# SAFETY ALERT

**Siemens protection relays type SIPROTEC: 7SA522, 7SA6, 7SD52, 7SD610, 7SJ64, 7UM6, 6MD66.**

**Number: SA 04/08**

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<th>Property Directorate Sponsor: Peter Meakin</th>
<th>Date of issue: 30 October 2008</th>
</tr>
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**Contact if different from Property Directorate Sponsor:**

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**Who Should Read this:** CEstOs, Top Level Budget Holders, Project Sponsors, MOD Project Managers and others within the IPT (for both Prime, PFI/PPP and traditionally procured contracts),  
Defence Estates Advisors and Property Managers/Site Estate Representatives  
with responsibility for MOD projects and Property Management Works Services (including the legacy work of EWCs/WSMs) Coordinating Authorising Engineers, Authorising Engineers Electrical,  
Authorised Persons Electrical, purchasers and installers of final electrical distribution equipment.

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<th>When it takes effect: Immediately</th>
<th>When it is due to expire: No expiry</th>
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**Document Aim:** To notify of a Siemens protection relay maloperation and promulgate information provided by the equipment manufacturers.
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<th><strong>Product</strong></th>
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<td>7SA522, 7SA6, 7SD52, 7SD610, 7SJ64, 7UM6, 6MD66</td>
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<td><strong>Problem</strong></td>
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<td><strong>Scope</strong></td>
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<td><strong>Risk</strong></td>
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<td><strong>Action</strong></td>
<td>Identify defective units and where identified apply live operation restriction until remedial action completed.</td>
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1. **Requirement:**

   1.1. **URGENT:** Addressees of this Safety Alert are to bring its contents to the attention of their Authorising Engineers (Electrical) (AE(E)), or equivalent, in order to make them aware of the risks posed by units in service.

   1.2. AE(E)s are to ensure that action is taken to identify any units that fall in the range identified on the attached letter from Siemens AG dated 3 December 02.

   1.3. Once units in range have been identified these are to be immediately reported to the MMO and the Authorising Engineer who is to ensure that an appropriate Operating Restriction is applied.

      1.3.1. Date of manufacture of the devices can be identified by the serial number which is in the form BFyymmdd0000 where the zeros are replaced by a sequential number.

      1.3.2. The Operating Restriction is to remain in place until such time as any remedial action is completed.

      1.3.3. For advice on appropriate remedial action Mr Derek Lee of Siemens T&D should be contacted at the address detailed at the bottom of this notice.

   1.4. Any action required by this Safety Alert is to be taken at the earliest possible opportunity.

      1.4.1. The earliest possible opportunity should be established commensurate with operational requirements and the risk to personnel and property; with the highest priority given to heavily used/urgent operational requirement facilities and the lowest to unoccupied or rarely occupied or non essential facilities.

2. **Background:**

   2.1. National Equipment Defect Report (NEDeR) 2008/0624/00 advised of the failure of Two Siemens 7SA61 (full model no.: 7SA6101-4BB02-ODJ1/DD) relays that had failed on the same 33kV switchboard within 14 months of each other. The first incident occurred on 8/6/2007 and the second on 23/07/2008. The NEDer and accompanying letter are attached to this Safety Alert.
3. Introduction:

3.1. COMPLIANCE WITH THE CONTENTS OF THIS ALERT WILL ENABLE COMPLIANCE WITH THE HEALTH & SAFETY AT WORK ETC ACT 1974 AND ITS SUBORDINATE REGULATIONS.

3.2. The appropriate MOD officer shall arrange for the RPC/ Maintenance Management Organisation (MMO) contractor to carry out all actions in accordance with this Alert.

3.3. Any work required as a result of this Alert must be carried out in accordance with JSP 375 Vol 3 – MOD’s Safety Rules & Procedures.

3.4. On MOD Establishments occupied by United States Visiting Forces (USVF) responsibility is jointly held by USVF and DE (USF). At base level this jointly managed organisation is to take appropriate action to implement the contents of this Alert. Where this Alert contains procedures which differ significantly from USVF practice DE (USF) code of practice will be issued.

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NATIONAL EQUIPMENT DEFECT REPORT (NEDeR)

Incident Date/Time: 8 Jun 2007

Manufacturer: Siemens

Equipment: Protection relay - Model 7SA61 - Siemens

Serial Number: BF0207062805

System Voltage: 33 kV Year Manufactured: 2002

Rating: 110V, 1A Date Commissioned: 28/04/2004

Indoor/Outdoor: Indoor Date Last Maintained: 28/04/2004

Op. Environment: No exceptional environmental factors

Area of Failure: Protection

Other Plant Affected: None

Event Description: Two Siemens 7SA61 (full model no.: 7SA6101-4BB02-ODJ1/DD) relays failed on the same 33kV switchboard within 14 months of each other. The first incident occurred on 8/6/2007 and the second on 23/07/2008. In both cases the relay watchdog contact operated and the error LED illuminated. In the second incident it was possible to successfully reset the relay but the alarm re-occurred 10 days later. Both relays were not capable of operating / tripping.

The serial no. of the second relay was BF0207062803

No. Defective Units: 2

Total in Company: 13

Defect - Details: In both cases the RAM memory modules were not functioning correctly. Siemens have become aware of a higher than normal failure rate on CPU cards (caused by these RAM memory module problems) used within 7SA522, 7SA6, 7SAD52, 7SD610, 7UM62, 7SJ64 and 6MD66 relays manufactured between February 2002 and November 2002.

Defect – Effects: According to Siemens, depending on the type of fault within the module, the memory failure can cause various responses, including:
1) Device does not start and LEDs flash.
2) The device reverts from normal operating mode to monitoring mode.

