

**WSA - 200**  
***WASTED SPARK ADAPTOR***

**OPERATOR'S MANUAL**



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# General

The Wasted Spark Adaptor model WSA-200, is a Sun engine analyzer accessory which allows test data to be captured and displayed from engines equipped with wasted spark ignition systems.

The WSA-200 adaptor may be used in conjunction with SUN engine analyzers like MCS 2000 SL, MEA 1500 SL, MEA 1200, MCA 3000 and TECH 80.

This operator's manual provides specific instructions for using the WSA-200 in conjunction with the MEA 1500 SL, MCS 2000 SL and the TECH 80.

The WSA-200 will allow these testers to carry out diagnostic tests on vehicles equipped with a wasted spark ignition system.

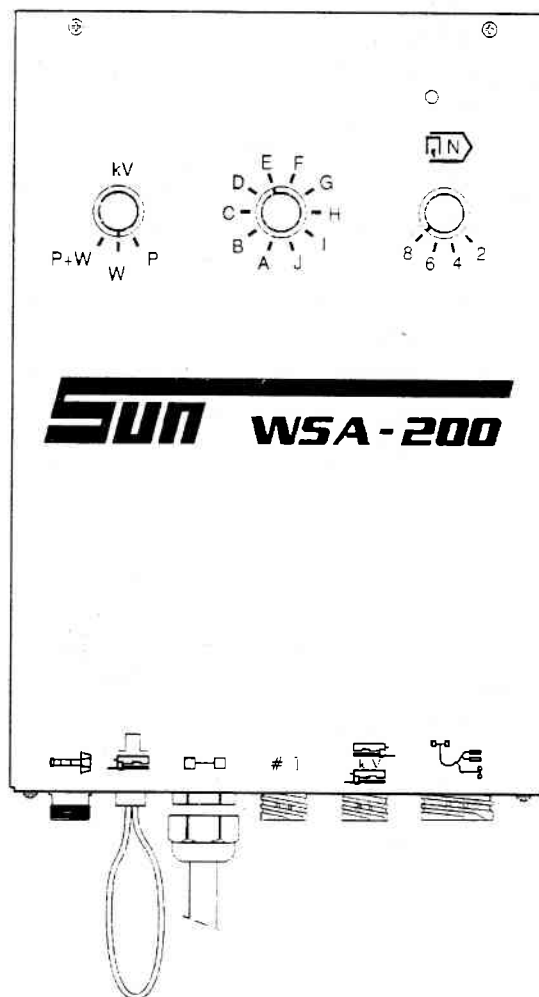


Figure 1, WSA - 200

# Safety Precautions

Read and pay attention to the safety precautions which are in the operator's manual of the host tester.

## Wasted Spark Ignition Systems Description

Many vehicles are nowadays built with ignition systems having no high voltage (secondary) distributor but instead of this the coil(s) are directly connected to the spark plugs.

Normally each coil has two outputs and therefore drives two plugs.

These double-ended coils fire pairs of cylinders simultaneously in what is called the "wasted spark" method of spark distribution.

The number of coils is equal to half the number of cylinders.

Each cylinder is paired with the cylinder opposite in the firing order:

For a 4 cylinder engine (firing order 1-3-4-2 or 1-2-4-3) pair 1 will always be cylinders 1 and 4 and pair 2 will always be cylinders 2 and 3.

When the ignition module triggers the first coil, spark plugs 1 and 4 will fire at the same time.

Cylinder No. 1 is in the compression stroke when cylinder No. 4 is in the exhaust stroke. As a result the voltage requirement to fire sparkplug number 1 is higher than the voltage requirement of sparkplug number 4.

Each spark plug fires two times, in one engine cycle. (which is two revolutions.) The first firing will be in the compression stroke, this event is called a "power" spark. The other firing of the same plug, will be near the end of an exhaust stroke, thus producing no useful effect, this event is called "wasted" spark.

Because there is one coil for two spark plugs, one sparkplug always has a positive (+) spark polarity and the other sparkplug always has a negative (-) spark polarity.

When the engine has a firing order of 1-3-4-2 the power spark polarity sequence could be - + + -.

If the leads of coil B secondary were interchanged, the engine would still run with the firing order 1-3-4-2 but the power polarity sequence would then be - - + +.

Another polarity sequence will have an effect on how the WSA-200 system type selector switch must be set (see page 8).

