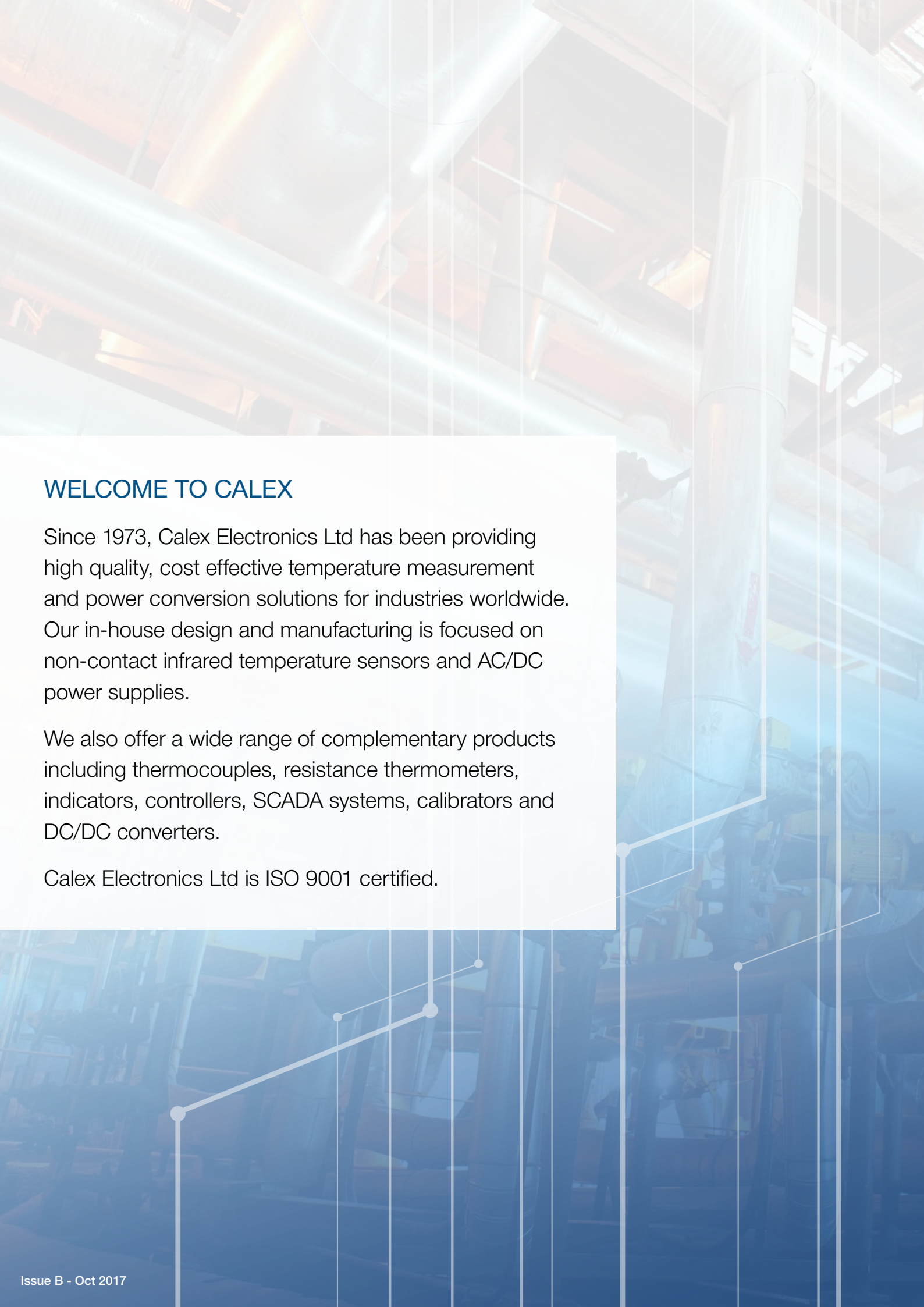
CALEX
ELECTRONICS LIMITED

resitec®
componentes industriais

catalogue

innovative infrared **temperature sensors**
low-noise industrial **power supplies**



WELCOME TO CALEX

Since 1973, Calex Electronics Ltd has been providing high quality, cost effective temperature measurement and power conversion solutions for industries worldwide. Our in-house design and manufacturing is focused on non-contact infrared temperature sensors and AC/DC power supplies.

We also offer a wide range of complementary products including thermocouples, resistance thermometers, indicators, controllers, SCADA systems, calibrators and DC/DC converters.

Calex Electronics Ltd is ISO 9001 certified.

Issue B - Oct 2017

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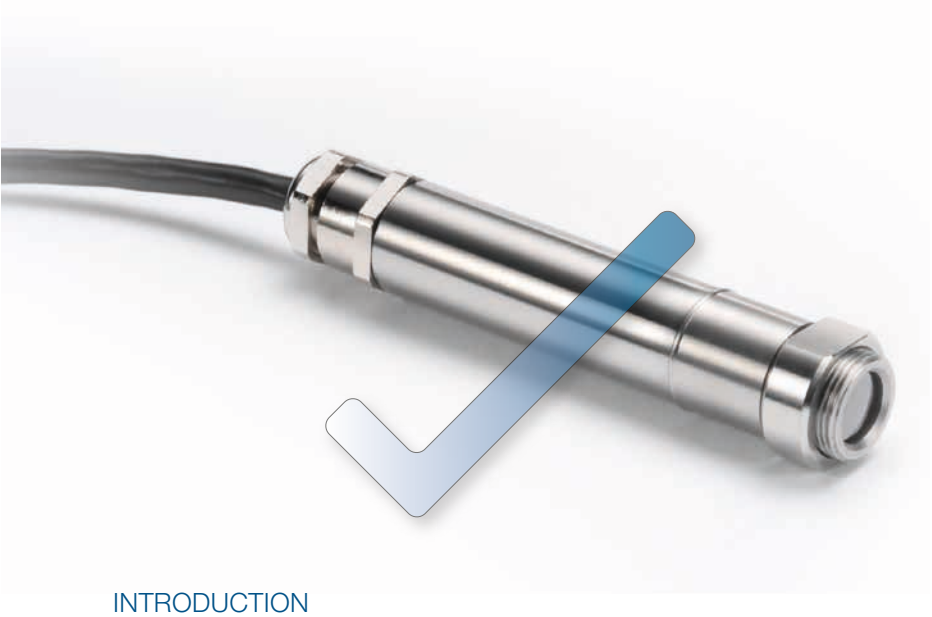


choosing a sensor

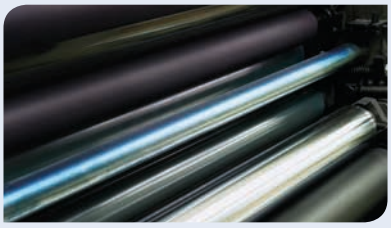
INTRODUCTION

The sensor detects the infrared radiation emitted by an area of the target surface, and converts this into a useful temperature measurement.

There are 3 main factors affecting the accuracy of the measurement:

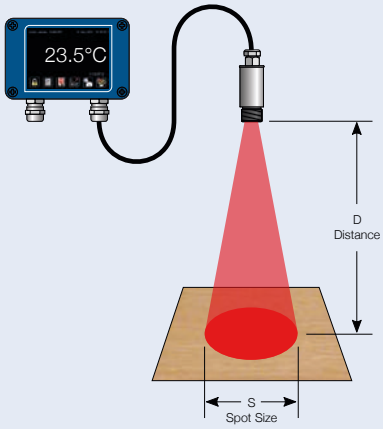
TYPE OF MATERIAL

Most non-reflective materials, such as paper, cardboard, asphalt, food, plastics, rubber and painted surfaces are easy to measure with a general-purpose, long-wavelength sensor.



Some materials, such as reflective metals, may require a specialised short-wavelength sensor for accurate results.

TARGET SIZE AND DISTANCE



The sensor measures the average temperature within an area on the target surface. The size of this area depends on the sensor's optics.

A choice of optics is available for most sensors. The size of the target and the measurement distance determine which optics should be chosen.

For each choice of optics, the spot size at any given distance can be determined using the D:S (Distance to Spot Size) ratio.

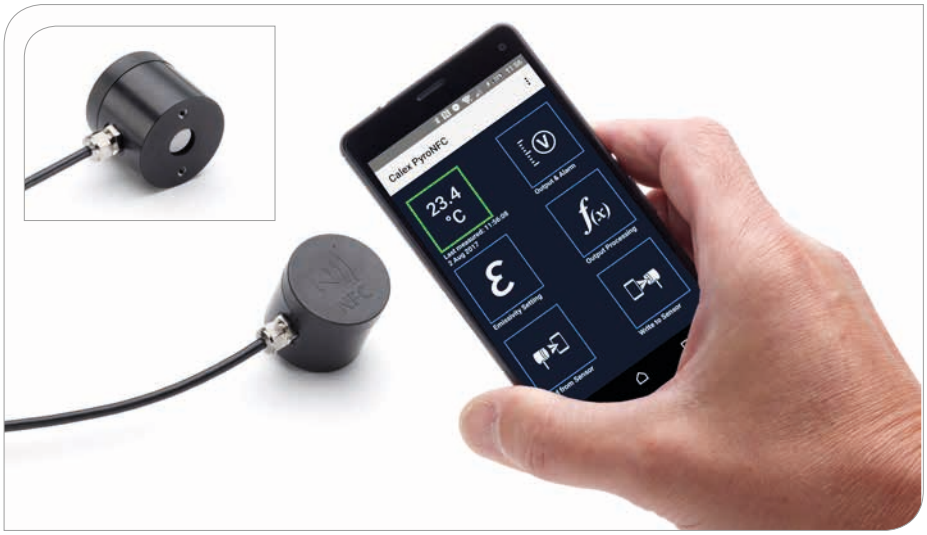
AMBIENT CONDITIONS

In normal room-temperature conditions, a simple, uncooled sensor may be used. For hotter environments, high-ambient-temperature models, or models with air or water cooling, are available.

Obstructions such as dust, steam and smoke can affect the reading, and specialised sensors are available for accurate readings in very damp or dirty conditions. However if the air looks clear, then it should be easy to get good results with a general-purpose sensor.

PyroNFC

Smartphone Configurable Infrared Temperature Sensor



- Non-contact industrial temperature sensor
- Fully configurable via smartphone app
- Choice of voltage or thermocouple outputs
- Simultaneous open collector alarm output
- Measures from 0°C to 1000°C, accurately and consistently
- Extremely small, with side-entry cable: ideal for mounting in tight spaces
- Fast response time: 125 ms
- Low cost, high performance
- Operates in ambient temperatures up to 80°C without cooling
- Form factor optimised for brake testing applications, plus many others

APP FEATURES

- Continuously read temperature from PyroNFC sensors
- Instantly configure PyroNFC sensors without powering them
- Simply touch the sensor with the device to communicate
- Compatible with NFC-equipped Android devices
- Get the app free from Google Play Store (search for “PyroNFC”)

GENERAL SPECIFICATIONS

Temperature Range
0 to 1000°C
Outputs
2 outputs, configurable via NFC:
0-5, 1-5 or 0-10 V DC output, linear with measured temperature, rescalable, and:
Open collector alarm output with temperature threshold and hysteresis
Field of View
15:1 (see OPTICS)
Accuracy
± 1.5% of reading or ± 1.5°C, whichever is greater
Repeatability
± 0.5% of reading or ± 0.5°C, whichever is greater
Response Time, t90
125 ms
Configuration
Via Android app using NFC-equipped device (e.g. smartphone or tablet)
Emissivity
Adjustable via app
Emissivity Setting Range
0.2 to 1.0
Max Temperature Span (Linear Output)
1000°C
Min Temperature Span (Linear Output)
100°C
Spectral Range
8-14 µm
Max. Supply Voltage
28 V DC
Min. Supply Voltage (at Sensor)
12 V DC (for 10 V output)
6 V DC (for 5 V or thermocouple output)
Max Current Draw
7 mA

ENVIRONMENTAL

Environmental Rating
IP65
Ambient Temperature Range
0°C to 80°C
Relative Humidity
95% max. non-condensing

CONFORMITY

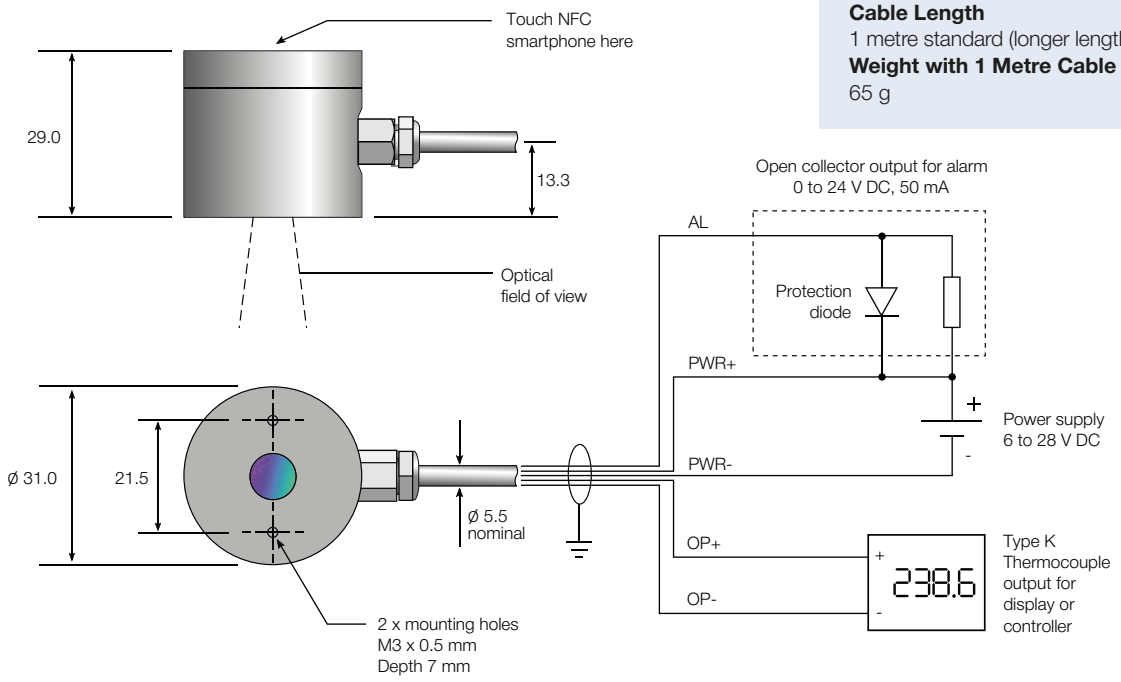
Electromagnetic Compatibility (EMC)
EN61326-1, EN61326-2-3 (Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements - Industrial)
RoHS Compliant
Yes

APP

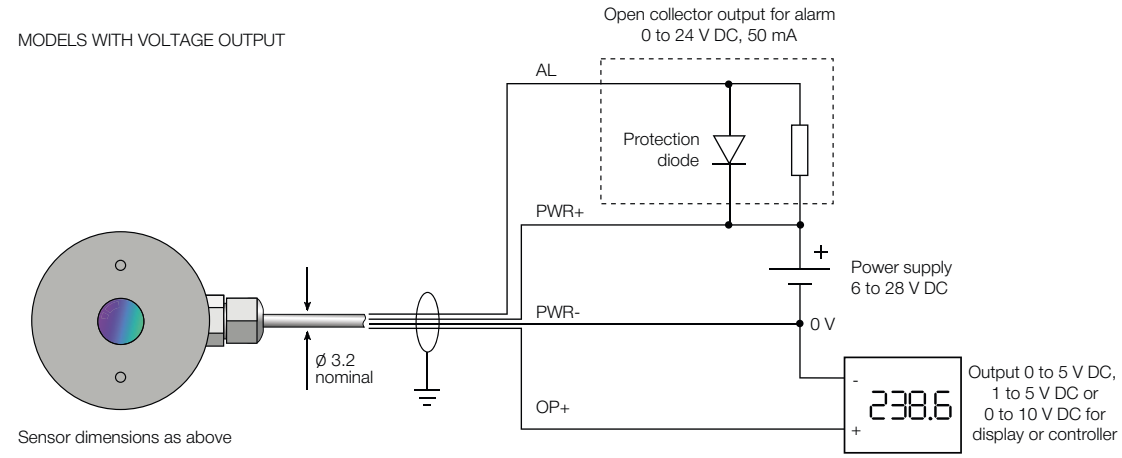
Configurable Parameters
Temperature range (linear output)
Linear voltage output type and scale
Alarm output threshold and hysteresis
Emissivity setting
Reflected temperature
Temperature Units
°C / °F
Signal Processing
Averaging Period (0.125 to 60 seconds)
Peak / Valley Hold
Hold Period (0.125 to 1200 seconds)
Real Time Temperature Reading
Hold NFC device against sensor for continuous in-app temperature updates

DIMENSIONS AND CONNECTIONS

MODELS WITH TYPE K THERMOCOUPLE OUTPUT



MODELS WITH VOLTAGE OUTPUT



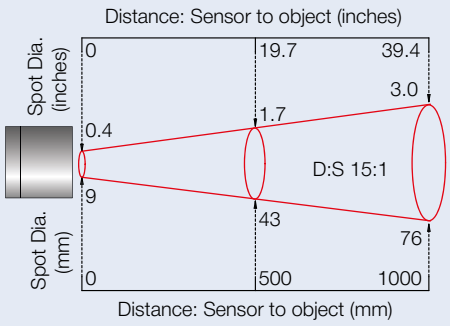
Sensor dimensions as above

MECHANICAL SPECIFICATIONS

Construction
Black anodised aluminium and ABS
Cable Length
1 metre standard (longer lengths available to order)
Weight with 1 Metre Cable
65 g

OPTICS

Diameter of target spot measured versus distance from sensing head (90% energy)



MODEL NUMBERS

PN | **151** | **K**

Outputs
(blank) = configurable 0-5 / 1-5 / 0-10 V DC output for measured temperature and open collector alarm output
K = Type K Thermocouple output for measured temperature, and open collector alarm output

Optics
151 = 15:1 divergent optics

Series
PN = PyroNFC infrared temperature sensor with NFC wireless communications and 1 metre cable

ACCESSORIES

Fixed mounting bracket **FBN**

Adjustable mounting bracket **ABN**

Air purge collar **APN**

3-point UKAS traceable calibration certificate **CALCERTA**

Extended cable (30 m max) **PNCE (voltage output) / PNCEK (thermocouple output)**

PyroCouple, PyroEpsilon, PyroBus, PyroCAN

General Purpose Infrared Temperature Sensors

shown actual size

- Temperature range: -20°C to 500°C
- Choice of precision optics for large or small targets at short or long distances
- Fast response with high stability
- Stainless steel housing, sealed to IP65
- Quick and easy installation
- Wide range of accessories

The Calex Compact Series is a range of high quality, low cost non-contact sensors that measure the temperature of inaccessible or moving objects and materials. They measure temperatures from -20°C to 500°C, accurately and consistently, with an outstanding response time of 240 ms. All models conform to industrial EMC standards.

PyroCouple with indicator

The **PyroCouple** is a simple infrared temperature sensor with a choice of analogue outputs. No complicated setup is required - just connect a temperature indicator and power supply, and instantly start taking measurements.

- Temperature ranges from -20°C to 500°C
- Suitable for non-contact temperature measurement on most non-reflective non-metal surfaces, such as paper, thick plastics, asphalt, painted surfaces, food, rubber and organic materials, among many others.
- Choice of analogue outputs for measured temperature:

  Two-wire 4-20 mA,
  Four-wire 0-50 mV,
  Four-wire Type K, J or T thermocouple
- Additional sensor body temperature output on four-wire models: indicates the air temperature around the sensor and helps prevent overheating or overcooling

PyroEpsilon with PyroTune emissivity adjuster

The **PyroEpsilon** is a simple sensor with an adjustable emissivity setting. It is ideal if the target is partially reflective.

- Temperature ranges from -20°C to 500°C
- Two-wire 4-20 mA output
- Emissivity adjustment via a separate two-wire 4-20 mA input
- Adjust the emissivity continuously during the process using a variable 4-20 mA source
- Set the emissivity manually with the PyroTune emissivity adjuster
- If you are not sure the emissivity of the target is high, choose the PyroEpsilon instead of the PyroCouple.

PyroBus sensors with PM180 touch screen display

The **PyroBus** is a networkable, fully configurable sensor with RS485 Modbus RTU communications.

- Temperature ranges from -20°C to 500°C
- Up to 247 sensors may be connected to a single network.
- Adjustable emissivity setting for use on a wide range of materials
- Averaging function to smooth the temperature output
- Peak and valley hold processing for measuring individual objects on a conveyor
- Reflected energy compensation for accurately measuring the temperature of objects in ovens or chillers, from outside
- Optional 6-channel touch screen terminal for local display, configuration and data logging
- Connect sensors and 6-channel terminals directly to an existing RS485 Modbus system

PyroCAN Sensor with CAN Bus Interface

The **PyroCAN** is a sensor with CAN communications.

- Temperature range: -20°C to 1000°C
- Raw CAN communications
- Adjustable emissivity setting for measuring a variety of materials
- Ideal for onboard vehicle temperature monitoring, and many other applications
- Conforms with EMC standard EN 13309:2010

GENERAL SPECIFICATIONS - SENSORS

Output (PyroCouple)

PyroCouple Output Option (see Model Numbers)	Target Temperature Output	Sensor Temperature Output
-0	4-20 mA	Not available
-1	0-50 mV	4-20 mA
-2	Type T thermocouple	4-20 mA
-3	Type J thermocouple	4-20 mA
-4	Type K thermocouple	4-20 mA
-5	0-50 mV (very low current draw: 3.2 mA)	Not available

	PyroCouple	PyroEpsilon	PyroBus	PyroCAN
Output	See Above	Two-wire 4-20 mA	RS485 Modbus RTU	Raw CAN
Temperature Range	LT = -20 to +100 °C MT = 0 to 250 °C HT = 0 to 500 °C		-20 to 500°C	-20°C to 1000°C
Accuracy	±1% of reading or ±1°C whichever is greater			
Repeatability	± 0.5% of reading or ± 0.5°C whichever is greater			
Emissivity Setting	Fixed at 0.95	Variable 0.2 to 1.0 via continuous 4-20 mA input	Adjustable 0.2 to 1.0 via RS485 Modbus	Adjustable 0.2 to 1.0 via CAN
Response Time	240 ms (90% response)			200 ms (90% response)
Spectral Range	8 to 14 µm			
Supply Voltage	24 V DC (28 V DC max.)		12 V DC (13 V DC max.)	24 V DC (28 V DC max)
Min. Sensor Voltage	6 V DC			12 V DC
Max. Loop Impedance	900 Ω (4-20 mA output)		-	
Output Impedance	56 Ω (voltage/thermocouple output)	-		
Input Impedance	-	50 Ω	-	
Current Draw	20 mA max. (PyroCouple -5 models: 3.2 mA @ 24 V DC)		50 mA max	
Baud Rate	-		9600 bps	250 kbps*
Format	-		8 data bits, no parity, 1 stop bit *	-

* Other configurations available upon request

MECHANICAL

	PyroCouple	PyroEpsilon	PyroBus	PyroCAN
Construction	Stainless Steel			
Dimensions	18 mm diameter x 103 mm long			
Thread Mounting	M16 x 1 mm pitch			
Cable Length	1m (longer lengths available to order)			
Weight with Cable	95 g			

ENVIRONMENTAL

	PyroCouple	PyroEpsilon	PyroBus	PyroCAN
Construction	IP65			
Dimensions	0°C to 70°C			0°C to 90°C
Thread Mounting	95% max. non-condensing			

PYROCAN

Example data message received from sensor:

		Object Temperature				Ambient Temperature			
Bytes	DLC	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
Value	8	0x51	0x39	0xB2	0x41	0xA4	0x70	0xDF	0x41
Hex		0x41B23951				0x41DF70A4			
Encoding		Float				Float			
Decimal		22.28 °C				27.93 °C			

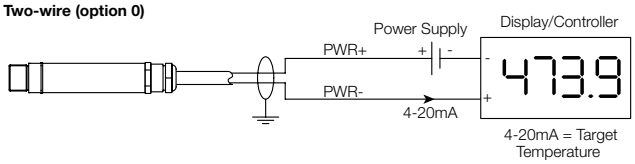
PYROTUNE

GENERAL SPECIFICATIONS	
Output	4-20 mA for emissivity adjustment of PyroEpsilon sensor
Supply Voltage	24 V DC (13 V to 28 V DC)
Display Format	3.5 digit LCD
Display Units	Emissivity (0.2 to 1.0) or current (4 - 20 mA)
Adjustment	Push-buttons (raise/lower/set)
MECHANICAL	
Construction screws	Polycarbonate with gasket, transparent lid (PC) and quick release
Mounting	Surface
Dimensions	65 mm tall x 50 mm wide x 35 mm deep
Weight	72 g
ENVIRONMENTAL	
Environmental Rating	IP65
Ambient Temperature Range	0°C to 70°C
Relative Humidity	95% max. non-condensing

CONNECTIONS

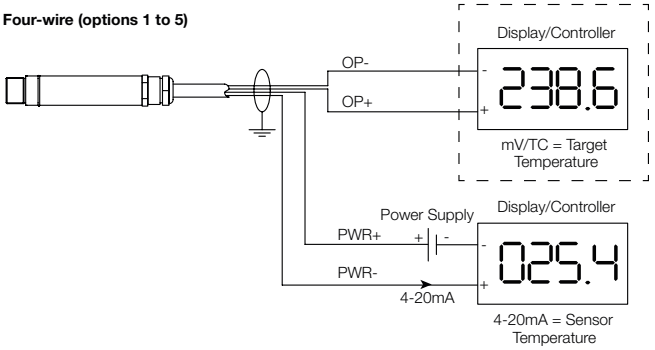
PYROCOUPLE

Two-wire (option 0)

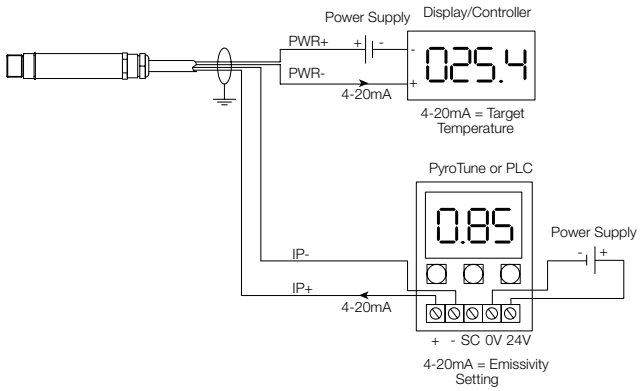


Four-wire (options 1 to 5)

