

# RayTech Automotive

## SynchroKing 8 - Instruction Manual

### Application

The SynchroKing 8® is a universal vacuum synchronization/balancing tool for both carburetors and throttle valve bodies. It is suitable for any combustion engine with up to eight intake ports from cars, motorcycles, mopeds, scooters, karts, mowers and outboard engines. The SynchroKing 8® is designed to provide a compact, easy to use and economical synchronisation tool for home and workshop use. The SynchroKing 8® is primarily designed for use with engines with eight inlet manifolds but is in principle suitable for any engine with more than one intake. If not all eight ports are used, the device will automatically ignore the sensor input from the disconnected ports, making it possible to use the device on 2 through 8 manifold engines. The device comes with a set of 8 of each M5 and M6 nipples, enabling easy connection to the vacuum test ports on most vehicles

This Owner's manual must be read in conjunction with the Workshop manual of the vehicle before using the SynchroKing 8®. Before proceeding the user should as a minimum be familiar with the test ports in the manifolds, the idle adjuster screws and the balancing adjuster screws.

### Features:

1. Australian designed and manufactured.
2. High quality, robust housing.
3. Digital display for vacuum for four vacuum channels.
4. Bar displays for differential vacuum display.
5. Adjustable bar graph increment.
6. Adjustable electronic dampening.
7. Automatic active channel detection (20mmHg threshold).
8. Selectable number of active channels (8,6,4 or 2).
9. No moving parts.
10. No battery required.
11. Reverse polarity protection.
12. Auto calibration function at startup.
13. 1-year limited warranty for the original Purchaser.

### The package includes:

- 1 x SynchroKing 8® device, c/w integrated power lead
- 8 x vacuum hoses [supplied separately]
- 8 x M5 brass nipples
- 8 x M6 brass nipples
- Detailed and illustrated user manual
- 1 x pouch containing everything except the hoses

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## Device Description:

1. Main displays - The two main displays indicate the vacuum measured in the inlet manifolds in mm of mercury [mmHg].
2. Bar displays - Each bar display indicates the level of vacuum *relative* to the average vacuum in the inlet manifolds.
3. On/Off button [Only implemented on battery operated models]
4. Pushbuttons ' + ' and ' - ' Used to adjust device setting and initiate a manual re-calibration
5. Sel button - Used to cycle through manu items.
6. Power cable - Connects to the vehicle's battery to power the device.
7. Hoses - Connect to the nipples in the inlet manifolds.
8. 8 x M6 and 8 x M5 nipples - screw into the test ports of the vehicle's intake manifolds.

