Leaptronix®

IWT-5000A Operation Manual

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Chapter-1 Introduction

1-1 Introduction to the Product

Ever since it's foundation in 1980, Leaptronix has dedicated to the services of IC programming and electronic component measurement, aiming to provide customers with reliable manufacturing and measurement equipment of highest quality.

With a view to meeting the rising measuring requirements of various components, we expanded our product range and formed a dedicated business unit, Leaptronix, for test & measuring instruments, further launching the main product, IWT Series, in the field of passive component analyzing.

IWT Series, Impulse Winding Tester, or so called Surge Tester is designed for testing the insulation of coils and inductors, easily finding pre-existing coil defects such as layer short, broken enameled cover, and poor winding...etc. IWT-5000A offers test voltage from as low as 200V up to 5,000V, four waveform comparing algorithms and extremely low out-put energy, providing fast and reliable test process without damaging the DUT(Devices Under Test).

1-2 Safety and Precautions

All the operation, repair & maintenance procedures must abide by the following safety instructions. We will not be responsible for any unexpected situation caused by misuse of the instrument without complying with the given instructions.

For the safe operation of the instrument, the following instructions must be strictly followed.

1. **Installation environment**

   Do not place any heavy or huge objects on the instrument, and do not block the vent of the cooling fan.

2. **Strict compliance with power input standard**

   Make sure of the specs and stability of the power supply to the instrument. Any instability of power input may cause damage to the instrument.

3. **Grounding**

   For the safety of the unit and operator, proper grounding with the attached cable and terminals must be installed.

4. Disassembly prohibited

Do not disassemble the instrument and touch the internal parts with bare hands, which may cause serious injuries or malfunctions due to the high voltage circuits.

5. High-Voltage Cables

The HV cables used for testing are attached to the rear panel of the instrument. Do not touch the terminals or the DUT during test to avoid electrical shocks.

6. Moving and transporting

It is required to detach all the plugs and cables before moving or transporting the instrument. To lower the extra forces on the handle, lift and carry the instrument while it's in a vertical state.

7. Cleaning

The instrument is partly made of plastic and coating components. Do not use liquid containing gasoline or diluent for cleaning the stained parts. Use soft cloth with water or a little neutral detergent.

8. Installation environment

In case of plastic deformation and internal heating, do not expose the instrument to direct sunshine or get close to heating equipment, and make sure of nice ventilation of the place. Also please avoid places of high humidity and dust level so as not to damage the internal HV circuits. It is recommended to place the unit in places of temperature at around 23 degrees Celsius without drastic temp variations.

1-3 Overview

Thanks for purchasing IWT Series impulse winding tester. For the flexible and proper use and understanding of all the functions, please read through the manual carefully before operation.

1-4 Introduction

Coils, magnetic materials, cores, and manufacturing process will cause more or less poor insulation between the layers of coil, cable, and out-put ends. Therefore it's necessary to assure the quality of each inductor/coil with impulse winding tester; it saves a master waveform, compares it with that of other DUT and finds out the discrepancies based on the preset comparison conditions(Waveform area difference, shifting, corona amount, and corona nos) to further qualify the DUT.

1-5 Principle of Impulse Winding Tester(Surge Tester)

Surge testers are equipped with low energy & high voltage discharging capacitors for releasing HV impulse without damaging the DUT while retrieving waveforms. The principle is to discharge the same programmed impulse voltage to the Master sample coil and DUT, and compare the damping waveforms of both. The waveforms show the overall quality, inductance, quality difference(Q), turns, turn-to-turn short, and core differences of the DUT. HV impulse also triggers corona discharges with which the poor insulation of coils can be identified.

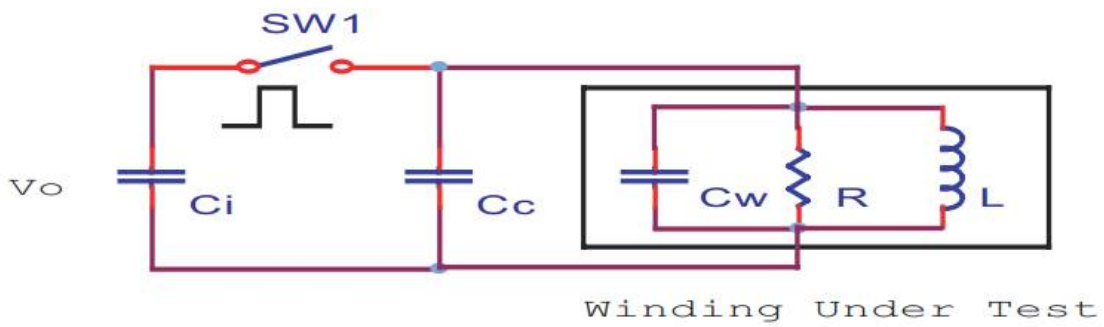


Figure 1: Illustration of the principle of surge tester

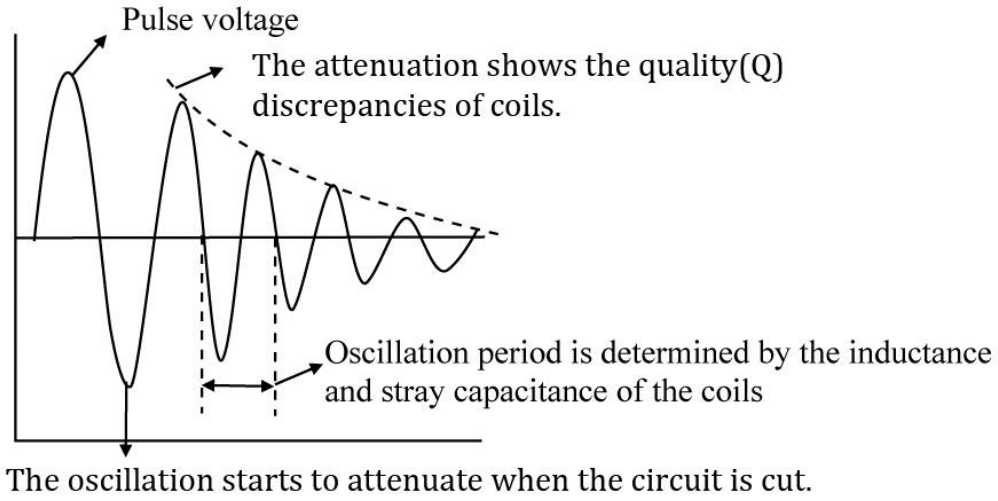


Figure 2: Typical damping waveform of coils

1-6 Specifications & Features

MODEL	IWT-1000L	IWT-5000A
Output Voltage	10V~1000V ± (3% of setting + 10v) + 2% of range (10V Step)	200V~5000V (100V Step) 3% ± 10V
Inductance Range	0.10uH ~ 3.5H	10uH ~ 3.5H
Impulse Energy(J)	Max 15mJ	Max 250mJ
Sampling Rate	200MHz - 8bit/5nS	100MHz - 8bit/10nS
Memory Depth	5K/Byte	
Time Division	13	10
Input Resistance	10MΩ	
Display	5.7” 320*234 TFT LCD	
Waveform Comparison	Area Size Comparison Difference Zone Comparison Corona Amount Comparison Corona Numbers Comparison	
Internal Waveform Storage	360 Waveforms	
PC-Link Interface	USB 2.0	
External Handling I/O	TTL I/O Standard D-Sub 15Pin	
String Command	RS232 Standard Female D-Sub 9Pin	
Power	90~260Vac, Auto Switching 50Hz / 60Hz	AC110V/220V, Manual Switching 50Hz / 60Hz
Fuse	AC250V/ 2.0A	
Operation Temp.	0℃ ~ 45℃ (32℉ ~113℉)	
Power Consumption	Operating: 60W / Stand-by: 20W	
Dimension	31(W) x 16.1 (H) x 18(D) CM	
	3.7KG	5.1KG

1-7 Comparison Methods

1-7-1 Area Size

A range of the waveforms of Master and DUT is selected to calculate the area size difference as shown in Figure 3. The more or less strict allowed difference percentage(%) can be set by users. Pass will be displayed if the result is within allowance. The size of the selected range can also be used for analyzing the energy consumption, as the size and consumption are in proportion.

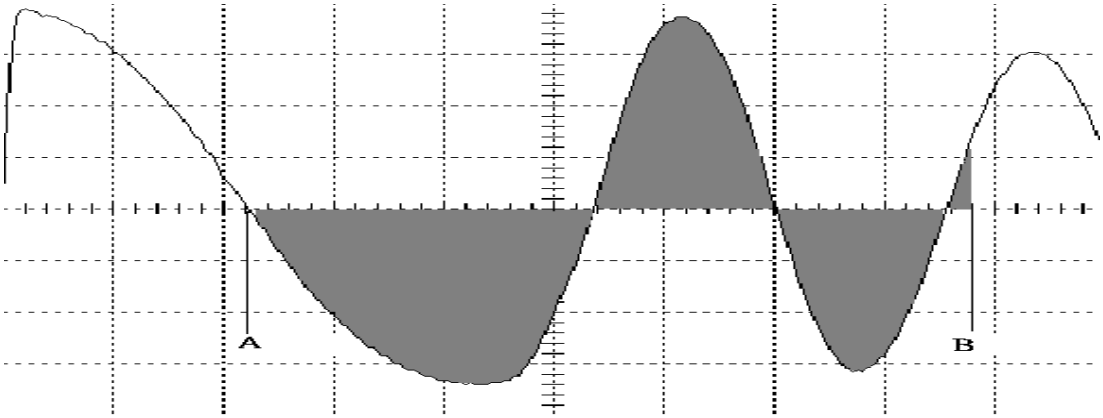


Figure 3: Illustration of Area Size Comparison

1-7-2 DiffArea of Shifted Waveforms Comparison

A range of the waveforms of Master and DUT is selected to calculate the total difference size of the shifted area of both waveforms as shown in Figure 4. The more or less strict allowed difference percentage(%) can be set by users. Pass will be displayed if the result is within allowance. The area size of the shifted waveforms shows the sum of the inductance and energy consumption and can be used for analyzing the difference of inductance(L).

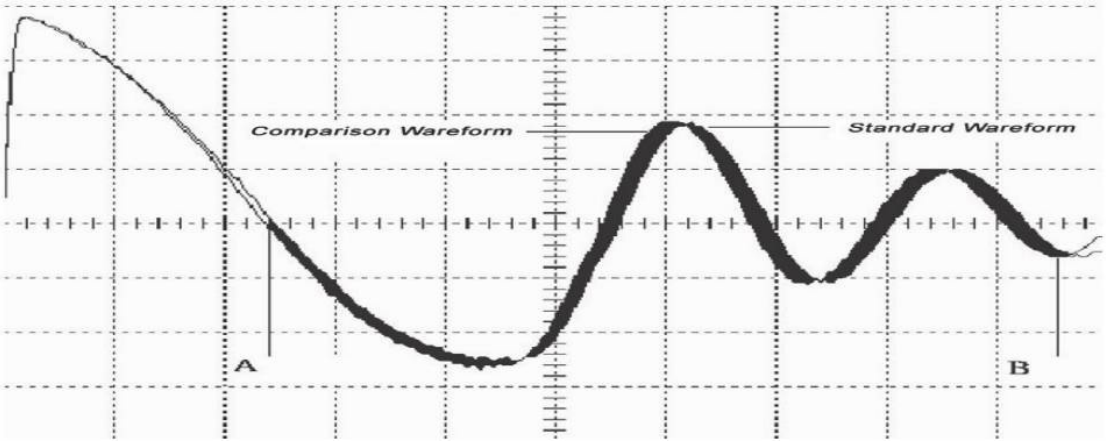


Figure 4: Illustration of DiffArea of Shifted Waveforms Comparison

1-7-3 Corona Discharge Amount & Numbers

Corona discharges, which are caused by damages of insulation materials, will be triggered by the HV impulse, and be seen on the waveform as shown in Figure 5. The corona discharge amount and numbers are calculated with the high frequency caused by corona discharges on the waveform of the DUT without comparing the Master waveform. The allowance can be set by users. Pass will be displayed if the result is within allowance. The calculation is based on the programmed algorithms and the area size of the differential waveform of the selected range. In a similar analog circuit the calculated value can be seen as the amount going through the high frequency filter.

