

CombuSense IoT

Power Measuring and Communication System

Properties and features

- Input Supply Voltage
 - + 8 - 16 [V]
- Current Measuring Range
 - + 0 up to ± 2000 [A]
 - + Hall-Effect measurement
 - + Galvanic isolation up to 4 [kV]
- Voltage Measuring Range
 - + 0 up to ± 1000
 - + Galvanic Isolation up to 4 [kV]
- Measurement accuracy
 - + 2 [%]
- Temperature Range
 - + -40 to +80 [°C]
- Communication interfaces
 - + WiFi
 - + LTE Cat M1
- Communication protocols
 - + MQTT

Description

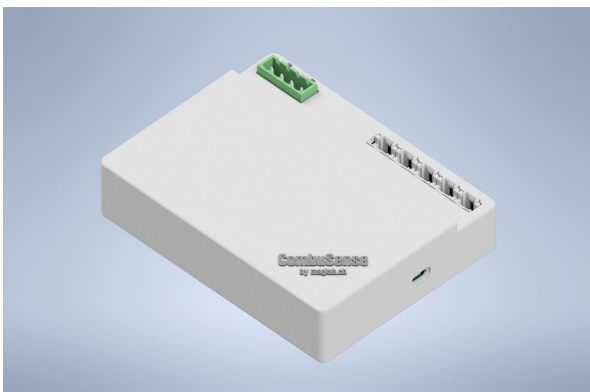
CombuSense® IoT is an Internet Of Things system platform, designed to monitor currents and voltages of electrical systems without the need of human physical interaction.

CombuSense® is an embedded system, which integrates all the necessary components to measure, compute, and transmit power/current data over the Internet.

CombuSense® IoT is specifically designed to monitor a wide range of currents and voltages, both AC and DC, of existing and new systems. Thanks to its unique current sensor technology based on a non-intrusive clamp-on, CombuSense® can be integrated without the need of modification of the existing system to be monitored.

CombuSense® IoT, is designed to cover a multitude of power measuring applications such as:

- Monitoring of Photovoltaics (PV) Solar Cells
- Monitoring of the State of charge (SOC) or depth of discharge (DOD) for battery application
- Monitoring of Power Grids
- Power Meter for home and industrial applications



System Overview

Absolute Maximum Ratings

Parameter	CMS	Unit
Supply Voltage	16	V
Maximum Current Measurement Range	±2000	Apk
Operating Temperature Range	-40 to +80	°C

Electrical Characteristics

(VCC = 12.0V, TA = 25°C, unless otherwise specified)

Parameter	Conditions	Min.	Typ.	Max.	Unit
Supply Current	Vcc = 12 V	N/D	N/D	N/D	mA
Supply Voltage		8	12	16	V
Input Sensing Range	Vcc = 12 V	0		5	V

Sensors Input Electrical Characteristics

(VCC = 12.0V, TA = 25°C, unless otherwise specified)

Parameter	Conditions	Min.	Typ.	Max.	Unit
Sensor Inputs		1		8	
Supply Voltage		4.5	5	5.5	V
Input Sensing Range	Vcc = 5 [V]	0		5	V
Signal Sensing Range	Vcc = 5 [V]	0.5		4.5	V

Current Measurement Ranges

Range [A]	Sensor Type	Description	Conductor Size
±20	Clamp-On + Hall	Clamp-On + Hall-Effect Current Sensor	Diameter 4 [mm]
±50	Clamp-On + Hall	Clamp-On + Hall-Effect Current Sensor	Diameter 4 [mm]
±150	Clamp-On + Hall	Clamp-On + Hall-Effect Current Sensor	Diameter 10 [mm]
±250	Clamp-On + Hall	Clamp-On + Hall-Effect Current Sensor	Diameter 10 [mm]
±500	LU-Shield + Hall	LU-15 + Bus-Bar + Hall-Effect CS	10 [mm] x 3 [mm]
±1000	LU-Shield + Hall	LU-20 + Bus-Bar + Hall-Effect CS	15 [mm] x 3 [mm]
±1500	LU-Shield + Hall	LU-25-3 + Bus-Bar + Hall-Effect CS	20 [mm] x 3 [mm]
±2000	LU-Shield + Hall	LU-25-4 + Bus-Bar + Hall-Effect CS	25 [mm] x 3 [mm]

Voltage Measurement Ranges

High Voltage

High voltage measurement is achieved by using a voltage divider combined with a galvanic voltage isolation barrier in order to separate the primary side (low-voltage) side from the secondary (high voltage) side.

