# INDEX



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# 1. Outline

STMAC-15HS high frequency spark tester is a professional instrument for on-line insulation leak testing in wire and cable industry, which detects little defects such as hole, gap, crack, etc. of wire and cable insulation coating. When defects are found, the instrument records relevant data and automatically generates sound and light alarms, meanwhile sending alarm signal by a relay. It can also send defect data through RS-232/422/485 to the PLC or PC for on-line control.

The instrument has a compact structure which is composed of control unit and operate panel as shown in figure 1. It applies voltage and current double closed loop control, which ensures secure and reliable operations. It can also be remotely controlled through serial communication.

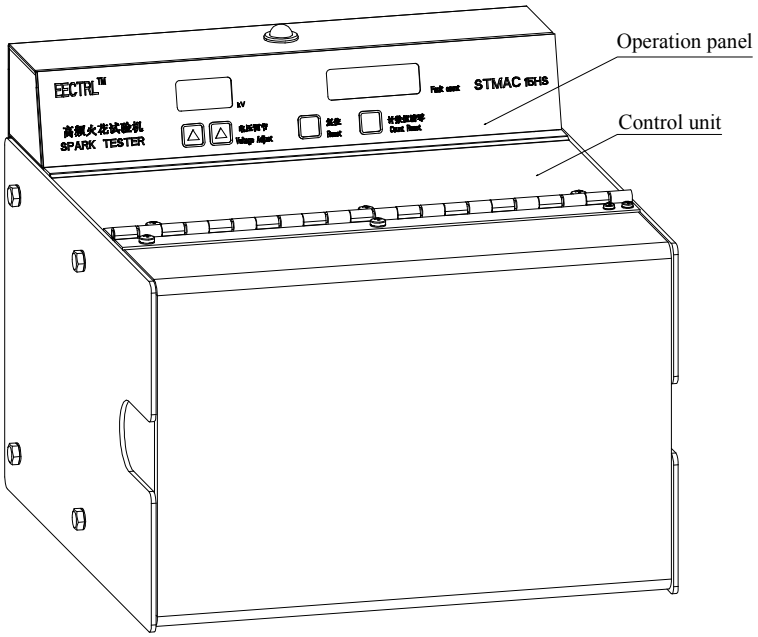
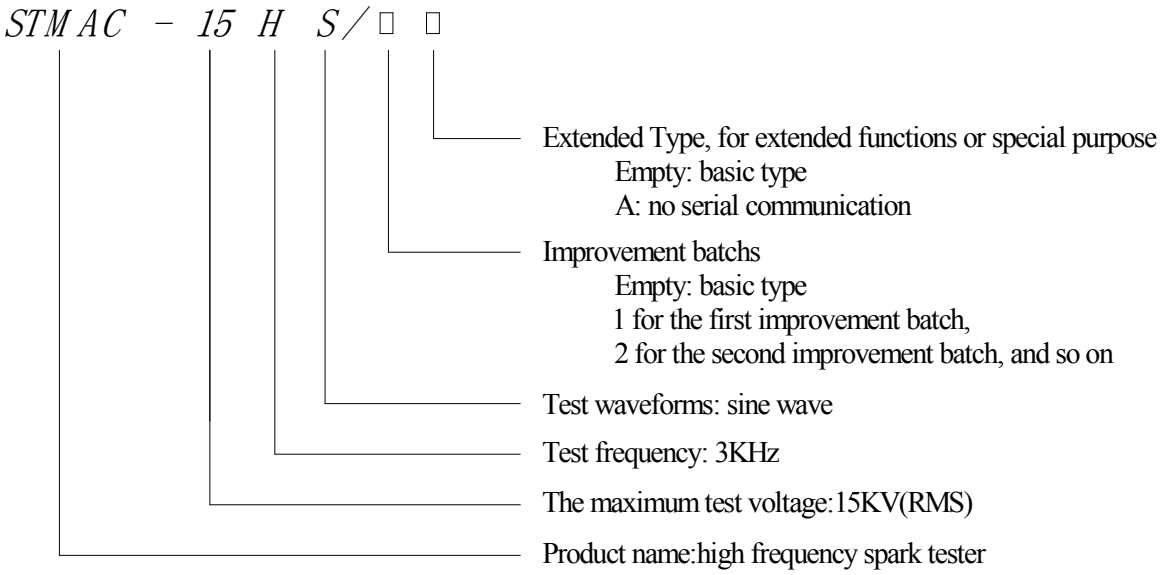