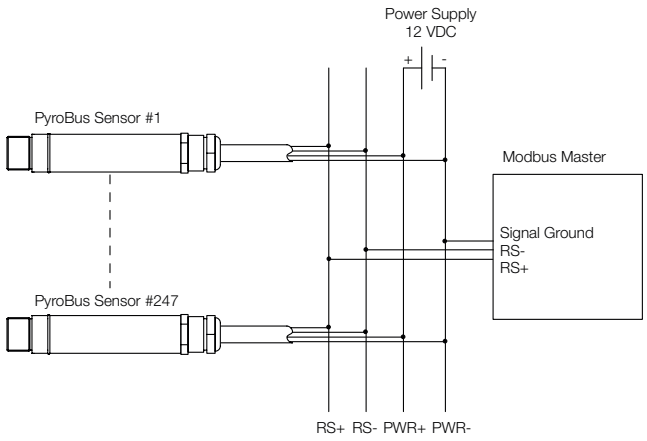
Output types 1 to 4 only (optional)



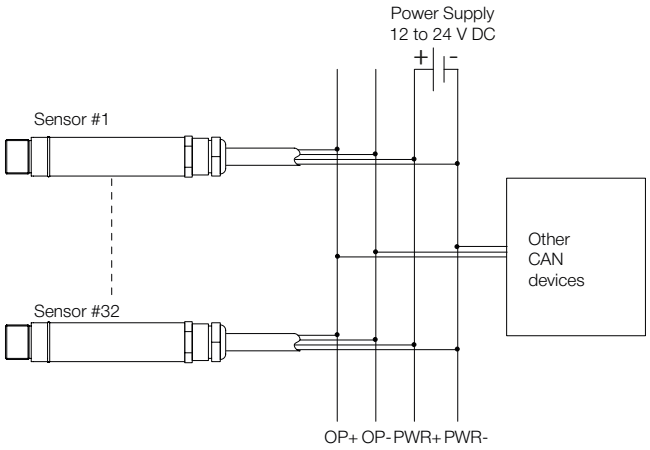
PYROEPSILON



PYROBUS



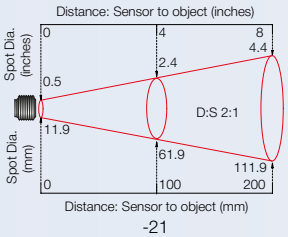
PYROCAN



OPTICS

Diameter of target spot measured versus distance from sensing head (90% energy)

Optics available for PyroCouple, PyroEpsilon, PyroBus



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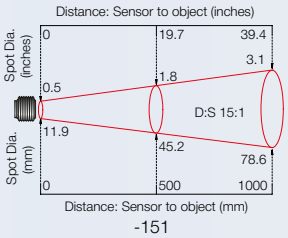

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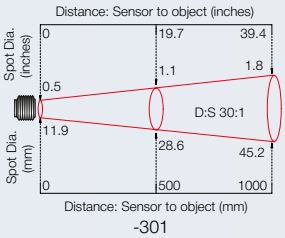
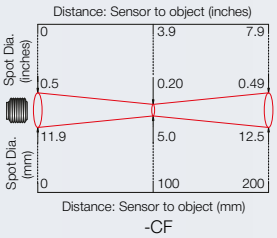
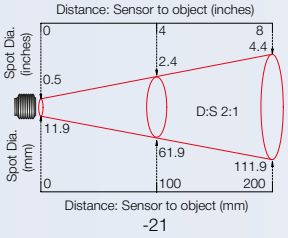


-301



-CF

Optics available for PyroCAN



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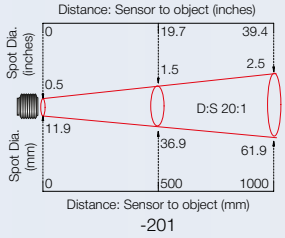


-201

ACCESSORIES

Fixed mounting bracket **FBS**

Air purge collar for 2:1 optics **APSW**
or for all other optics (shown above) **APSN**

Laser sighting tool **LSTS**

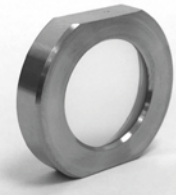
Adjustable mounting
bracket **ABS**

Air or water cooled jacket with
air purge collar **WJ** (see Model Numbers)

Dual laser sighting bracket, adjustable
DLSBAS or fixed **DLSBFS**

PyroTune emissivity adjuster **PT**
(for PyroEpsilon only)

6-channel touch
screen interface for
temperature display,
configuration and data
logging (PyroBus only)
PM180



Protective plastic window with
stainless steel holder **PWS**
(not compatible with PyroCouple)

MODEL NUMBERS

PC	151	MT	0	WJ

Cooling
(blank) = Sensor without cooling
WJ = Air/water cooled jacket with air purge collar

Output option (PyroCouple only)
0 = 2 wire, 4-20mA
1 = 4-wire, 0-50mV (target temp.), 4-20mA (sensor temp.)
2 = 4-wire, T Thermocouple (target temp.), 4-20mA (sensor temp.)
3 = 4-wire, J Thermocouple (target temp.), 4-20mA (sensor temp.)
4 = 4-wire, K Thermocouple (target temp.), 4-20mA (sensor temp.)
5 = 4-wire, 0-50 mV (target temp.), very low current draw

e.g. Model PC151HT-4 has a type K thermocouple output representing target temperatures of 0ºC to 500ºC plus a 4-20 mA output proportional to internal sensor temperature. For simplicity, the sensor temperature range is always set the same as the target temperature range

Temperature range (PyroCouple and PyroEpsilon only)
LT = -20 to +100 ºC
MT = 0 to 250 ºC
HT = 0 to 500 ºC (not normally available on PC21 models)

Field of view
21 = 2:1 divergent optics
151 = 15:1 divergent optics
301 = 30:1 divergent optics
CF = Close-focus optics (focal spot size 5 mm at 100mm distance)
201 = 20:1 general-purpose divergent optics (PCAN series only)
Note: PyroCAN sensors are available with 2:1 and 20:1 optics only

Series
PC = PyroCouple: fixed emissivity, choice of analogue outputs
PE = PyroEpsilon: adjustable emissivity, 4-20 mA output
PB = PyroBus: fully configurable, RS485 Modbus communications
PCAN = PyroCAN: Adjustable emissivity, CAN Bus communications

Example Model Numbers: PC151MT-0, PE151MT, PB151, PCAN201

PyroMini

Miniature Infrared Temperature Sensors with Optional Touch Screen Interface

PyroMini with touch screen

FEATURES

- Two-part sensor with miniature sensing head and configurable electronics module
- Touch screen (optional) for temperature indication and configuration
- Screen turns bright red in alarm condition for maximum visibility
- Adjustable emissivity setting on all models
- Data logging to MicroSD Card (optional) on touch screen models
- 4 to 20 mA or RS485 Modbus outputs
- Alarm relay outputs rated 24 V DC (optional) - no need for separate trip amplifier
- Maximum, minimum, average and instantaneous readings, peak or valley hold, reflected energy compensation

PYROMINI GENERAL PURPOSE

- High-ambient sensing heads (optional) withstand up to 120°C or 180°C without cooling
- Suitable for a wide range of target materials such as paper, plastics, food, painted surfaces, coated metal and many more
- Resistant to interference from movement of sensing head cable (-JA, -HA models) - ideal for mounting on robot arms
- Temperature ranges from -20°C to 1000°C

PYROMINI 2.2 HIGH TEMPERATURE

- Short-wavelength measurement for improved accuracy on reflective targets such as steel rollers and many other metal surfaces
- Temperature ranges from 100°C to 2000°C
- Choice of optics, including narrow options for long-distance measurements of very hot objects

GENERAL SPECIFICATIONS

	PyroMini General Purpose	PyroMini 2.2 High Temperature
Temperature Range	Choice of ranges from -20°C to 2000°C (see Model Numbers)	
Output	4 to 20 mA or RS485 Modbus (up to 247 sensors may be installed on each Modbus network)	
Alarm Relays (-CRT and -BRT models)	2 x Single Pole Changeover alarm relays rated 24 V DC, 1 A, isolated 500 V DC	
Accuracy	± 1°C or 1% of reading, whichever is greater	± 2°C or 1% of reading, whichever is greater
Repeatability	± 0.5°C or 0.5%, whichever is greater	
Field of View	Choice of optics (see Model Numbers on page 3)	
Emissivity Setting Range	0.20 to 1.00	
Emissivity Setting Method	-CRT and -BRT models: via touch screen -BB and -BRT models: via RS485 -CB models: via two rotary switches in electronics box	
Response Time, t90	240 ms (90% response)	
Spectral Range	8 to 14 µm	2.0 to 2.6 µm
Supply Voltage	24 V DC ± 5%	
Maximum Current Draw	100 mA	
Maximum Loop Impedance	CB and -CRT models: 900 Ω (4 to 20 mA output)	
Max Temp Span (-CRT models)	Full temperature range	
Min Temp Span (-CRT models)	100°C	

ELECTROMAGNETIC COMPATIBILITY STANDARDS

Conforms to EMC Directive EN61326-1:2006 (Electrical equipment for measurement, control and laboratory use – Industrial) as well as industrial standards for electromagnetic immunity and emissions.

MECHANICAL

	Sensing Head	Electronics Module
Construction	Stainless Steel 316	Cast aluminium
Dimensions	Ø 18 x 45 mm (see diagram)	98(w) x 64(h) x 36(d) mm
Mounting	M16 x 1 mm thread	Two M4 screw holes for wall mounting (see diagram)

Cable Length (sensing head to electronics module)
1 m (standard), up to 30 m (optional)
Weight with 1 m Cable
390 g (approx)
Cable Connections
Removable screw terminal blocks (see Connections)
Conductor size: 28 AWG to 18 AWG
Output Cable Gland
Suitable for cable diameters 3.0 to 6.5 mm

ENVIRONMENTAL

	Sensing Head	Electronics Module (without screen)	Electronics Module (with touch screen)
Environmental Rating	IP65 (NEMA 4)	IP65 (NEMA 4)	-
Ambient Temperature Range	See below *	0°C to 60°C	0°C to 60°C
Relative Humidity	Maximum 95% non-condensing	Maximum 95% non-condensing	Maximum 95% non-condensing
RoHS Compliant	Yes	Yes	Yes

***Ambient Temperature Range (Sensing Head)**
PyroMini: Ranges from 0°C to 180°C, depending on model (see Model Numbers)
PyroMini 2.2: 0°C to 70°C

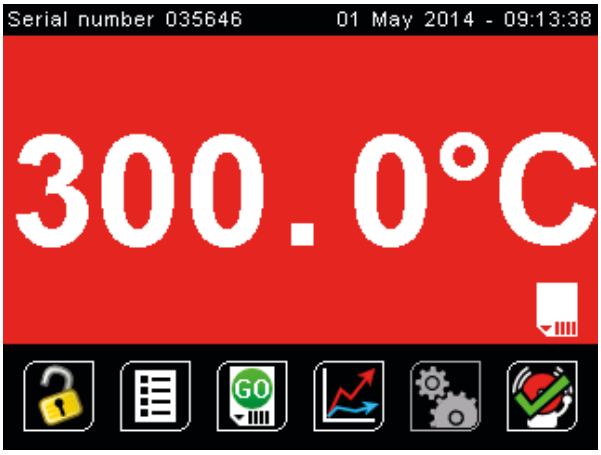
TOUCH SCREEN (-CRT AND -BRT MODELS)

The optional backlit touch screen interface mounted in the lid of the electronics module provides a large, bright display of the measured temperature, as well as controls allowing full configuration of the sensor. The graph view shows the history of the measured temperature.

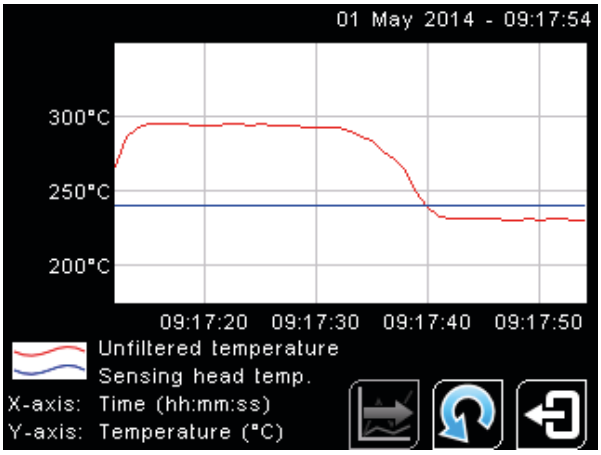
In alarm conditions, the display changes colour to provide an immediate and obvious alarm indication. Alarm modes and levels can be configured via the touch screen.

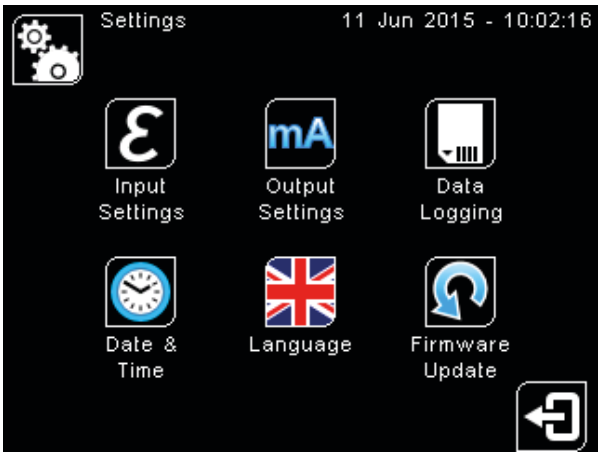
Touch Screen Specifications	
Touch Screen Display Format	2.83" (72 mm) resistive touch TFT, 320 x 240 pixels, backlit
Configurable Parameters	Temperature range, temperature units, emissivity setting, reflected energy compensation, alarms, signal processing, Modbus address (-BRT models), date and time, data logging
Temperature Units	°C or °F configurable
Temperature Resolution	0.1°
Alarm Configuration	Two alarms with adjustable level, individually configurable as HI or LO. Alarm 2 can be set to target temperature or sensing head internal temperature
Signal Processing	Average, peak hold, valley hold, minimum, maximum
Languages	English, Chinese (simplified), Japanese

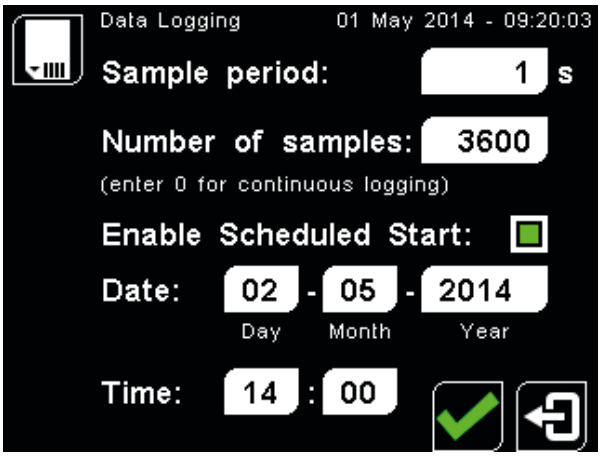
EXAMPLE SCREENSHOTS



Screen shown with red background to indicate alarm condition







Data Logging Specifications	
Data Logging Interval	1 to 86,400 seconds (1 day)
MicroSD Card	Max. capacity: 32 GB (not included)
Internal Clock Battery	1 x BR 1225 3V (not included)
Variables Logged	Target temperature, sensing head temperature, electronics module temperature, max, min, average, emissivity setting, reflected energy compensation temperature, alarm events
File Format	.csv
Configurable Parameters	Sample period, number of samples, scheduled start date and time

DATA LOGGING (-CRT AND -BRT MODELS)

The PyroMini can be used as a standalone data logger.

PyroMini models -CRT and -BRT include a MicroSD card slot for data logging, which can be configured via the touch screen interface. The user can select the sample rate and the number of samples to be taken and schedule the data logging to start at a certain time.

With a 2 GB card, the user can store 28.4 million readings, which provides almost 1 year's worth of data at the fastest possible sample rate of 1 per second.

Data is stored on the MicroSD card in .csv format and can be viewed and edited easily using spreadsheet software. Alarm events can also be logged to the MicroSD Card.

A MicroSD card with SD card adapter is available as an optional accessory.

The MicroSD card slot and battery holder are located on the touch screen circuit board in the lid of the PyroMini. Readings are time and date stamped using the sensor's internal clock. The clock is reset when the power is disconnected, or it will continue if the optional battery is fitted.

MODEL NUMBERS

Series	Sensing Head Operating Temperature Range (General Purpose only)	Field of View	Measurement Temperature Range	Output and Interface
PM (PyroMini - General Purpose)	MA	21 151 301 CF	LT MT HT XT	CB
			CT	CRT BB BRT
	HA JA	201	HT XT	CB
			CT	CRT BB BRT
PM2.2 (PyroMini 2.2 - High Temperature)	-	151	PT	CB CRT BB BRT
		251 751 CF	MT HT	

SENSING HEAD OPERATING TEMPERATURE RANGE (General Purpose models only)

-MA 0°C to 60°C
-JA 0°C to 120°C
-HA 0°C to 180°C

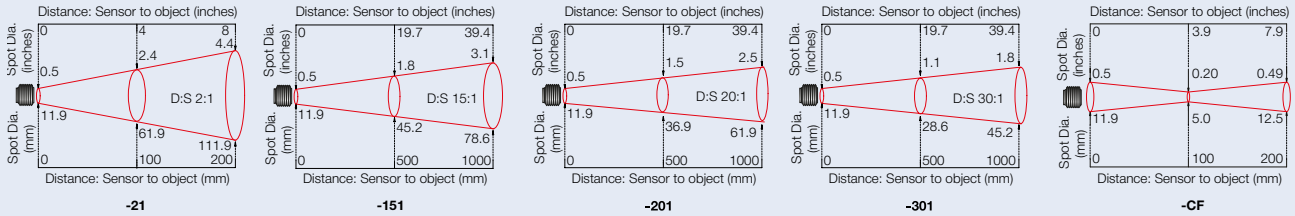
The sensing head on -JA and -HA models is able to withstand ambient temperatures of up to 120°C (-JA) and 180°C (-HA) without cooling. Both models are available with 20:1 optics.

There is no need to supply cooling air or water, and the miniature sensing head is much smaller than bulky, cooled sensors.

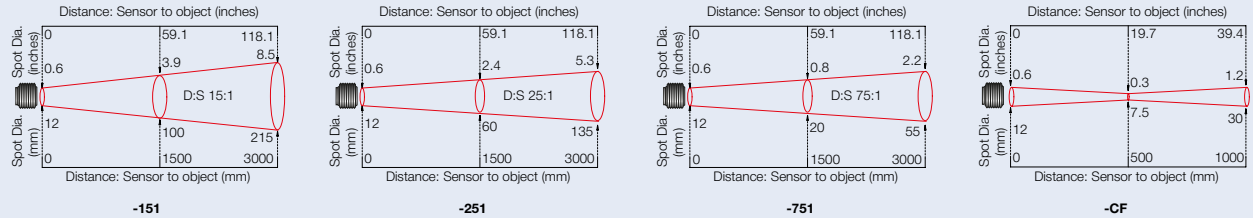
PyroMini without screen

FIELD OF VIEW (PyroMini - General Purpose)

Diameter of target spot measured versus distance from sensing head - 90% energy



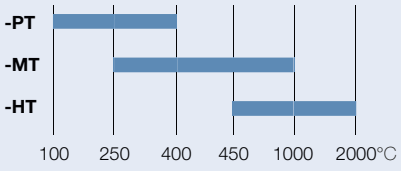
FIELD OF VIEW (PyroMini 2.2 - High Temperature)



MEASUREMENT TEMPERATURE RANGE (°C)

PyroMini (General Purpose)

PyroMini 2.2 (High Temperature)



-CB models: Fixed 4 to 20 mA output scale (e.g. -XT: 0°C @ 4 mA, 1000°C @ 20 mA)
-CRT models: 4 to 20 mA output is configurable within this range
-BRT and -BB models: Digital output, full temperature range

OUTPUT AND INTERFACE

-CB 4 to 20 mA output, no screen

-CRT 4 to 20 mA output and two alarm relay outputs, with touch screen

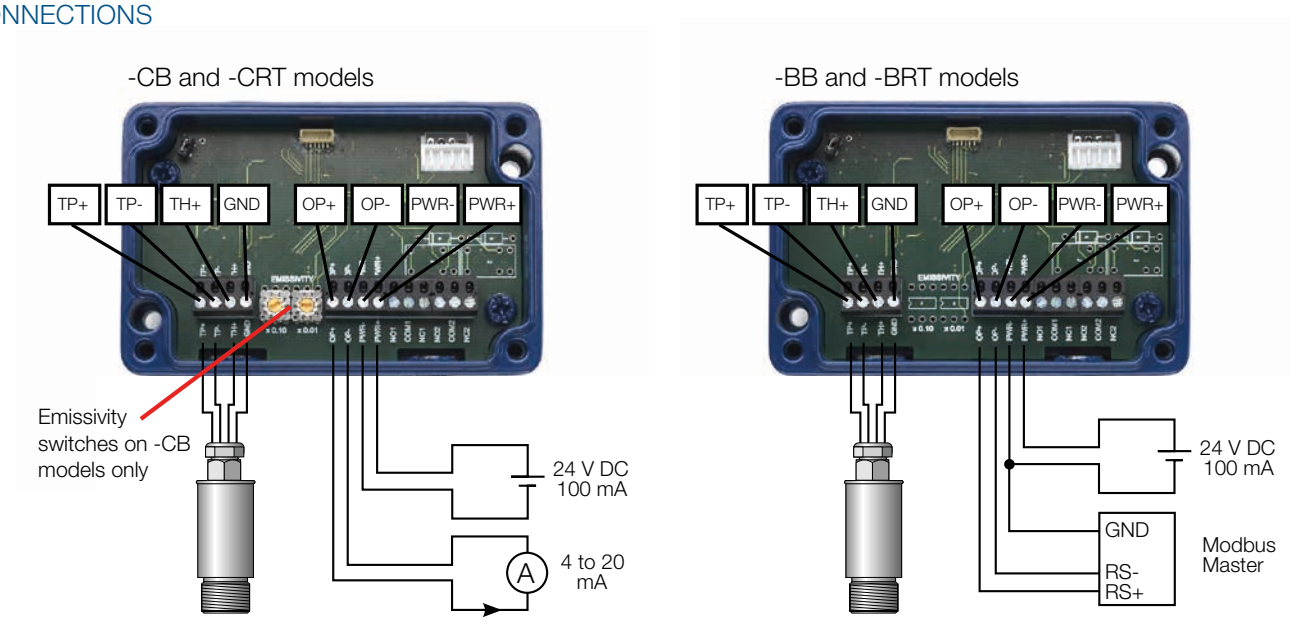
-BB RS485 Modbus output, no screen

-BRT RS485 Modbus output and two alarm relay outputs, with touch screen

EXAMPLE: PM-MA-301-CT-BRT

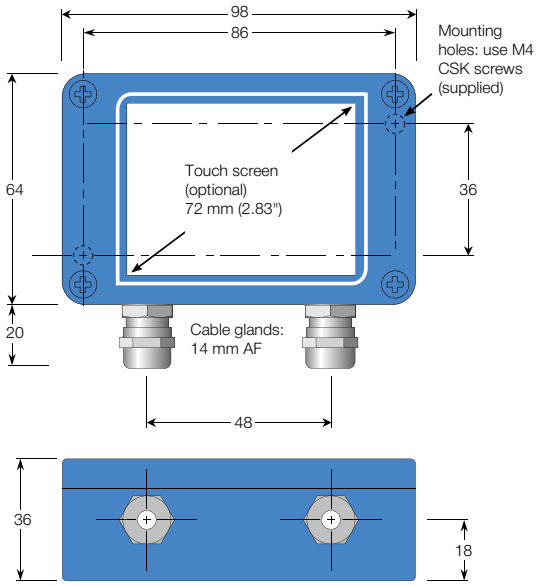
Series	Sensing Head Operating Temperature	Optics	Temperature Range	Output and Interface
PM PyroMini	**-MA** 0°C to 60°C	**-301** 30:1 divergent	**-CT** Digital output, -20 to 1000 °C	**-BRT** RS485 Modbus output and two alarm relay outputs, with touch screen

CONNECTIONS

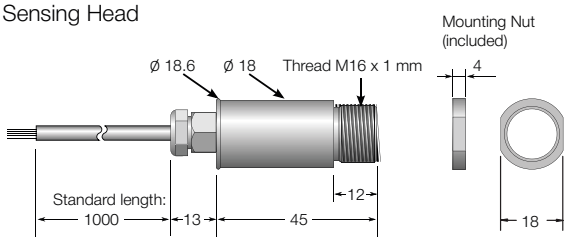


DIMENSIONS AND ACCESSORIES

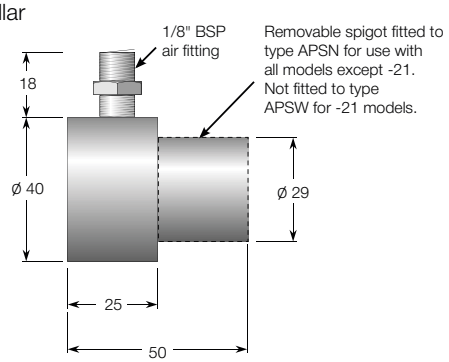
Electronics Module



Sensing Head



Air Purge Collar



All dimensions in mm

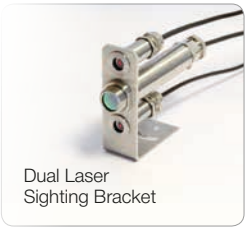
ACCESSORIES ALSO AVAILABLE

- MicroSD Card with SD Card adapter: stores logged data (-CRT and -BRT models) **MSD**
- Extended cable between sensing head and electronics module (PyroMini -MA models) **PMCE**, (PyroMini -HA and -JA models) **PMCEHT**, (PyroMini 2.2 models) **PM2.2CE**
- Calibration certificate **CALCERTA**
- Laser sighting tool **LSTS**
- Mounting bracket, Adjustable **ABS**, Fixed **FBS**
- Dual Laser Sighting Bracket, Adjustable **DLSBAS**, Fixed **DLSBFS**
- 6-channel Modbus temperature indicator with data logging **PM180**
- Protective plastic or silicon window in stainless steel holder (General Purpose models only) **PWS / SIWS**
- Panel Mounting Kit **PMK**


Laser Sighting Tool


PM180


Adjustable Mounting Bracket


Dual Laser Sighting Bracket

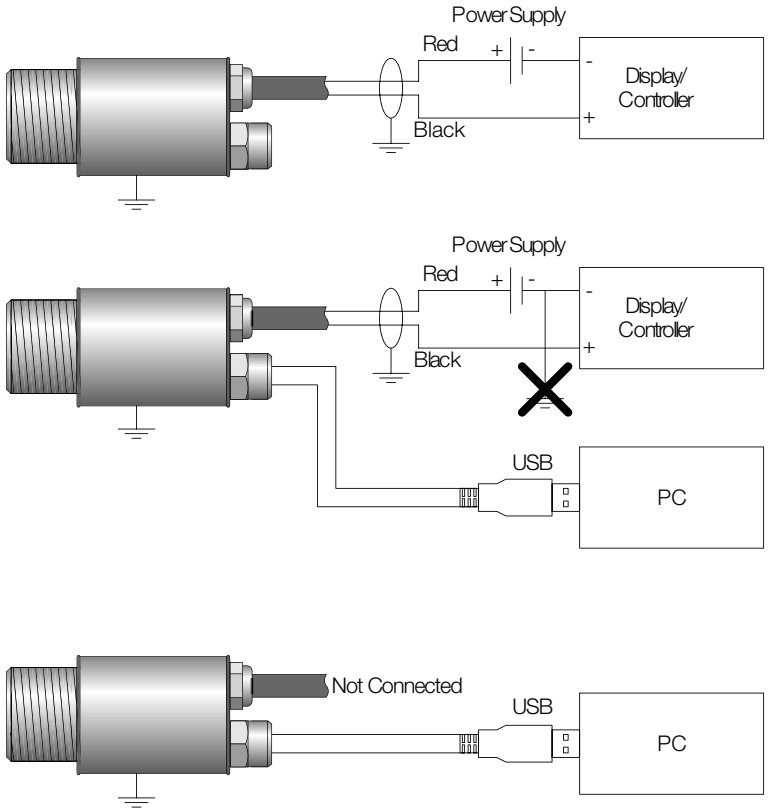
PyroUSB

USB Configurable Infrared Temperature Sensors with 4-20 mA Output

- Temperature ranges from -40°C to 2000°C
- 2-wire 4-20 mA output
- Fully configurable via USB using Modbus protocol. Cable and software included
- Specialised models for measuring metals, high-temperature objects or glass surfaces
- General-purpose models for most other applications
- Peak and valley hold mode allows easy measurement of objects on conveyors
- Stainless steel housing, sealed to IP65
- Quick and easy installation

CONNECTIONS

The sensor will operate with either the 4 to 20 mA cable connected, the USB cable connected, or both.