CombuSense® can measure voltage up to 1000 [V] while guaranteeing an isolation voltage up to 4 [kV].

Range [A]	Sensor Type	Description	Conductor Size
±300	Resistive	Resistive voltage divider	N/D
±600	Resistive	Resistive voltage divider	N/D
±1000	Resistive	Resistive voltage divider	N/D

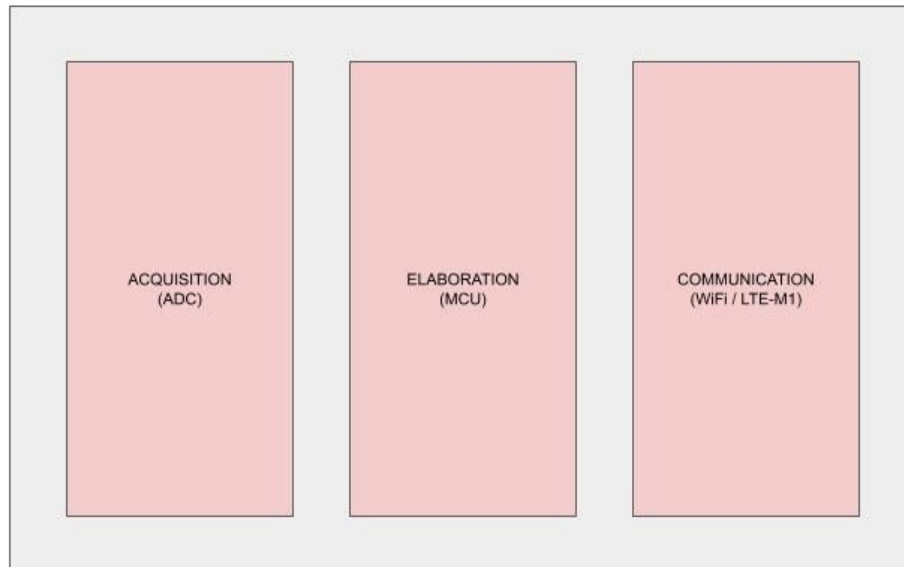
Low Voltage

Low voltage measurement is achieved by using a voltage divider.

Range [A]	Sensor Type	Description	Conductor Size
±50	Resistive	Resistive voltage divider	N/D
±100	Resistive	Resistive voltage divider	N/D

Functional Diagram

CommbuSense IoT platform can be divided into 3 subsystems



Acquisition

The acquisition subsystem is in charge of conditioning and converting the external current and voltage analog signals to digital values that will be successively used by the elaboration subsystem.

The acquisition subsystem is composed of:

- Connectors
 - + Used to attach the external sensors to the main unit
- Signal Conditioning electronics
- Analog to Digital Converter (ADC)
 - + Resolution: 12 [bits] -> for low resolution monitoring
 - + or
 - + Resolution: 16 [bits] -> for high resolution monitoring

Elaboration

The elaboration subsystem is in charge of the signal processing and elaboration coming from the acquisition subsystem and it is in charge of controlling all the system itself.

The elaboration subsystem is composed of:

- Micro Controller Unit (MCU)
- USB to Serial communication translator
- Power Unit

Communication

The communication subsystem is in charge of transmitting the gathered voltage and current information from CombuSense IoT to the Internet.

CombuSense IoT features two physical communication interfaces: WiFi and LTE Cat M1 (and NB-IoT).

The communication subsystem is composed of:

- WiFi transceiver
- LTE Cat. M1 and NB-IoT transceiver

Communication Protocols

CombuSense’s primary communication protocol is MQTT

MQTT

Message Queuing Telemetry Transport or MQTT is a standard communication protocol used to transmit data between the IoT device and an external dedicated server connected to the Internet. Due to its very light data structure MQTT protocol has become the leading standard for IoT applications.

CombuSense® uses as a standard protocol, MQTT V3.1.1. The IoT can also be enabled to use standard MQTT V3.1.

CombuSense® can authenticate with the server by:

- Username and Password
- Single Certificate Authentication (CA certificate)
- Mutual Certificate Authentication (Device and CA certificates)

