Distance Recorded on STATUS display})}$$

In the above example, if the Old **K** value was 1.004, then the New **K** value is calculated as follows:-

$$\begin{aligned} \text{New K value} &= \frac{1.004 \times 500}{530} \\ &= 0.9472 \end{aligned}$$

This new **K** value can then be entered into the **COXMATE SR** unit as described in following page, *Display 8.4*. If the value is obviously way out of range, it will not be accepted.

Display 8.0

M	E	N	U					1	3	:	0	5	:	4	5
1	0		C	A	L	I	B	R	A	T	E				



[Ent]



Display 8.1

C	A	L	I	B	R	A	T	I	O	N		A	U	T	O
+		A	U	T	O					-		M	A	N	



[Ent] The▼



[Menu]



Display 8.2

N	E	W						K	=	X	.	X	X	X	X
E	n	t		T	O			C	O	N	F	I	R	M	

If [Ent] is pressed, K is updated.

If [Menu] is pressed, K update is aborted.

Display will display either 'K UPDATED' or 'K NOT CHANGED' for 1 second.

For the **AUTO CALIBRATE** to be used, the boat must have been rowed and timed over 1000metres.

[Menu] or [Ent]



If there is no distance recorded, 'NO DISTANCE RECORDED' will be displayed If distance is out of range, 'DISTANCE OUT OF RANGE' will be displayed.

If **MANUAL CALIBRATE** selected on Display 8.1

Display 8.4

K					=	X	.	X	X	X	X				
+		-		T	O		A	D	J	U	S	T			

[▲] and [▼] are used to increase/decrease span value

If [Ent] is pressed, K is updated with new value.

If [Menu] is pressed, K update is aborted.

Display will display either 'K UPDATED' or 'K NOT CHANGED' for 1 second.

[Menu] or [Ent]



To Display 8.1

The adjustment speed of the **K** value will increase if the [**▲**] and [**▼**] buttons are held down.

### 3.4.9 Memory/Computer Link

This selection provides information on how much memory is available, The ability to clear memory and the setting up of SC for connection to a PC.

Display 9.0

M	E	N	U					1	3	:	0	5	:	4	5
9		M	E	M	O	R	Y								



[Ent]



Display 9.1

M	E	M	O	R	Y			P	C		C	O	N	N
S	C	R	O	L	L		+		-					



[Ent]



[▲] and [▼] will scroll through:  
**CONNECT** - enables connection to PC  
**CLEAR** - clears memory  
**AVAIL** - shows memory available

[Menu]



The last two options are self explanatory and require no further explanation.

If the **CONNECT function is** selected, then the following will be displayed:

Display 9.2

M	E	M	O	R	Y		A	V	A	I	L		5	0	%
S	C	R	O	L	L		+		-						



[Ent]



[Menu]

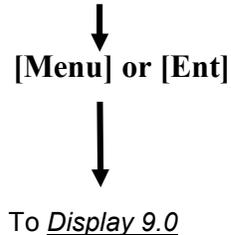


To Display 9.0

Display9.3

M	E	N	U					1	3	:	0	5	:	4	5
W	A	I	T	I	N	G		F	O	R		P	C		

The message will change to **PC Connected**, when the SC and the PC establish communications. If the SC memory is instructed to be cleared by PC, then there will be a message **Clearing memory**, whilst this is occurring. This will take around 30 seconds.



#### 4.0 Installation

There are four components which require permanent installation into the boat; The **speakers**, the **cable harness**, the **seat/stroke sensor** and the **speed sensor**. The **control box** and **microphone** are only connected when the boat is in use. Normally the cox will take the **control box** and **microphone** into the boat when they are going for a row. The **microphone is** permanently connected to the **control box**.

#### 4.1 Speakers

These are mounted under or near bow, 3, 5 and 7 in an eight, and bow and 3 in a four. The **speakers** are fitted with screws . Two stainless steel screws with nuts and washers are provided for this purpose. In some boats it might be adequate or easier to fix **speakers** using a good quality double sided tape.

The **speakers** connect to the **cable harness** via the rubber 2 pin connectors. To minimize any corrosion, especially in salt water applications, it is important that both the rubber and metal parts of the mating surfaces have a light coating of silicon grease applied. The four pin rubber connector should be greased monthly in salt water and 3 monthly in fresh water environments. The speaker and seat/stroke sensors need only be greased once per season.

