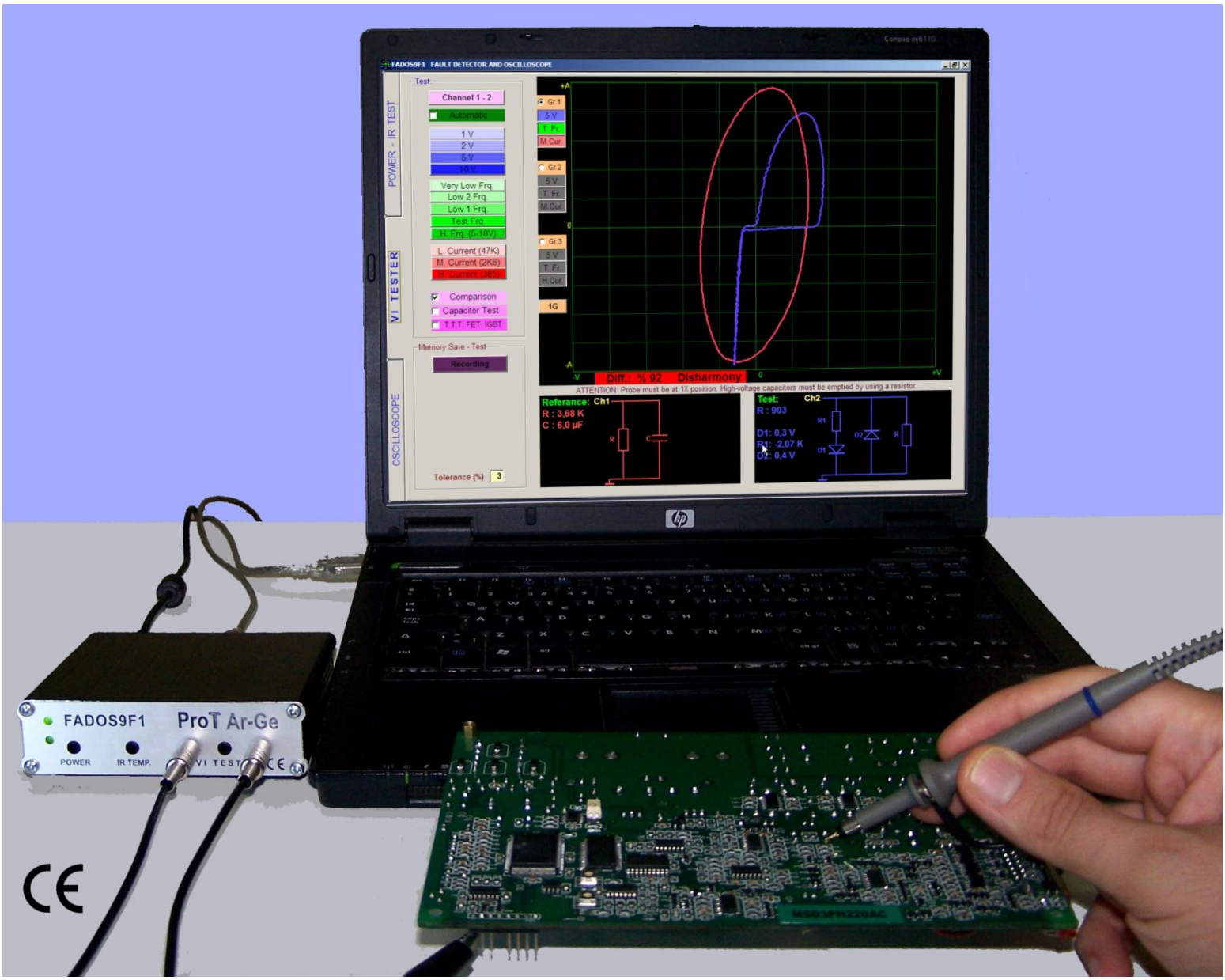
FADOS9F1

FAULT DETECTOR & OSCILLOSCOPE
9 FEATURES IN 1 DEVICE
USER MANUAL



PRODUCT DESCRIPTION

FADOS9F1 Fault Detector & Oscilloscope 9 Functions in 1 have been especially developed to determine and troubleshooting faults at all type electronic circuit boards by Prot Ar-Ge Industrial Project Design R&D Ltd. Co. FADOS9F1 is basically computer-based VI tester Voltage-Current (Signature Analysis) equipment.

FADOS9F1 has more 2 unique features from FADOS7F1. First feature is integrated DC power source. It can be adjusted between 0-16V and 20-1500mA with power output; DC voltage/current graph is created. Second unique feature is IR (infrared) non-touched temperature sensor for detecting more heated components. Using together 2 new features, it is possible to some of detecting failures to decreasing during 5-10 times. These features can be used as new technique fault detection.

Signature Analysis is a power-off test method that is used to troubleshoot circuit boards. FADOS9F1 works by applying a current-limited sine wave through a serial resistor point of touched on circuit and Voltage-Current (Signature) graph is displayed on the computer screen. In addition to this feature, computer software by analyzing signature graph to displays Equivalent Circuit Diagram and Values of Electronic Components and these features used for convenience to user in giving information for finding faulty easily.

By using Feature of Dual Channel VI test; signature of known good circuit boards and faulty or suspect boards comparable with touch of same points at the same time and using this method, faulty points out of tolerance can be quickly detected. All signature graphs are composed at 2,5 mV sensitivity and by taking 720 different measurement of signature. For this reason, FADOS9F1 is very sensitive.

By the help of Memory Feature; it is possible to save the features (values and signature) of good circuit board to memory for reference and then, to compare easily with faulty or suspects circuit boards sensitively. By using feature of recording reference values, signatures to memory and comparing data from memory, it can test easily circuit boards. It is possible to record data with circuit board's picture. As a result; while comparing data from memory, it is possible to see data on the picture which saved before.

In order to lower the loss of time during test procedure, it sounds different at compatible and incompatible points. By this way, users make the comparison quickly without any need to look at screen or circuit boards steadily and the sound feature can save you time when compared

circuit boards. Users can compare the circuit boards with 3 different steps at the same time. (Selected Current-Voltage-Frequency steps)

In addition to the basic features, FADOS9F1 VI Tester can also be used Dual-Channel Oscilloscope, Square-Wave Generator and Analogue Voltage Output. By using Square-Wave Signal Output, signal is applied to circuit boards; then, it is possible to see the other channel and output signals at oscilloscope screen.

Technicians, engineers and hobbyists have found VI graph to be an effective and efficient method for troubleshooting printed circuit boards. The signature comparison method is easy to use and allows for immediate feedback that will assist you in locating faulty component. As you gain some experience with VI graph you will realize that FADOS9F1 is an indispensable troubleshooting tool. Usage is very easy and users will find the faults just by looking at graphs without comparison.

When test Printed Circuit Assembly (PCA) with FADOS9F1, do not apply power to PCA. PCA and the devices must be made high-voltage capacitor discharges. There is no risk of further damage to the PCA while testing and troubleshooting.

FADOS9F1 is easy to carry since it's small. It can be carried in a laptop briefcase. Including many more features, it is like a Swiss knife of users dealing with electronics.

Usage Areas

ECU Automotive electronic circuit boards, servo-step motor drivers, circuit boards of medical devices, military electronic circuit boards, computer and monitor circuit boards, television-audio-radio circuit boards, circuit boards of textile machines, mobile phone electronic circuit boards etc. (all type electronic circuit boards.)

Electronic Components Test: Resistors, Capacitors, Inductors, Diodes (General purpose, Zener, High Voltage etc.) Transistors (NPN, PNP, JFET, MOSFET etc.), SCRs, TRIACs, Optocouplers, Integrated Circuits (Digital, Analog) etc.

Unique Features

Integrated DC Power Source, IR (infrared) Sensor (Temperature Test), Equivalent Circuit Diagram and Measuring Values of all Components features are unique in the World.

Integrated DC Power Source: It can be adjusted between 0-16V and 20-1500mA with power output. It gives energy to circuit boards and creating Power DC Voltage-Current Graph.
IR (infrared) Sensor (Temperature Test): This feature is used for detecting more heated components and draw out heat map of electronic card.
Equivalent circuit diagram and measuring values of all components features; as an example; if resistor connected parallel to capacitor, it shows circuit diagram and value of them at the same time.

SECURITY

1- FADOS9F1 is produced by using lead-free solder and designed in accordance CE regulations; users must use the following usage rules.

2- Chassis must be isolated and grounded. Connect the chassis ground connection point of the probe is the same as your computer, careful to avoid the potential difference.

3- Feature of oscilloscope, if probe key is set to 1X, it measures ±5 Voltage, probe key is set to 10X, it measures ±50 Voltage. Do not use above these limits of voltage.

4- It tests electronic circuit boards without giving to energy. Before test, electronic circuit board and the devices must be made high-voltage capacitor discharges.

5- The users of this equipment must have knowledge and experience to repair of electronic circuit boards. Thus, during using FADOS9F1, do not make this mistakes such as touch chassis to high-voltage, non-isolated ground, test high-voltage capacitor discharges. Without enough knowledge and experience in this subject, keep away high voltages such as mains voltage which can damage the system and themselves.

6- Giving high-voltage from probes, series resistors which contained in the device damaged and makes the circuit an open circuit. In this case, the computer port which is connected device via USB port damaged but observed in other parts of the computer is not damaged.

FADOS9F1 PERFORMANS AND MEASURUMENT TOLERANCE

1- FADOS9F1 is designed multi-function as Voltage- Current (VI) Signature Analysis Tester and Oscilloscope. The main of the feature device is VI Tester; in addition to this feature, computer software by analyzing voltage-current graph to displays equivalent circuit diagram and values of electronic components in specific tolerances. The equivalent circuit diagram and values are for informational purposes. As the device is not suitable for direct measurement. And Computer software creates "Power Voltage-Current Graph" and measures temperature of components in specific tolerances.

2- Equivalent circuit diagram is drawing by software using mathematical functions and formulas; but rarely has the possibility of making mistake. This probability is more increased with applied externally electromagnetic fields of generated interference. The EMC Testing; 3V/M and the range of 80MHz-1GHz is approximately capacitor %1, resistor %3, diodes %1. Some fast diodes make oscillation in some frequencies, so that can be perceived as 'active point' by the device. VI Graph the rate of change: <1%.

3- Components Value Measurement Tolerance:

- Resistor: %2
- Capacitor: %3
- Diode Transmit Voltage: 0,1V
- If Resistor and Capacitor are connected Parallel: Resistor:%4, Capacitor: %5
- If Resistor and Diodes are connected Serial: %4
- If Diode and Resistor are connected Parallel: %3
- If 2 Diodes and a Resistor are connected Parallel: %10

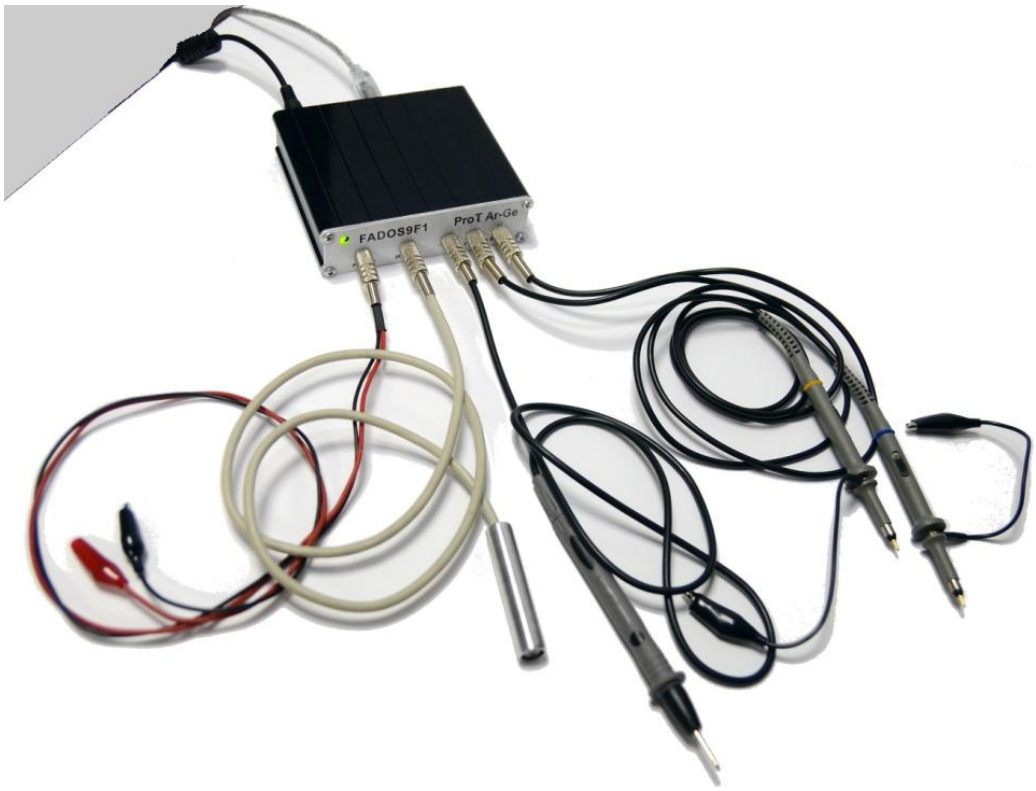
Note 1: These tolerances valid, if resistor curve makes angle between 10 and 80 degree to horizontal axis. If resistor curve close to horizontal line, select 'Low Current' Step and; if resistor curve close to vertical line, select 'Middle or High Current' Step for reducing mistake rate.

Note 2: These tolerance valid, if capacitor ellipse of width/length ratio is greater than 1/4. This ratio is less than 1/4 and ellipse's width - length is thin and long. In such a case; change current step or/and frequency step for selecting step appropriate to components.

4- Oscilloscope voltage measurement tolerance: %0,5.

PRODUCT OVERVIEW and CONTENT

- 1 FADOS9F1 Product
- 1 Software CD and User Manual (Pdf)
- 1 IR Temperature Probe
- 2 Oscilloscope Probes
- 1 Com Probe (Crocodile)
- 1 USB Cable
- 1 DC Cable
- 1 Power Adapter
- 1 Handbag



Picture 1: FADOS9F1 Sets

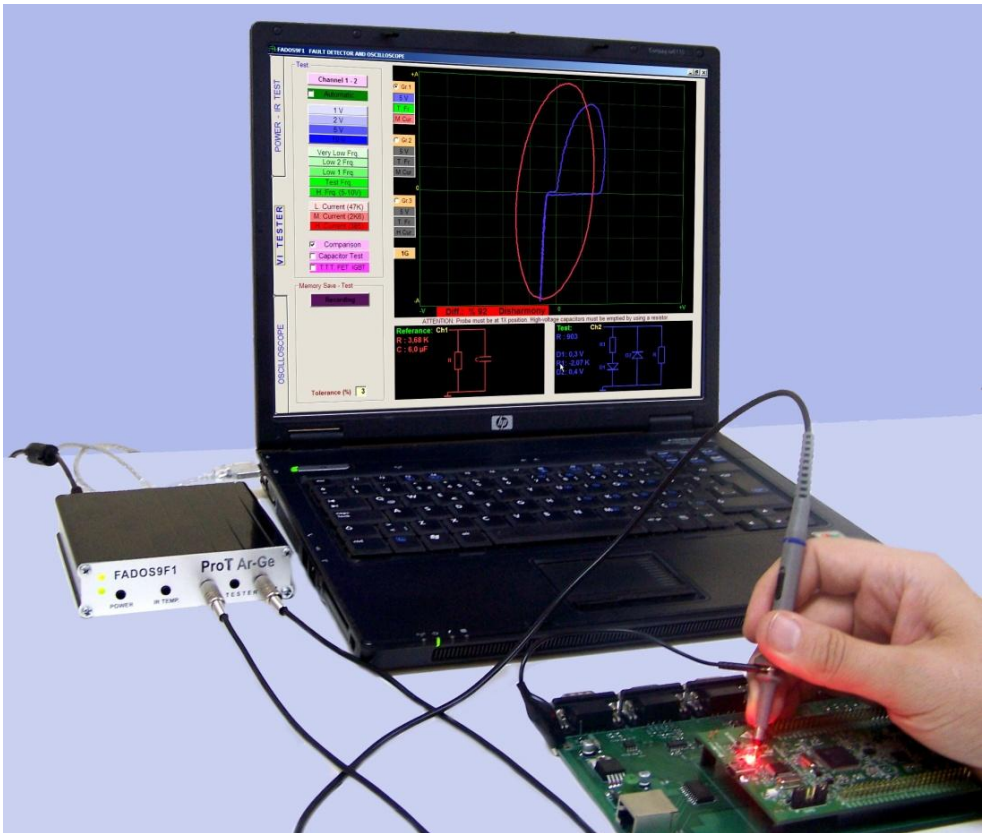
FADOS9F1 TECHNICAL SPECIFICATIONS

A- FAULT DETECTION SPECIFICATIONS:		
Test Voltages	**:** ±1V, ±2V, ±5V, ±10V, ±15V, ±24V	
Test Resistance	**:** Current Level: Low 47KΩ, Med1 3,5KΩ, Med2 700Ω High 250Ω	
Test Frequencies	**:** Very Low Frequency	: 2 Hz
	Low2 Frequency	: 4 Hz
	Low1 Frequency	: 12 Hz
	Test Frequency	: 32.5 Hz
	High Frequency	: 355.4Hz
Number of Channels	**:** 2 (Channel 1 and Channel 2)	
Scan Mode	**:** Manual or Automatic. Automatic selection steps of voltage, current, frequency.	
Other Feature	**: 1:** Equivalent circuit diagram.	
	2: Resistor, capacitors, diodes etc measurement.	
	3: Recording data and comparing with recorded data.	
	4: 3 graphs at different adjustments can be screened simultaneously.	
B- POWER – IR TEMPERATURE FEATURES:		
DC Power Source	**:** Adjustable between 0-16V and 20-1500mA with power output.	
IR (Infrared) Sensor	**:** Shows the difference between 0-120 degrees according to room temperature.	
C- PC OSCILLOSCOPE FEATURES:		
Sampling Rate	**:** 400 K/S	
Input Voltage	**:** Probe 1X: ±5 V	Probe10X: ±50 V
Channel / ADC	**:** 2 Channel / 12 Bit	
Sensitivity	**:** 2.5 mV	
Image Rate	**:** 0.02 mS/div….100 mS/div	
Instant Memory	**:** 64 Kbyte	
D- DIGITAL AND ANALOG OUTPUT:		
Output	**:** Channel 2	
Output Voltage	**:** -5V….+5V (Adjustable)	
Frequency (Digital)	**:** From 0.2KHz to 25KHz	
Dimensions	**:** 122mm L x 113mm W x 235mm H	
Weight	**:** 450 gram with all accessories	

Table 1: FADOS9F1 Technical Features

CONTENTS

FADOS9F1 FAULT DETECTOR & OSCILLOSCOPE



Picture 2: FADOS9F1

FADOS9F1 includes 9 important functions:

1. Double – Channel Fault Detection (Analog Signature Analysis - VI Graph)

   Comparing good and faulty or suspect circuit boards without giving power to boards.