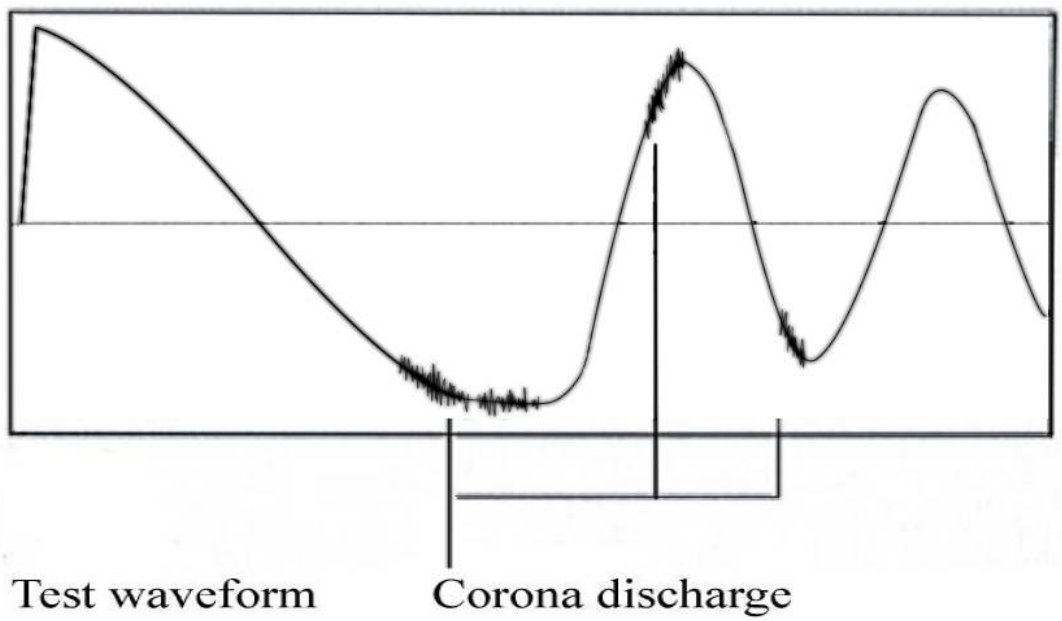
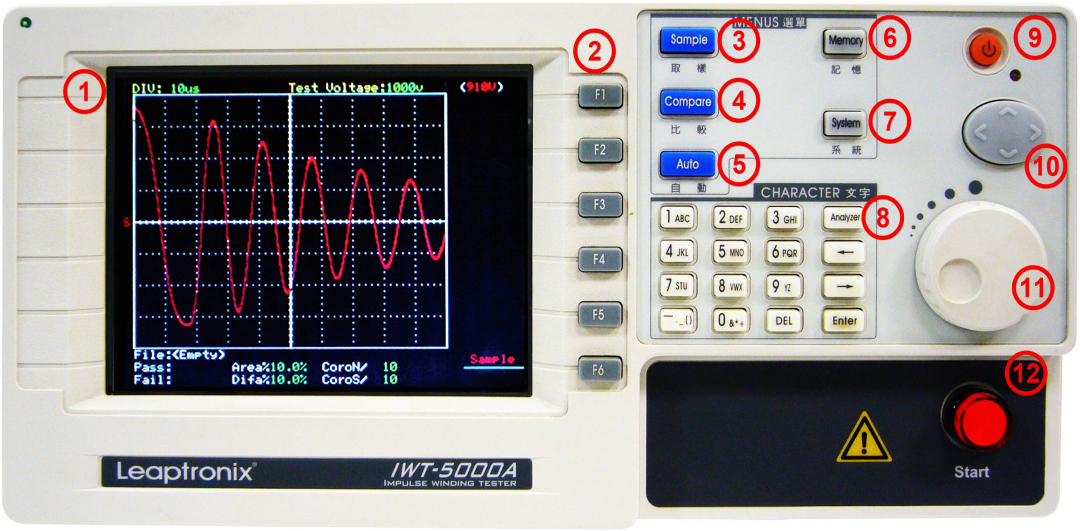


Figure 5: Illustration of Corona Discharge Amount and Numbers

1-8 IWT Series Accessories

NO	Accessories	Qty	Note
01	Content List	1	Detailed Packing List
02	CD	1	Includes PC-Link Software, Drivers, and Manual
03	Warranty Card	1	
04	AC Power Cord	1	3-Wire Cord
05	USB Cable	1	
06	RS232 D-Sub 9-Pin Cable	1	
07	USB to RS-232 Cable	1	
08	HV Cable	1	
09	IWT Main Unit	1	

Chapter-2 Panel and Display



2-1 Front Panel

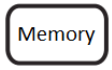
1. **5.7" Color TFT LCD**
2. **F1 ~ F6 Function Keys**

   For different functions under each screen
3. **Sample Button**

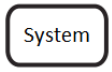
   Setting voltage, sampling rate, AVG testing times, self-calibration...etc.
4. **Compare Button**

   Setting the comparison methods(AreaSize, DiffArea, Corona Amount, Numbers)
5. **Auto Sampling Button**

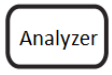
   Getting the waveform with best sampling parameters automatically.
6. **Save Button**

   Saving the current waveform and parameters
7. **System Button**

   Setting system parameters.
8. **Analyze Button**

   Waveform scaling and analyzing.
9. **Power Indicator & Button(Button for IWT-5000A Only)**

   Power button & indicator of the tester.
10. **Direction Buttons**

    Adjusting parameters.
11. **Rotary Button**

    Adjusting parameters.
12. **Start Button**

    Starting the test or sampling.

2-2 Rear Panel

13. HV+ Output Connector

Do not touch it during tests.

14. HV- GND Connector

Do not touch it during tests.

15. USB Connector

Connecting the tester to PC for uploading waveforms.

16. RS232 Connector

Sending string commands for controlling the tester and building automated testing system.

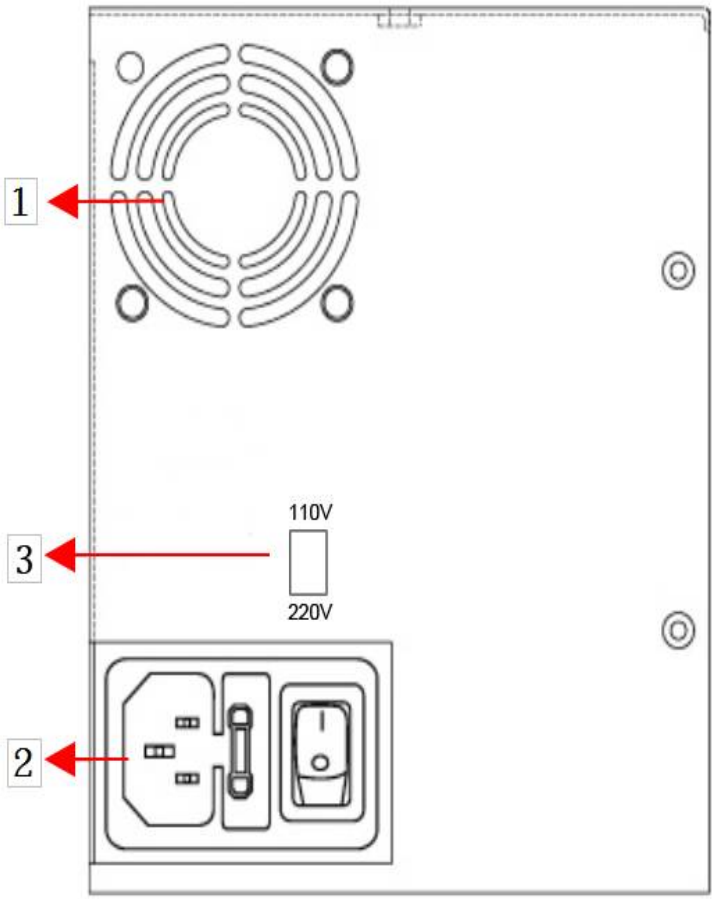
17. Handler Connector

Controlling the start of tests and retrieving Pass/Fail signals with external input signals or foot switch.

18. Plate

Warnings, manufacturing date, S/N, regulations...etc.

2-3 Side Panel



1. **Cooling Fan:**
   The fan is used for cooling the internal parts. Do not block the vent hole and make sure of the cleanliness regularly.

2. **AC Power Switch & 3-Wire AC Plug:**
   Powering up the tester. O = Off, I = On
   Fuse: 250V-2A, a spare is included.

3. **AC Voltage Switch:**
   Please make sure of the correct voltage of the input AC power.

Chapter-3 Installation

3-1 Inspection before installation

1. The instrument has undergone precise validation and examination before shipping. Still it's required to check if there's any damage or loosen parts caused by transportation when unboxing.
2. Please make sure of the complete accessories referring to the content list. Contact us or local distributor if there's anything missing.

3-2 Storing and Operating Place

1. The cooling system of this tester is formed by the cooling fan and the holes of outer case, so please place the tester in places of good ventilation. Do not block the vent holes with anything and make sure of the cleanliness on a regular basis.
2. Operation Temperature: 0℃~45℃ (77℉~104℉)
3. The tester in operation may generate magnetic field interfering with instruments placed nearby. Please put other instruments at least 10cm away from the tester. Also please avoid placing the tester in or near places of high magnetic fields.

3-3 Power Input Specs

1. Please make sure that the external AC input specs are within the allowance mentioned on the plate of the tester.
2. Allowed power input specs: 110~220V, 60/50Hz.

※ **Note that the power input must comply with the power specs of the tester.**

3-4 Spare Fuse

Confirm the specs of the spare fuse before replacing.

- Fuse Specs: 250V/2.0Amp
- A spare fuse is included in the fuse socket of the tester.

※ **Note that the specs of the fuse purchased by users must strictly comply with the above mentioned specs or otherwise it may cause damage to the tester.**

Chapter-4 Functions

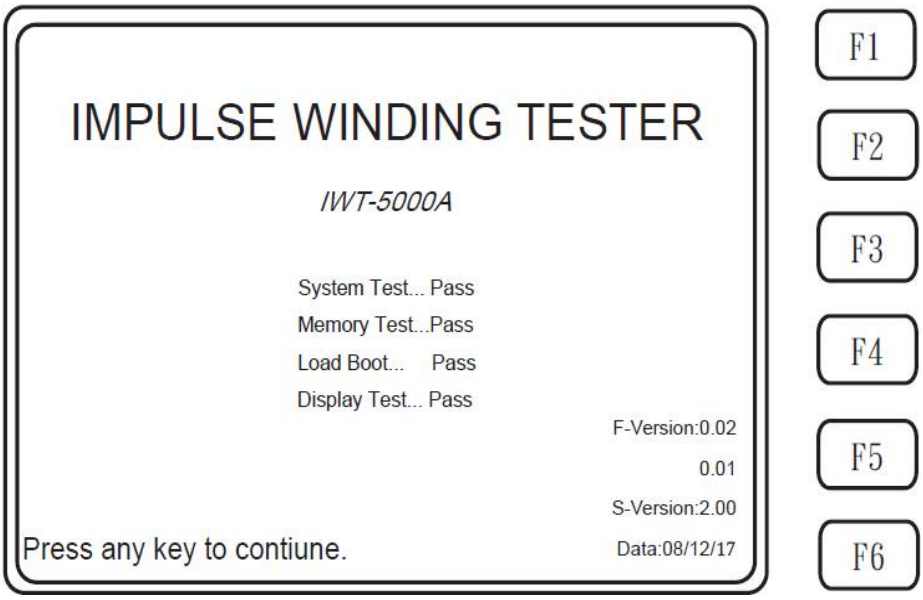
4-1 Cable Connection

1. Connect the HV test cables to the HV+ and HV-(GND) connectors on the rear panel of the tester.
2. Make sure that the HV cables are well connected to the tester in case of improper test results.
3. Attach the cables to the DUT.

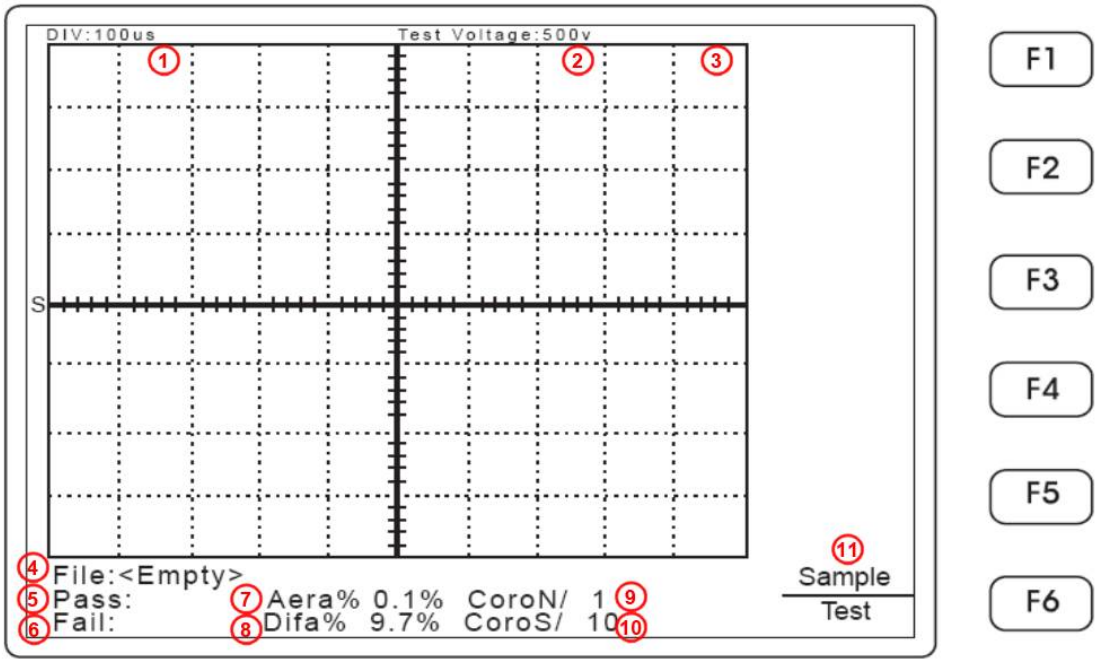
4-2 Boot Screen

1. It takes around three seconds for self tests after powering up, and then the boot screen will be displayed with firmware version shown on the bottom right corner of the screen.

