Electronic security systems in transmission/zone substations and switching stations

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1.0 PURPOSE
To set out the process, design, material and construction requirements for electronic security systems in transmission/zone substations and switching stations.

2.0 SCOPE
This instruction outlines the electronic substation security systems requirements for detection and deterrence of intruders attempting to gain access to transmission/zone substations and switching stations. This instruction also briefly details the assessment on necessity of electronic security systems, based on site criticality and vulnerability assessments which are regularly conducted by Endeavour Energy's Security Manager.

This instruction does not provide details on substation physical security systems or substations lighting, clearances or fencing for which an appropriate standard shall be consulted.

3.0 REFERENCES
- Board Policy 2.0.5 - Risk Management
- Company Policy 3.1.8 - Work Health And Safety
- Company Policy 9.1.10 - Network Electrical Safety
- Company Policy 9.2.5 - Network Asset Design
- Company Policy 9.2.6 - Network Asset Renewal
- Company Policy 9.7.1 - Network Asset Construction
- Earthing Design Instruction EDI 516 - Major substation earthing design, construct and commissioning
- Substation Design Instruction SDI 505 - Minimum requirements for design and construction of transmission and zone substations
- Substation Design Instruction SDI 524 - Fencing and perimeter security at zone and transmission substations, and switching stations
- Substation Design Instruction SDI 526 - Control cabling, panels and terminations
- Substation Design Instruction SDI 527 - Clearances
- Substation Design Instruction SDI 529 - Light and power
- Substation Design Instruction SDI 531 - Installation of conduits in transmission/zone substations and switching stations
- Endeavour Energy Network Management Plan - December 2013 Review
- Electrical Safety Rules
- AS 3000:2007 - Wiring rules
- AS 2201.1:2007 - Intruder alarm systems – Part-1: Clients premises - Design installation, commissioning and maintenance
- AS 2201.3:1991 - Intruder alarm systems Part-3: Detection devices for internal use
- AS 2201.5:2008 - Alarm transmission system
- AS 62040.1.1:2003 - Uninterruptible power systems (UPS) - Part-1.1 General and safety requirements for UPS used in operator access areas
- ENA National guidelines for prevention of unauthorised access to electricity infrastructure (Doc 015-2006)
- Electricity Supply Act, 1995
- Electricity Supply (Safety and Network Management) Regulation 2002
- NSW Work Health and Safety Act 2011
4.0 DEFINITIONS AND ABBREVIATIONS

Security system  A monitored intruder detection system installed to provide early notification of possible unauthorised access to a designated area/s.

CCTV¹  Closed circuit television - a unit containing a CCTV camera plus an appropriate lens and necessary ancillary equipment.

DVR¹  Digital video recorder – a unit for capturing and storing digitised video images on hard disk or other permanent storage medium.

EMI  electromagnetic induction

LED  light emitting diode

PIR - passive infra-red movement detector²  Detection device designed to initiate an alarm in response to the change in radiation at wavelengths within a specified band of the infra-red spectrum, which results from the presence of an intruder.

Reed switch  An electrical switch operated by an applied magnetic field. A magnetic field (from an electromagnet or a permanent magnet) will cause the contacts to pull together, completing an electrical circuit.

RFI  radio frequency interference

Site  For the purpose of this document, site refers to an Endeavour Energy network transmission/zone substation or a switching station

SMCC  Security Monitoring and Control Centre, Huntingwood

UPS²  Uninterruptible power systems – combination of convertors, switches and energy storage devices (for example, batteries) constituting a power system for maintaining continuity of load power in case of input power failure.

VPN³  Virtual private network - restricted-use logical computer network that is constructed from the system resources of a physical network, for example by using encryption and/or by tunnelling links of the virtual network across the real network.

VMD⁴  Video motion detector - a detection device generating an alarm in response to a change in the video signal (usually a change in motion, but also a change in light). It is very practical in CCTV because the VMD analyses exactly what the camera sees (for

¹ AS 4806.2:2006 – Closed circuit television (CCTV) Part-2: Application guidelines
² AS 62040.1.1:2003 – Uninterruptible power systems (UPS) Part-1.1 general and safety requirements for UPS used in operator access areas
⁴ AS 4806.2:2006 – Closed circuit television (CCTV) Part-2: Application guidelines
example, there are no blind spots).