2. DC Power Supply Output with Adjustable Voltage and Current

   For giving energy to circuit boards and creating Power DC Voltage-Current Graph.

3. Non Touched IR Temperature Sensor

   For detecting more heated components and draw out heat map of circuit board.

4. Equivalent Circuit Diagram

   Composing R, C, or Diode Circuit Diagram according to the point touched.

5. Measuring Value of Resistors, Capacitors, and Diodes

   Feature of measuring the value of touched point.

6. Fault Detection by Comparison from Memory

   By recording data of good circuit boards to memory, comparing faulty or suspects boards from memory.

7. Double – Channel Digital Oscilloscope

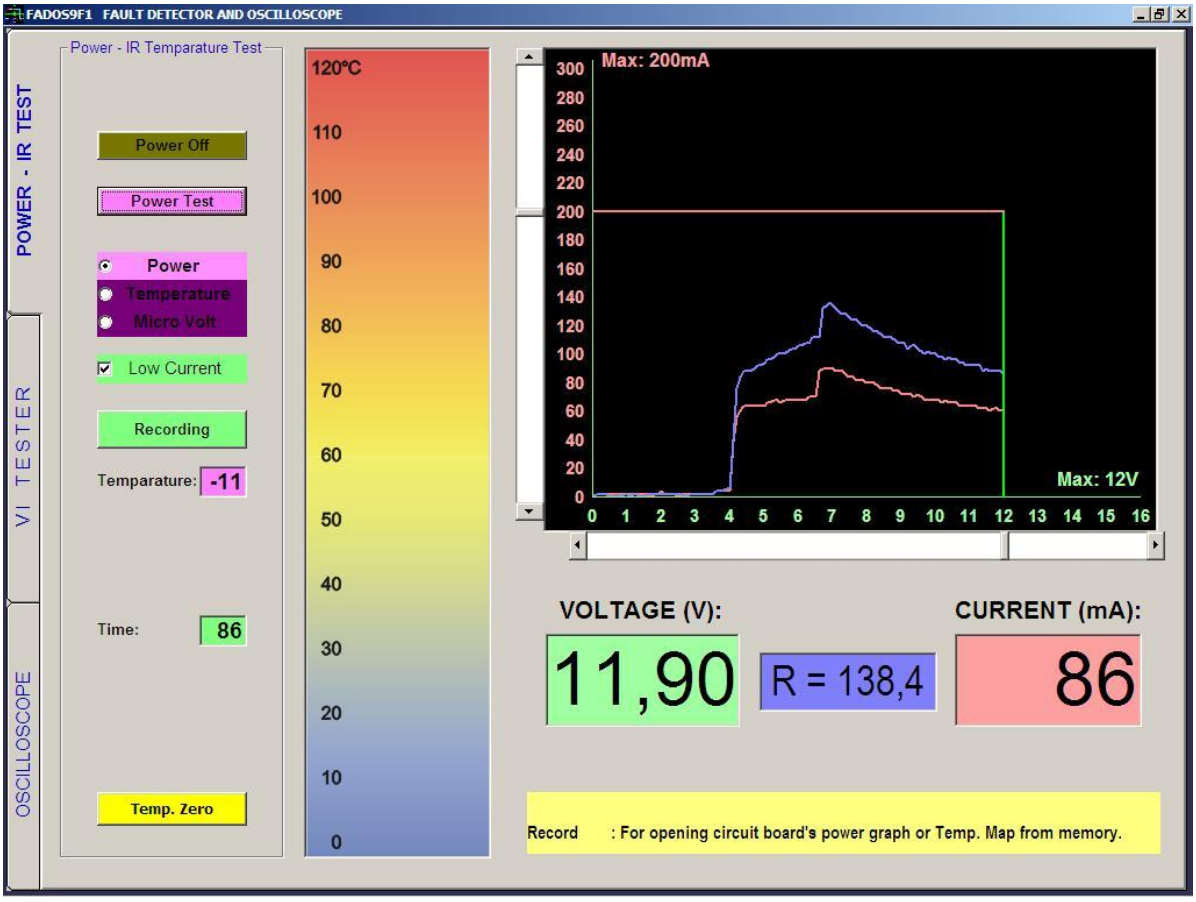
   As occasion may require, device can be used as oscilloscope.

8. Square Wave Signal Output

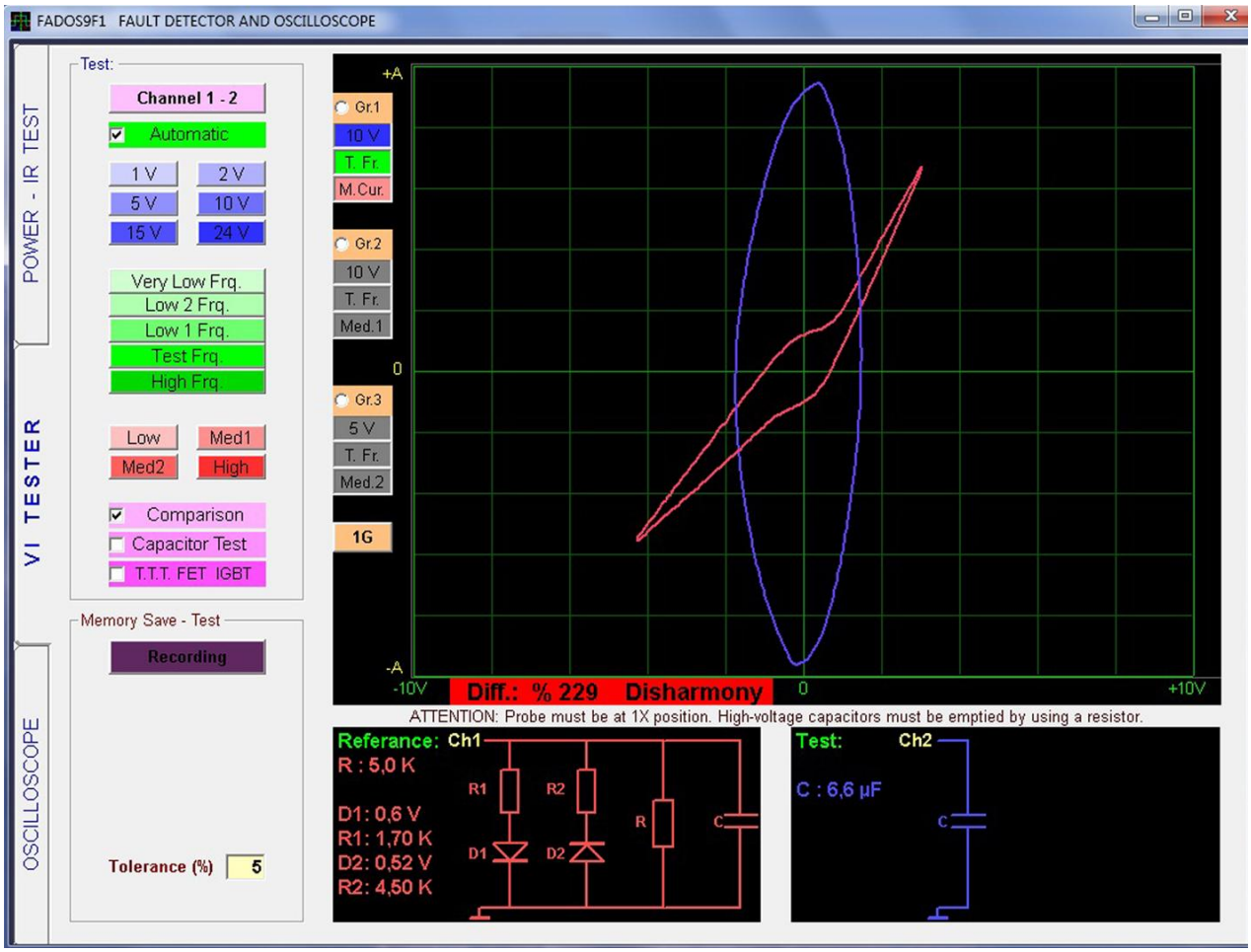
   Ch.1 is used as oscilloscope and Ch.2 is used as signal generator.

9. Analogue Voltage Output

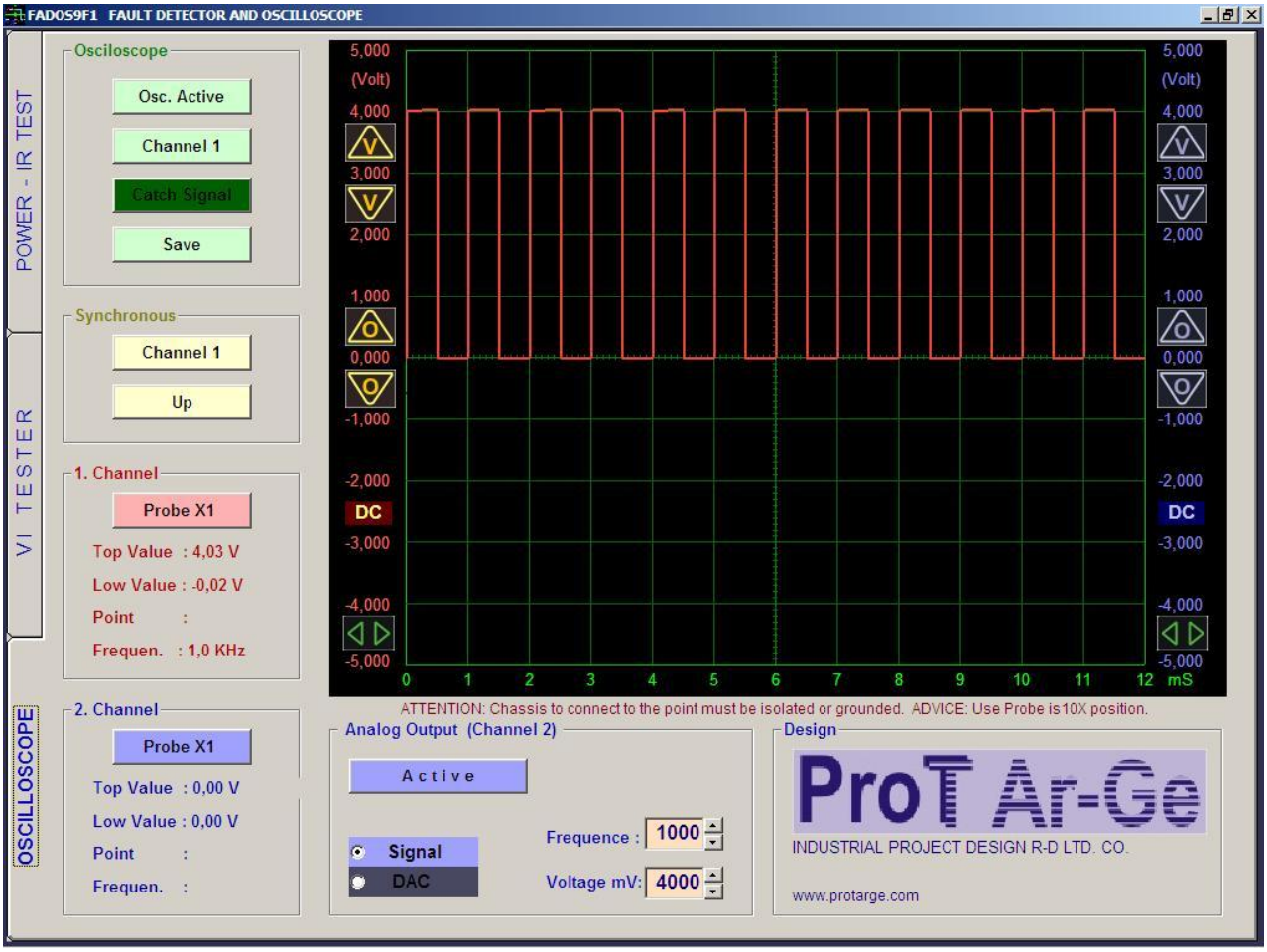
   Ch.1 is used as oscilloscope and Ch.2 gives analog voltage output.



Picture 3: Power – IR Test Screen



Picture 4: Fault Detector – VI Tester Screen



Picture 5: Oscilloscope – Analog Output Screen

INSTALLATION

1- Connect Power Adapter to FADOS9F1. Connect FADOS9F1 to PC via USB. Install drivers in CD.

2- Click FADOS9F1 SETUP.exe and install program.

3- Run FADOS9F1.exe

DRIVER INSTALLATION

1- Windows XP 'New Hardware Found' with warning direct you to install the driver. Insert the CD into the CD rom and install the driver.

2- Windows Vista and Windows 7 open Device Manager.

- On the desktop right-click on my computer and click Properties of open the Control Panel and double-click the System icon.
- In the System Properties window click the Hardware tab.
- In the Hardware tab click the Device Manager Button.

  Or

- Click Start
- Click Settings
- Click Control Panel
- In the Control Panel double-click the Systems icon.
- In the System Properties window click the Hardware tab.
- In the Hardware tab click the Device Manager Button.

3- Find "Prot Ar-Ge FADOS9F1 Fault Detector" inside Universal Serial Bus Controllers and click right then, select "update software driver".

4- Select (Search for the best driver location) and click browse, find FADOS9F1 Driver's folder.

5- Click OK and install driver.

Note: Each product has different calibration settings, so that please do not lost program CD.

CONNECT PROBES:

Connect DC Power Cable (Red-Black Cable) to Power socket. Connect IR Sensor to IR Temp. socket. Oscilloscope probes and Com probe (crocodile) can be connected each VI Tester socket. Yellow ring probe is always Channel 1; Blue ring probe is always Channel 2. Crocodile probe is always COM. USB cable for using communications between PC and FADOS9F1. Connect Power Adapter to Power (18-20 VDC).

GENERAL USAGE INFORMATION

1. When run software, Power – IR Temperature Test screen pop-up and if you click VI Tester button or Oscilloscope open VI Tester or Oscilloscope screen.

While testing circuit board; firstly, user should test supply line at Power – IR Test function.

- Firstly, create good circuit board's "Power Voltage/Current Graph". Than save this graph to memory.
- Compare faulty or suspect circuit boards with good circuit board's "Power Voltage/Current Graph".
- If more current is suffering from faulty card, it means that one or more components suffers more current on the board, and therefore heats the electronic board. For finding heated components, selects Temperature.

- If the faulty card is less current, in this case supply line is open circuit likely. Open "Oscilloscope Screen" and find line which does not get energy and broken-line is easily detected.
- If the faulty and good board has same graphs; in this case open "VI Test Screen" and finds faulty with it.

2. Open circuit's graph is in the middle and horizontal position at Test-Fault Detect screen. Current – Voltage Graph (VI) makes angle according to the value of resistance, capacitor is like circle and ellipse, short circuit is vertical position.

3. Middle current step if resistance values are high and VI graph is horizontal axis, you can see more clearly high resistance value at low current step. If VI graph is more closer to vertical axis, it means resistance value is low and values can be read more clearly at high current step.

4. Usually, test capacitor at high frequency mode. If capacitor value is low, test at low current step and if capacitor value is high, test high current step. If capacitor value is like slim ellipse at high current step and vertical axis, you can see value of capacitor by reducing frequency of the frequency step.

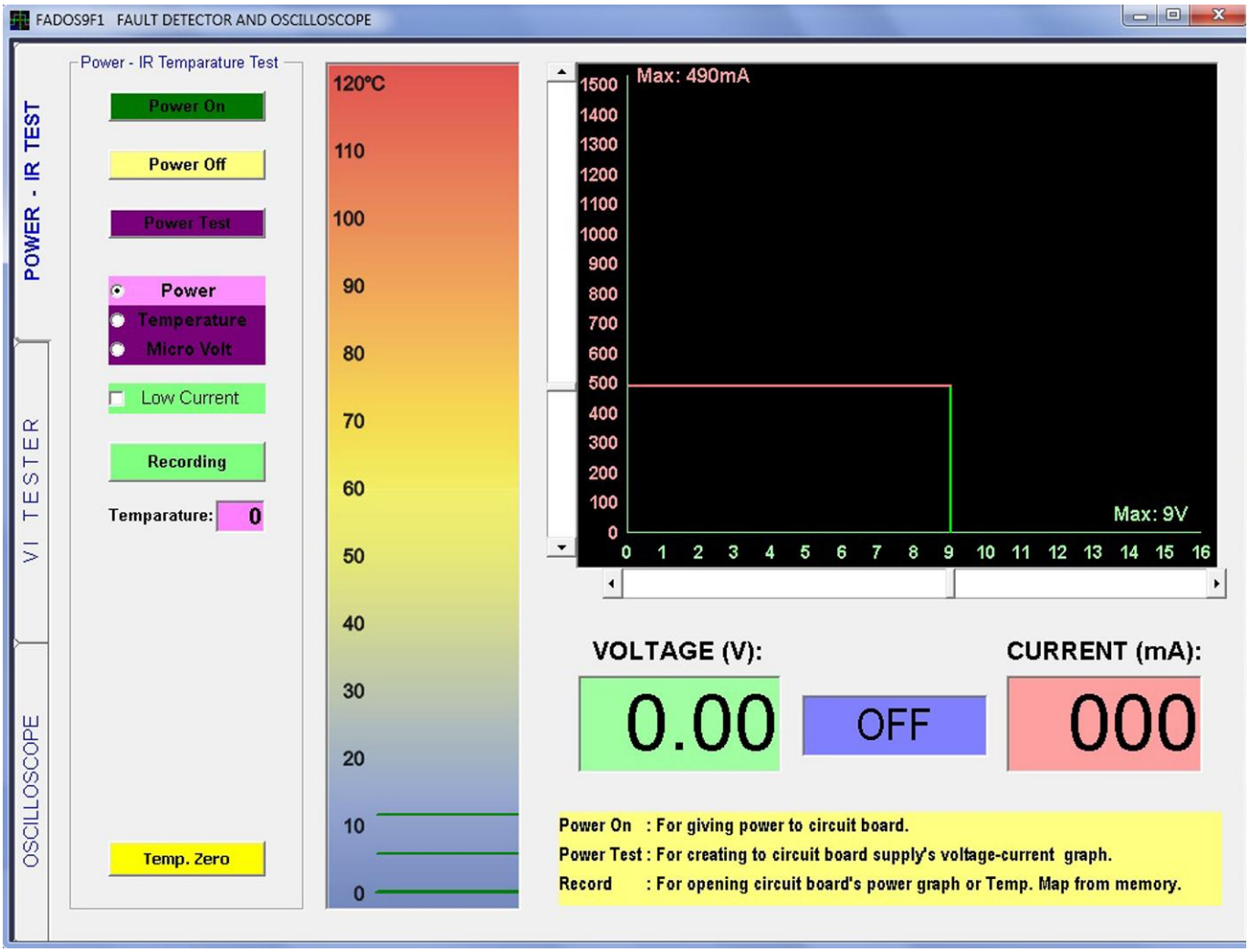
5. Good (solid) integrated pin (without pin of supply and ground) is usually like double reverse diode. Resistor or capacitor effects even as graph, observed double reverse diode. Some integrated output can be observed one diode. But, if you see pin of integrated like resistor, it means integrated is faulty.

