

# ST-IAM– Sensor Transmitter Integrated Area Monitor

## Check / Calibration Procedure\*

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### **\*Technician use only**

*These units must be checked /tested and /or calibrated by a suitably qualified technician who must test or calibrate the unit in accordance with the instructions as provided or set out in the relevant manual and the standards set down in their particular industry/country.*

*Suitably qualified operators of the unit should be aware of the regulations and standards set down by their industry/country for the testing or calibration of this unit. These notes are only intended as a guide and insofar as permitted by law the manufacturer accepts no responsibility for the Calibration and Testing or operation of this unit.*

*Failure to test or calibrate the unit in accordance with the then applicable instructions and with industry guidelines may result in serious injury including death and the manufacturer is not liable for any loss injury or damage arising from improper testing or calibration or inappropriate use of the unit.*

*The testing or calibration of the unit must be carried out by a suitably qualified technician, in accordance with the testing or calibration manual and in compliance with locally applicable guidelines and regulations.*

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## 1- INTRODUCTION

The frequency and nature of testing or calibration may be determined by local regulation or standards.

EN378 and the FGAS Regulation require an annual check in accordance with the manufacturer's recommendation.

**Murco recommends annual checks by bump test, and calibration by replacement of the sensor pcb with a Murco pre-calibrated certified unit every 3 years for semiconductor (SC), Infrared (IR) and catalytic (CAT) and 2 years for Electrochemical (EC) type sensors. The alternative to this exchange is a full on site gas calibration. Sensor replacement may be more cost effective, eliminate end of life concerns, and constantly renew the detection system. If the ST-IAM is exposed to a large leak it should be tested to ensure correct functionality by electrically resetting the zero setting and carrying out a bump test, see procedures below.**

There are two concepts that need to be differentiated: bump test and calibration

**Bump Test:** This consists of exposing the sensor to a gas and observing its response to the gas. The objective is to establish if the sensor is reacting to the gas and all the sensor outputs are working correctly. There are two types of bump test.

**Quantified:** where a known concentration of gas is used, or,

**Non-Quantified:** where a gas of unknown concentration is used.

**Calibration:** This consists of exposing the sensor to a calibration gas, setting the "zero" or "Standby voltage", the span or range, and checking/adjusting all the outputs, to ensure that they are activated at the specified gas concentration.

It is required by EN378 to record test results in the Logbook.

Procedures for bump test and calibration vary depending on the sensor technology used and the gas in question. The ST-IAM is available in four sensor versions: Semiconductor (SC), Electrochemical (EC), Catalytic (CAT), and Infrared (IR).

Before you carry out the test or calibration:

- 1- Advise occupants, plant operators, and supervisors.
- 2- Check if the ST-IAM is connected to external systems such as sprinkler systems, plant shut down, external sirens and beacons, ventilation, etc. and **disconnect as instructed by the customer.**
- 3- Deactivate alarm delays if selected at JP1, JP2 as per instructions in Diagram 1.
- 4- For Bump Test or Calibration the ST-IAM should be powered up overnight. If the unit has been installed and running for about 24 hrs, and you need to power it off for a short time to set the delay at 0 min, then the normalisation period is about 5 min and then you can begin the testing or calibration. If sensors have been in long-term storage or the detectors have been turned off for a long time, normalisation would be much slower. However within 1-2 hours the sensor should have dropped below the alarm setting and be operational. You can monitor the normalisation progress exactly by monitoring the sensor output, on CON 3 between pins 1 & 3, see Section 5.



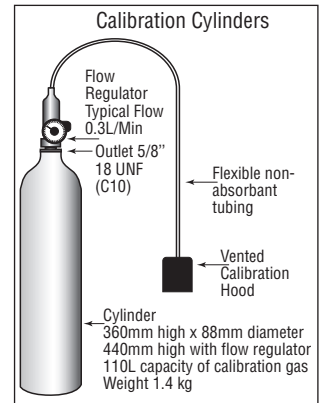
## 2- BUMP TEST (every year)

Ideally bump tests are conducted on site in a clean air atmosphere. Check and adjust, if necessary, the zero setting before carrying out a bump test, see gas calibration procedure page 3.



