IoT MINI START KIT

All-in-one Proof Of Concept (POC) for Industrial IoT Applications

LoRaWAN™ and Bluetooth® Low Energy (BLE) ready sensor node kit.

The IoT Mini Start Kit from TE Connectivity (TE) is a wireless platform featuring Bluetooth® and LoRaWan™ communication, this all-in-one kit can help engineers get started with developing IoT applications and enable them to quickly extract data and achieve success in real time.

The IoT Mini Start Kit provides an end-to-end solution which includes embedded sensors, wireless communication, and cloud data visualization all packaged in an easy-to-use module. Based on the unique needs of your application, this compact, battery-operated device can measure humidify, barometric pressure, 6 axis accelerations and temperature.

TE's IoT Mini Start Kit uses the LoRaWan™ communication protocol, offering a simple, reliable and secure means of testing wireless sensors to check in real conditions. IoT Mini Start Kit is ideal for CUSTOMERS to rapidly plug-and-play into their PoC application, with the industrial sensors required for their application like maintenance into plant areas where the cost to install wired systems is prohibitive, making data available to existing process control and information systems.

SENSORS

- Humidity
- Pressure
- Vibration
- Temperature

Contact TE for more information.

BENEFITS

- All-in-one IoT rapid PoC with multiple embedded sensors
- Flexible solution with compatible TE industrial sensors (force, pressure, temperature and vibration)
- Reduced installation costs – no wires or cables
- Certified for harsh environments
- Ability for growth with quick and scalable deployment
- Easy movable platform for evaluation
- Configurable periodic measurements
- Up to 5-year battery life
- Low power consumption radio operating on LoRaWAN™ protocol
- Instant turn-key experience over Bluetooth® with TE Sensor Tag mobile application

NOTE

- This is an evaluation kit intended for user's internal development and evaluation purposes only. It is not a finished product and may not comply with technical or legal requirements that are applicable to finished products, including, without limitation, directives or regulations relating to electromagnetic compatibility, recycling (WEE), FCC, CE or UL.
- This kit works only with the specified external TE Connectivity sensors and will be preconfigured for these sensors.

IOT MINI START FEATURES

- LoRaWAN™ Ready class-A sensor node
- Bluetooth® Low Energy 4.2
- 1xCR123(A) Battery powered
- Up to 10 years lifetime
- Region: US902-928, EU863-870, AS923, AU915-928, KR920-923
- Radio transmission up to 10km in open field
- 30 minutes default sampling period, customizable from LoRaWAN™ downlink

SPECIFICATION

EMBEDDED ENVIRONMENTAL DATA

Parameters		Unit	Notes
Operating Temperature	-20°C to +85°C	°C	
Temperature Measurements	-20°C to +85°C	°C	
Temperature Accuracy	±0.5°C	°C	
Humidity Measurements	0% RH to 100% RH	% RH	
Humidity Accuracy	±3%RH from 30%RH to 85%RH	% RH	
Pressure Measurements	300 to 1200mBar	mBar	
Pressure Accuracy	±4mBar full scale	mBar	
Power Supply	+3	VDC	
Battery	CR123 Long-life Lithium		Replaceable
Total Supply Current	<50	mA	
Battery Life	5 years typical		See other charts
Wireless Protocol	LoRaWAN™ Class-A		
Region	EU868 or US915		Other regions available upon request
Activation	OTAA	MHz	
Activation Keys	Factory Defined		Customization available upon request
Environmental Rating	IP65		
Material	PC Case		
Weight	90	g	Without cell