6. Capacity test especially determines quality of electrolytic capacitor. If this curve is horizontal, capacitor is quality. Low quality capacitor curve according to horizontal makes an angle. If angle is more, capacitor is faulty. Due to current this test may be misleading, while testing a capacitor at circuit. Therefore considering this situation to test. For capacitor quality, the best measurement in this product is done by looking at the Capacity Resistance curve.

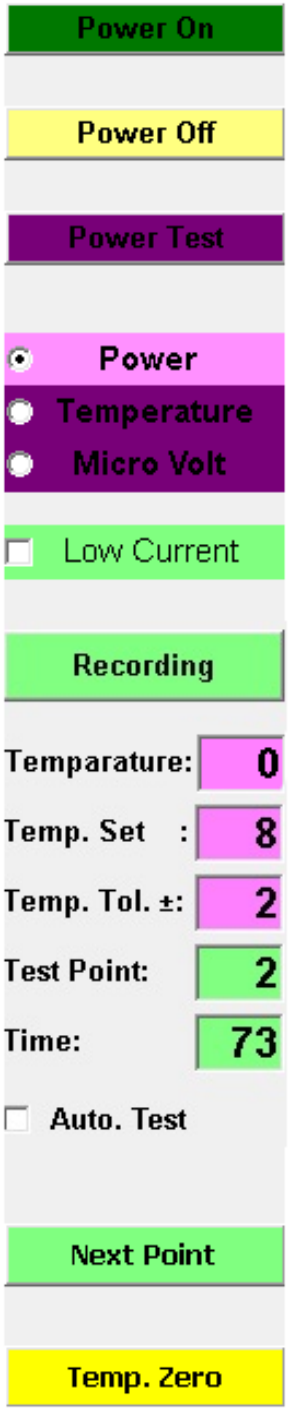
7. At fault detection important thing is graph display and interpret. First, try to find fault with compare. In a short time you will learn difference between good and faulty or suspect circuit board. The equivalent circuit and values are auxiliary elements. If you always look equivalent circuit and values, it can take more times to detect fault. This product interprets VI graph. The computer program composes equivalent circuit diagram and shows values of components by interpreting graph.

POWER - IR TEMPERATURE TEST

When run software; Power – IR Temperature Test screen pop-up. DC Voltage-Current Graph is seen at the screen. All control buttons are placed to the left of the panel used in Power – IR Test.



Picture 6: Power – IR Test Screen



Power On : FADOS9F1 gives "Output" to circuit board via "Power Cable". If more current is suffering from circuit board, adjusted current is limited by software and does not allow more current to suffer the circuit board.

Power Off : Break the voltage.

Power Test : It is used for create circuit board's "Voltage/Current Graph".

Power : This option is for DC Power Test and measurement.

Temperature : This option is for IR - Temperature Test and measurement.

Micro Volt : This option is for Microvolt measurement.

Low Current : This selection is for selection of 0-300 mA.

Recording : Opens file form and records; or opens recorded file.

Temperature : Shows temperature value of components.

Temp. Set : Shows temperature value of recording components.

Temp. Tol. ± : Shows Temperature Tolerance ±. User can change tolerance.

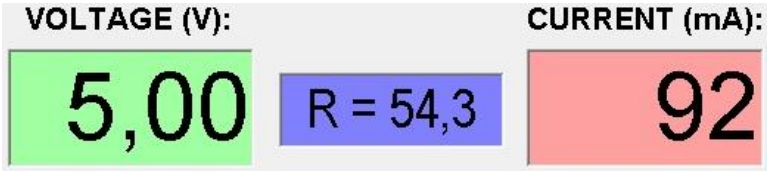
Test Point : Shows serial number of test point.

Time : Shows "Counting down from 90 seconds."

Auto Test : If tolerance of test point is lower than or equal to tolerance mentioned below, it goes to next test point automatically.

Next Point : Goes to next test point.

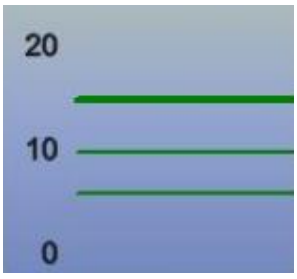
Temp. Zero : It is for blocking temperature of the external environment.



Voltage : Shows Max. Voltage.

R : Resistance of circuit board.

Current (mA) : Current of circuit board.

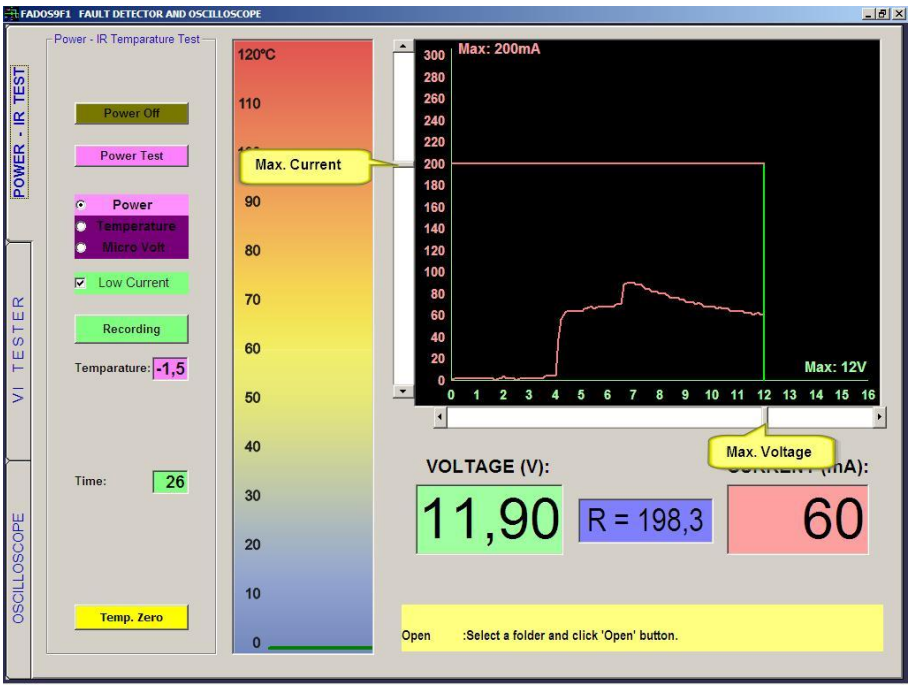


Bold Green Line : Shows temperature value of components.

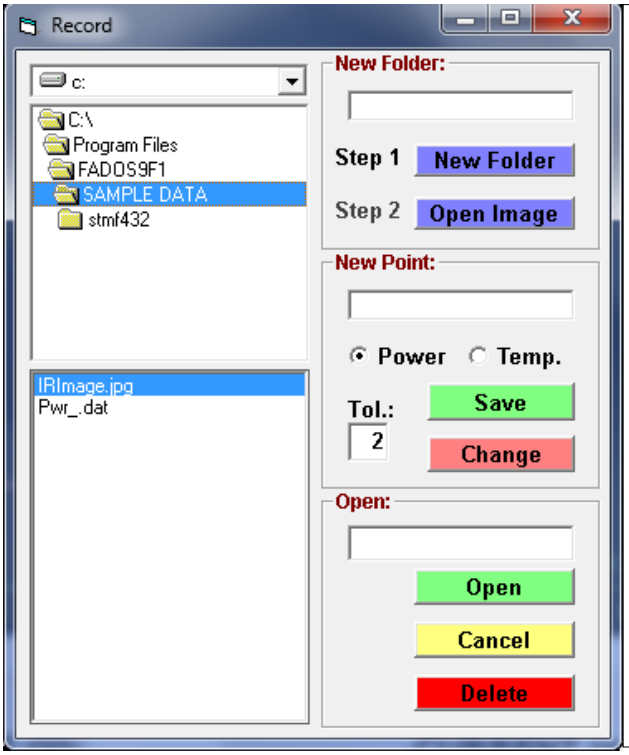
Thin Green Lines : Shows Temp. Set ± Tolerance, for example; If Temp. Set is 8°C, and Tolerance 2; green line sets between 6°C and 10°C.

Power Test – DC Voltage Current Graph

1. Firstly, adjust max. Voltage and Current.
2. Connect to Power Cable to circuit board's supply. Red Cable (+), Black cable (-)
3. Set (Determine) max. Voltage and Current for giving energy to Circuit boards.
4. Click Power Test Button. It creates 100 mV steps DC Voltage-Current Graph from 0 to V max.
5. Click "Record Button" to save DC Voltage-Current Graph for comparing graphs of faulty boards.



Picture 7: DC Voltage – Current Graph



New Folder : Opens a folder by using the name given to a new circuit.

Open Image : Open and upload the circuit of the image.

New Point : If New Points is empty, software saves data with automatic number like and add to file.

Power : If saves DC Voltage/Current Graph, select Power option.

Temp. : If saves Temperature of components, select Temp option.

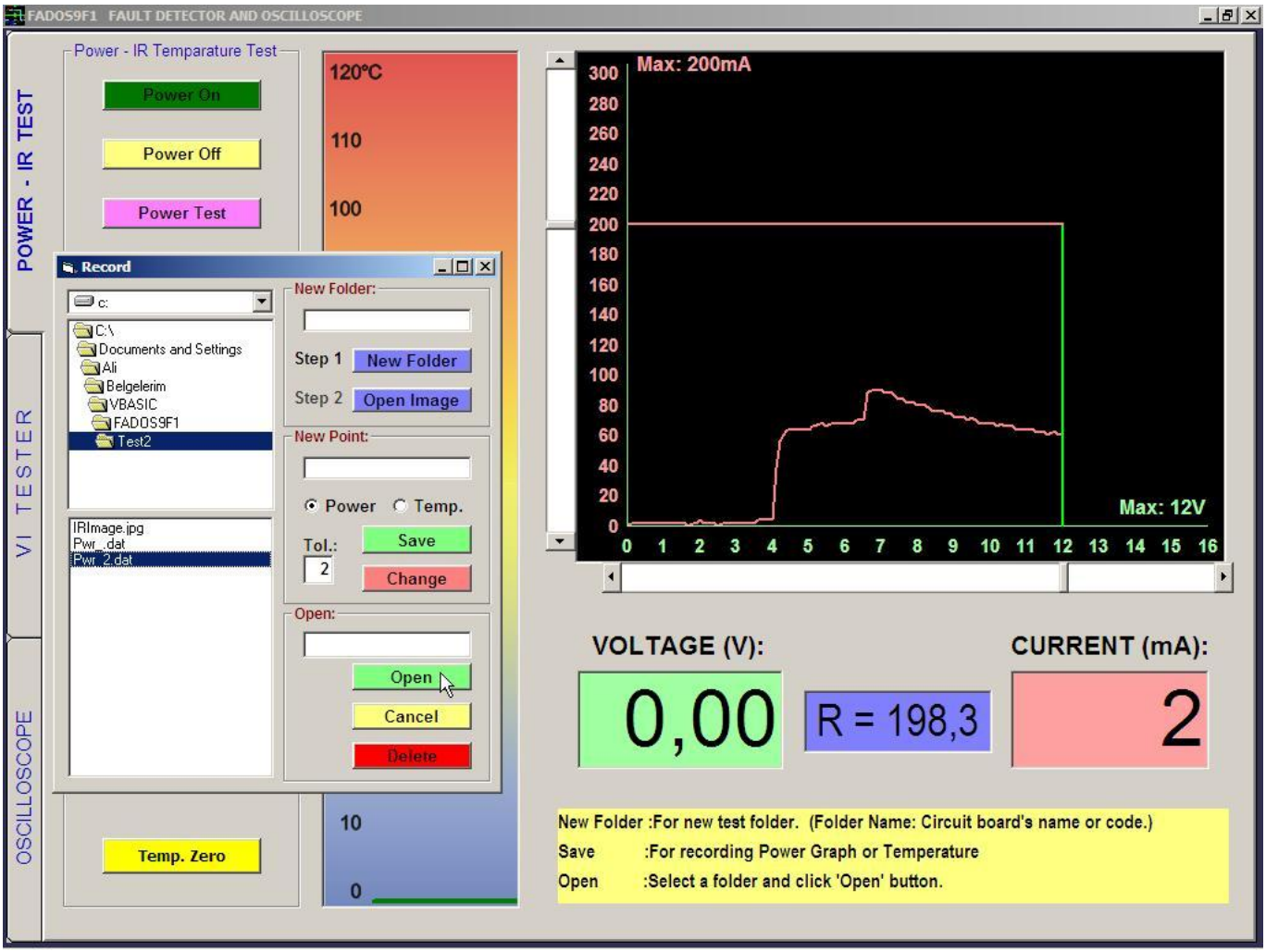
Save : Saves the value of test point with mentioned name to the determined folder. If name is not given, saves with serial number.

Change: Changes the marked test point data and save a new test point data.

Open : Opens data clicked on the list to screen.

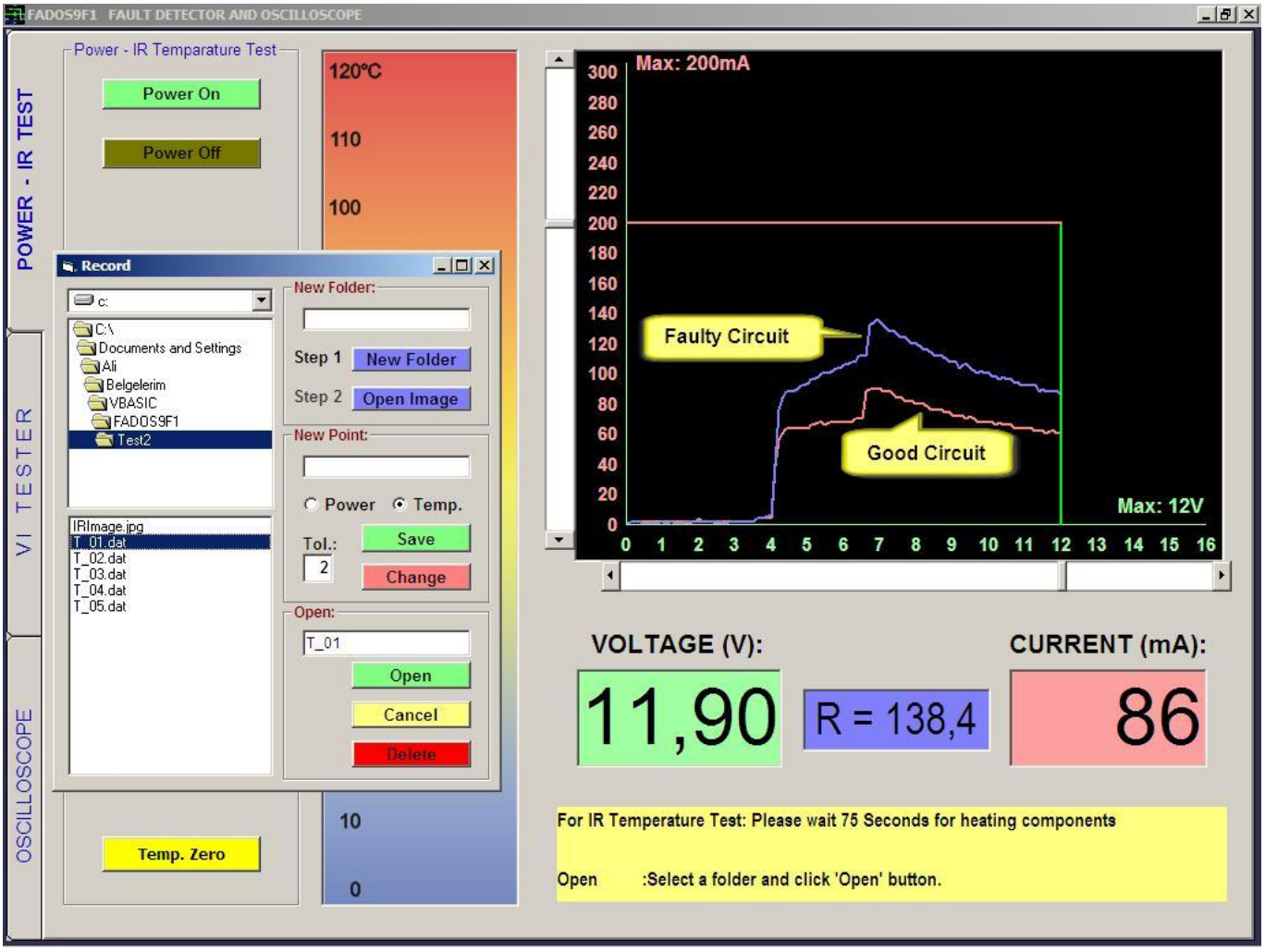
Comparison Power DC VI Graph with Faulty Boards DC VI Graphs

Open Power File : Click "Record Button" and selects power data, then click "Open Button" and saved a file is opened.



Picture 8: Record DC Voltage – Current Graph

- Open good (solid) circuit boards VI graphs from memory.
- Connect to power cable to circuit board's supply. Red Cable (+), Black cable (-)
- Click Power "Test Button" and creates faults circuit boards DC VI graph.



Picture 9: Compare DC Voltage – Current Graph

Two graphs appear on the screen. If more current is suffering from faulty card, it means that one or more components suffers more current on the board, and therefore heats the electronic board. For finding heated components, selects "Temperature Option".

If the faulty card is less current, in this case supply line is open circuit likely. In this case, open oscilloscope screen and find line which does not get energy and broken-line is easily detected. If the faulty card and solid card has same graphs; in this case opens VI tester screen and finds faulty with it.