The spark advance and timing is based on information given by the camshaft and crankshaft sensors and fed to the ECU, which has control over the injection and the ignition timing.

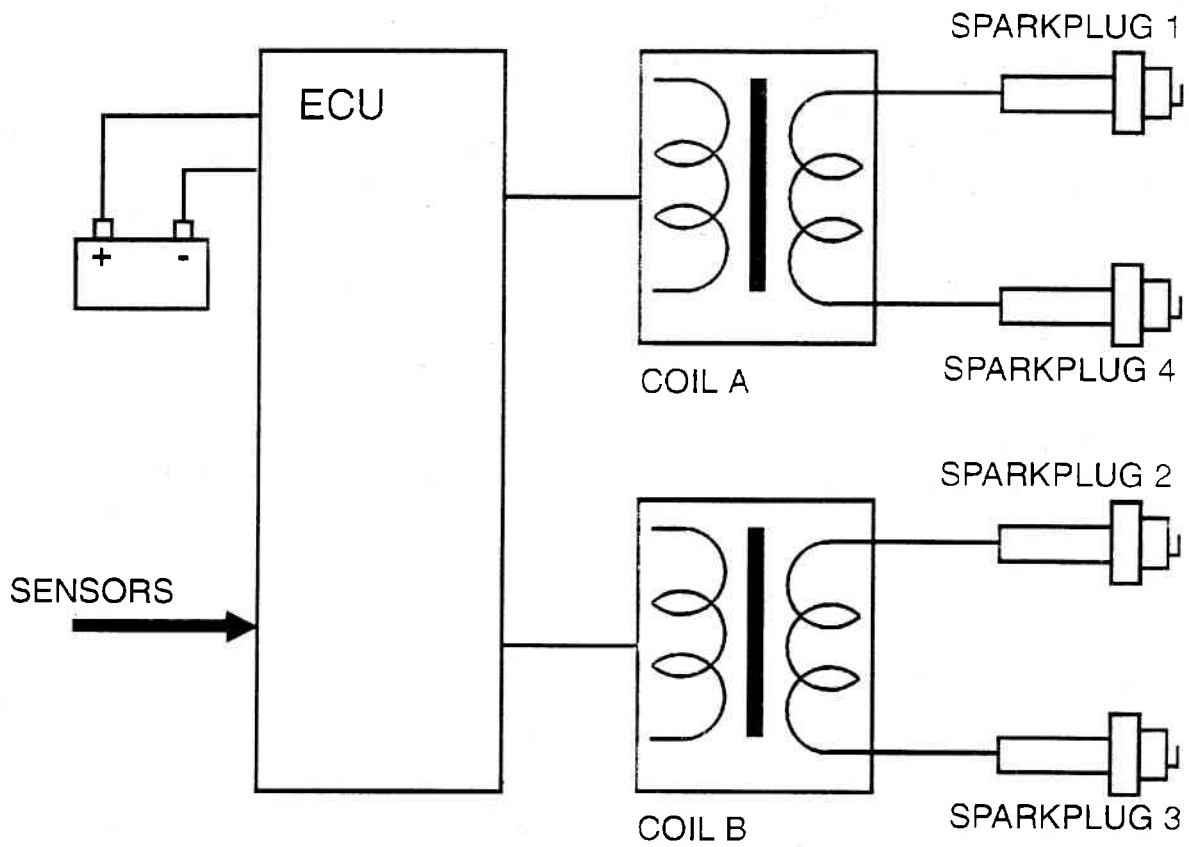


Figure 2, Typical example of a wasted spark ignition system

# Conventional Test Equipment

Conventional test equipment has one primary input and one secondary input, normally connected respectively to the single coil primary negative side and the high tension cable going from the coil to the distributor.

These signals are used to display and measure voltages of the various firing events in sequence of time, also to run a counter to enable single cylinder events to be selected for measurement or for power balance by shorting each cylinder in time.

In order to provide a reference point for the sequence, the firing of number one cylinder is taken. This signal is used to start the scope trace and reset the internal counter of the tester and also trigger the timing light.

The normal test equipment cannot receive useful primary and secondary signals from a wasted spark ignition system as described above, because there are several primary and several secondary signals on a wasted spark ignition system, none of which gives information for the whole engine.