2. Press any key to enter the main screen after booting.



4-3 Description of the Main Screen



NO	Item	Function Description
1	DIV	Sampling rate
2	Test Voltage	Output impulse voltage
3	xxxV	Actual output voltage at terminals
4	File	File loaded, Empty will be displayed if no file is loaded.
5	Pass	Total Pass Numbers under Test mode, Max=999999
6	Fail	Total Fail Numbers under Test mode, Max=999999
7	Area%	Allowed AreaSize difference %, Min=0.1, Max=99.9%
8	Difa%	Allowed Shifted Waveforms AreaSize %, Min=0.1, Max=99.9%
9	CoroN/	Allowed Corona Numbers, Min=1, Max=999
10	CoroS/	Allowed Corona Amount, Min=1, Max=999
11	Sample/Test	Press F6 or Direction Keys(Up/Down) to switch to Sample(Note1) or Test(Note2) mode.

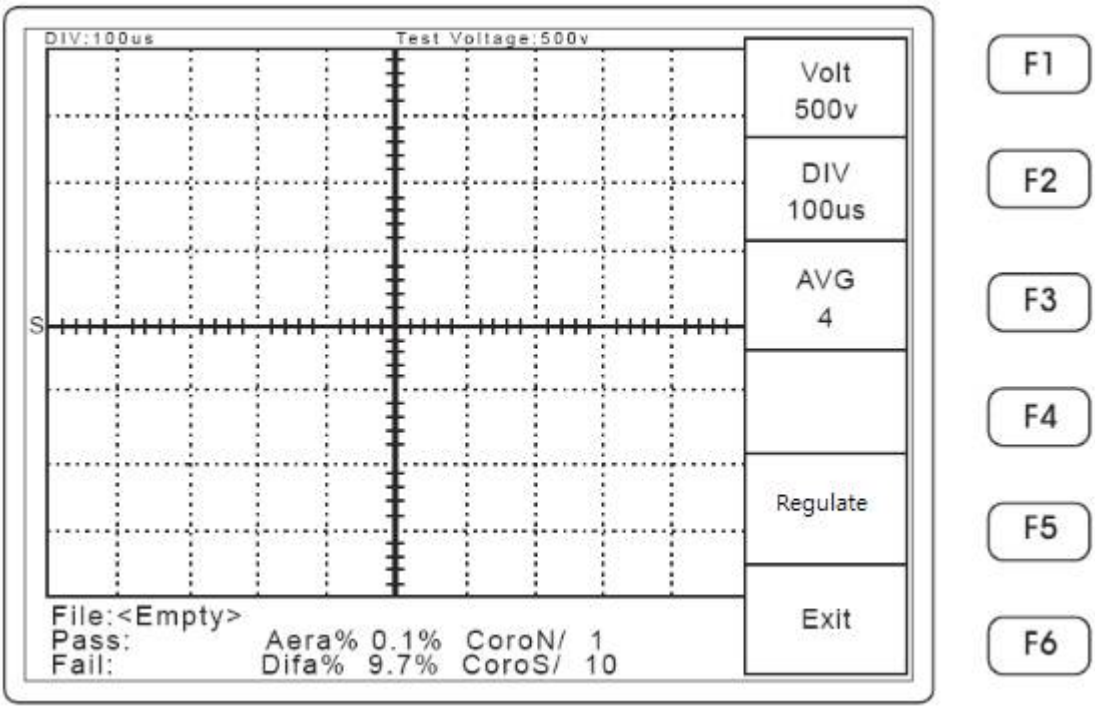
※ **Note1**: Under Sample Mode, all parameters can be set. Note that the current waveform on the screen will be erased when adjusting the parameters and a new sampling procedure will be required.

※ **Note2**: Under Test Mode, only comparison and system parameters are allowed for adjustment.

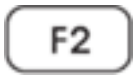
4-4 Description of Function Keys

4.4.1 Sample Button

Six parameter setting items will appear on the screen as shown in below picture after pressing Sample button. The six items are in accordance with Function Keys F1~F6. From top to bottom are the voltage, time division, average test numbers, voltage regulating, and exit.



Voltage: Set the output test voltage using the rotary button.
Range: 500V(Min)~5000V(Max), 100V/Step

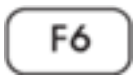


Sampling Rate: Set the ADC sampling rate using the rotary button.
Range: 250nS/DIV(Min)~250uS/DIV(Max)

Average Tests: Set the number of times of the HV test using the rotary or direction button(Up/Down). Range: 1(Min)~15(Max)

Regulate: Calibrate the output voltage at terminals so as to maintain precise voltage output during long-term use.

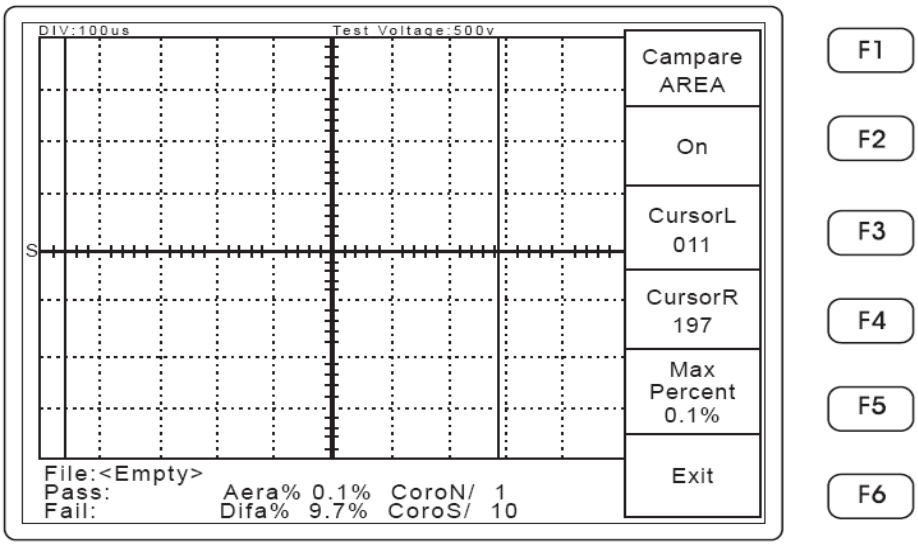
Note: Please refer to Chapter 5 for voltage calibration.



Exit: Return to the main screen.

4.4.2 Compare Button Compare

Comparison Parameter Setting: Set the parameters of AreaSize(AREA), Different Shifted Waveform AreaSize(D_AREA), Corona Numbers(CoroN), and Corona Amount(CoroS). Press the Compare button and the six items to be selected with F1~F6 will appear as shown in below picture.



F1 Four comparing methods switching: AreaSize, D_Area, CoroN, CoroS

F2 Enable or Disable each comparing method.

F3 CursorL(Left cursor) sets the starting location. Use the rotary button for moving in smaller steps or direction buttons(L/R) for larger steps. The selected range will be used for comparison.

F4 CursorR(Right cursor) sets the end location of the selected waveform area. Use the rotary button for moving in smaller steps or direction buttons(L/R) for larger steps. The selected range will be used for comparison.

F5 Set the parameters of each comparison method under Sample and Test mode using the rotary or direction button.

AreaSize: Allowed difference % = 0.1%(Min)~99.9%(Max)

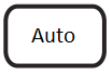
DiffArea: Allowed difference % = 0.1%(Min)~99.9%(Max)

CoroS: Allowed corona discharge amount = 1(Min)~999(Max)

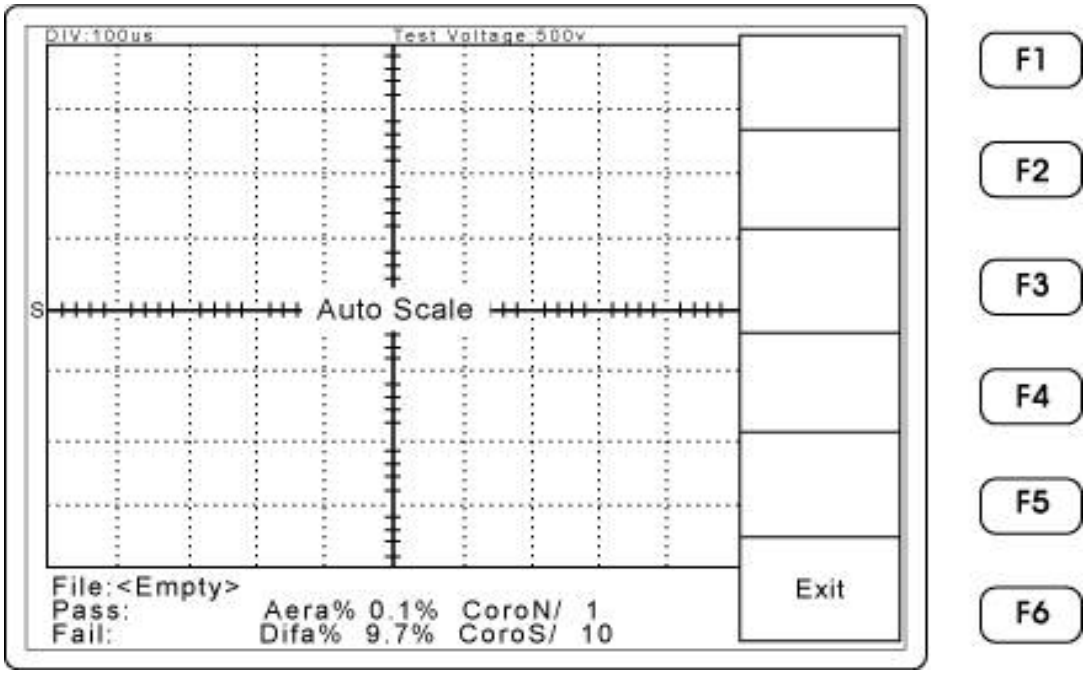
CoroN: Allowed corona discharge numbers = 1(Min)~999(Max)

F6 Exit: Return to the main screen.

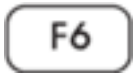
4.4.3 Auto Button



Auto sampling rate: Press this button to automatically get the best sampling rate for waveform observation. Note that Start button needs to be pressed to start.



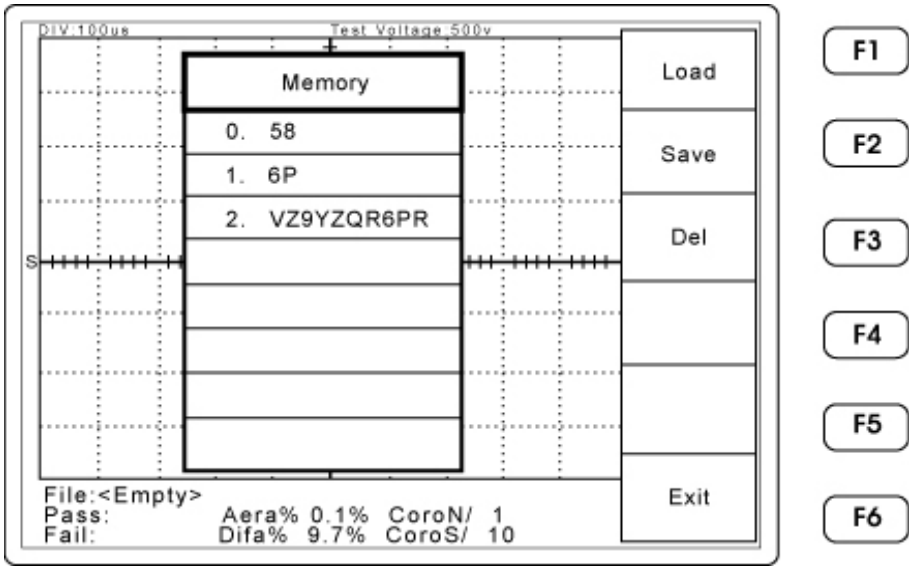
Start auto scaling.



