

# Sentinel™ TS-EFI-10

## EFI Test Set

### USER'S MANUAL



## CONTENTS

1. OVERVIEW .....	3
1.1 INTRODUCTION .....	3
1.2 FEATURES .....	4
2. OPERATION .....	5
2.1 CHARGING .....	5
2.2 CURRENT INJECTION .....	5
2.3 EFI TEST FAILURE CONSIDERATIONS.....	6
3. MAINTENANCE.....	7
3.1 BATTERY .....	7
3.2 INJECTION CABLE PLUG AND SOCKET .....	7
4. SPECIFICATIONS .....	8
5. SAFETY.....	9
6. WARRANTY.....	9

## 1. OVERVIEW

### 1.1 INTRODUCTION

The Sentinel™ TS-EFI-10 is a battery powered primary injection test set used for testing the trip function of earth fault indicators. It is extremely light-weight, self-contained and portable. The device is contained within a robust black ABS enclosure and ships with test leads and an external battery charger.

**FIGURE 1: SENTINEL™ TS-EFI-10**



## 1.2 FEATURES

- 10A nominal injection current using single turn
- 200ms injection timer
- Inherently overload proof
- Safe output voltage (<12V) under all conditions
- Battery powered using internal rechargeable SLA battery
- Battery reverse polarity protection
- Extremely lightweight (<1kg)
- Extremely compact (single handed operation)
- Current output indication via LED and audio buzzer
- Open-circuit and low battery alarm indication via LED and audio buzzer
- Wall charger included
- Convenient carry bag included
- Rugged and reliable solid state electronics
- ISO9001 based quality assurance
- Electromagnetic compatibility

## 2. OPERATION

### 2.1 CHARGING

Plug the external battery charger cable jack into the charging socket located on the side of the Test Set. Allow up to several hours for the internal battery of the Tester to be charged. The charger will usually have a red LED to indicate charging and a green LED to indicate when unit is fully charged. A fully charged Tester will usually be able to test at least 100 EFI's before requiring to be recharged.

### 2.2 CURRENT INJECTION

This Tester has been designed to test the basic trip functionality of EFI's. It has not been designed to inject highly accurate current waveforms. The Tester current output consists of a square wave with a nominal RMS current of 10A. The actual RMS current has been designed to be about 20% higher to allow for EFI accuracy tolerances and injection cable contact resistance tolerances. The output waveform is a square wave with a duration of 10 cycles (200ms at 50Hz).

The Tester output injection lead consists of a flexible cable. When testing an EFI, the cable is passed around the core of the EFI current transformer several times and then plugged into the socket on the Tester. The nominal injection current seen by the EFI is equal to the number of injection lead turns around the current transformer multiplied by the nominal injection current. So for example, an injection current of 50A can be generated by passing the injection lead 5 times around the EFI current transformer (50A=5x10A).

Initiation of a test current is performed by depressing the "INJECT" pushbutton for at least half a second. The output current injection is accompanied by illumination of the green LED labeled "CURRENT OUTPUT", as well as by a warble tone emitted from the audio buzzer. The red alarm LED labeled "OPEN CIRCUIT" illuminates during the current injection if the output current lead is not firmly fastened closed or if the contact resistance between the plug and socket is too high. The red alarm LED labeled "LOW BATTERY" illuminates during the current injection if the internal SLA battery needs to be recharged. Both alarms are also accompanied several warning beeps from the audio buzzer. If the red alarm LED's do come on they will extinguish after a successful current injection or after about 2s of inactivity.

The Tester output voltage is completely harmless being equal to or less than 12 volts under all conditions. The Tester design inherently prevents any shock potential from developing across its output under any electronic or mechanical failure mode. However the user should be aware that during live conditions on site the equipment under test is connected to the electricity grid and has the potential to have extremely hazardous and lethal high voltages. The user should take the necessary safety precautions as discussed later in this document under the section titled "SAFETY".

## 2.3 EFI TEST FAILURE CONSIDERATIONS

There is obviously effort and cost involved in replacing a faulty EFI. So if an EFI is found to “fail” under test, it is worth double checking the integrity of the test.

The first thing to do is to check whether the EFI can be tripped via its own test/reset facility (e.g. pushbutton or magnetic reed switch). This will at least prove some of the EFI functionality and also show if it has an adequate power supply (there may have been a mains power failure or the EFI may have a flat battery.)