5.0 ACTIONS

5.1 General

5.1.1 Site assessment

Site-based criticality, vulnerability and security risk assessment as well as site prioritisation for electronic security systems installation shall be coordinated and approved by the Security Manager using the Threat Assessment Priority Calculator that has been developed in collaboration between Endeavour Energy and NSW Police. This assessment shall be used to determine the appropriate level of electronic security systems requirements to minimise unauthorised access and associated risks to Endeavour Energy sites and its assets. Where required, the electronic security requirements as detailed below shall be followed.

5.1.2 General requirements

Based on need identified in 5.1.1, electronic security systems will be installed to monitor transmission/zone substations and switching stations, and generate an alarm at the presence of intruders.

The system will generally be separated into two (2) parts:

- Building entry detection, which includes the use of electromechanical locks on external main doors to provide authorised access to substation buildings and may include passive infra-red (PIR) movement detectors in rooms and corridors.
- Switchyard entry detection, which may include the use of CCTV cameras for providing security and surveillance of the complete station premises external to the building (that includes switchyards).

The security system shall allow the arming and disarming of the generated intruder alarm signal.

The security equipment forming part of the complete security system shall be compatible with the existing security equipment.

All security equipment, including field devices, shall be installed in accordance with the manufacturer's instructions and securely fixed in such a position as to minimise the risk of interference.

Alarms for building and switchyard entry detection shall be designed and constructed to allow detection of entry into the building and transmit an alarm signal to the SMCC through the approved VPN network.

Access to CCTV camera surveillance images, where required at SMCC and other Endeavour Energy locations shall be granted only by the Security Manager on a needs basis.

Keeping in view any additional security equipment in future, a sufficient number of spare conduits for supply of power, control and communications cables shall be incorporated in the design of the security system.

Consideration can be given to engage subject matter specialist consultants to provide site specific designs.

Final endorsement of the system is required from Endeavour Energy's Security Manager.

5.2 Building entry detection

Building entry detection and security shall be designed and constructed to allow detection of entry to the building from any external door or window by the installation of
PIR movement detectors. If PIR detectors’ ability to detect movement at the entry and exit doors and windows in substation buildings is hindered, series connected mechanical reed switches shall be installed at those points.

External main doors shall be fitted with company approved electromechanical locks to allow access to authorised personnel only. PIR movement detectors shall be installed to detect movement within any part of the building.

5.3 Switchyard entry detection

Primary yard protection and security is achieved by the encompassing perimeter fence. CCTV systems and PIR movement detectors shall be installed to detect any movement for security surveillance and provide video coverage of complete station premises, including fences and switchyards.

5.4 Security system design, material and construction details

5.4.1 CCTV system

The CCTV system shall be installed to perform several functions - video surveillance, intrusion detection when linked to PIR movement detectors and alarm verification.

The substation perimeter fence and the switchyard shall be monitored by CCTV cameras. The CCTV cameras shall be controlled by a DVR system. Where a substation building forms part of the site perimeter, the building shall also be covered with CCTV cameras to allow for protection and early notification of attempted unauthorised access through the building.

The minimum requirements for a CCTV system are:

- DVR, with the appropriate number of inputs.
- CCTV cameras, with both local and remote controlled functions and appropriate lenses and housings.
- CCTV cameras, preferably mounted on the control building’s external walls to reduce the need for poles.
- Where CCTV camera mounting poles are required, they shall be 4m poles appropriate for CCTV installations, with sufficient rigidity to prevent harmonic oscillation from weather conditions. Pole-mounted cameras shall be installed within the perimeter fencing.

Note: CCTV cameras shall not be installed on support structures, including lightning masts.

