HIGH VOLTAGE A.C.(50 or 60Hz) CONTACT CAPACITIVE HIGH VOLTAGE DETECTOR

INSTRUCTION MANUAL

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1. Safety notes

These Contact High Voltage Detectors have been designed with safety in mind. However, no design can completely protect against incorrect use.

Electrical circuits are dangerous and lethal through lack of caution or poor safety practice. Follows Safety rules to reduce danger and practice safety.

- Read the User's manual carefully and completely before using the tester. Fully understand the instructions before using this product. Follow the instructions for every test. Take all the necessary precautions. Do not exceed the limits of this instrument.
- Only personnel who are fully trained in the use of High Voltage Detectors should use this equipment. The systems that it will be used on are powered from High Voltages which are lethal.
- Always use a fiber glass rod or an authorised insulated Stick of the correct specifications and minimum safe operating distance.
- A High voltage test is carried out with the tester attached to an operating stick, sometime called "links stick" (or Hot Stick....etc....).
- Before use, ensure that the detector and it's accessories that are required for use are clean, free from cracks or deep scores, and are properly secured together.
- Always check that the detector is working Correctly before and after the test.
- Make certain that the detector is properly rated for the Voltage of the system under test.
- Do not touch any exposed wiring, connections or other "Live" parts of an electrical circuit.
- Check the operation of the assembled detector complete with accessories before and after each test.
- Do not allow a live high voltage conductor to come in contact with the detector at a point below the limit mark.
- The detector must never be used without a handle or without insulating rods incorporating a handle.
- Safe working distances must always be observed.

- The detector viewing face or facia must always be Considered to be at the same voltage as the conductor under test. The safe working distance must always be from that viewing face.
- Never attempt to touch the viewing face or press the test button should the lights go out when the contact electrode is touching, or is in the vicinity of, the conductor under test.
- **This instrument should only be used by a competent, suitably trained person which understand fully this test procedure. Personal working with High Voltage should Be trained regularly.**
- **Use Protective gear.**

Caution, risk of electric shock.

Caution, refer to the user's manual.

SAFETY RULES
READ MANUAL
UNDERSTAND INSTRUCTIONS
TRAINING
LINK STICK (SAFETY DISTANCE)
CHECK BEFORE & AFTER
RED MARK
ALWAYS BE SAFE AND PROTECTED

ALWAYS TREAT ALL CONDUCTORS AS LIVE

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2. General description

The range of capacitive high voltage detectors has been designed to meet the requirements of the latest International IEC standards (IEC 61243-1).

They may be used indoors and outdoors in all weathers. The detectors are intended for use on high voltage systems but not in switchgear.

Models are available to cover a wide range of system voltages. The function of the detector is to determine whether a conductor is energised or de-energised so that it may be safely earthed before commencing work.

Protection class : IP65.

3. Principles of how it work

A strong cone shaped nylon moulding houses the detector. The inner wall of the cone has a conductive screen coating to which the earthy parts of the circuit are connected.

This screen coating is capacitively coupled to the earth of the electric field and acts as a voltage divider with an internal sensing capacitor (The internal sensing capacitor is different from voltage range to voltage range).

High voltage appearing at the electrode is divided down and the voltage across the sensing capacitor is proportional to the voltage between the electrode and earth.

This proportional signal voltage is fed to the electronic circuitry whose output drives an audible warning device and a system of indicating lamps.

The electronic circuitry has some scaling circuitry, an amplifier, rectifier and a comparator circuit. The threshold of the comparator is set at the factory or set by an authorised calibration facility.

This range of capacitively coupled high Voltage Detectors uses multilayer boards with ground planes all over the board, eliminating false or noisy signals.

4. A quick overview of it's inside working

- **Arming**
  The detector has a combined manual and a self arming mode.