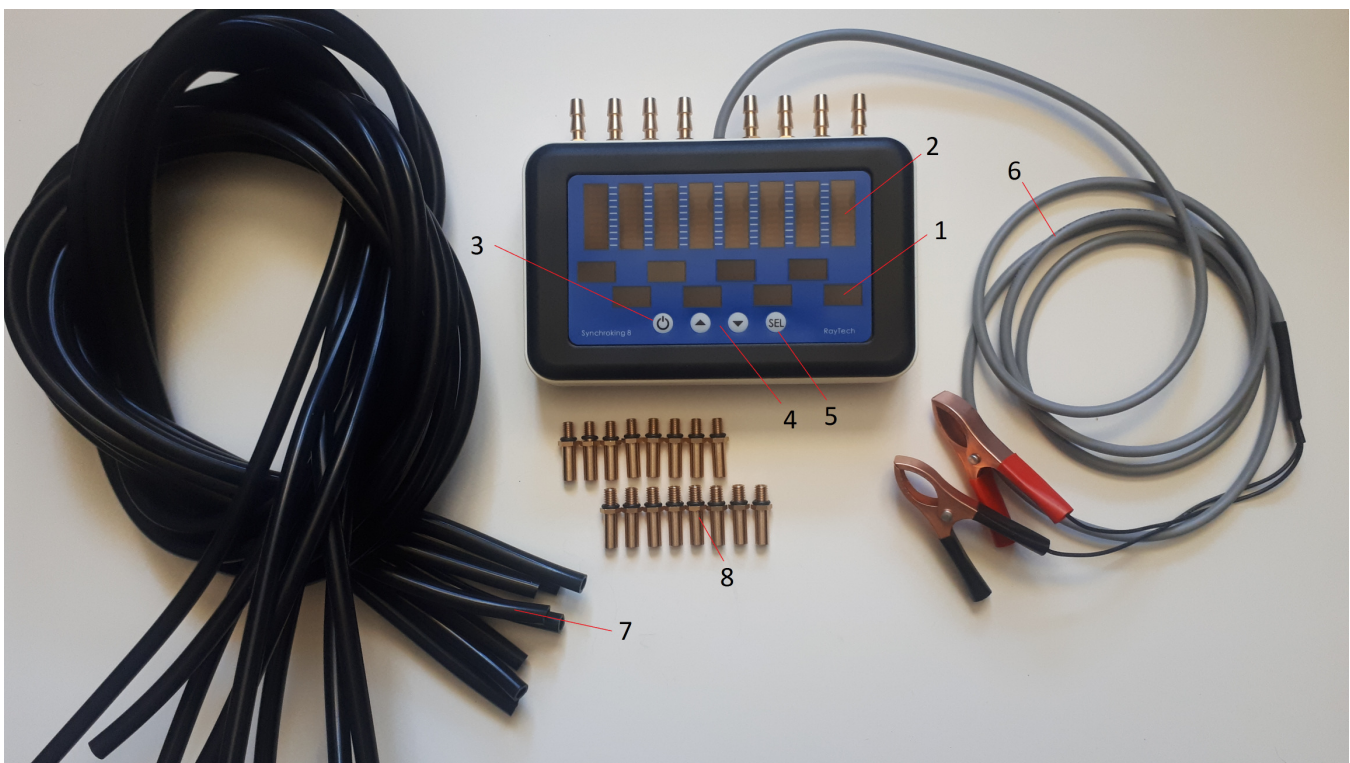
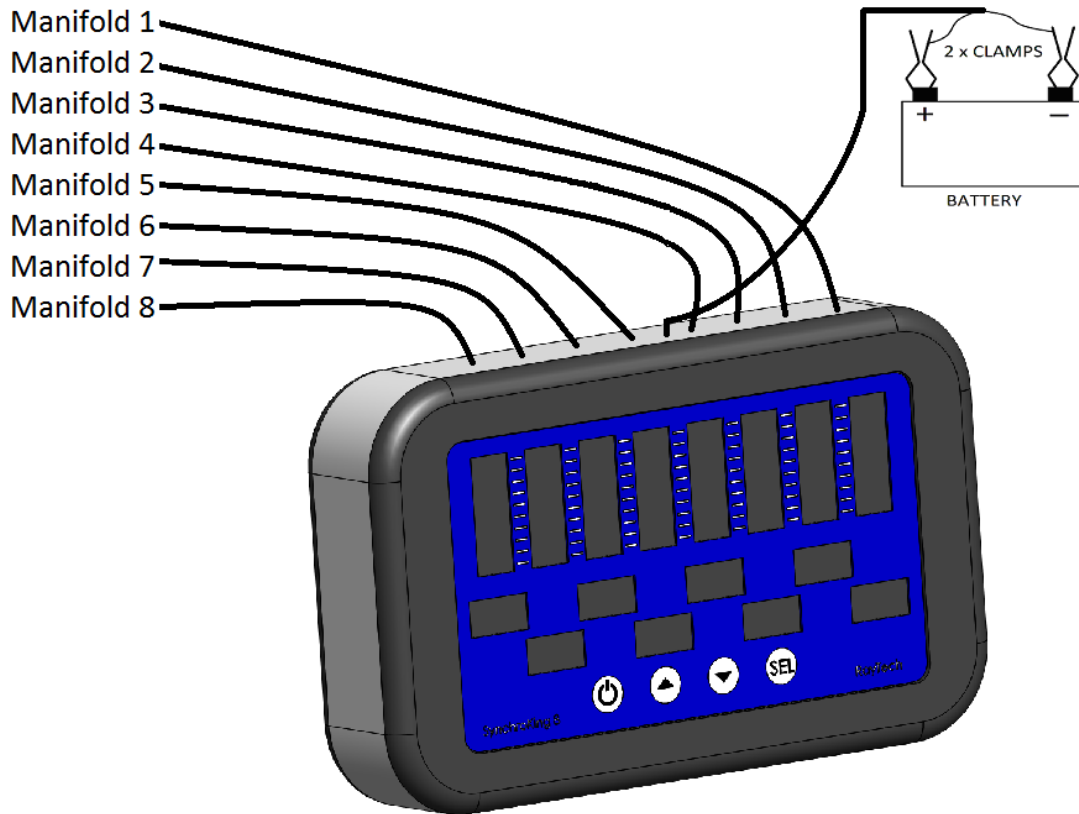


Figure 1 - Device Overview

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## Connections

Figure 2 shows the SynchroKing 8® connected to the battery and inlet manifolds



**Figure 2 - Connection Diagram**

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## Function description

### Main displays - Vacuum measurement

The SynchroKing 8® displays the vacuum of each individual channel in mmHg with a resolution of 1 mmHg. Values under 20mmHg are suppressed and the device will display ' - - - ' for any suppressed channels. If the channel is suppressed then it will be excluded from the calculation of the average value of all active channels.