Exit: Return to the main screen.

4.4.4 Memory Button Memory

Saving, loading, or deleting waveforms: Press this button to load, save or delete the waveforms in the internal storage. Six items to be selected with F1~F6 keys will appear as shown in below picture.



F1

Load:

1. Load and show the previously saved parameters and waveform. Select the item using the rotary button or enter the file name to select.
2. Select the item surrounded by the pink frame and then press Enter to load the parameters and waveform. The file name will be displayed on the main screen after loading.
3. You can also use ''Search:'' to enter and select the file directly for loading.

F2

Save:

1. Save all the current parameters and waveform on the screen to the internal memory. Use the digit keys to enter the file name. Press the arrow key → on the digit keypad to enter the next character, and ← to go backward. The file name allows up to 10 chars. Press Enter after entering the file name and the confirmation screen will be shown. Then press F1 to save the data.
2. To save the data, there must be waveform on the screen. The internal memory allows 360 waveforms to be saved.
3. An overwrite warning will be displayed if the file name entered already exists. Press F1(Yes) or F2(No) to choose whether to overwrite.

F3

Delete:

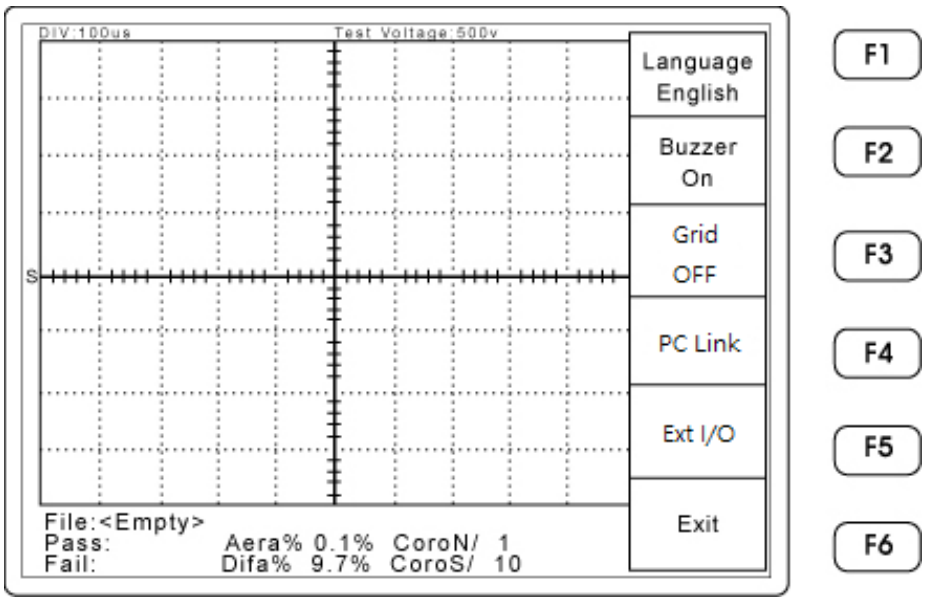
1. Delete the data in the internal memory. Select the file name to be deleted with the rotary button.
2. The item selected will be surround by the pink frame. Press Enter to delete the waveform data.
3. Deleting process will be not allowed if there are no data existing.

F6

Exit: Return to the main screen.

4.4.5 System Button System

System settings: Set the language, buzzer, grid style, PC link, and external I/O parameters. Six items to be selected with F1~F6 keys will appear as shown in below picture.



F1 Language: Set the interface language.

F2 Buzzer: Enable or disable the buzzer when showing Pass/Fail results.

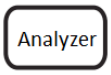
F3 Grid Style: Set the grid style on the main screen. There are 3 types to be chosen: Type 1(Standard), Type 2(Without center lines), Type 3(Dot).

F4 PC Link: Enable the PC link function.

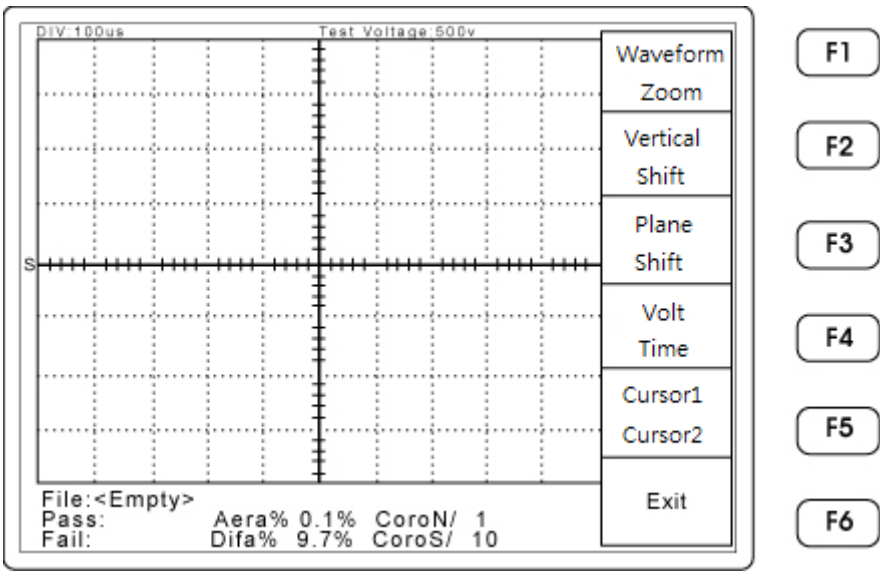
F5 External I/O: Enable the External I/O controlling.

F6 Exit: Return to the main screen.

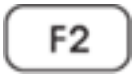
4.4.6 Analyzer Button



Waveform Analyzing: There must be waveform on the screen before pressing the button to analyze the waveform. Cursor can be used for measuring the voltage.



Waveform Zooming: Zoom in or out waveforms using the rotary button based on different sampling rates.



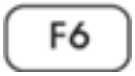
Vertical Shifting: Move the waveforms vertically using the rotary button in the range of 28 pixels.

Horizontal Shifting: Move the waveforms horizontally using the rotary button based of different sampling rates.

Voltage/Time Division: Set the voltage and time divisions for precise waveform analyzing.

Cursor 1 – Voltage/Time Analysis: Measure the voltage/time values using the rotary button.

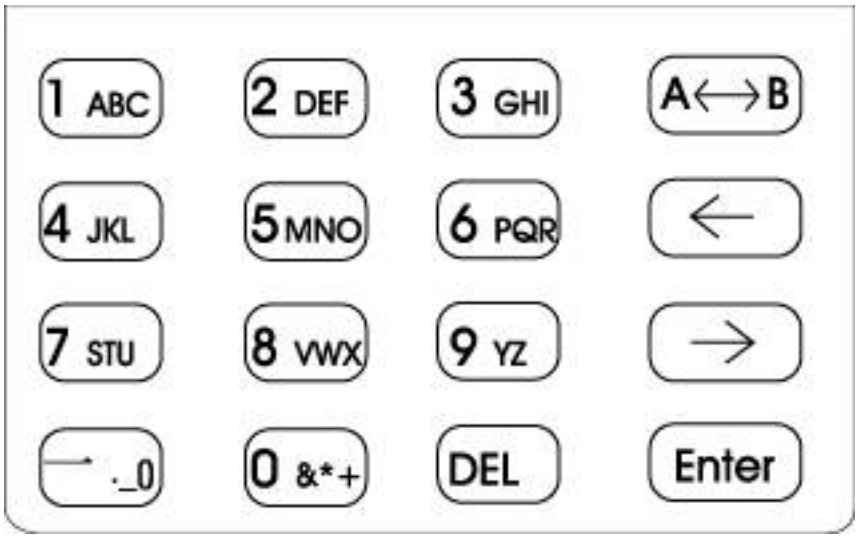
Cursor 2 – Voltage/Time Analysis: Measure the voltage/time values using the rotary button.



Exit: Return to the main screen.

4.4.7 Character Keypad

Digit/Letter/Symbol:



1. 10 Digit/Letter/Symbol keys: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. Each key contains digit, letters and signs which can be selected in sequence by pressing the number keys.

2. DEL : Delete characters.

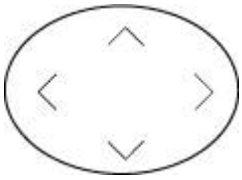
3. → : Right

4. ← : Left

5. Enter : Enter

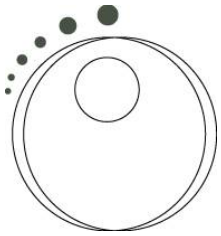
6. Analyzer : Waveform Analyzing

4.4.8 Multipurpose Keys



: **Direction buttons(Up/Down/Left/Right)**

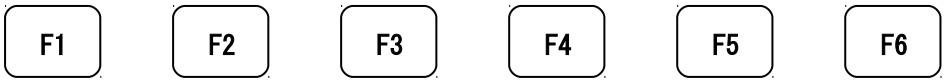
1. **Up/Down:** adjusting the values of parameters.
2. **Left/Right:** moving the cursors.



: **Rotary button**

It serves the function of adjusting different parameters under each function screen.

Function Keys: F1~F6



1. F1~F6 are used for entering each parameter item of Sample/Compare/System/Auto/Memory/Analyzer function screen.
2. F6 Switching to Sample or Test mode.
3. Start key: Press and release the Start key to start the HV test.
4. Note that "Sampling Failed to try again!" will be shown if the DUT is broken or the inductance is out of range.

4.4.9 Power Button(IWT-5000A Only)

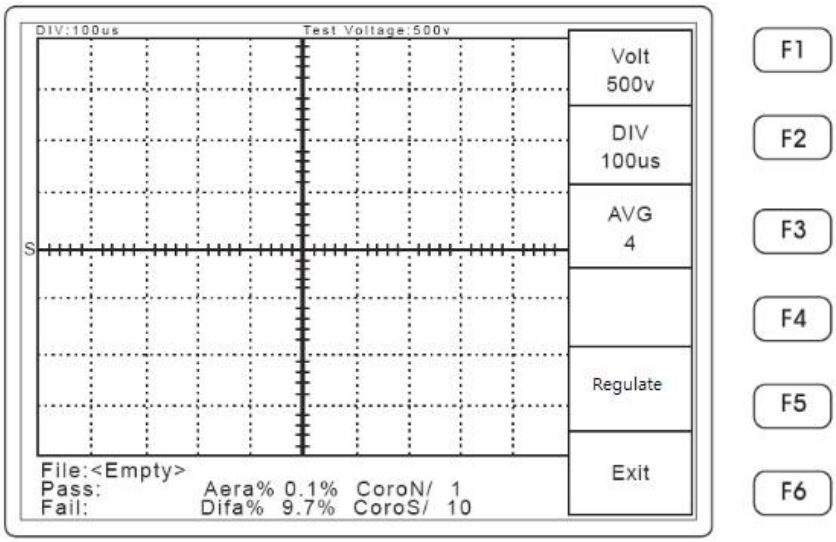
1. Press the power button to power on the machine, and the previously saved system parameters will be loaded
2. Press the power button to power down the machine, and the current system parameters will be saved.

Chapter-5 Voltage Calibration

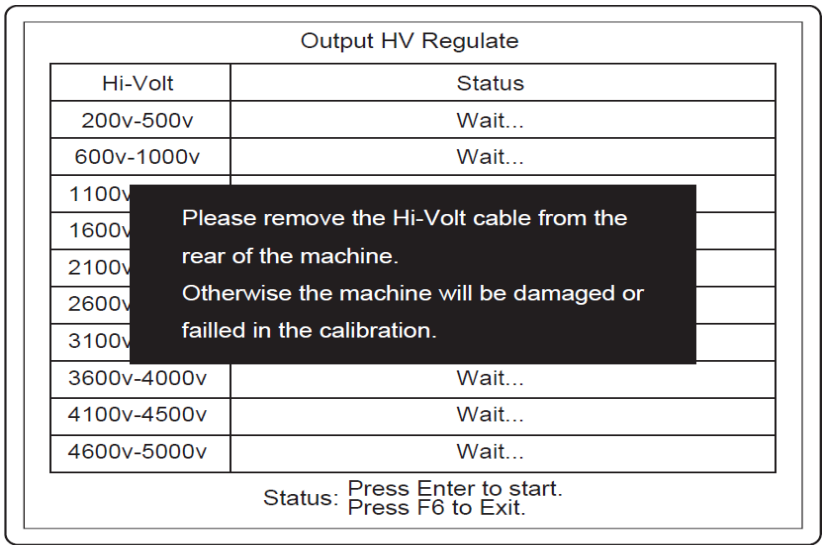
5-1 How to calibrate output voltage

The accuracy of the output voltage may shift a bit after long term use. IWT series offers self calibration functions to calibrate the voltage for consistently accurate and reliable test results.

