

Rex's Speed Shop

Guide Y-1 SR400 & SR500 Classic Models CDi Electronic Ignition Troubleshooting Guide



Introduction

The Yamaha SR400 and SR500 are among the best known of Yamaha's big single-cylinder motorcycles, the SR500 in particular has become an iconic Japanese thumper, valued for its simplicity, character and traditional styling.

Rex's Speed Shop specialises in ignition and charging systems for classic Yamaha SR400 and SR500 models, including testing, overhaul and manufacture of replacement components.

This guide covers the earlier SR400 and SR500 ignition systems. These 'Classic' models have an 8 wire CDi unit, found on models from 1978 to around 1993, although some markets had this system until 1995. It does not cover models with 11 or more wire CDi units, or fuel-injected SR400 EFI models. CDi units are not testable without very special equipment, so our focus is on the rest of the system that can be easily assessed and tested by mechanics.

A simple plug-in replacement unit or partial rewind of just one part of the stator may have been all that was required to restore a relatively new ignition system. Systems 30 years or older often require a more holistic approach to restore reliable operation. This often involves an electrical equivalent of a full engine rebuild, from the generator up.

This guide supplements the Yamaha workshop manual and assumes the person carrying out the tests is competent to use a good quality multimeter and interpret the results.

Start with the Basics

Before testing the ignition system, replace the spark plug and plug cap, don't assume they are good. Check the wiring and connections and rule out basic fuel or mechanical problems.

Define the fault:

- Runs with excess advance/retard or timing so far out of range the engine will not start?
- No spark?
- Difficult starting or only starts by bump starting?
- Misfire when hot?
- Misfire under load?
- Intermittent spark?
- Did the fault change, or the ignition stopped after fitting another CDi unit?
- Is the spark yellow or orange rather than whitish-blue?

These symptoms help determine where to test next.

A Rex's Rewind ~ Defining the Standard



Much of the equipment we deal with is now more than 30 years old and well beyond its intended design life. Age-degraded electrical insulation is one of the most common causes of stator failure.

First the stator is stripped of all copper and insulation material under controlled conditions so that its magnetic properties are not degraded. Replacing insulation before new winding wire is applied is an essential part of the rewinding process, not an optional extra. Careful replacement of the winding to exact OEM specification ensures maximum output and lifespan of the overhauled part.

SR Stators, Flywheels & CDi Units Form Matched Sets

SR400 and SR500 stators, flywheels and CDi units may be physically interchangeable and identical at first glance, but they must be used as a correctly matched set. Mixing components from different ignition versions can result in excessively advanced/retarded timing, causing serious engine overheating, poor running or an engine that simply will not run.

This is particularly common with bikes assembled from boxes of parts, or where a stator, flywheel or CDi unit has previously been replaced with one from another machine. This can be extremely difficult to diagnose because everything appears to fit correctly. Bikes have been dismantled or scrapped because of problems caused simply by mismatched ignition components.

If an SR will not run or the ignition timing cannot be set correctly, please contact our technicians and send clear photos showing:

- The number on the flywheel
- The stator installed on the engine
- The CDi unit and its part number