Figure 1 STMAC-15HS

The LC oscillator inside the instrument produces a fixed frequency test high voltage, and exerts the high voltage on tested items through the beads. Under the condition that the tested items are reliably grounded, if any insulation defect is detected, a spark discharge is produced in the insulation coating layer, meanwhile a pulse signal is sent to the detection circuit to increment the leak counter, so that the alarm device produces sound and light alarms and eventually detects the insulation leak.

# 2. Specifications

## 2.1. Technical Specifications




- Output Voltage: 0 ~ 15KV (RMS), sine wave.
- Output voltage regulation range: 0.1 ~ 15KV, 100V per adjustment.
- Defect Records: up to 999 records.
- MAX Diameter of Cable: 25mm
- Test frequency: 2500 ~ 3500Hz, varying with the equivalent load capacitance
- Electrode: beads-style, meet UL1581 standards
- Electrode length: 50mm
- Test mode: manual, automatic
- Automatic leak detection recovery time: < 20ms
- Level of sensitivity: ≥ 600uA when testing voltage is 3KV.
- Output current: 4mA for resistive load, 40mA for capacitive load.
- Max line speed allowed: 3067m/min, meet BS5099 and CCC standards; 1000m/min, meet UL1581 and CSA standards.
- Output relay's capacity: 2A, 250VAC.
- Serial communication: RS232/422 optional.
- Max communication distance: 300m.
- The cover of electrode has safe lock.

## 2.2. Work environment

- Power supply: 200 - 240VAC, 50/60Hz
- Environmental temperature: -5℃ ~ 50℃
- Relative humidity: 20% - 85%
- Power consumption: ≤150W

**Note:** The instrument must be reliable grounded!

## 2.3. Properties

- Volume: Width = 294mm, Height = 241mm, Length = 337 mm.
- Weight: about 13 kg.

# 3. Functions

## 3.1. Basic principles

The 220VAC is converted to a DC voltage used by inverter circuit and a DC power for control circuit, the former produces a test high voltage through LC oscillator inverter circuit, and implements dual-loop control with the feedback voltage and feedback current, and finally achieves the target of stabilizing the voltage and monitoring the current. The basic principle diagram of the circuit is shown in Figure 2.

