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| Logo-Radiy | | **НВПРадій**  **RPC Radiy** | | |
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| Project: | | Radiy Platform Configuration Tool | | |
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| **RPCT Requirements Specification**  D0.8.0 | | | | |
| Version | Description | Prepared by | Reviewed by | Approved by |
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# Scope and Purpose of the Document

This document is intended to provide specification and requirements for development of the Radiy Platform Configuration Tool (RPCT). Information covered requirements for the product, which are organized at hierarchical point of view, diagrams of components, data flow representation. Amount and quality of technical details shall be enough and understandable for designing architecture of product.

At the first section shown referenced documents, abbreviations and terms used in the whole document.

Section 2 introduces the FSC concept and describes the whole concept of the RPCT.

Section 3 contains diagrams and list of requirements to the RPCT.

## Reference Documents

1. IEC 61508:2010. Functional safety of electrical/electronic/programmable electronic safety-related systems.
2. IEC 62566:2011. Nuclear power plants – Instrumentation and control important to safety – Selection and use of complex electronic components for systems performing category A functions.
3. D2.1 FSC Functional Safety Management Plan.
4. D3.1. FSC Safety Requirements Specification.
5. D5.1. FSC Product Architecture Document.
6. D8.11 FSC FBL Detailed Description.

## Terms and Abbreviations

|  |  |
| --- | --- |
| FSC | The Radiy FPGA-based Safety Controller hardware platform, meaning a chassis with all modules. [PAD] |
| FSC Data | Data received from FSC which include information about FSC state and workflow data |
| Workflow Data | The state information of the controlled object received from FSC |
|  |  |
|  |  |
| FSC Module | The highest-level module within the FSC, such as Logic Module (LM), Discrete Input Module (DIM), etc. They can be identified by its position, type and serial number. Logic Module can and should be programmed and reprogrammed to support the work of programmed algorithm synthesized from the logical blocks. All modules provide specific inputs and outputs. |
| Application Functional Block (AFB) | The logic blocks that do primitive logical operation like Boolean OR, AND, or more sophisticated operations like delays, signal comparison, etc. |
| Application Functional Block Library (AFBL) | Set of the functional blocks for application logic building. |
| Tuning | Process which allows changing predefined values of Application Logic. |
| Application Project | Data which include chassis configuration, application logic, visualization schemes, SCADA software configuration, etc. |
| Application Project Database | Storage for application project data. |
| CAD | The software part for FSC platforms devices configuration, designing application logic, compilation, updating firmware, etc. |
| SCADA | The software part which provides workflow monitoring, visualization and tuning. |
| I&C System | Instrumentation and control system |
| Chassis Configuration | The set of modules, placed in the one chassis. Chassis configuration includes the combination of modules within module position in the chassis, module type, module revision and other service data. |
| Application Logic (взять определение из PAD на SIL3) | Main program of the FSC. There are algorithms which provide input data acquisition, performs the main functions of module (data processing, application logic etc.), output data conditioning, data exchange with other modules[PAD] |
| Signals Data | The Signals Data is a table of signals which includes properties, such as signal name, signal address, signal range, signal unit, etc. Signals Data is a helpful representation of data needed for design, tuning and monitoring. |

# RPCT Overview

The RPCT is the multicomponent software platform which allows user to configure FSC chassis, design application logic and monitoring FSC in on-line mode.

RPCT software consists of two main parts: CAD and SCADA.

The CAD part provides tools for FSC chassis configuration, application logic design and its compilation, firmware upload, visualization design and SCADA software configuration.

Firmware is a set of binary files which includes communications units’ configurations, application logic program and its parameters.

Processes and data flows are described in the Figure 2‑4



Figure 2‑4 Processes and data flow of design part of RPCT

The SCADA part provides monitoring and visualization of the whole system (stands with chassis), including information about chassis configuration, diagnostic and workflow data.

Also SCADA includes tuning component which provides ability for changing parameters in application logic of FSC.

All functional requirements of RPCT are described in the following sections of the present document.