1. Power on the tester and wait for around 5 to 10 minutes. Then press the Sample button and press F5 to enter the voltage calibration mode.
   (Refer to Chapter 4-4-1 for description of each item in the Sample function screen.)



2. Below screen shows after successfully entering the voltage calibration mode.
   ※ **Note**: The HV cables on the rear panel must be removed before calibrating to avoid damaging the tester or failing the calibration.
   Do not touch the HV connectors during calibration in case of injuries.



5-2 Activating & Finishing the Calibration

Make sure of detaching the HV cables and press Enter to activate the calibration or F6 to exit. The calibration will start verifying and tuning the output high voltage.

※ **Note: Do not power off the tester during calibration or otherwise the tester may get damaged.**

Output HV Regulate

Hi-Volt	<<Complete>>
200v-500v	Adjusting...
600v-1000v	Wait...
1100v-1500v	Wait...
1600v-2000v	Wait...
2100v-2500v	Wait...
2600v-3000v	Wait...
3100v-3500v	Wait...
3600v-4000v	Wait...
4100v-4500v	Wait...
4600v-5000v	Wait...

Status: Adjusting...Please wait

Press F6 to exit after calibration completed.

Output HV Regulate

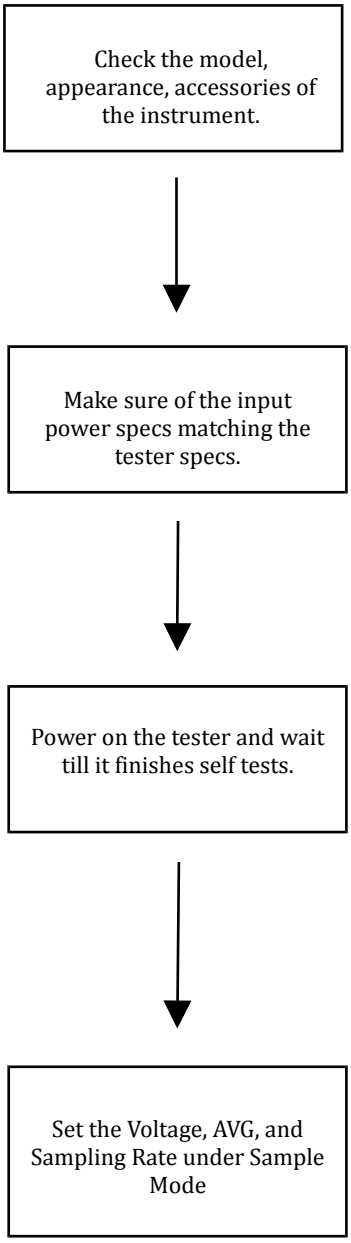
Hi-Volt	Status
200v-500v	<<Complete>>
600v-1000v	<<Complete>>
1100v-1500v	<<Complete>>
1600v-2000v	<<Complete>>
2100v-2500v	<<Complete>>
2600v-3000v	<<Complete>>
3100v-3500v	<<Complete>>
3600v-4000v	<<Complete>>
4100v-4500v	<<Complete>>
4600v-5000v	<<Complete>>

Status: Regulate Complete.
Press F6 to Exit.

Chapter-6 Operation Instructions

6-1 Quick Operation

IWT-Series Quick Operation Flow



IWT-Series Quick Operation Instructions

Check if the tester is in a proper and normal state.

1. Check if the model and accessories match the content list.
2. Check if there's any damage on the tester.

Make sure of the power input specs.

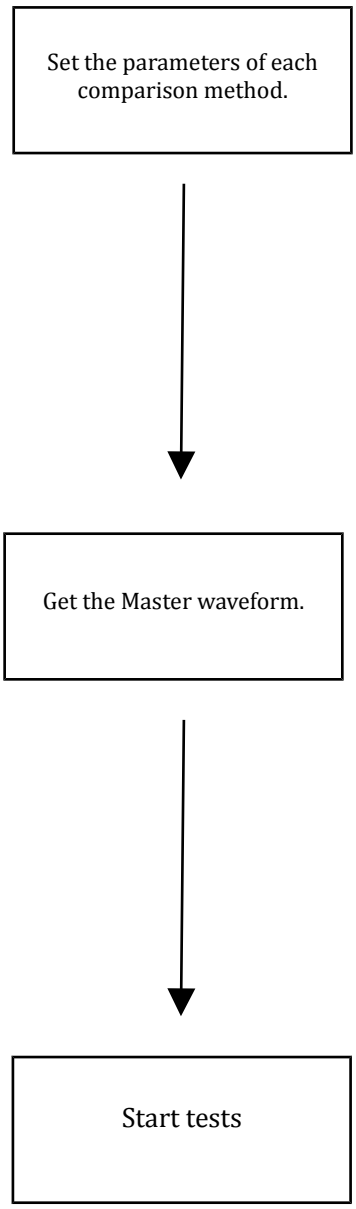
1. Make sure that the specs of power input are in accordance with what's on the rear plate.
2. Connect the attached 3-wire AC power cord.

Boot-up Test

1. Switch to the correct AC input voltage and then switch the power switch on the side panel of the tester from "O" to "I"
2. After hearing 2 beeps and around 3 secs of self tests, the tester enters the main screen.

Set the test parameters under Sample Mode

1. Press Sample button and then use F1~F6 to set the parameters of voltage, sampling rate, and AVG.
2. Use the rotary button to adjust the values of each parameter.
3. Press F6 to exit after finishing parameter settings.



Set the allowance of the four comparison methods

1. Press Compare button to enable or disable(ON/OFF) each comparing method and set the allowed range of each method using F1~F6 keys.
2. Use the rotary button to adjust the values.
3. Press F6 to exit parameter setting screen.

Get the Master waveform

1. Attach the HV cables to the Master sample.
2. Make sure that the cables are well connected.
3. Press Start button to get the waveform.
4. Do not touch the HV cables or terminals during tests in case of electric shocks and injuries.

Start comparing tests

1. Press F6 to switch to Test mode.
2. Attach the HV cables to the DUT.
3. Make sure the cables are well connected.
4. Press Start button to get and compare the waveform. compare
5. Do not touch the HV cables or terminals during tests in case of electric shocks and injuries.
6. Pass or Fail will show on the screen based on the pre-set allowance of each comparison method.

Chapter-7 PC-Link

7-1 PC-LINK Software Installation

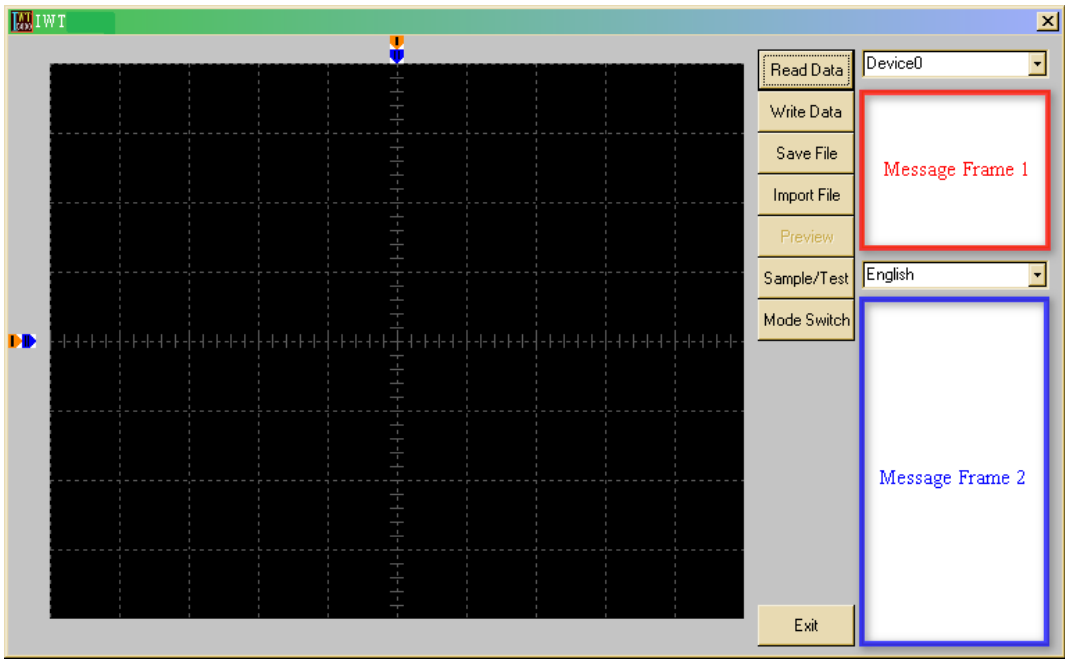
1. The main purpose of PC-Link function is to upload the waveform to PC for storage, observation and printing.
2. PC-Link uses USB2.0 as communication interface and therefore USB2.0 drivers are required when installing the software.
3. Install the PC-Link software attached with the tester, which can also be downloaded in the Download Center of Leaptronix website, on PC. Run the Setup.exe in the unzipped folder of the software and finish the installation.
4. A shortcut of the software will show on Desktop after successful installation.

7-2 PC-LINK Operation

1. Connect the USB cable to the USB port on the tester and PC.
2. Upload the waveform shown on the tester screen to the PC via the USB interface for further analysis and observation.
3. Press the System button and then press F4 to enable the PC-Link function to make the tester ready for uploading waveforms to PC.

7-3 PC-LINK Software Operation

1. Double click the IWT-PC LINK software shortcut to enter the software main screen as shown below.



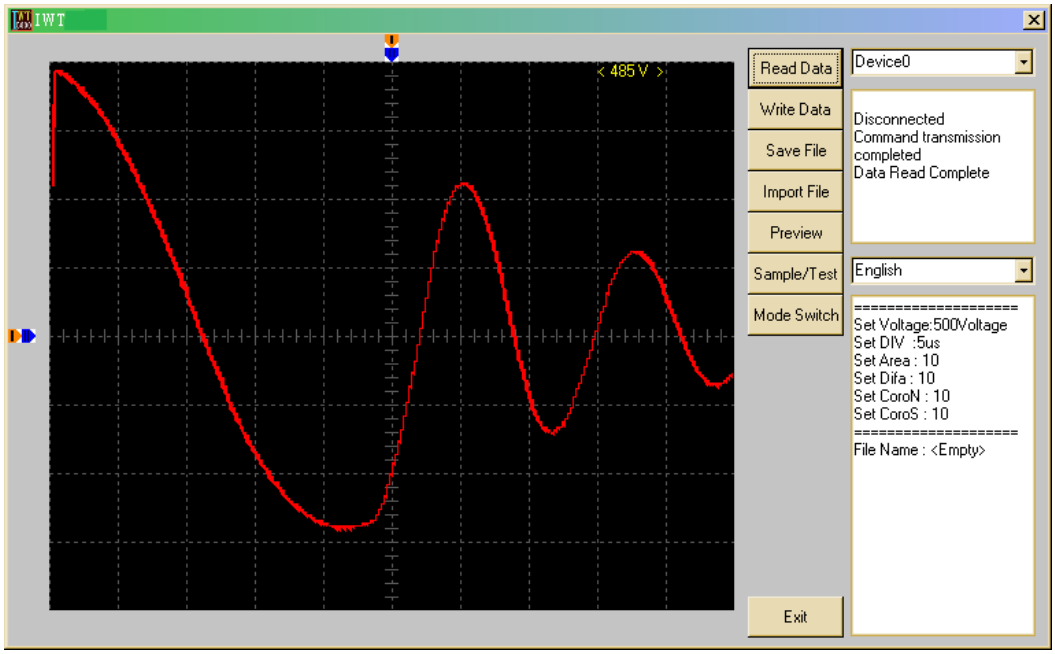
2. Button Description:

Display Screen:	Show the loaded waveform.
Read Data:	Upload the waveforms and parameters to PC.
Write Data:	Download the waveforms and parameters to IWT.
Save File:	Save the uploaded waveforms and parameters to PC in *.arg format.
Import File:	Download the waveforms and parameters from PC to the tester.
Preview:	Print out the current waveforms and parameters of the software.
Sample/Test:	Show the waveforms under Sample or Test mode.
Mode Switch:	Switch to waveform or wide range display mode.
Message Frame 1:	Info of the connection.
Message Frame 2:	Info of all the parameters and comparison results.