The next thing to do is to repeat the injection of test current ensuring that the test equipment is generating adequate test current. During each test make sure that after depression of the “INJECT” for at least half a second, the Tester control unit sounds a warble tone via the audio buzzer, showing a flash of green light on the LED indicator labeled “OUTPUT CURRENT”, while both the “LOW BATTERY” and “OPEN CIRCUIT” red LED indicators remain off.

If the EFI still appears not to trip, it is worth doing a few preliminary checks on the EFI installation. Is the EFI current sensor connected to the control unit? It may not have been installed or commissioned properly.

Finally before writing the EFI off, it is worth double checking the Tester on another EFI to prove the integrity of the test equipment and to prove the integrity of the testing procedure.

## 3. MAINTENANCE

### 3.1 BATTERY

The Tester is powered by a maintenance-free, rechargeable sealed lead-acid battery. At the end of its lifetime the battery is easily replaced by opening the Tester cover and removing the battery lead plug from the socket on the printed circuit board. A replacement battery of the exactly the same dimensions and electrical specifications should be used (See section titled "SPECIFICATIONS"). The battery has reached the end of its lifetime when it has to be recharged noticeable more often or is failing altogether to inject sufficient test current.

### 3.2 INJECTION CABLE PLUG AND SOCKET

For the Tester to inject its rated current it is critical that the injection cable has a very low resistance. This resistance is mainly determined by the contact resistance between the brass plug and socket. This contact resistance is a function of the force between the plug and socket (the tightness) and the resistance of the two surfaces. If the plug and socket connection begins to feel loose, the tightness can be restored by using a screwdriver to gently prise open the fingers of the plug a fraction. To maintain low resistance between the two surfaces, they should be kept clean. A very light sanding with water paper can easily restore the surfaces if there has been any oxidizing or blemishing. It is wise to protect the surfaces by keeping the plug and socket tightly closed when not in use.

## 4. SPECIFICATIONS

Output Current:	10A RMS nominal (typical safety factor of +20%)
Output Frequency:	50Hz $\pm$ 10%
Output Duration:	10 cycles (200ms at 50Hz) $\pm$ 10%
Output Voltage:	<12V Peak
Waveform Type:	Square wave
Alarms:	Open-circuit and low battery via LED and audio buzzer
Maximum EFI CT core diameter:	100mm
Injection Lead:	5m
Inject Button:	Press and hold for at least 0.5s to initiate test current
Battery:	12V, 0.8AH, rechargeable SLA, 97mm x 50mm x 24mm
Battery stock code:	AS0.8-12-X-5556-TL
Recharge Interval:	100 tests (typical minimum)
Control Unit Dimensions:	130 $\times$ 70mm $\times$ 45mm
Mass:	<1kg



## 5. SAFETY

To avoid electric shock read the following carefully:

- Ensure that the TS-EFI-10 is only used by qualified personnel practicing applicable safety precautions.
- Use caution during the installation and use of this product; high voltages and currents may be present in the circuit.
- Wear protective clothing and gloves as required.
- Always inspect the tester for damage before using the product.
- Do not use the product if damaged.

## 6. WARRANTY

The Sentinel™ TS-EFI-10 electronic hardware and software is copyrighted by Cybertronix.

This product is warranted to be free from defects in material and workmanship for a period of twelve months (12) from the date of shipment. Correction shall be in the form of repair or replacement of the defective items or components, freight paid by the customer both ways. Such correction shall constitute a fulfillment of all Cybertronix cc liabilities in respect to said items and components. In no event shall Cybertronix be liable for consequential damage.

No other warranties:

To the maximum extent permitted by applicable law, Cybertronix cc disclaims all other warranties, either express or implied, including but not limited to implied warranties of merchantability and fitness for a particular purpose, with respect to the Sentinel product and accompanying product manual. Cybertronix cc makes no representation or warranty that the product is 'error free', or meets any user's particular standards, requirements or needs.

Disclaimer:

To the maximum extent permitted by the applicable law, in no event shall Cybertronix cc be liable to the user for any special, indirect, consequential or similar damages, including any lost profits or lost data arising out of the use or inability to use the product or documentation or any other data supplied therewith even if the seller or anyone else has been advised of the possibility of such damages, or for any claim by any other party. In the event of the above limitation not applying to the user, then in no case shall the Cybertronix cc liability exceed the original purchase price of the product.