# Requirements

## General requirements

General requirements to RPCT are shown in the Table 3‑1.

Table 3‑1 General requirements to the RPCT

| **[T.GR]** | **Requirement Statement** | **VAL** |
| --- | --- | --- |
| GR.01 | Shall provide application project database for storing design data |  |
| GR.02 | Shall provide means for application logic design |  |
| GR.03 | Shall provide tool for compiling application logic |  |
| GR.04 | Shall provide tool for uploading firmware to FSC |  |
| GR.05 | Shall provide means for passing application project data to SCADA |  |
| GR.06 | Shall provide tools for acquisition, archiving and visualization of FSC data. |  |
| GR.07 | Shall provide tool for tuning FSC |  |
| **[/T.GR]** |  |  |

## CAD components requirements

CAD tool provides user with ability to design FSC-based solutions.

Component structure of CAD is shown is the Figure 3‑1.



Figure 3‑1 CAD components diagram

Main requirements to CAD are shown at the Table 3‑2.

Table 3‑2 Main requirements to the CAD components

| **[T.CAD]** | **Requirement Statement** | **VAL** |
| --- | --- | --- |
| CAD.01 | Shall provide ability for application project management |  |
| CAD.02 | Shall provide access to local or remote application project database |  |
| CAD.03 | Shall provide means for designing and storing application hardware configuration |  |
| CAD.04 | Shall provide tool for application functional block library management |  |
| CAD.05 | Shall provide tool for designing of application logic |  |
| CAD.06 | Shall provide tool for compiling application logic |  |
| CAD.07 | Shall provide application logic signal editor |  |
| CAD.08 | Shall provide tool for designing of FSC data visualization |  |
| CAD.09 | Shall provide SCADA configuration tool |  |
| CAD.10 | Shall provide generation data for SCADA and FSC |  |
| CAD.11 | Shall provide firmware uploading to FSC |  |
|  |  |  |
| **[/T.CAD]** |  |  |

### Application Project Management Module Requirements

Application Project Management Module provides general project operations like creating, deleting, opening projects and project user management.

Requirements to the Project Management Module are shown at the Table 3‑3.

Table 3‑3 Requirements to the Project Management Module

| **[T.APMM]** | **Requirement Statement** | **VAL** |
| --- | --- | --- |
| APMM.01 | Shall provide ability to create new project |  |
| APMM.02 | Shall provide ability to open existing project for editing or viewing. |  |
| APMM.03 | Shall provide ability to delete existing project |  |
| APMM.04 | Shall provide ability to create project users |  |
| APMM.05 | Shall provide ability to edit user profile |  |
| APMM.06 | Shall provide ability to assign user rights |  |
| [/T.APMM] |  |  |

### Application Hardware Configurator Requirements

Application Hardware Configurator is a tool for defining hardware configuration including racks, chassis, modules, its placement and properties.

Requirements to the Application Hardware Configurator are shown at the Table 3‑4.

Table 3‑4 Requirements to the Application Hardware Configurator

| **[T.AHC]** | **Requirement Statement** | **VAL** |
| --- | --- | --- |
| AHC.01 | Shall provide ability to add new racks, delete existing racks and edit its properties. |  |
| AHC.02 | Shall provide ability to add new chassis, delete existing chassis and edit its properties. |  |
| AHC.03 | Shall provide ability to define chassis configuration. |  |
| AHC.04 | Shall control modules and chassis compatibility |  |
|  |  |  |
|  |  |  |
| **[/T.AHC]** |  |  |

### Application Logic Designer Requirements

Application Logic Designer is a GUI tool that provides ability to design LM’s application logic.

Requirements to the Application Logic Designer are shown in the Table 3‑5.