### Bar Displays - Vacuum differential

The SynchroKing 8® calculates the average value of all active channels and compares the individual value of each channel to this average. The deviation from average is displayed on the bar graph of the channel. The precision of the bar graphs is user selectable between a range of 1 to 20 mmHg per increment, with a default setting of 5 mmHg per increment. See the Settings section for details

### Settings

The SynchroKing 8® is equipped with a number of adjustments that can be used to set up the device to best suit the engine characteristics. Pressing the 'Sel' button will cycle through the adjustment settings as depicted in Figure 3 below.

The devices default settings are set such that they will suit most applications without the need to make adjustments.

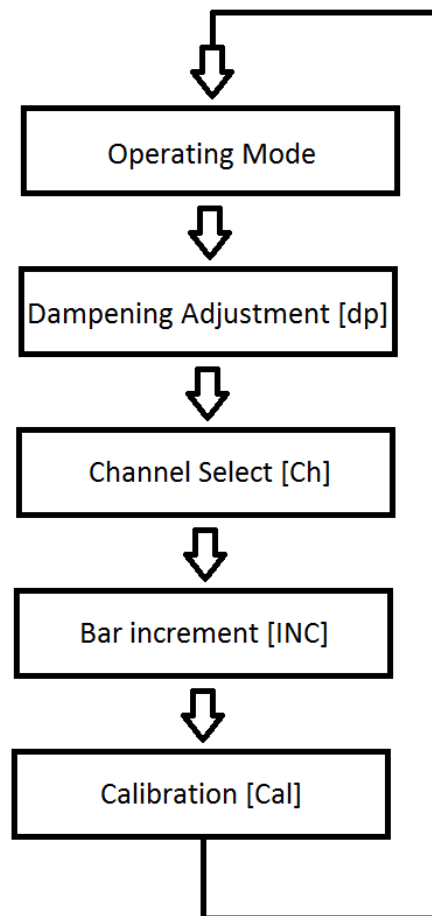


Figure 3 - Menu diagram

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### **Dampening [dp]**

The SynchroKing 8® is equipped with a dampening function to produce a meaningful and readable display of the vacuum level. The vacuum in the inlet manifold of a running engine will fluctuate which will result in a rapidly updating readout which makes it virtually impossible to read the vacuum level. (Equivalent to a rapidly bouncing needle on a conventional gauge).

To overcome this, the dampening function will store the average value of many measurements into the device memory and produce a display value based on these, resulting in a more stable readout (equivalent to a choke valve on a conventional gauge). The dampening factor is selectable in 100 increments. A higher dampening factor will result in a more stable display but reduced sensitivity and vice versa. The user should set the dampening factor such that a satisfactory balance is struck between readability and sensitivity.

At startup the device will be set at the default dampening factor of 30.

The dampening factor can be adjusted in increments of 1 by selecting 'dp' with the 'SEL' button, and pressing the 'UP' or 'DOWN' button momentarily. The dampening factor can be increased or decreased in increments of 10 by pressing and holding the 'UP' or 'DOWN' button respectively.

### **Channel Select [Ch]**

The SynchroKing 8® will automatically ignore any channels that read less than 20mmHg, so the device will operate correctly whilst connected to anywhere between 1 to 8 vacuum sources. Should the user wish to manually switch off any channels, then this can be done by selecting the 'Ch' setting using the 'SEL' button. Pressing the 'UP' or 'DOWN' buttons will cycle through 8,6,4 or 2 channel operation. The displays of the switched off channels will be turned off.

### **Bar Increment [Inc]**

The resolution of the bar graphs can be adjusted between 1 and 20mmHg per increment. Selecting a higher value will provide a broad measuring range but reduce precision and vice versa.

For instance if an increment value of 15 is selected, then the bars will operate with a 165mmHg range and 15mmHg resolution. Selecting a value of 2 will provide a 22mmHg range at a 2mmHg resolution.

Generally it is desirable to measure at the highest possible resolution but this will likely result in wild swings on the bar displays due to fluctuations that occur in any piston engine. The user should strike a balance between range and resolution to suit their application and preference.

To adjust the bar increment, press the 'SEL' button until 'Inc' is displayed. Use the 'UP' and 'DOWN' buttons to select the desired setting.