For testing faulty circuit boards; Good circuit board graph opens. Maximum current is determined and after click 'Power Test' button, created faulty circuit board's supply graph. If more current is suffering from faulty card with IR Sensor by controlling the temperature of the components that more heated components are determined in a short time. If the faulty card is less current, in this case supply line is open circuit likely. In this case, open oscilloscope screen and find line which does not get energy and broken-line is easily detected. If the faulty card and solid card has same graphs; in this case opens VI tester screen and finds faulty with it.

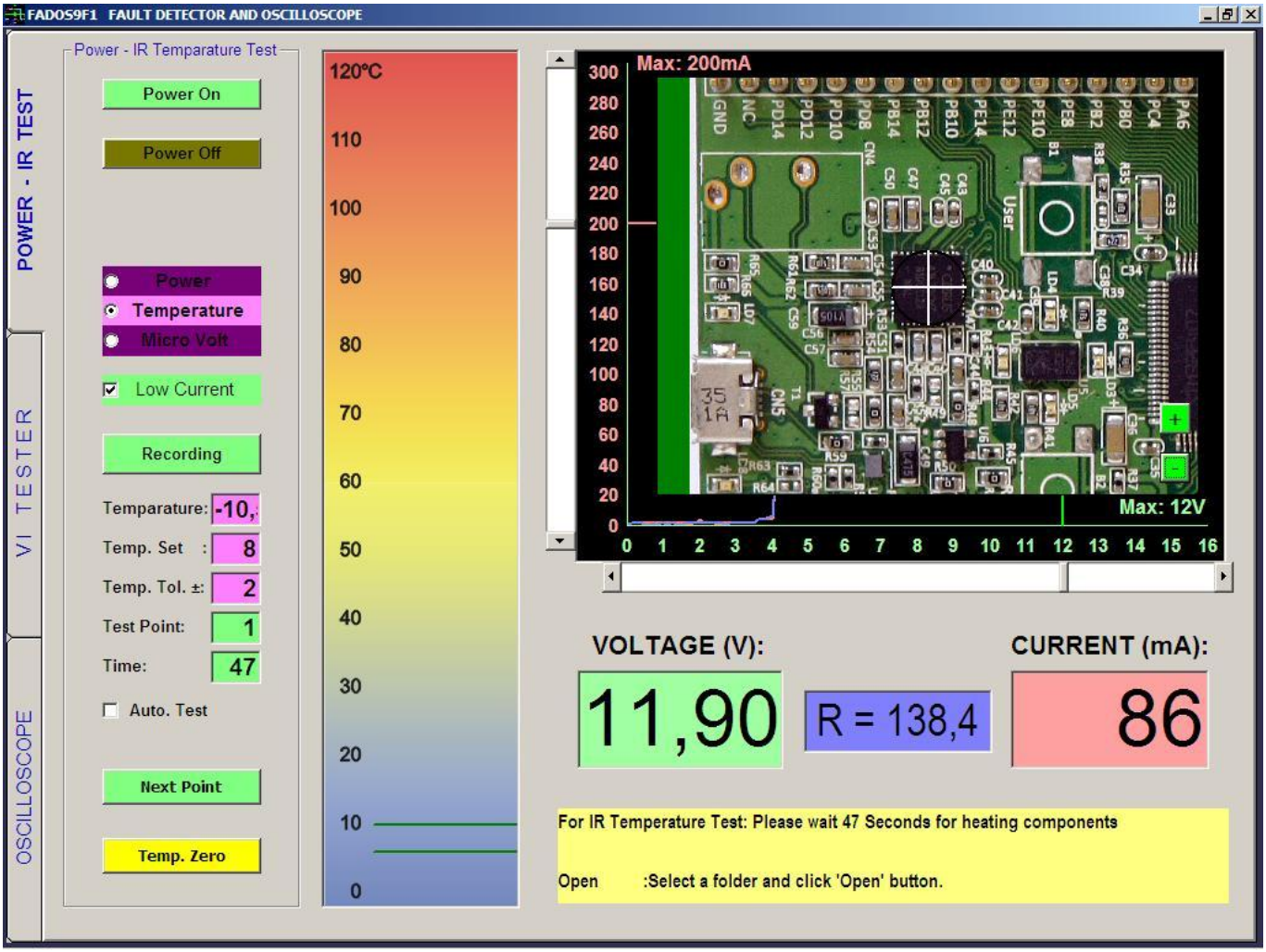
IR TEMPERATURE TEST

Record Temperature

Connect DC cable to circuit board's supply. And Click "Power On" button for giving energy to boards. Timer starts counting down from 120 seconds. Click "Record" button and open circuit board image, which uploaded before. IR sensor is kept to a point on the table and click "Temp Zero" button. The IR sensor measures the temperature of the component.

Bring on the IR sensor component and for measuring the temperature of components. And this point is marked on the image of circuit board. When Timer is 0, record is done by clicking the save button. Then the other components can save.

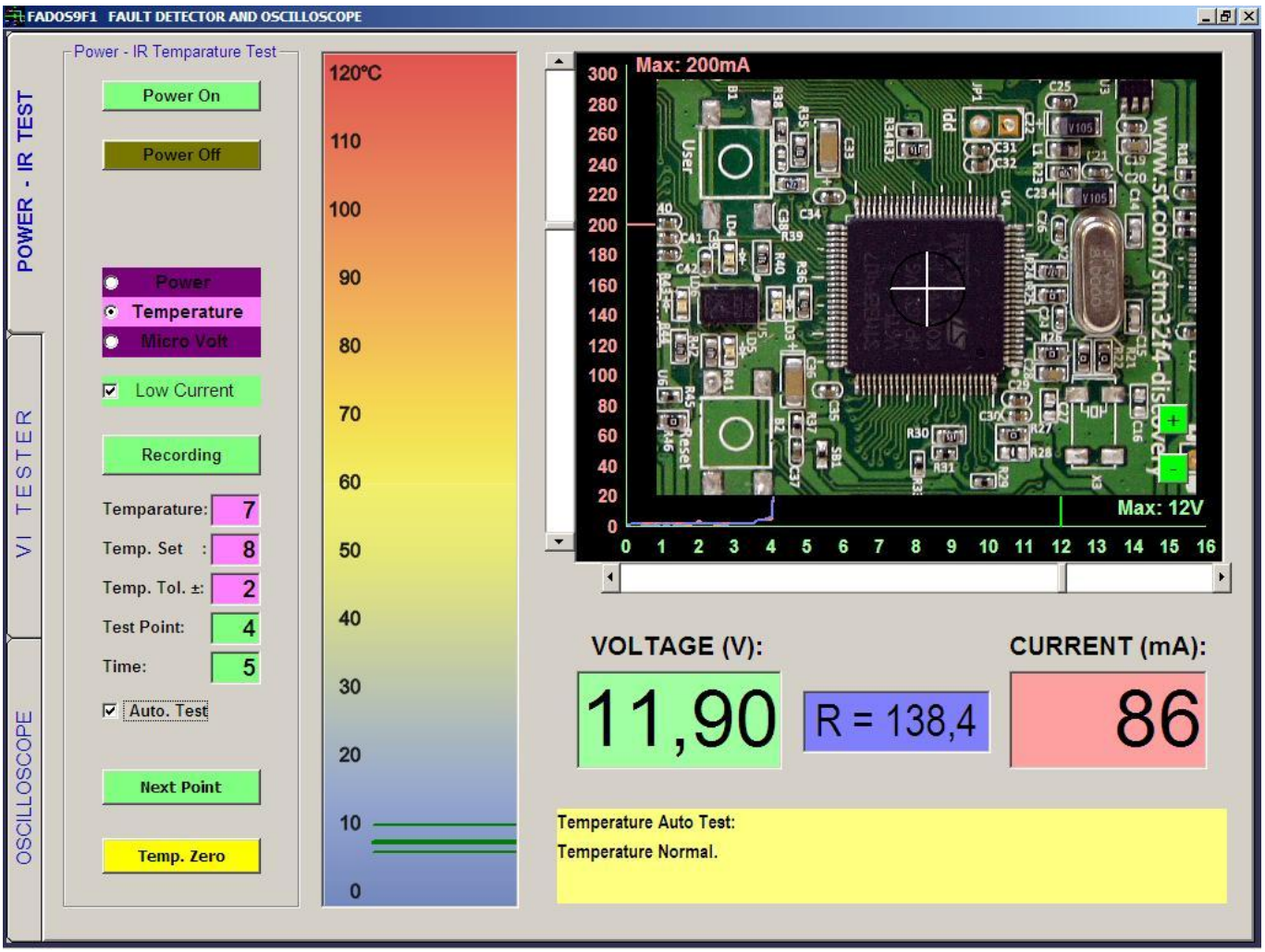
After waiting 120 seconds, it will be easy to detect more heated components and draw out heat map of electronic card.



Picture 9: Temperature Test

Temperature Control of Faulty Board

- Connect to Power Cable to faulty board's supply. Red Cable (+), Black cable (-)
- Click "Record" button, selects "IR-Temp data" and click "Open" button.
- Click "Power Test" button and wait 120 seconds for heating components. Measure the temperature of first components, if temperature is same, click "Next Point" for testing second data. Or, if you select auto test; and temperature is same, after 5 seconds automatically opens other data.



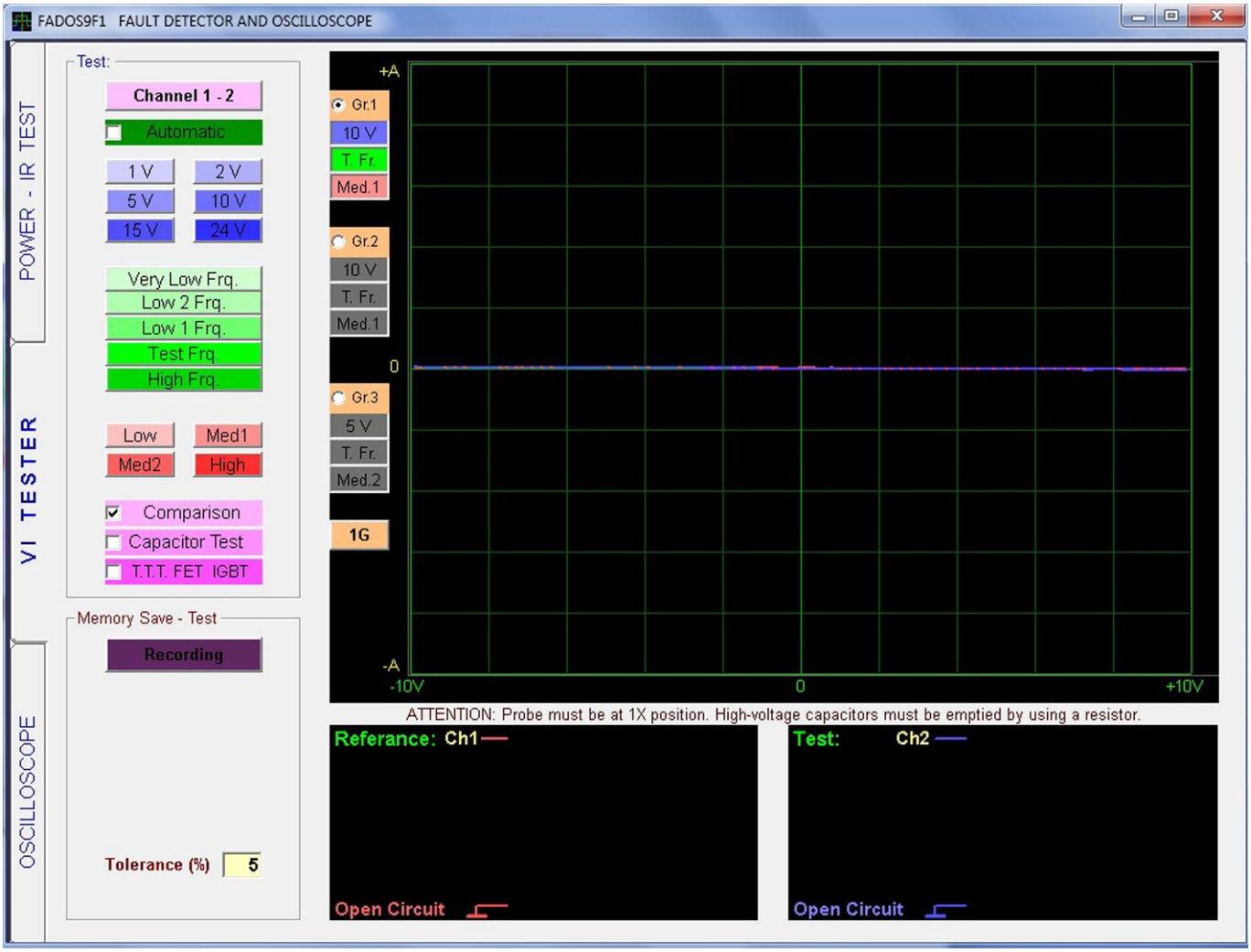
Picture 10: Compare Temperature

Micro-Volt: FADOS9F1 is used for microvolt measurement. If this option is selected, open micro Voltage screen. Connect one probe to IR plug and measure micro volt. It is used for measure voltage below 2,5 µV. max.

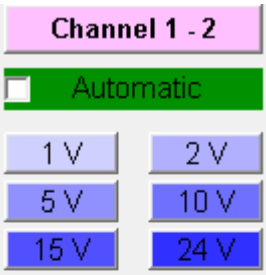
VI TEST – PROGRAM FEATURES OF FAULT DETECTION PART

While testing with V/I graph, do not apply power to board. Generally, probe chassis is connected to board chassis and a signal is applied to touch point by the device. V/I graph of this signal is seen at the screen. Signals scans from negative voltage to positive voltage and when open circuit, it appears horizontally in the middle of the screen.

All control buttons are placed to the left of the panel used in fault detection.



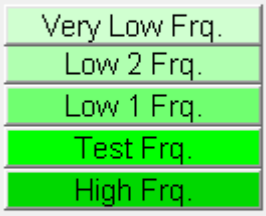
Picture 11: Fault Detector – VI Tester Screen



Channel: Used to select channel.

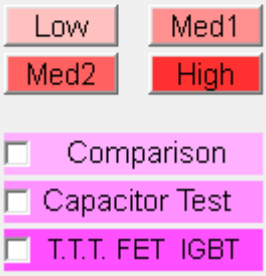
Auto: When Auto is selected, according to feature of touched point, the most appropriate values of voltage, frequency, and current steps are determined.

Voltage Step: FADOS9F1 has various voltage steps ±1V, ±2V, ±5V, ±10V, ±15V, ±24V simultaneously.



Frequency Step: FADOS9F1 has various frequency steps Very Low Freq., Low 2 Freq., Low 1 Freq., Test Freq., and High Freq.

Current Step: FADOS9F1 has various current steps Low Current, Middle1 Current, Middle2 Current and High Current.

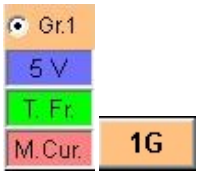


Comparison: If this option is selected, good (solid) and faulty or suspect circuit boards are compared by touching probes to the same points of both circuit board.

Capacitor Test: Capacitor test determines quality of electrolytic capacitor.

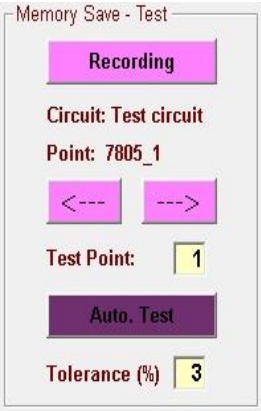
TTT FET IGBT: If this option is selected, determines TTT, FET, IGBT etc. Type of semi – conductors.

Recording: Opens file form and records; or opens recorded file.



Grf: For 3 different steps, 3 different graphs are generated and fast passage is possible at any time.

1G, 2G, 3G: 1, 2 or 3 graphs at different adjustments can be screened.



Recording: Opens file form and records; or opens recorded file.

Circuit: Indicates name or code of point to be tested. Folder name in the system.

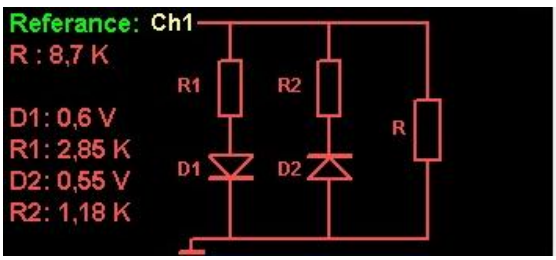
Point: Name or code of test point. Recorded as file name in the system.

←: Goes to previous test point.

→: Goes to next test point.

Test Point: Serial number of test point.

Auto Test: If tolerance of test point is lower than or equal to tolerance mentioned below, it goes to next test point automatically.



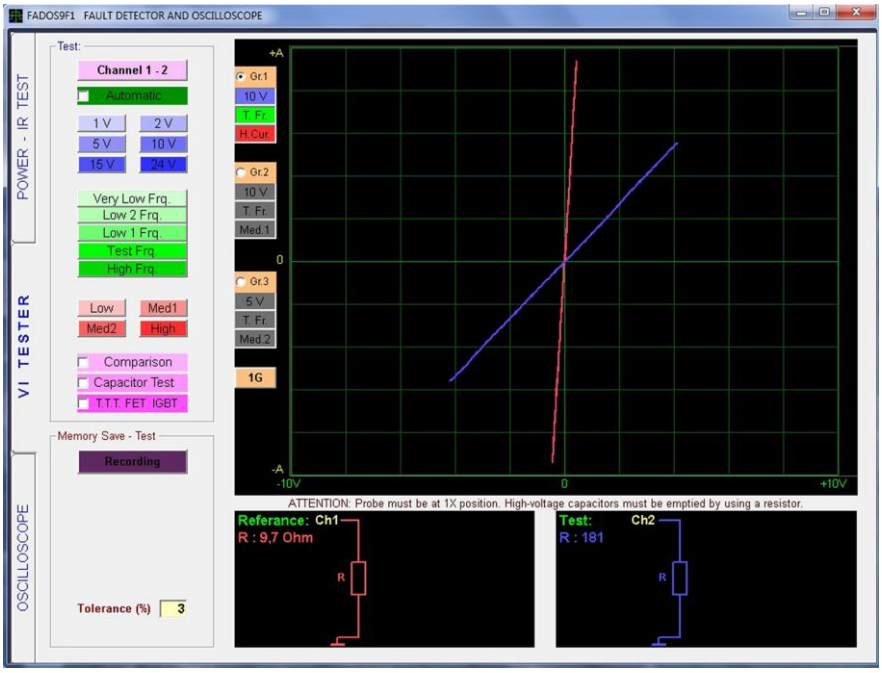
Reference: Channel1 indicates good (solid) circuit; Channel2 indicates faulty circuit or circuit to be tested. When saved at memory, Reference=Channel1 is saved. Values of circuits composed of resistance, capacitor, and diode are displayed.