DIMENSIONS (MILLIMETERS)
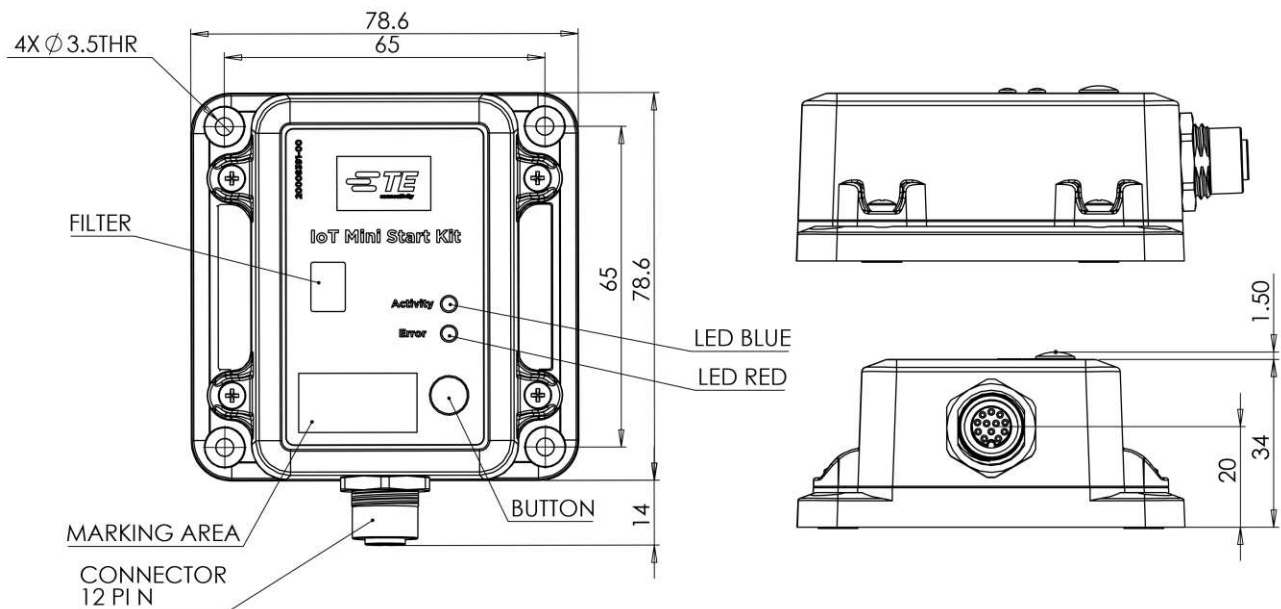
CONNECTOR PINOUT
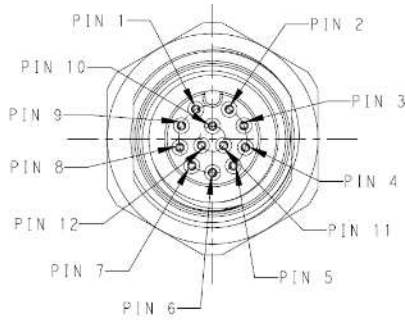
PIN 1	NSS		
PIN 2	MISO	SDA	RS232 TX
PIN 3	MOSI		
PIN 4	SCK	SCL	RS232 RX
PIN 5	Power Select		
PIN 6	Analog In 1		
PIN 7	Analog In 2		
PIN 8	*Reserved*		
PIN 9	*Reserved*		
PIN 10	GND		
PIN 11	VDD		
PIN 12	*Reserved*		

Mating connector PN 6-2271110-2.

EMBEDDED SENSORS

LORAWAN™ PAYLOAD

The sensor node conforms the Cayenne Low Power Payload protocol which provides a convenient and easy way to send data over LPWAN networks. However, the current definition does not contain all required types, so the protocol is enhanced in the following way:
- The pressure data type is added to represent pressure sensed by external pressure sensors.
- The Direction data type is added to represent the pitch and roll angle of the device relative to the horizon.

The following table shows the original cayenne Types definition and appends the ones added by this sensor:

Type	IPSO	LPP	Hex	Data Size	Data Resolution per bit
Digital Input	3200	0	0	1	1
Digital Output	3201	1	1	1	1
Analog Input	3202	2	2	2	0.01 Signed
Analog Output	3203	3	3	2	0.01 Signed
Illuminance Sensor	3301	101	65	2	1 Lux Unsigned MSB
Presence Sensor	3302	102	66	1	1
Temperature Sensor	3303	103	67	2	0.1 °C Signed MSB
Humidity Sensor	3304	104	68	1	0.5 % Unsigned
Accelerometer	3313	113	71	6	0.001 G Signed MSB per axis
Barometer	3315	115	73	2	0.1 hPa Unsigned MSB
Gyrometer	3334	134	86	6	0.01 °/s Signed MSB per axis
GPS Location	3336	136	88	9	Latitude: 0.0001° Signed MSB
					Longitude: 0.0001° Signed MSB
					Altitude: 0.01meter Signed MSB
Pressure	3323	123	7b	2	0.01 Bar
Direction	3332	132	84	2	0.01 degree Signed MSB
FFT Peaks Algorithm	N/A	200	c8	45	cf. below

UPLINK PAYLOAD

Standard Uplink payload channels:

	Channel	Range	Type
Battery Percentage (%)	1	0 – 100	Analog Input
Ambient Temperature (°C)	2	-40 – 85	Temperature Sensor
Relative Humidity (%)	3	0 – 100	Humidity Sensor
Barometric Pressure (hPa)	4	300 – 1200	Barometer
Pitch (°)	5	-180 – 180	Direction
Roll (°)	6	-180 – 180	Direction

DOWNLINK PAYLOAD

	Port	Range
Device Period Configuration	11	60s – 24h

Custom payload available upon request.

