



SPECIFICATION

Physical protection system (PPS) Training Complex (Interactive Training Mock-up Stands)

1 Scope

This specification describes requirements for a comprehensive interactive training mock-up complex intended for use in the classroom environment for the training of students, maintenance and operating personnel of key PPS equipment.

2 Applicable documents

The following documents apply to this Specification to the extent indicated below:

- IAEA Nuclear Security Series No. 13 “Nuclear Security Recommendations on Physical Protection of Nuclear Materials and Nuclear Installations” (INFCIRC/225 Rev.5), which is available at https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1481_web.pdf
- The General Requirements for the Physical Protection Systems of Nuclear Facilities and Nuclear Material approved by order #156 of the State Nuclear Regulatory Inspectorate of Ukraine dated Aug. 28, 2008, which is available at https://base.spinform.ru/show_doc.fwx?rgn=25166;
- “General Requirements for the Physical Protection Systems of Nuclear Facilities and Nuclear Material, Radioactive Waste and Other Sources of Ionizing Radiation” approved by order #176 of the State Nuclear Regulatory Inspectorate of Ukraine dated Dec. 5, 2011, registered with the Ministry of Justice of Ukraine on Dec. 23, 2011, #1505/20243, which is available at <https://www.seogan.ru/np-083-07-trebovaniya-k-sistemam-fizicheskoiy-zashiti-yadernix-materialov-yadernix-ustanovok-i-punktov-xraneniya-yadernix-materialov.html>

“The Operating Procedure for the Physical Protection Systems of Nuclear Facilities, Radioactive Waste Management Facilities and Other Radiological Facilities” approved by joint order #252/492/267 of the Ministry of Fuel and Energy of Ukraine, the Ministry of Emergencies of Ukraine and the Ministry of Internal Affairs of Ukraine dated June 23, 2010, registered with the Ministry of Justice of Ukraine on July 22, 2010, http://search.ligazakon.ua/l_doc2.nsf/link1/RE17844.html



3 Definitions, acronyms and abbreviations

Unless otherwise specified below, the following definitions, acronyms and abbreviations apply in this Specification:

PPS - physical protection system

UPS - Uninterruptible Power Supply

EOL – End-of-Line

ETM - engineering and technical means (equipment)

ITMS - Interactive Training Mock-up Stand/Complex

ARCP -Access Remote Check Point

CCTV – closed-circuit television

CMS – Content Management System

BNC - Bayonet Neill-Concelman

VGA - Video Graphics Array

HDMI – High Definition Multimedia Interface

HDD SATA - Hard (magnetic) Disk Drive Serial Advanced Technology Attachment

NO - Normally Open

NC - Normally Closed

PTZ - Pan–tilt–zoom

KPI – National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”, also referred to as “End-user”.

4 Requirements

4.1 Functional and performance requirements

The system shall meet the following functional and performance requirements:

4.1.1 The full functionality of comprehensive interactive mock-up complex is intended to help form general concepts on the full functionality of functional groups of PPS, such as: detection equipment, communication equipment, access control and management equipment, a functional group of CCTV equipment and a switch stand (each functional group should have a dedicated stand with the possibility of connecting to the general circuit of an integrated interactive mock-up complex).

4.1.2 A dedicated stand shall be created for the functional group of detection equipment with the ability to connect it to the general circuit of the integrated mock-up complex, which shall fulfill the following requirements:

4.1.2.1 It shall contain at least 5 detection devices with different physical principles of detection, outdoor and indoor types:

- infrared sensors:



- indoor monostatic sensors;
 - outdoor bi-static sensors;
 - indoor microwave sensor;
 - outdoor addressable vibration sensor;
 - outdoor capacitance or wired microwave sensor.
- 4.1.2.2 Detection equipment effectiveness should be at least 0.94;
- 4.1.2.3 Device protection class should be:
- IP65 for outdoor devices;
 - IP54 for indoor devices;
- 4.1.2.4 Stand power supply should be for 220 V AC, the plug should match the Ukrainian requirements. Should any detection equipment need to be powered with a 12-24V power source, the stand shall be equipped with respective power units with back-up power batteries.
- 4.1.2.5 All detection devices shall be installed on the stand without external protective covers to highlight key components and operating principles of the device. If it is not possible to do this based on the functional characteristics, then next to a functional (connected) detection device should be another disassembled device (not connected).
- 4.1.2.6 If a detection equipment manufacturer provides for the use of special configuration and debugging software, the stand shall be additionally equipped with appropriate switching equipment and software.
- 4.1.2.7 The equipment shall retain its full functionality under the following environmental characteristics:
- Any equipment intended for outdoor use shall be fully functional in the temperature range between -20 to +40 degrees Celsius, with relative humidity of up to 93%.
 - Any equipment intended for indoor use shall be fully functional in the temperature range between +5 to +40 degrees Celsius, with relative humidity of up to 90%.
- 4.1.2.8 All the detection equipment shall have warranty for free service and maintenance for at least for the first 12 months of service.
- 4.1.2.9 All the detection equipment shall have detailed user manuals in English and Ukrainian languages.
- 4.1.2.10 All detection equipment specifications shall correspond to the switching requirements of the switch devices located on the switch stand of the interactive training mock-up complex.
- 4.1.3 A dedicated stand will be created for the functional group of communication equipment with the ability to connect it to the general circuit of the integrated mock-up complex and must fulfill the following requirements:
- 4.1.3.1 at least 5 communication means, including wired (fixed) and wireless



communication channels; at least two devices shall use wireless communication channels that do not require additional permissions and certifications;

4.1.3.2 all wireless communication devices shall operate in the frequency range permitted by the laws of Ukraine;

4.1.3.3 The effectiveness of the provided communication equipment shall be confirmed by the certificate of conformity;

4.1.3.4 device protection class shall be:

- IP65 for outdoor devices;
- IP54 for indoor devices;

4.1.3.5 Stand power supply should be for 220 V AC, the plug should match the Ukrainian requirements. Should any communication equipment need to be powered with a 12-24V power source, the stand shall be equipped with respective power units with back-up power batteries.

4.1.3.6 The communication equipment shall be installed on the stand without external protective covers to highlight key components and operating principles of the device. If it is not possible to do this based on the functional characteristics, then next to a functional (connected) communication device should be another disassembled device (not connected). This requirement may not apply to any wireless communication device.

4.1.3.7 If a communication equipment manufacturer provides for the use of special configuration and debugging software, the stand shall be additionally equipped with appropriate switching equipment and software.

4.1.3.8 The communication equipment shall retain its full functionality under the following environmental characteristics:

- Any communication equipment intended for outdoor use shall be fully functional in the temperature range between -20 to +40 degrees Celsius, with relative humidity of up to 93%.
- Any communication equipment intended for indoor use shall be fully functional in the temperature range between +5 to +40 degrees Celsius, with relative humidity of up to 90%.

4.1.3.9 All the communication equipment shall have warranty for free service and maintenance for at least for the first 12 months of service.

4.1.3.10 All the communication equipment shall have detailed user manuals in English and.

4.1.4 A dedicated stand shall be created for the functional group of access control and management equipment with the ability to connect it to the general circuit of the integrated mock-up complex and must fulfill the following requirements:

4.1.4.1 The stand shall include:

4.1.4.1.1 Access card models with different encoding methods:



- bar codes;
- Wigand type wired codes;
- optical codes;
- magnetic point codes;
- digital magnetic codes;
- remote contactless proximity-type codes;
- smart card codes.

4.1.4.1.2 Contact and proximity readers, with and without the code dialing functionality. Individual card readers for cards with digital magnetic code, remote proximity-type contactless code and smart card code.

4.1.4.1.3 A biometric fingerprint reader and an infrared finger and palm scanner.

4.1.4.1.4 A door model with a closing device and an electromagnet connected to a proximity-card reader via the switch stand using the ARCP module.

4.1.4.1.5 A half-height turnstile mock-up connected to a digital magnetic code reader (the turnstile can be mounted separately from the stand but shall be connected to it).

4.1.4.2 All access control and management equipment shall comply with the requirements of Ukrainian legislation for the first and second type errors. Please refer to the following link: <https://zakon.rada.gov.ua/laws/show/z1509-11>

4.1.4.3 The effectiveness of the provided functional group of access control and management equipment shall be confirmed by the certificate of conformity.

