

Document No.	Prep By	IN2244	R E V E C N						Sheet 1
	AWH	System Requirements Specification - PMU							Of 14

System Requirements Specification

for

Pressure Measurement Unit (PMU)

Document No.	Prep By	IN2244	R E V E C N						Sheet 2 Of 14
	AWH	System Requirements Specification - PMU							

Revisions of This Document

Revision	Date	Originator	Comments
0.1	November 28 2011	Alexander Walsch (AWH)	Initial Version
0.2	December 1 2012	AWH	Update

Document No.	Prep By	IN2244	R E V E C N						Sheet 3 Of 14
	AWH	System Requirements Specification - PMU							

Table of Contents

- 1. Introduction..... 4**
 - 1.1 Purpose.....4
 - 1.2 References.....4
 - 1.3 Interpretation4
- 2. Overall Description..... 5**
 - 2.1 System Description.....5
 - 2.2 Use Cases.....5
 - 2.3 Interfaces8
- 3. System States 10**
- 4. Requirements..... 12**
 - 4.1 General12
 - 4.2 Interfaces12
 - 4.3 Mechanical13
 - 4.4 Environmental13
 - 4.5 RAMS.....13

Document No.	Prep By	IN2244	R E V E C N						Sheet 4 Of 14
	AWH	System Requirements Specification - PMU							

1. Introduction

1.1 Purpose

The purpose of this document is to define the systems requirements for the pressure measurement unit. The intended audience is hardware and software developers, product managers, and the leadership team.

1.2 References

Reference	Title	Version Nr.	Author	Source / Location
[1]	EMI guideline			Internal design practice DP102345
[2]	Microchip			www.microchip.com
[3]	IEC61508			www.iec.ch

Table 1: References

1.3 Interpretation

Shall	a mandatory action (requirement)
May	a recommended action
should	a strongly recommended action

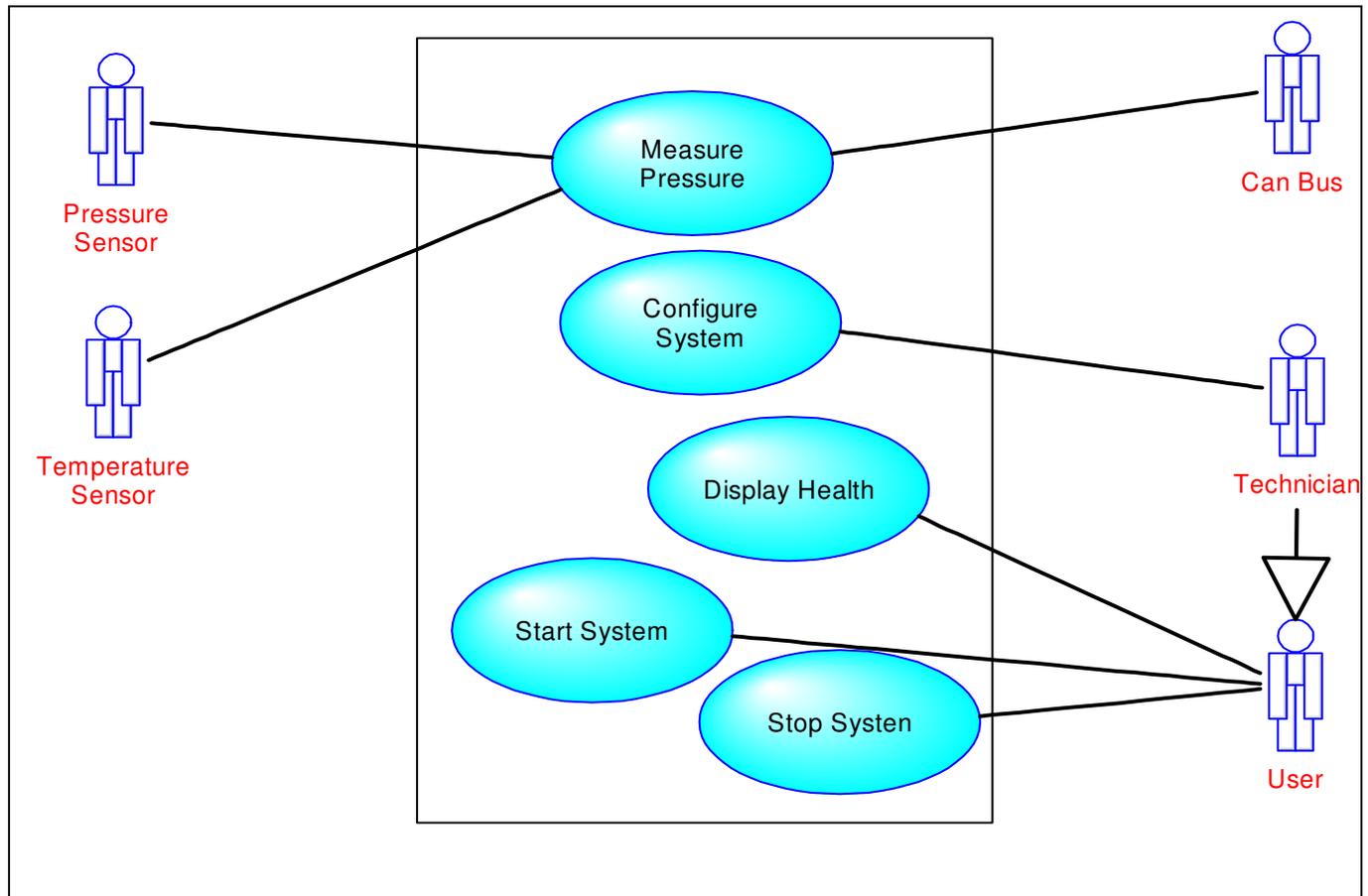
Document No.	Prep By	IN2244 System Requirements Specification - PMU	R					Sheet 5 Of 14
	AWH		E					
			C					
			N					