BATTERY LIFE

The sensor battery life will greatly depend on LoRa® spread factor, therefore, on sensor proximity from a gateway and network quality.
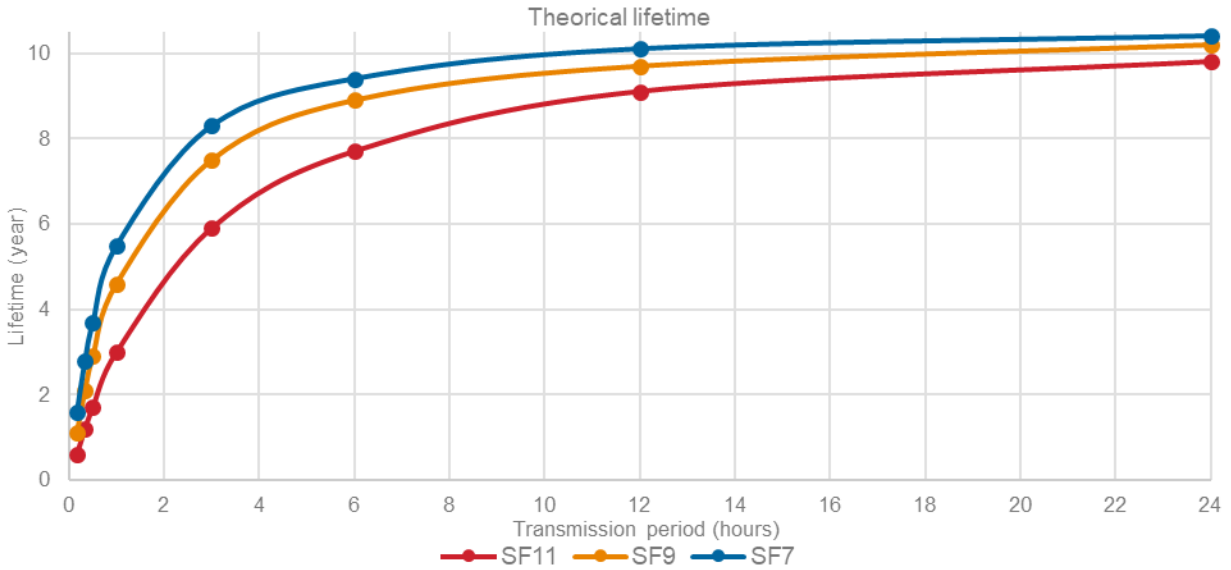
NB:

*Battery life is a theoretical value. Battery life is negatively affected by moisture, high temperature, dirt, vibration and more. Most battery manufacturers guarantee maximum 10 years of battery life (storage and usage).

*Battery life time would be affected by optional external sensor connected.

LEDs

The IoT Mini Start Kit features 2 LEDs that indicate its status, a blue one and a red one. The LEDs will have different behaviors depending on whether the sensor is plugged in to a computer through a USB cable.

BLUE

- will light-up for two seconds when sensor requests to join LoRaWAN™ network, and receives join acceptation
- will light-up shortly when sensor samples data, transmits LoRaWAN™ payload, receives acknowledgement

RED

- will light-up for two seconds if the LoRaWAN™ network join request is not accepted
- will light-up short shortly if a transmitted LoRaWAN™ payload is not acknowledged

