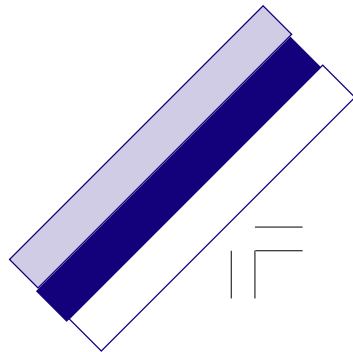


SPA DESIGN

MICROPROCESSOR

SPEEDO MANUAL





SPA DESIGN MICROPROCESSOR SPEEDO INSTALLATION AND OPERATING MANUAL

CONTENTS

PAGE 2INSTRUMENT FEATURES.

PAGE 3INSTALLATION DETAILS.

PAGE 4OPERATING INSTRUCTIONS.



PAGE 5MENU SYSTEM.



PAGE 10....SPECIFICATIONS.

PAGE 11....WIRING SCHEMATIC.

PAGE 12....MOUNTING DATA





INSTRUMENT FEATURES

- CALIBRATES TO ANY TYRE CIRCUMFERENCE
- MAXIMUM SPEED RECALL
- ACCELERATION TIMER
- BUILT IN ODOMETER
- RECORD MODE FOR TAKING SNAPSHOTS OF SPEED
- BACKLIT LCD DISPLAY
- LOW BATTERY WARNING
- TRIGGERS OF ANY TARGET OR NUMBER OF TRIGGER POINTS
- COMPATIBLE WITH MOST TYPES OF SENSORS, OPTO/HALL
- AUTO MODE FOR SELF CALIBRATION OVER STANDARD 1/4 MILE
- READOUT SELECTABLE FOR MPH OR KMH

MENU SYSTEM FOR :-

- SETTING THE CIRCUMFERENCE 0.1 - 4.00 METRES
- SETTING THE NUMBER OF TRIGGER POINTS 1 - 40
- SETTING THE READOUT TO MPH OR KMH
- SETTING THE SPEED FOR ACCELERATION TIME
- REPLAYING STORED SNAPSHOTS 1 - 60
- RECORD MODE ON/OFF
- RESET RECORD NUMBER
- RESET STORED MAXIMUM SPEED
- RECALL STORED MAXIMUM
- RECALL STORED DISTANCE (MILES OR KM)
- RECALL OR MEASURE ACCELERATION TIME
- TEST / SETUP MODE
- AUTO CALIBRATION MODE
- BACKLIGHT ON/OFF



INSTALLATION DETAILS

INSTRUMENT INSTALLATION DO'S AND DONT'S

DO not allow any stress on the mounting feet on the case.

DO ensure that the instrument is slightly below the drivers head for the clearest view.

DO ensure that the back of the instrument is protected from any water spray that may occur.

CABLE INSTALLATION, DO'S & DONT'S

DO ensure that the black screened cables do not run next to power cables, especially if they are ignition power cables. Ideally, run all screened cables next to the chassis (earth).

DO ensure that any exposed plugs that are likely to get water spray are protected with rubber boots.

DO NOT allow cables to run through sharp edged apertures without protection.

DO NOT fix the cables next to or onto any surface likely to exceed 80 degrees Centigrade.

SENSOR INSTALLATION DO'S AND DON'TS

DO ensure that the sensor is pointing toward the south pole of the magnet (see page 12).

DO ensure that the sensor is aligned with the end of the magnet when the suspension is under normal load (car not jacked up).

DO NOT mount the magnet on the mounting flange of a shaft coupling, mount the magnet on either the shaft, or the main body of a CV joint.





OPERATING INSTRUCTIONS

The SPA Microprocessor Speedo is factory set to standard parameters, but may be adjusted to your requirements using a menu system which will be explained further on. All settings and maximums are stored in EEPROM memory, which will store them for many years without any power needed.

As supplied the Circumference is set to 1.800 Metres, using 1 trigger points for use with the trigger magnets supplied as standard. Speed measurements are taken for one revolution of the wheel and then displayed on the LCD. The speedo display and the distance total is always updated every 0.36 Sec (totals measured in speedo mode only), but the maximum speed and snapshot recordings are always measured and stored at a much higher rate (typically 40 times a second) thus storing true values.