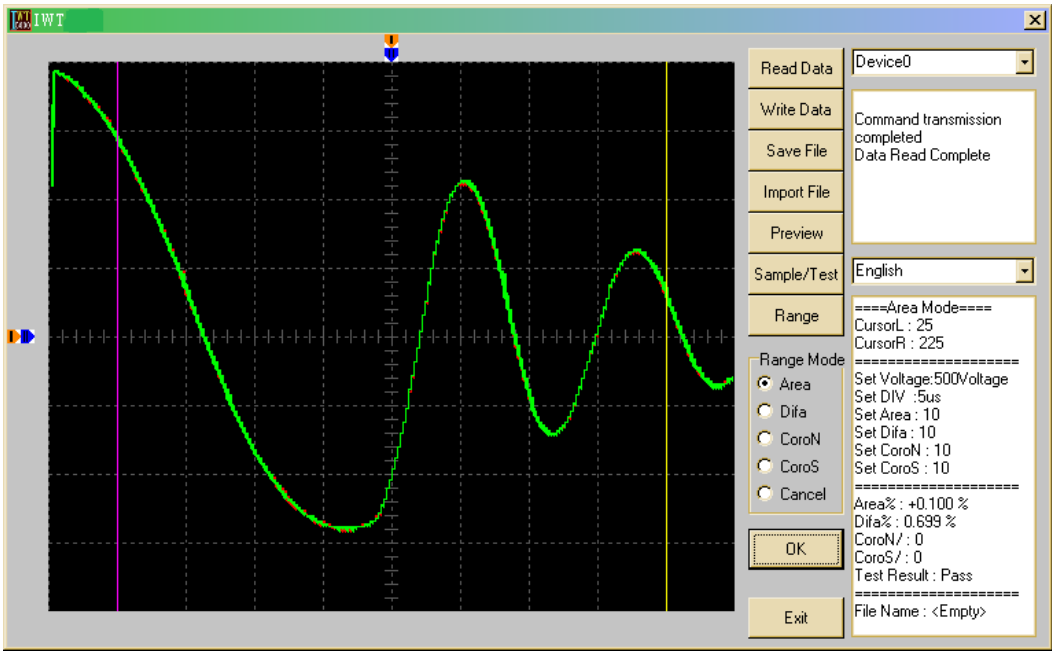
3. The PC-Link function on the tester must be enabled before using the software to send commands.

4. The device info will be shown on the message box when the software detects the tester, which means the connection is successful.

5. Press the Read Data button and the waveform and parameters will be uploaded to the PC software as shown in below picture.(Sample Mode)



6. All the comparison parameters and results will be shown in Message Frame 2 after comparing tests.



7. Preview Button:

   Press the preview button and all the data including waveforms on the software will be printed.

8. Exit:

   (1) Press the Exit button in the bottom of the screen.

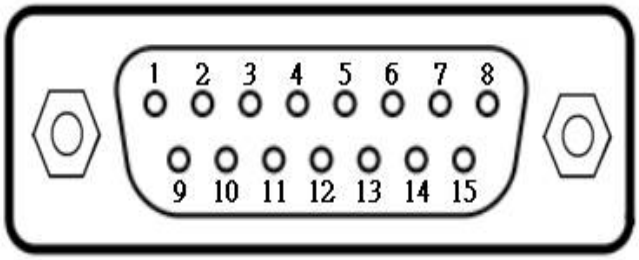
   (2) Press F6 on the tester to exit PC-LINK mode.

   (3) End the software.

Chapter-8 External Handler Control

8-1 HANDLER Connector Pin Description

The external handler connector is a standard RS232 15-Pin female one, the I/O pins of which are as follows:



Pin1 (EXT_GND): The reference ground of the external 5V power supply to Pin5. Please refer to the Handler I/O signal circuit description.

Pin2 (/PASS I/O): OUTPUT signal of **Pass** which is sent from the tester to the external control circuit for informing test result of Pass.

Pin3 (/FAIL I/O): OUTPUT signal of **Fail** which is sent from the tester to the external control circuit for informing test result of Fail.

Pin4 (/BUSY I/O): OUTPUT signal of **Busy** which is sent from the tester to the external control circuit for informing test state.

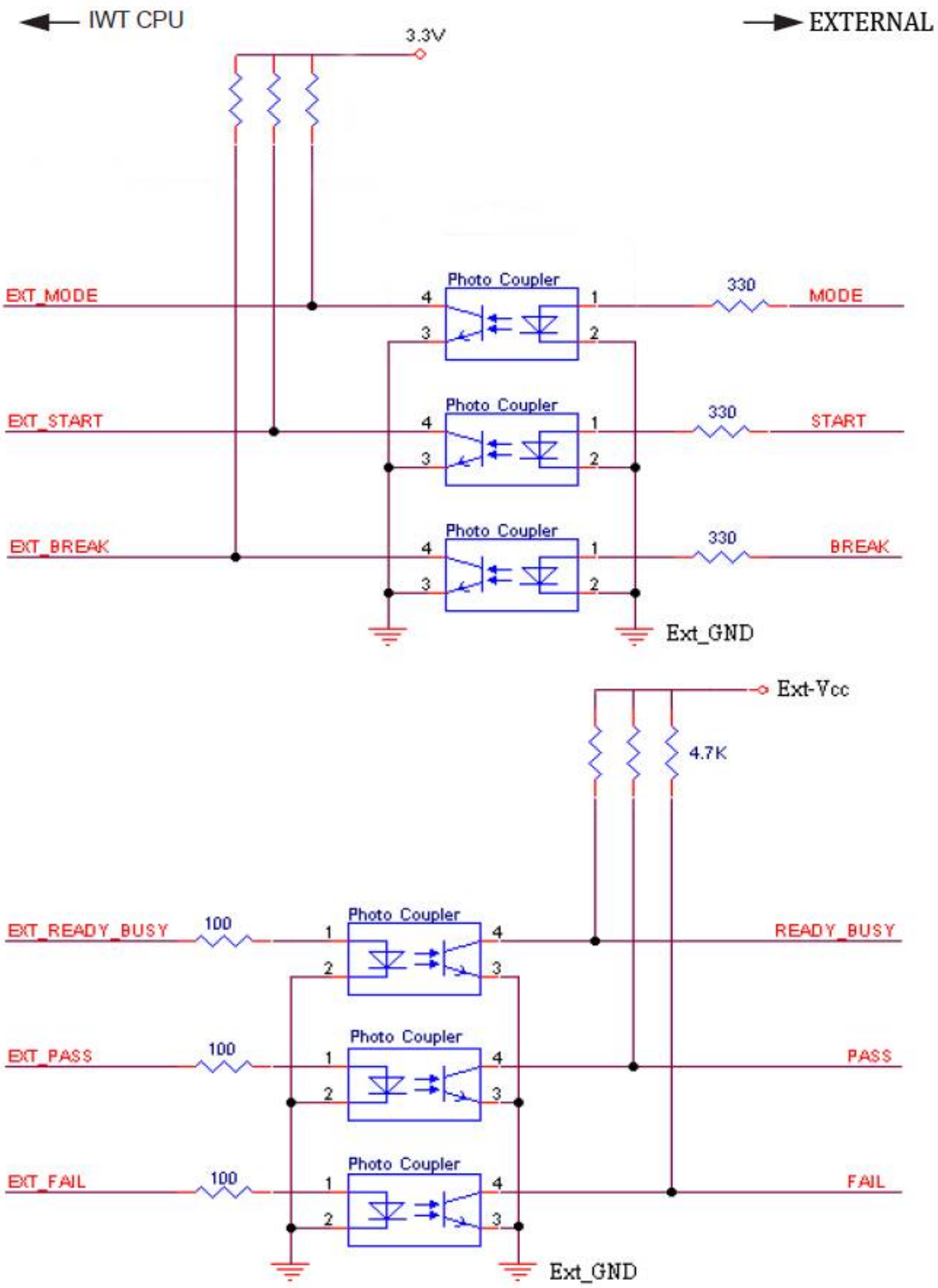
Pin5 (EXT_Vcc): External DC 5V reference power supply to the tester. Note that this is optional as the tester also has built-in 5V reference voltage.

Pin10 (/BREAK I/O): INPUT signal of **BREAK**, which should be sent from the external control circuit to the tester to ask the tester to be ready for starting test.

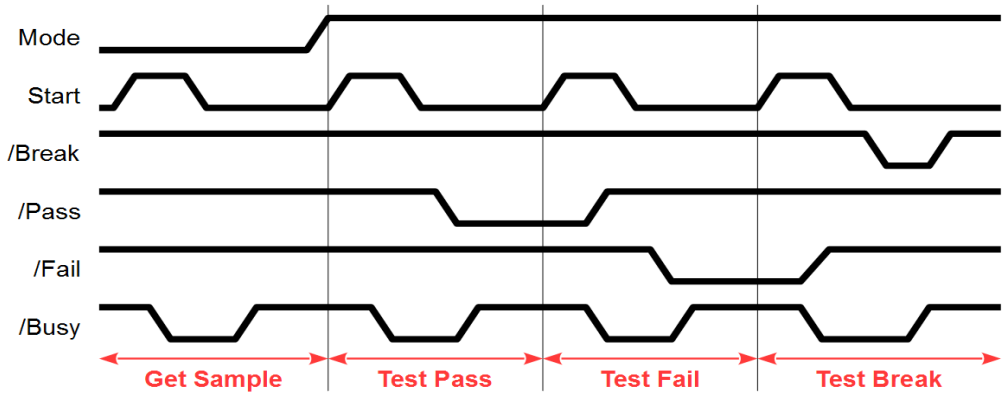
Pin11 (MODE I/O): INPUT signal of **MODE**, which should be sent from the external control circuit to the tester to switch to Sample or Test mode.

Pin12 (START I/O): INPUT signal of **Start** , which should be sent from the external control circuit to the tester to start the test.

8-2 HANDLER Internal Circuit Diagram



8-3 Control Timing & Sequence



Quick Operation – Enter the External I/O Mode by Pressing [System] and F5.

Step 1

From External: First switch to Sample or Test mode by sending High(Test Mode) or Low(Sample Mode) voltage signal to Pin11(Mode). The reference voltage is either the built-in DC 5V or the DC voltage sent to Pin5 from the external circuit by user. Second please keep Pin12(Start) as Low, and finally keep Pin10(Break) as High.

From Tester: Pin4(Busy) will send a signal of High meaning the tester is ready for starting tests.

Note: Please make sure that the Master waveform has been set before doing tests under Test mode.

Step 2

From External: Send a signal of High to Pin12(Start) for around 0.2~1 second, then back to Low. The tester will start sampling or testing. Note that the Start signal is rising-edge triggered.

Step 3

From Tester: When the test is executed, Pin4(Busy) will turn from High to Low meaning test is now being done.

Note: Do not touch the terminals or DUT during tests in case of electric shocks.

Step 4

From Tester: After testing, a signal of Pass or Fail will be sent via Pin2(Pass) or Pin3(Fail), and Pin4(Busy) will turn from Low to High meaning the test is finished, and the DUT is ready for being replaced.

Note: Pin2(Pass) and Pin3(Fail) signals will be kept and not be reset until Pin12(Start) is triggered again.

Repeat Step 1~4 to run tests continuously.

8-4 Break Mode(For Average Tests > 1)

Note that this mode is used for AVG parameter set above 1. For example, if the AVG parameter is set to 10, there will be 10 HV impulses sent and 10 waveforms retrieved, and the result is the average value of the 10 waveforms. You can break the test procedure during the retrieving of the 10 waveforms.

Step 1

From External: First switch to Sample or Test mode by sending High(Test Mode) or Low(Sample Mode) voltage signal to Pin11(Mode). The reference voltage is either the built-in DC 5V or the DC voltage sent to Pin5 from the external circuit by user. Second please keep Pin12(Start) as Low, and finally keep Pin10(Break) as High.

From Tester: Pin4(Busy) will send a signal of High meaning the tester is ready for starting tests.

Note: Please make sure that the Master sample waveform has been set before doing tests under Test mode.

Step 2

From External: Send a signal of High to Pin12(Start) for around 0.2~1 second, then back to Low. The tester will start sampling or testing. Note that the Start signal is rising-edge triggered.

Step 3

From Tester: When the test is executed, Pin4(Busy) will turn from High to Low meaning test is now being done.

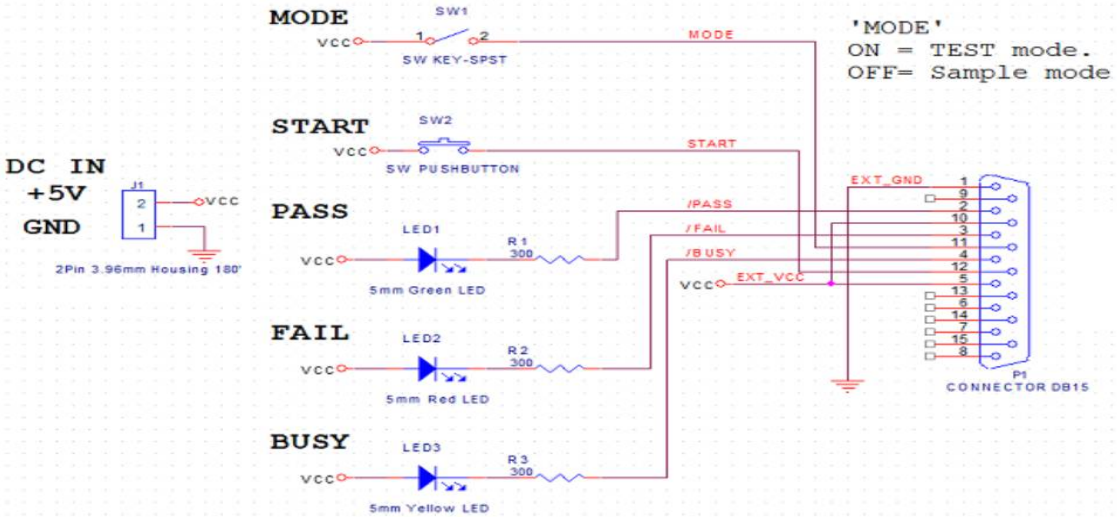
Note: Do not touch the terminals or DUT during tests in case of electric shocks.