WORKFLOW

When the TE IoT Mini Start Kit powers up it performs a self-diagnostic then tries to join the LoRaWAN™ network using OTAA. The Strat Kit tries to join the network every 10 second and increases the join timer at every failed attempt by 20%, up to 1 hour maximum. After successful join the TE IoT Mini Start Kit enters sampling mode.
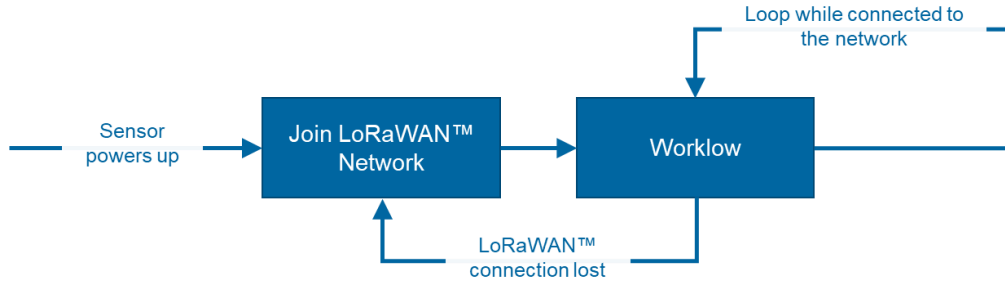
Once a LoRaWAN™ network has been joined, the Start Kit will loop through this workflow with a user defined period. If the LoRaWAN™ transmission fails too many times the Start Kit will consider it has left the LoRaWAN™ network and will go back to joining a network.
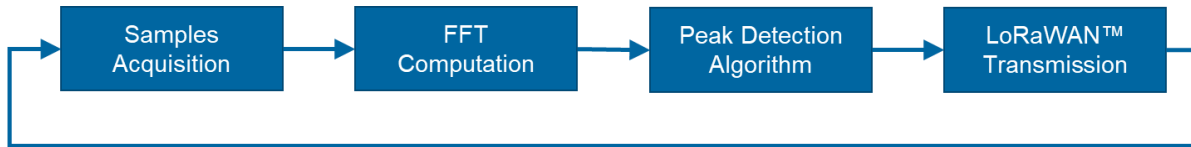
Pressing the push button on the Start Kit at any point during the product's life cycle will automatically trigger a new capture and data analysis.

BLUETOOTH® LOW ENERGY (BLE)

BLE connection can be initiated by pressing the button. The LED blinks Blue once ready to connect. The TE Sensor Tag application available on App Store and Google Play can be used to connect to IoT Mini Start Kit and retrieve sensor data.

EMBEDDED HUMIDITY SENSOR (TE HTU21D)

Service UUID	b614c010-b14a-40a6-b63f-0166f7868e13

Characteristics	UUID	Bytes	Read / Write	Notified
Data	b614c011-b14a-40a6-b63f-0166f7868e13	8	Read	YES

Bytes	0	1	2	3	4	5	6	7
Data	Humidity (%RH)				Temperature (°C)			

All fields are floating point numbers (IEEE 754), LSB first.

Please refer to HTU21D sensor datasheet for more information.

EMBEDDED BAROMETRIC PRESSURE SENSOR (TE MS5637)

Service UUID	b614c020-b14a-40a6-b63f-0166f7868e13

Characteristics	UUID	Bytes	Read / Write	Notified
Data	b614c021-b14a-40a6-b63f-0166f7868e13	8	Read	YES

Bytes	0	1	2	3	4	5	6	7
Data	Pressure (hPa)				Temperature (°C)			

All fields are floating point numbers (IEEE 754), LSB first.

Please refer to MS5637 sensor datasheet for more information.

EMBEDDED PITCH & ROLL SENSOR (STM LSM6DSL)

Service UUID	b614c0f0-b14a-40a6-b63f-0166f7868e13

Characteristics	UUID	Bytes	Read / Write	Notified
Data	b614c0fc-b14a-40a6-b63f-0166f7868e13	8	Read	YES

Bytes	0	1	2	3	4	5	6	7
Data	Pitch (rad)				Roll (rad)			

All fields are floating point numbers (IEEE 754), LSB first.

Please refer to LSM6DSL sensor datasheet for more information.

BATTERY

Service UUID	b614c000-b14a-40a6-b63f-0166f7868e13

Characteristics	UUID	Bytes	Read / Write	Notified
Data	b614c001-b14a-40a6-b63f-0166f7868e13	4	Read	YES

Bytes	0	1	2	3
Data	Level (%)			

All fields are floating point numbers (IEEE 754), LSB first.

EXTERNAL OPTIONAL SENSORS

The following tables define how the external sensors data is output in the BLE or LoRaWAN™ frame.
- The LoRaWAN™ profile column defines the format of the data that this sensor will generate on the LoRaWAN™ uplink frame.
- The BLE Profile column defines the format of the data that this sensor will generate on the BLE link, as well as it's specific Service and Characteristic UUID.

The format for each profile mentioned is detailed after the tables.

PRESSURE

PN / Web link	Description
M32JM-000105-100PG M32JM-000105-05KPG	M3200 Pressure Transducer

Even though sensor output is in PSI, the mini start publishes the value in Bar as stated by the LPP protocol used.

