Rex's Speed Shop

Guide Y-2 XT500 G & H American Market Models

CDi Electronic Ignition Troubleshooting Guide

Introduction

The Yamaha XT500 is perhaps one of the best known of Yamaha's big single-cylinder motorcycles, an iconic Japanese thumper, valued for its simplicity, character and traditional styling. The vast majority came with points ignition, finding one with factory CDi ignition is rare.

Rex's Speed Shop specialises in ignition and charging systems for classic Yamaha XT500, SR400 and SR500 models, including testing, overhaul and manufacture of replacement components.

This guide covers only the American market models, G & H produced for 1980 and 1981 respectively. It does not cover points ignition bikes that have been converted to electronic ignition, for example by fitting one of our electronic ignition kits. 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. These systems are now 45 years or older and 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:

- 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.

Rex's Rewinds (SR500 Stator Shown)

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.

XT500 & Poor Starting
Before looking more deeply into the ignition system, it is worth addressing a commonly asked question: is the ignition causing a starting problem? It certainly can be, but experience with the XT500 suggests that ignition faults are not always the cause of difficult starting. On many occasions we have started a customer's supposedly difficult XT with a single operation of the kick starter, much to the surprise of its owner. This demonstrates that other factors should be checked before investigating the ignition system in detail.

Correct valve clearances and carburettor settings are particularly important. These should be checked and adjusted as suggested in the shop manual before assuming that an ignition fault is responsible. A correctly set up XT500, including points ignition models, should normally start readily. Two particularly common causes of difficult starting are:

Incorrect idle mixture
An idle mixture that has been deliberately set too rich can make the engine considerably more difficult to start, especially when the engine is hot. Set the mixture correctly using the procedure described in the Yamaha workshop manual before carrying out further ignition tests.

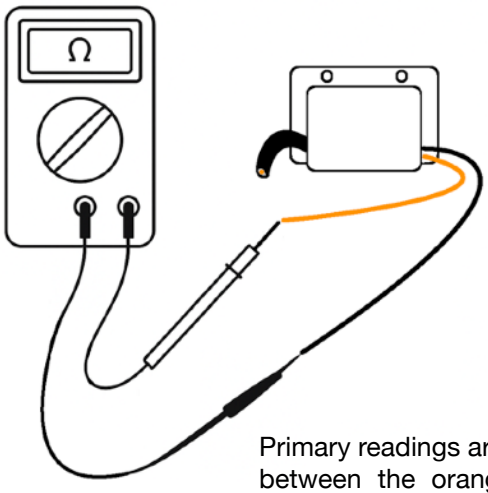
Starting technique
Starting technique can make a surprisingly large difference. If possible, speak to experienced XT owners whose machines start reliably and compare the procedure they use. Learning and consistently applying the correct technique can transform starting behaviour.

Having addressed these issues, let's now look at common ignition system faults and causes.

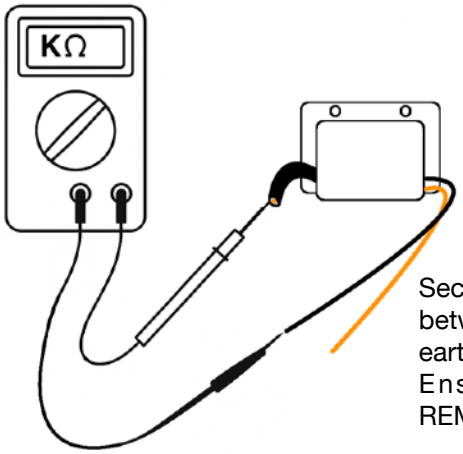
Test 1. No Sparks - HT Coil
Owners should be aware of a discrepancy. The parts book suggests these models use the HTC10 type HT coil with 70 mm mounting centres (0.98 Ω primary, 12 kΩ secondary). However, the limited number of machines we have examined were fitted with HTC8 type coils, with 55 mm mounting centres (1.0 Ω primary, 6 kΩ secondary). We would welcome further information from owners regarding which type is fitted.