Furthermore, sparkplug number one fires twice in every engine cycle, which would reset the tester's logic system too frequently, resulting in an incorrect RPM and timing flash reading.

Therefore it is necessary to have an adaptor which connected to the several pick-up points of the vehicle, translates these signals into a useful signal.

## Analyzer Preparation

1. Power up the tester as directed in the tester's Operator's Manual and follow the prescribed warm-up and calibration procedures.
2. Set the number of cylinders by selecting the vehicle under test or set the selector switches in the correct position.
3. Connect the tester leads to the WSA-200 as described in the following chapter.

# Controls and Connections

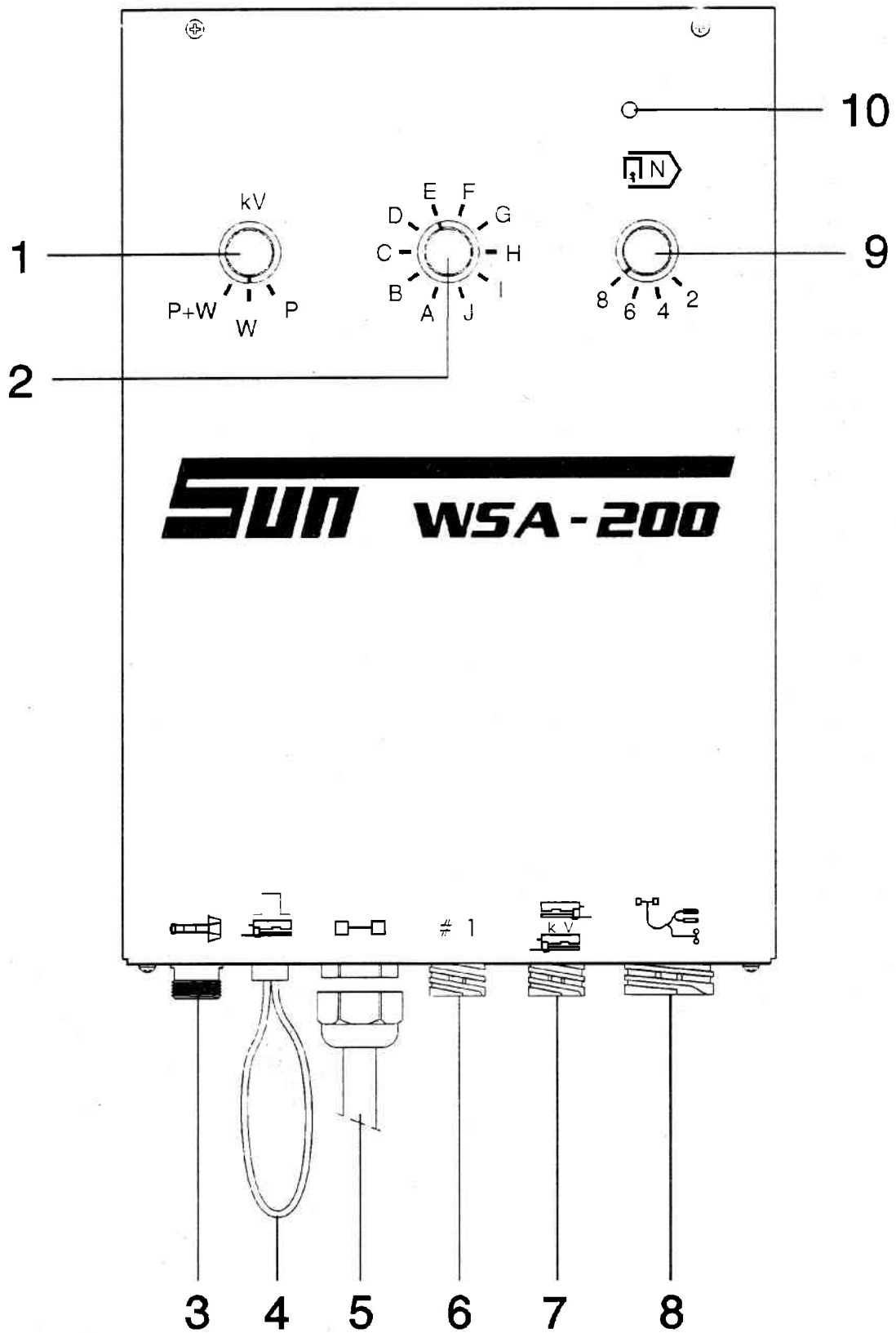


Figure 3, Controls and Connections



1. **THREE-POSITION kV DISPLAY SWITCH:**

This switch controls the mode of per cylinder kV data which is displayed graphically or digitally, depending on the engine analyzer capabilities. The three positions are ADDED (P+W), WASTED (W) and POWER (P).