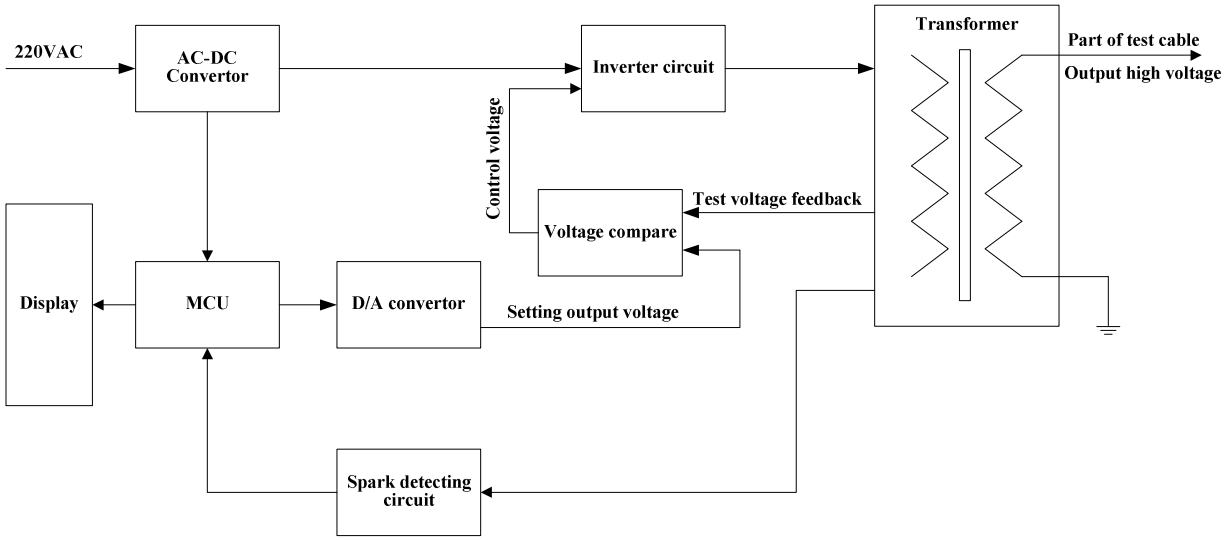



Figure 2 Basic principles

## 3.2. Profile and function

The profile and function of the instrument follows Figure 3.