The Yamaha workshop manual describes the full test procedure for testing HT coils. A 5KΩ spark plug cap must be used, which must be removed for testing.

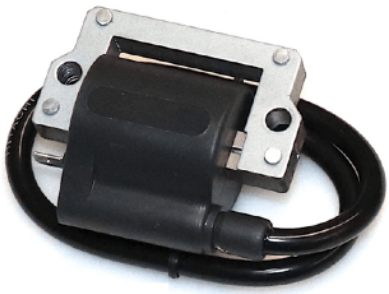
A coil that is open circuit, gives an unstable reading or is drastically out of range should be considered faulty.



Primary readings are made between the orange wire and black earth wire. Budget aftermarket coils may not have an earth wire. Measure between metal frame and primary connection in this case.

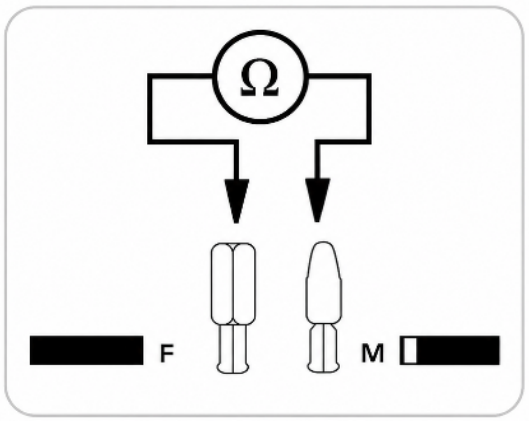


Secondary resistance is taken between HT lead and black earth wire, or the metal frame. Ensure the plug cap is REMOVED from the HT lead.



HTC8, 55mm Mounting Centre Option
HT coil designed specifically for CDi systems.

Test 2. No Sparks - Kill Circuit
The XT500 kill circuit is simple to test. Locate the CDi unit on the left side of the motorcycle, near the battery, and disconnect the black/white wire. Separate bullet connectors are used. If sparks return when this wire is disconnected, there is a fault in the kill circuit.



If you find the issue here, next disconnect the black wire too, then using a multimeter, set to resistance, test between the black/white wire and black wire coming from the motorcycle's loom.

Investigate why continuity remains when the Ignition is ON and any Kill switch is set in the running position. Repair faults then retest to confirm there is no continuity between these two wires when ON + RUN are selected.

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.

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

Taking the age of the parts into consideration is now important when diagnosing these systems. Original stators are more than 45 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.

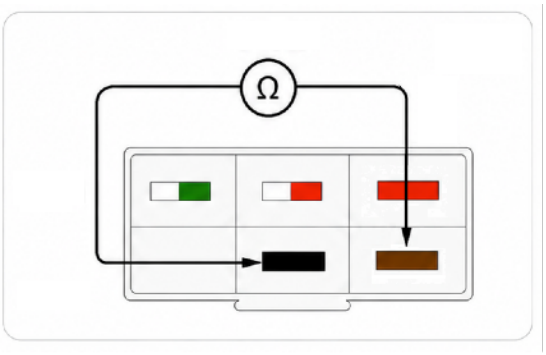
The resistance measurements are taken via the bullet connectors on the stator lead using a good quality multimeter. Use the form at the end of this guide to record all your readings.

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

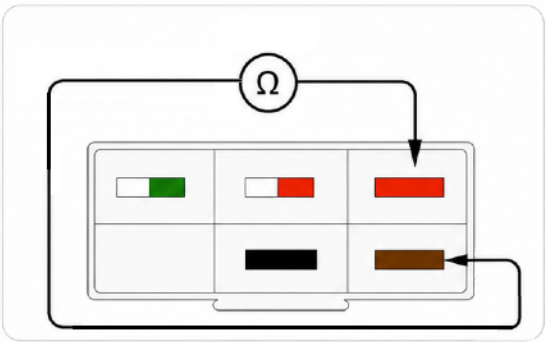
Advice When Taking Winding Resistance Readings

The manual gives the winding resistances at 20 ºC, but suggests accepting a tolerance of 10% on all measured coil resistance readings. This is considerably better than earlier manuals but can still be improved upon. It can be misleading as copper wire changes its resistance predictably with temperature. It is possible to accurately calculate the resistance/temperature variation of copper wire, thereby reducing a very grey area from your troubleshooting. 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.