When the instrument is first switched you will see SPA displayed momentarily before speed measurements are displayed. Also an "MPH" or "KMH" logo will appear on the bottom right of the LCD display to indicate that MPH or KMH is being displayed. Pressing the red button after this will recall any stored maximum speed on the display.

If you have set the instrument to RECORD mode you will momentarily see a record number displayed as "r" followed by a two digit number in the range 1-60 after the SPA. This is to remind you of the record number for the next snapshot to be used. The RECORD mode is also indicated by an "REC" symbol on the top right of the LCD display. Pressing the red button in this mode causes the instrument to take a snapshot of the currently measured speed and store it with the record number displayed while holding down the button.

If the supply voltage to the instrument drops to below 8.00 Volts, a small BATTERY symbol will be displayed on the left of the LCD display indicating that battery volts are low. The speedo will still function normally at this voltage, but if the voltage drops down to 7.00 volts, the instrument will reset itself.





MENU SYSTEM

To access the menu, hold down the red button and then switch on the instrument. On the display you will see "bon" indicating that the backlight is on (unless you have switched it off previously), you now release the button. If you now press the red button momentarily again you will see it increment to the next menu option, keep doing this to familiarise yourself with them. The sequence of displays and there meaning is shown below:-

tot = Total distance recall recorded on odometer.

bon = Backlight on or, **b--** = Backlight off.

rtP = Reset Peak, IE reset stored maximum speed to zero.

tr = set TRigger points routine.

CAL = set CALibration to tyre circumference routine.

rcP = Recall Peaks, IE recall stored maximum speed, this will be needed while in RECORD mode.

rEC = RECord mode on or, **r--** = Record mode off.

rEP = REPlay of stored snapshots routine.

rtr = ReseT Record number, IE sets record number back to 1.

tSt = TeST mode, used to set up and test wheel sensors.

AUt = Auto calibrate mode, used to set the calibration of the speedo by driving over a standard 1/4 mile.

rEA = set REAdout to KMH or MPH, indicated by "KPH" or "MPH" on the bottom right of the LCD display.

SSP = set Start SPeed for the acceleration and mid range timer.

FSP = set Finish SPeed for the acceleration and mid range timer.

ACC = routine for displaying and measuring acceleration time.

The display then scrolls back round to backlight on/off.

To activate any option or routine, press and hold down the red button, the display will change after 2 seconds.

A more detailed breakdown of each menu option is detailed on the following pages.



tot (TOTAL DISTANCE RECALL):- Press and hold down the red button, after 2 seconds the highest part (thousands) of the current distance will be displayed. Press and hold down the red button again, after 2 seconds the lower part (units) of the current distance will be displayed (indicated by a decimal point to the left of the 3 digits). The distance will be in miles or KM according to the current readout selected. To return to menu at any point momentarily press the red button and the next menu item will appear.

bon (BACK LIGHT ON/OFF):- Press and hold down the red button, after 2 seconds the display changes to the desired option.

rtP (RESET PEAKS):- Press and hold down the red button, after 2 seconds the display increments to the next menu item. The stored maximums are now reset to zero. This should be done before any new maximums are to be stored.

tr (SET TRIGGER POINTS):- Use this routine to enter the number of points that are to pass the speed sensor for one revolution of the wheel (or shaft).

Press and hold down the red button, after 2 seconds the display changes to "t" and a two digit number, indicating the current number of trigger points the instrument is set to.

To change the number, press the red button momentarily to increment it one at a time, or press and hold, and the display will count up quickly. When the display reaches **40** it will scroll back round to **01**. To exit the routine simply switch off the instrument.

CAL (SET CALIBRATION of tyre circumference):- This routine is used to enter the rolling circumference of the tyre being used. Since the whole accuracy of the speedo hinges in the accuracy of this data it is important to learn how to use it.

It can also be used to "Trim" the speedo to take into account external errors and to cater for differential ratio's when measuring from prop shafts.

Alternatively use the Auto calibration system described further on could be used. PLEASE NOTE: If the speedo is not calibrated and the sensor not set correctly, the speedo may record incorrect distance on the odometer. Correct operation is important since the odometer cannot be reset.