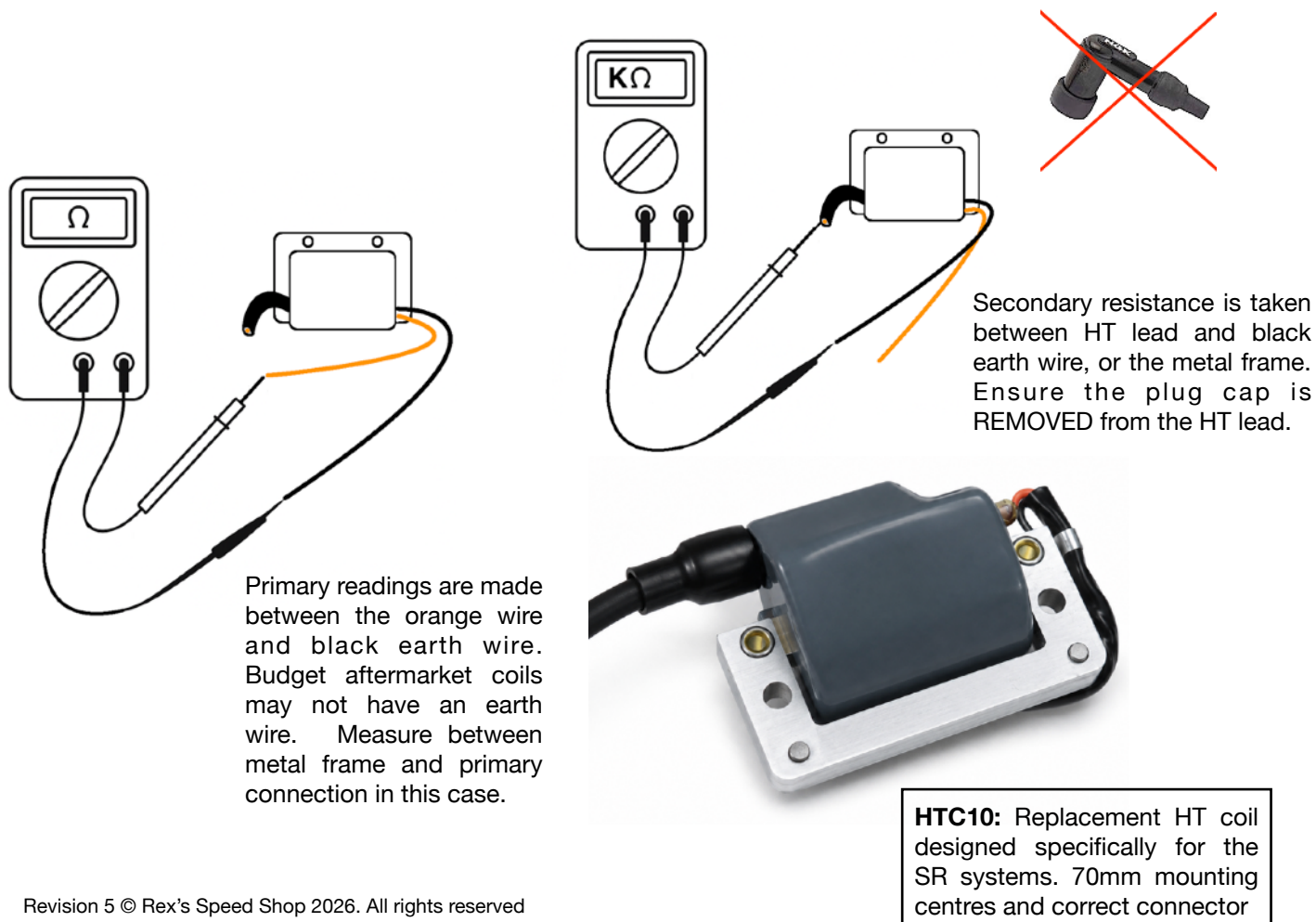
We can then confirm whether the components form a correctly matched set or not and advise on the best course of action.

Test 1. No Sparks - HT Coil

The HT coil is located under the fuel tank. The shop manual specifies $0.98\ \Omega$ primary and $12\ \text{K}\Omega$ secondary. Aftermarket and later Yamaha coils may differ from these figures, so exact readings are less important than sensible, stable results.

The Yamaha workshop manual describes the full test procedure if further information is required. The HT coil must be used with a $5\ \text{K}\Omega$ spark plug cap, which must be removed while testing.

A coil that is open circuit, gives an unstable reading or is drastically out of range should be considered faulty.

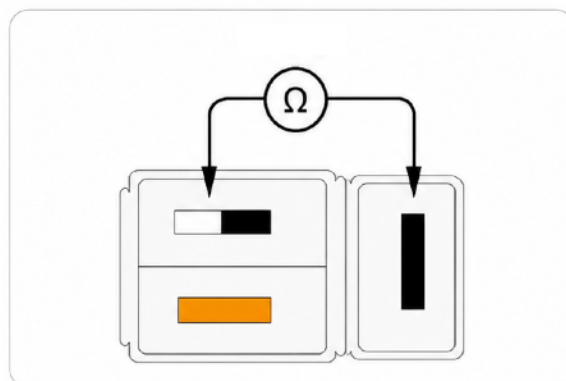


Test 2. No Sparks - Kill Circuit

The SR400/500 has both an ignition switch and an engine kill switch. Either switch can prevent the CDi unit from producing a spark. A simple way to test both switches is to locate the CDi unit on the left side of the motorcycle, near the battery, and disconnect its three-pin connector. Carry out the following tests on the motorcycle wiring side of the connector, not the CDi unit.