- **Manual Arming Mode**
  The ARMING/TEST button is mounted on the front viewing face of the detector (the front viewing face of the detector has the buzzer, mounting stud (which has the attachment adaptor to the link stick), arming/test button and the lights It's also called the Facia).
  When this button is depressed, the High Bright Red Leds flashes twice per second and the loud Buzzer (audible warning device) sounds also twice per second.
  This is the display for voltage PRESENT.
  Pressing the button, activate an internal oscillator, and couple it to the input of the sensing circuitry, tough, simulating an external voltage.
  When the button is released the display changes to the High Bright Green flashing LEDs (also twice per second).
  This is the display for voltage NOT PRESENT and battery OK. The detector is then armed and ready for use. This armed condition lasts for about 3 minutes.

  Arming the detector also functionally checks the internal circuitry but does not check the input protections or contact electrode extension nor the internal sensing capacitor for an open circuit condition. Use an external proofing unit for this.

- **Self Arming Mode**
  In this mode of operation the detector automatically switches, ON when a High Voltage A.C. is applied to the contact electrode.

- **Indicating lights**
  Two sets of High Bright Leds, one is Green, one is Red are available.
  One is green for voltage NOT PRESENT and Battery OK and the other is red for voltage PRESENT.

- **Limit mark**

  At the narrow top end of the detector housing, there is a red band which indicates the limit mark.

  By definition the limit mark indicates the physical limit to which the detector may be inserted between live components or may touch them.

  However, when the detector is used with a contact electrode extension, the shroud of the extension covers the limit mark. In some models, from third party manufacturers the shroud is clear and the limit mark is still vis ble but in others it is coloured red and the shroud itself constitutes the limit mark.

5. Labeling

Designed, manufactured and tested to IEC 61243-1 for capacitive type contact voltage detector for voltages above 1kV 50/60Hz.

Read and understand the instruction manual before using the detector.

Meet the latest EMC standards and European requirements in force at the time of testing. Please enquire for test results.

Manufacturer's details, physical address and postal address. Manufacturer's brand.

DO NOT USE AS A LINK CHANGER

As a precautionary measure, it is recommended not to use this detector as a link changer.

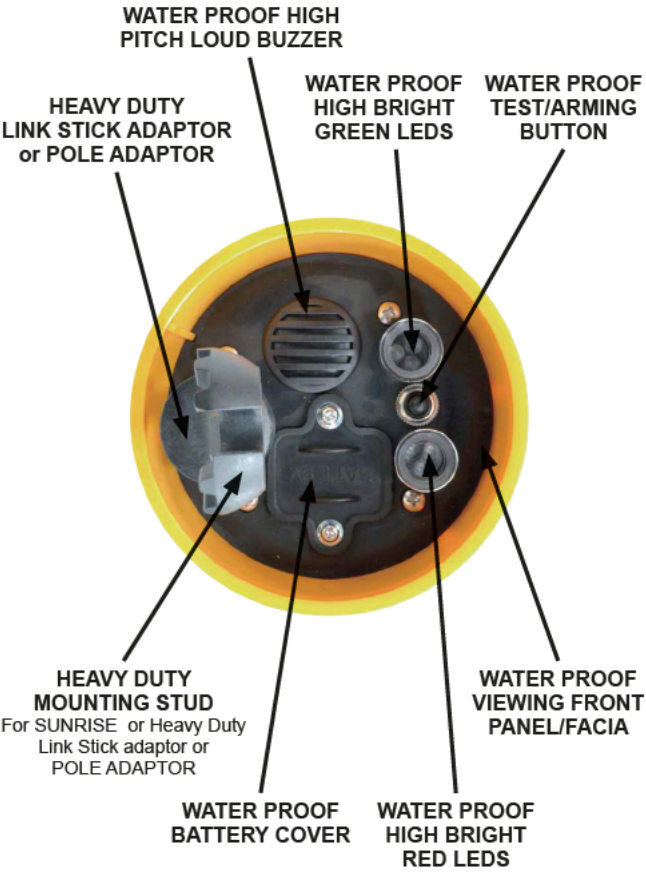
DO NOT USE AS A MECHANICAL TOOL

Never use this detector as a tool, or any mechanical device on which force is applied.