### **Calibration [Cal]**

At startup the SynchroKing 8® will perform an automatic calibration, during which the output signal of each sensor unit is baselined at zero. (Note that values below 20 are suppressed thus not showing on the display). This function ensures that each of the four sensors are referencing the same start value.

The device is also equipped with a manual calibration option. In normal operation it is not necessary to execute a manual calibration. Only in the event that the previous (auto) calibration was not successful, manual calibration is needed. Incorrect calibration occurs for instance when the pressure on one or more channels was not atmospheric during the calibration.

The manual calibration function is provided in order not to initiate a reset of the adjustments options as is the case with turning the device off and on.

To execute a manual calibration, press the 'SEL' button until 'Inc' is displayed. Then press and hold the 'UP' and 'DOWN' buttons. The No.4 display will show 'CAL'. The No.5 display will show a count down by adding a '-' to the display every one second. Calibration is complete when the

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No.3 display goes blank. Releasing either button before the cycle is complete will abort the calibration.

*Ensure that at the time of calibration, all channels are at atmospheric pressure. Vacuum or pressure being present at the time of calibration will result in incorrect measurements. It is suggested to turn the engine off and have the throttle wide open when calibrating.*

### Operation

The following paragraphs describe the generic synchronization procedure which will be applicable to most vehicles. The user should read these in conjunction with the vehicle's service manual. Some manufacturers specify specific vacuum levels.

1. Find the test port plugs in the inlet manifold test ports and remove them.
2. Select the correct size of nipple (either M5 or M6) and install them into the manifold's test ports. Apply 'snub tight' torque only, enough to compress the O-rings. Some vehicles are fitted with vacuum test port that accept the 5mm hose to be connected directly; if this is the case the nipples are unnecessary.
3. Push the hoses onto nipples, take note which manifold connects to which port on the SynchroKing 8®
4. Connect the alligator clamps to the vehicle's battery. The device will now come on-line and execute to automatic calibration. - CAUTION: Observe correct polarity and take care not to cause a short circuit.
5. The device will power up and indicate "- - -" on all displays.
6. Start the vehicle and allow the engine to warm up to normal operating temperature.
7. With the throttle fully closed, adjust, as necessary, the stationary adjuster screw on the carburettor or throttle valve body, until the bar displays equal vacuum in both inlet manifolds. (See Figure 3).
8. Adjust the 'dp' and 'rng' parameters as required. Bear in mind that increasing dampening, 'dp' will reduce bounce but reduces sensitivity and vice versa, whilst increasing the 'Inc' setting will increase range and reduce resolution of the bar graphs. *Most engines will not achieve a perfect and stable readout, the user should aim for the best practically achievable setting.*
9. After the idle balancing has been completed, proceed by slowly opening the throttle and allow the engine speed to increase to roughly 1/3 of maximum RPM. Repeat the procedure above for idling only using the balancing adjuster screw(s) - refer to the manual.
10. Re-check and re-adjust the idle and balancing screws as required and stop the engine.
11. Remove the hoses.
12. Allow the nipples to cool off and remove them from the manifolds.
13. Reinstall the test port plugs (do not forget any seals or gaskets, observe the instructions in the workshop manual).