LORAWAN™ PROFILE: PRESSURE

	Channel	Range	Type
External Temperature (°C)	7	-40 – 125	Temperature
External Pressure (Bar)	8	0 – 350	Pressure

BLE PROFILE:

Service UUID	b614c130-b14a-40a6-b63f-0166f7868e13

Characteristics	UUID	Bytes	Read / Write	Notified
Data	b614c131-b14a-40a6-b63f-0166f7868e13	8	Read	YES

Bytes	0	1	2	3	4	5	6	7
Data	Pressure (Bar)				Temperature (°C)			

All fields are floating point numbers (IEEE 754), LSB first.

TEMPERATURE

LORAWAN™ PROFILE: TEMPERATURE

	Channel	Range	Type
External Temperature (°C)	7	-40 – 125	Temperature

BLE PROFILE:

Service UUID	b614c120-b14a-40a6-b63f-0166f7868e13

Characteristics	UUID	Bytes	Read / Write	Notified
Data	b614c121-b14a-40a6-b63f-0166f7868e13	4	Read	YES

Bytes	0	1	2	3
Data	Temperature (°C)			

All fields are floating point numbers (IEEE 754), LSB first.

PN / Web link	Description
GA10K3435STM010	Temperature Sensor Probe

LORAWAN™ PROFILE: TEMPERATURE

	Channel	Range	Type
External Temperature (°C)	7	-40 – 125	Temperature

BLE PROFILE:

Service UUID	b614c180-b14a-40a6-b63f-0166f7868e13

Characteristics	UUID	Bytes	Read / Write	Notified
Data	b614c181-b14a-40a6-b63f-0166f7868e13	4	Read	YES

Bytes	0	1	2	3
Data	Temperature (°C)			

All fields are floating point numbers (IEEE 754), LSB first.

VIBRATION

PN / Web link	Description	
8201-0025	Accelerometer	

LORAWAN™ PROFILE: TEMPERATURE

	Channel
FFT Peaks Algorithm	9

Bytes	0	1	2	3	4	5	6	7	8	9	…
Data	Total Energy (MSB First)		Integration Size (MSB First)		**n** Peaks Detected	Peak 1 Frequency (MSB first)		Peak 1 Magnitude (MSB first)		Peak 1 Ratio	…

BLE PROFILE:

Service UUID	b614c170-b14a-40a6-b63f-0166f7868e13

Characteristics	UUID	Bytes	Read / Write	Notified
Data	b614c171-b14a-40a6-b63f-0166f7868e13	45	Read	YES

Bytes	0	1	2	3	4	5	6	7	8	9	…
Data	**n** Peaks Detected	Total Energy (LSB First)		Integration Size (LSB First)		Peak 1 Frequency (LSB first)		Peak 1 Magnitude (LSB first)		Peak 1 Ratio	…

NB: Frequency, Magnitude, Ratio pattern will repeat **n** times.

- Total Energy is the total energy (integrated over the whole FFT)
- Integration Size is the size of the integration around the peak. For each peak detected, the embedded algorithm will integrate over a range around the peak to measure the relative energy around this peak, and will also have the effect to disable detection of new peaks around this detected peak
- Frequency is the center frequency of the peak detected
- Magnitude is the magnitude value of the peak detected
- Ratio is the locally integrated (over 'Integration Size' Hz) around this peak compared to the total energy

Data conversion:

	Range	Resolution	Offset	Error code
Total Energy (g)	0 – 40	0.001g / bit	0g	N/A
Integration Size (Hz)	0 – 18000	1Hz / bit	0Hz	N/A
Frequency (Hz)	0 – 18000	1Hz / bit	0Hz	N/A
Magnitude (g)	0 – 40	0.001g / bit	0g	N/A
Ratio (%)	0 – 100	1% / bit	0%	N/A

Characteristics	UUID	Bytes	Read / Write	Notified
Data	b614c172-b14a-40a6-b63f-0166f7868e13	5	Read	NO

Bytes	1	2	3	4	5
Data	Max Peaks	Sampling Frequency (LSB First)		Sample Count (LSB First)	

Data conversion:

	Range	Resolution	Offset	Error code
Max Peaks	0 – 8	1 / bit	0	N/A
Sampling Frequency (Hz)	0 – 36000	1Hz / bit	0Hz	N/A
Sample Count	0 – 4096	1 / bit	0	N/A

REFERENCE MATERIALS

Sensor Tag mobile phone application installation guidelines.

ORDERING INFORMATION

DESCRIPTION	PART NUMBER
IoT Mini Start	20011530-00
IoT Mini Start Kit – High Pressure	20011526-00
IoT Mini Start Kit – Low Pressure	20011527-00
IoT Mini Start Kit – Vibration	20011528-00
IoT Mini Start Kit – Temperature	20011529-00