MOCAS Apparel System Specification
For Asensei

Version 2.01

Version History

Version #	Author	Revision Date	Approval	Approval Date	Reason

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1. Product Description

1.1 Motion Capture System (MOCAS Shirt & Pants) includes wearable technologies designed to capture 3D data about human movement by using sensors integrated into shirt and pants connected to a module that processes the sensor data and then wirelessly sends the data to a handheld device (tablet or smartphone) and/or Cloud.

1.2 Data from the MOCAS Shirt & Pants tracks body postures (arms, legs, spine, waist) and provides real time and historical records and detailed analysis for review by the end user and others.

1.3 10pcs of 9-axis sensors are integrated into MOCAS shirt (wrists, arms, spine) and MOCAS pants (thighs, calves, waist).

1.4 A battery powered Control Module (CM) connects the MOCAS Shirt & Pants to the Asensei App via BLE running on an iOS or Android device.

1.5 The CM supports updating the firmware via the nRF Toolbox App that will run on iOS and Android.

2. Scope

This document contains general requirements for the electrical and mechanical elements. The App is detailed in a separate specification.

3. Materials

3.1 CM: ABS (black)

3.2 Sensor Housing: PP (black)

3.3 Cable between sensors and control module: WEEL Stretchable Textile Cable (WSTC-6)

3.4 MOCAS Shirt: Fabrics – Black, 78% Nylon + 22% Spandex, Inserts - Black mesh 83% Polyester + 17% Spandex.

3.5 MOCAS Pants Fabric – Black, 78% Nylon + 22% Spandex

4. Part Numbers

CM	W01-CM01
WSTC-6	WSTC6-01
USB Charge Cable	W01-CC01

5. Control Module Electronics Characteristics

Working Voltage Max	5V
Working Current Max	70mA
Power Off Current Max	12µA
Battery Life (continuous working time)	≈3 hours
Battery Charging Time	≈2 hours
Communication Speed	UART=115200bps I2C=100khz
Sensor Data Rate	33hz
Communication Distance Max	20m

6. Battery Specification & Features

Mechanical Form Factor	30 x 20 x 4mm
Battery Type	Lithium Polymer Battery
Battery Capacity	3.7 V DC, 200mAh
Protection IC	S8261G3J
Working Environment	-20°C ~ 60°C

7. Bluetooth Specification

7.1 Work Voltage: 1.7V ~ 3.6V

7.2 Work Frequency: 2402 ~ 2480Mhz

7.3 Max Transmit Power: +4dBm (-20dBm ~ +4dBm)

7.4 Receive Sensitivity: -96dBm sensitivity in Bluetooth low energy mode

7.5 ARM Cortex-M4 32-bit processor with FPU, 64 MHz

7.6 Working Temperature: -20°C ~ 60°C

7.7 Storage Temperature: -40°C ~ 85°C

7.8 Receive Current: 5.4mA peak current

7.9 Transmit Current: 5.3mA peak current (0dBm)

8. Control Module (CM) Operation & Features

8.1 POWER ON State

8.1.1 The CM default state is POWER OFF. From the POWER OFF state, press and hold the CM button for 3 seconds to enter into the POWER ON state.

8.2 POWER OFF State

8.2.1 Under the POWER ON state, if the CM is connected to App, press and hold the CM button for 8 seconds to POWER OFF it.

8.2.2 Under the POWER ON state, if the CM is not connected to App, press and hold the CM button for 3 seconds to POWER OFF it.

8.3 RUN State

8.3.1 The CM will enter into the RUN state after it connects to the App. Under this state, the CM will acquire data from all 10 Sensors every 40ms and then send the data to the App via BLE after receiving the acquisition command from App. The CM does not store any data in memory.

8.3.2 The CM will automatically update the battery power status to App every 5 seconds.

8.3.3 Under RUN state, if the CM is disconnected from the Sensors, the CM will detect and automatically power OFF within 5 seconds.

8.4 WARNING State

8.4.1 When the CM powers ON and starts running, it will automatically check the battery power level, Bluetooth connection and sensors. If all are ok, it will enter into the proper RUN state. If any are not ok, it will enter into WARNING state by flash the red LED for 8 seconds and then power OFF.