### 2.1 Semiconductor, Catalytic sensors and IR Sensors for hydrocarbons:

The same procedure can be used to test all these sensor types. We offer cylinders of gas at known concentrations for quantified tests. This consists of exposing the sensor to the gas and checking that alarm lights and relays are activated. If this is not available, for a non-quantified test you can use a gas cigarette lighter. By cracking open the valve without igniting the gas, you release the gas onto the sensor and force it into alarm. Check that alarm lights, and relays are activated.

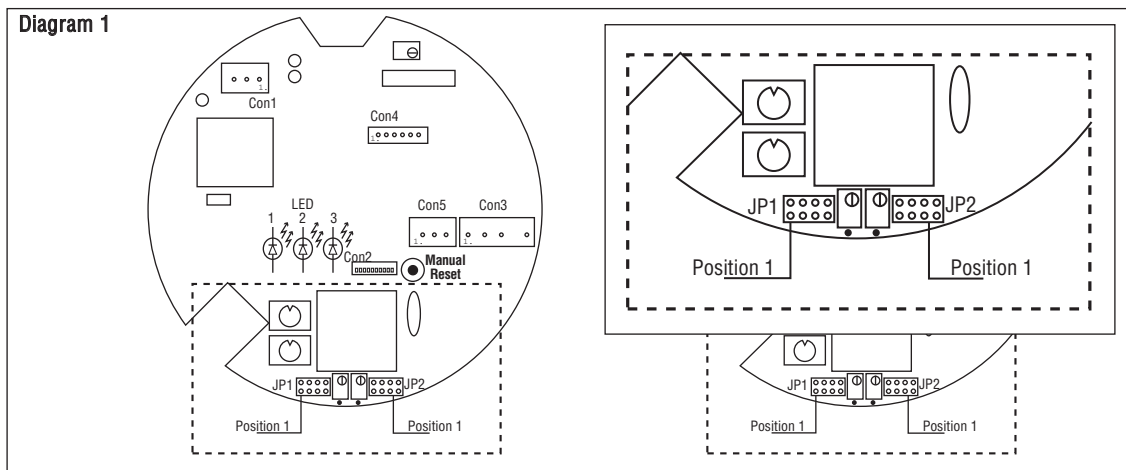


**2.2 Infrared sensors for CO2 Detection:** You can check the carbon dioxide using Murco ampoules filled with CO2 at 5000ppm in air. This is a quantified test. If these are not available, then you can breath on the sensor. The human breath has enough CO2 to trigger the alarm. This is a non-quantified test.

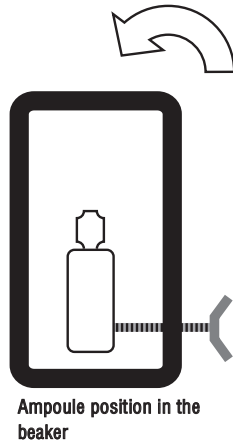
**2.3 Electrochemical sensors:** We offer Ampoules of ammonia (NH3) at 100ppm and 1.000 ppm. This is a quantified test. For details of ampoules for other gases please contact us.

### 2.4 Bump test using gas ampoules:

- 1- Make sure that both the ampoules and the calibration beaker are clean and dry.
- 2- Unscrew the beaker hold screw and place the ampoule so that it sits in the base of the beaker. As per illustration.



- 3- Tighten on the screw ampoule without breaking it.
- 4- Remove the enclosure lid of the gas detector (not in Ex area).
- 5- Connect voltmeter to monitor sensor response, monitor 0-10v response on CON3 between pins 1 & 3.
- 6- Place the beaker over the sensor head using the multi sensor adaptor to fit the sensor, or, if an Exd or Remote sensor head version, screw the beaker on the remote sensor head M42 thread, or M35 thread using the M35 adaptor. It should be as tight fitting as possible to allow maximum exposure to the gas.



- 7- Tighten on the ampoule until it shatters allowing the contents to diffuse in the beaker. It should be left in place for approximately 5 min.
- 8- Sensor voltage output will increase. This confirms that the sensor is responding. In the case of an ampoule test a response equivalent to at least 50% of the test gas will confirm that the system is in order.
- 9- Carefully remove any ampoule remains from the gas detector, and replace the sensor enclosure.