2. Overall Description

2.1 System Description

The pressure measurement unit provides an industrial rated interface to commercial 4-20mA based pressure transducers. The PMU allows integration into a CAN network and configuration via a personal computer. The product will help our company to extend our existing sensing portfolio.

2.2 Use Cases



Document No.	Prep By	IN2244	R						Sheet 6 Of 14
	AWH	System Requirements Specification - PMU	E						

Measure Pressure

Description	A request is received from the CAN bus. A temperature compensated pressure reading is sent as response.
Pre-condition	The system must be in 'Running' state.
Post-condition	The system will be in 'Running' state.
Non-functional Requirements	Pressure is read with a maximum cycle time of 100ms, output accuracy is 2%, precision is 0.5%.
Alternate Courses	Pressure outputs are in a range equivalent 0 - 16 bar. The valid temperature ranges from -45°C to +85°C. If either range is violated it must be signalled via CAN.

Configure System

Description	A request for configuration is communicated to the system. The requester is a technician which is equivalent to someone with restricted access rights. During configuration the system is not accepting CAN requests. The system reports valid configuration.
Pre-condition	The system must be in 'Active' state.
Post-condition	The system will be in 'Active' state.
Non-functional Requirements	Access should be protected by a password. The configuration data shall be stored in non-volatile memory.
Alternate Courses	All configuration options are checked for validity. If the configuration data are not valid the system signals the 'Error' state.

Display Health

Description	Health of the system is requested by a user. The system displays health using LEDs. Three LEDs are used. Green for 'Running', Red for 'Error', and yellow for all other system states. The LEDs are visible from outside the system such that the user gets visual feedback.
Pre-condition	The system must be in 'Active' state.
Post-condition	NA
Non-functional Requirements	NA
Alternate Courses	NA

Document No.	Prep By	IN2244	R E V E C N						Sheet 7 Of 14
	AWH	System Requirements Specification - PMU							