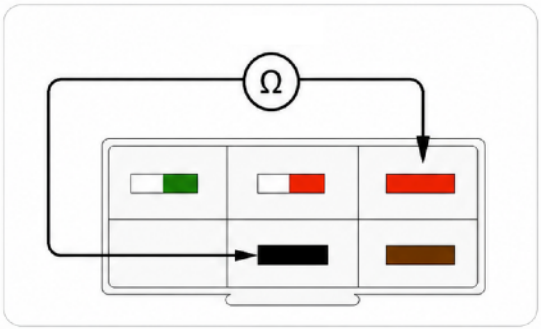
Take the following readings via the stator's bullet terminals and write them down. Note the ambient temperature too. The ambient temperature correction chart (given below) reduces temperature error. Note the SR plugs are shown, but the wire colours and tests are identical to the XT.



Test 3: Black to Brown



Test 4: Brown to Red



Test 5: Black to Red

Original Specifications at 20ºC

Source Coils

Test 3: Low Speed Source - Black to Brown: 381Ω

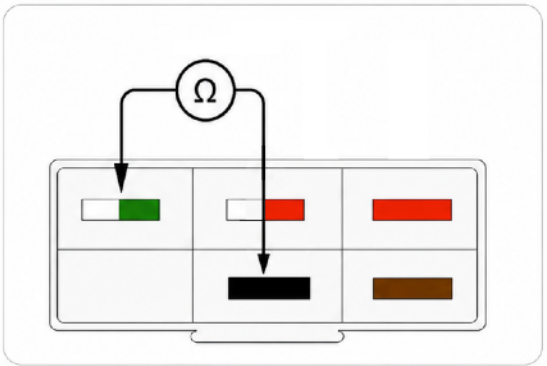
Test 4: High Speed Source - Brown to Red: 9Ω

Test 5: Source Coil Integrity - Black to Red: 390Ω

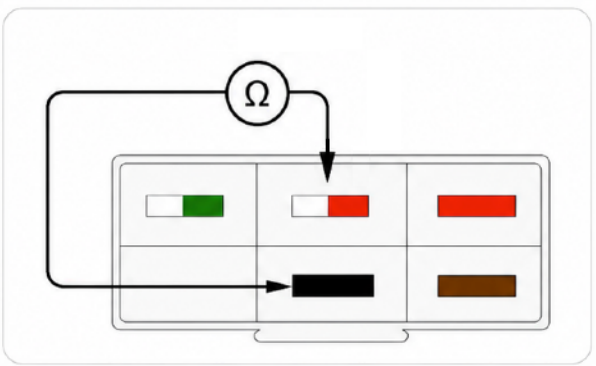
Trigger Coils (Pick-ups)

Test 6: Low Speed - White/green to black: 91Ω

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



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** Circle what you have fitted: **70mm** Yamaha 0.98Ω/12KΩ **55mm** Yamaha 1.0Ω/6KΩ	Primary - Ω	
		Secondary - K Ω	
Test 2	Kill Switch - Resistance between Black & Black/white wire. **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.

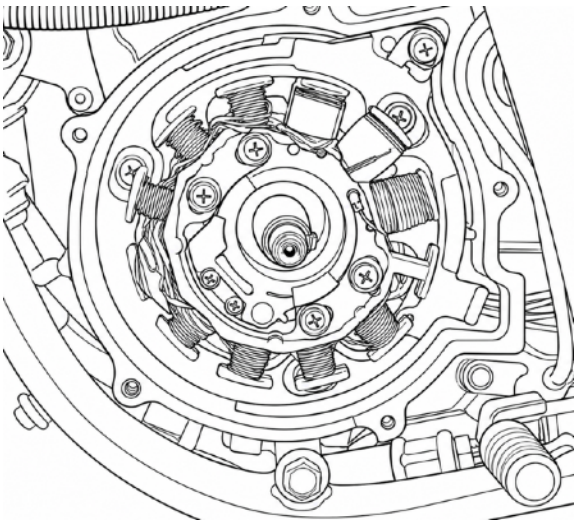
A clear photo of this page, once filled out with your data, is a good way of getting this to us.