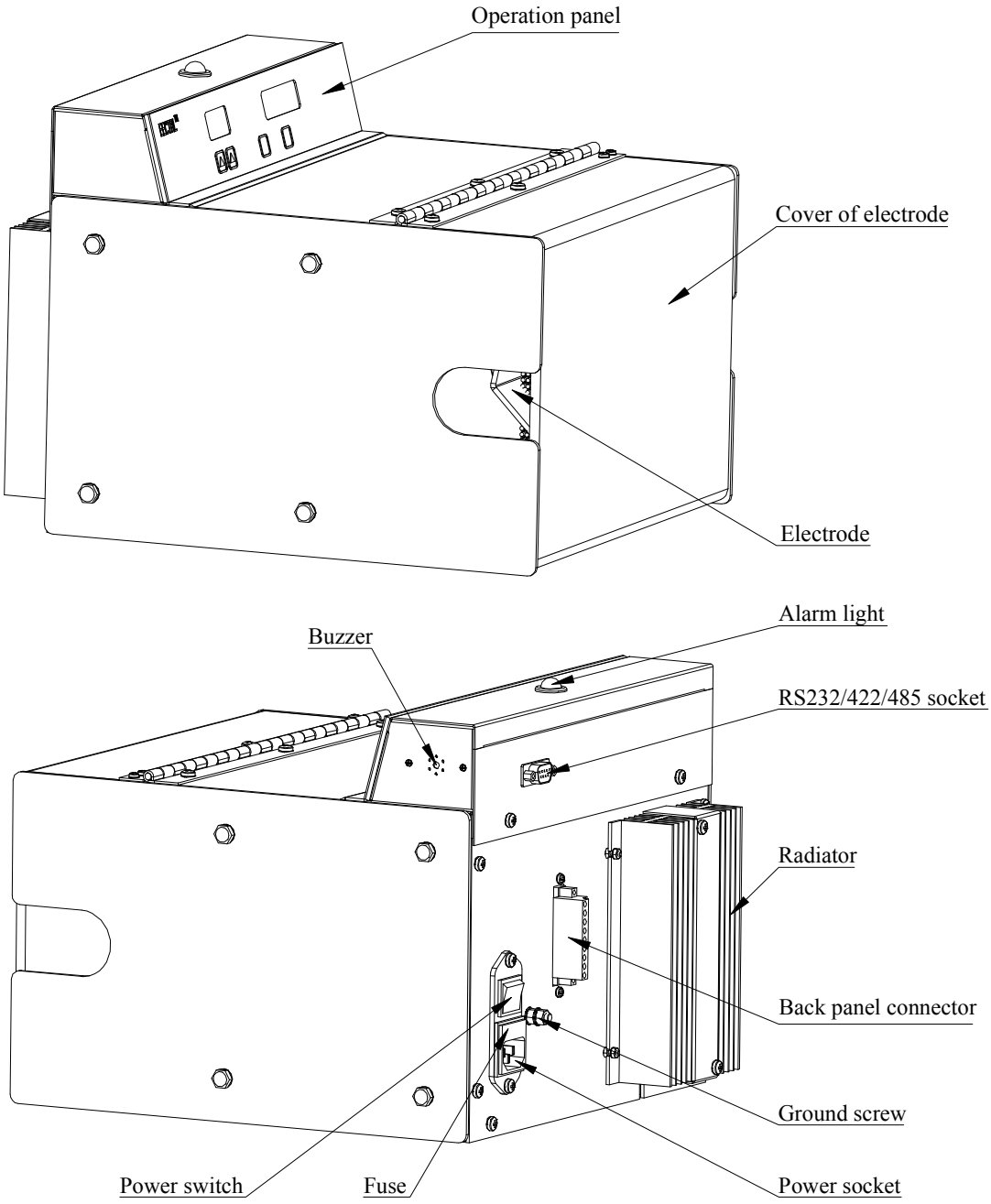



Figure3 Profile and function

## 3.3. Serial communication

STMAC, except STMAC-15HS/☐A, can communicate with PLC or PC via RS-232/422/485 interface. The RS-232/422/485 socket is a standard 9-pin D-type connector. The pin definition of the serial port is shown in Table 1.

Data format: 1 start bit, 8 data bits, 1 stop bit, no parity check.

Table 1

| Pin | Symbol | Function |
|---|---|---|
| 2 | TX+ | Sending positive signal |
| 3 | RX+ | Receiving positive signal |

| | | |
|---|---|---|
| 5 | GND | Grounded |
| 7 | TX- | Sending negative signal |
| 8 | RX- | Receiving negative signal |

In general, both ends of communication cable shall be connected to a common ground in order to reduce the common mode interference affect and eventually prevent accidental burns.

## 3.4. Back panel connector

The back panel connector is a 9-pin socket, whose pin definition and function description are shown in Table 2. The location of the connector is shown in Figure 3.

Table 2

| Pin | Symbol | Function |
|---|---|---|
| 9 | Normally Closed | Defect indicator action: As defect is detected, the normally open contact(Pin 7) will close and the normally closed contact(Pin 9) will open. Pin 7 and 8 can be used to activate a external alarm device. |
| 8 | Common Port | |
| 7 | Normally Open | |
| 6 | Common Port | High voltage indicator: when the test voltage ≥ 500V, Pin 5 and 6 will closed. An external alarm device can be connected to indicate the voltage of test electrodes. |
| 5 | Normally Open | |
| 4 | NC | Not used. |
| 3 | Reset | Connect pin 1 and 2 to enable high test voltage output; Disconnect pin 1 and 2 to disable high test voltage output. If connecting pin 1 and 3 for more than 100ms, the instrument will then reset from leak detection/alarm status back to detecting status. |
| 2 | High voltage enable | |
| 1 | GND | |

## 3.5. Operation panel

The operation panel is located on the top of instrument as shown in Figure 3. The operation panel is used for parameter configuration, sound and light alarm configuration, and data display. The function layout of operation panel is shown as Figure 4.