### 2.5 Bump Test Using Gas Cylinders.

1. Remove the enclosure lid of the gas detector (not in an Ex area).
2. Connect the voltmeter to monitor sensor response, monitor 0-10v response on CON3 between pins 1 & 3.
3. Expose the sensor to gas from the cylinder. You can place the entire ST-IAM into a plastic bag or use a plastic hose/hood to direct gas to the sensor head. A response of above 80% is acceptable.

## 3- CALIBRATION

The alternatives we describe are:

- a. Exchanging sensor board
- b. Gas Calibration

### 3.a EXCHANGING SENSOR BOARD – (as required for different sensor types)

Murco recommends replacement of the sensor pcb with a Murco pre-calibrated certified unit every 3 years for semiconductor (SC), infrared (IR) and catalytic (CAT), and 2 years for Electrochemical (EC) type.

Tools required:

- 1- A pre-calibrated PCB sensor board
- 2- A voltmeter- crocodile clips recommended
- 3- Estimate 10 min per sensor

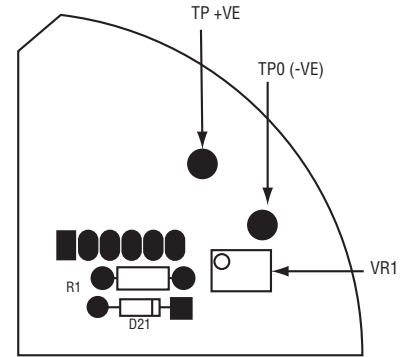
In this case you need to:

- 1- Power off the unit
- 2- Check motherboard functions using the Function PCB Tester (follow procedure below).
- 3- Fit the new pre-calibrated sensor, set time delays if appropriate, and power on the unit.
- 4- Carry out a bump test to confirm that the sensor is responding.
- 5- Keep records of the test date, sensor serial number, and any observation.

### Checking Motherboard - Function PCB Tester

This tester is used to check all the functionality of the ST-IAM motherboard: 0-5V, 0-10V, 4-20mA, RS485, the 2 relays and their response time delays.

- 1- Power off the unit, removed the sensor PCB, and set the alarm delays at 0 min (JP1 and JP2)
- 2- Install ST-IAM tester at CON 4 and connect the power.
- 3- Connect voltmeter to **TP +VE** (red lead) and **TP0(-VE)** (black lead) on tester. Adjust **VR1**.
- 4- Adjust **RV1** to just above low level alarm point (yellow LED) and verify low alarm level



- 5- Adjust **RV2** to just above high level alarm point (red LED) and verify the high alarm level.
- 6- Verify analog Output 0-5v, 0-10v and 4-20 mA by monitoring or measuring Con 3 pin 4, pin 3 and pin 2 respectively all in relation to TP0 (4-20mA monitoring: A 100 OHM resistor should be fitted between con3 pin 1 and 2 unless connected to an external system).
- 7- Power off the unit, remove the tester and carefully re-installed the sensor PCB.
- 8- Check the sensor is working by checking the 0-10V output. The sensor will trend towards 0V as it normalizes. See Sensor Normalisation Section 5.

There are a number of advantages to sensor exchange. It is simpler and quicker than gas calibration. Murco guarantees the correct calibration and functioning of the new sensor, which is supplied with a calibration certificate. Finally, you avoid problems of sensor deterioration or end-of-life concerns.

Murco, in compliance with the WEEE directive, operates a take back scheme. We recommend that you return old sensor boards to us for recycling.

### 3.b GAS CALIBRATION

This is the adjustment of the gas detector's accuracy using calibration gas.

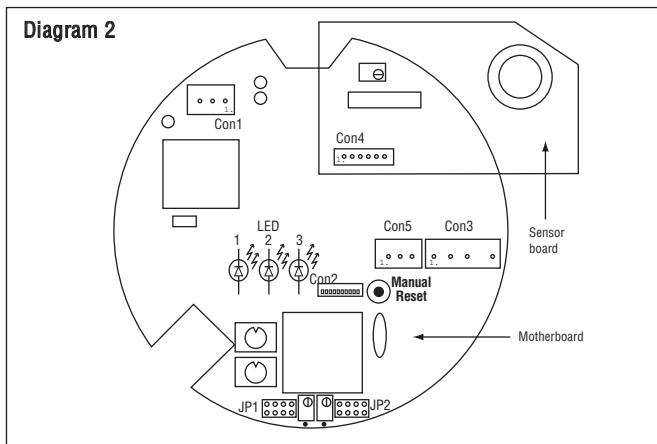
Murco offers a calibration kit that consists of a Calibration gas cylinder add a flow regulation valve with flexible non-absorbant tubing and vented calibration hood.