1) General calibration procedure:- Measure the exact circumference of the tyre at its centre. This circumference is now entered in two parts, set metres and set millimetres.

Press and hold down the red button, after 2 seconds the current circumference will be displayed in metres. To change the number, press the red button **momentarily** only to increment it 0.1 at a time.





When the display reaches **4.0** it will scroll back round to **0.1**. When this has been set correctly, press and hold down the red button. The decimal point will now shift to the left and display the remaining millimetres of circumference.

To change the number, press the red button momentarily to increment it one at a time, or press and hold and the display will count up quickly. When the display reaches **.099** it will scroll back round to **.000**. To exit the routine simply switch off the instrument.

2) Special calibration:- If you require to trigger off a target with 10 teeth, then set the trigger points number to **10** in the SET TRIGGER POINTS menu.

If the target is running at wheel RPM then simply enter the tyre circumference as described above. However if the target is driving a differential, then using a calculator, divide the circumference of the tyre by the ratio of the differential, and enter this value as the circumference, as described at the beginning of this section.

If you require to trim the accuracy of the speedo because for example the differential ratio is not accurately known, and you have determined that the speedo is reading say 2% high, then using a calculator, subtract 2% off the currently stored circumference value and enter this new value as described in the at the beginning of this section. The speedo will then read 2% lower than previously.



Alternatively, if you have access to an accurate 1/4 mile marked road, use the Auto calibration mode described further on.



rcP (RECALL PEAKS):- If you are in record mode, then you need this option to gain access to stored maximums, as the red button during speed measurements is used to store snapshots. Simply press and hold down the red button to view stored maximum, and release the button to return to the menu.

rEC (RECORD MODE on/off):- Press and hold down the red button, after 2 seconds the display changes to the desired option.

When this mode is on a small "REC" symbol will displayed in the top left of the speedo display, and pressing the red button during speed measurements will cause the instrument to take a "snapshot" of your current speed instead of recalling the stored maximum speed. It will store the current speed at the instant that you pressed the button, into the instruments memory.

Up to 52 snapshots can be taken on the standard speedo and each one is given a "Record number". These numbers are displayed while pressing the button to take a snapshot as "r" followed by the record number. After you have taken a snapshot the record number will increment to the next one. When you have reached **52** it will return back to **01** and overwrite the previous data.

Each time you switch on the instrument in the record mode, it will





show you the record number that will be used, next time you press the button. If you wish to start again from record number 1 and overwrite old data, then use the RESET RECORD NUMBER option described further on.

rEP (REPLAY ROUTINE):- This routine is used for replaying or “viewing” your stored snapshots. The routine always starts from record number 1, but can be quickly scrolled through the whole range. Press and hold down the red button, after 2 seconds the display will change to “**r01**” indicating that it will display the snapshot for record number 1, release the button to view the snapshot.

Press the button again and the record number 2 will be displayed, release the button and the snapshot for record number 2 will be displayed etc. If you wish to scroll up the record number quickly, press and hold the button and they scroll up quickly to **60** and back around to **01**.

rtr (RESET RECORD NUMBER):- Press and hold down the red button, after 2 seconds the display increments to the next menu item. The record number is now reset to one. This should be done if you want to overwrite old data, instead of recording sequentially from the previous record number.

tSt (TEST MODE):- This mode is used for setting up the mechanical position of the wheel speed sensor, to check that it is triggering properly. The display counts up every time a trigger pulse is received from the sensor so you can “see” it working.

To use this mode, press and hold down the red button, after 2 seconds the display change to “**t00**”. The speedo is now ready to receive trigger pulses. To exit this routine, press the red button and you will return to the menu.

AUt (AUTO CALIBRATION MODE):- This mode is used for calibrating the speedo by using a 1/4 mile of road as a standard. You do not need to enter any circumference data, only the correct number of trigger points being used, before you use this mode. The car is then driven over an accurate 1/4 mile stretch, and the speedo then calibrates itself by working out the exact effective circumference of the tyre. It will also calibrate out any errors due to differential ratios, IE if you are triggering of a drive shaft that does not rotate at wheel RPM.