Note: The sensor must be grounded at only one point, either the cable shield or the sensor housing.

The PyroUSB Series measures temperatures from -40°C to 2000°C accurately and consistently, with an outstanding response time of 200 ms. The 4 to 20 mA output is compatible with almost any indicator, controller, recorder or data logger. without the need for special interfacing or signal conditioning.

A choice of measurement wavelengths is available to suit a range of applications.

General-purpose PUA8 (8-14 µm) models can measure from -40°C to 1000°C. They are suitable for measuring high-emissivity materials such as paper, thick plastics, food, pharmaceuticals, rubber, asphalt and painted surfaces. These models are capable of measuring very low temperatures, so they are ideal for sub-zero measurements in the food, logistics and storage industries.

Short-wavelength PUA2 (2.2 µm) models have a choice of temperature ranges from 45°C to 2000°C. They provide a more accurate reading when measuring low-emissivity materials such as many reflective metals. They are also capable of measuring through glass viewports.

Glass PUA5 (5 µm) models have a choice of temperature ranges from 50°C to 1650°C. They are filtered at a wavelength where glass is least reflective, making them an ideal pyrometer for glass surface temperature measurement.

All models have USB communications. A USB cable and Windows software is included. All data is transmitted via Modbus, so it is also easy to configure and read temperatures from the sensor using third-party software. The USB cable has an IP65 connector at the sensor end. An IP65 cap protects the sensor when the USB cable is not connected.

SOFTWARE

The sensor is configurable via software. It is also possible to take temperature readings, see temperature charts and log data from the USB connection in real time.
There are three software options:

CalexConfig
Simple, touch-friendly software, compatible with versions of Windows from Vista onwards. CalexConfig is supplied with the sensor.

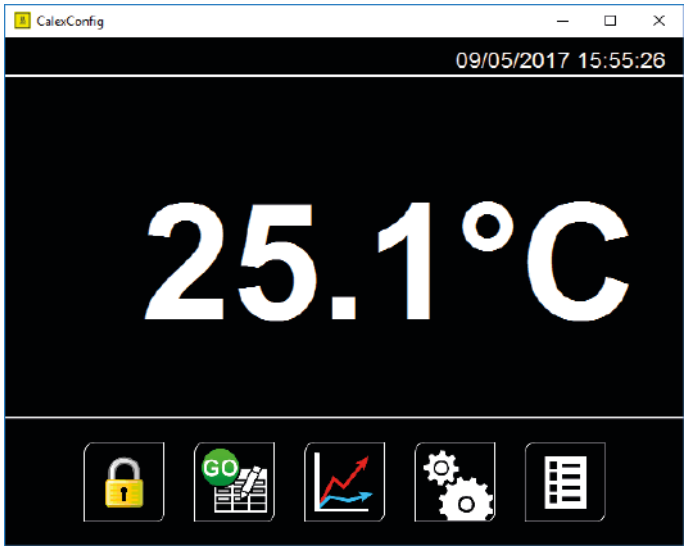
CalexSoft 2
Multi-channel software for all Calex sensors with digital communications. CalexSoft 2 is available to download free of charge from www.calex.co.uk. For more information, see the CalexConfig / CalexSoft 2 data sheet.

Third party software
The sensor's Modbus protocol allows it to be used with other Modbus software. Modbus protocol information is provided in the Operator's Guide.

FEATURES (CalexConfig and CalexSoft 2)

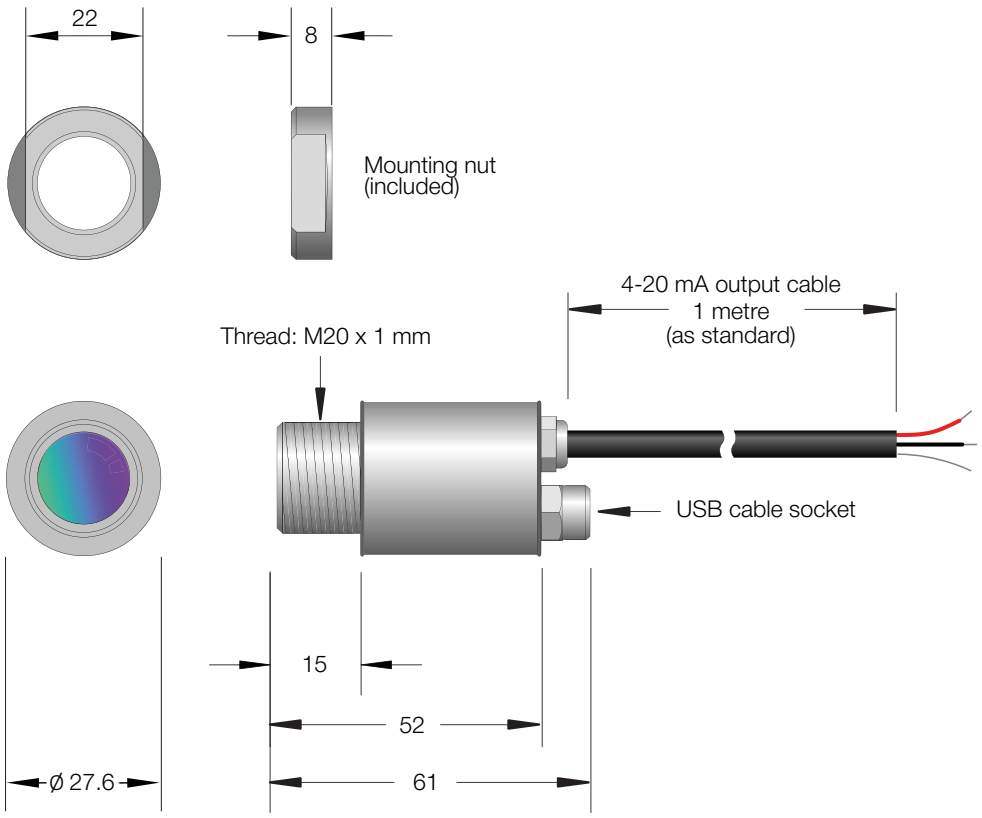
Temperature display
Scrolling temperature chart
Data logging to comma-separated text file, compatible with Excel
PyroUSB sensor configuration:
- Emissivity setting
- Averaging
- Peak/valley hold processing
- Reflected energy compensation
- 4-20 mA output temperature scale

CalexConfig



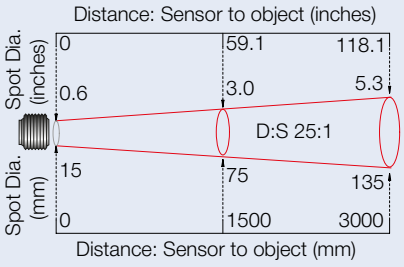
CalexSoft 2

DIMENSIONS



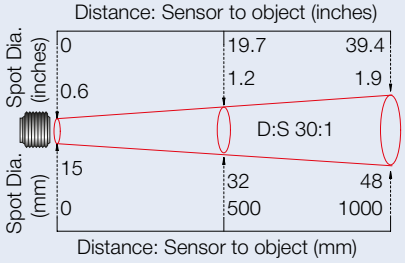
OPTICS Diameter of target spot measured versus distance from sensing head (90% energy)

Optics (PUA2 and PUA5)

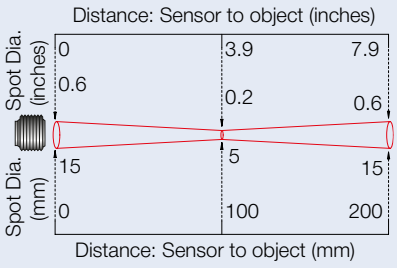


251

Optics (PUA8)

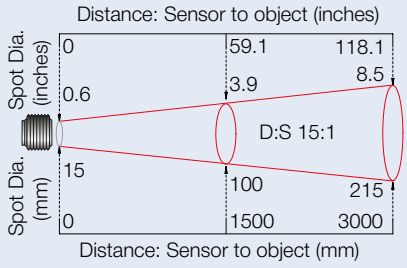


301

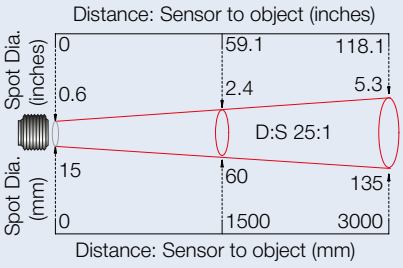


CF

Optics (PUA2)



151



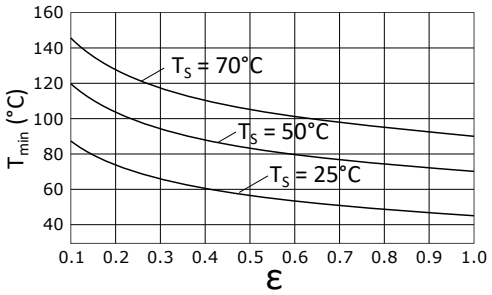
251

General Specifications			
Model	**PUA2**	**PUA5**	**PUA8**
Spectral Response	2.2 µm	5 µm	8 to 14 µm
Application	Ferrous metals and high-temperature targets	Glass	General purpose
Temperature range	Choice of ranges from 45°C to 2000°C	Choice of ranges from 50°C to 1650°C	-40°C to 1000°C
Response time	200 ms		
Output	2-wire, 4-20 mA, linear with measured temperature		
Communications	USB 2.0 (removable USB cable and software included) using the Modbus protocol		
Optics	Choice of divergent or focused optics for small or large targets at short or long distances (see Optics)		
Accuracy	± 2°C or 1% of reading, whichever is greater	± 1°C or 1% of reading, whichever is greater	
Repeatability	± 0.5°C or 0.5% of reading, whichever is greater		
Emissivity Setting	0.1 to 1.0		
Maximum Span (4-20 mA output)	Full temperature range		
Minimum Span (4-20 mA output)	100°C		

Electrical	
Supply Voltage	24 V DC (28 V DC max)
Sensor Voltage (minimum)	6 V DC
Maximum Loop Impedance	900 Ω @ 24 V DC
Mechanical	
Construction	Stainless Steel
Dimensions	Ø 27.6 x length 61 mm including cable glands
Thread mounting	M20 x 1 mm pitch, length 15 mm
4-20 mA Output Cable Length	1 m (standard), up to 30 m (optional)
Weight with 1 m Output Cable	155 g
USB Cable Length	1.8 m
Environmental	
Environmental Rating	IP65
Ambient (Operating) Temperature	0°C to 70°C (cooled models are available for higher temperatures)
Relative Humidity	95% max. non-condensing

MINIMUM MEASURABLE TEMPERATURE

(PUA2-151-LT ONLY)



Graph showing the minimum measurable object temperature (T_{min}), determined by surface emissivity (ε) and sensor temperature (T_S).

MODEL NUMBERS

Short Wavelength	**PUA2**	-	**251**	-	**MT**	-	**WJ**
Glass	**PUA5**	-	**251**	-	**GHT**	-	**WJ**
General Purpose	**PUA8**	-	**301**	-		-	**WJ**

Cooling

(blank)	Sensor without cooling
WJ	Air/water cooled jacket with air purge collar

Temperature range

PUA2

LT	45°C to 300°C (151 models only)
PT	100°C to 400°C (151 models only)
MT	250°C to 1000°C
HT	450°C to 2000°C

PUA5

GLT	50°C to 1000°C
GHT	200°C to 1650°C

PUA8

(blank)	All models: -40°C to 1000°C

Field of view

PUA2

151	15:1 divergent optics (LT & PT models only)
251	25:1 divergent optics
751	75:1 divergent optics
CF	Close-focus optics (focal spot size 7.5 mm at 500mm distance)

PUA5

251	25:1 divergent optics

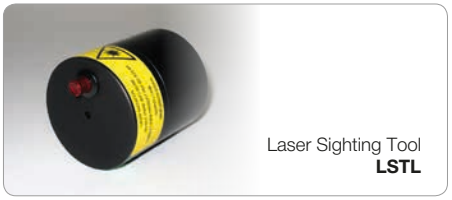
PUA8

301	30:1 divergent optics
CF	Close-focus optics (focal spot size 5 mm at 100mm distance)

Spectral response

PUA2	2.2 µm, for measuring reflective metals and high-temperature objects
PUA5	5 µm, for measuring glass surface temperature
PUA8	8 to 14 µm, general-purpose, for most other applications

ACCESSORIES

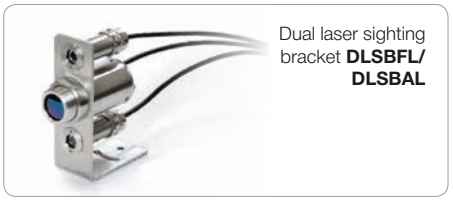


Laser Sighting Tool **LSTL**

Adjustable mounting bracket **ABL**

Air/water cooled housing **WJ**

Air purge **APL**



Dual laser sighting bracket **DLSBFL/ DLSBAL**

Protective Window **PWL**

ACCESSORIES ALSO AVAILABLE

Fixed mounting bracket **FBL**
Extended analogue output cable (30 m max):
- for PyroUSB models without cooling **PUACE**
- for PyroUSB WJ models **PUACEHT**

3-point calibration certificate **CALCERTA**

PyroMiniUSB

USB Infrared Temperature Sensor for Benchtop, Laboratory and Education

- Miniature non-contact temperature sensor with USB communications
- Measures from -20°C to 1000°C
- USB cable and PC software included for data logging and configuration
- Open Modbus protocol - use your own software to communicate with the sensor

SPECIFICATIONS	
Temperature Range	-20°C to 1000°C
Interface	USB
Accuracy	±1% of reading or ±1°C whichever is greater
Repeatability	± 0.5% of reading or ± 0.5°C whichever is greater
Emissivity Setting	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 CalexConfig software (included), CalexSoft 2, or Modbus
Configurable Parameters	Emissivity Setting, Averaging, Reflected Energy Compensation
MECHANICAL	
Construction	Stainless Steel
Dimensions	18 mm diameter x 45 mm long
Thread Mounting	M16 x 1 mm pitch
Cable Length	1.5 m
Weight with Cable	85 g
ENVIRONMENTAL	
Environmental Rating	IP65
Ambient Temperature	0°C to 75°C
Relative Humidity	95% max. non-condensing
CONFORMITY	
RoHS Compliant	Yes
Electromagnetic Compatibility	EN61326-1, EN61326-2-3 (Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements - **Industrial**)

The PyroMiniUSB is a miniature infrared sensor that measures the surface temperature of a solid or liquid without contact. It can measure non-metal surfaces between -20°C and 1000°C, with a response time of just 125 ms.

Materials including paper, thick plastics, rubber, food and organic materials, as well as painted metals and most dirty, rusty or oily surfaces, are measured accurately, safely and cleanly.

A choice of optics is available to measure small or large targets at distances ranging from a few millimetres up to tens of metres.

It has a rugged stainless steel housing, sealed to IP65, and is built to withstand ambient temperatures of up to 75°C.

COMPACT

The sensor is just 45 mm long (plus cable gland), so it can fit into very small spaces. The USB interface is built into the sensor, so there is no need for additional bulky interface modules.

BENCHTOP AND LABORATORY

With the precision and robustness of our industrial pyrometers, and the plug-and-play convenience of USB, the PyroMiniUSB is the ideal benchtop temperature sensor for testing and experimentation.

EDUCATION

The PyroMiniUSB is ideal for teaching science concepts such as emissivity, reflectivity, thermal conductivity, energy transfer, insulation and internal energy.

SOFTWARE

Two Windows applications are available:

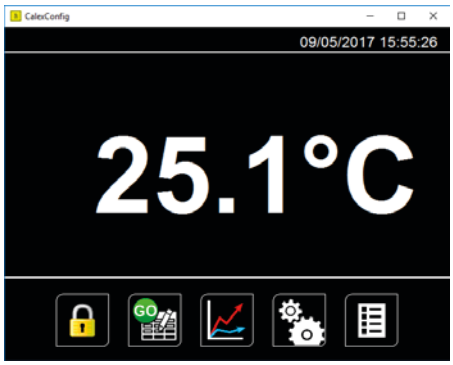
CalexConfig is simple, touch-friendly software for use with one sensor. It is supplied with the sensor.

CalexSoft 2 is capable of displaying, graphing and logging temperature data from multiple sensors at the same time. It is available as a free download from www.calex.co.uk.

Both programs allow tempertaure display, temperature graphs, data logging and sensor configuration.

For more information, please see the CalexConfig / CalexSoft 2 data sheet.

It is also possible to use third-party Modbus software to communicate directly with the sensor.

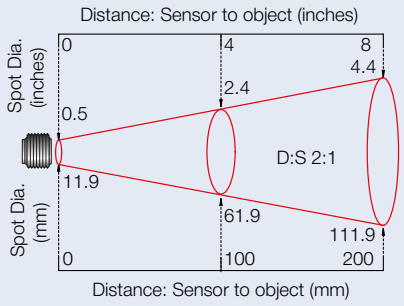


CalexConfig

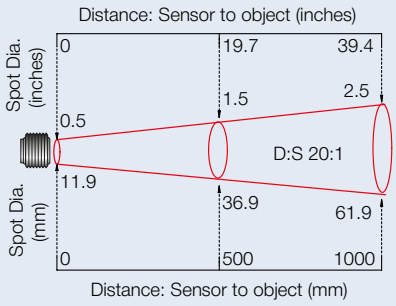
CalexSoft 2

OPTICS

Diameter of target spot measured versus distance from sensing head (90% energy)

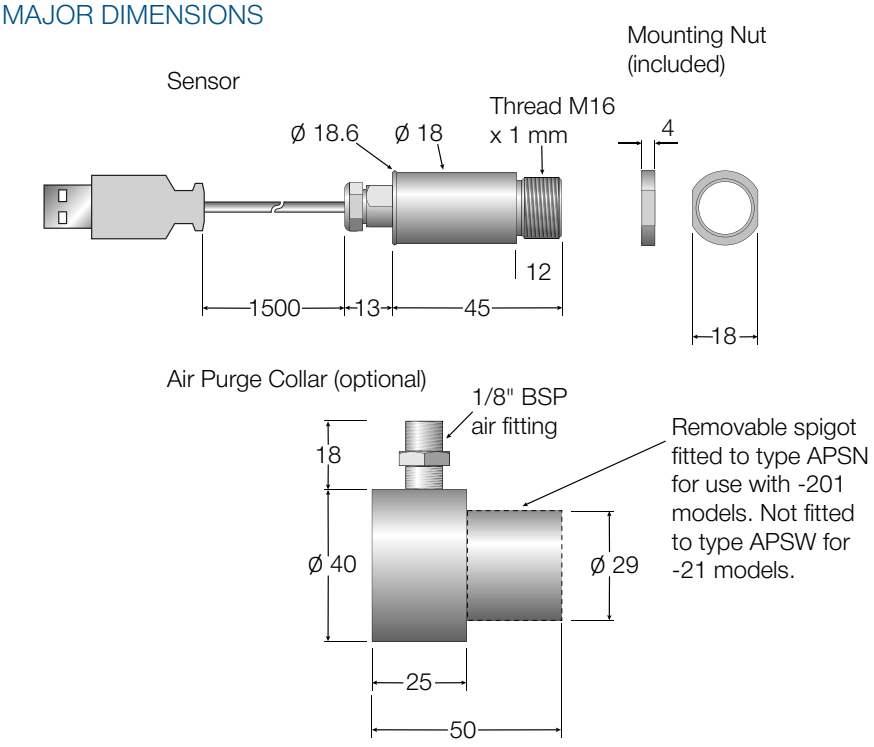


PMU21



PMU201

MAJOR DIMENSIONS



All dimensions in mm

ACCESSORIES

Laser sighting tool

Air purge collar

Adjustable mounting bracket

Fixed mounting bracket

Adjustable mounting bracket **ABS**

Fixed mounting bracket **FBS**

Calibration certificate **CALCERTA**

Laser sighting tool **LSTS**

Fixed or Adjustable mounting bracket with continuous laser sighting **DLSBFS / DLSBAS**

MODEL NUMBERS

PMU | **201**

Field of view
21 = 2:1 divergent optics
201 = 20:1 divergent optics

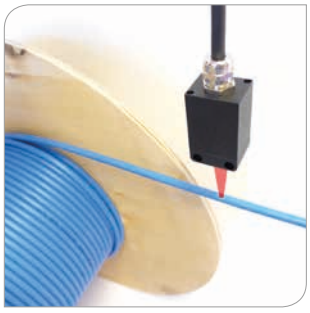
Series
PMU = PyroMiniUSB sensor

PyroCube Series

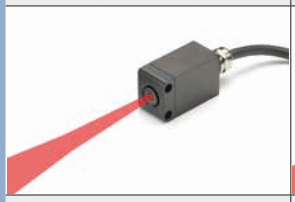
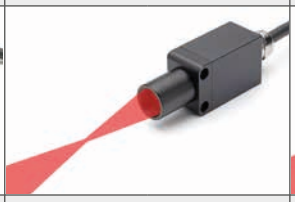
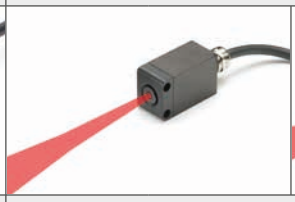
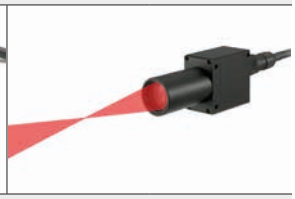
Infrared Temperature Sensors for Special Applications

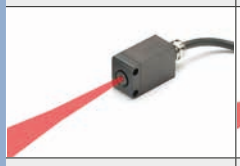
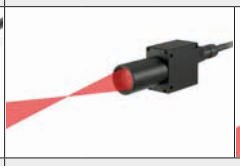
PyroCube sensor with optional touch screen interface

- High performance infrared temperature sensors
- Choice of specialised models for demanding applications
- Continuous LED sighting on all models shows position and size of measured spot while readings are being taken
- Current, voltage and alarm outputs
- Digital communications
- Optional touch-screen display with configuration and data logging



PYROCUBE SENSOR SPECIFICATIONS

PyroCube Type	S			F		G			
Application	General purpose			Fast response		Glass			
									
Description	The general-purpose PyroCube S is suitable for measuring most non-reflective non-metals. Advantages over other general-purpose sensors are the built-in LED aiming light, fast response time, and small measured spot size.			The PyroCube F has a lightning-fast response time of 0.001 seconds.		Glass-specific measurement wavelength for improved accuracy when measuring glass surface temperature. G models are ideal for annealing, e.g. light bulb and fluorescent lamp manufacturing. GH models are suitable for high-temperature glass melting, such as in glass-to-metal sealing.			
Temperature Range	0°C - 500°C			50°C - 500°C Measurements below 50°C are possible with reduced stability		100°C - 1200°C Measurements below 100°C are possible with reduced stability		100°C - 2400°C Measurements below 100°C are possible with reduced stability	
Analogue output scale (adjustable via optional touch screen module or RS232)	Factory set: 4 mA = 0°C 20 mA = 500°C					Factory set: 4 mA = 50°C 20 mA = 1200°C		Factory set: 4 mA = 50°C 20 mA = 2400°C	
Response Time (adjustable up to 5 s via averaging function)	10 ms			1 ms		50 ms		10 ms	
Accuracy of Measurement †	± 3°C or 1%, whichever is greater			± 3.5°C or 1%, whichever is greater		All models: ± 3°C or 1%, whichever is greater -GH models: ± 2% above 1200°C			
Repeatability †	± 0.5°C			± 1°C		± 1°C		± 0.2% + 2°C	
Temperature Resolution †	<0.5°C			<0.7°C		0.5°C			
Spectral Response	2 - 7 µm					5 µm			
Model No. PCU-	S1.6	S1.6	S5.5	F3.5	F7.0	G7.0	G20.0	GH2.2	GH4.5
Focal Spot Diameter (mm)	1.6	3	5.5	3.5	7	7	20	2.2	4.5
Focal Distance (mm)	35	70	120	100	200	180	500	150	300
Maximum Measurement Distance (mm)	150	200	300	300	500	500	1000	300	500
Weight (without cable)	85g					85g		190g	

PyroCube Type	P	XS		M			
Application	Thin film plastics	Very small targets		Metals, low temperature			
							
Description	Accurately measures the temperature of thin film plastics that cannot be measured with general-purpose sensors. Materials include polyolefins, polyamide, polyethylene, polypropylene, polystyrene, nylon, PVC, acrylic, polyurethane and polycarbonate.	Extremely small measured spot size. Applications include measuring individual electronic component temperatures on a circuit board, and plastic welding where the seam is very narrow.		Short-wavelength sensors for measuring metals as cool as 50°C, with a very fast response time of 0.001 seconds and a very small measured spot size			
Temperature Range	120°C - 350°C Measurements below 120°C are possible with reduced stability	50°C - 500°C Measurements below 50°C are possible with reduced stability	100°C - 500°C Measurements below 100°C are possible with reduced stability	100°C - 600°C Measurements below 100°C are possible with reduced stability			
Analogue output scale (adjustable via optional touch screen module or RS232)	Factory set: 4 mA = 80°C 20 mA = 350°C	Factory set: 4 mA = 0°C 20 mA = 500°C		Factory set: 4 mA = 50°C 20 mA = 600°C			
Response Time (adjustable up to 5 s via averaging function)	10 ms	10 ms	50 ms	1 ms			
Accuracy of Measurement †	± 4°C	± 3°C or 1%, whichever is greater	± 5°C	± 3°C or 1%, whichever is greater			
Repeatability †	± 1°C	± 1°C	± 2°C	± (0.2% + 2°C)			
Temperature Resolution †	0.5°C	0.5°C	1.5°C	0.5°C			
Spectral Response	3.4 µm	5 - 7 µm		2.2 µm			
Model No. PCU-	P12.0	XSA0.7	XSB1.0	MA1.0	MA2.0	MA3.5	MB11.0
Focal Spot Diameter (mm)	12	0.7	1	1	2	3.5	11
Focal Distance (mm)	200	40	100	50	100	200	200
Maximum Measurement Distance (mm)	500	100	300	100	200	400	500
Weight (without cable)	85g	200g	85g	190g			85g

GENERAL SPECIFICATIONS (ALL MODELS)

Measurement Specifications	
Emissivity Setting	Adjustable, 0.3 to 1.0, via RS232C or optional touch screen interface
Averaging	Adjustable up to 5 seconds
Target Sighting*	Red LED built-in as standard on all models, shows the position and size of the measurement area. Switchable on/off.