8.5 CHARGING State

8.5.1 The CM will enter into CHARGING state and the LED will flash red when it connects the charge cable to a charger. The LED will change from flashing red to always on red when the CM completes charging. The CM will power off automatically if disconnected from the charge cable.
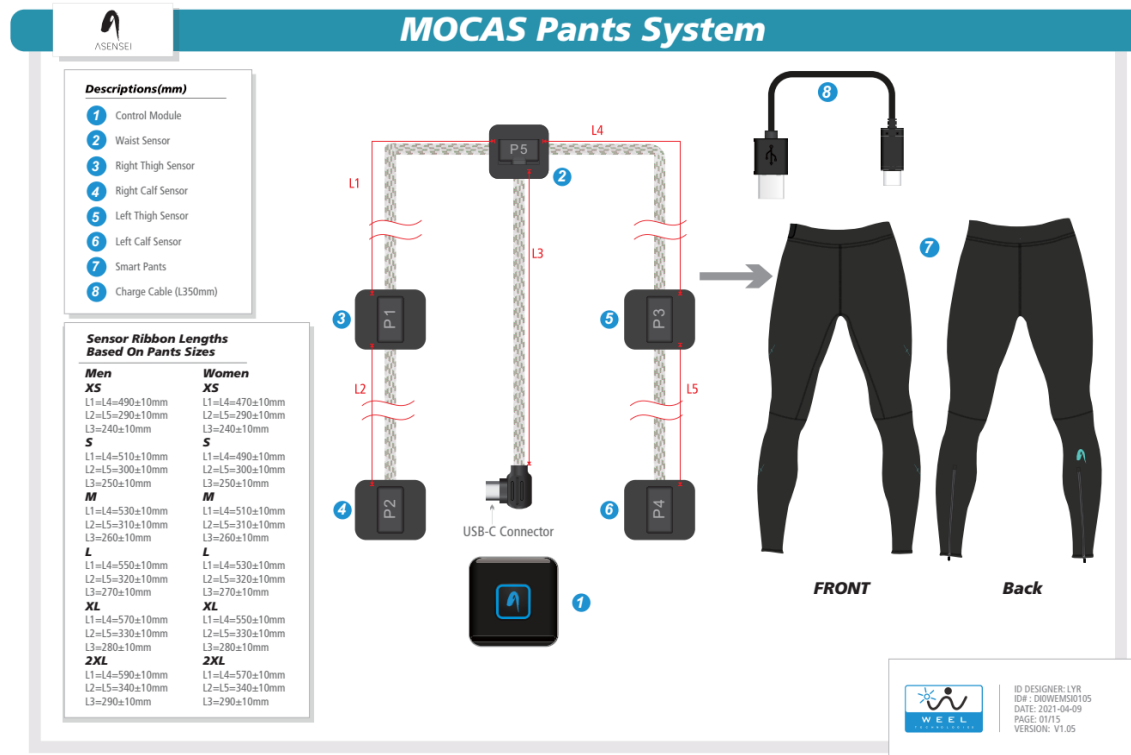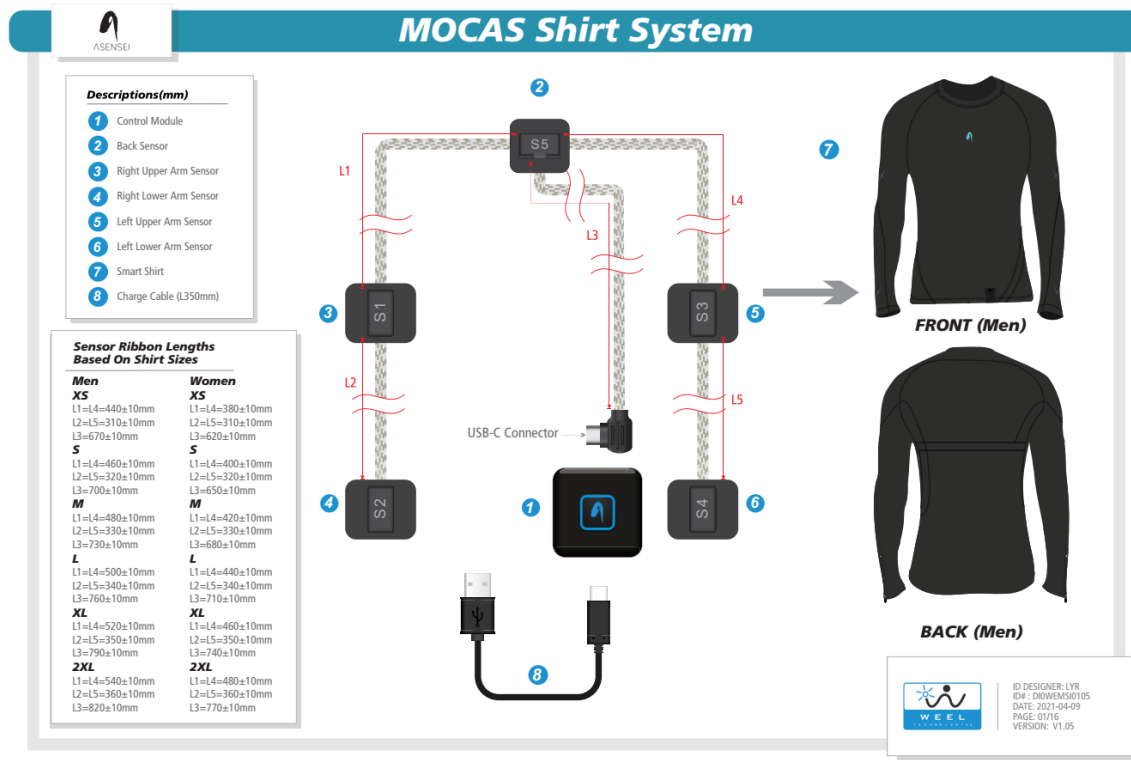
8.6 RESET State