Defect – Causes: Incorrect functioning of RAM memory the module causes the data held in the device to become corrupted.

Remedial Action: 1) The CPU boards in the two defective relays have been replaced.
2) CPU boards will be replaced within all other Siemens relays in the affected range (manufactured February 2002 and November 2002).
Information regarding Device Failures of SIPROTEC 4-Devices

Affected Devices: 7SA522, 7SA6, 7SD52, 7SD610, 7SJ64, 7UM6, 6MD66

In the course of quality based product monitoring, an increase of device failures was observed with respect to the devices mentioned above. Different causes of failure were discovered during the analysis. In the meantime, measures that avoid these failures were implemented in the ongoing production. As we assume, that further devices in service might also be affected, we would like to inform you about our findings as well as implemented measures and our recommendations.

Two principle causes of failure were pinpointed.

1. RAM Memory Modules:

In failed devices it was noted that certain memory modules did not function correctly, which caused the content of individual memory cells to be corrupted during device operation. The protection memory in the device is checked intensively during device start and subsequently during operation; it is permanently checked by background routines. Depending on the type of fault in the module, the memory failure causes various responses of the SIPROTEC-devices:

- The device does not start and all LEDs apart from LED 1 start flashing.
- The device reverts from normal operating mode to the monitoring mode.

In both cases, the devices are no longer serviceable and must be returned to the factory for repair. Until detailed analysis together with the memory module manufacturer has been completed, the modules supplied by this manufacturer are no longer used in the production of SIPROTEC devices. Furthermore, detailed investigation of the memory modules indicated, that control signals exceeded the recommended operating range, but still were within the specified operating range. Present understanding however indicates that these circumstances are not related to the memory failures. As a pre-caution however, this effect was remedied with an immediate measure.

Based on the information gained so far, the following statement can be made:

- All deliveries from the 01.12.2002 have been provided with the relevant remedial measures.

According to the device failure statistic gained so far, the following devices, using this CPU module, delivered from February 2002 onwards, are affected (7SA522, 7SA6, 7SD52, 7SD610, 7UM62, 7SJ64 and 6MD66). A closer definition of the affected devices may be possible, once the investigation of the memory module manufacturer has been completed.
All the information gained so far indicates that the failure causes the device to block and issue a corresponding alarm. The risk of incorrect tripping due to memory failure is not indicated.

Relative to the number of devices manufactured during this time span, the number of devices that have failed is very small (approx. 3-5%). Therefore a general preventative upgrade of all devices is not recommended at this point in time. If the described failures occur in devices of a particular delivery, case specific measures are recommended which may go as far as exchanging the CPU module on all devices in this delivery.

2. A/D-Converter:

A second source of failures was detected on the A/D converter modules that use Sigma-Delta converters. Individual devices with failures on these components were observed. Two failure mechanisms in this context exist. They affect the accuracy of the measuring algorithms and may cause an under function of the devices:

- Offset of the A/D-converter:

Investigation of the affected devices indicated that the offset of the A/D converter is outside the specified limits (component failure). As a consequence, the offset in the devices can no longer be corrected prior to measured value processing, thereby affecting the measuring accuracy of the devices. (Example: The stabilising signal of the line differential protection is increased as a result of the DC component; thereby the protection becomes less sensitive).

Consequently, testing of the offset was immediately included in the routine testing during production, so that failure-prone A/D converters can be detected and exchanged prior to shipment. This measure was already introduced into the production during mid-September 2002.

Furthermore, for the affected devices, new firmware versions that permanently monitor the offset are being generated. If the permissible range is exceeded, the device issues the alarm "Offset Error" and takes appropriate function-specific action. An excessively large offset is only seen as a critical condition in the differential protection devices 7SD52 and 7SD610, as the sensitivity is affected here. We accordingly recommend a check of the offset values in all 7SD52 and 7SD610 devices that were delivered prior to October 2002. An impermissible offset can be detected by generating a test disturbance recording. The offset may be checked on the current and voltage traces. If the offset is greater than 0.5*IN for the current channels or greater than 1V for the voltage channels then the device should be returned for repair. In the remaining devices, no further measures are necessary.

- Range limiting circuit on the A/D converter:

The range limiting circuit restricts the input signals of the A/D converter to the permissible range.

When the measured values obtained from the A/D converter are outside this range, then it may be assumed that the A/D converter is defective, causing a device dependent failure response. The investigation of some devices indicated that although the limiting circuit operates correctly, component tolerance can cause the limitation to take place too late. As a result, device specific responses occur. The response of the distance protection 7SA5/6 in the version with sensitive measuring input for the residual current is
regarded as critical [This affects the versions 7SA5222*, 7SA5226*, 7SA6**2 and 7SA6**6]. On this measuring input the range limiting circuit operates in the event of short circuits with large currents. If this limitation takes place too late as described above, all protection functions are blocked in the 7SA522/7SA6.

The other protection devices, such as the 7SJ64 and 7UM6 have a less critical response. In these devices, the sampled values that are indicated as invalid, are eliminated. As an immediate measure, the circuit was newly dimensioned. This measure was introduced into production on 29.10.2002. Furthermore, the response in the case of range transgression of the A/D converter was changed in the version V4.3 of the 7SA5/6 so that range transgression of the sensitive earth current conversion is tolerated without error. This version will be available from mid-December 2002.

For devices that are in service, the following recommendations are issued:

- All 7SA522 and 7SA6 versions with sensitive measuring input for the residual current should be upgraded to version V4.30 as soon as it becomes available.
- In 7UM6 no upgrade is required.
- In 7SJ64 no upgrade is required.