DO NOT USE AS FUSE CHANGER

Never use this detector as a fuse changer, or never attempt to remove fuse or change them with the detector or it's accessories.

6. Front panel layout - facia



7. Main label meanings

RANGE:	11/36kV	System Voltage for this detector.
SERIAL No:	0123456789	For traceability purpose.
MODEL:	BST-HVD5	Model relate to Threshold voltages
DATE:	22/10/2004	Date of Manufacture / Cal bration

CLIMATIC CLASS: Normal. The detector will perform correctly over the temperature range -25°C to +55°C and in 20% to 96% humidity.

Outdoor. The detector is suitable for use either indoor or outdoor and in wet conditions.

8. Preparation for use

Cleanliness

Dirt can cause surface tracking and it is therefore necessary to keep the detector and its accessories clean by using a detergent solution. The detector and other plastic accessories should then be polished with the liquid polymer polish provided.

Mechanical damage

If surface scratches or dents can be easily seen by the naked eye then the equipment should be returned to the manufacturer for repair since these blemishes act as traps for dirt and moisture. Mechanical damage to stud or bush screw threads would also necessitate the return of the equipment to the manufacturer.

Battery check

Depress and release the TEST/ARMING button. The Green High Bright Leds should flashes twice per second. If this is not the case, replace the battery with a new one.

9. Care and maintenance

Storage

The detector and its accessories should be stored in the proprietary carrying case/bag when not in use. If the equipment is not going to be used for an appreciable length of time (one month or more) then it is a wise precaution to remove the battery. Remember to replace the battery when the equipment is used again. It's advisable to replace the battery with a new one.

Transporting

When the equipment is in transit it should be stored in its carrying case/bag. Whilst the equipment has been designed for field use it should not be subjected to excessive bumps and shocks.

10. Periodic maintenance

Battery Replacement

It is expected that the battery life will be many months of normal use. It is recommended therefore that the battery be replaced every six months whether or not it is found to be satisfactory when testing/arming the detector.

The battery is located on the viewing facia of the detector. Its position is clearly indicated. Undo the two captive fixing screws and turn left anti-clockwyse, remove the battery compartment cover. Slide out the battery and unclip the battery connector. Fit a new battery type9V. Insert the battery into it's place, the battery cover and it's screws, making sure that the fixing screws are properly tightened (turn clockwyse) to ensure a good water seal. There are no other replaceable or serviceable parts.

Recalibration and Proof Testing

Every twelve months the detector and accessories should be rechecked. This should include checking the threshold voltage and voltage proof testing of all the accessories. It is recommended that this rechecking be done by the manufacturer or it's authorised appointed representative.

11. Checking and proofing the tester checking

Checking

Press the TEST/ARMING button to check the function of the internal circuitry and the condition of the battery.

While depressing, the High Bright Red leds should flash about twice per second and the Buzzer should also sound twice per second.

When the button is released the High Bright Green leds will flash for about 3 minutes.

If the High Bright Green leds goes off immediately , replace the battery (see battery replacement).

If the detector still does not arm correctly, then it is faulty and should be returned to the manufacturer for repair.

Proofing

Using a known high voltage AC source.

Arm the detector if necessary.

Present the detector, armed if necessary, to a high voltage source, touching it with the contact electrode. The High Bright Red Leds will flash and the Buzzer alarm will sound, both, twice per second.

12. Typical uses

The main function of the detector is to determine whether a conductor is energised or de-energised so that it may be safely earthed before commencing work.

The Detector is utilized to determine if a conductor is at a potential (conductor to earth) higher than the threshold level for which the detector is set.

Once the conductor is at a potential higher than the set threshold, the detector will buzz and the red high bright leds will flashes twice per second.