8.6.1 If a system error occurs, press and hold the CM button for 8 seconds to reset the CM.

9. LED Functions

MOCAS Apparel System		LED Status
Power On		Blue LED fast flash 0.25S on/off, fast flash twice
Power Off		Red LED fast flash 0.25S on/off, fast flash twice
System Run	Disconnect App	Blue and Red LED alternately flash 0.2S on/off
	Connect App	Blue LED 0.5S on and 2S off
Warning Mode (system error or low battery power)		Red LED fast flash 0.25S on/off, flash 8S
Charging		Red LED 0.5S on/off
Charging Completed		Red LED always ON
System Reset		Purple LED fast flash once

Product: MOCAS Apparel

Model: Asensei

File Number: 20210608001

Date: Jun 8, 2021

10. System Drawing

MOCAS Shirt System

Descriptions(mm)

1. Control Module
2. Back Sensor
3. Right Upper Arm Sensor
4. Right Lower Arm Sensor
5. Left Upper Arm Sensor
6. Left Lower Arm Sensor
7. Smart Shirt
8. Charge Cable (L350mm)

USB-C Connector

FRONT (Men)

BACK (Men)

Sensor Ribbon Lengths Based On Shirt Sizes

Men	Women
XS L1=L4=440±10mm L2=L5=310±10mm L3=670±10mm	**XS** L1=L4=380±10mm L2=L5=310±10mm L3=620±10mm
S L1=L4=460±10mm L2=L5=320±10mm L3=700±10mm	**S** L1=L4=400±10mm L2=L5=320±10mm L3=650±10mm
M L1=L4=480±10mm L2=L5=330±10mm L3=730±10mm	**M** L1=L4=420±10mm L2=L5=330±10mm L3=680±10mm
L L1=L4=500±10mm L2=L5=340±10mm L3=760±10mm	**L** L1=L4=440±10mm L2=L5=340±10mm L3=710±10mm
XL L1=L4=520±10mm L2=L5=350±10mm L3=790±10mm	**XL** L1=L4=460±10mm L2=L5=350±10mm L3=740±10mm
2XL L1=L4=540±10mm L2=L5=360±10mm L3=820±10mm	**2XL** L1=L4=480±10mm L2=L5=360±10mm L3=770±10mm

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MOCAS Pants System

Descriptions(mm)

1. Control Module
2. Waist Sensor
3. Right Thigh Sensor
4. Right Calf Sensor
5. Left Thigh Sensor
6. Left Calf Sensor
7. Smart Pants
8. Charge Cable (L350mm)

USB-C Connector

FRONT

Back

Sensor Ribbon Lengths Based On Pants Sizes

Men	Women
XS L1=L4=490±10mm L2=L5=290±10mm L3=240±10mm	**XS** L1=L4=470±10mm L2=L5=290±10mm L3=240±10mm
S L1=L4=510±10mm L2=L5=300±10mm L3=250±10mm	**S** L1=L4=490±10mm L2=L5=300±10mm L3=250±10mm
M L1=L4=530±10mm L2=L5=310±10mm L3=260±10mm	**M** L1=L4=510±10mm L2=L5=310±10mm L3=260±10mm
L L1=L4=550±10mm L2=L5=320±10mm L3=270±10mm	**L** L1=L4=530±10mm L2=L5=320±10mm L3=270±10mm
XL L1=L4=570±10mm L2=L5=330±10mm L3=280±10mm	**XL** L1=L4=550±10mm L2=L5=330±10mm L3=280±10mm
2XL L1=L4=590±10mm L2=L5=340±10mm L3=290±10mm	**2XL** L1=L4=570±10mm L2=L5=340±10mm L3=290±10mm

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11. System Reliability Tests

Test Item	Test Condition	Result
Working Environment	1) Ambient Temperature: -20~65°C 2) Relative Humidity: ≤80%	Pass
Charge Cable Pull Test	1) End of USB: ≥10KG 2) End of USB-C: ≥10 KG	Pass
WSTC Pull Test	≥3KG	Pass
WSTC Stretch Test	Confirm stretch range: 60%	Pass
WSTC Wash Test	Test Cycle: 50 wash cycles + hang dry	Pass
WSTC Salinity Test	Soak in 5% salt water solution for 1 hour	Pass
CM Drop Test	1) Falling Height: 1m Free Fall 2) Test Cycle: 30 cycles	Pass