**TABLE OF CONTENTS**

1 INTRODUCTION 3

1.1 Document overview 3

1.2 Abbreviations and Glossary 3

1.2.1 Abbreviations 3

1.2.2 Glossary 3

1.3 References 3

1.3.1 Project References 3

1.3.2 Standard and regulatory References 3

1.4 Conventions 4

2 REQUIREMENTS 6

2.1 States 6

2.2 Functionalities and Performance 6

2.3 SW\_Configuration 9

2.4 Human\_Machine\_Interface 9

2.5 Regulatory requirements 10

2.6 System environment 10

2.7 External interfaces 10

2.7.1 Hardware interfaces 10

2.7.2 Hardware resources 11

2.7.3 Software resources 11

2.8 Verification 11

2.9 Packaging and installation 11

3 VERIFICATION METHODS 13

4 REQUIREMENTS TRACEABILITY 16

5 CRITICAL REQUIREMENTS 17

# INTRODUCTION

## Document overview

This document presents the software requirements specifications of 101 software development project.

It describes:

* Requirements of functionalities, performances, interfaces, environment …
* Tests principles and definitions of validation methods of requirements,
* The compliance of requirements to customer needs,
* The relative importance and precedence of requirements

## Abbreviations and Glossary

### Abbreviations

Add here abbreviations

### Glossary

Add here words definitions

## References

### Project References

| # | Document Identifier | Document Title |
| --- | --- | --- |
| [R1] | ID | Integrative Project |

### Standard and regulatory References

|  |  |  |
| --- | --- | --- |
| # | Document Identifier | Document Title |
| [STD1] | Tema: 1.2.1. "SPICE", "CMMI" | ISO/IEC 15504, CMMI  ISO/IEC 9899-2011  ISO/IEC 19769:2004  ISO/IEC 9899:tc2 |

## Conventions

Requirements listed in this document are constructed according to the following structure:

|  |  |
| --- | --- |
| Requirement ID | SRS-101-000 |
| Title | Title of XXX-000 requirement |
| Description | Description of XXX-000 requirement |
| Version | Version of XXX-000 requirement |

|  |  |
| --- | --- |
| Requirement ID | SRS-Power input -001 |
| Title | Main power input |
| Description | The power voltage supply must be 12 Volts DC. |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS-Work load frequency range-002 |
| Title | Main work load frequency range |
| Description | The frequency work load shall be in the f = 100 Hz to f = 1 KHz, range. |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS-PWM Duty Cycle-003 |
| Title | Main duty cycle |
| Description | The PWM duty cycle shall be defined after working frequency. |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS-Set point (Speed)-004 |
| Title | Main set- point range |
| Description | The set point shall be defined within the range 0 to 3000 RPM |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS-Display behaviour-005 |
| Title | Main information displayed |
| Description | The LCD shall display the motor speed, set point and square signal work percentage. |
| Version | V1.0 |

# REQUIREMENTS

## States

FOO software works in three states:

* Starting: the software loads its components;
* In use: all the functionalities of the software are available to the users;
* Stopping: the software is being stopped.
* Maintenance: the software is in maintenance mode

States and transitions. (Need diagram--UML)

## Functionalities and Performance

This is the core of the SRS. It contains the purpose of the software expressed in technical requirements.