13. Instructions for use

Visual Inspection
Remove detector from its carry case then visually, inspect it. Feel it and caress by hand, and fingers.
Everything must be smooth, just like a young women's breast. Should it not be the case, send the detector to the factory to replace the case.

Cleaning the detector using a cloth
Gently, clean the detector external body, using the supplied cloth and fluid. Make sure all traces of dirts and unclean objects si removed.

Battery Check
Depress the Red "TEST/ARM" button, then release. The High Bright Green Leds should flash twice per second if the battery is ok. If not, replace the battery.

Buzzer, and High Bright Red Light.
Depress and hold down the Red "TEST/ARM" button, The buzzer and the High Bright Red Leds should flash, both twice per second If not, send the detector back to the factory for repairs.

Check the Adaptor
Make sure the adaptor is not cracked and is tightly screwed onto the detector. Should the adaptor show any type of crack, do not use it, as it could break while you are using it.
Only use a good quality adaptor.

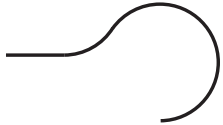
14. Assembling the equipment

For use on overhead lines and bus-bars.
Select a contact electrode to suit the application and screw it onto the detector.

Standard "Y" Contact Electrode

Standard "HOOK" 40 mm Contact Electrode

Standard "HOOK" 60 mm Contact Electrode



Standard "HOOK" 100 mm Contact Electrode
Assemble the detector to the to the link stick or the insulating fiberglass stick. Never use the detector without a contact electrode and without an insulating stick. Always ensure proper contact electrode is attached securely to the head.

For use on capacitive test points
High Voltage Detectors have been specifically designed for use on capacitive test points of separable connectors and on insulated polymeric cables in fused cable boxes.

15. Using the equipment

Assemble the equipment as required Press the TEST/ARMING button to check the function of the internal circuitry and the condition of the battery.
While depressing, the High Bright Red leds should flash about twice per second and the Buzzer should also sound twice per second. When the button is released the High Bright Green leds will flash for about 3 minutes. If the High Bright Green leds goes off immediately , replace the battery (see battery replacement). If the detector still does not arm correctly, then it is faulty and should be returned to the manufacturer for repair.

Manual Arming

Depress the TEST/ARMING button and the High Bright Red leds and the aud ble alarm (buzzer) will flash and sound twice per second and on releasing the alarming/test button the High Bright Green leds will flash twice per second. The detector is now in its armed state ready for use. This condition lasts for about 3 minutes, unless contact with High Voltage is made (see Self Arming).

Self Arming

Once the contact electrode is in Contact with High Voltage, the detector will switch ON by itself, the High Bright Green leds will flash twice per second, unless the High Voltage is higher than the threshold, in which case, the High Bright Red leds will flash about twice per second and the Buzzer should also sound twice per second.

Proofing

The complete assembled equipment should now be checked using a known high voltage AC source. Arm the detector if necessary. Present the detector, armed if necessary, to a known high voltage source, touching it with the contact electrode. The High Bright Red Leds will flash and the Buzzer alarm will sound, both, twice per second.

Testing

Now present the detector to the conductor under test, touching it with the contact electrode. If the voltage on the conductor is greater than the threshold voltage of the detector, then the High Bright Red Leds will begin to flash and the audible alarm will sound, twice per second. This indicates that the conductor is live. The voltage present display will continue for as long as the

detector contact electrode is in contact with the live conductor. If the voltage on the conductor is less than the threshold voltage of detector, then High Bright Red Leds and the aud ble alarm will not operate. The High Bright Green leds will flash, twice per second.

16. Interference voltages

In certain situations, due to the dimensions or configuration of the installation, electrical fields capable of affecting the indication of the detector may occur.
Erroneous indication will only occur if the body of the detector is situated within such a field.
Correct indication can be achieved by applying the detector to horizontal conductors away from bends or connections.
Unambiguous indication of the detector depends upon the capacitance of the detector to earth being unaffected by other fields.