Using a multimeter set to continuity, test between the black/white wire and black wire:

- With either the ignition switch OFF or kill switch OFF, there should be a good, solid connection.
- With the ignition switch ON and kill switch set to RUN, there must be no connection.



If continuity remains when both switches are in the running position, there is a fault in the kill circuit which will prevent the CDi from producing a spark. Check the switches and wiring to clear any fault.

Still No Fix? In-depth Stator Checks

The stator contains dedicated windings that power and trigger the CDi unit. These are completely separate from the much heavier windings used for lighting and battery charging.

Taking the age of the parts into consideration is now important when diagnosing these systems. Original stators are more than 30 years old - well beyond their expected design life and deterioration of these components is now extremely common and can manifest in a number of ways.

CDi units are simple to replace but cannot be tested without specialist equipment. Never connect the CDi unit, or an HT coil connected to it, to DC power from the bike's battery or charging system. Doing so will cause its immediate failure.

Inspecting the stator

Having completed the initial checks, the next step is a careful visual inspection of the stator. Pay particular attention to the wiring leaving the stator. Electrical stress and temperature in this area are high, so the generator wiring must be in first class condition, with no joins, repairs or hard and brittle insulation. Corroded, loose or unsuitable connectors are unacceptable in this high stress area of the wiring.

Look carefully for mechanical damage to the windings and deterioration of the insulation. Discolouration or flaking of the coating on the windings is a warning sign. If the insulation appears burnt, brittle or readily comes away, the stator has deteriorated and should not be considered serviceable.

If no obvious faults are found, the next step is to measure the resistance of the individual CDi source and trigger windings. These are divided into high and low speed source windings that power the CDi unit and high and low speed trigger windings that give the timing advance.

The resistance measurements are taken via the 6 way socket on the stator lead using a professional level multimeter. Use the form at the end of this guide to record all your readings.

In production since 2008, Rex's replacement CDi units have earned respect with owners worldwide. (Standard model shown.)



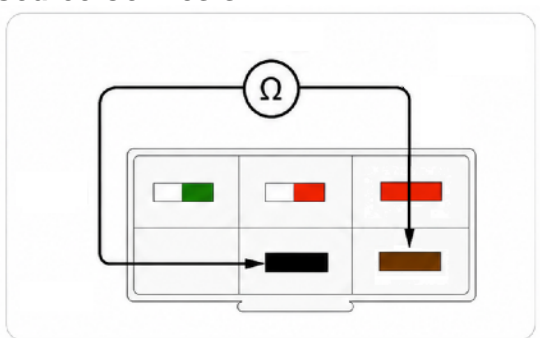
XB05F: Correct plug cap for SR & XT models. This system requires a 5KΩ resistor in the cap

Advice When Taking Winding Resistance Readings

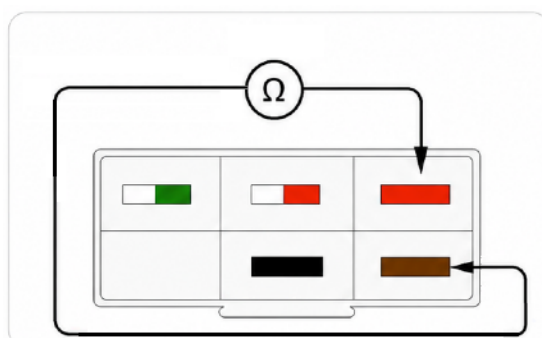
The manual gives the winding resistances at 20 degrees C, but suggests accepting a large tolerance of 30% on all measured coil resistance readings. This is entirely misleading as copper wire changes its resistance predictably with temperature. It is possible to accurately calculate the resistance/temperature variation of copper wire, then remove this large tolerance, which is a very large grey area, from your readings. CDI windings are precision components, so once ambient temperature has been accounted for, any significant difference between the specification and measured value is a clear warning that the coil has a wire fault. In reality, only a very small tolerance is allowable, but due to copper being highly temperature-sensitive and meters varying slightly in accuracy small variations of up to 2% are normal. Once the discrepancy reaches 5% or more, the winding should be considered faulty, especially if it is more than 20 years old. Additionally, any winding that gives no reading, or one that does not remain steady, has also failed.

Take the following readings via the stator's 6 way connector and write them down. Note the ambient temperature too. The ambient temperature correction chart (given below) indicates a good reading at different temperatures, removing temperature error.