Table 3‑5 Requirements to the Application Logic Designer

| **[T.ALD]** | **Requirement Statement** | **VAL** |
| --- | --- | --- |
| ALD.01 | Shall provide visual tool for designing application logic using application functional block library items and application logic signals |  |
| ALD.02 | Shall provide binding of application logic to particular hardware |  |
| ALD.03 | Shall provide static application logic analysis (detection of non-compatible, not connected or unused items) |  |
| ALD.04 | Shall provide application logic version control |  |
| ALD.05 | May provide source data for FSC data visualization |  |
| **[/T.ALD]** |  |  |

### Application Functional Block Library Manager Requirements

Application Functional Block Library Manager (AFBLM) provides ability to define Application Functional Blocks for using in Application Logic Designer.

Requirements to the Application Functional Block Library Manager are shown in the Table 3‑6.

Table 3‑6 Requirements to the Application Functional Block Library Manager

| **[T.AFBLM]** | **Requirement Statement** | **VAL** |
| --- | --- | --- |
| AFBLM.01 | Shall provide ability to create Application Functional Blocks |  |
| AFBLM.02 | Shall provide Application Functional Block property editor |  |
| AFBLM.03 | Shall provide Application Functional Block version control |  |
| AFBML.04 | Shall provide repository of Application Functional Blocks for Application Logic Designer |  |
| **[/T.AFBLM]** |  |  |

### Application Logic Compiler Requirements

Application Logic Compiler (ALC) is tool for compiling Application Logic Data to firmware which can be uploaded to FSC.

Requirements to the ALC are shown in the Table 3‑7.

Table 3‑7 Requirements to the Application Logic Compiler

| **[T.**ALC**]** | **Requirement Statement** | **VAL** |
| --- | --- | --- |
| ALC.01 | Shall translate Application Logic Data to FSC firmware |  |
| ALC.02 | Shall detect errors in application logic data |  |
| ALC.03 | Shall provide ability to store compilation result in the Project Database for later use |  |
| ALC.04 | Shall provide report on process and result of compilation |  |
|  |  |  |
| **[/T.**ALC**]** |  |  |

### Application Logic Signal Editor Requirements

Application Logic Signal Editor intend for creation and editing Application Logic signal set.

Requirements to the ALSE are shown in the Table 3‑8.

Table 3‑8 Requirements to the Signals Editor

| **[T.ALSE]** | **Requirement Statement** | **VAL** |
| --- | --- | --- |
| ALSE.01 | Shall provide ability to create and edit analogue signals and theirs properties |  |
| ALSE.02 | Shall provide ability to create and edit discrete signals and theirs properties |  |
| ALSE.03 | Shall provide repository of signals for Application Logic Designer |  |
|  |  |  |
| **[/T.ALSE]** |  |  |

### Visualization Editor Requirements

Visualization Editor is GUI tool that provides ability to design schemes for workflow visualization.

Requirements to the Visualization Editor are shown at the Table 3-9.

Table 3‑9 Requirements for Visualization Editor

| **[T.VE]** | **Requirement Statement** | **VAL** |
| --- | --- | --- |
| VE.01 | Shall provide ability to manage visualization schemes |  |
| VE.02 | Shall provide visual tool for designing visualization schemes using predefined set of visualization items |  |
| VE.03 | Shall provide ability to change visualization items properties and behavior |  |
| VE.04 | Shall provide ability to bind visualization items to FSC signals |  |
| VE.05 | Shall provide visualization schemes version control |  |
|  |  |  |
| **[/T. VE]** |  |  |

### SCADA Configuration Tool Requirements

SCADA Configuration Tool is intended for defining SCADA software and hardware configuration.

Requirements to the SCADA Configuration Tool are shown at the Table 3-10

Table 3-10 Requirements for SCADA Configuration Tool

| **[T.** SCT**]** | **Requirement Statement** | **VAL** |
| --- | --- | --- |
| SCT.01 | Shall provide ability to define SCADA hardware configuration |  |
| SCT.02 | Shall provide ability to define SCADA software configuration |  |
| SCT.03 | Shall provide version control for SCADA configuration data |  |
|  |  |  |
| **[/T.** SCT**]** |  |  |

### Application Project Builder Requirements

Application Project Builder is the tool intended for generation complete set of data required for FSC and SCADA.