4.1.4.4 Equipment protection class shall be:

- IP65 for outdoor devices;
- IP54 for indoor devices;

4.1.4.5 Stand power supply should be for 220 V AC, the plug should match the Ukrainian requirements. Should any access control and management equipment need to be powered with a 12-24V power source, the stand shall be equipped with respective power units with back-up power batteries.

4.1.4.6 If any manufacturer of the functional group of access control and management equipment provides for the use of special configuration and debugging software, the stand shall be additionally equipped with appropriate switching equipment and software.

4.1.4.7 The functional group of the access control and management equipment shall retain its full functionality under the following environmental characteristics:

- Any equipment intended for outdoor use shall be fully functional in the temperature range between -20 to +40 degrees Celsius, with relative humidity of up to 93%.



- Any equipment intended for indoor use shall be fully functional in the temperature range between +5 to +40 degrees Celsius, with relative humidity of up to 90%.

4.1.4.8 All access control and management equipment shall have warranty for free service and maintenance for at least for the first 12 months of service.

4.1.4.9 All the access control and management equipment shall have detailed user manuals in English and Ukrainian languages.

4.1.4.10 All specifications of the access control and management equipment shall correspond to the switching requirements of the switch devices located on the switch stand of the interactive training mock-up stand.

4.1.5 A dedicated stand will be created for the functional group of CCTV equipment with the ability to connect it to the general circuit of the integrated mock-up complex and must fulfill the following requirements:

4.1.5.1 The stand shall include:

4.1.5.1.1 Analog CCTV cameras with night mode:

- for outdoor and indoor use;
- with fixed focus and zoom lenses;

4.1.5.1.2 Digital IP cameras with night mode (PoE adapters must be included in the camera kit):

- for outdoor and indoor use;
- with fixed focus and zoom lenses.

Cameras should be compatible with the software described in clause 4.1.7.

4.1.5.1.3 A thermal-imaging camera compatible with the software described in clause 4.1.7.

4.1.5.1.4 Infrared spotlights for cameras' night mode operation

4.1.5.1.5 Examples of protective covers:

- heated;
- without heating;
- tamper-resistant functionality;

4.1.5.2 All the CCTV equipment shall comply with the requirements of Ukrainian legislation regarding the ability to identify an object with the size of 30 x 30 x 30 cm.

4.1.5.3 All the CCTV equipment shall be connected to appropriate elements of the communication stand.

4.1.5.4 The effectiveness of the CCTV equipment shall be confirmed by the certificate of conformity;

4.1.5.5 Equipment protection class shall be:

- IP65 for outdoor devices;
- IP54 for indoor devices;



4.1.5.6 Stand power supply should be for 220 V AC, the plug should match the Ukrainian requirements. Should any CCTV equipment need to be powered with a 12-24V power source, the stand shall be equipped with respective power units with back-up power batteries.

4.1.5.7 If a CCTV equipment manufacturer provides for the use of special configuration and debugging software, the stand shall be additionally equipped with appropriate switching equipment and software.

4.1.5.8 The CCTV equipment shall retain its full functionality under the following environmental characteristics:

- Any equipment intended for outdoor use shall be fully functional in the temperature range between -20 to +40 degrees Celsius, with relative humidity of up to 93%.
- Any equipment intended for indoor use shall be fully functional in the temperature range between +5 to +40 degrees Celsius, with relative humidity of up to 90%.

4.1.5.9 All the CCTV equipment shall have warranty, free service and maintenance for at least the first 12 months of service.

4.1.5.10 All the CCTV equipment shall have detailed user manuals in English and Ukrainian languages.

4.1.5.11 All CCTV equipment specifications shall correspond to the switching requirements of the switch devices located on the switch stand of the interactive training mock-up complex.