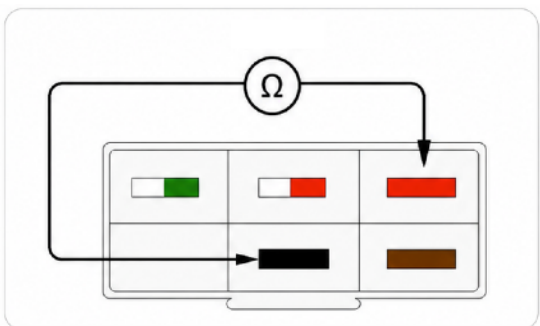
Source Coil Tests



Test 3: Black to Brown



Test 4: Brown to Red



Test 5: Black to Red

Original Specifications at 20°C

Source Coils

Test 3: Low Speed Source - Black to Brown: 329Ω

Test 4: High Speed Source - Brown to Red: 5Ω

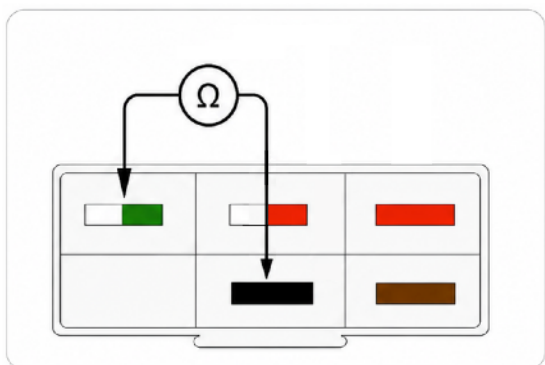
Test 5: Source Coil Integrity - Black to Red: 334Ω

Trigger Coils (Pick-ups)

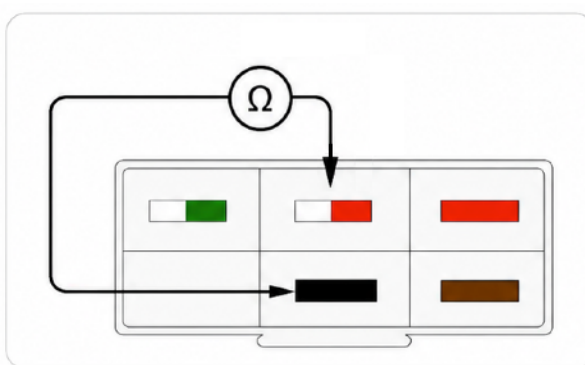
Test 6: Low Speed - White/green to black: 87Ω

Test 7: Advance/High Speed White/red to black 16Ω

Trigger Coil Checks (Pick-ups)



Test 6: White/Green to Black



Test 7: White/Red to Black

Interpreting your Readings

First, compile your readings so the data is easy to assess and compare to the 'look-up' table which shows the acceptable range at a particular temperature. Tests 3, 4, 6 & 7 are where temperature compensation is important, test 5 is simply a 'back check' to confirm integrity of the internal source winding interconnections, so should always equal the total of tests 3 & 4.

The engine must not have been run for several hours, ensure it has cooled to the ambient temperature, also make an accurate note of the temperature at the motorcycle's location.

Ambient Temperature:		C or F (please circle)	
TEST	ITEM UNDER TEST	YOUR RESULTS	
Test 1	HT Coil - Cap REMOVED 1978 Yamaha 0.98Ω/12KΩ	Primary - Ω	
		Secondary - K Ω	
Test 2	Kill Switch - Resistance between Black & Black/white wire at the 3 way plug. Confirm continuity or if none.	Ign ON + Kill set to RUN	
		Either Ign or Kill Set to OFF	
Test 3	Low speed source	Black to Brown	
Test 4	High Speed Source	Brown to Red	
Test 5	Source coil interconnection integrity	Black to Red	
Test 6	Low speed trigger	Black to White/green	
Test 7	Advance/high speed trigger	Black to White/red	

It can get quite complicated at this point, if you'd like us to interpret this data for you please e-mail: tech@rexs-speedshop.com.

A clear photo of this page, once filled out with your data, is a good way of getting this to us.