In many cases this option may be expensive because of the cost of visiting a site and the cost of the calibration gas and possibly excess delivery charges as it is classified as a hazardous substance. Ampoules are not classed as hazardous.

Tools required:

- 1- Gas can with the appropriate gas and concentration
- 2- A voltmeter- crocodile clips recommended
- 3- Estimate 30 min per sensor

The ST-IAM consists of a motherboard PCB and a sensor board PCB. There are four sensor board versions: SC, EC, CAT and IR, but the motherboard is the same for all models.



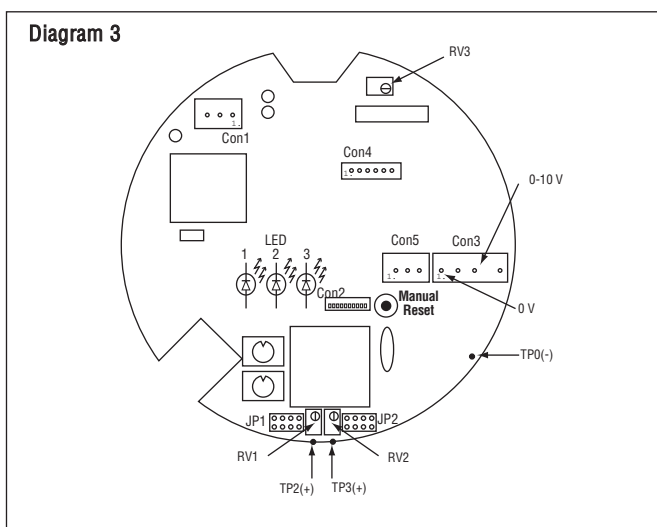
Calibration is done on a 0-10V scale, however the alarm relay setting pots work on a 0-5V scale.

*Example: For a range of 0-10,000ppm, relay 1 @ 1000ppm and relay 2 @ 9,000ppm*  
 Relay 1 = 1000 ppm x  $\frac{5}{10,000}$  so that Low alarm relay = 0.5 Volts  
 Relay 2 = 9,000 ppm x  $\frac{5}{10,000}$  so that High alarm relay = 4.5 Volts  
 while the 0-10V sensor signal corresponds to 0-10,000 ppm range.

**Motherboard – adjusting the alarm relays**

The first step is to set the alarm relays at the desired levels:

- 1- Pot RV1 is used to adjust the set point at which the low relay activates (set on 0-5 V scale). Monitor the output between TP0 (negative) and TP2 (positive).
- 2- Pot RV2 is used to adjust the set point at which the High relay activates (set on 0-5 V scale). Monitor the output between TP0 (negative) and TP3 (positive).
- 3- Pot RV3 is used to adjust the relationship between the 0-10 V scale and the 4-20mA scales. THIS IS FACTORY SET AND SHOULD NOT BE ADJUSTED.



Remember that after adjusting relay settings or modifying jumpers, the unit must be powered off and on again to store the new settings.

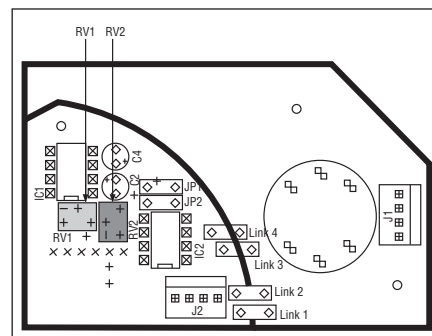
**Sensor board – adjusting the detection range**

**1- Semiconductor Sensor (SC)**

There are two adjustments required: the zero and the span. They are all performed on the sensor board but are monitored on the motherboard at Con 3, 0-10V output.

- 1- Pot RV2 is used to adjust the zero of the range (span). On the motherboard, monitor the output between TP0 (negative) and Con 3 pin 3 (positive) and adjust the Pot to 0 V or slightly positive (0.01 V is acceptable).

- 2- Pot RV1 is used to calibrate the range (span) of the sensor. Monitor the output between TP0 (negative) and Con 3 pin 3 (positive) at the 0-10V signal. Expose the sensor to calibration gas and allow to stabilise and adjust pot RV1 to 10V on the 0-10V signal.