Start System

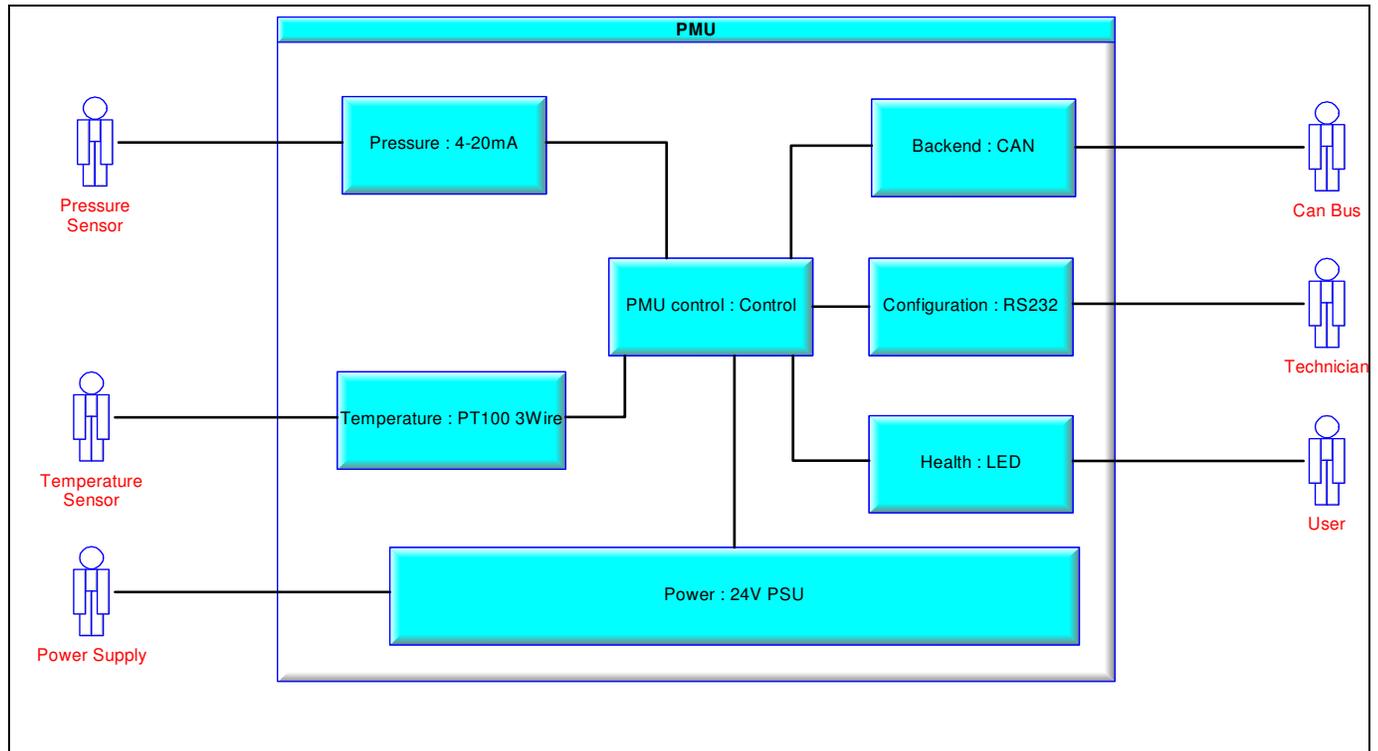
Description	Power is applied and the system starts. The system performs a self test. Upon successful completion the system automatically enters the 'Running' state.
Pre-condition	The system must be in 'Inactive' state
Post-condition	The system will be in 'Active' state
Non-functional Requirements	The system shall be in 'Running' state in less than 10s.
Alternate Courses	If the system detects a fault the 'Error' state shall be entered. In this case the system shall report the error state in less than 10s.

Stop System

Description	Power is removed.
Pre-condition	The system must be in 'Active' state.
Post-condition	The system will be in 'Inactive' state.
Non-functional Requirements	NA
Alternate Courses	NA

Document No.	Prep By	IN2244	R	E	V	E	C	N	Sheet 8
	AWH								

2.3 Interfaces



Component	Description
Pressure Sensor	Pressure sensor
Temperature Sensor	Temperature sensor mounted at the pressure sensor used for temperature compensation.
Power supply	External +24V DC power supply
CAN bus	CAN bus
Technician	User who accesses the PMU using RS232.
User	User who visually monitors the PMU.
Pressure: 4-20mA	1 x 4-20mA interface, screw terminal
Temperature: PT100 3wire	1 x 3 wire PT100 interface, screw terminal