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

Ambient Temp ºC	**Test 3 Pass Range**	**Test 4 Pass Range**	**Test 6 Pass Range**	**Test 7 Pass Range**
-10	329 - 343Ω	7.8 - 8.1Ω	78.7 - 82.0Ω	13.8 - 14.4Ω
-5	337 - 350Ω	8.0 - 8.3 Ω	80.0 - 84.0Ω	14.1 - 14.7Ω
0	344 - 358Ω	8.1 - 8.5Ω	82.0 - 85.5Ω	14.5 - 15.0Ω
5	351 - 366Ω	8.3 - 8.6Ω	84.0 - 87.0Ω	14.8 - 15.4Ω
10	359 - 373Ω	8.5 - 8.8Ω	85.7 - 89.0Ω	15 - 15.7Ω
15	366 - 381Ω	8.7 - 9.0Ω	87.0 - 91.0Ω	15.4 - 16Ω
20	373 - 389Ω	8.8 - 9.2Ω	89.0 - 93.0Ω	15.7 - 16.3Ω
25	381 - 396Ω	9.0 - 9.4Ω	91.0 - 95.0Ω	16.0 - 16.6Ω
30	388 - 404Ω	9.2 - 9.5Ω	92.7 - 96.5Ω	16.3 - 17Ω
35	395 - 412Ω	9.3 - 9.7Ω	94.4 - 98.3Ω	16.6 - 17.3Ω
40	403 - 419Ω	9.5 - 9.9Ω	96.2 - 100.1Ω	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.

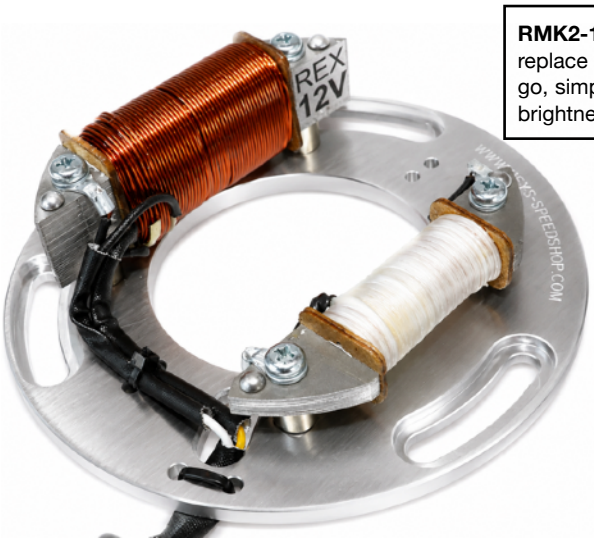
Age, heat and high voltage can all cause electrical insulation to deteriorate, much as mechanical parts inside an engine gradually wear as the engine is used. The difference here is electrical components can also deteriorate simply through age, even when they have seen little or no use. In electrical 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.

Fitting our electronic ignition kit (you will need a points ignition flywheel) can be a cost effective fix when faced with having to renew an entire system that is age degraded. The kit has a new stator, CDi unit, HT coil and voltage regulator (12V) to upgrade the lights too.

That said, we understand many owners, quite rightly, wish to keep the bike fully original to retain maximum cool appeal of the rare CDi models, so our workshops have full facilities to overhaul stators and we are happy to advise before you send parts to us for work.



RMK2-12V Electronic Ignition Kit - replace all major ignition parts in one go, simple to fit & improves headlamp brightness with 12V electrics.

XT1-SE Special Edition CDi unit.
Thoroughly tried and tested electronics mounted in a much improved case. Visually similar to the original unit. Made in UK.