In-Phase Interference

This occurs when the conductor under test is adjacent to another conductor whose voltage is in-phase.
The field which is then generated can act as a screen between the detector and earth, thereby reducing the effective capacitance of the detector to earth.
This results in an increased threshold voltage which could mean that the detector will not indicate that a conductor is live.
This increases the threshold voltage of the detector which may, therefore, not indicate. This is of course a dangerous situation.

Phase-Opposition Interference

If a conductor under test has adjacent conductors which are in phase opposition, then erroneous indication can occur. For instance, if the conductor under test is earthed and the detector came close to a live conductor then it is possible that the detector will indicate that the conductor under test is live. This, however,can be seen as a fail safe condition, although it is incorrect.

17. Specifications

Electrical

Threshold Voltage:

For **a single voltage detector (for example 11kV) the threshold voltage should be in the range 0.15 X detector voltage to 0.4 X detector voltage i.e. for 11kV, $V_{THRESHOLD}$ is in the range 1.65 to 4.4kV.**

For a detector with a **two to one voltage range (for example 66 to 132kV) the threshold voltage should be in the range 0.15 X detector maximum voltage to 0.4 X detector minimum voltage i.e. for 66/132kV, $V_{THRESHOLD}$ is in the range 19.8 to 26.4kV.**

Where none of the above rules can be applied the ***threshold may be set to a value agreed with the customer.***

Accuracy of threshold voltage: ±5% of set level and under our factory test and setup conditions.

Operating Time: About 3 minutes nominal with VOLTAGE NOT PRESENT on the contact electrode.
Continuous with VOLTAGE PRESENT on the contact electrode.

Response Time: Less than 1 second.

Spark Protection: The detector will not be damaged as a result of spark discharge while making contact with the conductor under test.

Bridging Protection: The detector and its accessories will not cause flashover or breakdown between live parts of the installation or between live parts of the installation and earth.

Current Consumption:30mA maximum.

Battery Low: 7,2V nominal (Arming via the testing/arming button is inhibited at this voltage but self-arming from signals is maintained down to 6.5V.)

Battery: 9 V manganese alkaline PP3-C IEC 6F22.

VISUAL INDICATION

Voltage Present: High Bright Red Leds flashes twice per second.

No Voltage Present: High Bright Green Leds flashes twice per second.

AUDIBLE INDICATION

Voltage Present: Buzzer beep loudly twice per second

MECHANICAL

Detector

Length:	180mm
Diameter:	100mm
Material:	NYLON

Electrodes

Length:	40mm
Material:	Stainless Steel

"Y" electrode

Length:	35mm
Width:	40mm
Material:	Stainless Steel

Hook electrodes

Diameter:	40, 60 or 100mm
Material:	Stainless Steel/ Aluminium

Contact Electrode (optional)

Length:	100, 250, 650
Extension:	1000mm
Material:	PVC/Stainless Steel

Pole adaptors(optional)

Bowthorpe

Length:	125mmm
Extension:	46mm
Material:	Acetal/Steel

Universal Star

Length:	95mm
Diameter:	27mm
Material:	Acetal/Steel

Karl Pfisterer

Length:	85mm
Diameter:	25mm
Material:	Acetal/Steel

Chance

Length:	85mm
Diameter:	45mm
Material:	Acetal/Steel

Extension Poles

Length:	1200mm total
Material:	F breglass

Vibration Resistance: In accordance with (IEC 68-2-6 Test Fc).
The indicator and contact electrode are subjected to sinusoidal rectilinear v brations in two perpendicular directions.
The frequency ranges from 10Hz to 500Hz and the duration of the sweep is set at 2hours for each direction.
The test is considered passed if the detector shows no apparent mechanical deterioration.

