

# SOC Sense

## Nano Pico Femto Sensor Nodes

## Product Summary

SOC Robotics, Inc.

## SOC Sense Overview

Sensors have come down in price to point that using lots of them to measure the behavior of real world phenomena is now economical. In addition to the sensors a sensor network needs sensor processing technology, network interconnect and cloud applications that tie the whole system together make the data available in a meaningful way. SOC Sense is a step in that direction. It consists of sensors, sensor processing nodes, wireless network and desktop management software. The system is open as source code is provided allowing specific application tuning, enhancement and protection and complete access to the network protocol.

There are three device families – Nano, Pico and Femto – with a mix of processors, software development tools, features and performance levels. There is also a set of third party supplied modules integrated with the family to simplify and cost reduces the overall system.

## Nano Sensor Nodes

Nano sensor nodes attach to the desktop as a communication gateway, development platform and sensor node. Three different Nano devices are available Nano, NanoM and NanoMP. Each addresses a slightly different need in the system. Nano and NanoM are both development platform focused while NanoMP is a communication hub.

## Pico Sensor Nodes

Pico sensor nodes are mobile sensors that collect sensor data but with local processing capability. Each Pico is able to acquire sensor data, process it locally and act on the processed data if needed and communicate with the wireless network hub.

## Femto Sensors

Femto sensors are individual sensors that measure motion, light and environmental parameters. Motion sensors are available with 3, 6 and 9DOF axis along with environmental sensors for humidity, temperature and light.

## Third Party Devices

Nano and Pico sensor nodes make use of RF modules and displays supplied by third parties. These modules are low cost, available from multiple vendors and are tightly integrated with the software running on each device. The devices plug and play with the sensor nodes.

## Wireless Network

The wireless network is based on a third party module that uses the Nordic Semiconductor RF24L01 chip. This chip operates in the 2.4G band with 126 channels, up to 2Mbps and range up to 1Km with an antenna boost model and uses an open well documented over air protocol. Also supported is a low cost serial WiFi device to allow direct integration with a local router.

## Source Code

By making the project source available and offering multiple processor options you are not tied to a specific vendor approach or tool chain. Arduino, Atmel Studio 6.2 and CooCox are supported.

## Nano Overview

Nanos are general purpose interface boards that support popular wireless module integration with the desktop, enable 10DOF sensor application development and provide a communication link with Pico IMU sensor nodes. The Nano and NanoM both have 10DOF sensor capability while the NanoMP is primarily a wireless sensor node hub communications device.

### Features:

- Choice of processor:
  - Nano: ATxmega128A4U
  - NanoM,MP: STM32F042, STM32F072 or STM32F303
- 12bit DAC running at 1Msps
- 12-16bit A/D running at 2Msps
- USARTS (one connected to PI)
- Two SPI interface to PI
- On chip DFU boot loader for software field upgrades
- SPI interface connector for RF2401 Wireless module
- Digital IO and Analog brought to connectors
- Expansion connectors on 0.1" centers for proto board
- Real time data acquisition application communicating wirelessly with Pico sensors using RF24L01 module
- Nano, NanoM - optional MPU-9150 9DOF sensor
- Nano, NanoM - optional BMP180 barometric
- Open source application software:
  - Nano: AVR Studio 6.2
  - NanoM, MP: Coocox IDE

The Nano and NanoM is a 10DOF sensor platform for prototype development and wireless base station use. Nano comes with a real time wireless communications application that communicates with other members of the SOC Sense sensor family. Source code for the application is available for download. An onboard bootloader allows new software to be uploaded without the need for specialized programming hardware.