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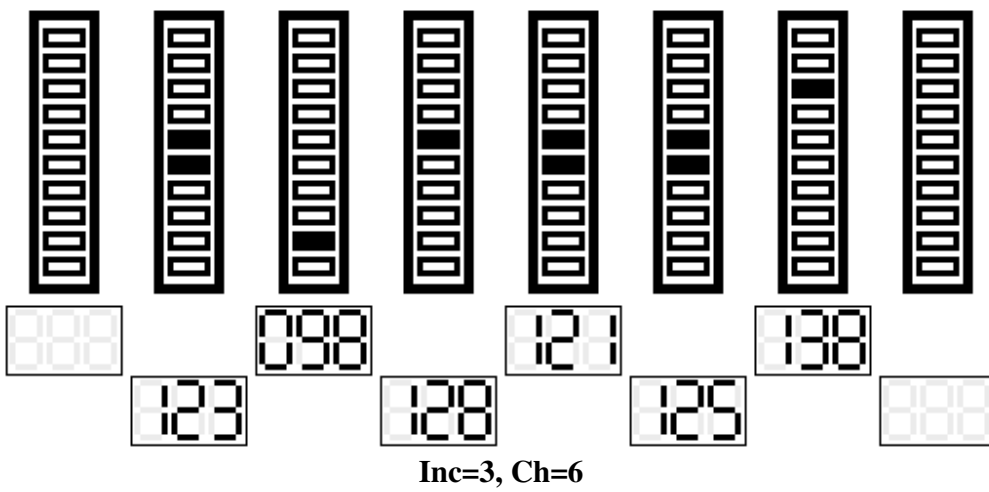
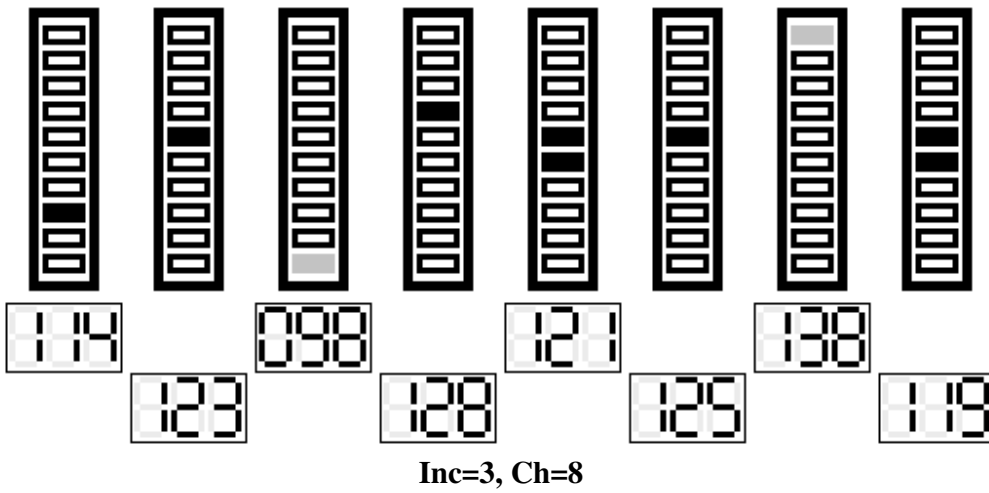
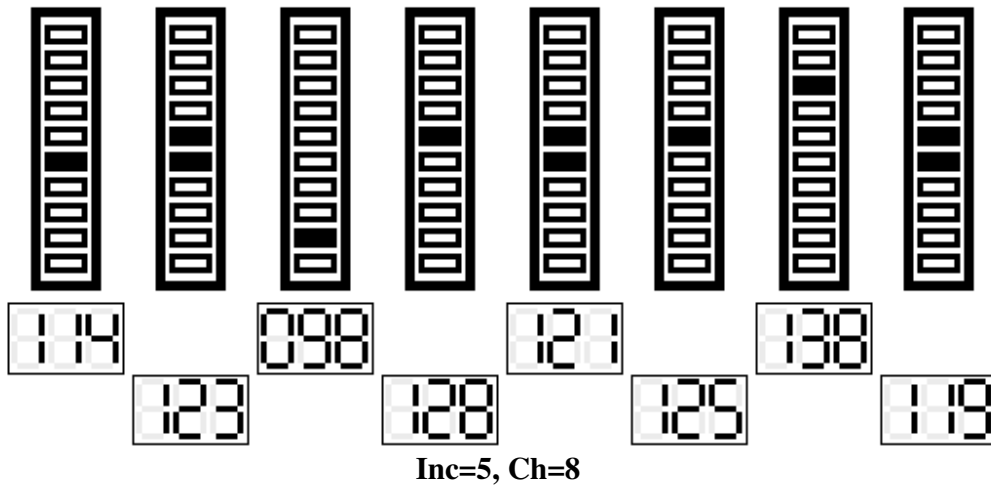


Figure 4 - Examples of readout with various settings

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**Specification**

Dimensions	160 x 120 x 32	mm
Nipple, M5 dimensions	M5, d_barb=6, L=25	mm
Nipple, M5 dimensions	M6, d_barb=6, L=25	mm
Supply Voltage Max	15	V
Supply Voltage Min	6	V
Current draw, typical	30	mA
Current draw, max	60	mA
Operating Temp, Max	50	deg C
Operating Temp, Min	-5	deg C
Measurement resolution	1	mmHg
Measurement range	0 - 400	mmHg
Typical maximum deviation between channels at 200mmHg	<2mm	mmHg

*Limited Warranty-*

*The SynchroKing 8® comes with a limited 1-year warranty for the original purchaser. RayTech will repair, replace or refund any unit found to have defects in material workmanship during this period. Any warranty claims must be submitted to raytechcontact@yahoo.com. Opening of the device will void the Warranty.*

*The customer is liable for return shipping. RayTech will pay for shipping back to the customer, only if the device has been determined to be defective by RayTech.*

*RayTech does not guarantee the fitness of its products for any purpose other than described in this manual. RayTech shall not be liable for any loss from use of the product or accidental or consequential damages.*