2. **TEN POSITION SYSTEM TYPE SWITCH:**

The switch positions are marked alphabetically to match every possible type of wasted spark engine system. The switch must be moved to the correct position for each engine system type.

3. **PATTERN LEAD CONNECTOR:**

Remove the chrome pattern pick-up from the pattern lead by turning it loose, and connect the pattern lead to the WSA-200.

4. **TRIGGER LEAD CONNECTOR:**

Clamp the RED trigger from the tester around the trigger pick-up loop on the WSA-200. The tester will pick-up the signal of the first cylinder from this loop.

5. **UNIVERSAL HARNESS**

Remove the universal harness from the host tester and put the WSA-200 universal harness in it's place.

6. **TRIGGER PICK-UP (6004E9312-25)**

If it is not possible to connect the primary lead (see 8), connect the first cylinder pick-up to one of the spark plug leads of the coil which fires sparkplug No 1.

7. **SECONDARY PATTERN CLAMP CONNECTOR: (6004E9312-23)**

Refer to the WSA-200 application bulletin to know which spark plug leads must be put in the pick-up which is connected with the red lead. The remaining spark plug leads must be put in the second pick-up. Make sure that the spark plug leads are not crossed, as the WSA-200 will be confused.

**NOTE :** Never put two spark plug leads of one coil in the same pick-up.

**NOTE:** Each secondary pick-up has a spring lock which opens the pick-up when its button is moved backwards. This enables the jaws to be snapped shut with the fingers when clamping the pick-up. Both secondary pick-ups must be closed tightly around each set of spark plug leads, to ensure an accurate and consistent sensing of each cylinder's secondary signal. Also, the leads should be parallel, not crossed. Make sure that the spark plug lead of the first cylinder is positioned in the clamp on the red lead.

## 8. EXTENSION CABLE : (6004E9312-22)

Connect battery clips onto the vehicle battery.  
If it is possible, remove vehicle primary connector and place the WSA primary T-connection in series with the vehicle circuit.

- NOTE: If the primary lead connection is not connected to the vehicle, the WSA-200 will still function except for the following :
- The dwell cannot be measured.
  - It is not possible to do a power balance test (cylinder shorting is not possible).
  - For a starttest it is necessary to disable the injection system.

If possible, connect the mag timing probe (see figure 4).

## 9. CYLINDER SELECTOR :

The switch must be set in the correct position for the vehicle under test (2,4,6 or 8 cyl. types).

## 10. POWER INDICATOR LIGHT

The WSA-200 is powered from the vehicle's battery. The power indicator light indicates whether or not the WSA-200 is on.