4.1.6 Separately, a switch stand is created with the ability to connect all the above-mentioned stands and generate output signals to be processed at the central and backup server running specialized software. The stand shall meet the following requirements:

4.1.6.1 The stand shall include:

4.1.6.1.1 A controller that is used as the control element of a functional access control and management group that supports the autonomous implementation of the entire logical system of the access control and management system and provides control over the ARCP (Access Remote Check Point) modules, which in turn implement the control algorithms at access points of different types (doors / turnstiles / gate / sliding gate / mantrap). The controller shall ensure the connectivity with the central and backup server (running respective software), ARCP modules to manage and control access control and management equipment.

4.1.6.1.2 Two unified ARCP modules (Access Remote Check Point), which in turn implement the algorithms of control of various access points of different types. The selection of the required access point modification is performed by DIP switches. Ability to connect up to 2 Wiegand interface readers. 220 V control, DC, tamper



contact. Ability to connect VNC and ABC controllers via the RS-485 interface.

- The first module should be connected and configured to work with the mock-up door.
- The second one should be connected and configured to work with the half-height turnstile.
- Both modules shall be connected with the controller used as the control element of the functional group of the access control and management equipment.

4.1.6.1.3 The main board of the receiving and controlling device shall ensure:

- support for 8 - 32 zones;
- the possibility of dividing the system into 16 groups, 4 sites;
- support for 8 - 32 programmable outputs;
- bus connections ensuring the connectivity of keyboards and expansion modules;
- an auto-dial system - a built-in communicator for monitoring, notification and remote control;
- controlling the system via LCD keyboards, group keyboards, group keyboards, key fobs and proximity cards as well as a remote control functionality via a computer or a mobile phone;
- 28 independent system timers for automatic control;
- access control and home automation controls;
- memory for 439 events with the print function;
- number of users in the system: $64 + 4 + 1$;
- RS-232 port - RJ connector;
- device firmware updates via a PC;
- a built-in 1.2 A pulse power supply unit with battery charging and diagnostics functions;

The main board should be connected with the detection equipment stand and be able to generate command signals to appropriate equipment as well as generate a signal for processing on the central and backup server.

4.1.6.1.4 The zone extension module shall include the following functionality:

- system extension to 8 zones;
- loop support:
 - NO, NC
 - EOL, 2EOL / NO, 2EOL / NC (in conjunction with control and actuating devices)
 - 3EOL (INTEGRA Plus device)
- programmable value of EOL resistors (in conjunction with control and actuating devices)



- support for roller shutter vibration detectors and motion detectors (in combination with receiving and control devices)
- RS-485 bus connection (firmware upgrade via bus)

The expansion module shall be connected to the main board and 2 detection devices of the corresponding stand

4.1.6.1.5 Analog video recorder with the following specifications:

- At least 4 video inputs.
- Recording quality at least 960 x 576 @ 25fps per channel.
- Configuration of speed and bitrate settings by channel.
- Pentaplex. H.264 Standard Profile compression.
- HDD SATA.
- Outputs HDMI, VGA, BNC and Audio.
- At least 2 audio inputs. 4 alarm IN, 1 alarm OUT.
- Control PTZ cameras via RS-485.
- Mouse control or remote control (included).
- Ability to work with mobile devices. CMS for Windows and Mac OS.
- Ability to browse the archive online, the number of channels shall correspond to the incoming feeds, at least 4 channels directly.
- Back up copying via USB or over the network.
- Power supply according to regional specifications (220V, 50 Hz).

The recorder must be connected with the CCTV stand (namely, the analog cameras on this stand), and generate an output signal to be processed at the central and backup server. It also should be compatible with the software described in clause 4.1.7.

4.1.6.1.6 A PoE switch for CCTV systems. The switch shall combine the specifications of security systems, provide a fast way to transfer packets and good bandwidth. The switch shall have a built-in surge protection circuit. The switch shall have the following specifications:

- Uplink: two 100Mbps ports;
- Downlink: four 100Mbps ports; each port shall MDI/MDIX support;
- Power: 60 W;
- Transmission range: up to 100 meters in 100Mbit mode; up to 250 meters in 10Mbit mode (CCTV mode);
- Standards: IEEE802.3x, Auto MDI / MDIX;
- Support: Span, IEEE802.3 af;
- Compatibility: IEEE802.3, IEEE802.3u, IEEE802.3af.

The switch shall have UkrSEPRO state certificate of compliance.