To use this mode, press and hold down the red button, after 2 seconds the display will change to “**Str**” which means “start” indicating that the program is now ready for a start signal by pressing the red button. Do not do this until you are ready. Unless you are using hall effect or opto sensors, it will be necessary for car to be moving fast enough for the sensors to operate as you pass your start mark on the road. This should be determined before you use this mode.





Start driving the car slowly, but fast enough for the sensors to work, toward the start mark on the road.

As you pass the start mark, press and release the red button firmly and the display will change to "c00" and start counting up quickly in response to wheel sensor pulses, this display is only for reference, to show you that everything working. You may increase your speed now as long as you don't cause any wheel slip, but you must slow down again before you approach the 1/4 mile mark.

As you pass the 1/4 mile mark, travelling at the same speed as you started (fast enough for the sensors to work), press and release the red button firmly again and the display will return to the menu showing "AUt". This indicates that calibration is complete and you can verify this by toggling the button through the menu to "CAL" and entering the routine to "view" your effective circumference.

rEA (SET READOUT):- Use this option to change the readout to MPH or KMH. Press and hold down the red button, after 2 seconds the display changes to the desired option, as indicated by "KPH" or "MPH" on the bottom right of the LCD display.

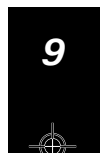
SSP (START SPEED):- Use this routine to enter the start speed that you wish to measure the acceleration for. EG set to 0 for a 0-60 MPH timing.

Press and hold down the red button, after 2 seconds the display indicates the current acceleration start speed the instrument is set to. To change the number, press the red button momentarily to increment it one at a time. When the display reaches 150 it will scroll back round to 000. To exit the routine, either press and hold down the red button, and after 2 seconds the display will return to SSP, or simply switch off the instrument.

FSP (FINISH SPEED):- Use this routine to enter the finish speed that you wish to measure the acceleration for. EG set to 60 for a 0-60 MPH timing.

Press and hold down the red button, after 2 seconds the display indicates the current acceleration finish speed the instrument is set to. To change the number, press the red button momentarily to increment it one at a time. When the display reaches 150 it will scroll back round to 010. To exit the routine, either press and hold down the red button, and after 2 seconds the display will return to FSP, or simply switch off the instrument.

ACC (ACCELERATION TIME):- This routine is used to display the current stored acceleration time, and to measure and store new acceleration times. To access this routine, press and hold down the red button, after 2 seconds the display will show the currently stored acceleration time.





To start a new acceleration measurement, press and hold down the red button, after 2 seconds the display changes to "---" indicating it is ready.

Now accelerate the car. If you are measuring acceleration from a standing start, then as soon as the wheels begin moving, the speedo will start the acceleration timer, and your road speed will be displayed along with the "REC" symbol on the top right of the display. If you measuring a mid range time (EG 30-70 MPH), then you see your road speed indicated, but the "REC" symbol will not appear until your car has reached your start speed, at which point the timer is started.

When your car has reached the programmed finish speed, the "REC" symbol will go out, and your new acceleration time will be displayed. To return to the menu at any point in this routine, press the red button momentarily and the display will change back to "ACC".

SPECIFICATIONS



INPUT VOLTAGE 8.0-16 VOLTS (working)
CONSUMPTION 10 mA @ 12 VOLTS (42 mA BACKLIT)

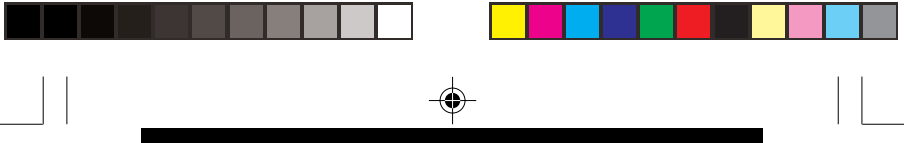
ACCURACY:- 0.05% TYPICAL
ACCELERATION TIMER 0.1 SEC +/- 0.03%
CALIBRATION:- DIGITAL
DATA STORAGE:- EEPROM
WEIGHT:- 190g INCLUDING SENSORS, CABLES, ETC
SIZE:- 50mm x 30mm x 25mm DEEP
PLUS 10mm EACH SIDE FOR MOUNTING FEET