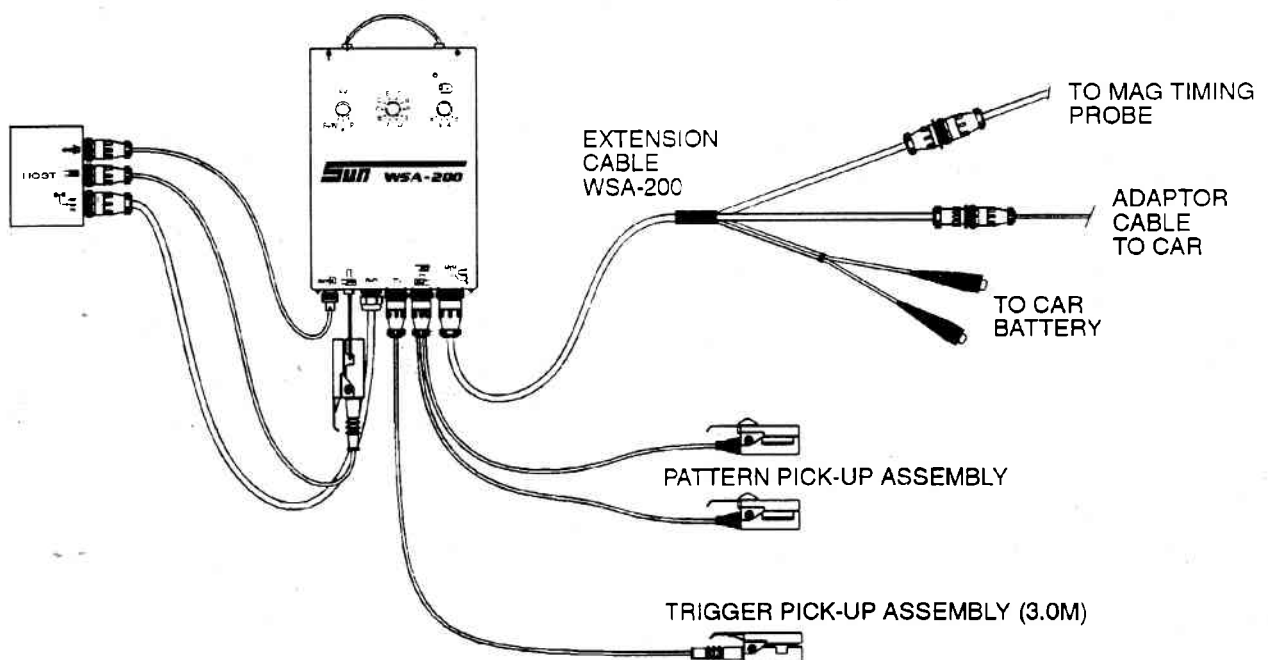
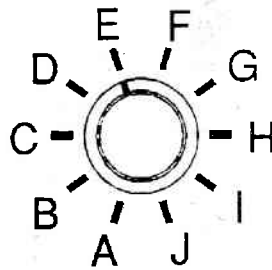


Figure 4, Hook-up

# System type selector switch

Because the construction of the wasted spark ignition systems is not always the same, the WSA-200 should be able to adapt to different types of systems. Also when two sparkplug leads of an ignition coil are interchanged, the WSA-200 must still be able to give good test results. For this reason, the WSA-200 is provided with a system type selector switch.



The position in which the selector switch must be set is mentioned in the WSA-200 application bulletin for each known engine type. A few examples are given on page 14. If the engine which you want to test is not in this list or the given position does not give correct test results, you can determine the correct position yourself (see the procedure below). If the position given in the list is not correct, it is possible that two spark plug leads of one coil are interchanged.

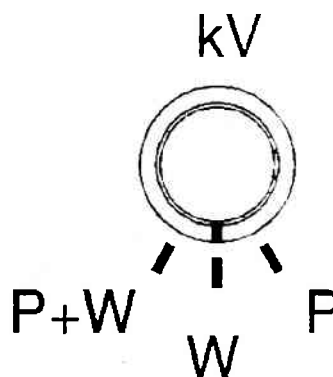
## Position determining procedure

1. Connect the WSA-200 as described in "Controls and Connections"
2. Refer to the Operator's manual of the host tester to set the ignition scope to show the secondary ignition pattern in parade.
3. Set the kV selector switch in the P+W position.
4. Try each position and look for a number of correct and positive firing lines. The number of lines are equal to the number of cylinders. You should find two positions where this applies.
5. Set the kV selector switch in the P position and try the found positions, now only one position will give a correct pattern.

# kV Selector Switch

The kV selector switch is used for correct diagnosis of the secondary circuit. The following positions are possible with the kV selector :

1. P (power) position  
In the P position, the voltages (in kV) of the power stroke are measured. It is used to observe the firing peak kV. If the firing peak kV it is not in the specified limits, this can be caused by a wrong air/fuel ratio, temperature, compression or ignition timing.
2. W (wasted) position  
In the W position, the firing voltages of the exhaust stroke of the engine are measured. It is used to measure firing voltages under low pressure circumstances in the cylinder and will therefore give information about the spark plug gap and any other gap in the secondary circuit.
3. P+W (added) position  
Each coil delivers a power and a wasted spark simultaneously. In the P+W position, the two signals of these sparks are added. It is used to judge the total energy delivered by one coil. Furthermore this position makes it possible to observe the firing line and the spark duration. This can indicate that the resistance in the sparkplug lead or in the spark plug is too high.