PASSIVE COMPONENTS R, L, C (RESISTOR, INDUCTOR, CAPACITOR) V/I GRAPH

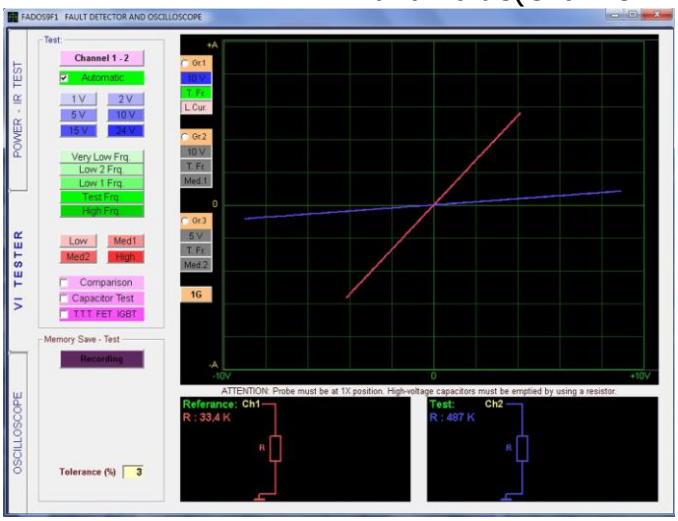
Resistor VI Graph

Resistor signatures appear with a specific angle to horizon; and resistor symbol and value are seen at the bottom of the graph. While resistors at high values appear with angle close to horizontal axis, resistors at low values are seen at screen with an angle close to vertical axis. Picture 12, 13 display resistors typical signals and values for the equivalent circuit. Picture 14 short and open circuit.

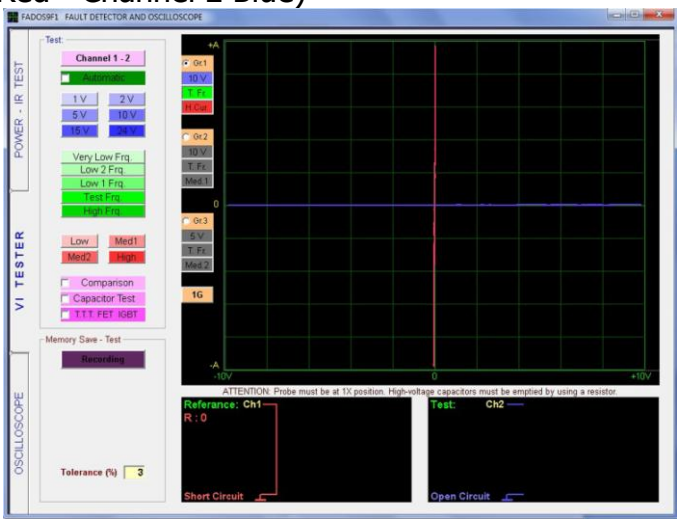
High resistor generates a line close to horizontal line. So that, for testing high resistance selects low current step. Low resistor generates a line close to vertical line. So that, for testing low resistance selects high current step.



Picture 12: Resistors VI Graphs, The Equivalent Circuit Diagram and Value(Channel 1 Red - Channel 2 Blue)



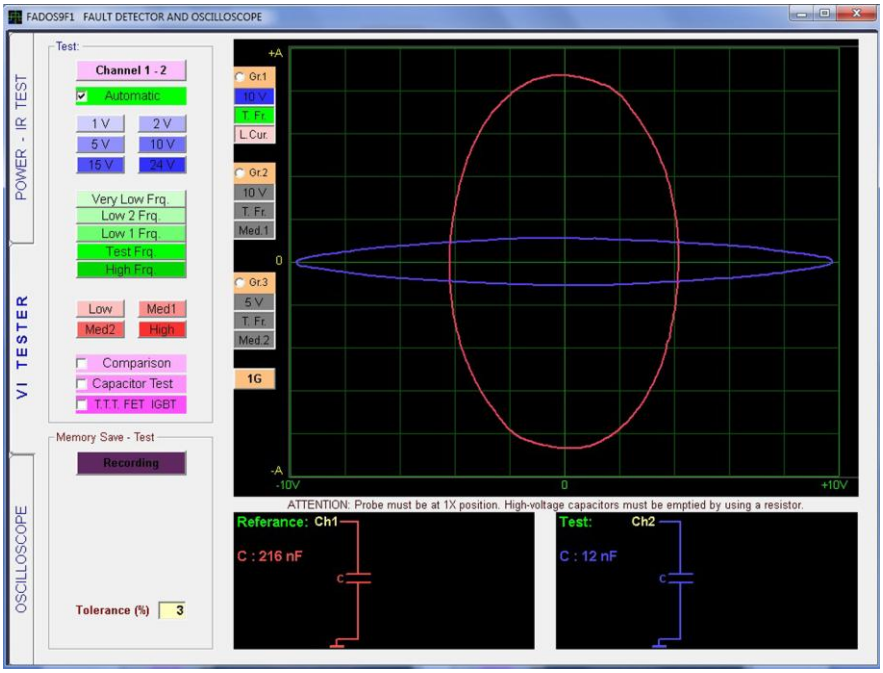
Picture 13: Resistors VI Graphs



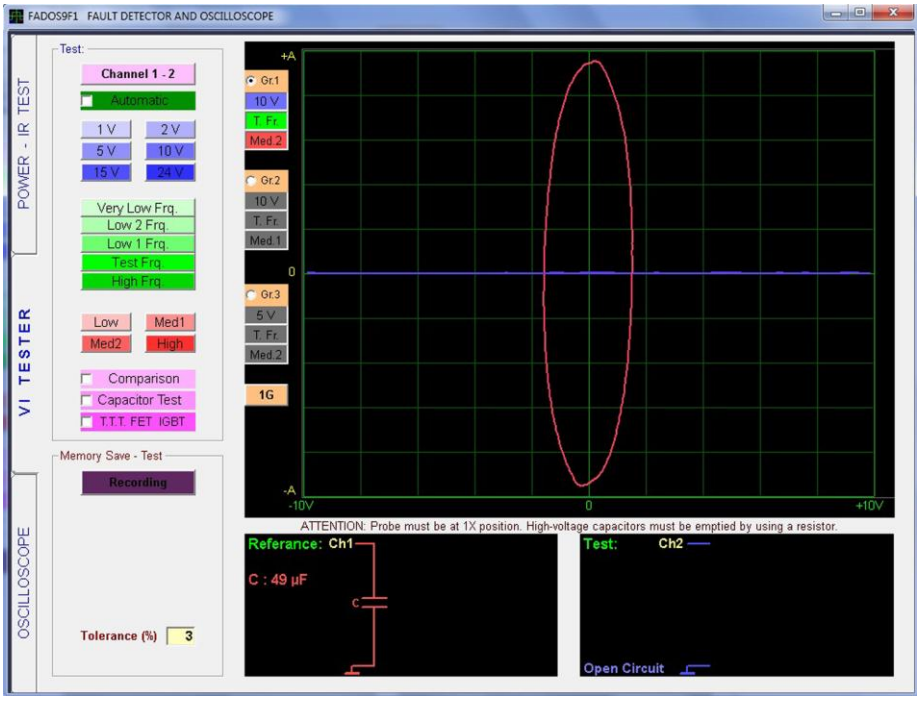
Picture 14: Short Circuit (Channel 1) and Open Circuit (Channel 2)

Capacitor VI Graph

Due to their energy storage characteristics, reactive components produce a phase shift between voltage and current flow. This is displayed as a circular or elliptical signature. Capacitor symbol and value are seen at the bottom. Picture 15 - 16 displays capacitor typical signals and values for the equivalent circuit. High capacitor generates vertical ellipse. For testing high capacitor select high current and low frequency. Low capacitor generates horizontal ellipse. For testing low capacitor (lower than 10 nF) select low current and high frequency.



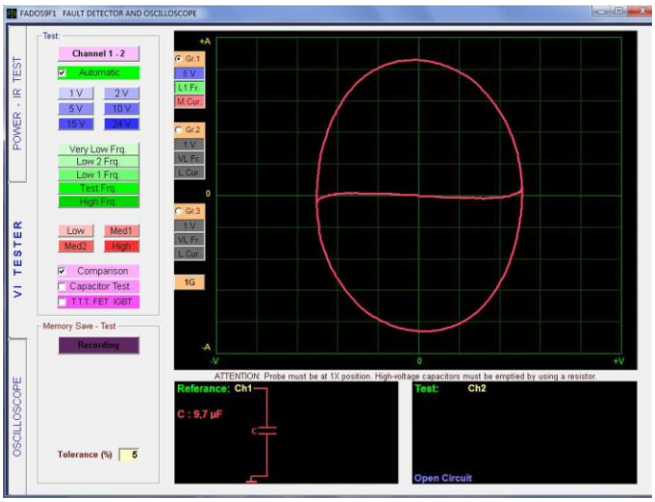
Picture 15: Capacitor VI Graph,
The Equivalent Circuit diagram and Value



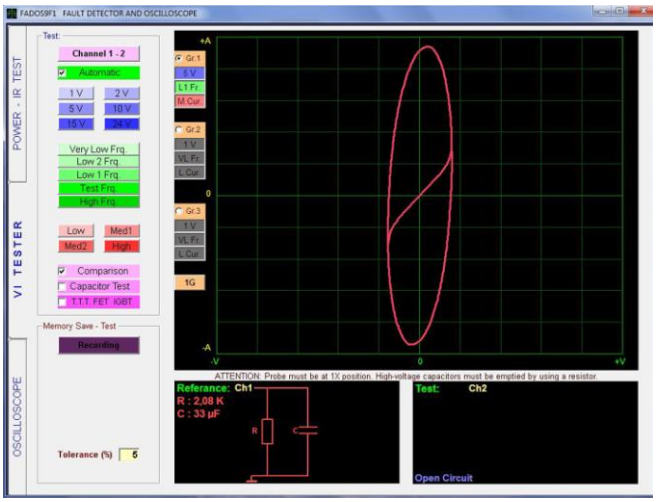
Picture 15: Capacitor VI Graph

Capacitor Quality Test and RC Circuit

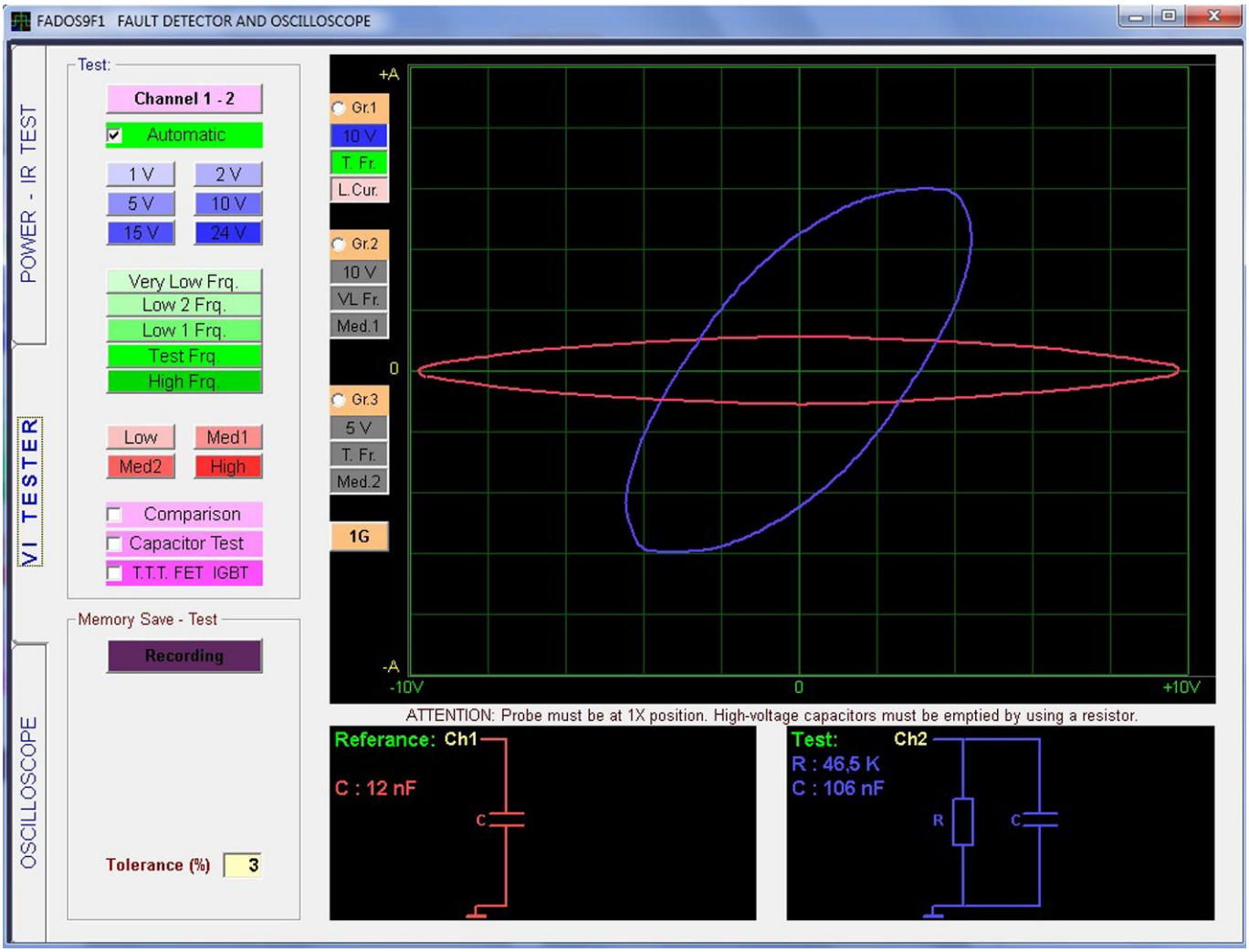
When "Capacitor Test" is selected, an additional curve displaying the quality of capacitor appears. If this curve is at horizontal axis or close to it, quality is high; and quality is low as much as the angle degree is high. High quality capacitor generates a horizontal line.



Picture 17: High Quality Capacitor



Picture 18: Low Quality Capacitor



Picture 19: Capacitor and RC Circuit

If capacitor and resistor are parallel, elliptical shape makes an angle to horizon.