If Yamaha were publishing these specifications today, we believe the resistance table would look more like this once copper temperature is taken into account:

Ambient Temp °C	Test 3 Pass Range	Test 4 Pass Range	Test 6 Pass Range	Test 7 Pass Range
-10	284 - 296Ω	4.3 - 4.5Ω	75 - 78Ω	13.8 - 14.4Ω
-5	291 - 302Ω	4.4 - 4.6Ω	77 - 80Ω	14.1 - 14.7Ω
0	297 - 309Ω	4.5 - 4.7Ω	79 - 82Ω	14.5 - 15.0Ω
5	303 - 315Ω	4.6 - 4.8 Ω	80 - 84Ω	14.8 - 15.4Ω
10	310 - 322Ω	4.7 - 4.9Ω	82 - 85Ω	15 - 15.7Ω
15	316 - 329Ω	4.8 - 5.0Ω	84 - 87Ω	15.4 - 16Ω
20	322 - 336Ω	4.9 - 5.1Ω	85 - 89Ω	15.7 - 16.3Ω
25	329 - 342Ω	5.0 - 5.2Ω	87 - 90Ω	16.0 - 16.6Ω
30	335 - 349Ω	5.1 - 5.3Ω	89 - 92Ω	16.3 - 17Ω
35	341 - 355Ω	5.2 - 5.4Ω	90 - 94Ω	16.6 - 17.3Ω
40	348 - 362Ω	5.3 - 5.5Ω	92 - 96Ω	16.9 - 17.6Ω

Conclusion

Resistance measurements show if the wire resistance within a winding is the same as when it was newly made. This can help show whether the tightly packed turns of fine wire are still properly insulated from one another. If that insulation begins to fail, adjacent turns can become shorted together, reducing the effective resistance of the winding.

The seemingly random symptoms of CDI ignition failure are caused by the random way insulation breaks down. There is a possibility that the winding resistance can be perfect, yet the winding is leaking its power to the stator core. This fault does not show on a multimeter test, however it does show up with the application of heat and load.

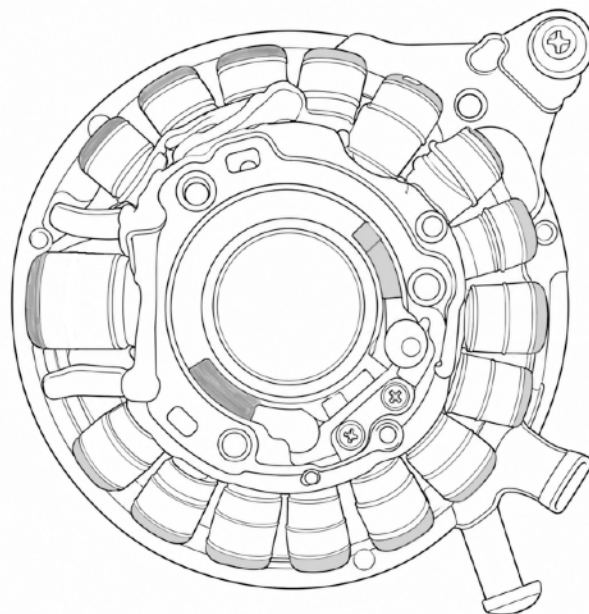
Age, heat and high voltage can all cause electrical insulation to deteriorate, much as mechanical parts inside an engine gradually wear as the engine is used. The difference here is electrical components can also deteriorate simply through age, even when they have seen little or no use. In electrical components, this deterioration may show up as shorted turns, leakage to earth, or other changes in resistance.

If your stator gives perfect, stable resistance readings but the bike still does not run properly, look further for other symptoms. Does the fault worsen when the bike is hot? Is there a mysterious misfire or problems only under load? Is the bike difficult to start, perhaps needing bump starting? Has fitting a new CDI caused it to stop working altogether? New CDI units load the windings to their full design power, charging much faster and to a higher voltage than an old CDI can achieve, which highlights weaknesses in ageing windings. If heat or load triggers problems, this strongly indicates insulation failure that a multimeter test may not always detect.

Please note that we are not responsible for misdiagnosis of your motorcycle's ignition faults, so where brand new parts are returned for re-testing our standard test fees apply. This guide highlights the problems you are likely to encounter when fitting new parts to aged systems that are beyond their useful life expectancy.

If you find off-specification resistances or suspect failing insulation, the cure is usually to have the generator overhauled back to its 'as new' specification. Our workshops have full facilities to overhaul stators and are happy to advise before you send parts to us for work.

We stock a wide range of SR500 parts from Kedo



Special Edition CDI unit.

Thoroughly tried and tested electronics mounted in a much improved case. Visually similar to the original unit. Made in UK.