The switch must be connected with the CCTV stand (namely, the IP cameras of this stand), and generate an output signal to be processed at the central and backup



server.

4.1.6.2 Equipment protection class shall be:

- IP65 for outdoor devices;
- IP54 for indoor devices;

4.1.6.3 Stand power supply should be for 220 V AC, the plug should match the European standard socket. Should any equipment need to be powered with a 12-24V power source, the stand shall be equipped with respective power units with back-up power batteries.

4.1.6.4 If a switch equipment manufacturer provides for the use of special configuration and debugging software, the stand shall be additionally equipped with appropriate switching equipment and software.

4.1.6.5 The switch equipment shall retain its full functionality under the following environmental characteristics:

- Any equipment intended for outdoor use shall be fully functional in the temperature range between -20 to +40 degrees Celsius, with relative humidity of up to 93%.
- Any equipment intended for indoor use shall be fully functional in the temperature range between +5 to +40 degrees Celsius, with relative humidity of up to 90%.

4.1.6.6 All the switching equipment shall have warranty for at least the first 12 months of service.

4.1.6.7 All the switching equipment shall have detailed user manuals in English.

4.1.7 To manage and configure the interactive training mock-up stand special software shall be used, which should match the following requirements:

4.1.7.1 The software shall be designed to create integrated security systems of any scale:

4.1.7.1.1 The software shall be able to seamlessly integrate CCTV, security and fire alarm systems, perimeter security system, access control and management system and audio control in a coordinated infrastructure.

4.1.7.1.2 The software shall have a modular architecture in order to be able to select those functions that are required to build an effective security system for a particular site, thus obtaining a system with the optimal set of functions.

4.1.7.1.3 The software shall have the following modules:

- Core system.
- CCTV module to connect surveillance cameras.
- PTZ device control module.
- Integration module to connect the controller used as the control element of the functional group of the access control and management equipment.



- Integration module to connect the main board of the receiving and controlling device of the security and fire alarm system.
- Photo identification module.
- Work time accounting module.
- Bandwidth control module.
- Reporting module.
- Backup system launch module.

4.1.7.1.4 All major software modules described above shall be provided in two copies for installation on the main and backup servers.

4.1.7.2 Besides the main modules to be installed on the main and backup servers there is also a need for the following:

- Three Remote Workstation software modules for system configuration and setup in the administrator version with administrator privileges and full access to all software and system configuration elements.
- Five operator workstations (with user rights only for the operational management of the interactive training mock-up stand).

4.1.7.3 The software shall integrate on the program level elements of all stands into a single complex and have the ability to graphically summarize and display operational information for every device, its parameters and functionality on the central, backup servers and operator workstations.

4.1.7.4 The software shall upgrade from time to time and have developer warranty support.

4.1.7.5 The representative office shall provide references of software installation, configuration and operation at real sites and training centers that include the software modules listed in clause 4.1.7.1.3.

4.1.7.6 The software product shall have warranty for free service and maintenance for at least for the first 12 months of service.

4.1.7.7 The software product specifications shall correspond to the switching requirements of the switch devices located on the switch stand of the interactive training mock-up complex.

4.1.8 The following elements are required to control the interactive training mock-up stand:

- The primary server.
- The backup server.
- 10 workstations.
- UPS for servers and workstations.

4.1.8.1 The primary and backup servers shall have identical configuration and meet the following specifications:

- Processor: 2x Intel Xeon E5-2680v4 (2400 MHz);



- RAM: 8 Gb;
- HDD 6 Tb (3x2Tb);
- Video card NVIDIA GeForce GT1060;
- Two-channel motherboard with the ability to connect two hard drives as RAID 0, and one HDD without the RAID;
- Two power supply units with the capacity of at least 1000 W and the hot swap functionality;
- Available HDD hot swap function in RAID;
- System enclosure.