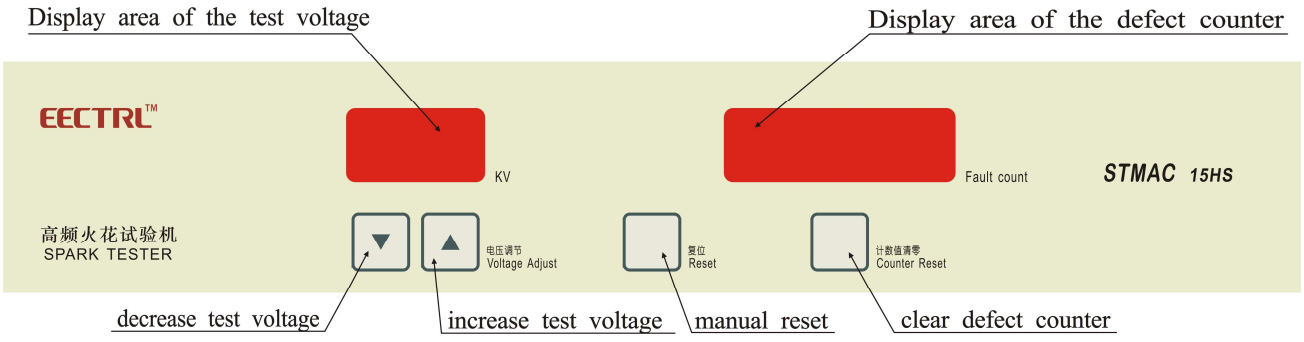



Figure4 Operation panel

## 3.6. Description of parameters

The parameters of STMAC spark tester are defined in Table 3.

Table 3

| Parameter 's code | Function description | Option | Option description |
|---|---|---|---|
| Lch | How to clear the defect indicator (Pin 7~9 of the back panel connector) after the leak spark is detected. | ON | The defect indicator can be cleared by manual reset or remote reset via the back panel connector. It is depended by parameter "rUF" whether the instrument continues to output test voltage when the leak spark is detected. |
| | | OFF | The instrument continues to output test voltage and counts defects when the defect indicator is activated. How long the defect indicator is kept is decided by parameter "PCd". |
| rUF | Whether the instrument continues to output test voltage when the leak spark is detectd. Only available when parameter "Lch" is on. | ON | When leak spark is detected, stop generating test voltage until manually reset or remotely reset via the back panel connector. |
| | | OFF | When leak spark is detected, continue to output test voltage. |
| | | nA | Not available when parameter "Lch" is off. |
| PCd | Set the holding time of the defect indicator. | Set value | The function is only available when parameter "Lch" is off. The value determines the holding time of the defect indicator after it is activated. The value range: 50ms ~ 2.5s, step size: 10 ms. Most alarms and lights have at least 1 second response time. The value should be larger than 1 second when the defect indicator is used for such applications. |
| | | nA | The function is not available when parameter "Lch" is on. |
| ELE | Electrode length,read-only. | 2 | The electrode length is 2-inch. |
| dFn | Read-only | | The version of the software in the operation panel. |
| EFn | Read-only | | The version of the software in the control unit. |

## 3.7. Setting of parameters

1) Turn off the power switch on the back panel.
2) Hold on the "RESET" button then turn on the power switch.

3) When the test voltage display area shows “CON”, defect counter display area shows “SYS”, release the “RESET” button in order to set parameters.
4) Now “Lch” is displayed in defect counter display area, and the parameter’s options will appear at test voltage display area.
5) The parameter’s options are selected via the test voltage regulation button.
6) To set the next parameter, press the counter reset button. The parameter’s code will appear at defect counter display area, and the parameter’s options will appear at test voltage display area. Select the parameter options via the test voltage regulation button.
7) Repeat the above steps to complete settings all parameters.
8) After setting all parameter features, hold the “RESET” button for 2 seconds in order to save the current configuration, then power on the system again.

# 4. Communications

The instrument, except STMAC-15HS/□A, uses the standard RS-232/422/485 serial interface, which can be used to set system parameters such as testing voltage etc.

The ASCII code is used to encode transmission information. The communication frame format is:

#ccXXXXSS<CR><LF>.

Here cc is the 2-character command(from PC/PLC), request(from PC/PLC) or response(from STMAC), which can be request or response; XXXX represents the data, which is not needed in some request and can be filled with “0000”; SS is the 2-character ASCII code for checksum, where the checksum is used to prevent data transfer errors. <CR> is the ASCII code for carriage return, whose hexadecimal value is 0D, and <LF> is the ASCII code for linefeed, whose hexadecimal value is 0A.

The checksum is calculated by adding the ASCII value of the first 7 characters of the frame and taking the lowest byte of the sum. Fox example, if the first 7 character of a frame is “#AV0085”, then the sum is 187H and the lowest byte is 87H, so the complete frame is “#AV008587”.

