

PyroMiniUSB Series

Operator's Guide



CALEX
ELECTRONICS LIMITED

The PyroMiniUSB is a simple, compact infrared temperature sensor with USB communications. It measures the surface temperature of a variety of materials without contact.

The included software is intuitive and easy to use, and the open Modbus protocol allows users to connect directly to the sensor using software of their own design.

The sensor's rugged construction makes it ideal for benchtop, laboratory and education applications.

SPECIFICATIONS

Model Numbers

| Field of View | Model Number |
|---------------|--------------|
| 2:1 | PMU21 |
| 20:1 | PMU201 |

| | |
|---|--|
| Interface | USB |
| Accuracy | $\pm 1\%$ of reading or $\pm 1^\circ\text{C}$ whichever is greater |
| Repeatability | $\pm 0.5\%$ of reading or $\pm 0.5^\circ\text{C}$ whichever is greater |
| Emissivity | 0.2 to 1.0 |
| Response Time, t_{90} | 125 ms (90% response) |
| Spectral Range | 8 to 14 μm |
| Supply Voltage | 5 V DC (provided by USB) |
| Supply Current | 50 mA max. |

VIRTUAL COM PORT

| | |
|------------------|--------------------------------------|
| Baud Rate | 9600 baud * |
| Format | 8 data bits, no parity, 1 stop bit * |
| Protocol | Modbus over Serial Line |

* Other configurations available upon request

CONFIGURATION

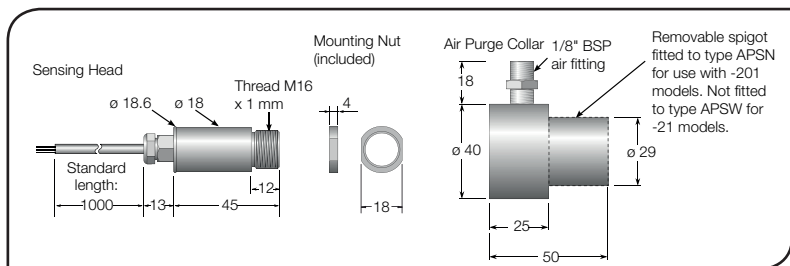
| | |
|--------------------------------|--|
| Configuration Method | Via USB using included CalexConfig software or Modbus |
| Configurable Parameters | Emissivity Setting, Averaging, Reflected Energy Compensation |

MECHANICAL

| | |
|------------------------------|---|
| Construction | Stainless Steel |
| Dimensions | 18 mm diameter x 45 mm long (excluding cable gland) |
| Thread Mounting | M16 x 1 mm pitch |
| Cable Length | 1 m standard, longer cable available to order |
| Weight with 1 m Cable | 85 g |

ENVIRONMENTAL

| | |
|-----------------------------|---|
| Environmental Rating | IP65 |
| Ambient Temperature | 0°C to 75°C |
| Relative Humidity | 95% max. non-condensing |



ACCESSORIES

A range of accessories to suit different applications and environments is available. These may be ordered at any time and added on-site. The following accessories are available:

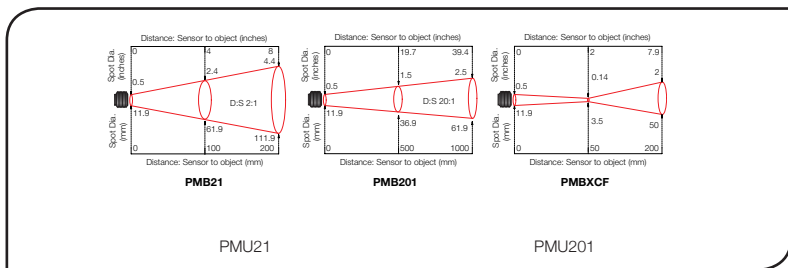
- Fixed mounting bracket
- Adjustable mounting bracket
- Air purge collar
- Laser sighting tool

OPTIONS

An optional certificate of calibration is available for newly-manufactured sensors. If required, it must be ordered at the same time as the sensor.

OPTICAL CHART

The optical chart below indicates the nominal target spot diameter at any given distance from the sensing head and assumes 90% energy.