* LED SIGHTING AND ALARMS

Sensor Only

These functions are selectable via RS232C and share a common connection, which is configurable either as an input to switch the LED sighting on/off, or an open drain alarm output, but not both at once.

Sensor with PM030

These functions may be configured via the PM030 interface. Two alarm relay outputs are provided in place of the open drain output.

Environmental Specifications	
Environmental rating	IP67
Operating ambient temperature	0°C to 50°C
Storage temperature	-15°C to 70°C
Operating ambient humidity	30% to 85% RH non condensing

† Ambient temperature 23 ± 5°C, emissivity 1.0, averaging time 50 ms
‡Voltage can be 0-1, 0-5, or 0-10 V DC, depending on model (see Model Numbers).

Electrical Specifications	
Outputs	1 analogue output and 1 alarm output
Analogue Output Type	4-20 mA (set by default), 0-20 mA, mV/°C or voltage‡, selectable via optional PM030 touch screen interface
Alarm Output*	1 open drain alarm output, rated 27 V DC, 0.2 A
Digital Communications	RS232C Modbus RTU, non-isolated
Output Cable Connection	Hardwired
Supply Voltage	5 to 27 V DC, 100 mA max

Analogue Outputs (configurable via touch screen)	
Output Type	0 to 1 V DC mV/°C 0 to 20 mA 4 to 20 mA
Effective Minimum Output	30 mV 30 mV 0.2 mA 4.0 mA
Output Accuracy (additional to Measurement Accuracy)	±1.5 mV ±1.5 mV ±0.02 mA ±0.02 mA

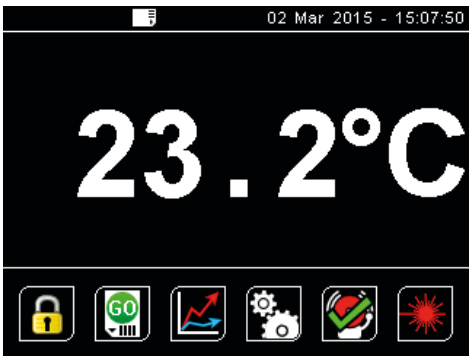
PM030 - TOUCH SCREEN INTERFACE FOR PYROCUBE (ALL MODELS)

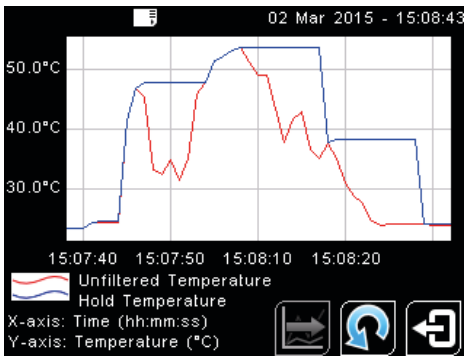
- Optional wall-mounted display, data logging, configuration and alarm unit for PyroCube sensor
- **Read the temperature**
  The large, bright backlit temperature display is visible from a distance and turns red in an alarm condition.
- **Record the temperature history**
  See a graph of the measured temperature, and log more than a year of data to a single MicroSD Card. The data is stored in a simple text format that can be imported easily into Excel.
- **Configure the sensor**
  All the sensor's configuration settings can be adjusted via the intuitive touch screen interface.
- **Trigger temperature alarms**
  Two alarms are individually configurable as high, low, band or error. The screen turns bright red to signal an alarm condition, and the built-in 24 V, 1 A relay outputs can be connected directly to alarm sounders and beacons.
- **Accurate measurements, even with reflections of hot objects**
  Place the sensor outside an oven or furnace and accurately measure the temperature of objects inside by using the Reflected Energy Compensation feature.

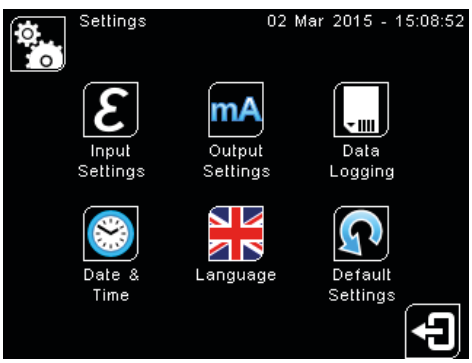
PM030 Specifications	
Inputs	1 x PyroCube sensor (any model)
Outputs	Retransmitted analogue output from PyroCube sensor, plus 2 relays, rated 24 V DC, 1 A
Display Format	2.83" (72 mm) resistive touch TFT, 320x240 pixels, backlit
Touch Screen Display Format	2.83" (72 mm) resistive touch TFT, 320 x 240 pixels, backlit
Storage	MicroSD Card (optional), max. 32 GB, equal to 16 years of data at the fastest sample rate of 1 per second
Data Logging Interval	1 second to 1 day (configurable)
Internal Clock Battery	1 x BR 1225 3V (not included)
Variables Logged	Instantaneous target temperature, hold temperature, alarm events
File format	.csv
Configurable Parameters (Data Logging)	Sample period Number of samples Scheduled start
Configurable Parameters (Alarm Logging)	Log times when triggered, acknowledged, reset Log data while triggered

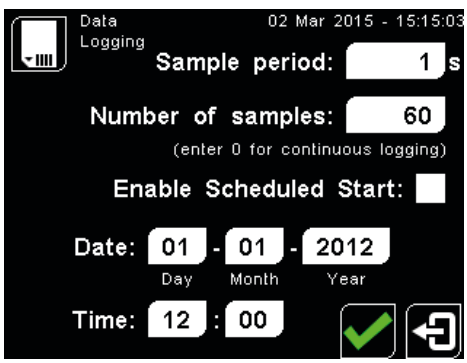
Configurable Parameters
Languages English, Chinese (simplified), Japanese
Temperature units °C/°F
Displayed temperature
LED sighting on/off
Password
Date & time (for data logging time stamps)
Peak hold period, decay level
Averaging period
Correction (gain/offset)
Emissivity setting (with teach function)
Reflected energy compensation (with teach function)
Output type
Output temperature range
Polarity on error
Alarm mode, levels, hysteresis

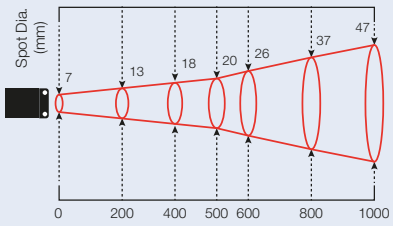
SCREENSHOTS (PM030 interface)











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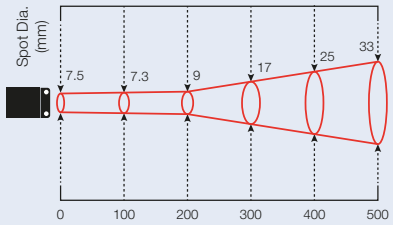
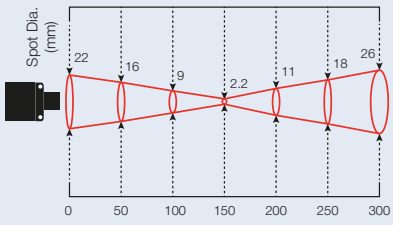
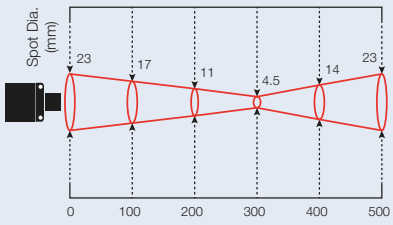


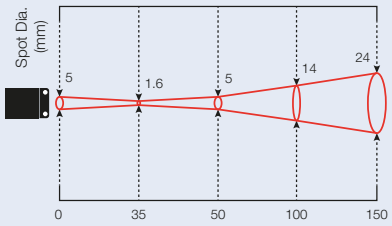
PCU-G7.0



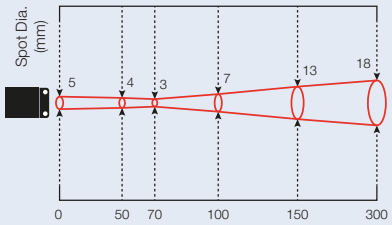
PCU-GH.2.2



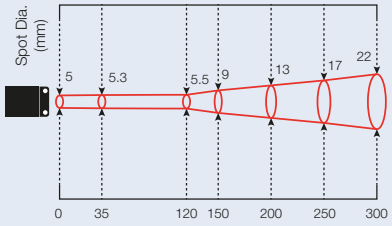
PCU-GH4.5



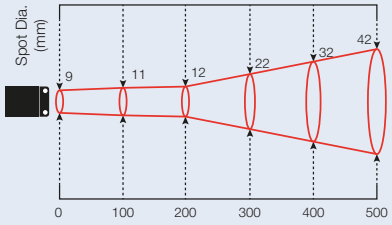
PCU-S1.6



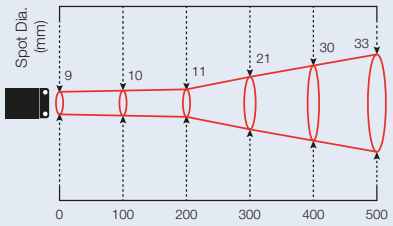
PCU-S3.0



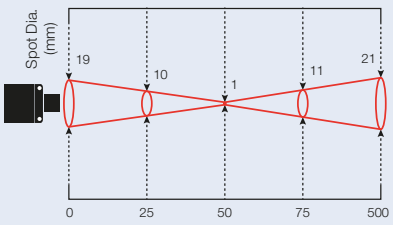
PCU-S5.5



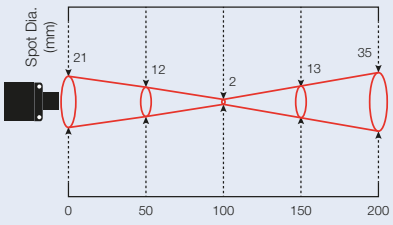
PCU-P12.0



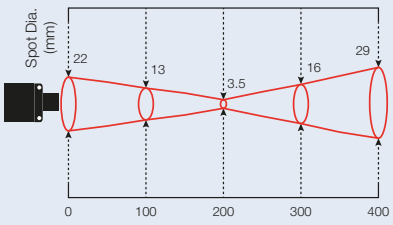
PCU-MB11.0



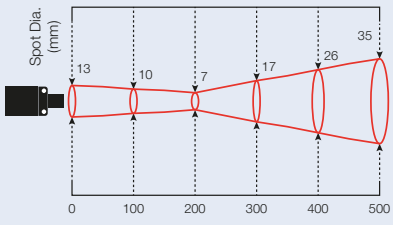
PCU-MA1.0



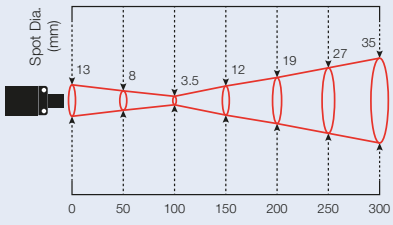
PCU-MA2.0



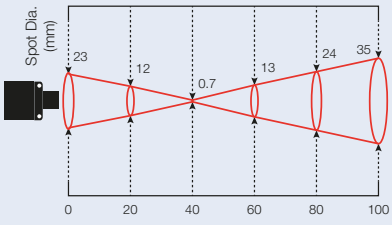
PCU-MA3.5



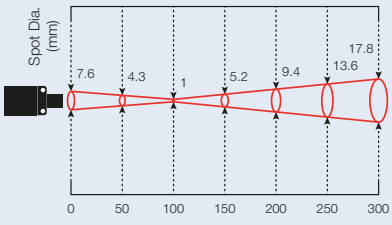
PCU-F7.0



PCU-F3.5



PCU-XSA0.7

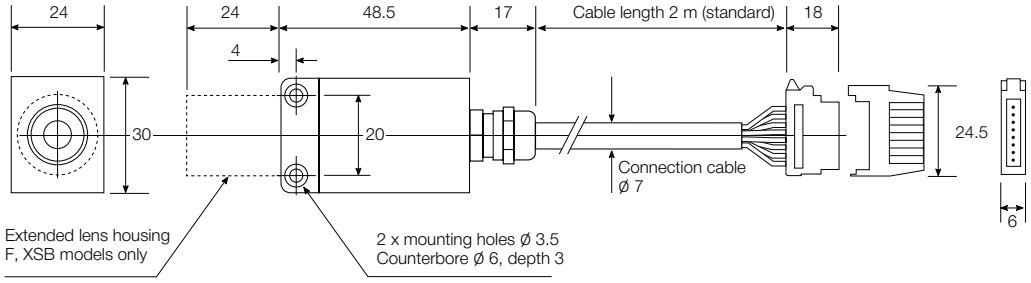


PCU-XSB1.0

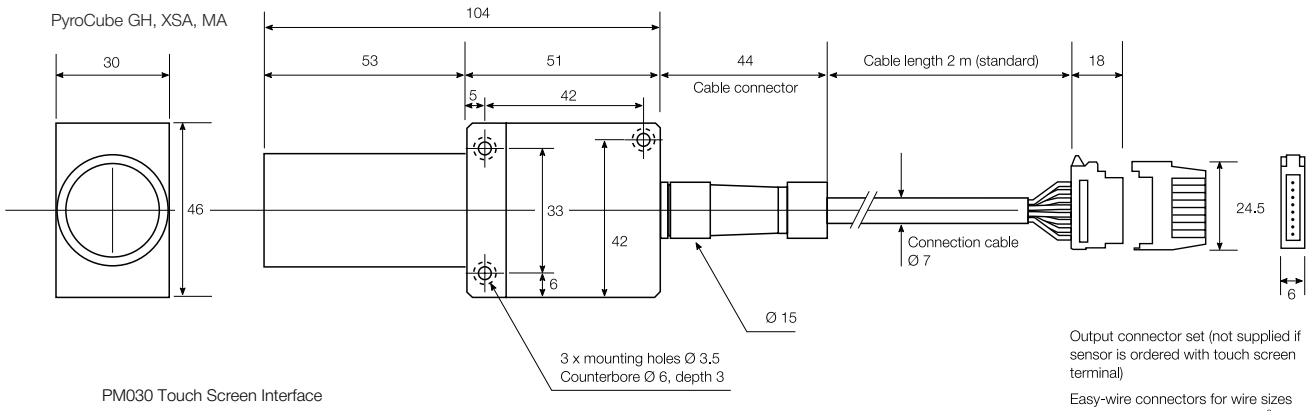
PyroCube accuracy specifications are valid up to the maximum distances shown.

DIMENSIONS

PyroCube Sensor
S, F, G, P, XSB, MB models



PyroCube GH, XSA, MA

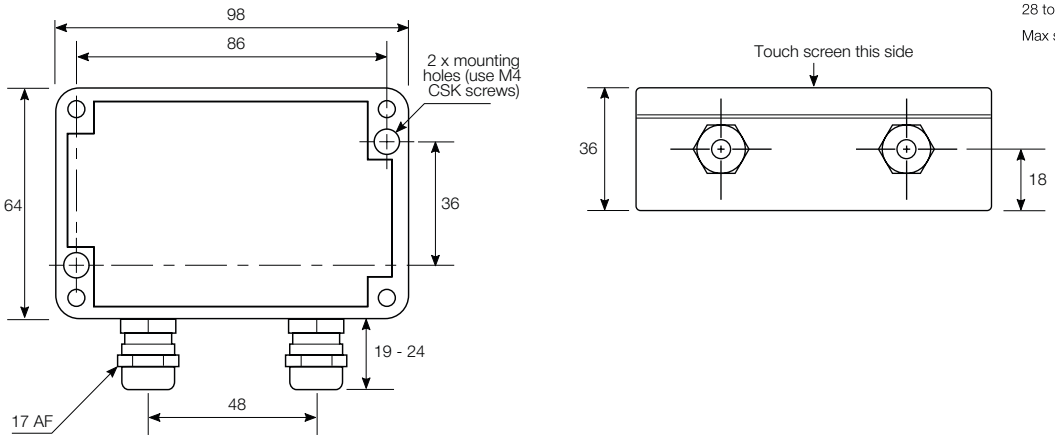


Output connector set (not supplied if sensor is ordered with touch screen terminal)

Easy-wire connectors for wire sizes 28 to 20 AWG (0.08 to 0.5 mm²)

Max sheath Ø 1.5 mm

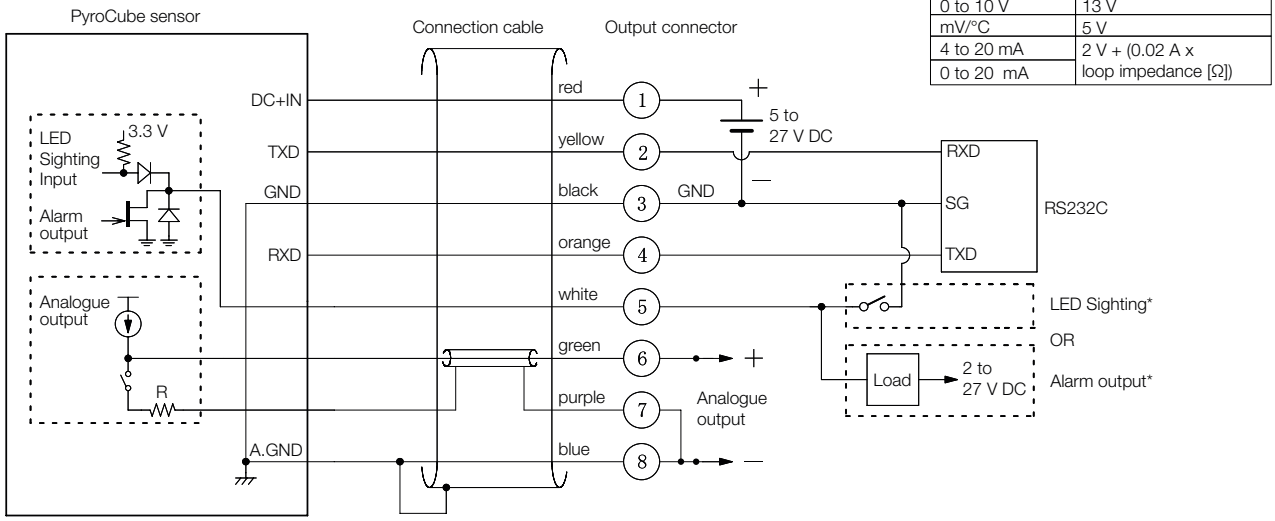
PM030 Touch Screen Interface



All dimensions in mm

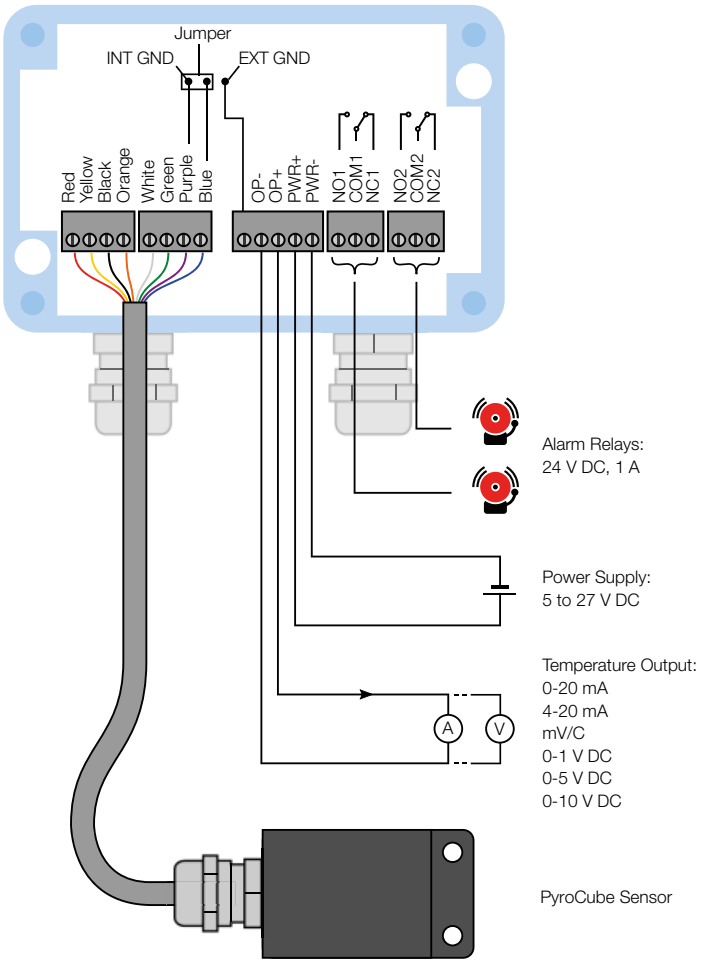
PYROCUBE CONNECTIONS - SENSOR ONLY

Analogue output	Minimum supply voltage
0 to 1 V	5 V
0 to 5 V	8 V
0 to 10 V	13 V
mV/°C	5 V
4 to 20 mA	2 V + (0.02 A x loop impedance [Ω])
0 to 20 mA	



* See LED SIGHTING AND ALARMS (with Specifications)

PM030 CONNECTIONS



MODEL NUMBERS

PyroCube S, G, P, MB

PyroCube F, XSB

PyroCube GH, XSA, MA

PCU - S1.6 - 2M - 1V

Voltage output option
1V = 0 to 1 V DC
5V = 0 to 5 V DC
10V = 0 to 10 V DC
Note: All models also have 0-20 mA, 4-20 mA, and mV/°C outputs as standard.

Cable length
2M = 2 metres
5M = 5 metres
10M = 10 metres

Response time and optics
S1.6 = 10 ms response, 1.6 mm spot at 35 mm distance
S3.0 = 10 ms response, 3.0 mm spot at 70 mm distance
S5.5 = 10 ms response, 5.5 mm spot at 120 mm distance

F3.5 = 1 ms response, 3.5 mm spot at 100 mm distance
F7.0 = 1 ms response, 7.0 mm spot at 200 mm distance

Series
PCU = PyroCube sensor

Application and Optics

General Purpose
S1.6 = 1.6 mm measured spot diameter at 35 mm distance
S3.0 = 3 mm measured spot diameter at 70 mm distance
S5.5 = 5.5 mm measured spot diameter at 120 mm distance

Fast Response
F3.5 = 3.5 mm measured spot diameter at 100 mm distance
F7.0 = 7 mm measured spot diameter at 200 mm distance

Glass
G7.0 = 7 mm measured spot diameter at 180 mm distance
G20.0 = 20 mm measured spot diameter at 500 mm distance
GH2.2 = 2.2 mm measured spot diameter at 150 mm distance
GH4.5 = 4.5 mm measured spot diameter at 300 mm distance

Thin Film Plastics
P12.0 = 12 mm measured spot diameter at 200 mm distance

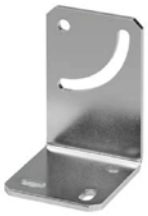
Very Small Measured Spot
XSA0.7 = 0.7 mm measured spot diameter at 40 mm distance
XSB1.0 = 1 mm measured spot diameter at 100 mm distance

Metals
MA1.0 = 1 mm measured spot diameter at 50 mm distance
MA2.0 = 2 mm measured spot diameter at 100 mm distance
MA3.5 = 3.5 mm measured spot diameter at 200 mm distance
MB11.0 = 11 mm measured spot diameter at 200 mm distance

PM030

Touch screen interface module for PyroCube sensor (any model)

ACCESSORIES



Mounting bracket

Protective lens cover

Air purge collar

Airless dust protector

Right angled mirror

Water Cooling Jacket

5 m extension cable with connectors

Panel Mounting Kit

FibreMini

Fibre Optic Infrared Temperature Sensor for Harsh Applications

- Temperature ranges from 250°C to 2000°C
- Miniature sensing head withstands 200°C ambient temperature
- Short measurement wavelength for improved accuracy on metals
- No electronics in the sensing head - ideal for use near induction heaters and strong electromagnetic fields
- Touch screen display with configuration and data logging
- Choice of analogue or digital output
- Alarm relays on all models
- Advanced signal processing functions
- Built-in laser sighting, simultaneous with measurement

GENERAL SPECIFICATIONS

Temperature Range
MT models: 250°C to 1000°C
HT models: 450°C to 2000°C
Maximum Temperature Span (-CRT models)
Full temperature range (up to 1550°C)
Minimum Temperature Span (-CRT models)
100°C
Output
4 to 20 mA or RS485 Modbus (up to 247 sensors may be installed on a single Modbus network)
Field of View
Choice of optics (see Optics)
Accuracy
±1% of reading
Repeatability
±0.5% of reading
Emissivity Setting Range
0.10 to 1.00
Emissivity Setting Method
-BRT models: via RS485
-CRT and -BRT models: via touch screen
Response Time, t_{90}
≥240 ms (90% response)
Spectral Range
2.0 to 2.6 µm
Supply Voltage
24 V DC ± 5%
Maximum Current Draw
100 mA
Maximum Loop Impedance
-CRT models: 900 Ω (4 to 20 mA output)
Alarm Relays
2 x Single Pole Changeover alarm relays rated 24 V DC, 1 A, isolated 500 V DC

MECHANICAL

	Sensing head	Electronics Module
Construction	Stainless Steel 316	Cast aluminium
Dimensions	Ø 12 x 48 mm (see diagram)	98(w) x 64(h) x 36(d) mm
Mounting	M12 x 1.5 mm thread	Two M4 screw holes for wall mounting (see diagram)
Fibre Optic Cable Length (sensing head to electronics module)	3 m, 5 m or 10 m	
Cable Connections	Removable screw terminal blocks (see Connections) Conductor size: 28 AWG to 18 AWG	
Output Cable Gland	Suitable for cable diameters 3.0 to 6.5 mm	

ENVIRONMENTAL

	Sensing head	Electronics Module (without touch screen)	Electronics Module (with touch screen)
Environmental Rating	IP65 (NEMA 4)	IP65 (NEMA 4)	
Ambient Temperature Range	0°C to 200°C	0°C to 60°C	0°C to 60°C
Relative Humidity	Maximum 95% non-condensing	Maximum 95% non-condensing	Maximum 95% non-condensing
CE Marked	Yes	Yes	Yes
RoHS Compliant	Yes	Yes	Yes

ELECTROMAGNETIC COMPATIBILITY STANDARDS:

EN61326-1, EN61326-2-3 (Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements - Industrial)

TOUCH SCREEN

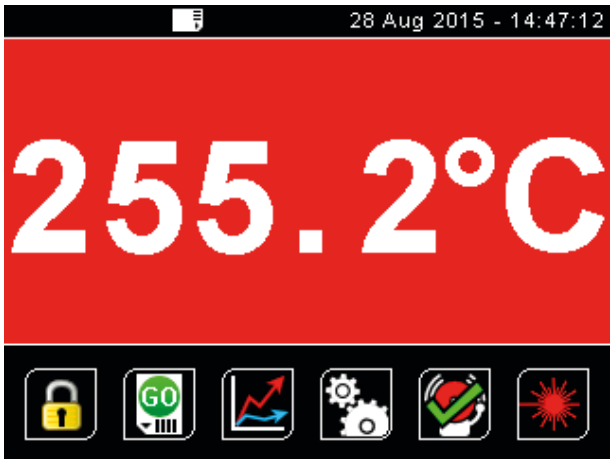
The backlit touch screen interface mounted in the lid of the electronics module provides a large, bright display of the measured temperature, as well as controls allowing full configuration of the sensor. The graph view shows the history of the measured temperature.