### RF24L01 Wireless Connector

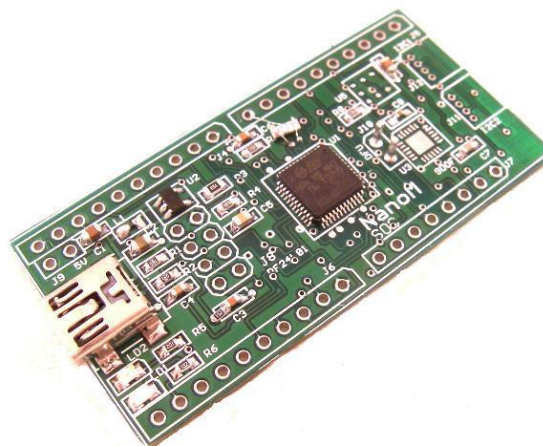
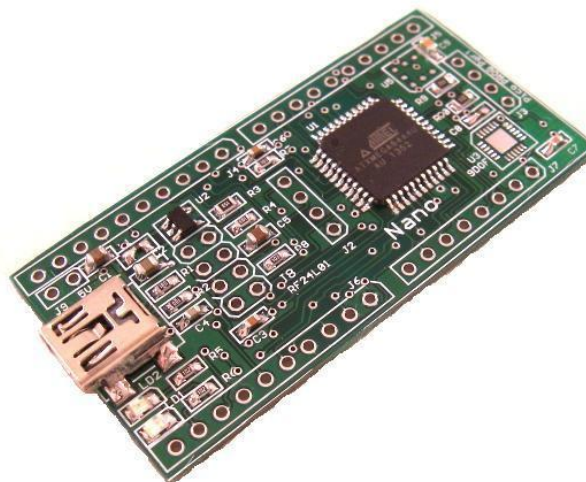
Nano has a connector that allows direct connection of a low cost RF2401 wireless communication module allowing the Nano to be a wireless base station for low cost wireless data acquisition modules.

### MPU9150 9DOF Inertial Sensor

An optional 9 Degree of Freedom Inertial sensor can be mounted. The sensor measures acceleration, rotation and magnetic heading on three axis.

### BMP180 Barometer Sensor

An optional barometer can be mounted. The barometer resolution is 75 cm.



RF Modules



RF24L01



ESP8266 WiFi

## Nano Configurations

Nanos are available in three different configurations with and without sensors. Nano has a single processor option – the ATxmega128A4U. NanoM and NanoMP are available in three different processor configurations – STM32F042, STM32F072 and STM32F303. provides analog input, analog output, digital IO, SPI, USARTs and I2C interfaces. All three have a dedicated wireless connector compatible with the popular RF24L01 wireless communication module. An optional 9 DOF Inertial sensor (MPU-9150) and barometer (BMP180) are available as well. The Nano and NanoM bring all processor signal pins to expansion ports enabling prototype development and the attachment of other sensors. All three have a dedicated connector allowing direct connection of a low cost OLED 128x64 pixel display. Nano can program Pico IMUs using the PDI programming port. Nanos also support the ESP8266 Serial WiFi module (with an adapter).

### Nano



- 10DOF (A,G,M,B)
- ATxmega128A4U
- Wireless Connector
- USB
- AVR Studio 6.2
- Project source

### NanoM



- 10DOF (A,G,M,B)
- STM32F303,72MHz, FPU (or STM32F072, 48MHz)
- Wireless Connector
- USB
- CooCox IDE
- Project source

### NanoMP



- STM32F303,72MHz, FPU (or STM32F072, 48MHz)
- Wireless Connector
- USB
- CooCox IDE
- Project source

Nanos are members of the SOC Sense wireless sensor node family of products consisting of Nano, Pico and Femto sensor nodes.

Nano/NanoMP



Pico



Femto





## Pico Overview

Picos are general purpose wireless sensor nodes with several processor and sensor options. PicoA,B,M and M305 are 10DOF sensor capable while the PicoC is 7DOF, PicoD is a humidity/temperature/light level sensor and PicoM305 is 50DOF sensor node. All Picos have USB, LiPo battery and wireless capability.