As the instrument receives the frame, it returns "!" character (ASCII 21H) if the checksum is correct, returns "?" character (ASCII 3FH) is any error happens. If a "?" character is returned, the sender must re-send the frame. Example is shown in Table 4.

Table 4

| PC/PLC | STMAC-15HS | Description |
|---|---|---|
| #av0000 | | Request message sent by PC/PLC, to ask for the actual test voltage exerted on electrodes |
| | ! | Response message sent by STMAC, to indicate the correct receipt of last message |
| | #AV008587 | Response message sent by STMAC, to indicate that current electrode voltage is 8.5kV |
| #SP007592 | | Request message sent by PC/PLC, to set electrode voltage to 7.5kV. |
| | ! | Response message sent by STMAC, to indicate the correct receipt of last message |

The serial communication can be used to operate the instrument replacing the operation panel, shown as table 5. The command, request and repsonse shown in the table doesn’t include the checksum and the end characters.

Table 5

| Button/ Display/Light | Command/ Request/ Reponse | Description |
|---|---|---|
| Voltage regulator button | #SPXXXX | Command to set test voltage by XXXX (unit: Hundred Volts). |
| Test voltage display area | #av | Request for current test voltage. |
| | #AV0085 | Response that current test voltage is 8.5kV. |
| Reset button | #FR0000 | Command to reset. |
| Alarm light | #ft | Request for the status of the defect indicator light on the operation panel and the action of the defector indicator in the back panel connector. |
| | #FT0001 | Response that defect indicator light is on. |
| Defect counter | #fc | Request for current defect counter |
| | #FC0031 | Response that 31 defects are detected |
| Counter reset button | #CR0000 | Request for resetting defect counter |

The command from PC/PLC is formatted as table 6.

Table 6

| Command | Description | Data |
|---|---|---|
| CR | Reset defect counter | always “0000” |
| FM | Set defect detect mode | 0000 represents Latch OFF, rUF OFF<br>0001 represents Latch ON, rUF OFF<br>0002 represents Latch ON, rUF ON |
| FR | Reset defect indicator in the back panel connector. | always “0000” |
| PC | Set parameter “PCd”. The data is invalid if the value of FM is “0001" or “0002” | 4 decimal value, time unit is ms. For 50ms ~ 2.5s time range, the corresponding data is 0050~2500. |
| RV | stop outputting test voltage, while the voltage setting is not affected | always “0000” |
| SP | Set test voltage | 4 decimal value, unit is Hundred Volts, i.e., 0123 represents 12300V. |

The request from PC/PLC and the corresponding response of STMAC is formatted as Table 7.

Table 7

| Request | Description | Sending data | Response |
|---|---|---|---|
| av | Request the current test voltage | N/A | AV |
| et | Request the length of electrode | N/A | ET |
| fc | Request defect counter value | N/A | FC |
| fm | Request defect detect mode | N/A | FM |
| ft | Request defect indicator status | N/A | FT |
| is | Request internal interlock status | N/A | IS |
| pc | Request recovery time under program control | N/A | PC |
| sp | Request pre-set test voltage. In large loads | N/A | SP |

| | | | |
|---|---|---|---|
| | cases, the current test voltage (AV) might be different from the pre-set voltage (SP). AV must be read at work to verify if the instrument works at SP. | | |
| vn | Request version for operation panel and control unit. | 0001 represents requesting the version of operation panel, 0002 represents requesting version of control unit. | VN |

The response of STMAC is described as Table 8.