# Testing with MEA 1500 SL

## TEST PREPARATION

- a. Hook-up the test leads as described in Controls and Connections
- b. Set the controls of the MEA 1500 SL to adapt to the engine you want to test.
- c. Refer to the MEA 1500 SL Operator's manual for testing. In which position of the KV selector switch you can diagnose certain things is described on page 9 of this book.

## SCOPE TESTING

Scope testing with the MEA 1500 SL is performed with the ignition oscilloscope. The secondary circuit waveform may be observed in the display, superimposed, or raster modes, with or without five millisecond sweep, selectable with the scope control keys.

Additionally, scope patterns in display, superimposed or raster modes may be viewed in the **ADDED**, **POWER** and **WASTED** modes of KV display, selectable with the WSA-200 kV selector switch.

(For scope diagnosis refer to the MEA 1500 SL Operator's manual and page 9 of this manual.)

**NOTE:** The sum of the individual **POWER** and the **WASTED** firing kV readings are generally **greater** than the displayed **ADDED** firing kV readings. This is a known phenomenon which will not influence the diagnostic value of the signal.



# Testing with MCS 2000 SL

## TEST PREPARATION WITH LIMIT DISK

- a. Hook-up the test leads as described in Controls and Connections.
- b. To work with the WSA-200 it is best to use a vehicle specific limit disk (V 5.25 or higher) in conjunction with the required system disk. (The required version of the system disk is printed on the limit disk.
- c. Follow the instructions which are given on the screen.

## TEST PREPARATION WITH SYSTEM DISK ONLY

- a. Hook-up the test leads as described in Controls and Connections
- b. Use a system disk (V 5.2x or higher)
- c. Refer to the MCS 2000 SL Operator's manual for testing. In which position of the KV selector switch you can diagnose certain things is described on page 9 of this book.

## SCOPE TESTING

Scope testing with the MCS 2000 SL is performed with the scope, enabling firing voltage, dwell and other critical information to be observed graphically.

The MCS 2000 SL is able to show scope patterns in :

- Parade.
- One cylinder (5 ms).
- All cylinders one by one (5ms).
- All cylinders one by one (100%).

These patterns may be viewed in the ADDED, POWER and WASTED modes of kV display, selectable with the WSA-200 kV selector switch.

**NOTE:** The sum of the individual POWER and the WASTED firing kV readings are generally greater than the displayed ADDED firing kV readings. This is a known phenomenon which will not influence the diagnostic value of the signal.

# Testing with TECH 80

## TEST PREPARATION

- a. Hook-up the test leads as described in Controls and Connections.
- b. To work with the WSA-200 the tester needs a vehicle specific limit disk (V 5.25 or higher) in conjunction with the required system disk. (The required version of the system disk is printed on the limit disk.
- c. Follow the instructions which are given on the screen.

## SCOPE TESTING

Scope testing with the TECH 80 is performed with the scope, enabling firing voltage, dwell and other critical information to be observed graphically.

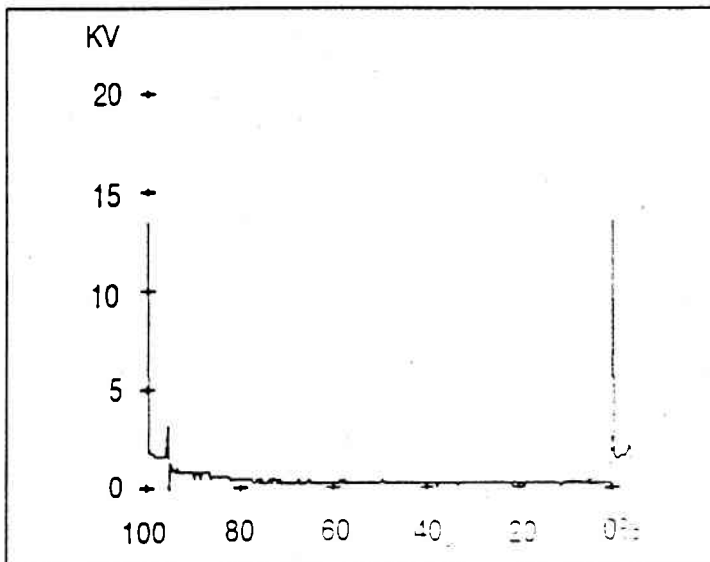
The TECH 80 is able to show scope patterns in :

- Parade.
- One cylinder (5 ms).
- All cylinders one by one (5ms).
- All cylinders one by one (100%).