SENSOR FIXING DIA:- 10mm

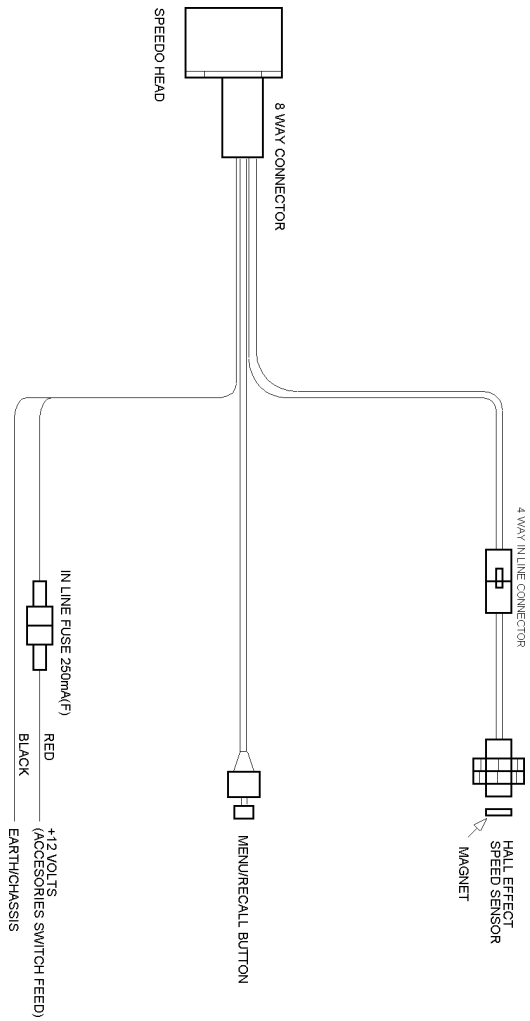
CABLE LENGTHS:- WHEEL SPEED SENSOR - 120"
POWER SUPPLY - 12"
SWITCH LEAD - 24"

ABSOLUTE MAXIMUM RATINGS:-
INPUT VOLTAGE - 18 VOLTS
SPEED 999 MPH/KMH
ODOMETER 999,999 MILES/KM
INSTRUMENT TEMPERATURE 0 - 50°C





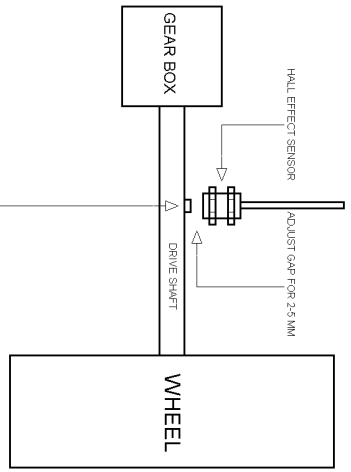
WIRING SCHEMATIC





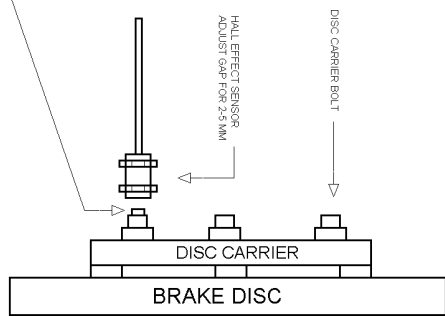
WIRING SCHEMATIC

TYPICAL CAR INSTALLATION



A SUITABLE BRACKET WILL NEED TO BE MADE FOR MOUNTING THE HALL EFFECT SENSOR. THIS SHOULD BE MOUNTED ON A NON MOVING MEMBER.

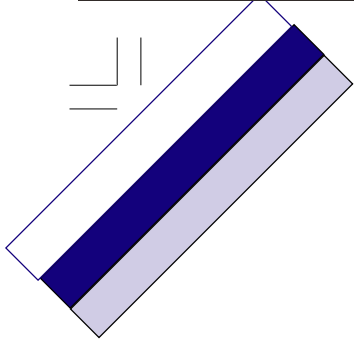
TYPICAL MOTORCYCLE INSTALLATION



DISC MAGNET
GLUE WITH NORTH POLE FACING DOWN* ON THE DRIVESHAFT. USE EPOXY GLUE TO FIX. EG ARALDITE OR PERMABOND.

* MARKED BY DIMPLE OR RED PAINT





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