#### 4.2 Cable Harness

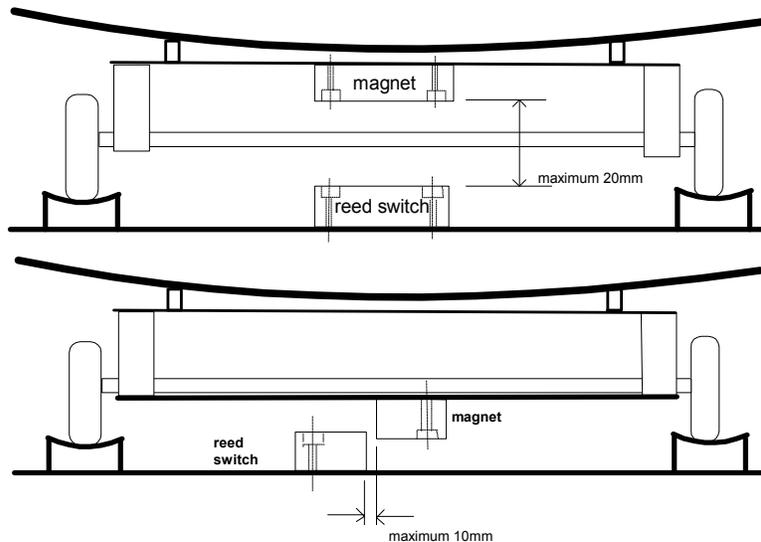
There are two cables. One connects to the speed sensor via a 4 pin bayonet connector on **SC** unit and the other is the **speaker and seat sensor cable harness** which connects via 4 pin rubber connector. Enough slack wire should be provided to ensure cable will reach **control unit**, when it is in it's normal operating position. A number of self adhesive retaining clips are provided, these should be applied to strategic points to prevent cable falling out when the boat is upside down, and keep cable tidy and clear of any seats etc. It is important to ensure boat surface is clean and dry before clips are stuck on, and leave them to set for a few minutes before any force is applied to them. An alcohol impregnated pad is included with harness and seat stroke sensor for cleaning surface prior to adhering retaining clips. Make sure the alcohol has dried from the surface before adhering clips. There are two (for an four) and four (for an eight) 2 pin rubber connectors, one for each of the speakers. There is also a separate cable spur, approximately 2 metres long, with a 2 pin connector for the **stroke/seat sensor**. All **Coxmate** 2 pin connectors are colour coded to assist in connecting:

- Red band for **speakers**
- Green band for **stroke/seat sensor**
- Blue band for **mid harness connection** – only normally supplied with harness' for eights, to enable them to be sectioned into two halves

Note: If the **Modular Harness System** is used, then there is no requirement for colour coding and connectors are not colour coded.

### 4.3 Stroke/Seat Sensor

This has two components, a **magnet** and a **reed switch** (the one with the wires connected). The **magnet** mounts under the seat of stroke or bow, and the **reed switch** mounts on the frame/platform under the seat, such that the magnet passes over the **reed switch** every stroke. The **reed switch** should be positioned at approximately the mid point of the seat slide. The **magnet** should pass directly over the **reed switch** if mounted as shown in the first option below. Each of the two components has two holes, and can be fitted with two screws or double sided tape. The following sketches show two options for the orientation of the reed switch and magnet. The exact arrangement will depend on the structure of seat and slide.