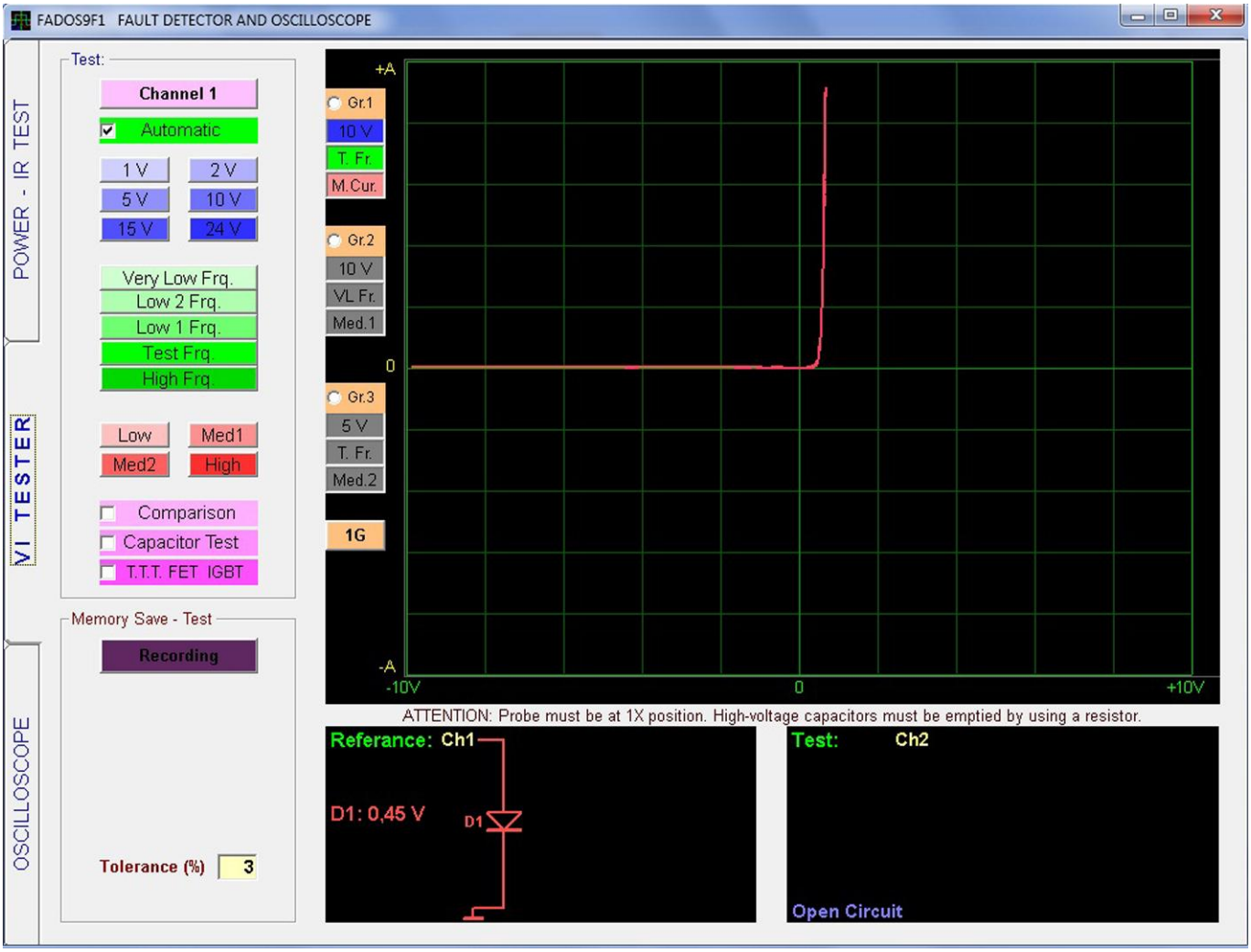
SEMI CONDUCTORS VI GRAPH

Diode – Zener Diode VI Graph

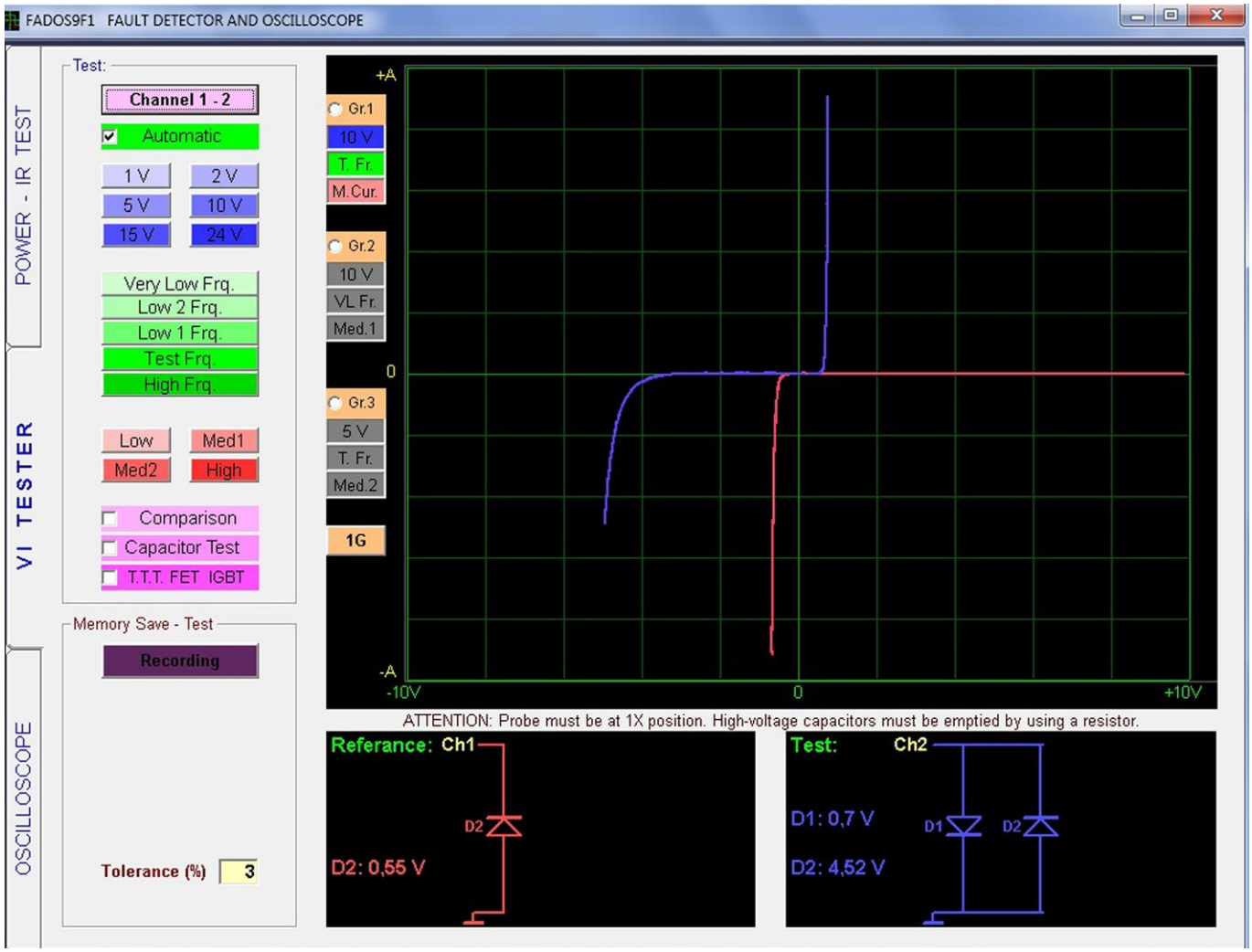
Diodes start to transmit current after high transmission voltage. For this reason, diodes are seen horizontally at one part of the graph, and are seen vertically at the other part. If cathode of diode is connected to chassis, a curve appears at horizontal axis at negative voltage and before transmits voltage; and the curve appears at vertical axis at transmit voltage. If anode of diode is at chassis, a curve appears to down at negative voltage.

A Zener diode exhibits the same signature as a conventional diode for voltages below the Zener voltage. When the reverse bias exceeds the Zener voltage, a low resistance signature is displayed.

If diode and resistor are serial on circuit, after transmission, graph makes an angle to horizon.



Picture 20: Diode and Serial Diode - Resistor VI Graph, The Equivalent Circuit Diagram



Picture 21: Diode VI Graph (Channel1), Zener Diode VI Graph (Channel2), Transmission Voltage

Transistor – Triac – Thyristor – FET - IGBT VI Graph

Active components such as transistor, triac and FET can be tested by transmitting them while both of two channels are used. A transistor contains two semiconductor junctions connected. Transistors also must have emitter chassis. First, touch collector with a probe (Channel 1 probe or Channel 2 probe). Collector must be at non-transmission position. Then, touch other probe (Channel 1 probe or Channel 2 probe) base in order to provide transistor to start transmitting. Transistor characteristics should be seen as at the screen.

Triac, Thyristor, Fet and IGBT can be tested in the same way.

If Thyristor,Triac, Transistor, FET, IGBT selection (T.T.T FET IGBT button) is applied, type of component can be determined.

INTEGRATED CIRCUITS (ICs – SMD INTEGRATES)

Integrated circuits can be tested all the pins with the help of probes. Circuits made up of many components encapsulated within a single package. The component count within an IC may vary from as few as half a dozen devices on a "chip" to many thousands of components in, for instance, a modern microprocessor. Because of the need to package so many components into an extremely small space, components within an IC are often microscopically small.

As a result, modern ICs contain components and connections which are susceptible to damage from electrical stress and static discharge at levels far lower than those which would damage normal components.

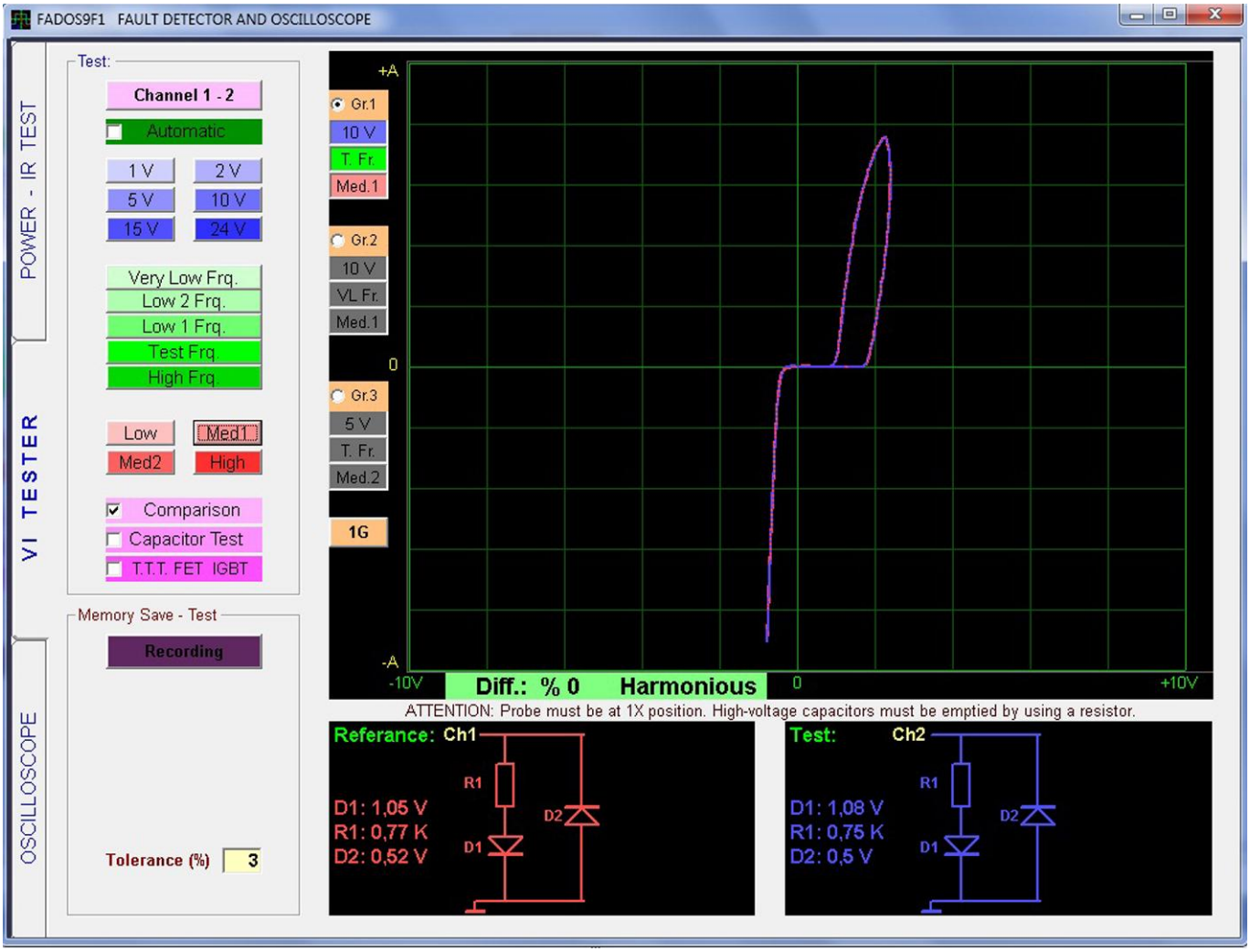
For this reason, many ICs incorporate protection diodes on their signal input and output pins.

When testing integrates signals display similar to the double-inverse diode, zener diode and diodes. It can be capacitors or resistors are connected to these. If pin of integrated has double reverse diode, it means this pin can be solid.
We can use the same technique to locate faults in ICs which are large and very complex, such as memory chips and microprocessors. The pin arrangement of such complex ICs means that it is especially appropriate to use comparison techniques to test these devices.

As we look at these devices we will find that, despite the large number of pins, there are only a few distinct graph patterns on a digital IC.

Note: You will frequently notice differences in the signatures between similar ICs from different vendors or which have been manufactured using different technologies.

Compare the graph on a suspect pin with graphs from other pins on the same device before regarding the device as faulty.



Picture 22: Good (Solid) Integrated Pins – Compare 2 Integrated Pins

ELECTRONIC CIRCUIT BOARDS REGISTRATION MEMORY AND COMPARISON FROM MEMORY

It is possible to save points touched on a circuit board in an order, and then comparing them with other circuit boards.

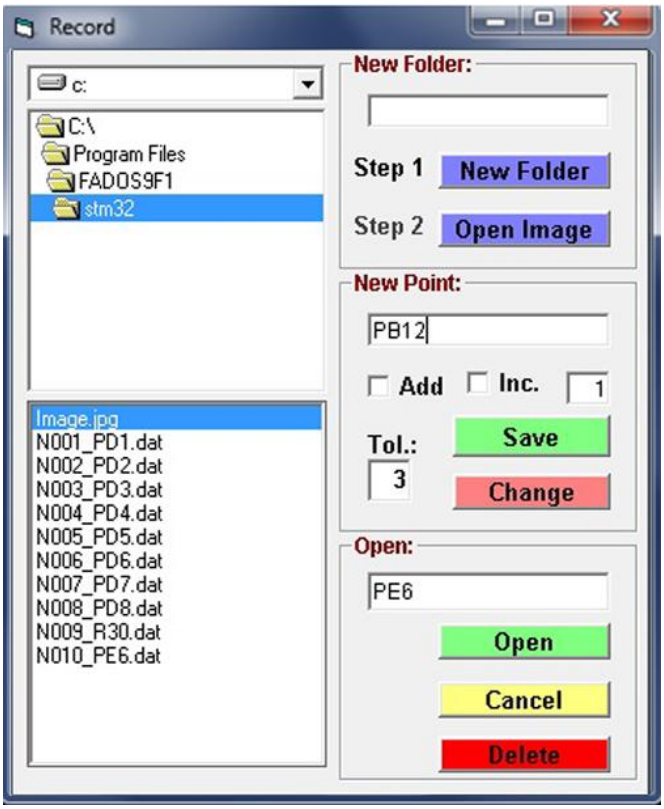
First, open a new file by writing name or code of circuit board that will be saved. Touch the point which is in the electronic circuit board, will be saved by channel 1; write the name of point, which will be saved, on the new point label. If New point label is empty, software saves data with automatic number (N001, N002 etc) to file. Because, all files need a serial number (N001) for saving an order. In a folder data limit is 999 points (N001 to N999). Then, press save button. If Add number selections, software adds number automatically data. If Increment selections, software increments number automatically to data.

In order to test from saved file, press "record memorized test" button, select data to be tested and open first saved point. Saved data is seen as a red graph at first channel. Touch the point

to be tested with second channel. If it is same as the saved data or in tolerance values, it is written "Harmonious" at screen. If it is out of tolerance values, it is written "Disharmony", percentage value is seen and wrong voice is heard.

When automatic test is activated, if a test point is harmonious, then it goes to next point automatically. By this way, circuit boards can be tested faster with the help voices.

Note: Electronic circuit test points, we can only register with Channel 1. Using recording menu to open as a reference test points by recorded Channel 1, using Channel 2 comparison data with faulty or solid circuit.



New Folder: Opens a folder by using the name given to a new circuit.

Open Image: Open and upload the circuit of the image.

New Point: If New Points is empty, software saves data with automatic number like"N001, N002" Add to file.

Add Number: Add numbers automatically test point.

Inc.: Increments number automatically.

Save: Saves the value of test point with mentioned name to the determined folder. If name is not given, saves with serial number.

Change: Changes the marked test point data and save a new test point data. For example: Select N009_ULN2003_10.dat, touch point on the card, and then click change button.

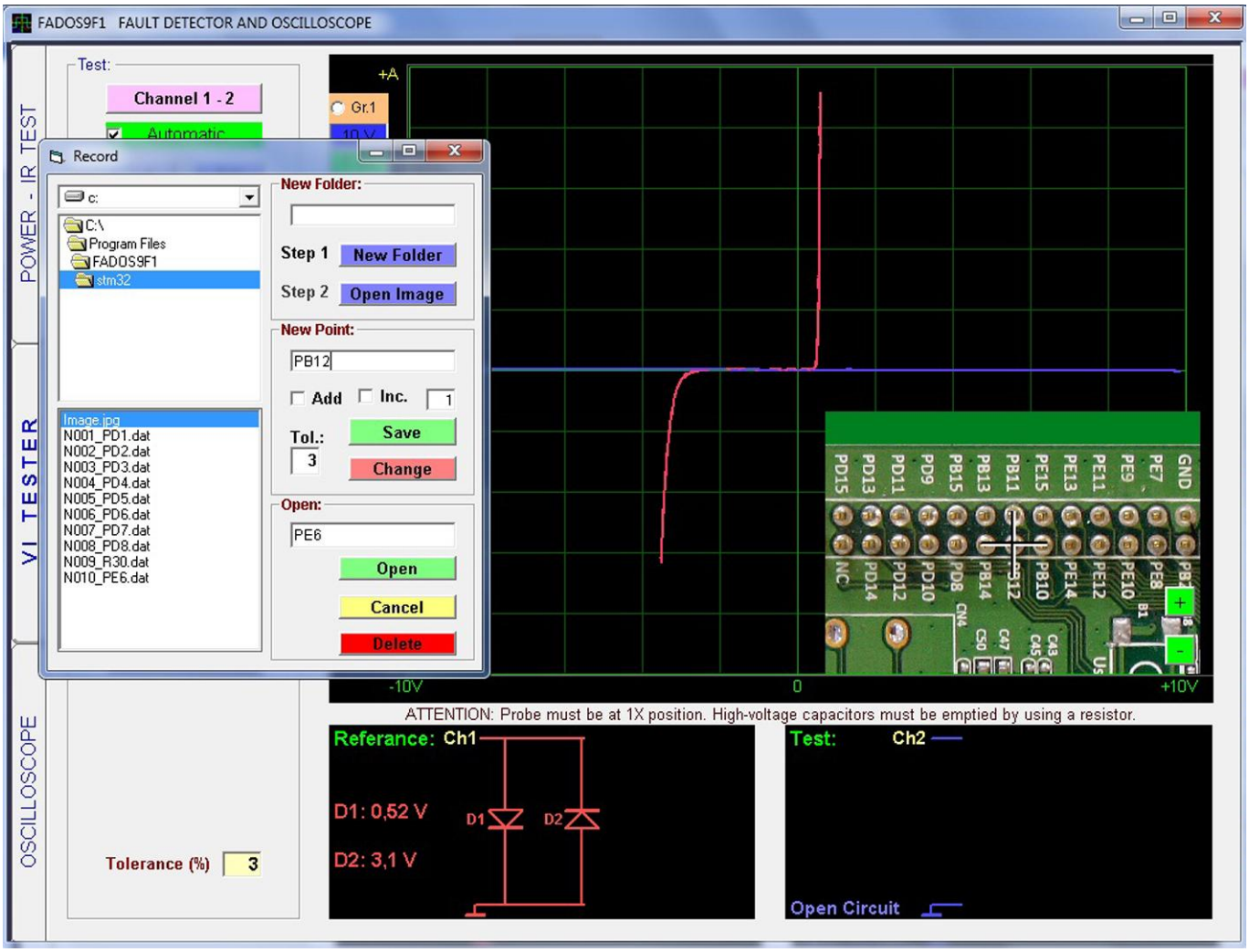
Open: Opens data clicked on the list to Channel1.

Delete: Deletes the marked test point data from computer.

Recording Data with Image

First, open a new file by writing name or code of circuit board that will be saved. For uploading image; click open image and select the circuit of the image and again click open for uploading circuit board's image. Software changes automatically name of circuit board's Picture. For example, Picture name is "picture4.jpg" and program changes the name automatically "image.jpg" and adds folder. If you copy a picture in folder, you have to write name of Picture "image.jpg". Software checks only image.jpg or not in folder. If picture name is not "image.jpg", this function does not work. After uploaded image, you see circuit board's image on the right. On the image "+", "–" buttons are for zoom. Click point on the image which you

want to save than touch the point which is in the circuit board, will be saved by channel 1. Then, press save button. When you compare data from memory; you can see data which you saved before on the picture.