As per example above, if the gas/range is 0-10,000 ppm, then 10V output = 10,000 ppm.

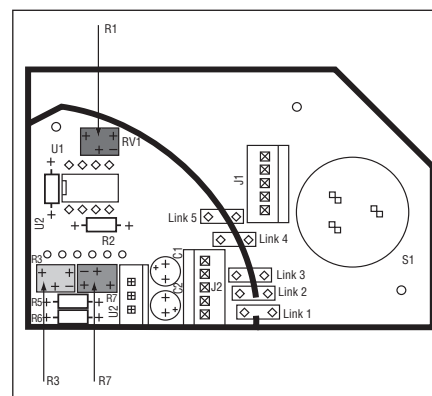
**2- Catalytic Sensor –Pellistor (CAT)**

There are two adjustments required: the zero and the span. They are all performed on the sensor board but are monitored on the motherboard at Con 3, 0-10V output.

*NOTE:* Pot R7 is used to set the supply voltage to the sensor head and can be monitored between TP0 (negative) and Link 4 (positive) THIS IS FACTORY SET AND SHOULD NOT BE ADJUSTED.

- 1- Pot R3 is used to adjust the zero of the range (span). On the motherboard, monitor the output between TP0 (negative) and Con 3 pin 3 (positive) and adjust the Pot to 0-1V approximately, as this sensor is accurate at high end readings.

- 2- Pot R1 is used to calibrate the range of the sensor (span). Monitor the output between TP0 (negative) and Con 3 pin 3 (positive) at the 0-10V signal. Expose the sensor to calibration gas and allow to stabilise and adjust pot R1 to 10V on the 0-10V signal.



As per example above, if the Gas/range is 0-10,000 ppm, then the 10V output = 10,000 ppm.

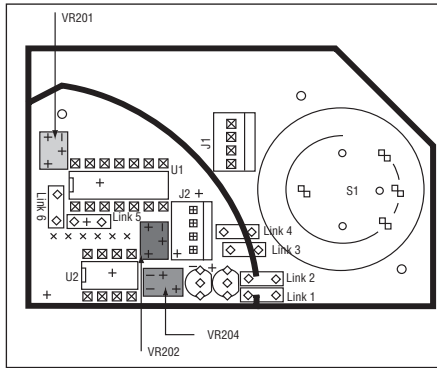
**3- Electrochemical Sensor (EC)**

There are two adjustments required: the zero and the span. They are all performed on the sensor board but are monitored on the motherboard at Con 3, 0-10V output.

*NOTE:* Pot VR204 (not always fitted) is used to set the bias voltage to the sensor head and can be monitored between TP0 (negative) and U2 Pin 3 (positive) THIS IS FACTORY SET AND SHOULD NOT BE ADJUSTED.

- 1- Pot VR201 is used to adjust the zero of the range (span). Monitor the output between TP0 (negative) and Con 3 pin 3 (positive) and adjust the Pot to 0 V or slightly positive (0.01 V is acceptable).

- 2- Pot VR202 is used to calibrate the range (span) of the sensor. In this case monitor the output between TPO (positive) at the 0-10V signal. Expose the sensor to calibration gas and allow to stabilise and adjust pot VR202 to 10V on the 0-10V signal.



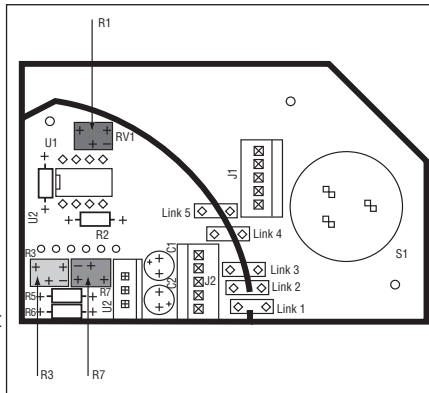
As per example above, if the gas/range is 0-1,000 ppm, then 10V output =1,000 ppm.

#### 4- Infrared (IR)

There are two adjustments required: the zero and the span. They are all performed on the sensor board but are monitored on the motherboard at Con 3, 0-10V output.

NOTE: Pot R3 not fitted.