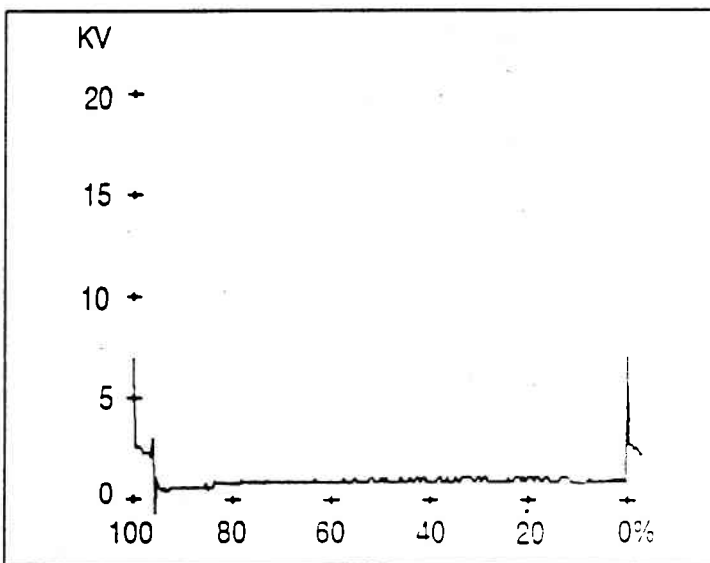
These patterns may be viewed in the ADDED, POWER and WASTED modes of kV display, selectable with the WSA-200 kV selector switch.

**NOTE:** The sum of the individual POWER and the WASTED firing kV readings are generally greater than the displayed ADDED firing kV readings. This is a known phenomenon which will not influence the diagnostic value of the signal.

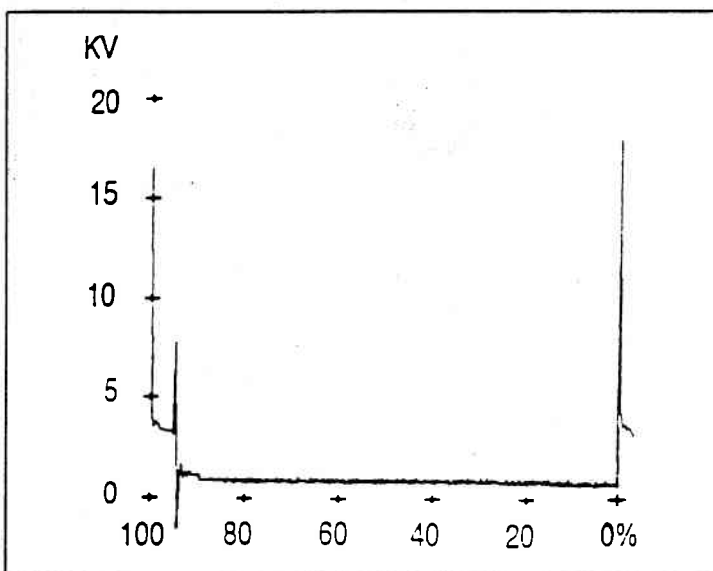
# Typical examples of scope patterns



This is a typical example of a secondary scope pattern measured with the WSA 200 kV selector switch in the P position.



This is a typical example of a secondary scope pattern measured with the WSA 200 kV selector switch in the W position.



This is a typical example of a secondary scope pattern measured with the WSA 200 kV selector switch in the P+W position.

# Example of engine type selector switch positions

Make	Model	Type/Engine	Firing order	clamp on red lead	Position	Part number of adaptor cable
Opel	Astra	C18XE	1342	1-3	E	6004E9311-69
Opel	Vectra	C25XE	123456	1-3-5	A	6004E9311-93
Opel	Corsa-B	C14SE	1342	1-2	H	secondary only
Opel	Monterey		123456	1-3-5	D	secondary only

## Description of the WSA-200 kit

The WSA kit contains :

- WSA (7009E9318-11)
- Extension cable (6004E9312-22)
- Pattern pick-up assy (6004E9312-23)
- Trigger pick-up assy (6004E9312-25)
- Operator's manual (0692E9309-83)
- Application bulletin (0692E9309-86)

## Options

Different primary adaptor cables are available for different engines. Refer to the application bulletin for the partnumber of the correct cable.



Part No: 0692E9309-83 Rev: A

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