4.1.8.2 The workstations shall have the following configuration:

- Computers:
 - Intel Core™ i7-4790K 4x 4.00 GHz
 - NVIDIA GeForce® GTX 980 4.0 GB
 - 32 GB RAM, 480 GB SSD, 4.0 TB HDD, DVD Writer
 - WiFi, 12x USB 3.1 Gen1, 2x USB 2.0
- Monitors:
 - 61.0 cm (24") 16:9 TN-Panel
 - 1920 x 1080 Full HD, 1 ms, 250 cd/m² cd/m², up to 60 Hz
 - 1x VGA, 1x HDMI
- Keyboards and mice:
 - Wireless Connection via Radio (2.40 GHz)
 - Layout: US / UK / UKR (QWERTY) incl. Mouse.

4.1.8.3 Software for servers and workstations:

- Windows Server 2016 Standard;
- Windows 10 Pro;
- Microsoft Office 2016 Standard;
- Adobe Acrobat Pro;
- Antivirus software

4.1.8.4 Uninterrupted power sources (UPS) for servers and workstations with the following specifications:

- Power, full: VA: 1000.
- Power, active: 600 W.
- Input voltage range processed without switching to battery: 180-287 V.
- Output voltage form: sinusoid.
- Nominal output voltage: 230 V.
- Time required to switch to battery: up to 10 ms.
- Battery operation under maximum load: 7-10 min.
- Number of outputs (load/filter): not less than 4 (IEC-320-C13).
- The UPS shall support a hot battery swap feature.



- The UPS shall have the possibility to connect an external battery pack.
- Control: PC communication interface via USB, RS232.

4.1.8.5 Equipment protection class shall be:

- IP65 for outdoor devices;
- IP54 for indoor devices;

4.1.8.6 Equipment power supply requirements shall be configured for 220 V AC, the plug shall match the European standard socket .

4.1.8.7 If a server or UPS manufacturer provides for the use of special configuration and debugging software, appropriate switching equipment and software shall be additionally provided.

4.1.8.8 The servers and UPS shall retain its full functionality under the following environmental characteristics:

- Any equipment intended for outdoor use shall be fully functional in the temperature range between -20 to +40 degrees Celsius, with relative humidity of up to 93%.
- Any equipment intended for indoor use shall be fully functional in the temperature range between +5 to +40 degrees Celsius, with relative humidity of up to 90%.

4.1.8.9 All the servers and UPS shall be certified in Ukraine.

4.1.8.10 All the servers and UPS shall have warranty for free service and maintenance for at least for the first 12 months of service.

4.1.8.11 All servers and UPS equipment shall have detailed user manuals in English and Ukrainian languages.

4.1.9 Equipment power supply for the entire interactive mock-up complex shall be configured for 230 V AC, and the plug shall match the European standard socket.

4.1.10 The backup battery power system for uninterrupted power supply of the mock-up complex shall ensure its operation for at least 1 hour if the main power is lost.

5 Marking

The System shall have all safety markings in English and Ukrainian languages.

6 Packing

The interactive training mock-up complex shall be manufactured from a nonflammable material and meet the fire safety requirements established for educational organizations.

7 Quality requirements

7.1 The system shall be manufactured, shipped and installed in accordance with



the ISO Contractor quality assurance procedures or an equivalent QA system.

7.2 The Contractor shall document compliance with the said quality assurance system.

8 Configuration, testing, training and acceptance

8.1 The mock-up complex shall be inspected by the Contractor prior to shipment to ensure its compliance with the operational requirements of the manufacturer and the minimal requirements provided for in this document.

8.2 The Contractor shall install the mock-up complex upon delivery in the location specified by the End-user in Ukraine.

8.3 Upon installation in Ukraine, the integrated training mock-up complex shall be tested by the Contractor together with the End-user in order to demonstrate that the equipment meets the manufacturer's technical specifications and the minimum requirements specified in this document as defined by the IAEA.

8.4 The results of the integrated training mock-up complex tests before and after the shipment shall be documented by the Contractor in the acceptance protocol signed by the End-user. End-user acceptance testing is carried out during the period of at least seven (7) working days.

8.5 The Contractor provides three (3) days training for up to three (3) End-user employees while operating and maintaining the mock-up complex at the End-user's site immediately after the complex installation.

9 Warranty

The Contractor shall provide a service and maintenance warranty for at least for a 12 month period.

10 Supplied data

The Contractor shall provide two full sets of operating and maintenance manuals, as well as technical drawings in English.