|  |  |
| --- | --- |
| Requirement ID | SRS-VOLTAGE |
| Title | Voltage |
| Description | FOO hardware shall deliver 12V |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS-SetPoint |
| Title | SetPoin |
| Description | HARDWARE\_CONFIGURATION for the SetPoint shall be defined as designed and specified in the Integrative Project document, page 6. |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS-SetPoint\_Adjustment |
| Title | Setpoint\_Adjustment |
| Description | HARDWARE\_CONFIGURATION for SetPoint shall set reference values using the potentiometer as defined in the Integrative Project document, page 6 – fig 5. |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS- SetPoint\_Noise\_Atenuation |
| Title | Setpoint SetPoint\_Noise\_Atenuation |
| Description | HARDWARE\_CONFIGURATION SetPoint offset value shall be defined by sampling the signal at 100ms period.  Sampling shall be average to yield offset value. |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS- SetPoint\_Reference\_Value\_UART |
| Title | SetPoint\_Reference\_Value\_UART |
| Description | HARDWARE\_CONFIGURATION SetPoint offset values must be tested as defined in the Integrative Project design document, page 6 using the UART protocol.  Offset\_ updated \_messsage shall be set to 200 ms.  UART\_transmition\_velosity shall be set to 115200 bps |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS-PWM |
| Title | HARDWARE\_CONFIGURATION\_PWM |
| Description | HARDWARE\_CONFIGURATION for the PWM shall be defined at a frequency of 1Khz of duty cycle. |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS-PWM |
| Title | HARDWARE\_CONFIGURATION\_PWM |
| Description | HARDWARE\_CONFIGURATION for the PWM shall be sampled with in a period of 100ms. |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS-PWM |
| Title | HARDWARE\_CONFIGURATION\_PWM |
| Description | HARDWARE\_CONFIGURATION for the interface shall set discreate values of RPM corresponding to percentage of signal duty cycle as defined in value table in the Integrative Project document, page 6 – table 1. |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS-PWM |
| Title | HARDWARE\_CONFIGURATION\_PWM |
| Description | HARDWARE\_CONFIGURATION for the tachometer shall set discreate values of RPM corresponding to percentage of signal duty cycle as defined in value table in the Integrative Project document, page 6 – table 1. |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS-PWM |
| Title | HARDWARE\_CONFIGURATION\_PWM |
| Description | HARDWARE\_CONFIGURATION shall set the output of the Hall\_effect sensor to a square signal. |
| Version | V1.0 |

## SW\_Configuration

|  |  |
| --- | --- |
| Requirement ID | SRS-Model |
| Title | Speed control |
| Description | Speed control shall compute the PWM control signal with the 100 ms parameter, with the use of the PID algorithm. |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS-Model |
| Title | Speed control |
| Description | Speed control shall set the motor to the RPM, using the ACD feedback and varying voltage from SetPoint |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS-Controller |
| Title | Speed control\_setpoint |
| Description | Setpoint value shall be read every 100ms. |
| Version | V1.0 |

## Human\_Machine\_Interface

|  |  |
| --- | --- |
| Requirement ID | SRS- HMI\_Display |
| Title | HMI\_Display |
| Description | HMI\_Display software shall display the following items:  **Name of the project:** Speed Control DC motor  **Duty cycle:** XXX %  **Speed:** XXXX RPM  **SW:** X.X  **HW:** CESEQ-C001 / CESEQ-P001  **Developer:** Lastname1, Name1  Lastname2, Name2 |
| Version | V1.0 |

## Regulatory requirements

|  |  |
| --- | --- |
| Requirement ID | SRS-Speed control |
| Title | About SP\_C |
| Description | SP\_C display shall display an “About…” Tag. This window displays the current version of the application. |
| Version | V1.0 |

## System environment

software is integrated in a specific system, describe briefly the system and add specific requirements for the integration of your software in this system

## External interfaces

This section describes hardware and software interfaces of the software in the system

### Hardware interfaces

add requirements about integration of software and hardware.

### Hardware resources

|  |  |
| --- | --- |
| Requirement ID | SRS-Speed\_Control (SP\_D)- Renesas |
| Title | Hardware configuration |
| Description | SP\_Cshall run with the expected response times on a Synergy S7G2 MCU with the following minimal configuration:   * 2 Go RAM * ... |
| Version | V1.0 : <https://www.renesas.com/jp/ja/doc/products/renesas-synergy/doc/r12um0004eu0100_synergy_sk_s7g2.pdf> |

### Software resources

|  |  |
| --- | --- |
| Requirement ID | SRS-SP\_C-SW |
| Title | Software configuration\_ SP\_C-SW |
| Description | SP\_C-SW runs in the following software environment:   * Renesas e2 estudio \_ V6.2.0 |
| Version | V1.0 [stakeholder\Installation Instructions.pdf](stakeholder/Installation%20Instructions.pdf) |

## Verification

Special functions to test the software, if necessary. For example, a hidden function to activate a log file during beta tests. But not a backdoor or a security hole!!!