INSTALLATION

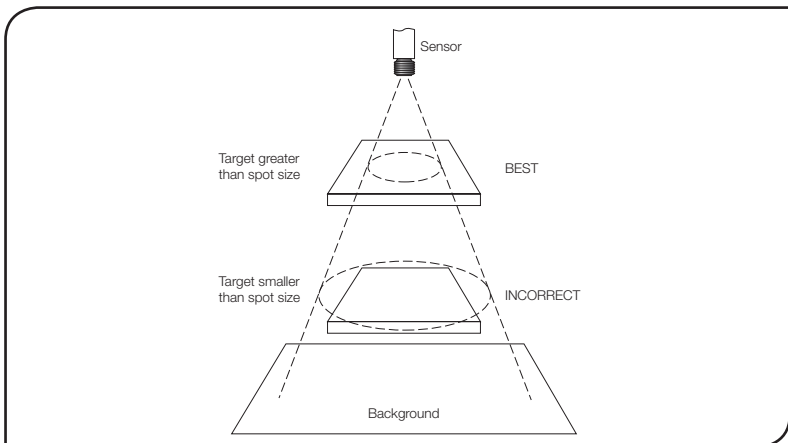
The installation process consists of the following stages:

- Preparation
- Mechanical installation
- Electrical installation

Please read the following sections thoroughly before proceeding with the installation.

PREPARATION

Ensure that the sensor is positioned so that it is focused on the target only.



DISTANCE AND SPOT SIZE

The size of the area (spot size) to be measured determines the distance between the sensor and the target. The spot size must not be larger than the target. The sensor should be mounted so that the measured spot size is smaller than the target.

AMBIENT TEMPERATURE

The sensor is designed to operate in ambient temperatures from 0°C to 75°C.

Avoid thermal shock. Allow 20 minutes for the unit to adjust to large changes in ambient temperature.

ATMOSPHERIC QUALITY

Smoke, fumes or dust can contaminate the lens and cause errors in temperature measurement. In these types of environment the air purge collar should be used to help keep the lens clean.

ELECTRICAL INTERFERENCE

To minimise electromagnetic interference or 'noise', the sensor should be mounted away from motors, generators and such like.