Document No.	Prep By	IN2244	R E V E C N						Sheet 9 Of 14
	AWH	System Requirements Specification - PMU							

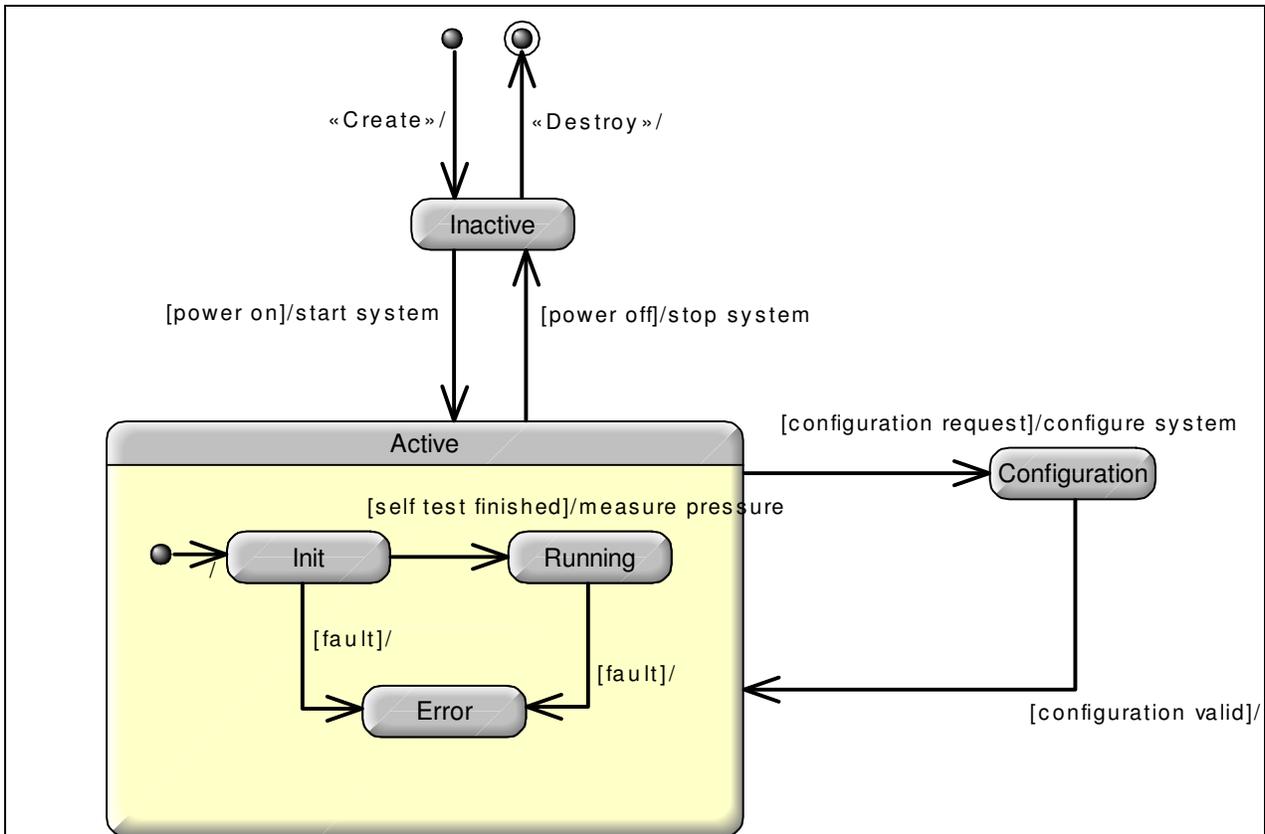
Component	Description
Power: 24V PSU	2 x power connector, screw terminal
Health: LED	LED interface for visual monitoring
Configuration:RS232	PC interface for configuration
Backend: CAN	CAN interface
PMU control: Control	Main control function

Document No.	Prep By	IN2244 System Requirements Specification - PMU	R					Sheet 10 Of 14
	AWH		E					
			N					

3. System States

The PMU has system states as defined below:

- Inactive
- Active
 - Init
 - Running
 - Error
- Configuration



On a system level the following events need to be processed.