## Packaging and installation

|  |  |
| --- | --- |
| Requirement ID | SRS-XXX-PAK-010 SAMPLE |
| Title | Packaging |
| Description | XXX shall be delivered on zzz media. |
| Version | V1.0 |

|  |  |
| --- | --- |
| Requirement ID | SRS-XXX-PAK-010 SAMPLE |
| Title | Install-shield |
| Description | XXX shall be installed with the use of an install shield. |
| Version | V1.0 |

# VERIFICATION METHODS

Discard this section if you don’t want to have verification methods attached to your requirements.

The verification methods of the requirements are defined below:

* Inspection (I): control or visual verification
  + Control of the physical implementation or the installation of a component. The control verifies that the implementation or the installation of a component is compliant with the requirements of diagrams.
  + Control of the documentation describing a component. The control verifies that the documentation is compliant with the requirements.
* Analysis (A): verification based upon analytical evidences
  + Verification of a functionality, performance or technical solution of a component by analyzing the data collected by tests in real conditions, by simulation of real conditions or by a analysis report.
  + Analysis of test data or of design data is used as appropriate to verify requirements.
  + The verification is based upon analytical evidences obtained by calculations, like modeling, simulation and forecasting.
  + Analysis is used when an acceptable level of confidence cannot be established by other methods or if analysis is the most cost-effective solution.
* Demonstration (D): verification of operational characteristics, without quantitative measurement
  + Verifying a requirement by demonstration implies that the required functionality specified by a requirement is complete.
  + Demonstration is used when quantitative measurement is not required for verification of the requirements
  + Demonstration includes the control of the technical solutions specified by the non-functional requirements.
* Test (T): verification of quantitative characteristics with quantitative measurement
  + Verifying a functionality, performance or technical solution of a component by executing testing scenarios in predefined, controlled and traceable testing conditions.
  + Tests require the use of special equipment, instrumentation, simulation techniques, or the application of established principles and procedures,
  + Data produced during tests is used to evaluate quantitative results and compare them with requirements.

For each requirement of the SRS, a verification method is defined. Method is abbreviated I, A, D or T.

|  |  |  |
| --- | --- | --- |
| Requirement ID | Requirement Title | Method |
| REQ-001 | Verify that the speed is displayed in rpm | D |
| REQ-001 | Verify that the color of background is blue | I |

Note: do not mistake the two meanings of the word “test” in this document:

* The method of verification, named Test and abbreviated (T), as defined above.
* A test, or test case, is a sequence of actions to verify a requirement. Tests are defined in the software test plan.

Examples of tests methods:

Inspection:

* Verify that the color of background is blue,
* Verify that the user manual has the CE mark on its cover
* Verify that the PC has 4Gb memory
* Verify that firmware version on electronic card is 1.0.1

Demonstration

* Verify that when the user closes the window, a confirmation message appears
* Verify that the file is saved in the output directory
* Verify that the result is shown
* Verify that if a value is out of range, a warning is displayed

Analysis:

* Verify that the statistical distribution of results of xxx algorithm is a Gaussian with mean=x and stdev=y, when input data are blah blah
* Verify that the linear regression of results of xxx algorithm is a line which value is 1 on the y-axis, at zero on the x-axis,

Test:

* Verify that a file of 1Gb is processed in less than 3s
* Verify that the response time of the server is 15ms with 20 simultaneous requests

Rule of thumb for software, 80% of requirements are verified by demonstration, 15% by inspection and 5% by analysis or test methods.

# REQUIREMENTS TRACEABILITY

Add a table with traceability of software requirements of this document with user or system requirements.

Example

|  |  |  |  |
| --- | --- | --- | --- |
| SRS Req. | Req Title | Functional Req. | Req. Title |
| SRS-REQ-001 | Reading ECG values | FUN-REQ-00A | ECG post treatment |
| SRS-REQ-002 | Writing results | FUN-REQ-00A | ECG post treatment |

# CRITICAL REQUIREMENTS

If necessary, add a list of critical requirements, or a list of reference to requirements in previous sections.

This list may be the result of risk analysis (ISO 14971).

Examples

|  |  |  |
| --- | --- | --- |
| Requirement ID | Requirement Title | Origin |
| REQ-001 | Alarm when value out of range | Risk Analysis |
| REQ-002 | Do not open file if no patient name | Risk Analysis |
| REQ-003 | Display negative values in red color | Human factor engineering |