Step 4

From External: The test can be stopped at this point by sending a signal of Low to Pin11(Break) for around 0.5~1 second then back to High. The tester screen will show "User Interrupt!" to inform that the sending of HV impulses is stopped.

8-5 External I/O Verification Procedures

1. **Diagram of IWT External I/O Verification Tool:**

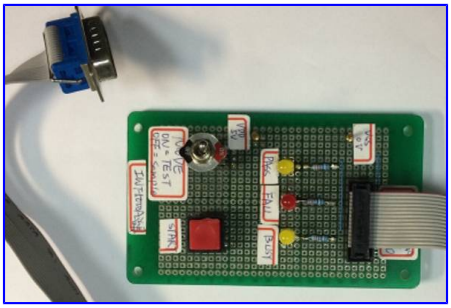


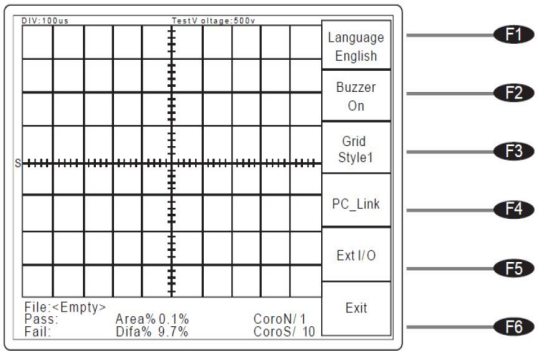
2. **Procedures:**

Step 1: Prepare the above tool and connect it to the 15-pin D-sub port on the rear panel of IWT.

Step 2: **Attach** the Golden/Master sample of DUT to the HV clips of IWT and set the configuration of test voltage, DIV, AVG...etc.

Step 3: Press the [System] button on IWT panel and then press [F5] to enter External I/O mode.





Step 4: Switch the [**SW1**] of the tool to OFF(Sample Mode).

Step 5: Check the LED of 'BUSY' signal on the tool. If it's off, then IWT is ready for running tests. Press [**SW2**] button on the tool and do not let go until 'BUSY' LED goes from on to off, which means the sampling is successful.

Step 6: Replace the Master sample with normal DUT, and switch [**SW1**] to ON(Test Mode).

Step 7: Press [**SW2**] button and do not let go until 'BUSY' LED is from on to off, and then you will get a signal to PASS or FAIL LED.

Step 8: Press F6 and power off IWT to exit external I/O mode.

Chapter-9 RS232 String Command

9-1 Preparation

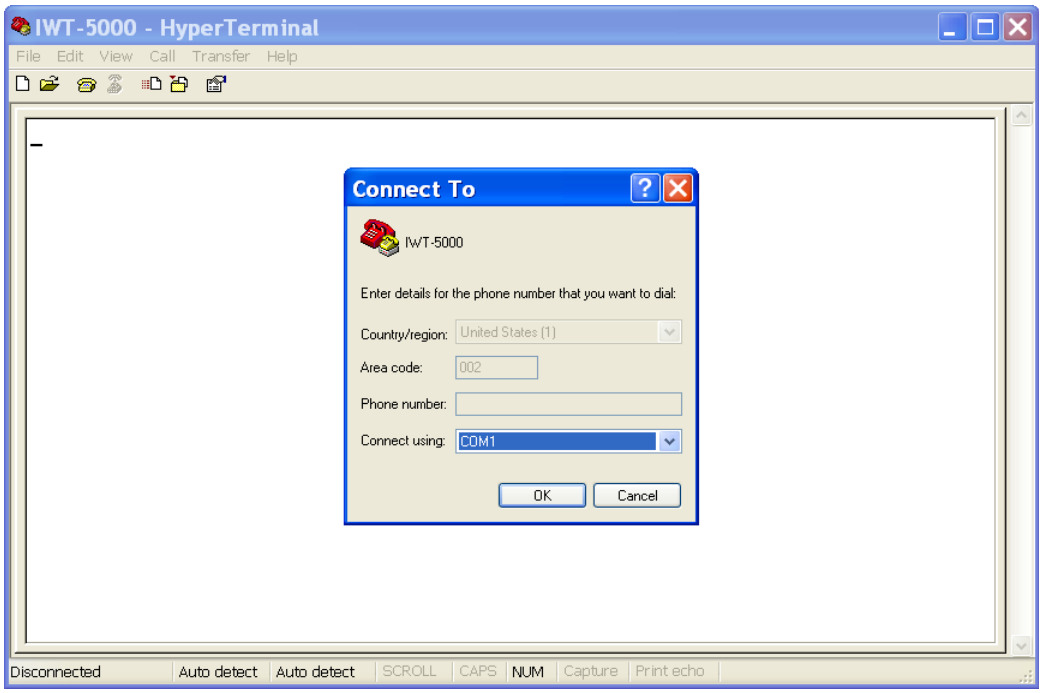
Please use a standard 9-Pin RS232 cable(Female to Male) to connect the tester and PC.

9-2 How to connect via HyperTerminal

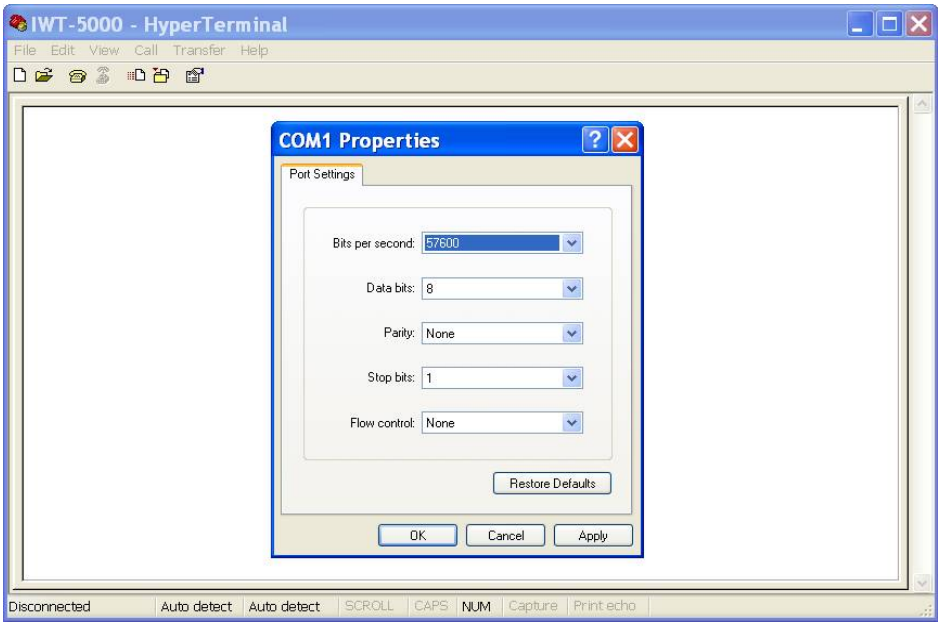
HyperTerminal can be used for sending commands on Windows OS as shown in below pictures:

Step1：Run HyperTerminal

The COM port setting screen will show after running HyperTerminal. Please make sure of the correct COM port of IWT before selecting.



Step2：Setting Parameters



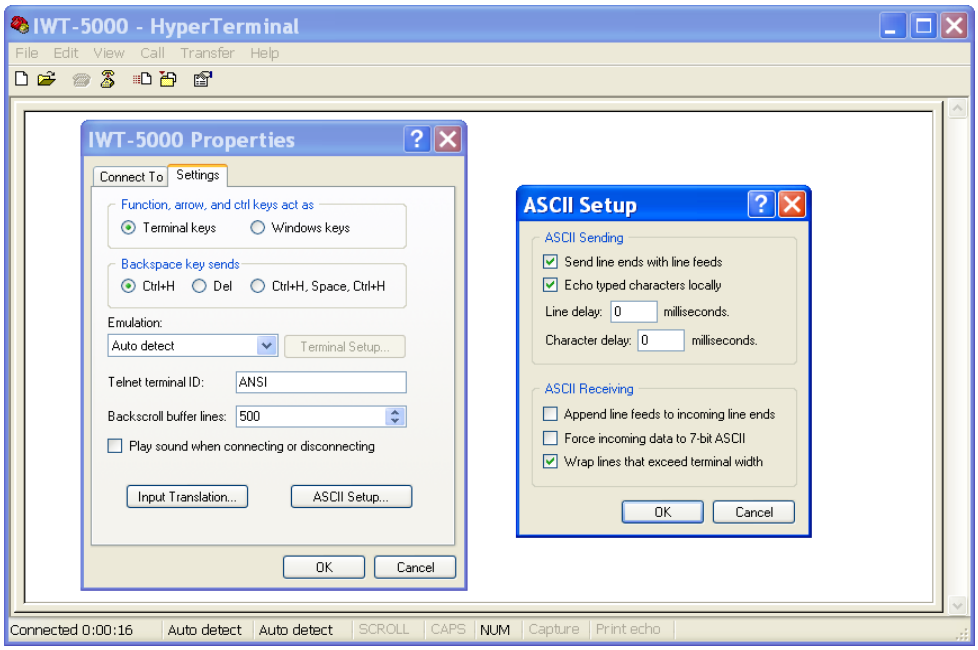
Set the parameters following below given settings to connect the IWT and PC:

1. Baud rate: 57600bps **2. Data bits: 8 bits**

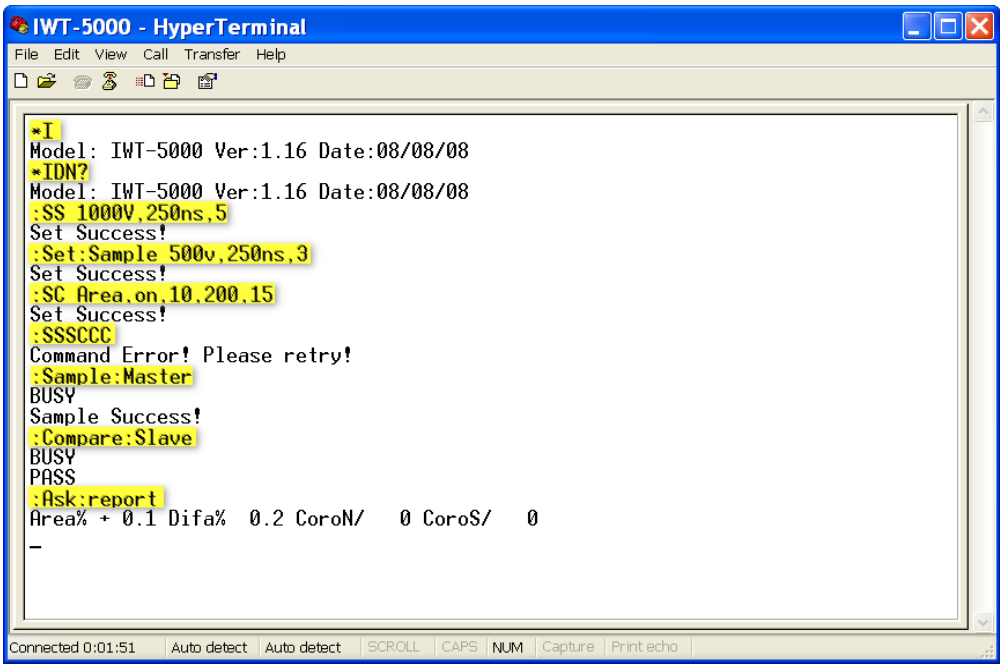
3. Parity: None **4. Stop bits: 1 bit** **5. Flow Control: None**

Press OK to initiate connection.

Click "ASCII Setup" from File\Properties\Settings tab and below screen will show. Please check and enable "**Send line ends with line feeds**" and "**Echo typed characters locally**" options so that user can see the commands sent and feedback.



Step3：Sending Commands



Finishing the correct settings of the above steps, you should be able to send the commands for testing. For all the commands please refer to **8-3**. As shown in above picture the strings marked yellow are the commands sent by user from PC and the other messages are the feedback from the tester.