## Features:

- Choice of processor:
  - PicoA,C,D: ATxmega32E5, PIC14F45
  - PicoM: STM32F042, STM32F072 or STM32F303
  - PicoM305: STM32F303
- 12bit DAC running at 1Msps
- 12-16bit A/D running at 2Msps
- USARTS (one connected to PI)
- Two SPI interface to PI
- On chip DFU boot loader for software field upgrades
- SPI interface connector for RF2401 Wireless module
- Digital IO and Analog brought to connectors
- Expansion connectors on 0.1" centers for proto board
- OLED and Color TFT display support
- Real time data acquisition application communicating wirelessly with Pico sensors using RF24L01 module
- PicoA,B,M - Optional MPU-9150 9DOF sensor
- PicoA,B,C,D,M - optional BMP180 barometric
- Open source application software:
  - PicoA,C,D: AVR Studio 6.2
  - PicoB: AVR Studio 6.2, Arduino
  - PicoM, PicoM305: CoCoX IDE

The PicoA,B,M and M305 are a 10DOF sensor node for and wireless base station use. Nano comes with a real time wireless communications application that communicates with other members of the SOC Sense sensor family. Source code for the application is available for download. An onboard bootloader allows new software to be uploaded without the need for specialized programming hardware.

## RF24L01 Wireless Connector

Each Pico has a connector that allows direct connection of a low cost RF2401 wireless communication module allowing completely mobile wireless operation.

## MPU-9150 9DOF Inertial Sensor

An optional 9 Degree of Freedom Inertial sensor can be mounted. The sensor measures acceleration, rotation and magnetic heading on three axis.

## BMP180 Barometer Sensor

An optional barometer can be mounted. The barometer resolution is 75 cm.

PicoA



PicoB



PicoC



PicoD



PicoM



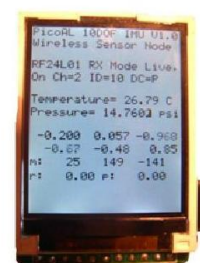
PicoM305



OLED 128x64



Color TFT 128x160



RF Modules



RF24L01



ESP8266 WiFi

## Femto Overview

Femtos are small individual sensors for motion detection, light level and environment parameter monitoring. Femtos are peripherals that add additional sensor data input to Pico sensor nodes. For example, by using fifteen FemtoB 6DOF sensors real time finger tracking becomes possible.

### Features:

- 3,6,9 DOF motion sensors
- RGB light sensors
- I2C communication
- Very small size
- Compatible with Nano and Pico sensor nodes
- Software application library included with Pico

The PI communicates with Paella using either a serial USART or high speed SPI connection. The ATxmega16E5 can be instructed by the user to execute complicated real time data acquisition/monitoring functions without PI intervention.

Pico software drivers are available to integrate Femto sensors.

### Software Drivers

Each Femto sensors comes with the appropriate driver software to allow quick integration with a Pico or Nano sensor node.

#### FemtoA



- 10DOF
- 3-Axis Accel
- 3-Axis Gyro
- 3-Axis Mag
- I2C Interface
- 2 Sensors per chain

#### FemtoB



- 6DOF
- 3-Axis Accel
- 3-Axis Mag
- I2C Interface
- 4 Sensors/chain

#### FemtoC



- 3DOF
- 3-Axis Accel
- I2C Interface
- 2 Sensors/chain

#### FemtoD



- 3DOF
- 3-Axis Gyro
- I2C Interface
- 2 Sensors/chain

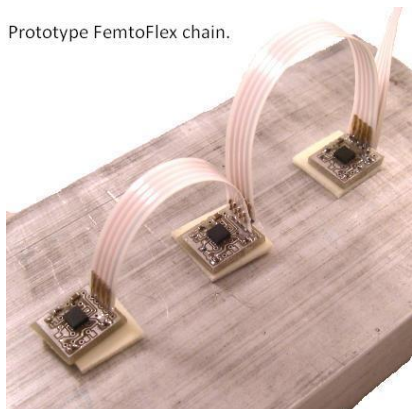
#### FemtoE



- RGC Color
- Light level
- I2C Interface

Femto sensors can be combined on a Femto flex circuit chain.

Prototype FemtoFlex chain.



FemtoB 6DOF Sensor



FemtoB uses the Freescale FXOS8700 6DOF sensor -  
3-axis accelerometer  
3-axis magnetometer