- CCTV cameras, installed in vandal-resistant outdoor housings.
- One (1) infra-red illuminator for each camera, if required.
- DVR hard disk size to allow for 30 days local recording.
- Local DVR integration through an approved VPN network to the DVR located in the SMCC at Huntingwood.
- The DVR, UPS, monitor, keyboard and mouse shall be housed in a lockable rack with appropriate fans so that the equipment inside maintain an operating temperature at or below 35°C.
- UPS system, providing power to the DVR and cameras for at least 30 minutes in the event of loss of main power. The DVR shall always be supplied by the UPS to eliminate power spikes.

The installation of CCTV cameras shall conform to AS 4806.2:2006.
5.4.2 **CCTV alarm interface**

The CCTV alarm relay outputs for each camera shall be cabled to the access control or similar controller, or I/O expansion module, as inputs. These inputs shall be programmed so that if the PIR movement detector detects movement, an alarm is generated through the access control system.

5.4.3 **Access control/intruder detection and alarm system**

The access control/intruder detection and alarm system installed in the building shall meet the following requirements:

- A personnel access card reader shall be fitted to a bollard external to the building to arm and disarm the intruder detection system (refer to section 5.4.4 Access card reader and bollard post).
- External main doors in substation buildings shall be fitted with company approved electromechanical locks to allow access to authorised personnel only.
- PIR movement detectors shall be installed to provide coverage at all entry and exit doors and windows in substation buildings. Internal areas of all buildings shall also be fitted with PIR movement detectors to allow the detection of movement in all internal spaces, rooms and corridors. If adequate level of coverage at substation doors and windows is not achievable through the PIR movement detectors, series connected mechanical reed switches shall be installed at those points.
- All detection devices shall be set up as a separate input or zone with a separate alarm point programmed for each one.
- Provide 4-state monitoring.
- Battery backup with self-supervision remote monitoring signaling system (in situations of low power prior to battery discharge), as set out in AS 2201.
- All access control/intruder detection and alarm system shall be capable of self-supervision including complete supervision of wiring and/or circuits, as set out in AS 2201.
- The security system alarm shall initiate sirens installed internal to building, and a single strobe light installed external to the control building at the main entrance door area.

5.4.4 **Access card reader and bollard post**

An access card reader shall be installed to allow authorised personnel to arm and disarm the intruder detection system.

The access card reader shall be easily accessible to personnel entering substation premises.

In order to make the access card reader easily accessible, it shall be fitted to a bollard post. The bollard post shall be positioned inside the substation fence line near the main entrance/personnel gate.

In locations where this arrangement is not possible, the access card reader shall be fitted to the building wall facing the personnel gate.

The bollard post shall be constructed as follows:

- Single height reader pill mounted (face flush, reader components inside) on a standard steel bollard post.
- Powder coated finish (orange in colour), for optimum visibility in all light conditions.
The bollard post shall be covered by at least one (1) fixed CCTV camera.

5.4.5 *Security access control/alarm panel and DVR panel location*

The security access control/alarm panel shall be either stand alone or mounted on a wall inside the substation. As much as possible, the access control/alarm panel shall be located in close proximity to the building main entrance door that provides access to the operator’s desk and telephone area. The DVR system including keyboard and monitor shall be racked separately.

5.4.6 *Programming*

All programming of the access control and VMD systems, both at site and the SMCC at Huntingwood, shall be carried out and completed as part of the construction by the channel partner that holds the current software maintenance agreement.

5.4.7 *Signage and instructions*

Signs shall be placed on the outside of all external doors of buildings protected and shall read:

**WARNING**
THIS SITE IS CONSTANTLY MONITORED
BY CLOSED CIRCUIT SECURITY CAMERAS

Larger signs stating the above must be installed on the outside of the substation fence line, a minimum of one (1) every 30 metres.

Signs shall be placed on the inside of the substation control building main exit door and shall read:

**WARNING**
ARM THE SECURITY SYSTEM
PRIOR TO LEAVING SITE

Instructions on how to enable and disable the security system, and other instructions deemed to be relevant to persons operating the system, shall be provided at or adjacent to the security panel at any bollard. Instructions shall be obvious and legible.

5.4.8 *Alarm system controller*

The controller shall be capable of withstanding any EMI or RFI that may arise as a result of high voltage switching in substations or resultant earth potential rise (EPR) that may arise from system faults.