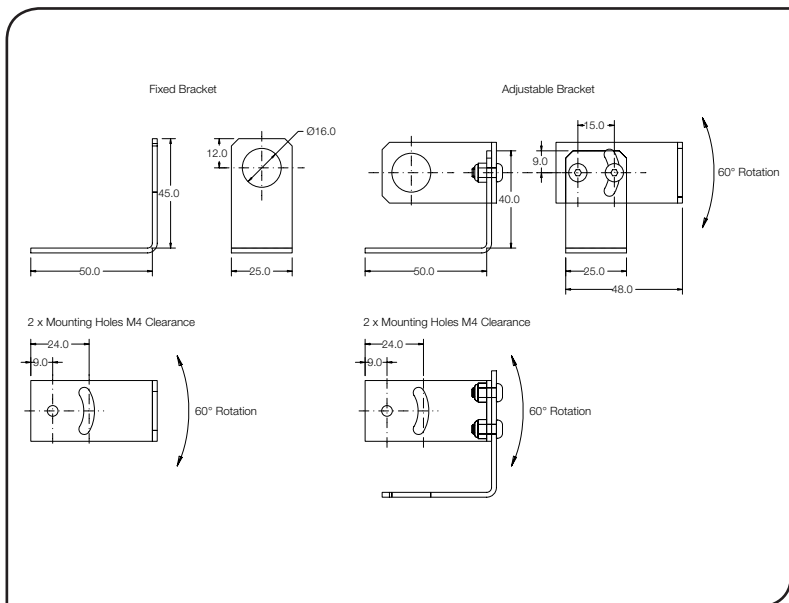
MECHANICAL INSTALLATION

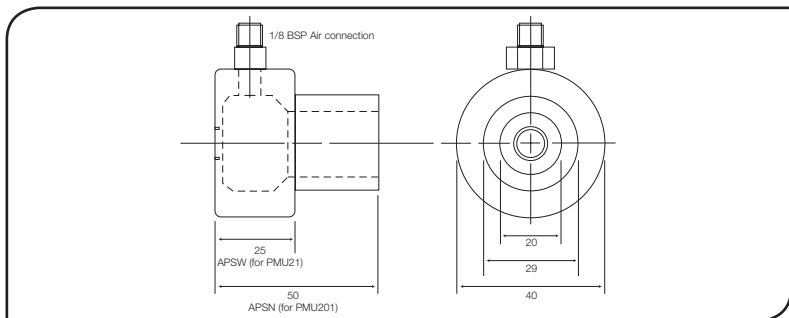
All sensors come with a 1.5 m USB cable and a mounting nut. The sensor can be mounted on brackets, clamps or cut outs of your own design, or you can use the fixed and adjustable mounting bracket accessories which are shown below.

AIR PURGE COLLAR

The air purge collar below is used to keep dust, fumes, moisture, and other contaminants away from the lens. It must be screwed in fully. Air flows into the 1/8" BSP fitting and out of the front aperture. Air flow should be no more than 5 to 15 litres/min.

Clean or 'instrument' air is recommended.





SOFTWARE

The sensor may be used with a choice of software: CalexConfig (for one sensor), CalexSoft 2 (for multiple sensors), or third-party Modbus software.

See MODBUS OVER SERIAL LINE for details of the Modbus registers.

System Requirements:

Windows 7 or newer (CalexConfig: Windows Vista or newer)

USB 2.0 port

Internet access (for software download)

Installation

NOTE: Do not connect the sensor until the software has been fully installed. The software will tell you when to connect the sensor. This will ensure the USB driver for the sensor is installed properly.

1. Download the Calex software free of charge at www.calex.co.uk/software.
2. Unzip the files and run Setup.exe.
3. Follow the on-screen instructions.

Using the Software for the First Time

1. After the software has been installed, when prompted, connect the sensor to an available USB 2.0 port.
2. Start Calex software using the desktop icon.

SOFTWARE FUNCTIONS

Temperature Units

Click °C or °F to switch between Celsius and Fahrenheit.

Graph

The graph is a scrolling chart of the measured temperature.

Unlocking the Software

The software settings are locked by default. To unlock the software, click the Unlock icon, enter the password, then click the Unlock icon again.

The default password is 1234. This can be changed on the Lock/Unlock screen.

Settings

The sensor is fully configurable via the Settings menu.

Output Processing

The sensor has a response time of 125 ms. If this is too fast, or to minimise the the effects of temperature fluctuations or noise on the measurement, the averaging period can be set between 0 and 60 seconds.

If required, hold processing can be applied by setting Hold Mode to "Peak" or "Valley" and setting the hold period. This is useful if the temperature reading is interrupted by gaps between moving objects, or by an obstruction.

Emissivity Setting

Enter the desired emissivity setting here. Emissivity can be set between 0.2 and 1.0.

For an accurate temperature reading, the sensor's emissivity setting should match the actual emissivity of the target surface.

Non-reflective non-metals, such as rubber, foods, thick plastics, organic materials and painted surfaces, generally have a high emissivity, around 0.95. This is the default setting.

Bare, clean metal surfaces can have a very low emissivity, and are often difficult to measure accurately. If possible, a measurable area of the surface should be painted or coated to reduce reflections and increase the emissivity.

For more information about emissivity, contact Calnex.

Reflected Energy Compensation

In most applications, the target surface has the same surroundings as the sensor (for example, it is in the same room). In this case, Reflected Energy Compensation should remain disabled for an accurate measurement.

However, if the sensor is positioned outside an oven or furnace, with the target surface inside, the reflection of the hot furnace interior can affect the measurement. In this case, Reflected Energy Compensation should be enabled, and set to the temperature inside the oven or furnace.