- 1- Pot R7 is used to adjust the zero of the range (span). On the motherboard, monitor the output between TPO (negative) and Con 3 pin 3 (positive) and expose the sensor to Nitrogen or zero air, and once stable, adjust the Pot to 0 V or slightly positive (0.01 V is acceptable).



- 2- Pot R1 is used to calibrate the range of the sensor (span). Monitor the output between TPO (negative) and Con 3 pin 3 (positive) at the 0-10V signal. Expose the sensor to calibration gas and allow to stabilise and adjust pot R1 to 10V on the 0-10V signal.

As per example above, if the Gas/range is 0-10,000 ppm, then the 10V output= 10,000 ppm.

NOTE: All sensors provide a linear output, thus as long as you have a gas canister of known concentration you can calibrate to any desired range.

Example: For a range of 0-10,000ppm, and a canister of the same gas of 8,000ppm

The 0-10V signal corresponds to 0-10,000, thus if using the above canister:

$$\text{Voltage} = 8,000 \text{ ppm} \times \frac{10}{10,000} \text{ the voltage signal should be adjusted to } 8V.$$

#### 4- ADDITIONAL RECOMMENDATIONS

**FALSE ALARMS:** If false alarms are being triggered by background gases, paint fumes, etc, extreme humidity or temperature conditions, you will find that the zero has moved to a + value, you can adjust the zero setting back to zero to compensate. You may also increase the response time delay to help eliminate false alarms.

#### 5- Normalisation Period

Below we show typical time to normalize for various sensor types. The units are powered up and the output voltage monitored on the 0-10V output. The approximate time for the signal to drop to 0V is shown.

Sensor Type	Stabilised ~ 0V
Electro-Chemical	20-30Seconds
Catalytic	7-15 Minutes
Semi-Conductor	1-3 Minutes
Infrared	120 Seconds

The electro-chemical sensor on power up outputs a signal voltage normally below the set alarm level. IR typically shows 0V. Semiconductors and Catalytic output are normally over the + max scale i.e. > 10V. All move towards zero as they stabilise.

If sensors have been in long-term storage or the detectors have been turned off for a long period, normalisation would be much slower. However within 1-2 hours sensors should have dropped below the alarm level and be operational. You can monitor progress exactly by monitoring the 0-10V output, when the output settles around zero (400ppm in the case of IR CO2 sensors) the sensor is normalised. In exceptional circumstances the process can take up to 24hours or more, again monitor the 0-10V output and you can see what is happening.

# STIAM Test Certificate (Example)



(Download original from our web site [www.murcogasdetection.com](http://www.murcogasdetection.com). Use in Conjunction with the Murco Check Calibration Procedure)

**Product Description:** STIAM, SC, EC, CAT, IR    **Serial Number:** 12345    ST-MON (If Fitted)    **Serial Number:**

**Date of First Calibration:** (see Rating Label) 25/10/05    **Date of Last Calibration:** 25/10/07

**Type/Range of Test Gas:** Cylinder 1000ppm R404a, batch no xxxx

## 1. Carry out Bump Test (Set delay to zero)

Power (Green LED) _____	<input checked="" type="checkbox"/>
Visual Alarm(s) (Yellow, Red LED) _____	<input type="checkbox"/>
Relay(s) Operating _____	<input type="checkbox"/>
Remote system if connected to relays _____	<input type="checkbox"/>
<b>Analogue Outputs</b>	
4 – 20 mA _____	<input type="checkbox"/>
0 – 5 V _____	<input type="checkbox"/>
0-10 V _____	<input type="checkbox"/>
RS485 (If Connected) _____	<input type="checkbox"/>

If system failed, or if scheduled, carry out a sensor exchange or gas calibration. See below.

## 2. Sensor Exchange (SC/CAT/IR 3 Yearly, EC 2 Yearly.)

Install new sensor PCB. Carry out bump test to confirm function. \_\_\_\_\_

## 3. On site Gas Calibration

Follow the Murco procedure and record final outcome.

**System Passed** \_\_\_\_\_

If the sensor element could not be recalibrated due to age, exposure to gas etc exchange the sensor PCB and repeat bump test.

**System Passed** \_\_\_\_\_

***We hereby certify that the above specified test procedure has been performed and the ST – IAM is performing as specified***

Test Performed by \_\_\_\_\_  
Signature \_\_\_\_\_ Date \_\_\_\_\_