Requirements to the Application Project Builder are shown at the Table 3-11

Table 3-11 Requirements for Application Project Builder

| **[T. APB]** | **Requirement Statement** | **VAL** |
| --- | --- | --- |
| APB.01 | Shall fetch relevant data from Application Project Database |  |
| APB.02 | Shall generate output files for FSC |  |
| APB.03 | Shall generate output files for SCADA |  |
| APB.04 | Shall store build data to Application Project Database |  |
| APB.05 | Shall provide ability to download build data to local storage |  |
|  |  |  |
| **[/T. APB]** |  |  |

### Firmware Uploader Requirements

Firmware Uploader is the tool for uploading corresponding data from application project database to FSC modules.

Requirements to the Firmware Uploader are shown at the Table 3-12

Table 3-12 Requirements for Firmware Uploader

| **[T. FU]** | **Requirement Statement** | **VAL** |
| --- | --- | --- |
| FU.01 | Shall load relevant data from application project database |  |
| FU.02 | Shall upload data to FSC module |  |
| FU.03 | Shall validate uploaded data |  |
| FU.04 | Shall save uploading history |  |
|  |  |  |
| **[/T. FU]** |  |  |

## SCADA Components Requirements

SCADA software is intended for acquisition, parsing and archiving FSC data, displaying it to users and FSC tuning. SCADA consists of server and client parts.

On the Figure 3-2 shown component structure of SCADA



Figure 3-2 Component diagram of SCADA

Main requirements to SCADA are shown at the Table 3-13.

Table 3‑13 Main Requirements for SCADA

| **[T.SCADA]** | **Requirement Statement** | **VAL** |
| --- | --- | --- |
| SCADA.01 | Shall receive configuration data from CAD[/] |  |
| SCADA.02 | Shall receive data from FSC |  |
| SCADA.03 | Shall archive FSC data |  |
| SCADA.04 | Shall transmit tuning data to FSC |  |
| SCADA.05 | Shall display FSC data to user |  |
| SCADA.06 | All SCADA software components should interact in local network environment |  |
|  |  |  |
| **[/T.SCADA]** |  |  |

### SCADA Server Software Requirements

SCADA Server Software receives configuration files from CAD and spreads it to all SCADA components including client software. Also server part is intended for receiving, parsing and archiving FSC data, which can be passed to client part.

The main requirements to the SCADA Server Software are shown in the Table 3-14.

Table 3‑14 SCADA Server Software requirements

| **[T.SS]** | **Requirement Statement** | **VAL** |
| --- | --- | --- |
| SS.01 | Shall receive configuration data from CAD |  |
| SS.02 | Shall spread configuration data to SCADA components |  |
| SS.03 | Shall receive and parse data from FSC |  |
| SS.04 | Shall archive FSC data and provide ability to later access to it |  |
| SS.05 | Shall transmit FSC data to client software |  |
| SS.06 | Shall receive tuning data from client software |  |
| SS.07 | Shall transmit tuning data to FSC |  |
| SS.08 | Shall provide ability for monitoring and control server software components. |  |
|  |  |  |
| **[T.SS]** |  |  |

### SCADA Client Software Requirements

SACADA Client Software receives FSC data from server part and displays it to user. Also client part provides ability to FSC tuning.

The requirements to the SCADA Client Software are shown in the Table 3-15.

Table 3‑15 SCADA Client Software requirements

| **[T.CS]** | **Requirement Statement** | **VAL** |
| --- | --- | --- |
| CS.01 | Shall receive and apply configuration data from SCADA Server Software [/] |  |
| CS.02 | Shall receive current workflow data from SCADA Server Software |  |
| CS.03 | Shall request and receive workflow data stored in SCADA archive |  |
| CS.04 | Shall represent workflow data to user |  |
| CS.05 | Shall provide UI for FSC tuning |  |
| CS.06 | Shall transmit FSC tuning data to SCADA Server Software |  |
|  |  |  |
| **[T.CS]** |  |  |