Table 8

| Response | Description | Data |
|---|---|---|
| AV | Indicate current test voltage | 4 decimal value，unit is hundred volts. i.e., 0123 represents 12300V |
| ET | Indicate the electrode length, i.e. parameter ELE. | 0001 represents 1 inch long<br>0002 represents 2 inch long<br>0003 represents 3 inch long<br>0004 represents 4 inch long<br>0005 represents 5 inch long |
| FC | Indicate defect counter value | counter scope is 000～999 |
| FM | Indicate the test mode | 0000 represents Latch OFF，rUF OFF<br>0001 represents Latch ON，rUF OFF<br>0002 represents Latch ON，rUF ON |
| FT | Indicate the defect indicator status, i.e. the result of defect detection | 0000 represents no fault is detected<br>0001 represents fault is detected |
| IS | Indicate interlock status | 0000 represents internal interlock on<br>0001 represents internal interlock off |
| PC | Indicate recovery time under program control, i.e. parameter PCd. | 4 decimal value，time unit is ms，scope is 50ms～2.5s，corresponding data is 0050～2500 |
| SP | Indicate the setting value of test voltage | 4 decimal value， unit is Hundred Volts, i.e., 0123 represents 12300V. In large loads cases, the current electrode voltage (AV) might be different from the setting voltage (SP). AV must be read at work to verify if the instrument works at SP |
| VN | Indicate version of operation panel or control unit, i.e. parameter EFn. | VN1xyz represents the version of the software of operation panel is x.y.z<br>VN2xyz represents the version of the software of control unit is x.y.z |

## Summary of common used commands

1) Set test voltage: #SP0080 Set voltage to 8000V
   Data format: 23h 53h 50h 30h 30h 38h 30h 38h 45h 0Dh 0Ah
2) Read the actual test voltage: #av0000

Data format: 61h 76h 30h 30h 30h 30h 42h 41h 0Dh 0Ah

3) Manual reset: #FR0000
   Data format: 23h 46h 52h 30h 30h 30h 30h 37h 42h 0Dh 0Ah
4) Read the defect counter: #fc0000
   Data format: 23h 66h 63h 30h 30h 30h 30h 41h 43h 0Dh 0Ah
5) Reset defect counter: #CR0000
   Data format: 23h 43h 52h 30h 30h 30h 30h 37h 38h 0Dh 0Ah
6) Stop outputting test voltage: #RV0000
   Data format: 23h 52h 56h 30h 30h 30h 30h 38h 42h 0Dh 0Ah
7) Request pre-set test voltage: #sp0000
   Data format: 23h 73h 70h 30h 30h 30h 30h 43h 36h 0Dh 0Ah
8) Set the holding time of the defect indicator: #PC0500 Set recovery time 500ms
   Data format: 23h 50h 43h 30h 35h 30h 30h 37h 42h 0Dh 0Ah
9) Read the holding time of the defect indicator: #pc0000
   Data format: 23h 70h 63h 30h 30h 30h 30h 42h 36h 0Dh 0Ah
10) Set test mode: #FM0001 Set Mode 1
   Data format: 23h 46h 4Dh 30h 30h 30h 31h 37h 37h 0Dh 0Ah
11) Read test mode: #fm0000
   Data format：23h 66h 6Dh 30h 30h 30h 30h 42h 36h 0Dh 0Ah
12) Read interlock status: #is0000
   Data format: 23h 69h 73h 30h 30h 30h 30h 42h 46h 0Dh 0Ah

# 5. The use of instrument

1) Place the tested item through the electrodes, and assure the item is located in the middle of electrodes.
2) Assure the tested item is grounded in prior to any following-up steps.
3) Turn on the power of the instrument. Press the reset button to clear the defect counter if necessary.
4) Adjust the test voltage to the required voltage.
5) Start testing after finishing the following-up steps.

Note: DO NOT touch the test item during the test.

# 6. Outline & installation dimensions

The outline profile and installation size of the instrument are demonstrated in Figure 5.