5.4.9 *Power supply scheme and UPS*

Power shall be provided to the UPS system located in the DVR panel through a dedicated substation 230V +14% to -10% single phase AC supply.

Both the DVR and the access/control alarm panels shall be powered from the UPS. The UPS shall be capable of providing continuous and quality AC supply to the connected equipment. Refer to single line diagram in Figure 1 (below) for arrangement of the power supply and the security equipment.
The supply to the UPS shall be adequately protected from any spikes or interference. This may be inherent in the DVR panel or may be achieved by the use of an external surge protection device. The design, protection and installation of UPS shall conform to AS 62040.1.1:2003.

5.4.10 Access/control alarm panel backup battery supply

The access/control alarm panel backup battery supply shall comply with AS 2201. Backup batteries shall be included to provide a minimum period of eight (8) hours backup supply for the alarm system in the event of 230V mains supply failure. The battery backup supply shall be independent of the station battery system.

5.4.11 Alarms and indications

All access control, intruder and CCTV alarm events shall be transmitted to the SMCC through the approved VPN network.

A minimum number of zones shall be provided that match the number of inputs connected to the system. The CCTV zones can be shown as one (1) zone for this indication purpose. Expansion capability would be required for the system provided.

5.4.12 Alarm transmission and communication

Internet protocol addresses shall be allocated for identification of the installed alarm system controller and DVR recording equipment. Alarms from the local security alarm control panel shall be transmitted to the SMCC through the approved VPN network.

Note: Installation of security equipment cannot be completed until the communications link to the Endeavour Energy Network has been commissioned.

A list and details of alarms or group alarms shall be kept in records.
5.4.13 **Power, control and communication wiring, cabling and conduits**

As a minimum, wiring and cabling for power, control and communications used for security systems shall comply with SDI 526, AS 3000 and AS 2201.1.

The type and size of cabling used for connection of security equipment shall be adequately selected to achieve optimum system performance. All cabling installed between equipment or alarm devices shall consist of a single length of cable, with no joints in between the cable ends.

All cables shall be securely supported and protected from mechanical damage.

All PVC conduits and fittings used for CCTV/VMD system shall be white\(^5\).

5.4.14 **Earthing**

All metal enclosures shall be earthed to the substation earth grid (refer to EDI 516).

The installation of electronic security equipment at each substation must not compromise the existing earthing system by creating potentially hazardous situations for employees, or damage to existing equipment, or to the electronic security equipment under power system fault conditions.

6.0 **AUTHORITIES AND RESPONSIBILITIES**

**General Manager Asset Management** has the authority and responsibility for approving this instruction.

**Manager Asset Standards & Design** has the authority and responsibility for making recommendations to the General Manager Asset Management in respect to this instruction.

**Network Substations Manager** is responsible for updating the content of this instruction in accordance with company procedures in coordination with the Security Manager.

**All Project Managers/Design Engineers** have the authority and responsibility for:

- Complying with the requirements of this instruction and that of Substation Design Instruction SDI 505 - Minimum design and construction requirements for transmission and zone substations and switching stations;
- Working in accordance with local and statutory requirements.
- Meeting the requirements of this instruction within their area of responsibility.
- Determining that Endeavour Energy employees and/or contractors engaged to perform the work have appropriate qualifications.
- Determining that appropriate equipment details are entered into the Ellipse database as part of the work.

**Security Manager** shall be responsible for determining that:

- The requirements of this instruction are met when designing, augmenting or constructing security systems in substations and switching stations.
- The level of security risk and the requirements of security systems for each substation and switching station site are assessed.
- Access authorisation for CCTV camera image monitoring at SMCC, SOCC and other Endeavour Energy locations is coordinated.
- Final endorsement of complete electronic security systems.

\(^5\) AS 4806.2:2006 – Closed circuit television (CCTV) Part-2: Application guidelines
7.0 DOCUMENT CONTROL

Documentation content coordinator: Network Substations Manager

Documentation process coordinator: Branch Process Coordinator