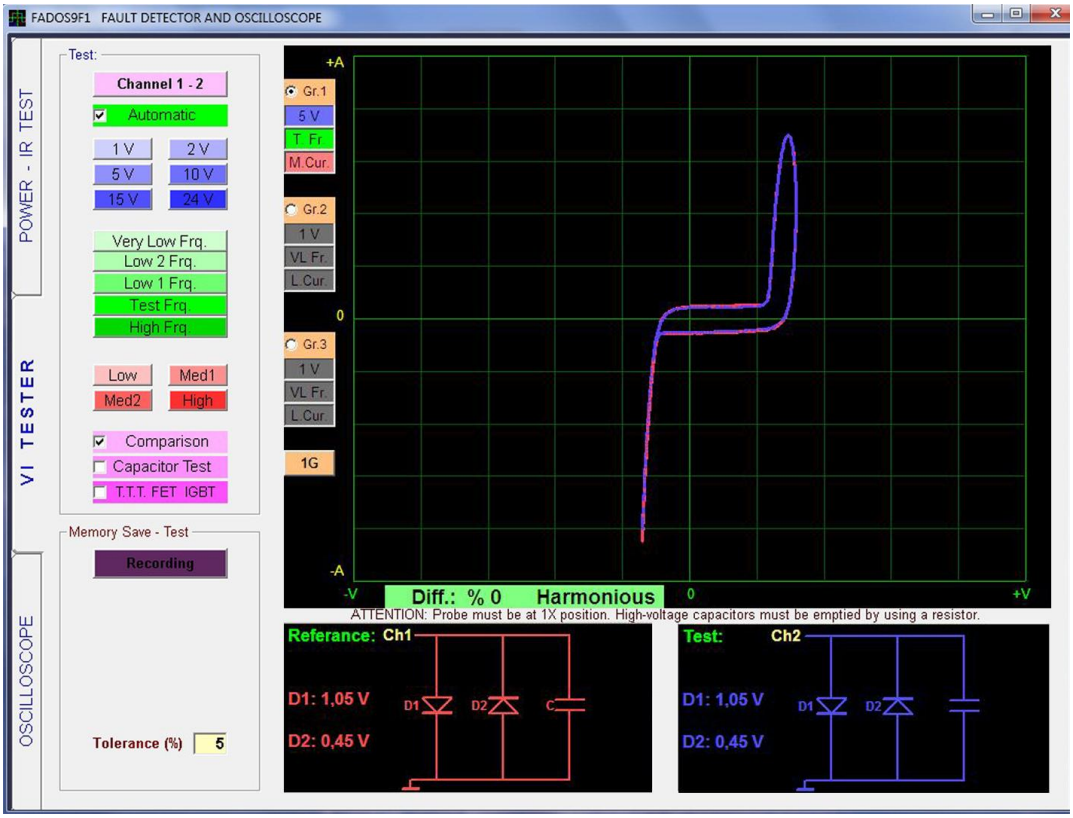


Picture 23: Recording Data With Image

COMPARISION TESTING COMPONENTS OF ELECTRONIC CIRCUIT BOARDS

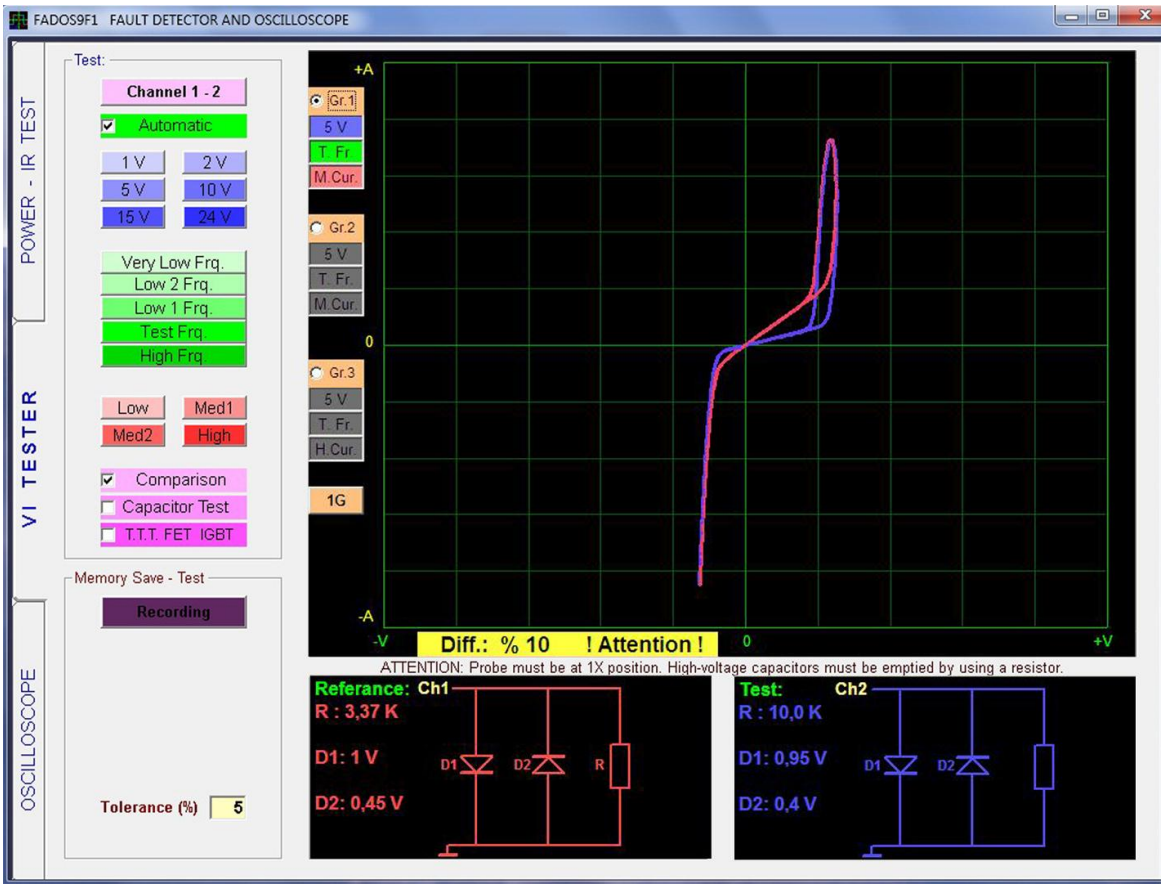
When a component is tested in a circuit, generates a complicated signal other due to parallelism other components in the circuit. FADOS9F1 makes the comparison by removing the component values of the equivalent circuit and measuring signals.

Connect good circuit board to Channel 1, connect fault or suspect circuit board to Channel 2 and touch same points at the same time. If it is same as, it is written "Harmonious" at screen. If it is out of tolerance values, it is written "Disharmony", percentage value is seen and wrong voice is heard.



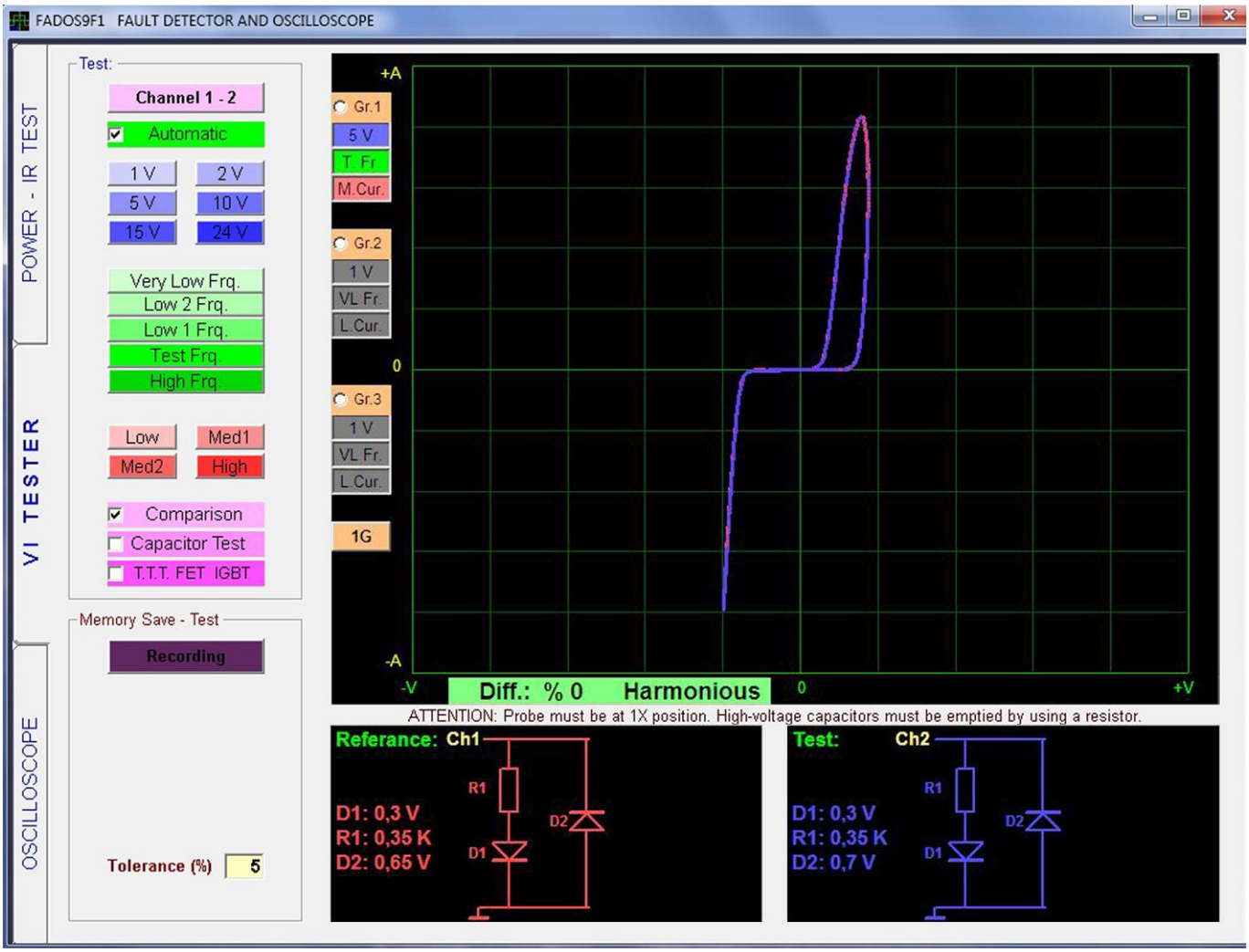
Picture 24: Comparison Test

Comparing this system is very sensitive and is considered compatible with the values within the given tolerance.



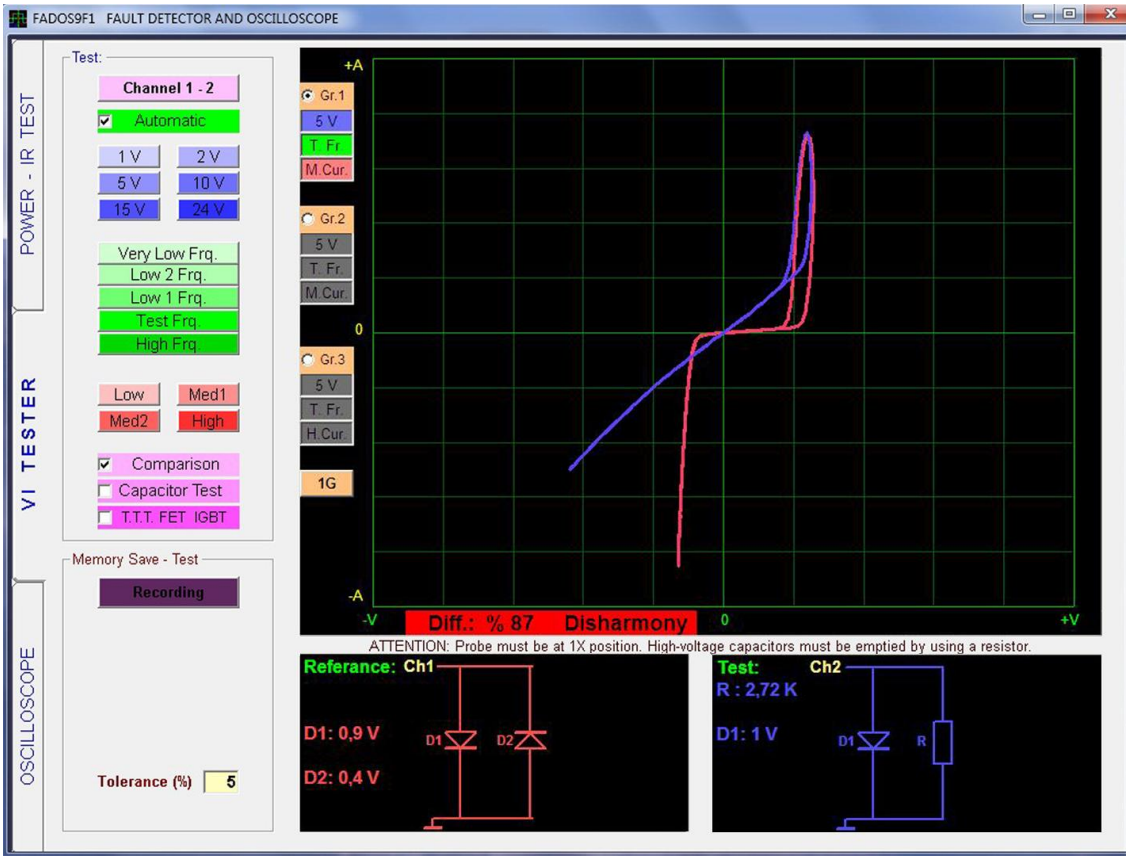
Picture 25: Comparison Test

A significant difference, different resistance value of the test circuit from reference circuit.



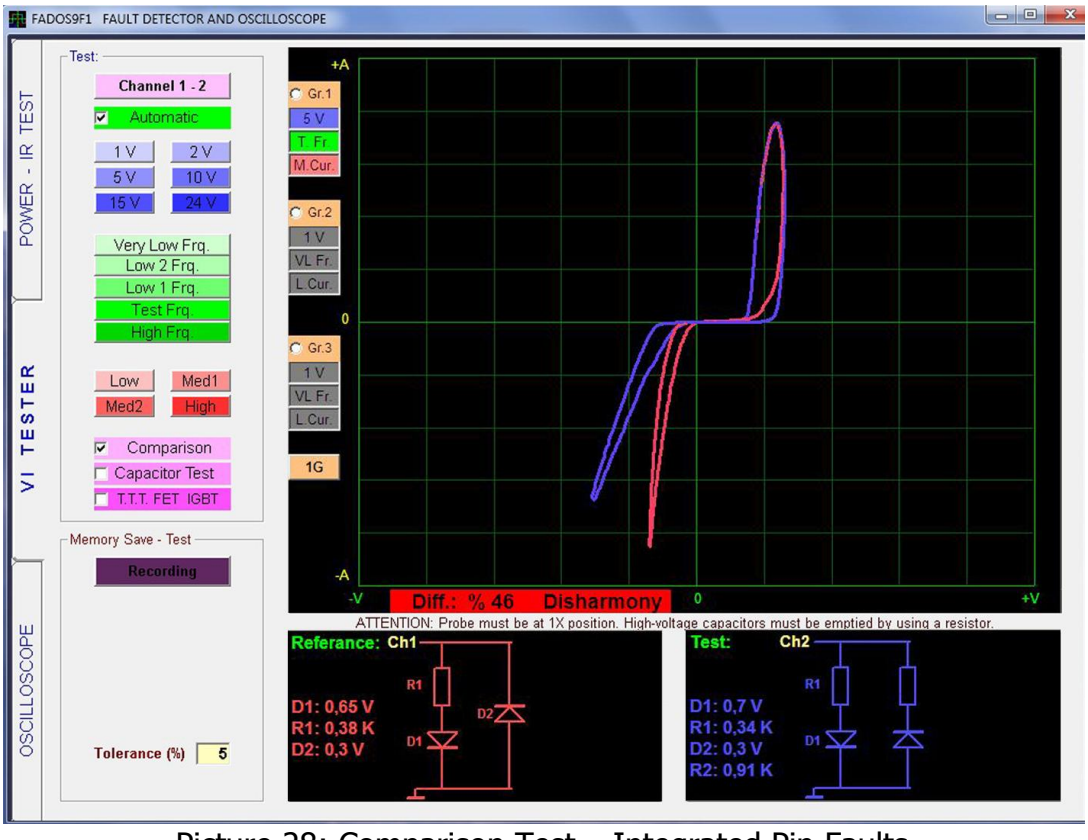
Picture 26: Comparison Test

Integrated circuit is usually double reverse diode. It can be capacitors or resistors are connected to these. If pin of integrated has double reverse diode, it means this pin can be good (solid).