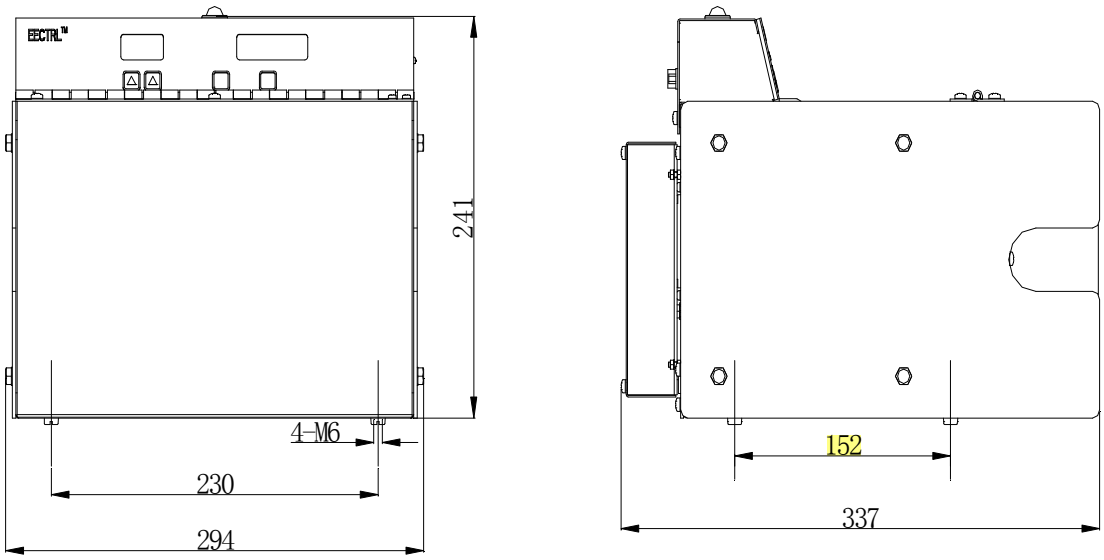



Figure 5 Outline and size, unit: mm

# 7. Maintenance

Due to the impact of dust and wear, regular inspection of electrodes and electrode retaining plate must be performed.

Residual water may reduce the efficiency of the instrument. The electrode retaining plate must be wiped with clean, dry cloth. If wire insulation layer enters into the beads, the beads must be taken out from the high-voltage test module and cleaned by steel wire brush.

If the transparent protective shield, or electrode retaining plate, or electrode is damaged, they must be replaced immediately.

# 8. Common Fault & diagnosis

- Wrong detection of defect:
  1) The cable wire swings too significantly, or water seepage happens. Solution: fix the cable wire in the middle of electrode and dry test cable.
  2) The high-voltage fixed panel is too dirty with electrical conductivity materials. Solution: remove impurities and relocate it.
  3) Check if the tested item is grounded according to requirement.
  4) If the above three options are excluded, the fault might be caused by the effects of capacitive loads.
- Test voltage display area flashes “00.0”
  1) The transparent protective shield needs to be closed.
  2) Pin 1and 2 of the back panel connector is disconnected, then short-circuit them to enable test voltage
- Place the tested item in electrodes, adjust test voltage to a high value, and release the regulator button for a few seconds. The test voltage display area indicates a value smaller than the pre-set voltage.
  1) Due to the impact of capacitive loads of the tested item, the instrument might have reached the maximum voltage of current test item. Inquire manufacturer about the specific test application.

- The alarm device is connect to pin 7 and 8 of the back panel connector. The defect is detected, while no action is performed by the alarm device.
  1) The pre-set value of parameter “PCd” is too small, thus can’t be identified by the alarm device.
  2) Check whether the fuse on main board is burned out.
- The instrument is not able to work as power is turned on.
  1) The interlock is not closed.
  2) The connector on the back panel is not plugged in.
  3) The fuse on main board is burned out.
  4) The pin 1 and 2 on the back panel connector is not short-circuited. Solution: short-circuit them.

# 9. Accessories

| | |
|---|---|
| Power cable | 1 |
| User manual | 1 |
| Female socket to the back panel connector | 1 |
| DB-9 standard female socket | 1 |

The accessory configuration is subject to the shipping list.

STMAC-15HS/□A does not include DB-9 standard female socket.

# 10. Service & Warranty

We offer a 1-year warranty included as standard on the instrument since the date of shipment, for any fault or damage due to the product quality problems, under the circumstance of reasonable storage and usage.