MODBUS OVER SERIAL LINE

INTERFACE

| | |
|-------------------------|---------------------------|
| Baud rate | 9600 |
| Format | 8 data, No parity, 1 stop |
| Reply delay (ms) | 20 |

SUPPORTED FUNCTIONS

| | |
|--------------------------------|------------|
| Read register | 0x03, 0x04 |
| Write single register | 0x06 |
| Write multiple register | 0x10 |
| Mask write register | 0x17 |

The list below includes all available addresses:

R = Read, W = Write

| Address | Length (words) | Description | R/W |
|---------|----------------|---|-----|
| 0x00 | 1 | Sensor Type (16 for PyroMiniUSB, 17 for PyroMiniBus) | R |
| 0x01 | 1 | Field of view 0 for 2:1; 1 for 20:1 | R |
| 0x02 | 2 | Serial number | R |
| 0x04 | 1 | Modbus slave address | R/W |
| 0x05 | 1 | Reflected Energy Compensation 0 for Off; 1 for On | R/W |
| 0x06 | 1 | Reflected Temperature | R/W |
| 0x07 | 1 | Emissivity (1 LSB = 0.0001) Minimum 0.2000, Maximum 1.0000 | R/W |
| 0x08 | 1 | Hold Mode 0 for Off; 1 for Peak; 2 for Valley | R/W |
| 0x09 | 1 | Hold Period (1 LSB = 0.1 seconds) Minimum 0.1 seconds, Maximum 1200.0 seconds | R/W |
| 0x0A | 1 | Average Period (1 LSB = 0.1 seconds) Minimum 0.1 seconds, Maximum 60.0 seconds | R/W |
| 0x0B | 1 | Average Temperature | R |
| 0x0C | 1 | Minimum Temperature | R |
| 0x0D | 1 | Maximum Temperature | R |
| 0x0E | 1 | Filtered Temperature | R |
| 0x0F | 1 | Unfiltered Temperature | R |
| 0x10 | 1 | Sensor Temperature | R |
| 0x11 | 1 | Status (bits active high) Bit 0: Measurement error Bit 1: Sensor temperature low Bit 2: Sensor temperature high Bit 3: Object temperature low Bit 4: Object temperature high | R |
| 0x16 | 1 | Reflected Temperature (not saved to non-volatile memory) | R/W |
| 0x17 | 1 | Emissivity (not saved to non-volatile memory) | R/W |

Notes:

1. All temperature are in tenths of degrees C
2. With the exception of addresses 0x16 and 0x17, all write operations are saved to non-volatile memory
3. For further information please refer to <http://www.modbus.org/specs.php>
4. Use address 255 to communicate with any connected sensor (only one sensor connected)
5. Use address 0 to broadcast to all connected sensors (no response expected)

OPERATION

Once the sensor is in position and the appropriate power, air, water, and cable connections are secure, the system is ready for continuous operation by completing the following simple steps:

1. Turn on the power supply
2. Turn on the Modbus Master
3. Read / monitor the temperature

IMPORTANT

Be aware of the following when using the sensor:

- If the sensor is exposed to significant changes in ambient temperature (hot to cold, or cold to hot), allow 20 minutes for the temperature to stabilise before taking or recording measurements.
- Do not operate the sensor near large electromagnetic fields (e.g. around arc welders or induction heaters). Electromagnetic interference can cause measurement errors.
- Wire must be connected only to the appropriate terminals.

MAINTENANCE

Our customer service representatives are available for application assistance, calibration, repair, and solutions to specific problems. Contact our Service Department before returning any equipment. In many cases, problems can be solved over the telephone. If the sensor is not performing as it should, try to match the symptom below to the problem. If the table does not help, call Calex for further advice.

| Troubleshooting | | |
|--|---|---|
| Symptom | Probable Cause | Solution |
| Sensor cannot be found, or software will not start | Software or USB driver failed to install properly | Disconnect sensor. Uninstall software. Reinstall as Administrator (right-click the installer and select "Run As Administrator"). Do not connect the sensor until prompted by the installer. |
| Software will not start, or will not install | Incompatible Windows version | Check System Requirements: Calex software requires Windows 7 or newer. CalexConfig also works on Windows Vista. |
| Erroneous temperature | Field of view obstruction | Remove obstruction. |

LENS CLEANING

Keep the lens clean at all times. Any foreign matter on the lens would affect measurement accuracy. Blow off loose particles (if not using the air purge accessory) with an air 'puffer'.

GUARANTEE

Calex guarantees each instrument it manufactures to be free from defect in material and workmanship under normal use and service for the period of two years from the date of purchase. This guarantee extends only to the original buyer according to Calex terms and conditions of Sale.

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