In alarm conditions, the display turns bright red to provide an immediate and obvious alarm indication. Alarm modes and levels can be configured via the touch screen.

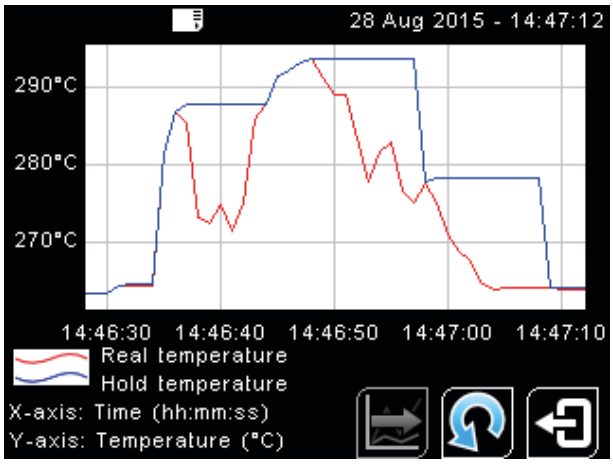
TOUCH SCREEN SPECIFICATIONS

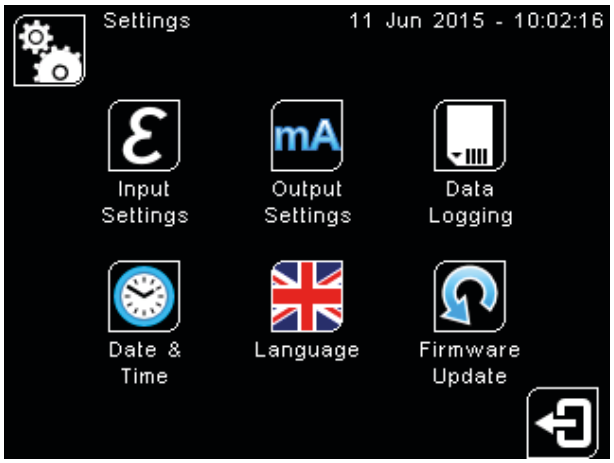
Touch Screen Display Format	2.83" (72 mm) resistive touch TFT, 320 x 240 pixels, backlit
Configurable Parameters	Temperature range (-CRT models), temperature units, emissivity setting, reflected energy compensation, alarms, signal processing, Modbus address (-BRT models), date and time, data logging
Temperature Units	°C or °F configurable
Temperature Resolution	0.1°
Alarm Configuration	Two alarms with adjustable level, individually configurable as HI or LO. Alarm 2 can be set to target temperature or sensing head internal temperature
Signal Processing	Average, peak hold, valley hold, minimum, maximum
Languages	English, Chinese (simplified), Japanese

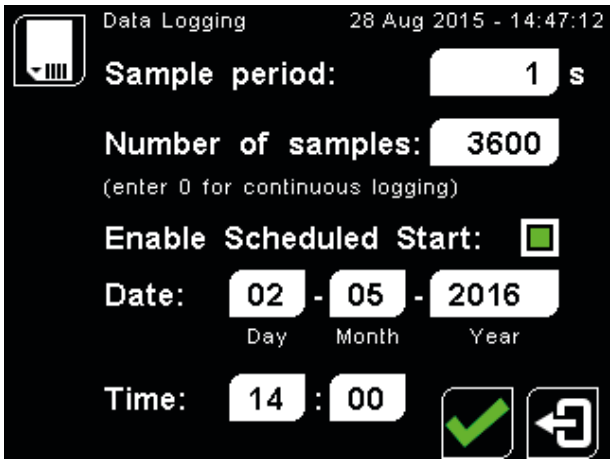
EXAMPLE SCREENSHOTS



Screen shown with red background to indicate alarm condition







DATA LOGGING SPECIFICATIONS

Data Logging Interval	1 to 86,400 seconds (1 day)
MicroSD Card	Max. capacity: 32 GB (not included)
Internal Clock Battery	1 x BR 1225 3V (not included)
Variables Logged	Target temperature, electronics module temperature, max, min, average, emissivity setting, reflected energy compensation temperature, alarm events
File format	.csv
Configurable Parameters	Sample period, number of samples, scheduled start date and time

DATA LOGGING (-CRT AND -BRT MODELS)

The FibreMini can be used as a standalone data logger.

All models include a MicroSD card slot for data logging, which can be configured via the touch screen interface. The user can select the sample rate and the number of samples to be taken and schedule the data logging to start at a certain time.

With a MicroSD card larger than 2 GB, years of data can be stored, even at the fastest possible sample rate of 1 per second.

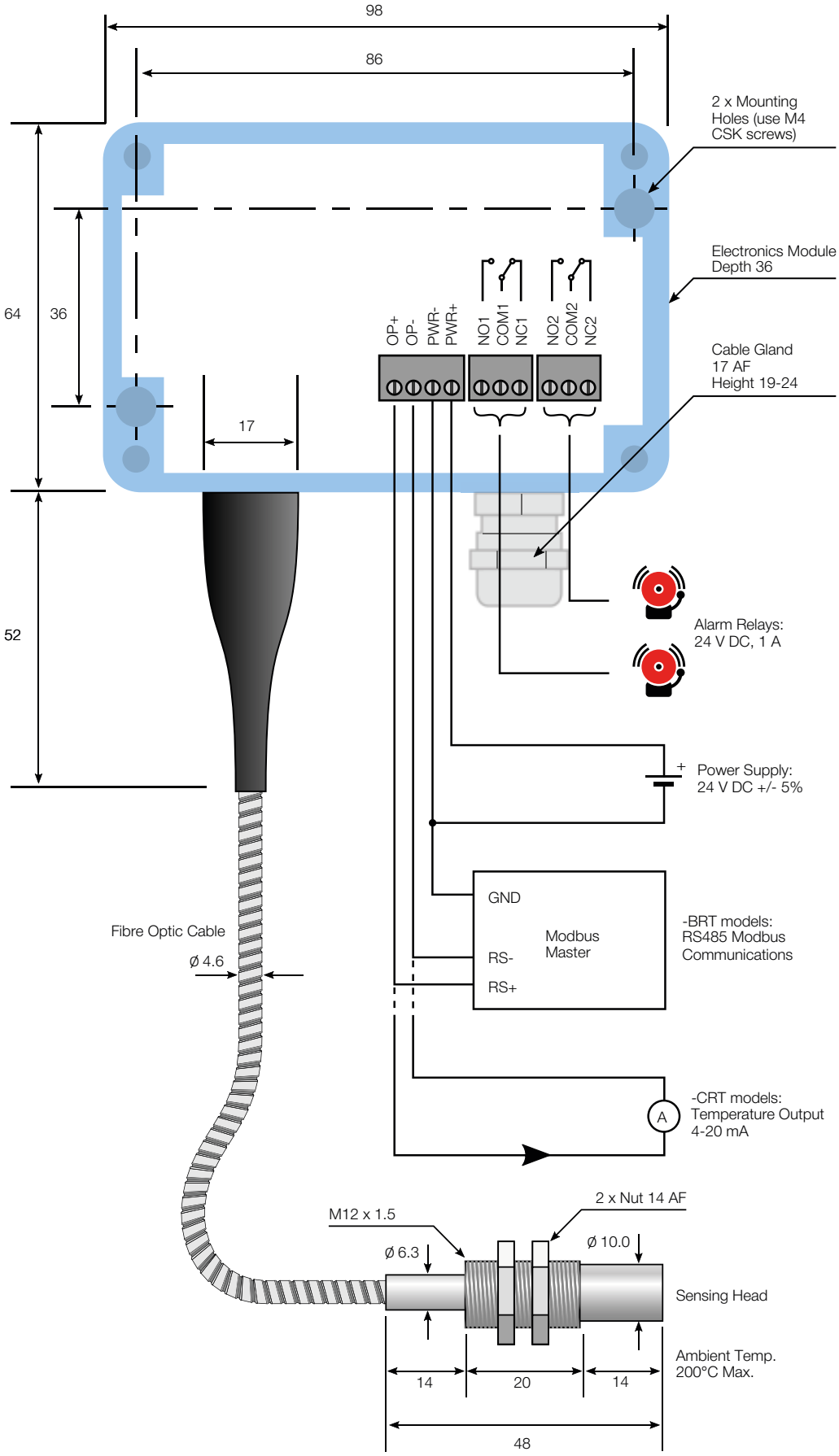
Data is stored in .csv format and can be viewed and edited easily using spreadsheet software.

Alarm events can also be logged to the MicroSD Card.

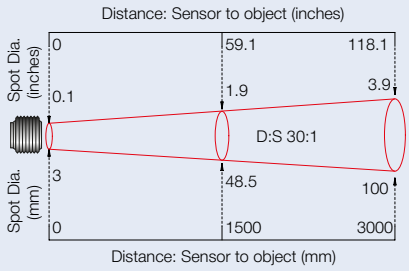
A MicroSD card with SD card adapter is available as an optional accessory.

The MicroSD card slot and battery holder are located inside the electronics module. Readings are time and date stamped using the sensor's internal clock. The clock is reset when the power is disconnected, or it will continue if the optional battery is fitted.

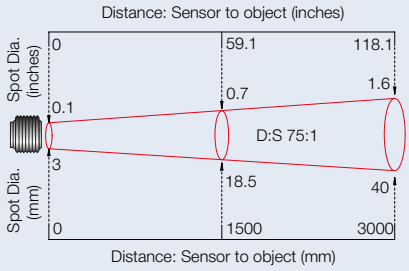
CONNECTIONS AND DIMENSIONS



FIELD OF VIEW



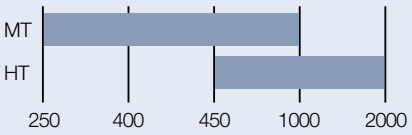
-301



-751

Diameter of target spot measured versus distance from sensing head - 90% energy

MEASUREMENT TEMPERATURE RANGE (°C)



-CRT models: 4 to 20 mA output is configurable within this range

-BRT models: Digital output, full temperature range

MODEL NUMBERS

FM2.2 - **301** - **HT** - **CRT** - **5M**

Fibre Optic Cable Length
3M = 3 metres
5M = 5 metres
10M = 10 metres

Output and Interface
CRT = 4-20 mA output, two alarm relay outputs, with touch screen
BRT = RS485 Modbus output, two alarm relay outputs, with touch screen

Temperature Range
MT = 250°C to 1000°C
HT = 450°C to 2000°C

Field of view
301 = 30:1 divergent optics
751 = 75:1 divergent optics

Series
FM2.2 = FibreMini with 2.2 µm spectral response

ACCESSORIES ALSO AVAILABLE

MSD	MicroSD Card with SD Card adapter: stores logged data
CALCERTA	Calibration certificate
ABF	Adjustable mounting bracket
FBF	Fixed mounting bracket
APF	Air purge collar
PM180	6-channel Modbus temperature indicator with touch screen interface and data logging
PMK	Panel Mounting Kit

ExTemp

Intrinsically Safe Infrared Temperature Sensor

- Suitable for hazardous areas, Zone 0, 1 and 2 (gas), and Zone 20, 21 and 22 (dust), with a suitable Intrinsically Safe isolator
- Temperature range: -20°C to 1000°C
- Two wire, 4-20 mA output
- Rescalable output and adjustable emissivity setting via optional USB adapter
- Fast response time and high stability
- Stainless steel 316 housing - ideal for offshore applications
- IP65 sealed
- Supplied with up to 25 m cable

General Specifications	
Temperature range	See table of Model Numbers
Maximum Temperature Span	1000°C
Minimum Temperature Span	100°C
Output	4 to 20 mA
Field of View	See table of Model Numbers
Accuracy	± 1°C or 1%, whichever is greater
Repeatability	± 0.5°C or 0.5%, whichever is greater
Emissivity Setting Range	0.20 to 1.00 (pre-set to 0.95)
Emissivity Setting Method	User configurable via USB interface
Response Time, t_{90}	240 ms (90% response)
Spectral Range	8 to 14 µm
Supply Voltage	12 to 24 V DC ± 5%
Maximum Current Draw	25 mA
Maximum Loop Impedance	See Application Guide (available separately)
Mechanical	
Construction	Stainless Steel 316
Major Dimensions	Ø 20 x length 150 mm (see Dimensions)
Mounting	M20 x 1.5 mm thread, length 46 mm, supplied with two mounting nuts
Cable Length	5 m, 10 m or 25 m as standard (custom lengths also available)
Weight with 5 m Cable	475 g
Environmental	
Environmental Rating	IP65 (NEMA 4)
Ambient Temperature Range	0°C to 70°C (Operating range)
Relative Humidity	Max. 95% non-condensing
CE Marked	Yes
RoHS Compliant	Yes

Hazardous Area Classification	
The ExTemp is ATEX, IECEx and TIIS certified.	
ATEX Classification	Ex II 1GD
IECEx Classification (Gas)	Ex ia IIC T4 Ga
IECEx Classification (Dust)	Ex ia IIIC T135°C IP65 Da
Ambient Temperature Rating	-20°C ≤ Ta ≤ 70°C
Maximum DC Input Voltage	Ui = 28 V
Maximum Input Current	Ii = 93 mA
Maximum Input Power	Pi = 650 mW
Maximum Internal Capacitance	Ci = 8 nF
Maximum Internal Inductance	Li = 0 mH
ATEX Certificate Number	CML 14ATEX2079
IECEx Certificate Number	IECEx CML 14.0032
TIIS Certificate Number	TC21097

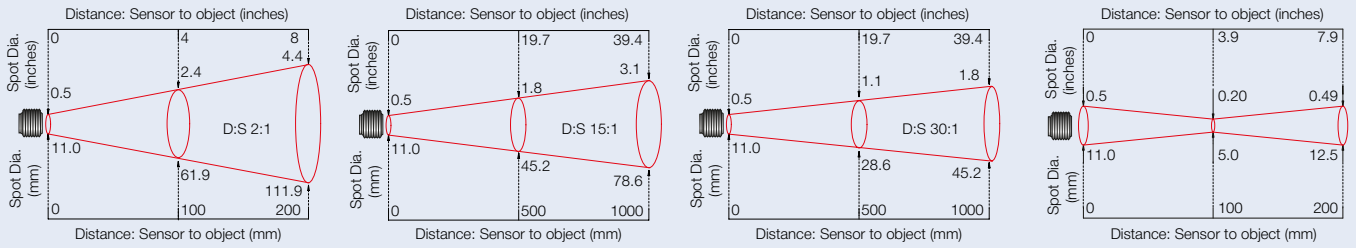
CONFIGURATION

The ExTemp sensor may be connected to a PC via the optional USB adapter and included Windows software.

Configurable settings include the emissivity setting, 4-20 mA temperature range, averaging, peak and valley hold processing and reflected energy compensation.

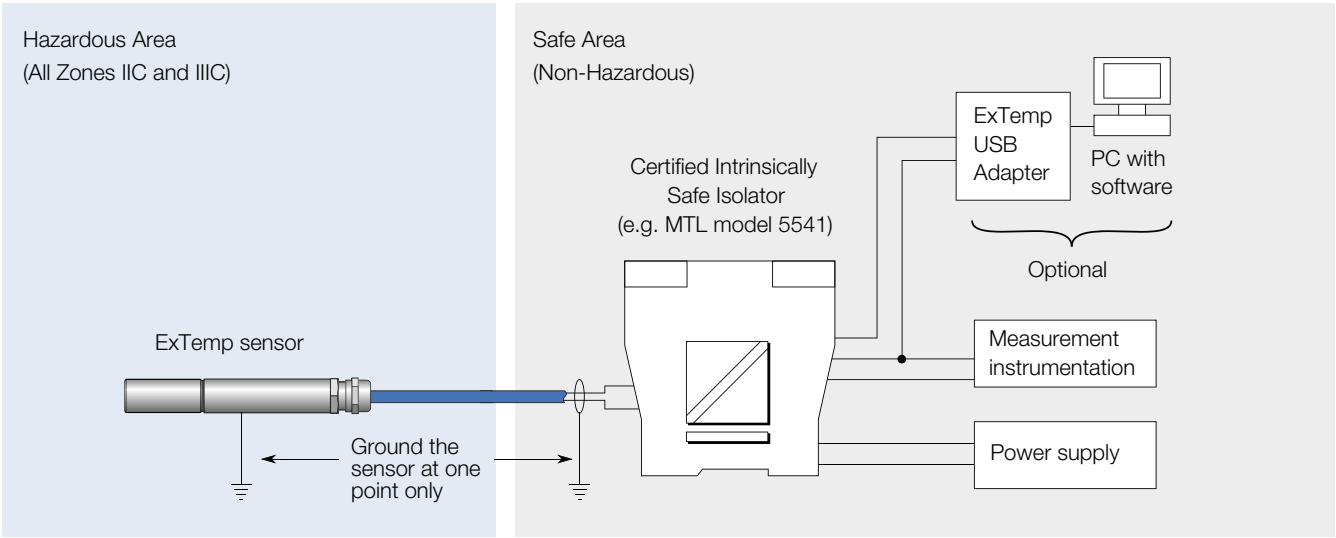
For more information on the software, please see the CalexConfig / CalexSoft 2 data sheet.

DIAMETER OF TARGET SPOT MEASURED VERSUS DISTANCE FROM SENSING HEAD

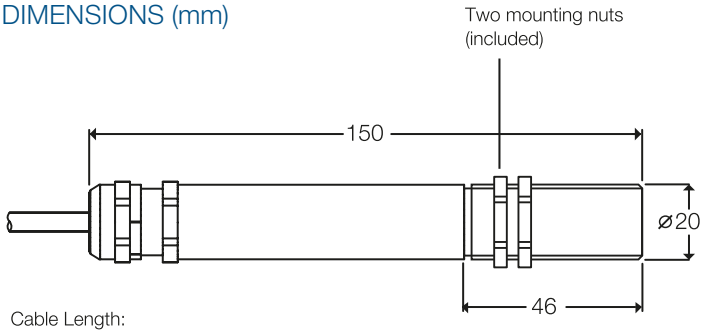


-21 **-151** **-301** **-CF**

CONNECTIONS



DIMENSIONS (mm)



Cable Length:
5 m, 10 m, 25 m as standard
Custom lengths also available
User may extend cable subject to safety requirements

MODEL NUMBERS

EX - FFF - TT - C - LL

Cable Length
5 = 5 m
10 = 10 m
25 = 25 m
Custom lengths also available

User Configurable
C = Configurable via optional USB adapter

Temperature Range
LT = -20°C to 100°C
MT = 0°C to 250°C
HT = 0°C to 500°C
XT = 0°C to 1000°C
ST = Special temperature range
Temperature range may be re-scaled between limits -20°C and 1000°C via optional USB adapter and software

Field of view
21 = 2:1 divergent optics
151 = 15:1 divergent optics
301 = 30:1 divergent optics
CF = Close focus optics
(Spot Ø 5 mm at distance 100 mm)

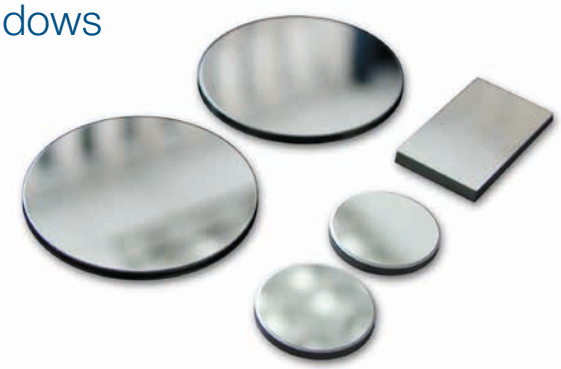
ACCESSORIES

FBL	Fixed mounting bracket (1-axis rotation)
ABL	Adjustable mounting bracket (2-axis rotation)
APMW	Air purge collar (for 2:1 optics)
APMN	Air purge collar (for all other optics)
CALCERTA	Calibration certificate, 3 temperature points, UKAS traceable
LCT	USB adapter and configuration software

Protective Windows

for Infrared Temperature Sensors

IR Viewport Windows



- Mount the window in a flange on your process
- Protect the sensor from high pressure, high temperature or vacuum
- Choice of materials to suit a range of sensors and applications
- Wide range of standard sizes, or custom-made to suit your requirements

Calex provides IR-transmissive windows in a choice of sizes. Windows are commonly circular, however other shapes are available, and we can provide windows manufactured to suit your requirements.

The material should be chosen to suit the type of sensor and the conditions in the process, such as the pressure and temperature. Short-wavelength sensors, such as the PyroUSB 2.2, PyroMini 2.2 and FibreMini, can view through glass, quartz and calcium fluoride. Other materials, such as zinc selenide and germanium, are required for use with long-wavelength (8 to 14 µm) sensors.

The sensor must have an adjustable emissivity setting to compensate for the small percentage of infrared energy lost to reflection and absorption by the window. Use this formula to ensure maximum accuracy.

Emissivity setting =
actual emissivity of target x transmission of window

MATERIALS

Window Material	Transmission Range	Transmission (approx.)	Maximum Temperature
Zinc selenide (ZnSe)	4 to 14 µm	72%	250°C
Germanium (Ge)	2 to 14 µm	46% uncoated (around 90% if anti-reflective coated)	70°C
Calcium fluoride (CaF2)	0.2 to 7 µm	94%	1200°C
Sapphire (Al2O3)	0.2 to 4.5 µm	85%	2000°C
Quartz Crystal (SiO2)	0.4 to 3 µm	92%	490°C

ORDERING

These windows are inexpensive compared with the cost of replacing the lens of an infrared temperature sensor. Contact Calex for a quotation, or for assistance on choosing a suitable window.

Protective Plastic Window -

ideal for the food and pharmaceutical industries

The protective plastic window models PWS and PWL are designed to help protect the germanium lens of Calex infrared temperature sensors from mechanical damage, and to help retain fragments of the lens if it is damaged.

To use the window, simply screw the stainless steel window holder onto the front of the sensor, tighten with a spanner, adjust the emissivity setting using the formula below, and begin taking measurements.

Emissivity setting = actual emissivity of target x window transmission

SPECIFICATIONS

Model	SIWS	PWS	PWL
Mounting	M16 x 1 mm		M20 x 1 mm
Compatible With	PyroEpsilon, PyroBus, Pyro CAN, PyroMini*, PyroMiniBus, PyroMiniUSB		PyroUSB*
Transmission (8 to 14 µm)	69%	76.8%	76.8%
Ambient Temperature Range	0°C to 180°C	0°C to 100°C**	
Window material	Silicon	IR-transmissive plastic	
Holder material	Stainless steel		

*General Purpose models only. Not compatible with Short Wavelength models.