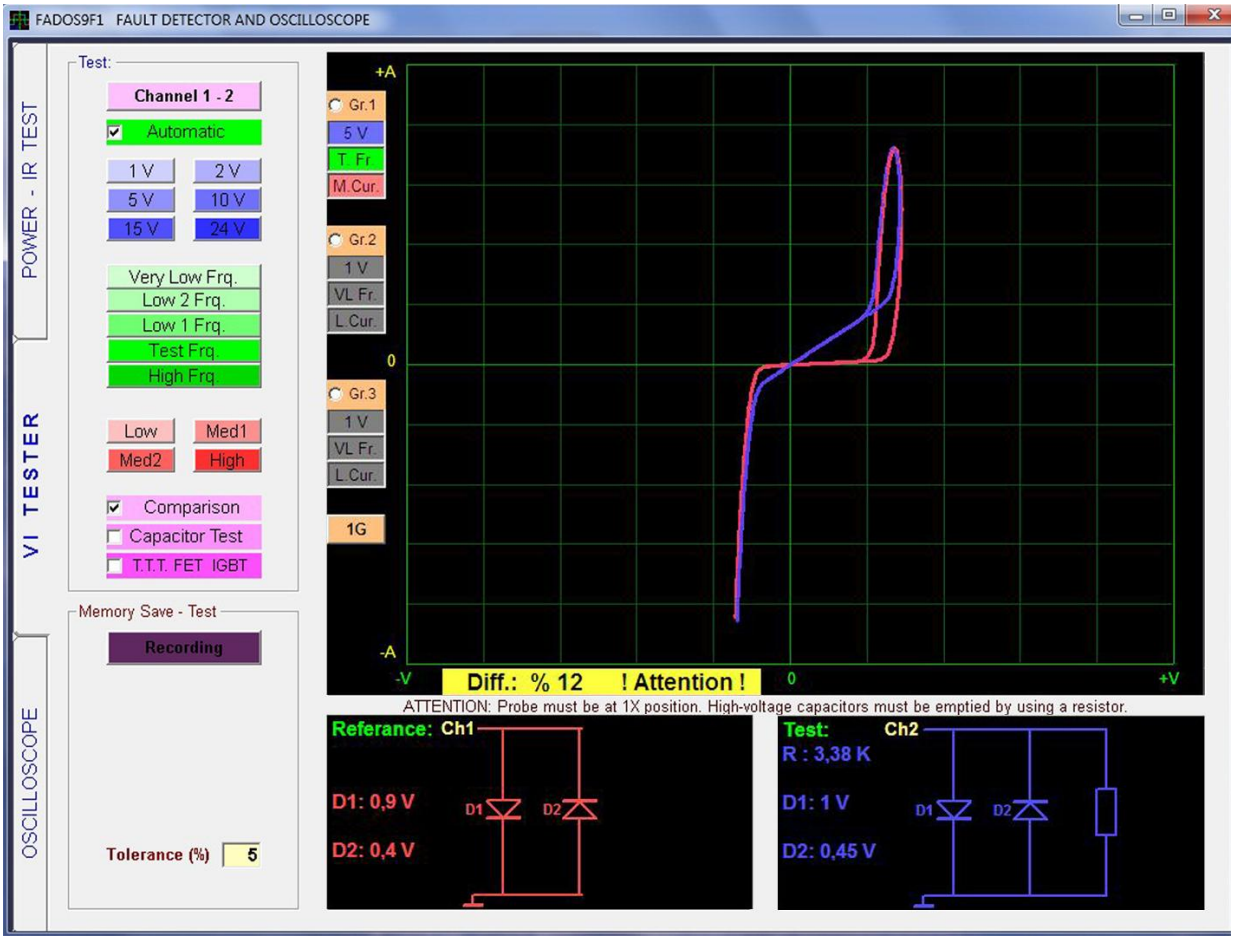


Picture 27: Comparison Test – Integrated Pin Faults

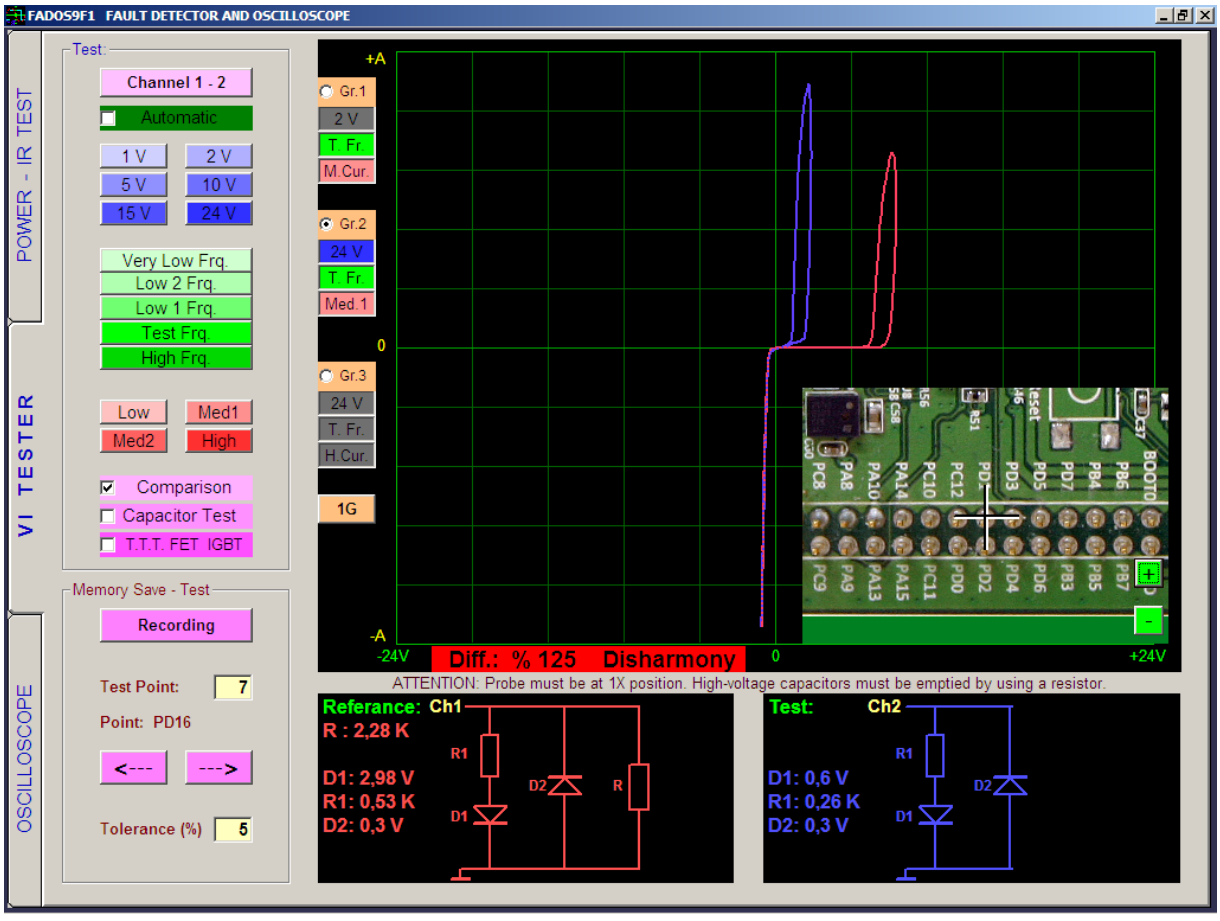
Using FADOS9F1, faults can be easily found. Pin of integrated is damaged reverse diode by deterioration; diodes can be resistance, open circuit or short circuit. It is integrated fault. One diode damaged and now it is a resistor.



Picture 28: Comparison Test – Integrated Pin Faults



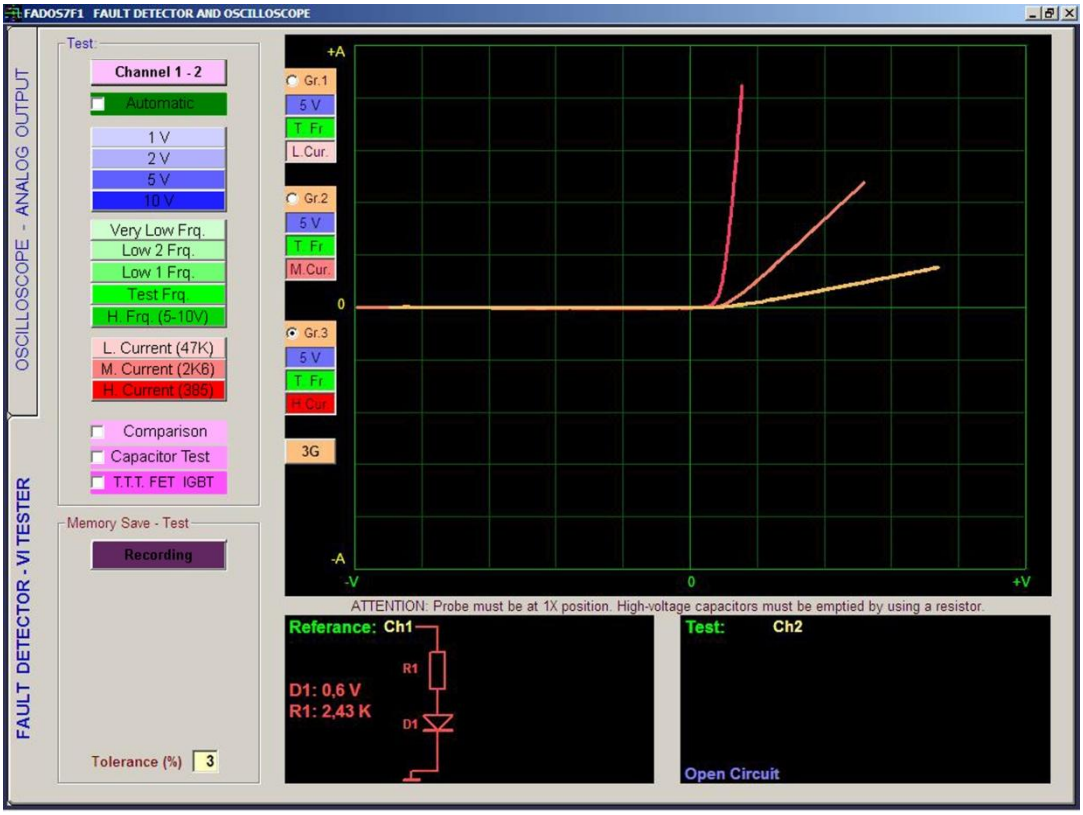
Picture 29: Comparison Test – Parallel Resistor Faults



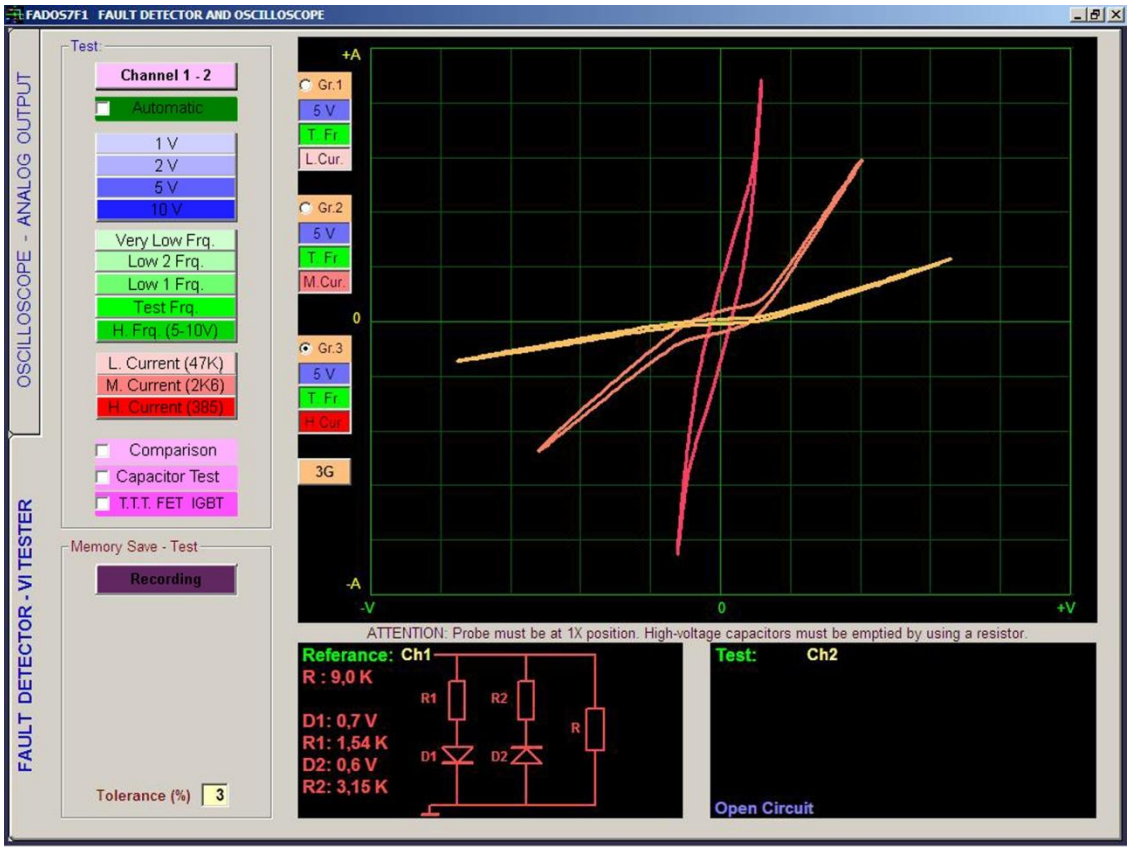
Picture 30: Comparison Test From Memory

3G - 3 DIFFERENT GRAPHS DISPLAY

If you click 1G button, you see 2G and 3G. It means 1, 2 or 3 graphs at different adjustments (voltage, frequency and current) can be screened simultaneously.

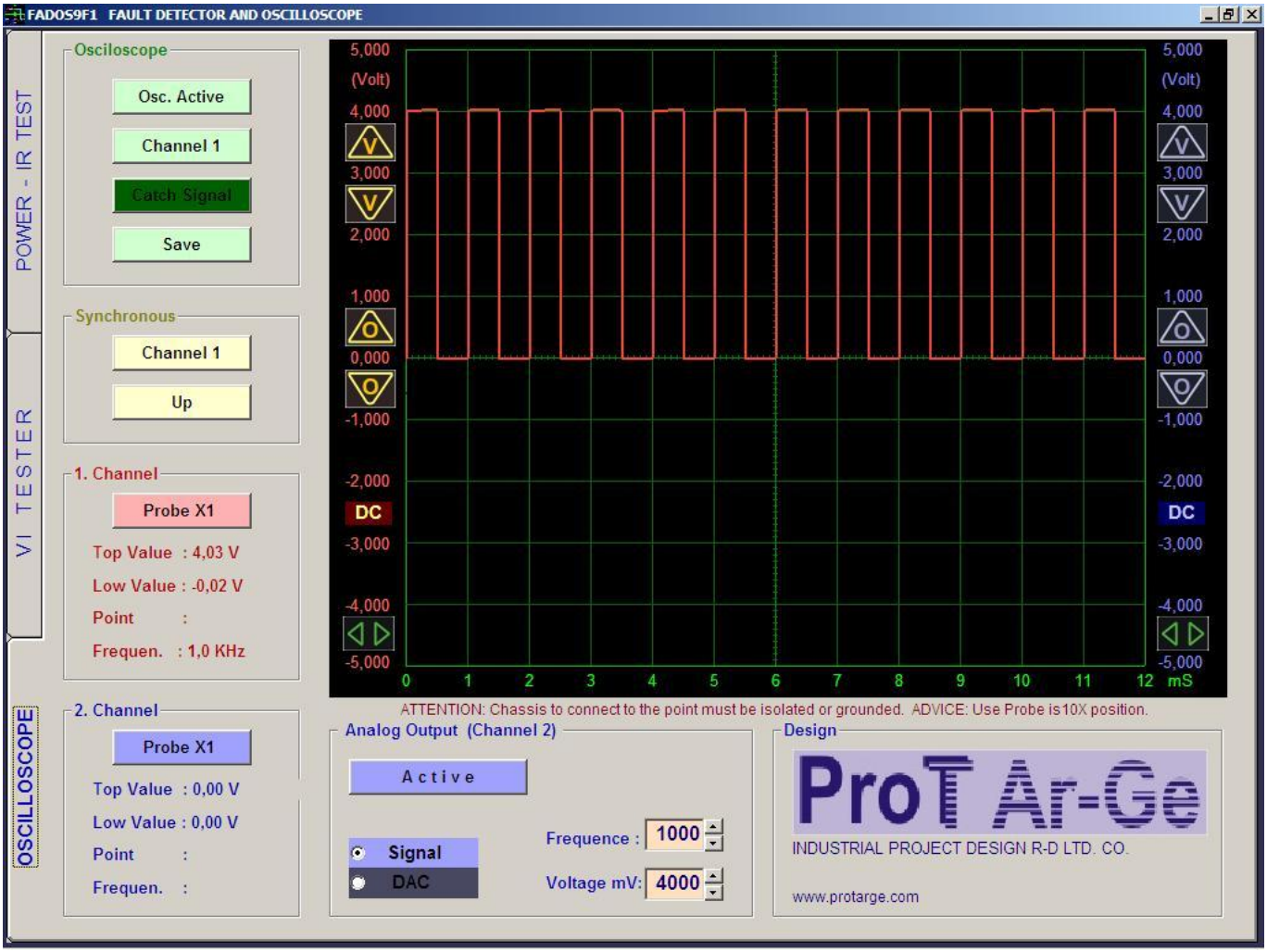


Picture 31: 3G Graph Display



Picture 32: 3G Graph Display

OSCILLOSCOPE – PROGRAM FEATURES



Picture 33: Oscilloscope Screen

Osc. Active/Passive: Activates oscilloscope or shows latest screen display.

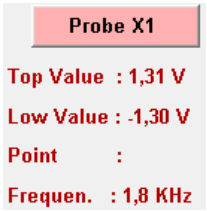
Channel: Selects channel. Channel1, Channel2 and both channels are selected in an order.

Manual/Auto: When automatic, catches the latest signal if the signal is off.

Save: Saves oscilloscope data or opens recorded data.

Channel: Channel is selected for synchronous.

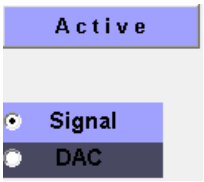
Up/Down: Starts synchronous at increasing or decreasing signal.



Probe X1: Adjusts voltage value according to X1 or X10 coefficient probe.

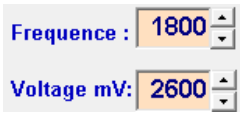
Top or Low: Highest or lowest value on screen.

Point: Displays voltage value of cursor at vertical line while at memory position.



Active/Passive: If active, then gives square wave or analogue output from Channel2.

Signal / DAC: Square wave or analogue output is selected.



Frequency: Output frequency.

Voltage: Voltage of square wave or analogue output.

Voltage Adjustment: (Voltage/Division) Adjusts screen sensitivity of voltage. Data received from device is 12 Bit, 2.5mV sensitive.

Zero Adjustment: Moves position of '0V' point up or down. Numbers indicate voltage values. If numbers are double-clicked, '0V' reference of that channel starts from clicked point.

Displayed Part: If 'Osc. Passive', then adjusts starting point of displayed part of whole memory.

Time Adjustment: Time/Division.

RECOMMENDATIONS

1. Fault detection probes must be set to 1X at fault detection.
2. Test good (solid) circuit board channel 1, faulty or suspect circuit board channel 2. First touch the channel 1 probe, and then touch channel 2 probes.
3. Fault detection is important to have same graphics at channel 1 and channel 2. The circuit diagram and values are elements of help. The circuit diagram values are not for measuring purposes, it is only for comparison purposes.
4. For fault detection, usually use middle current level. For high value resistor or low value capacitor, select low current step.
5. When recording in the memory, click save button after touching good (solid) circuit board's pins with channel 1. When the data open from memory, using Channel 2 comparison data with faulty, suspect or good (solid) circuit board.
6. Each product has different calibration settings which is include in CD, so that please do not lost program CD.

WARRANTY AND CONDITIONS

1. The warranty period is 1 year from the date of product delivery.
2. The repair period is seven (7) business days.
3. Used the product contrary to the matters contained in FADOS user manual are not covered by the warranty. Giving high-voltage from probes, series resistors which contained in the device damaged and makes the circuit an open circuit. It is a user error and this situation is not covered under warranty.
4. The device is in a solid box. Normally use, the card is not physically damaged. Breaking, wetting etc. are not covered by warranty.
5. Depending of intensive use probes, copper which is in the cable may be damaged. Therefore, failure of the probe is not covered by warranty.
6. If device is faulty, send an authorized repair service or Prot Ar-Ge Company.

ProT Ar-Ge Endüstriyel Proje Tasarım Ar-Ge Ltd. Şti.
Industrial Project Design R&D Co. Ltd.

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