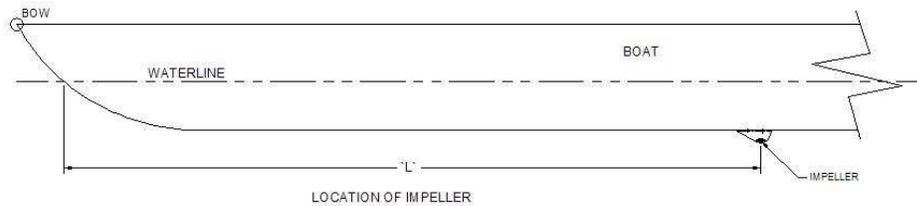


**Schematics Showing two Mounting Arrangements of Seat/Stroke sensor**

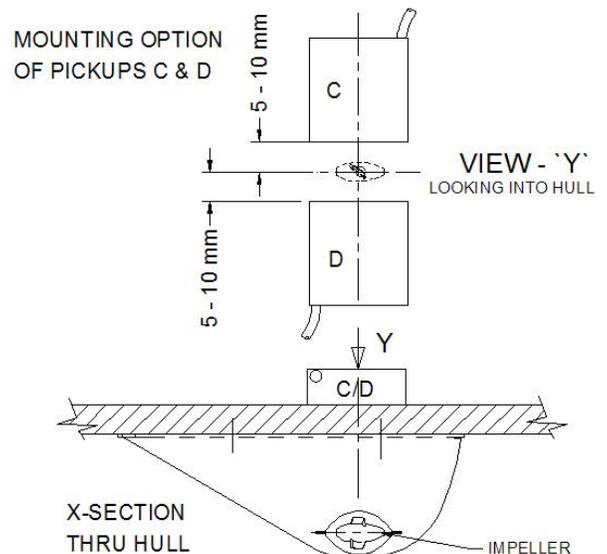
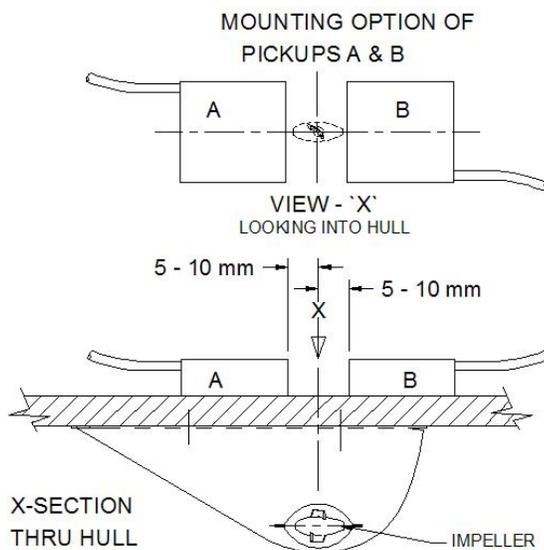
### 4.4 Speed Sensor

The speed sensor comprises a small magnetic impeller which mounts to the outside of the shell, and an electronics pick up/conditioning unit to transmit speed signal to **SC** control unit. The conditioning unit can also be used with the Nielsen Kellerman impeller unit supplied with Speed Coach™ unit – however this would require a different calibration constant, and would have to be calibrated.

The nominal calibration figure supplied with sensor, assumes it is mounted 2.0 metres from the bow at the waterline (L=2m). However as this is only a nominal calibration, it is not critical, provided 'in boat' calibration is performed. It is important to mount the speed sensor as far forward as possible. As the sensor gets further from the bow, so does the degree of turbulent noise. This noise appears on the instantaneous speed curve, and reduces it's value for analysis. Practical access restrictions may limit how close to bow sensor is mounted. If access was not a problem then a distance less than the 2 metres eg 1 - 1.5 metres would be preferable.



The mounting of the speed sensor impeller and pick up is shown in following diagram. Four mounting arrangements, A,B, C and D are shown. To assist in positioning the sensor in respect to the impeller, a magnet may be helpful – place magnet eg stroke sensor magnet, on inside of hull and determine position on outside of hull with a small piece of magnetic material eg a paperclip. The location of the pick up is relatively tolerant. However the alignment of the impeller fin is critical – it must be in line with the hull. It is helpful to use a long straight edge or a piece of string to align fin. It is generally recommended for the fin to be mounted at or near the centreline of the hull. The fin is normally affixed with double sided tape. If you are using the tape, carefully mark intended position of fin on hull with a pencil. It is important to position fin correctly first time -once backing tape is removed from fin, and it is stuck to boat, it is difficult to reposition it. The fin has two holes in it, so it can also be fitted with 2 x 3mm screws. The advantage of using screws is it makes it easy to remove and refit fin. Some boatbuilders are looking at providing the threads built into the hull for this purpose. When double sided tape is used for affixing fin, the hull must be clean and dry. If the unit is removed from boat, then apply a steady force, to ease fin off. Wrenching it off without care may result in damage to the gel coat or paint finish.



The impeller spins within an enclosed 316 stainless steel fin. This fin provides mechanical protection for the impeller. The impeller is fitted with brass bushes, so it is less affected by spinning at speed if boat is being towed. However for long distances it is recommended to tape impeller to stop it spinning. The impeller and fin should be kept clear of weed or other foreign material. The fin may generate some audible noise. This is not of concern. The pick up is connected to the SC via a 4 pin waterproof connector. The mounting of pick up is shown in diagram. It is supplied with double sided tape. The inside of boats is sometimes difficult to stick due to residual materials. It is important for the surface to be thoroughly cleaned. It may need a slight abrading to remove foreign materials and ensure a clean surface. An alcohol swab is provided to assist. If the double sided tape does not work, then duck tape, or standard adhesive sealants can be used. The SC-XP speed sensor cable is available in several lengths, depending on boat type. This cable must be fed through the boat to the cox's position.

Due to continuing development, specifications may change without notice.