** Do not exceed the ambient temperature limits of the sensor.

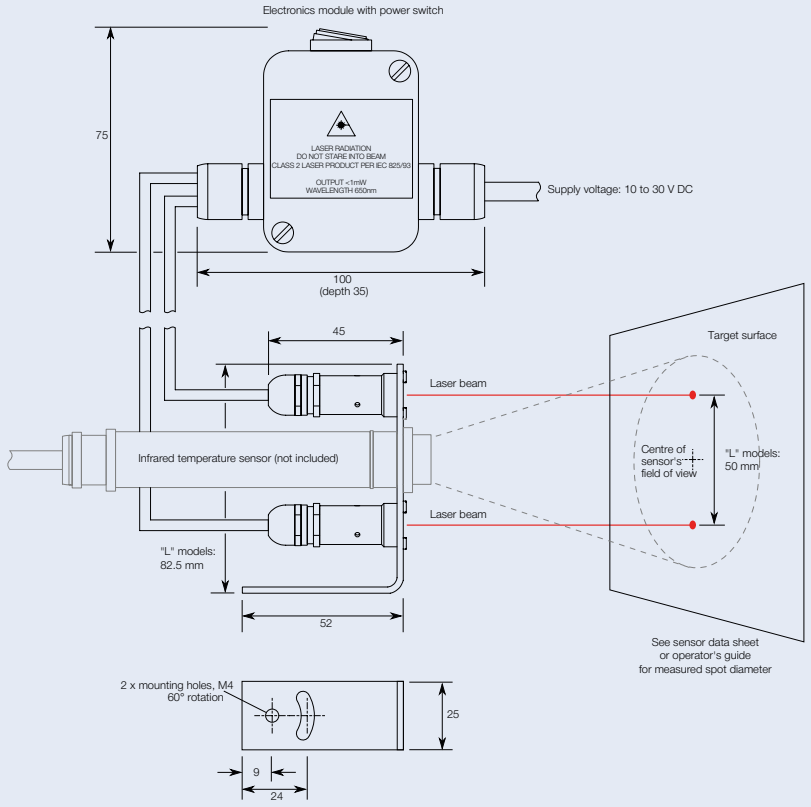
Issue A - Sept 17
Specifications subject to change without notice

DLSB

Dual Laser Sighting Bracket

- Mounting bracket for Calex infrared temperature sensors
- Two parallel lasers indicate the centre of the measured spot
- Allows continuous targeting while taking measurements
- IP65 sealed
- Remote on/off switch

DIMENSIONS (mm)



ORDERING INFORMATION

Description	Compatibility	Type	Model number
Dual Laser Sighting Bracket	Sensors with 16 mm mounting thread (e.g. PyroCouple, PyroMini, PyroBus, PyroEpsilon)	Fixed (1-axis rotation)	DLSBFS
		Adjustable (2-axis rotation)	DLSBAS
	Sensors with 20 mm mounting thread (e.g. PyroUSB)	Fixed (1-axis rotation)	DLSBFL
		Adjustable (2-axis rotation)	DLSBAL

GENERAL SPECIFICATIONS

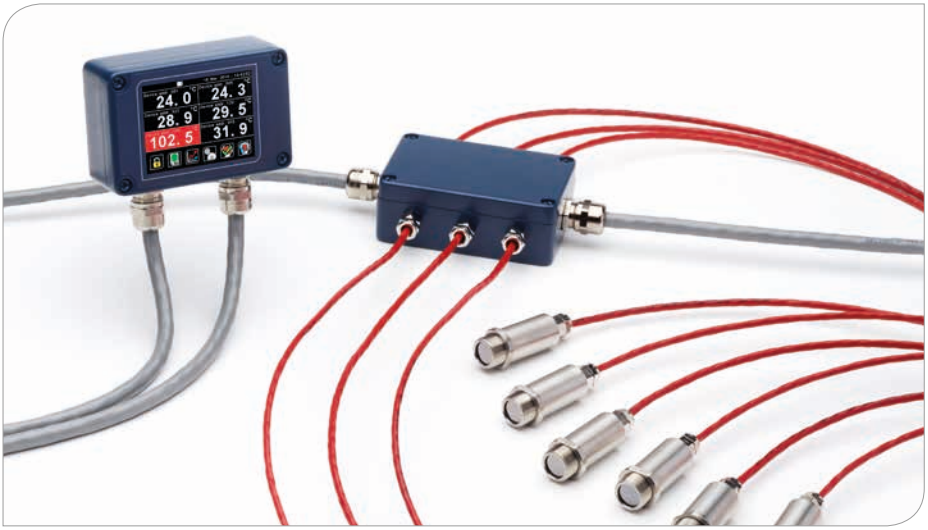
Supply voltage
10 to 30 V DC
Max current draw
100 mA
Electrical connection
Removable screw terminals
Power cable type
Use two-core cable with outer diameter 4.5 to 10 mm
Connection cable (lasers to electronics module)
Two cables, length 1 m as standard (longer cable available to order)
Construction
Bracket & laser housing: Stainless steel
Electronics module: Polycarbonate
Separation of laser dots
42 mm (calibrated at 1.5 m distance)
Dimensions (electronics module)
With glands & switch:
100 (w) x 75 (h) x 35 (d) mm
Box only: 50 (w) x 65 (h) x 35 (d) mm
Dimensions (bracket)
25 (w) x 74 (h) x 52 (d) mm
Weight (without sensor)
202 g
Environmental Rating
IP65
Relative humidity
95% max. non-condensing
Operating temperature range
-10°C to +60°C

OPTIONS

- Extended cable for all models (30 m max)

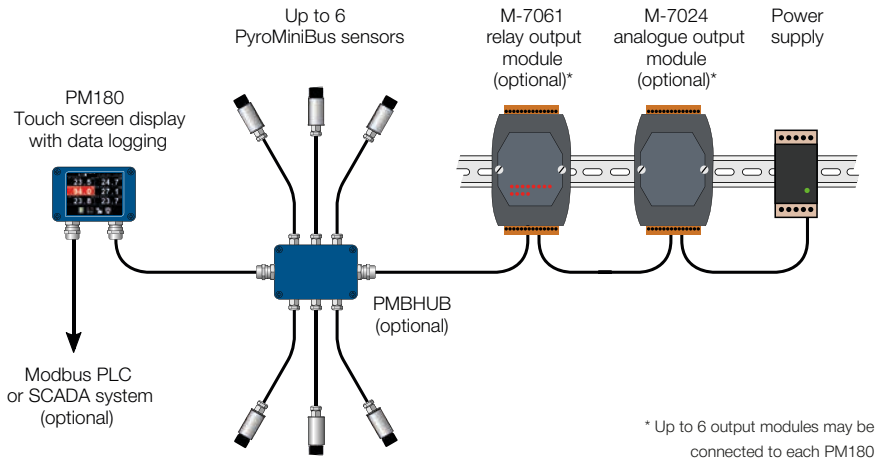
PyroMiniBus

Multi-Channel Infrared Temperature Monitoring System



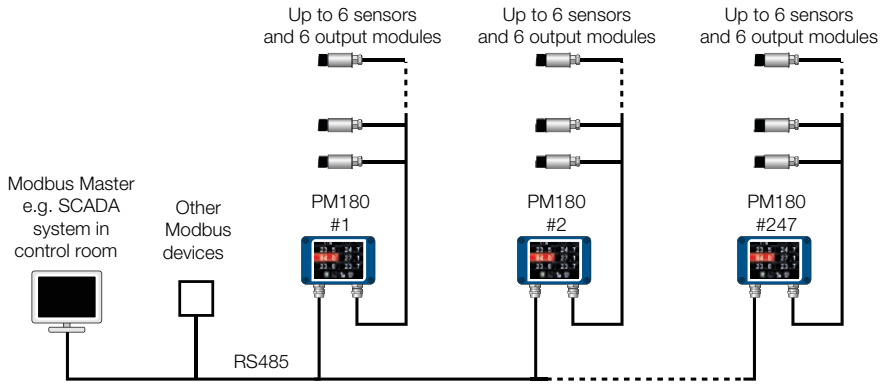
- Miniature non-contact temperature sensors with RS485 Modbus communications
- Touch screen terminal for configuration, display, alarms and data logging
- Low-cost standalone 6-channel system
- Build larger systems using the PM180's separate Modbus Master and Slave interfaces
- Analogue and alarm relay outputs via optional modules
- Conforms to industrial EMC standards

PM180 AS MODBUS MASTER



* Up to 6 output modules may be connected to each PM180

PM180 AS MODBUS SLAVE



Each PM180 is a slave device on the main network and the master on each network of sensors.

The PyroMiniBus is an industrial infrared temperature monitoring system, with miniature sensing heads and optional display modules. PyroMiniBus sensors are designed to measure the surface temperature of non-reflective materials in industrial applications, from -20°C to 1000°C. They are sealed to IP65, built from 316 stainless steel, and fully tested to industrial EMC standards. They can measure food, paper, thick plastics, asphalt, paint, bulk materials and organic materials, as well as most dirty, rusty or oily surfaces.

ROBUST

PyroMiniBus sensors have an operating temperature rating of up to 120°C with no need for cooling (70°C on XCF models).

COMPACT

The sensors measure just 45 mm long (plus cable gland), so they can fit into the smallest of spaces.

CONFIGURABLE

Up to 6 sensors can be connected to the optional PM180 interface module, which provides temperature display, configuration, and high-capacity data logging to a MicroSD Card. Analogue and relay outputs are available via separate DIN rail mounted modules.

LOW COST

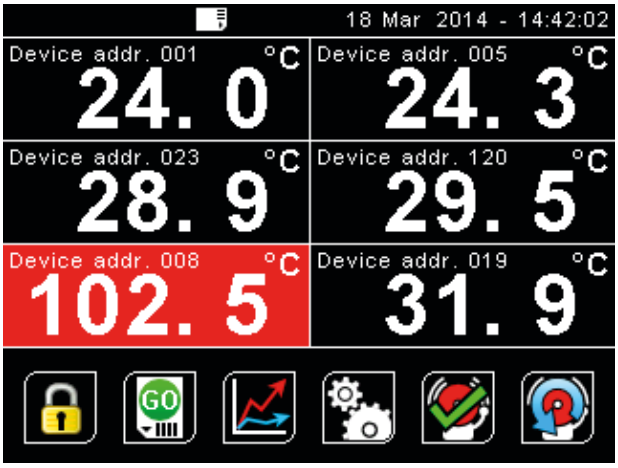
With up to 6 sensors connected to one PM180, the PyroMiniBus is an ideal low-cost non-contact temperature measurement system.

NETWORKABLE

To measure more than 6 locations, PyroMiniBus sensors and PM180 sub-networks may be connected to an RS485 Modbus SCADA system or PLC. It is possible to measure the temperature of hundreds or thousands of locations on the same network.

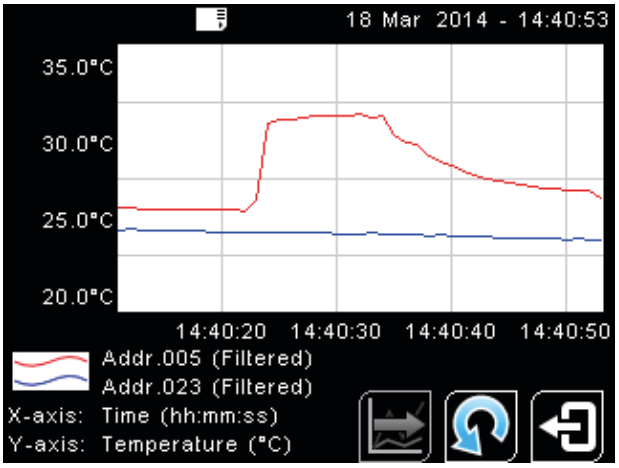
PM180 6-CHANNEL TOUCH SCREEN TERMINAL

- Configure, display and log data and alarms from up to 6 sensors per terminal unit, simultaneously or individually
- Operates as Modbus master and Modbus slave
- High capacity data logging to MicroSD Card
- Bright touch screen with backlight
- Analogue and relay outputs via optional ICP DAS modules
- 2-channel scrolling temperature chart



Intuitive touch screen interface

Display and configure all 6 channels individually or simultaneously. The display for each channel turns red in an alarm condition

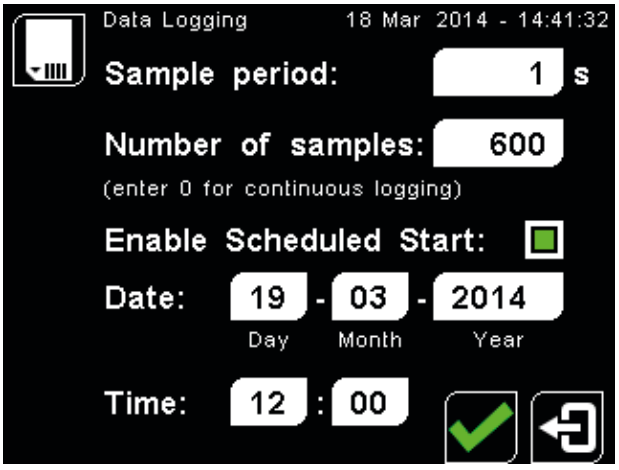


Temperature chart

Display temperature data from two channels in a scrolling graph

Password-protected settings

Configure options for each sensor and the PM180 itself via the touch screen interface



Data logging

Schedule a start time, or start and stop logging at the touch of an icon. Temperature data and alarm events may be logged to a MicroSD Card (not supplied)

PYROMINIBUS SENSOR SPECIFICATIONS

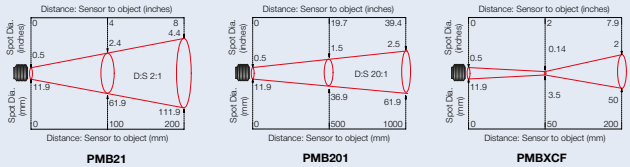
General	
Temperature Range	-20°C to 1000°C
Interface	RS485 Modbus RTU
Accuracy	±1% of reading or ±1°C whichever is greater
Repeatability	± 0.5% of reading or ± 0.5°C whichever is greater
Emissivity Setting	0.2 to 1.0
Response Time, t90	125 ms (90% response)
Spectral Range	8 to 14 µm
Supply Voltage	6 to 28 V DC
Supply Current	50 mA max.
Baud Rate	9600 baud *
Format	8 data bits, no parity, 1 stop bit *

* Other configurations available upon request

Configuration	
Configuration Method	Via PM180 touch screen, or directly via RS485 Modbus
Configurable Parameters	Emissivity Setting, Averaging, Reflected Energy Compensation
Mechanical	
Construction	Stainless Steel
Dimensions	18 mm diameter x 45 mm long
Thread Mounting	M16 x 1 mm pitch
Cable Length	1m (longer lengths available to order)
Weight with Cable	85 g
Environmental	
Environmental Rating	IP65
Ambient Temperature	0°C to 120°C (70°C on XCF models)
Relative Humidity	95% max. non-condensing
Conformity	
See PM180 Specification (right)	

OPTICS

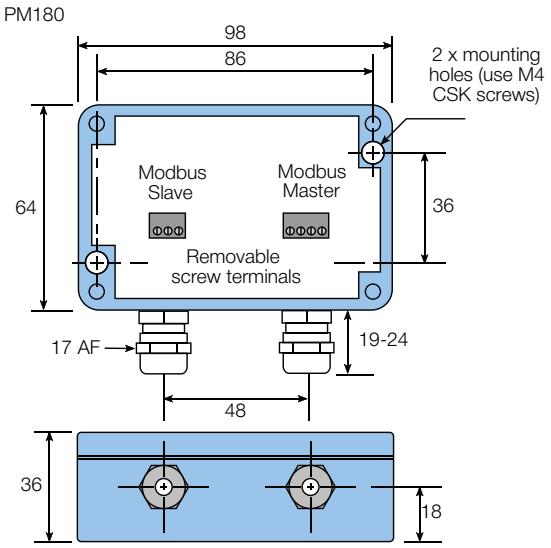
Diameter of target spot measured versus distance from sensing head (90% energy)

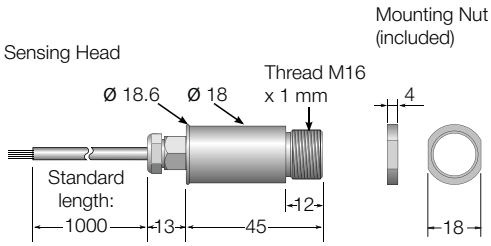


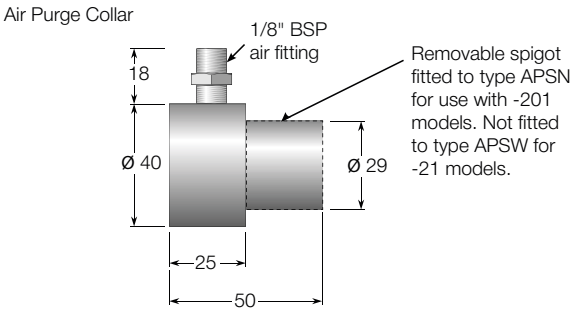
PM180 SPECIFICATIONS

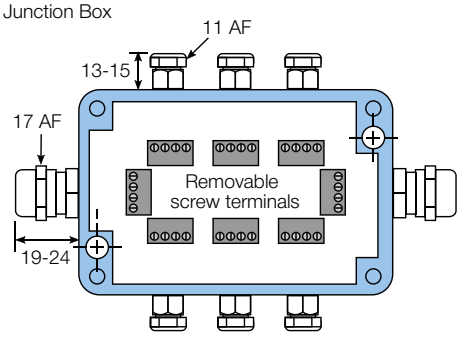
General	
Compatible Sensor Types	All models of PyroMiniBus and PyroBus sensors -BB and -BRT models of PyroMini and FibreMini sensors
Display	2.83" (72 mm) resistive touch TFT, 320 x 240 pixels, backlit
Supply Voltage	10 to 30 V DC
Maximum Current Draw	100 mA
Configurable Parameters (global)	Temperature units, date and time, data logging, graph channels, alarm logging
Configurable Parameters (per channel)	Signal processing, emissivity setting, reflected energy compensation, alarms, Modbus address
Alarm Configuration	12 alarms (2 per sensor) with adjustable level, individually configurable as HI or LO.
Temperature Units	°C or °F selectable
Temperature Resolution	0.1°
Signal Processing	Averaging with configurable period
Display Sample Period	120 ms per sensor (720 ms in total for 6 sensors)
Data Logging	
Logging Interval	1 to 86,400 seconds (1 day)
MicroSD Card	Max. capacity: 32 GB (not included - stores years of logged data)
Internal Clock Battery	1 x BR 1225 3V (not included)
Variables Logged	Target temperature, sensing head temperature, alarm events
File Format	.csv (can be imported to Excel)
Configurable Parameters	Sample period, number of samples, scheduled start date and time
Mechanical	
Construction	Die Cast Aluminium
Electrical Connections	Removable screw terminals, 28 AWG to 18 AWG
Dimensions	98(w) x 64(h) x 36(d) mm excluding cable glands
Weight	280 g
Environmental	
Environmental Rating	IP65
Ambient Temperature	0°C to 60°C
Relative Humidity	Maximum 95%, non-condensing
Conformity	
RoHS Compliant	Yes
Electromagnetic Compatibility	EN61326-1, EN61326-2-3 (Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements - **Industrial**)

MAJOR DIMENSIONS









All dimensions in mm

PMBHUB SPECIFICATIONS

Construction
Die Cast Aluminium

Electrical Connections
Removable screw terminals, 28 AWG to 18 AWG

Weight
250 g

Environmental Rating
IP65

Enclosure Dimensions
Same as PM180

MODEL NUMBERS

PMB | **201**

Field of view
21 = 2:1 divergent optics
201 = 20:1 divergent optics
XCF = Close Focus optics (3.5 mm spot diameter at 50 mm distance)

Series
PMB = PyroMiniBus sensor

SENSOR ACCESSORIES

IP65 junction box for 6 sensors **PMBHUB**

Adjustable mounting bracket **ABS**

Fixed mounting bracket **FBS**

Extended cable for PyroMiniBus sensor **PMBCE**

RS485 network cable **PMBSC**

Calibration certificate **CALCERTA**

Laser sighting tool **LSTS**

Fixed or Adjustable mounting bracket with continuous laser sighting **DLSBFS / DLSBAS**

Panel Mounting Kit **PMK**

PM180 ACCESSORIES

International AC mains power supply for PM180 PM180MA

MicroSD Card for PM180 data logging MSD

12-channel Modbus relay output module M-7061

4-channel Modbus voltage or current analogue output module M-7024


Laser sighting tool


Air purge collar


Adjustable mounting bracket


Fixed mounting bracket

PM7P and PM10P

Industrial Panel PCs

PM10P

PM7P

- Touch screen, panel mounted industrial PCs with Windows 7 and CalexSoft 2 multi-channel software
- Resistive touch screen can be used with gloves on
- USB and RS485 ports for connection to infrared temperature sensors
- Access temperature data via Ethernet or RS232, or save it to a USB drive via the front USB port
- Built-in UPS automatically saves data and shuts down the operating system if power is lost
- Robust solid-state hard drive
- Fanless design with aluminium housing for effective heat dissipation

The PM7P and PM10P panel PCs are ideal for use with systems of multiple infrared temperature sensors.
They are supplied pre-installed with CalexSoft 2 multi-channel software.

General specifications	PM7P	PM10P
Power supply	24 V DC ±10%	
Consumption	Approx. 12W	18 W
Display	7" 800x600 resistive touch screen, LED backlight	10.4" 800x600 resistive touch screen; LED backlight
Operating conditions	Temperature 5-50°C, humidity 10-90% RH (non condensing)	
Frontal panel	6mm aluminium alloy, milled	
Weight	Approx. 2 kg	Approx. 3 kg
Sealing	Front panel: IP65, enclosure and terminal blocks: IP20	
Cooling	Fanless	
UPS	Integrated, assisted shut-down	
Hardware features	**PM7P**	**PM10P**
CPU	Intel® Celeron® J1900 Quad Core @2.0GHz, 2MB Cache	
RAM	2GB DDR3 SDRAM	
Hard Disk	SATA Solid State Disk (SSD) 2,5" 24h/24h Anti shock 32GB	SATA Solid State Disk (SSD) 2,5" 24h/24h Anti shock 64 GB
Ethernet	1 x LAN 10/100 Base-TX Ethernet RJ-45 interface	2 x LAN 10/100/1000 Base-TX Ethernet RJ-45 interface
Serial Interfaces	1 x RS232, 1 x RS485 Optoisolated from power supply	1 X RS232, 1 X RS485 Optoisolated from power supply
USB ports	1 Front + 2 Rear, USB 2.0	
Audio	1 Mono 1W Out or 1 Stereo 500 Ohm Out	1 Stereo Output 600 Ohm
Clock	Real-Time clock, Back-up battery	
Software features	**PM7P**	**PM10P**
Operating system	Windows® 7 Embedded	
Software provided	CalexSoft 2 multi-channel software for Calex infrared temperature sensors, with: Data logging to Excel compatible file Remote communications with other CalexSoft 2 terminals via Modbus TCP (over Ethernet) Sensor connectivity via RS485 and USB Fully customisable temperature displays and graphs	

Dimensions (mm)					
Model	L	H	W	L (cut out)	H (cut out)
TD750	204	160	34	181	145
TD850-A	325	260	26	302	242

Ordering	
PM7P	7” panel PC with CalexSoft 2
PM10P	10.6” panel PC with CalexSoft 2

Sensors available separately – contact Calex

Issue A - Sept 17
Specifications subject to change without notice

Temperature Measurement Software

CalexSoft 2

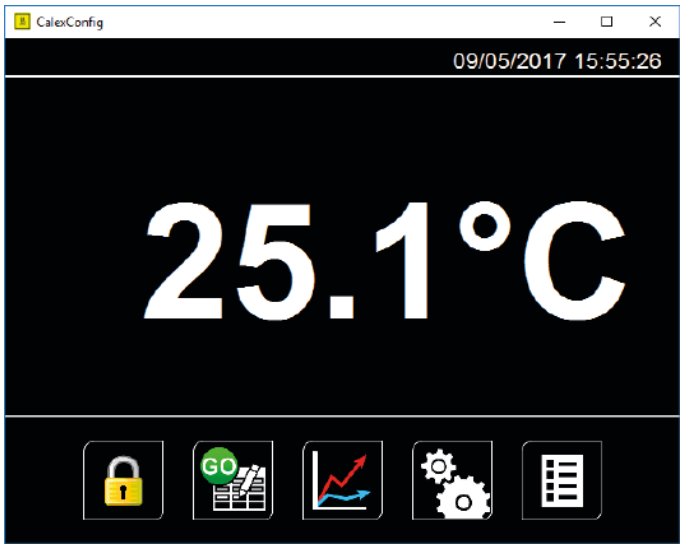
Multi-channel software

- Read temperatures from multiple sensors
- View scrolling temperature graphs
- Customisable layout with multiple pages and simple, touch-friendly drag-and-drop interface
- Arrange sensors in colour-coded groups and see the average temperature for the group
- Alarms, configurable per sensor
- Data logging to comma-separated text file (compatible with Excel), with the option to enter batch names
- Remote communications via Modbus TCP
- View temperatures remotely on another instance of CalexSoft 2
- Usernames and optional passwords with 2 permission levels (operator and admin)

Compatible with (USB)	PyroMiniUSB, PyroUSB, ExTemp* (via LCT)
Compatible with (RS485)	PyroMiniBus, PyroBus, PM180 (read only), FibreMini (-BRT), PyroMini (-BB and -BRT)
System requirements	Desktop PC or Panel PC with Windows 7 or newer (32 or 64 bit), 800x600 minimum screen resolution, touch screen or mouse and keyboard

CalexConfig

Simple, touch-friendly software for one sensor



- Read the measured temperature
- Configure the sensor
- View a scrolling temperature graph
- Log data to a comma-separated text file (compatible with Excel)

Compatible with (USB)	PyroMiniUSB, PyroUSB, ExTemp* (via LCT)
Compatible with (RS485)	PyroBus, PyroMiniBus, FibreMini (-BRT), PyroMini (-BB and -BRT)
System requirements	Desktop PC or Panel PC with Windows 7 or newer (32 or 64 bit), 800x600 minimum screen resolution, touch screen or mouse and keyboard

* When used with the ExTemp, the software is designed for configuration of the sensor. For continuous temperature measurement, use the 4-20 mA output.

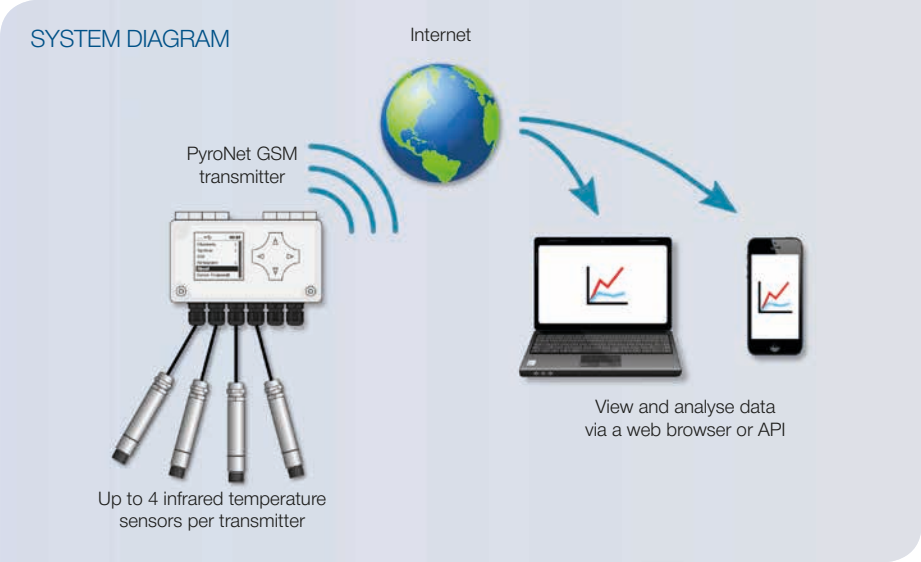
ORDERING

CalexConfig and CalexSoft 2 are available to download free of charge from www.calex.co.uk.

PyroNet GSM

Remote Sensor Telemetry System

- Monitor temperatures from anywhere in the world
- Unit transmits measurement data to the internet via cell phone network
- Up to 4 sensor inputs per unit
- View, analyse and download data via the hosted web interface

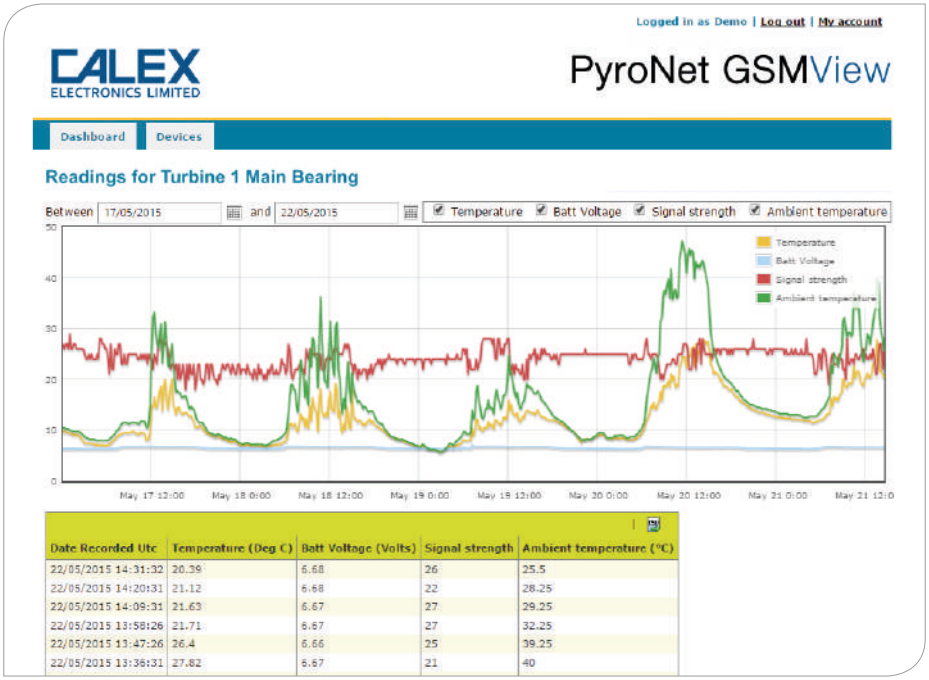


The PyroNet GSM telemetry module transmits readings from up to 4 devices with analogue output, such as the PyroCouple and PyroMini infrared temperature sensors.