Document No.	Prep By	IN2244	R						Sheet 11 Of 14
	AWH	System Requirements Specification - PMU	E						
			C						
			N						

- power_on: physically power on the system
- power_off: physically power off the system
- configuration request:: a configuration setting is entered via the configuration interface
- configuration valid: the configuration is valid
- fault: an internal or external fault has been detected
- self-test finished: the initial built in self-test has finished

Document No.	Prep By	IN2244	R						Sheet 12 Of 14
	AWH	System Requirements Specification - PMU	E						
			C						
			N						

4. Requirements

4.1 General

PMUSysRQ 1: The PMU shall be powered by +24V DC.

PMUSysRQ 2: The power consumption shall not exceed 2W.

PMUSysRQ 3: A dsPIC microcontroller from Microchip [2] or equivalent shall be used.

PMUSysRQ 4: The on-board material cost shall be less than \$50.

PMUSysRQ 5: The pressure readings shall be communicated via the CAN bus.

PMUSysRQ 6: The CAN pressure request rate is not more than 100ms.

PMUSysRQ 7: Pressure readings shall have an accuracy of 2% or better.

PMUSysRQ 8: Pressure readings communicated via CAN shall not be older than 100ms.

PMUSysRQ 9: Pressure reading precision shall be 0.5% or better.

PMUSysRQ 10: Pressure readings shall cover a range between 0 and 16 bar.

PMUSysRQ 11: Pressure readings shall be temperature compensated.

PMUSysRQ 12: The PMU shall run a self-test before measuring pressure.

PMUSysRQ 13: PMU version information shall be stored in on-board non-volatile memory.

4.2 Interfaces

PMUSysRQ 14: The PMU shall provide a 4 – 20 mA interface to the pressure sensor.

PMUSysRQ 15: The pressure sensor shall be powered externally..

PMUSysRQ 16: The PMU shall provide a three wire PT100 interface.

PMUSysRQ 17: The PMU shall provide an LED based visual interface for health monitoring.

PMUSysRQ 18: The PMU shall provide two power supply interfaces.

PMUSysRQ 19: The PMU shall provide a configurable, standard CAN interface.

Document No.	Prep By	IN2244	R						Sheet 13 Of 14
	AWH	System Requirements Specification - PMU	E						

PMUSysRQ 20: All CAN configuration options shall be accessible from the configuration interface.

PMUSysRQ 21: The PMU shall provide an RS232 interface.

4.3 Mechanical

PMUSysRQ 22: The physical size shall not exceed 50 x 25 x 10 mm.

PMUSysRQ 23: All on-board components shall be soldered directly.

PMUSysRQ 24: All add-on components shall be fastened securely using washers, nuts, and locktite glue.

4.4 Environmental

PMUSysRQ 25: Natural convection cooling shall be used.

PMUSysRQ 26: The PMU shall operate at an ambient temperature range between -40 degree C and +85 degree C.

PMUSysRQ 27: The internal electronics shall be monitored by one temperature sensor per printed circuit board.

PMUSysRQ 28: The internal temperature sensor shall have accuracy of +/- 1 degree C.

PMUSysRQ 29: The PMU shall communicate an internal temperature exceeding a preconfigured temperature limit.

PMUSysRQ 30: The limits on EMI according to reference [1] shall be applied.

4.5 RAMS

PMUSafetyRQ1: The PMU shall communicate a pressure compensated pressure reading.

PMUSafetyRQ2: Hardware shall meet SIL2 requirements according to IEC61508 [3].

PMUSafetyRQ3: Software shall meet SIL3 requirements according to IEC61508 [3].

Document No.	Prep By	IN2244	R						Sheet 14 Of 14
	AWH	System Requirements Specification - PMU	E						
			C						
			N						

PMUSafetyRQ4: The process safety time shall not exceed 3s.

PMUSafetyRQ5: The PMU shall be a high demand system..