Drop Resistance: In accordance with (IEC 68-2-32 Test Ed).
The voltage detector is dropped from horiz. and vertical positions from a height of 1m onto a test surface of concrete.

Shock Resistance: In accordance with IEC 61243-1 Test 6.4.5.
Five mechanical shocks are performed on the most fragile parts of the indicator.
The test is passed if the indicator shows no incipient fracture.

Cleaning Kit: Cloth and bottles of polymer liquid

18. Models and comparison table

PART#	BST-HVD5
System Voltage	11/36 kV
Threshold Set within Range	3.3 kV To 4.95 kV
Response Time	<1 Sec
Auto-OFF[1]	±3Min
Bridging Protection[2]	YES
Spark Protection[3]	YES
Battery Low[4]	<7V
Threshold[5]	4.12 kV
Battery Current[6]	<30mA
Green = Armed[7]	YES
Red = V Detected[8]	YES
Test / Arming Button[9]	YES

Please note the internal proofing circuit does not test the electrode and the protection devices.

Auto-OFF[1] = The auto-OFF timer is reset every time the contact electrode of the Model x touch a High Voltage or each time High Voltage is detected. The auto-off timer is also reset each time the device is armed and tested, using the front button. Auto-OFF timer is approximatively 3 minutes.

Bridging Protection[2] = The Detector and it's accessories will not cause flashover between live parts of the installation or between live parts of the installation and earth/ground.

Spark Protection[3] = The Detector will not be damaged as a result of spark discharge while making contact with the conductor under test.

Battery Low[4] = When battery is low, the HVD will not stay armed after depressing the "TEST/ARMING" button, and green LED will not flashes. (The flashing green Light indicates the standby mode). Do not use if the green Led does not flashes after depressing "TEST/ARMING", This indicate a low battery condition. Replace battery immediately. DO NO OPERATE.

Threshold[5] = This is he optimum recommended Threshold to set the detection level at which the detector show and sound an High Voltage Alarm. This is the recommended level at which the calibration laboratories must set the detector. In Factory, it is set within a range, but optionally, it can be set to this threshold and a calibration certificate issued.

Battery Current[6] = This is the total current consumption taken from the battery when the buzzer sounds and Red Light lit (voltage detected mode). This is the worst case of current consumption.

Green = Armed[7] = The Green light flashes when the detector is armed and waiting for HV to be detected. This also mean that the battery is ok.

Red = V Detected[8] = The Red light flashes when High Voltage is detected. This happen when The voltage detected is higher than the threshold of that model (see tables).

Test / Arming Button[9] = This button is utilized to arm (turn ON) the detector. When this button is pressed, and while pressing it, a internal proofing oscillator is connected to the detector and simulate HV on the electrode. While the "TEST/ARMING" button is depressed, the RED light flashes and the buzzer sounds, indicating hat the detector works properly. When releasing this button, the green light must flash, indicating the battery is ok, and the detector is in standby, waiting for detection.

19. Questions / Answers

The Pole adaptor mounting stud is not seen in the case
Are you sure it's not simply still attached onto the detector? Many users keep it attached onto their detector, even after use.

I press "Test/Arming" button, but all the Leds Stays off and the detector looks dead!!!!
The battery may not be present or is so low that nothing is happening. First, change the battery

I press "Test/Arming" button, The High Bright Red Leds and the Buzzer sound intermittently, but when I release the "Test/Arming" button, but all the Leds goes off and the detector looks dead!!!!
The battery is low. Replace the battery with a new one.

The Detector is dirty. What can I use to clean it with, and how?
In the case, should be a full bottle of cleaning material.

I can't find the battery. Which battery must I buy, and what kind?
The battery is situated in the front panel. Remove the 2 screws first, then slowly and gently, remove the battery. Replace with any 9V battery.

The body of the Detector is scratched. Is it dangerous?
Yes, it's advised that if your detector has any trace of scratches, you can get a replacement casing. However, this operation can only done at the factory.