Measurements are taken at regular intervals and transmitted to the internet via the GSM cellular phone network, using the PyroNet GSM's built-in SIM card.

Our hosted web interface, PyroNet GSMView, allows you to access and analyse data anywhere in the world via the internet.

A choice of battery-powered, solar-powered or 6-24 V DC-powered versions is available for indoor or outdoor use - contact Calex for advice. Optional relay outputs rated 30 V DC, 2 A are available for connection directly to alarm hardware.



PyroNet GSMView

- View and export data via a web browser
- Configure the PyroNet GSM unit remotely
- API included for third-party data export
- See configurable graphs
- Send alarms via email

PyroNet GSMView is a web-based interface for data acquisition and analysis. Your data is hosted securely on the PyroNet GSMView servers and access is included as standard in your monthly subscription.

You can export measurement data to be used in a spreadsheet, and configure the system to send email or SMS alarms, for temperature alerts or loss of communication (for example, due to power failure).

GENERAL SPECIFICATIONS

Inputs
4 x analogue inputs, selectable 0-20 mA, 4-20 mA, 0-5 V, 0-10 V or digital ON/OFF
Optional plug-in board with 5 x digital or pulse inputs - contact Calex.
Compatible with
PyroCouple, PyroMini, PyroUSB, or any other sensor with analogue voltage or current output
Input resolution
10 bit (1024 increments) over 10 volts
Accuracy
0.25%
Sample rate
Configurable depending on data subscription (typically 1 transmission per 10 minutes, or 1 transmission per hour)
Outputs
-R models: 2 relay outputs rated 30 V DC, 2 A
Display
40 x 40 mm, 128 x 128 pixel resolution, backlit
Programming interface
USB port for configuration and firmware updates
Firmware updates
Via USB or GSM network
Warranty
2 years

ELECTRICAL

Input connector
Removable screw terminals, pitch 3.81 mm. 4 x 3-pin connectors for sensors, 1 x 2-pin connector for power
Power supply
3.9 V battery (-B models) or 6-24 V DC, 0.5 A (-DC models)
Output power to sensors
3.9 V (unregulated), 5 V or 21.6 V
Output current to sensors
31.25 mA max.

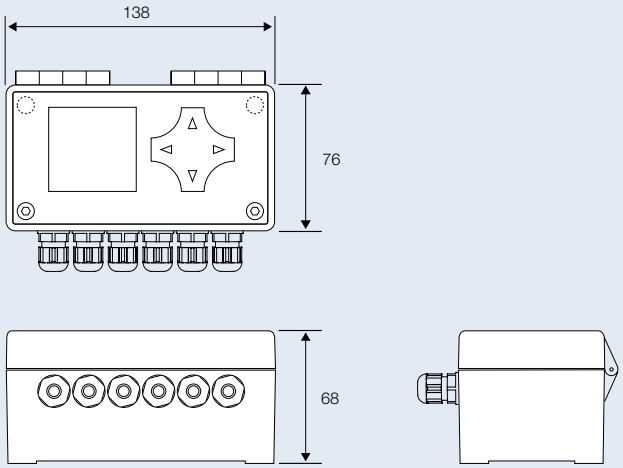
ENVIRONMENTAL

Environmental rating
IP67
Dimensions
138 x 76 x 68 mm (exclusing cable glands)

TELECOMMUNICATIONS

Approvals & Conformity
Conforms with R&TTE Directive; GE, GCF, FCC, PTCRB, IC, ANATEL approved
Modem type
Quad-band GSM & GPRS 850/900/1800/1900 Mhz
Output power
Class 4 (2 W) 850/900 MHz
Class 1 (1 W) 1800/1900 MHz
Antenna
Internal antenna built in as standard. Optional external antenna via SMA connector

DIMENSIONS (mm)



ORDERING

PyroNet GSM telemetry transmitter with 4 analogue inputs, IP67 weatherproof enclosure, built-in display, GSM modem for GPRS or SMS communications and internal antenna

PGSM - XX - X

Relay Outputs
(blank) = No relay outputs
R = 2 relay outputs rated 30 V DC, 2 A

Power Supply
DC = 6-24 V DC
B = Internal 3.9 V battery
S = Solar panel, backup battery and regulator

OPTIONS AND ACCESSORIES

PGANT External antenna with connection kit

PGBAT Battery, 3.9 V, 16 Ah, non-rechargeable, with built-in secondary cell. For PGSM-B models.

Monthly Subscriptions
Subscriptions include a SIM card, access to PyroNet GSMView, and a daily allowance of 24 transmissions (1 per hour) or 144 transmissions (1 every 10 minutes) as standard. Other options are available.

Optionally, alarm events may be transmitted by SMS and email.

Contact Calex to discuss your requirements.

ST640 Series

Low Cost Handheld Infrared Thermometer

- Wide temperature range
- Built-in laser pointer to improve aim
- Narrow field of view
- Input for type K thermocouple (ST642)
- Adjustable emissivity (ST642)
- Adjustable high and low alarms, audible and visual
- Backlit display with Data Hold
- °C/°F switchable
- Fast sampling time
- Auto-hold and power off
- High quality construction

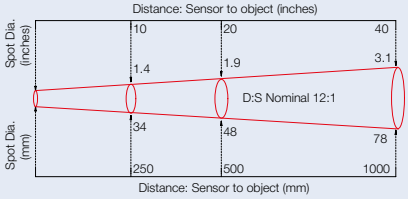
GENERAL SPECIFICATIONS

Field-of-view	12:1
Temperature Range	-32°C to 535°C (-25°F to 999°F)
Accuracy*	±3°C (±5°F) from -32°C to -20°C (-25°F to -4°F) ±2°C (±3°F) from -20°C to 100°C (-4°F to 212°F) ±2% above 100°C (212°F)
Spectral Range	5 to 14µm
Repeatability	±1°C (±2°F)
Resolution	0.1°C (0.1°F)
Response Time	500ms
Ambient Range	0°C to 50°C (32°F to 122°F), 10% to 90%RH
Power OFF	Automatic after approx. 7s
Display	LCD with backlighting
Battery Type	9V, PP3
Dimensions	180mm x 130mm x 40mm
Weight	195g

*Accuracy is given at ambient temperature of 25°C (77°F)

	ST640	ST642
Emissivity	Fixed at 0.95	Adjustable 0.1 to 1.0
Type K Thermocouple Input	NO	YES
eSmart Emissivity Correction	NO	YES
Audible Alarm	YES	YES
CIS Visual Alarm	YES	YES
°C/°F Switchable	YES	YES
Backlight	YES	YES
Laser Sight Switchable	YES	YES
Max/Min/Avg/ΔT	YES	YES
Carrying case	YES	YES

DISTANCE (D) TO SPOT SIZE (S)



The ST640 Series is a range of low cost, handheld infrared thermometers with laser sighting and large backlit LCD displays.

Each unit measures from -32°C to 535°C with 0.1°C resolution. They also offer a superior 12:1 field of view, which helps to minimise errors by producing a small diameter measurement area.

The emissivity setting on the ST640 is fixed at 0.95, making it ideal for most organic materials and non-shiny (painted, corroded or anodised) metals. The emissivity setting on the ST642 is adjustable from 0.1 to 1.0 and can be set automatically by using the thermocouple input and eSmart feature.

Both models provide adjustable audible and visual alarms in which the colour of the display changes when the target temperature exceeds the alarm set point.

Readings can be taken in °C or °F, and when the trigger is released the last measurement is held for approximately 7 seconds before the unit automatically turns off.

ST640 series thermometers will operate in ambient temperatures from 0°C to 50°C and are powered by a standard PP3, 9V battery.

Each unit is supplied complete with a soft carrying case.

ST680 Series

Handheld Infrared Thermometer

- Wide temperature range, -50°C to 1000°C
- Narrow 50:1 field of view
- USB Data Output (ST689)
- Input for type K thermocouple (ST689)
- Built-in laser pointer to improve aim
- Adjustable emissivity
- Adjustable high and low alarms
- Backlit LCD display
- °C/°F switchable
- Fast sampling time
- Auto-hold and power off
- High quality construction

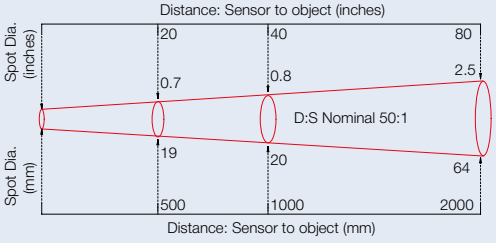
GENERAL SPECIFICATIONS

Field-of-view	50:1
Temperature Range	-50°C to 1000°C (-58°F to 1832°F)
Accuracy*	±3°C (±5°F) from -50°C to -20°C (-58°F to -4°F) ±2°C (±3°F) from -20°C to 100°C (-4°F to 212°F) ±2% above 100°C (212°F)
Spectral Range	8 to 14µm
Repeatability	±1°C (±2°F)
Resolution	0.1°C (0.1°F)
Response Time	500ms
Ambient Range	0°C to 50°C (32°F to 122°F), 10% to 90%RH
Power OFF	Automatic after approx. 6s
Display	4-digit LCD with backlighting
Battery Type	9V, PP3
Dimensions	200mm x 127mm x 47mm
Weight	330g

*Accuracy is given at ambient temperature of 25°C (77°F)

	ST688	ST689
Emissivity	Adjustable 0.1 to 1.0	Adjustable 0.1 to 1.0
Type K Thermocouple Input	NO	YES
USB Data Output	NO	YES
10 point memory	YES	YES
Audible Alarm	YES	YES
°C/°F Switchable	YES	YES
Backlight	YES	YES
Laser Sight Switchable	YES	YES
Max/Min/Avg/ΔT	YES	YES
Carrying case	YES	YES

DISTANCE (D) TO SPOT SIZE (S)



The ST680 Series is a range of high quality, handheld infrared thermometers with laser sighting and large backlit LCD displays.

Each unit measures from -50°C to 1000°C with 0.1°C resolution. They also offer a superior 50:1 field of view, which helps to minimise errors by producing a small diameter measurement area.

Model ST689 has a USB data output.

The emissivity setting is adjustable from 0.1 to 1.0 and both models provide adjustable audible alarms.

Readings can be taken in °C or °F, and when the trigger is released the last measurement is held for approximately 6 seconds before the unit automatically turns off.

ST680 series thermometers will operate in ambient temperatures from 0°C to 50°C and are powered by a standard PP3, 9V battery.

Each unit is supplied complete with a soft carrying case.

DRR245

DIN-Rail Mounted Multifunction Indicator/Controller

- Universal analogue input
- Relay outputs
- SSR output
- Analogue voltage or current output for control, retransmission, or emissivity adjustment on PyroEpsilon sensor
- Universal supply voltage 24 to 230 V AC/DC
- Remote control via RS485 Modbus
- Ideal as a signal converter

GENERAL SPECIFICATIONS

Housing	DIN 43880 for mounting on type EN 50022 rail or on a flat surface
Supply Voltage	24 to 230VAC/DC +/- 15% 50/60Hz
Power Consumption	3W
Display	4-digit dual LED, 8 red status LEDs
Operating Conditions	0-45°C, 35-95%RH
Inputs	1 configurable for J, K, R or S thermocouples; Pt100; Ni100; Pt1000; Pt500; PTC1k; NTC10k; 0 to 10V; 0/4 to 20mA; 0 to 40mV; potentiometer 6kΩ / 150kΩ; TA 50mA.
Outputs	2 relays 5A resistive + 1 logic SSR 12V-30mA / 4 to 20mA / 0 to10V for control or retransmission, galvanically isolated from input and power supply RS485 Modbus RTU (57600 baud max) Input TA 50mA for Loop Break Alarm
Digital Input	Tuning start, Setpoint change, Man/Auto selection, Hold function, Start/Stop preprogrammed cycle
Control Modes	ON/OFF, P, PI, PID, Autotuning
Accuracy	0.5%±1digit for TC/RTD; 0.2%±1digit for V/mA
Sampling Time	Selectable (15ms max)
Sealing	IP20
Configuration	Parameters protected by password; optional memory card with battery for repeat configurations; LabSoftView software for configuration via a PC
Optional Enclosure	Polycarbonate with transparent lid, IP65, 160H x 90W x 90D mm

The DRR245 DIN-rail mounted controller provides a highly versatile alternative to panel-mounted instruments. It has one analogue input which is configurable for up to 18 different sensors/signals, two relay outputs, and a third output which can be configured either as a SSR logic signal or a 4 to 20mA /0 to 10V analogue signal for control or re-scalable retransmission of the process variable or setpoint.

The analogue output can also be used to adjust the emissivity setting on a PyroEpsilon non-contact temperature sensor – the value is adjusted between 0.2 and 1.0 using the lower (red) LED display and associated push buttons.

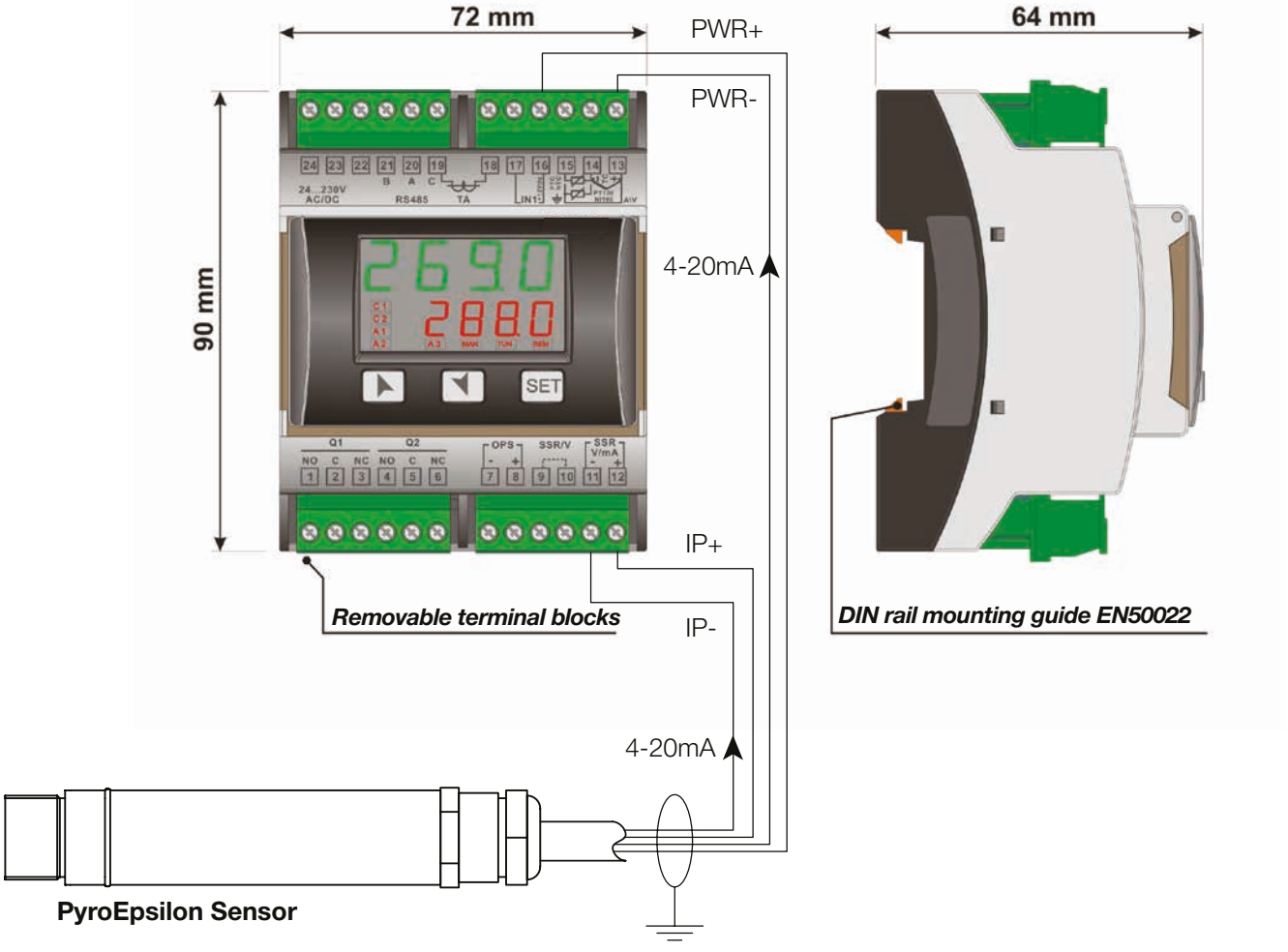
The built-in switching power supply has an extended range of 24 to 230VAC/DC and does not require any jumper setting. The control modes are ON/OFF, PID + Autotuning and Heating/Cooling PID with a neutral zone.

Software features include launch tuning, setpoint selection via digital input, optional manual reset of the output via the front keypad, latch-on function for sensor calibration (including load cells) and a programmable cycle of 3 steps. RS485 serial communication (Modbus RTU) and load monitoring function (Loop Break Alarm) with current transformer TA are also provided.

There is an optional Memory Card to copy all of the configuration parameters from one controller to another without powering them up, whilst LabSoftView for Windows enables setting and monitoring of parameters on a PC.

The DRR245 is also available mounted in an IP65 enclosure with clear lid, which is ideal for mounting on a machine or close to the process where the operator can see the display.

If the DRR245 is ordered with a PyroEpsilon sensor, it is supplied pre-configured to display the 4 to 20mA signal from the sensor over the appropriate temperature range. It is also pre-configured to allow the emissivity setting on the sensor to be adjusted over the range 0.2 to 1.0. Since the PyroEpsilon derives its power from the DRR245 no other power source is required. The DRR245 can be supplied from a 24V to 230V source (+/-15%), AC or DC.



MODEL	INPUTS	OUTPUTS	POWER SUPPLY
DRR245-21ABC-T	Selectable	2Relays + SSR / 4..20mA / 0..10V + RS485	24...230V AC/DC +/- 15% 50/60Hz

ATR121

Controller with Dual Setpoint

- Low-cost indicating PID controller
- Panel mount
- 2 setpoints
- Universal input
- Relay and SSR outputs
- Universal supply voltage

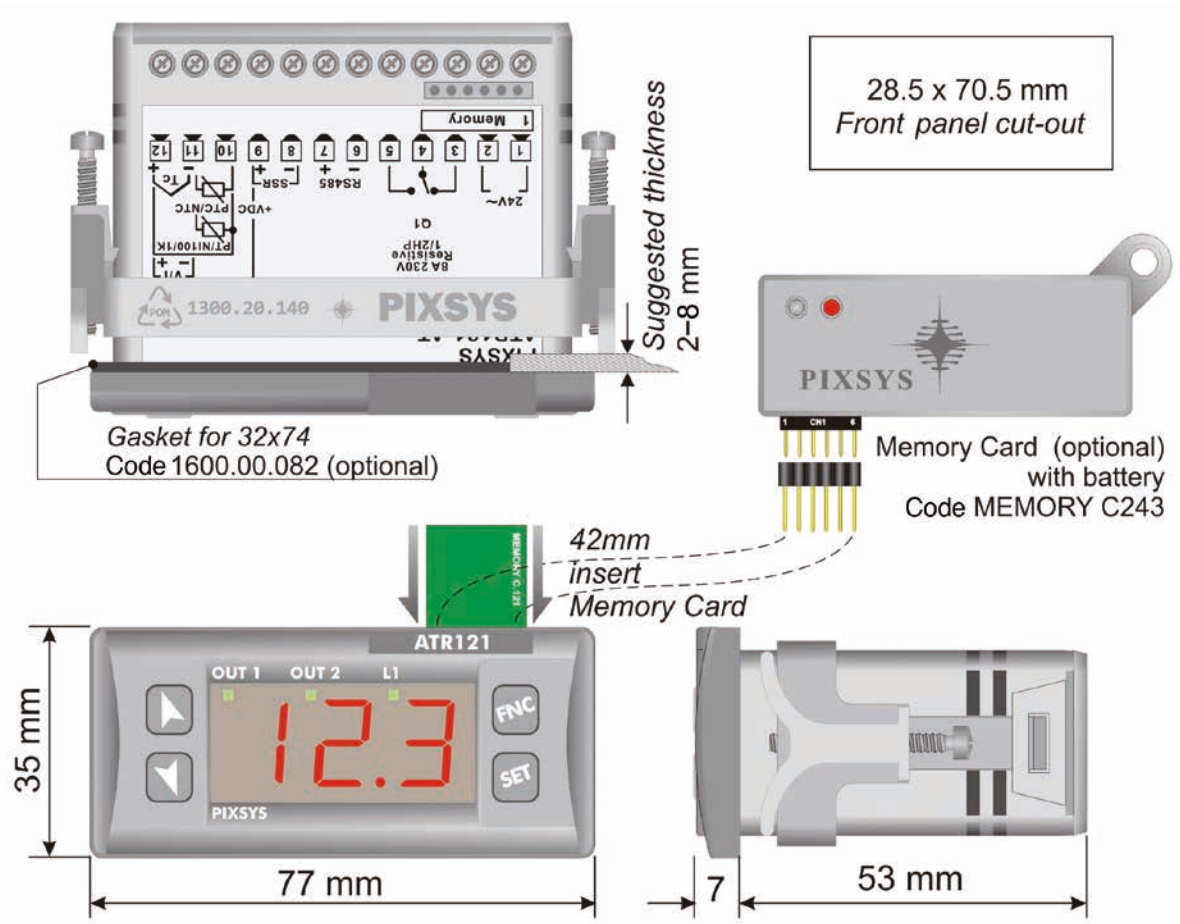
General Specifications	
Inputs	1 input, configurable for J, K , R or S thermocouples; Pt100; Ni100; Pt500; Pt1000; PTC; NTC; 0/4 to 20mA; 0 to 10VDC; potentiometers <= 6kΩ or <= 150kΩ
Outputs	Control relay 8 A; Alarm relay 5 A; SSR Control/Alarm; Open/Close logic (time-proportioned), RS485 Modbus RTU Slave (-ADT models)
Control Action	ON/OFF; PID Autotuning; Heating/Cooling PID
Configuration	Via push-button controls, or memory card, or LABSOFTVIEW software. Parameters protected by password
Display	3-digit red LED plus decimal point; green status LEDs
Accuracy	0.5% ± 1 digit for TC/RTD; 0.2% ± 1 digit for mA/V
Sampling Time	66 ms (selectable software filter on input and display)
Supply Voltage	230 V AC or 12-24 V AC/DC (depending on model)
Power consumption	2 W
Operating Temperature	0°C to 40°C
Operating Humidity	35% to 95% RH
Sealing	IP54 front panel (IP65 with gasket), IP30 housing, IP20 terminal blocks
Dimensions	32H x 74W x 58D mm
Product Markings	CE, UL, RoHS Compliant

The ATR121 is a dual-setpoint controller with a 3-digit red LED display. The input is configurable for thermocouples type J, K, S & R; Pt100; PTC1000; Ni100; NTC10k (typically used in the refrigeration industry); Pt500/Pt1000 (widely used in air-conditioning); 0 to 1V; 0 to 10V; 0 to 20mA and 4 to 20mA. Potentiometers with a full scale value of 6kΩ or 150kΩ may also be used and there is a “latch on” function for quick calibration and setting of minimum, maximum and zero via the front keys.

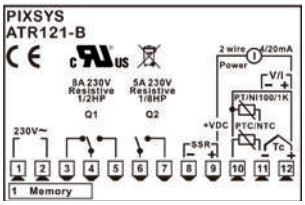
Two set-points are available, one for control and one for the alarm function. They can be configured to activate two relay outputs or an SSR output. The main relay for the control output is rated at 8A. The alarm relay is rated at 5A (alarm modes: threshold, band, deviation). Open/Close logic for motorised valves is also available.

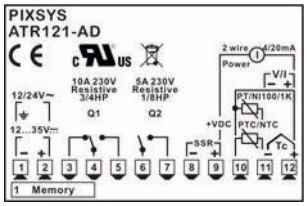
Software features include ON/OFF control, PID + Autotuning and Heating-Cooling PID with a neutral zone. A single output (1 relay + SSR) version is also available.

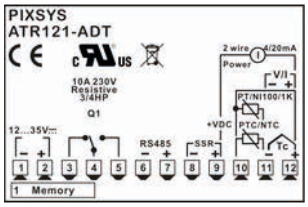
Front of panel sealing to IP65 can be achieved using a gasket (optional). There is also an optional Memory Card to copy all of the configuration parameters from one controller to another without powering them up.