Note 1: It is not allowed to send ":Download:Master" and ":Upload:Master" via HyperTerminal. These two commands need to be sent following the packet uploading/downloading protocol mentioned in Chapter 8-4 with customized application. You can refer to the Demo Software in the CD.

Note 2: The above mentioned images and logos all belong to the legal registered companies.

9-3 String Command List

Abbr.	Full Command	Required Parameters	Description
*I	*IDN?		Ask for the model name and system version.
*R	*Rst		Reset system.
:SR	:Sys:Rm	on | off	Enable or disable RS232 control mode.
:SK	:Sys:Kl	on | off	Enable or disable keypad lock.
:SB	:Set:Beep	on | off	Enable or disable the buzzer.
:SS	:Set:Sample	Volt, Div, Times	Set the sampling voltage, sampling rate, and AVG tests.
:AS	:Ask:Compare		Ask for the current parameters of voltage/sampling rate/AVG.
:SC	:Set:Compare	AREA, on | off, CursorL, CursorR, MAX Percent	Enable or disable AreaSize comparison and set the parameters.
:SC	:Set:Compare	D_AREA, on | off, CursorL, CursorR, MAX Percent	Enable or disable D_AreaSize comparison and set the Parameters.
:SC	:Set:Compare	CoroN, on | off, CursorL, CursorR, MAX Number	Enable or disable CoroN comparison and set the parameters.
:SC	:Set:Compare	CoroS, on | off, CursorL, CursorR, MAX Number	Enable or disable CoroS comparison and set the parameters.
:AC	:Ask:Compare	AREA | D_AREA | CoroN | CoroS	Ask for the current parameters of each comparison.
:SM	:Sample:Master		Run sampling procedures for Master waveform based on the Configured parameters.
:CS	:Compare:Slave		Start comparing the waveform with that of Master and get Pass/Fail result.
:AR	:Ask:Report		Ask for the results of comparison.
:M	:Move	Cache0 | Cache1 | Cache2 | Cache3 | Cache4 | Cache5, Master	Load the current Master waveform to CacheX.
:M	:Move	Master, Cache0 | Cache1 | Cache2 | Cache3 | Cache4 | Cache5	Set the waveform of CacheX as the Master waveform.
:LM	:Load:Memory	FileName, Master	Set the selected file as the Master waveform & parameters.
:LM	:Load:Memory	FileName, Cache0 | Cache1 | Cache2 | Cache3 | Cache4 | Cache5	Load the selected file parameters to CacheX.
:VM	:saVe:Master	FileName	Save the current Master waveform to the internal memory.
:EM	:dEl:Memory	FileName	Delete the file in the internal memory.
:FL	:File:List		Show the current list of the files saved in the internal memory.
:UM	:Upload:Master	Refer to 9-4 for protocols.	Download the waveform data to IWT.
:DM	:Download:Master	Refer to 9-4 for protocols.	Upload the waveform data from IWT to PC.

Parameter Description & Format

Parameter	Range	Description
ON		Enable
OFF		Disable
Cache	Cache0~Cache5	Select Cache0~Cache5
FileName		10 Characters(Letter, digit, -()._&*+)
Master		Master Waveform
Area		Area Size Comaprison
D_Area		Different Area Size of shifted waveforms Comparison
CoroN		Corona Numbers Comparison
CoroS		Corona Amount Comparison
Volt	200~5000	Test voltage(100V/Step)
Div	250ns, 500ns, 1us, 2.5us, 5us, 10us, 25us, 50us, 100us, 250us	Sampling Rate(Time division)
Times	1~15	Average run times of test
CursorL	0~249	Start location of selected waveform range(R>L)
CorsorR	0~249	End location of selected waveform range(R>L)
Max Percent	0.1%~99.9%	Allowed percentage for Pass
Max Number	1~999	Allowed number for Pass

Note: "Invalid parameter!" will show if the entered parameters are out of range.

IWT is able to take both abbreviated and full commands. User can send parameter setting and comparing commands with or without variables according to the above sheet.

Below are examples:

Example 1. (No parameter) – Ask for the model name and version:

Type in the commands and press Enter to send out. Note that **<0DH><0AH>** should be added after the command if other developing tools are used instead of HyperTerminal.

Full Command: ***Idn? <0DH><0AH>**
Abbr. Command: ***I <0DH><0AH>**
Note that wrong commands such as *IDD? or *Id n? will make IWT return error message: **"Command Error! Please retry!"**

Example 2. (With Parameters) - Enable or disable the Buzzer:

Follow the given format of the parameter and remember to put a space before the parameter.

Full Command: **:Set:Beep on <0DH><0AH>**
Abbr. Command: **:SB on <0DH><0AH>**

Example 3. (With Parameters) - Save the current Master waveform data to the internal memory in the name of the parameter. Note that the FileName should not be longer than 10 characters.

Full Command: **:Save:Master WAVEFORM01 <0DH><0AH>**
Abbr. Command: **:VM WAVEFORM01 <0DH><0AH>**
Note that if the filename already exists, the previous file will be overwritten.

Example 4. (With Parameters) - Load the file of waveform data as the Master waveform. Note that the file name should not be longer than 10 characters.

Full Command: **:Load:Memory WAVEFORM01,Master <0DH><0AH>**
Abbr. Command: **:LM WAVEFORM01,Master <0DH><0AH>**

Example 5. Set the Area Size comparison parameters. Please refer to the parameter sheet for the range and format of parameters.

Full Command: **:Set:Compare Area,on,10,200,15 <0DH><0AH>**
Abbr. Command: **:SC Area,on,10,200,15 <0DH><0AH>**

9-4 Upload/Download Protocol

1. Communication Parameter Setting

The upload/download protocols are valid only for IWT series. Please set the communication parameters as follows:

Commands:

:Download:Master (from PC to IWT)

:Upload:Master (from IWT to PC)

Parameters:

Baud rate: 57600 bps

No parity

8 bits

1 stop bit

2. Data format of the packets

Recall	Type	Length	Data	Check Sum
←1Byte→	←1 Byte→	←1Byte→	← 40Byte →	← 2 Byte →
ASCII	ASCII	HEX	HEX	HEX

3. Description

(1) Recall: Starting with '$', format: 1 Byte of ASCII

(2) Type: Value functions are as follows, format: 1 Byte of ASCII

'0' : End signal, meaning the last packet

'1' : Start signal, meaning the first packet

'2' : The packets in between.

(3) Length: Used for defining the length of the Data, the max length of which is 40 Bytes. Format: 1 Byte of Hex.

(4) Data: The data sent or received based on the Length setting. Format: Up to 40 Bytes of Hex.

(5) CheckSum: The total checksum of the packet.
Format: 2 Bytes of Hex, High Byte at the first and Low Byte follows. The checksum includes all the 43 Bytes except itself.

4. The feedback message from the receiver after packets being sent:

Format: 1 Byte of ASCII

(1) '!' : Data Resending

(2) '@' : Data Correct

(3) '#' : Canceling Data Sending

5. Upload Master Examples:

Step 1.

Sending Command from PC:

:Upload:Master <0DH><0AH>

⇩

Step 2.

IWT sending packets:

$	31H	28H	Data	CheckSum

⇩

Step 3.

PC sending responses:

@

Note: Please send the data correct sign '@' from PC to IWT if the checksum of the received packet is correct, or send '!' if the checksum is incorrect to ask for resending the packet. Or please send '#' to quit packet sending.

⇩

Step 4.

IWT continuing sending packet:

$	32H	28H	Data	CheckSum

⇩

Step 5.

PC sending responses:

@

•

•

Last.

IWT sending the last packet:

$	30H	28H	Data	CheckSum

⇩

PC sending responses:

@

⇩

IWT sending success message:

Set Success! <0DH><0AH>

Note:

1. If there's no Master waveform when sending Upload Master command, a '!' will be sent following the command as warning and the packet sending will be stopped.
2. The total packet number is 126, and the completion info of sending will be received when the last packet with Type as 30H(ASCII = 0) is sent.

6. Download Master Examples:

Step 1.

Sending Command from PC:

:Download:Master <0DH><0AH>

⇩

Step 2.

PC sending packets:

$	31H	28H	Data	CheckSum

⇩

Step 3.

IWT sending responses:

@

Note: IWT will send the data correct sign '@' to PC if the checksum of the received packet is correct, or send '!' if the checksum is incorrect to ask for resending the packet.

⇩

Step 4.

PC sending packets after receiving responses:

$	32H	28H	Data	CheckSum

⇩

Step 5.

IWT sending responses:

@

•

•

Last :

PC sending the last packet:

$	30H	28H	Data	CheckSum

⇩

IWT sending responses:

@

⇩

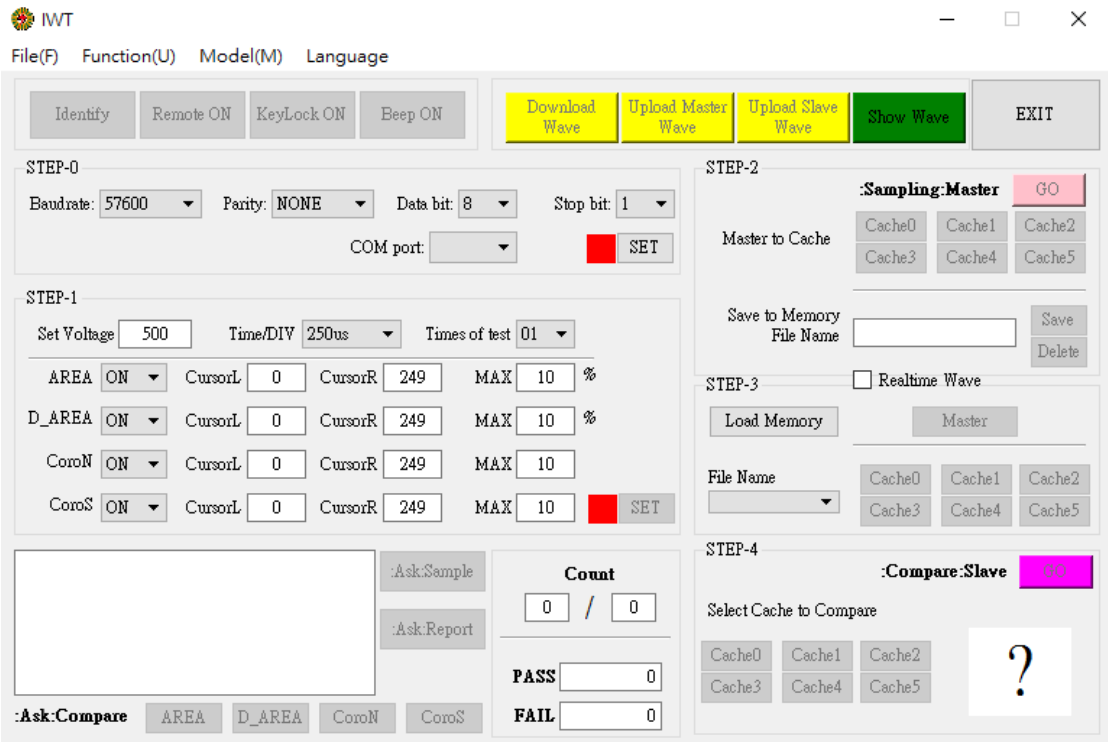
IWT sending success message:

Set Success! <0DH><0AH>

Note: The total packet number sent from PC is 126, and the completion info of sending will be received when the last packet with Type as 30H(ASCII = 0) is sent.

9-5 RS-232 Application Example:

Written with QT 4.8.6 offering high flexibility for different development platforms. Please refer to ***IWT-RS232 Manual*** for detailed operation.



9-6 Converting Waveform to Voltage Values

IWT-RS232 PC-LINK Software mentioned in 9-5 can be used for exporting *.iwt waveform files and these files can also be converted to actual voltage values. Please refer to ***Impulse Surge Tester Convert Manual***.

Chapter-10 Making Golden/Master Sample Waveform

Procedures:

Step 1. Power on IWT and wait for 5~10 minutes.

Step 2. Enter Sample mode and set the test voltage, time/div, and AVG to get the sample waveform. Pick 5~10 DUTs of good quality and attach them to the HV cables, and make sure that IWT screen shows at least 3 peak-to-peak waves for all of the good DUTs, referring to Chapter 4.4.1.

Step 3. Set the parameters of all the comparison methods and waveform range(CursorL/R, Allowance), and enter Test Mode. Run the testing procedures for all the good DUTs.

Step 4. Run Step 2 & 3 until all the testing results are Pass under the configured comparison allowance.

Step 5. Pick DUTs of bad quality and make sure that the results are Fail.

Step 6. Save the Master waveform data to the internal memory and finish making master waveform.