Model :







Model	Inputs	Outputs	Supply Voltage
ATR121-AD	1 configurable input	2 Relays 8 A + 1 SSR	12-24 V AC/DC (not isolated)
ATR121-B	1 configurable input	2 Relays 8 A + 1 SSR 12 V DC	230 V AC (isolated)
ATR121-ADT	1 configurable input	1 Relay 8 A + 1 SSR 12 V DC + RS485 Modbus RTU Slave	12-24 V AC/DC (not isolated)

ATR142

Controller/Indicator with Triple Setpoint

- Versatile indicating PID controller
- Panel mount
- 3 setpoints
- Universal input
- Relay and SSR outputs
- Optional Modbus communications
- Universal supply voltage

GENERAL SPECIFICATIONS

Dimensions	32H x 74W x 58D mm
Supply Voltage	24 to 230VAC/DC
Power Consumption	2W
Display	4-digit green + 4-digit red LED; 6 status LEDs
Operating Conditions	0-40°C, 35-95%RH
Inputs	1 configurable for J, K , R or S thermocouples; Pt100; Ni100; Pt500; Pt1000; PTC; NTC; 0/4 to 20mA; 0 to 10VDC; potentiometers <= 6kΩ or <= 150kΩ
Outputs	Control relay 8A; Alarm relay 5A; SSR Control/Alarm; Open/Close logic (time-proportioned); RS485 serial communication, MODBUS-RTU/Slave (version -T)
Control	ON/OFF; PID Autotuning; Heating/Cooling PID
Accuracy	0.5%±1digit for TC/RTD; 0.2%±1digit for mA/V
Sampling Time	15ms (selectable software filter on input and display)
Sealing	IP54 front panel (IP65 with gasket), IP30 housing, IP20 terminal blocks
Configuration	Parameters protected by password
Optional Functions	Timer ON/OFF; Pause/Continue Timer (assigned to alarm relay)

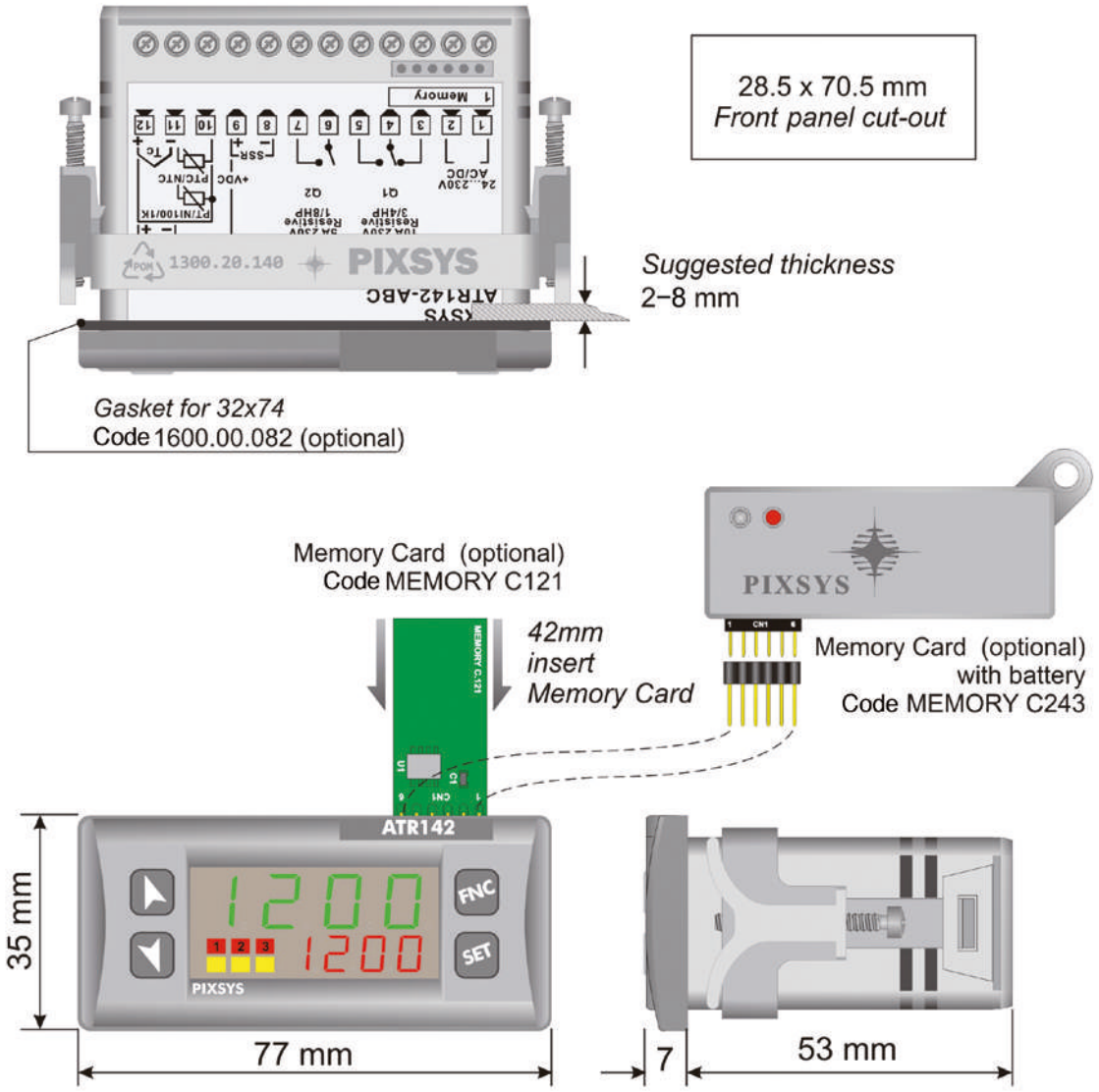
This triple-setpoint controller has a dual red/green LED display which shows the process variable and setpoint value at the same time. The built-in switching power supply has an extended range of 24 to 230VAC/DC and does not require any jumper setting. The analogue input is selectable for thermocouples J, K, R & S; Pt100; PTC1000; Ni100; NTC10k (refrigeration industry); Pt500/ Pt1000 (widely used in air-conditioning); 0 to 10V; 0 to 20mA and 4 to 20mA. Potentiometers with full scale up to 6kΩ and 150kΩ may also be used and there is a “latch on” function for quick calibration and setting of minimum, maximum and zero via the front keys.

Three setpoints are provided for control and/or alarm functions. They can be assigned to two relay outputs or an SSR output. The main control relay is rated at 8A. The alarm relay is rated at 5A (alarm modes: threshold, band, deviation). Open/ Close logic for motorised valves is also available.

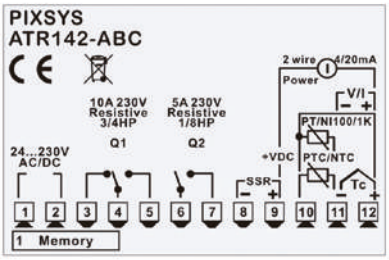
Software features include ON/OFF control, PID + Autotuning and Heating-Cooling PID with a neutral zone. A single output (1 relay + SSR) version is available with RS485 serial communication and Modbus-RTU/Slave protocol for supervisory systems.

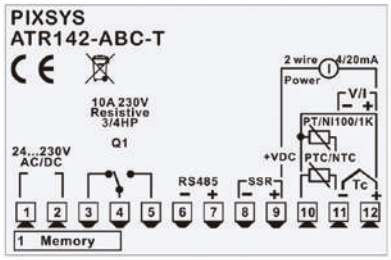
Front of panel sealing to IP65 can be achieved using a gasket (optional). There is also an optional Memory Card to copy all of the configuration parameters from one controller to another without powering them up.

Software application LabSoftView for Windows enables setting and monitoring of parameters on a PC. A special software release which integrates both the basic control loop and the timer function is available upon request.



Model :





MODEL	INPUTS	OUTPUTS	POWER SUPPLY
ATR142-ABC	Selectable	2 Relays + SSR	24...230V AC/DC
ATR142-ABC-T		1 Relay + SSR + RS485	+/- 15% 50/60Hz

ATR244

PID Controller with NFC Configuration

- Compact indicating PID controller
- Super-bright LED display
- Configurable via NFC with Android app
- Universal input
- Relay and SSR outputs
- Optional Modbus communications
- Analogue outputs for control or retransmission
- Universal supply voltage
- Optional dual input

ATR244 is a multifunction PID controller with dual bright LED displays and optional dual input.

It is fully configurable via the built-in controls, Pixsys USB memory card, or via NFC with the MyPixsys app on Android. There is no need to connect power to the ATR244 when configuring it via NFC.

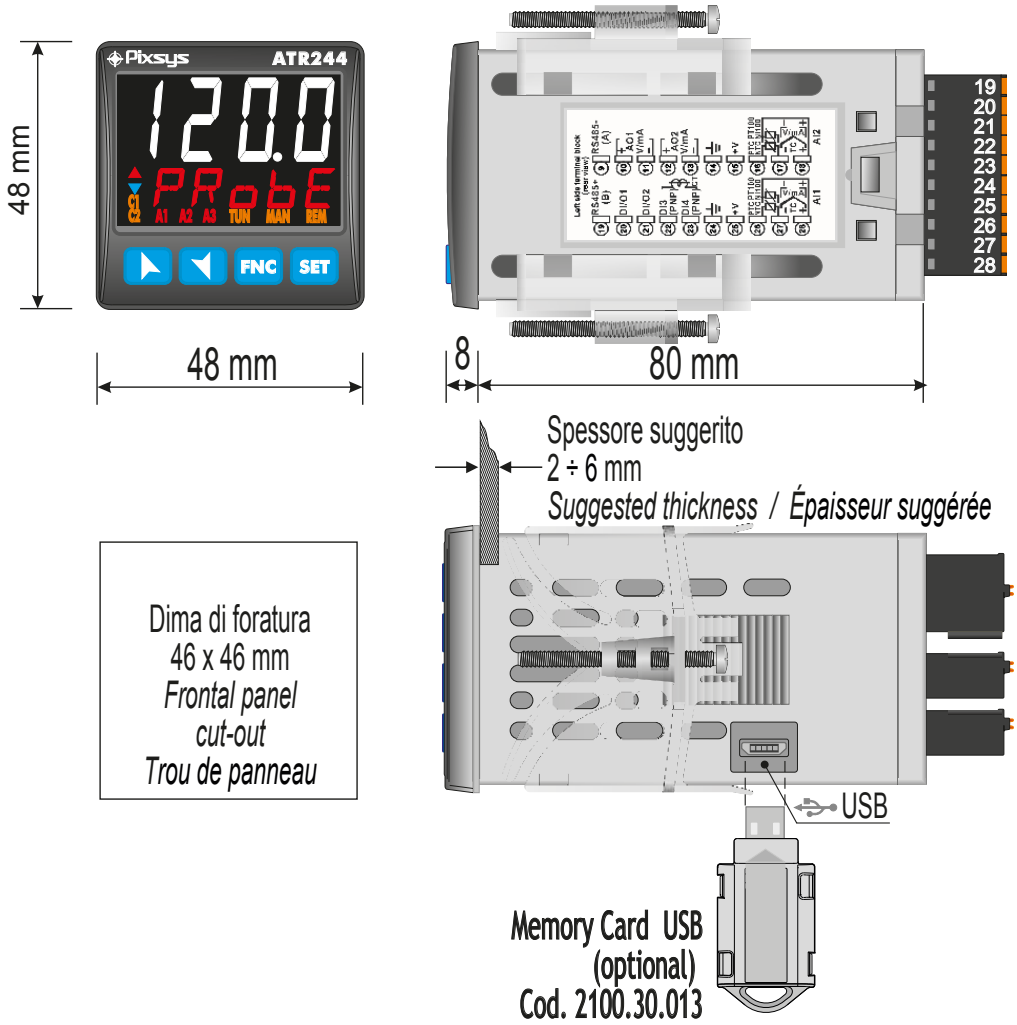
All models have a wide AC or DC supply voltage range, and a universal configurable input for all common signal types.
Optional RS485 Modbus RTU communications allow remote monitoring.

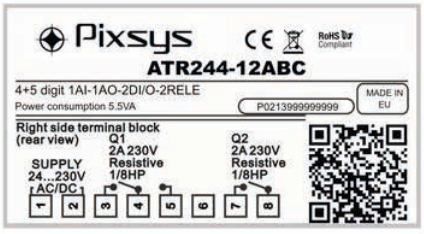
Models with dual input allow two separate heating/cooling PID loops in the same device, and mathematical oprations between two process values.

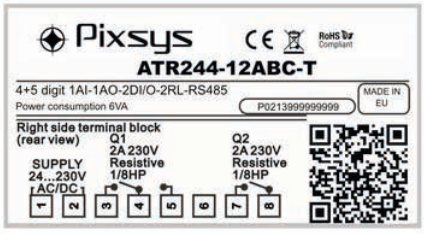
Outputs can be selected as control, alarm with multiple modes, or analogue retransmission.

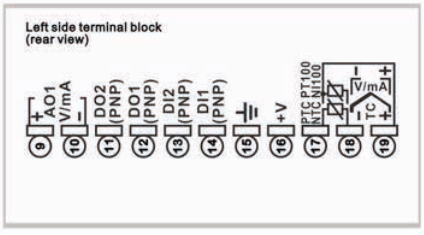
GENERAL SPECIFICATIONS		
Dimensions	48H x 48W x 105D mm	
Supply Voltage	24 to 230VAC/DC +/- 15% 50/60Hz , galvanic isolation 2.5 kV	
Power Consumption	8W	
Display	2 x LED displays: 4-digit white and 4-digit red	
Operating Conditions	0-45°C, 35-95%RH	
Inputs	1 or 2 configurable analogue inputs selectable as:	
	Thermocouple type K, S, R, J, T, N, B (with automatic cold junction compensation -25 to 85°C, ±0,2% of full scale ±1 digit, 16 bit resolution)	
	Pt100, Pt500, Pt1000, Ni100, PTC1K, NTC10K (β 3435K)	
	Linear analogue signals 0 to 10 V (50000 points), 0/4 to 20 mA (40000 points), 0 to 60 mV (25000 points)	
	Potentiometer 1 to 150 kΩ (50000 points)	
	Sampling time (analogue inputs)	Programmable from 2.1 ms (frequency up to 470 Hz)
	2 or 4 digital inputs	Configurable for setpoint change, hold, run, tuning launch, start / stop, lock configuration
	1 current transformer (CT) input:	50 mA, 800 µs - 4096 points
Outputs	2 or 3 relays:	250 V AC, 5 A, resistive change
	2 SSR outputs:	12 / 24 V DC, 30 mA max
	1 or 2 analogue outputs:	Selectable 4 to 20 mA (40000 points ± 0,2% full scale) or 0 to 10 V DC (40000 points ± 0,2% F.S.) for command or retransmission PV / SPV
	Serial communications (-T models):	RS485 Modbus RTU Slave (4800 to 115200 baud)
Control Modes	ON/OFF with hysteresis, P, PI, PID, PD time proportional, manual or auto tuning	
Alarm Modes	Absolute / Threshold, Band, High / Low deviation. Alarm with optional Manual reset. Loop Break Alarm	
Sealing	IP54 front panel (IP65 with gasket), IP20 (housing and terminal blocks)	
Configuration	Password-protected parameters, optional memory card for repeat configurations, PC software, NFC configuration via MyPixsys app for Android smartphones	

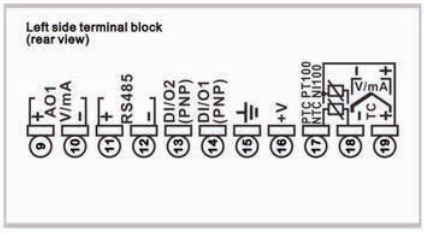
DIMENSIONS











MODEL NUMBERS	
All models have supply voltage 24 to 230 V AC/DC	
ATR244-12ABC	1 analogue input + 2 relays 5 A + 2 SSR output + 2 digital input + 1 analogue output V / mA
ATR244-12ABC-T	1 analogue input + 2 relays 5 A + 2 (SSR output or digital input) + 1 analogue output V / mA + RS485 communications

For dual input models please contact Calex.

STR571

8-Channel Panel-Mounted Display for Modbus Sensors

- Read or write 8 variables from Modbus sensors
- Simultaneously view up to 4 variables per page, with 2 pages
- Compatible with all Calex Modbus infrared temperature sensors, and other Modbus devices
- Isolated RS485 Modbus Master interface
- Multimaster – up to 16 STR571 masters on the same network of slaves
- RS485 Modbus Slave interface for connection to a larger network
- 2 Alarm Relay Outputs, and inputs for external controls

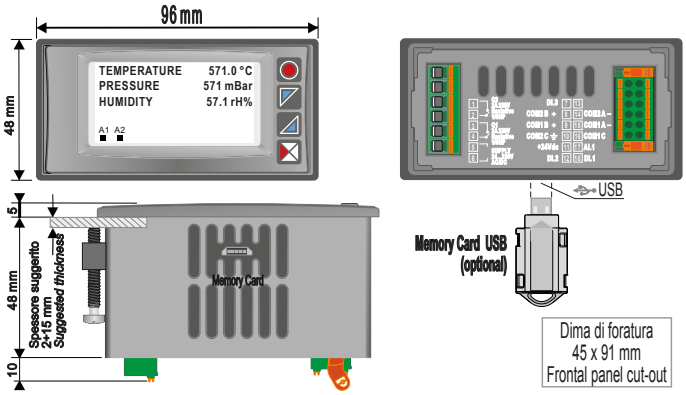
The STR571 is a versatile interface and display unit for Modbus sensors, I/O modules, signal converters and other Modbus devices in general.

Up to 8 variables may be read or written on Modbus slave devices, with the variables shown on-screen numerically or in text.

The description and measuring units of each variable are configurable, and display data may be rescaled.

Up to 4 variables may be displayed simultaneously. Text is automatically resized depending on the number of variables being displayed.

Digital inputs allow connection of a rotary encoder that makes it even easier to navigate the displayed data and the configuration interface, or connection to panel buttons with programmable functions.



SPECIFICATIONS

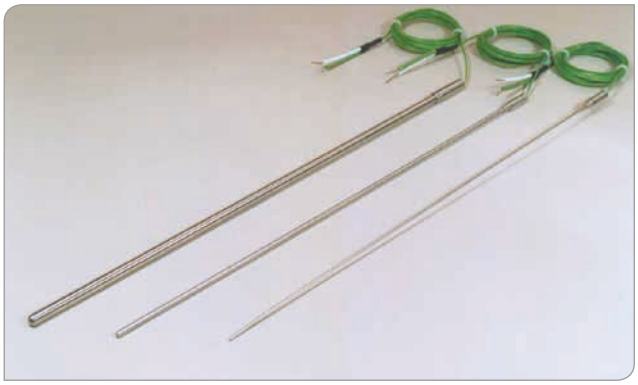
Communications and Outputs	
Communications and Outputs	1 x RS485 Modbus RTU Master interface, supports 8 channels, e.g. for PyroMiniBus temperature sensors
Modbus Slave	RS485 Modbus RTU Slave interface
Inputs	3 digital inputs allowing the connection of external controls such as a rotary encoder: 2 x PNP/NPN inputs e.g. to enable outputs, reset alarms, lock configuration, increase/decrease value; 1 x PNP input programmable to select values
Outputs	2 alarm relays, configurable, rated 250 V AC, 2 A, on/off, with hysteresis
General	
Display	OLED monochrome yellow
Supply Voltage	24-230V AC / DC ± 10% 50/60 Hz (with 2500 V galvanic isolation)
Power Consumption	6 VA
Mechanical	
Housing dimensions	96x48 (front) x 48 mm (1/8 DIN)
Housing material	Polycarbonate V0
Weight	Approximately 165 g
Wiring	Removable spring-lock terminal blocks
Configuration	Via built-in push-button controls using simple menu system

Environmental	
Temperature	Operating range 0-45 ° C
Humidity	Operating range 35-95% RH (non-condensing)
Protection	Front panel: IP54 (IP65 with sealing), and container terminals: IP20
Software Features	
8 Variables	8-channel data management, view 1 to 4 variables on each page, editable text description of each variable (max 16 characters), editable measurement units for each variable (max 5 characters), 1, 16, or 32 bit data format, editable text display for variable values between 0 and 4, configurable display value (offset, gain, limits, rescale).
2 Alarms	ON-OFF with hysteresis
Alarm mode	Absolute / threshold, band with choice of activation mode (instantaneous / delayed / retentive / by digital input), activation by serial line
Multimaster	Connect up to 16 x STR571 master devices on the same Modbus network
Interface Language	English, Italian, German, French, Spanish
Options	Optional front panel encoder to facilitate input of data
Model Numbers	
STR571-1ABC-T128	8-channel panel-mounted Modbus indicator
Options (contact Calex)	Compatible infrared temperature sensors Rotary encoder

Issue A - Sept 17
Specifications subject to change without notice

Thermocouples and RTDs

- Temperature probes manufactured to your requirements
- All thermocouple types including Type J, K, N, R, S, T and B
- Platinum resistance thermometers including Pt100 and Pt1000
- PTC and NTC thermistors
- Probe materials such as stainless steel, ceramic, Inconel and titanium
- Probes available with hardwired cable, or fitted with a sealed connection head
- Optional temperature transmitter and extension cable
- Curved or straight probes, diameters from 1 mm to 30 mm
- Choice of process connections
- Let us know your requirements and we will help you find a suitable probe



Ceramic probes

Curved probes

DIN connection head and threaded mounting

Exposed-junction wire thermocouples

Hardwired cables

Low-cost sealed connection boxes

Probes fitted with M12 connectors

Probes with flange mount

Screw clamp process connection

FTK

Fixed Mount Infrared Temperature Calibration Checker

The FTK provides a quick and accurate way to check the calibration of infrared temperature sensors.

This rugged and portable unit is designed to provide fast calibration checks anywhere they are needed, from the factory to the workshop or laboratory.

Eighteen models are available; offering target temperatures from 35°C or 150°C, all providing outstanding stability with less than ±0.2°C deviation.

The FTK takes between 5 and 15 minutes to heat and stabilise at the desired temperature (depending on the model), and uses a clear LED to show when it has reached that temperature: green when the FTK is warming up, orange when the FTK is ready for operation and red when the FTK is above the calibration temperature.

The FTK can be used with any infrared temperature sensor that is able to measure between 35°C and 150°C and can focus on a target area less than Ø 50.8 mm.

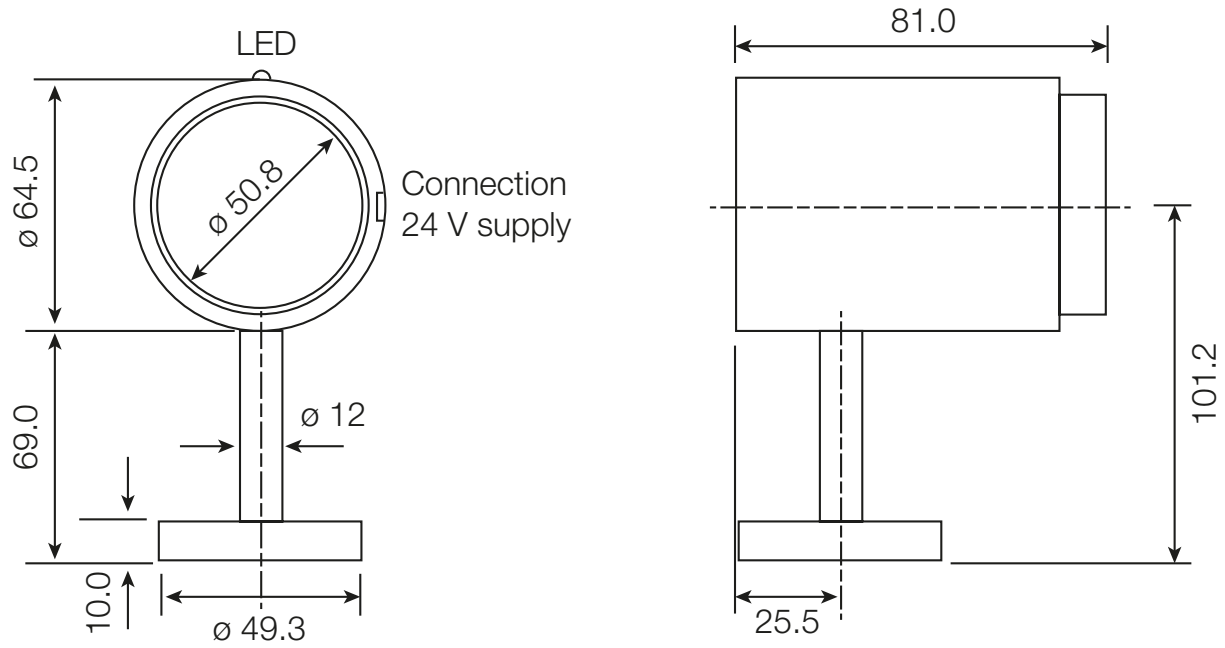
SPECIFICATIONS

Calibration Source	
Target Temperature:	from 35 °C to 150 °C depending on model (see table overleaf)
Emissivity (e):	0.98 ± 0.004 (for wavelength of 2 to 5.4 µm and 8 to 14 µm)
Aperture diameter:	50.8 mm
Warm-up time:	max. 5 minutes (FTK 35) to 15 minutes (FTK 150)
Temperature uncertainty:	0.4 °C for T_{amb} = 10 to 30 °C (FTK 35 - 120) 0.6 °C for T_{amb} = 0 to 10 °C (FTK 35 - 120) 0.5 °C for T_{amb} = 10 to 40 °C (FTK 130 - 150) 0.7 °C for T_{amb} = 0 to 10 °C (FTK 130 - 150)
Repeatability:	0.2 °C
Stability:	0.1 °C
Temperature uniformity:	0.2 °C (central area Ø 45 mm)
Operating temperature: T_{amb}:	0 to 30 °C, temporary (2 minutes) up to 70 °C
Storage temperature:	0 to 70 °C
Relative humidity:	10 to 85 %, non condensing
Status LED:	green: warm-up orange: ready for operation red: above calibration temperature
Power supply:	24 V DC, max. 1 A
Protection class:	IP50 (EN 60529)
Weight:	0.9 kg
Dimensions [mm]:	64.5 x 81.0 x 133.5 (Ø x D x H)
CE marking:	according to EU regulations

POWER SUPPLY

Model	Description
Power supply	100 to 240 V AC, 50 Hz
Output	24 V DC, 1.3 A
Protection class	EN 60950
Weight	approx. 0.3 kg
CE marking	according to EU directives regarding electromagnetic immunity

DIMENSIONS



All dimensions in mm

MODELS

Model	Description	Target Temperature
FTK 35	Calibration source FTK 35	35 °C
FTK 45	Calibration source FTK 45	45 °C
FTK 50	Calibration source FTK 50	50 °C
FTK 55	Calibration source FTK 55	55 °C
FTK 60	Calibration source FTK 60	60 °C
FTK 65	Calibration source FTK 65	65 °C
FTK 70	Calibration source FTK 70	70 °C
FTK 75	Calibration source FTK 75	75 °C
FTK 80	Calibration source FTK 80	80 °C
FTK 85	Calibration source FTK 85	85 °C
FTK 90	Calibration source FTK 90	90 °C
FTK 95	Calibration source FTK 95	95 °C
FTK 100	Calibration source FTK 100	100 °C
FTK 110	Calibration source FTK 110	110 °C
FTK 120	Calibration source FTK 120	120 °C
FTK 130	Calibration source FTK 130	130 °C
FTK 140	Calibration source FTK 140	140 °C
FTK 150	Calibration source FTK 150	150 °C

ACCESSORIES

Model	Description
FTKPSU	Power supply 100 to 240 V AC or 24 V DC
FTKPLUG-EU	Power plug EU
FTKPLUG-USA	Power plug US
FTKPLUG-UK	Power plug UK
FTKPLUG-AUS	Power plug AUS
FTKMOUNT	Adjustable ball and socket mounting block

BB976

Blackbody Source

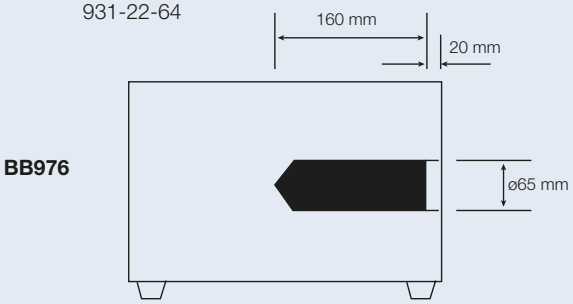
- High performance blackbody calibration source for infrared temperature sensors
- Adjustable temperature setpoint 30°C to 550°C
- Very high emissivity > 0.995
- 65 mm cavity diameter

GENERAL SPECIFICATIONS

Temperature Range	30°C to 550°C
Emissivity	Greater than 0.995
Stability	±0.1°C
Display Resolution	0.01°C to 99.99; 0.1°C from 100 to 550
Heating Time	45 minutes
Aperture Diameter	65 mm
Cavity Depth	160 mm
PC Interface	Included
Power	1000 W typical
Voltage	100-130 or 208-240 V AC, 50/60 Hz
Dimensions	H 310 mm, W 265 mm, D 200 mm
Weight	10 kg

OPTIONS

Gallium Hockey Puck Cell	431-03-00
Indium Hockey Puck Cell	976-05-00A
Tin Hockey Puck Cell	976-05-00B
Zinc Hockey Puck Cell	976-05-00C
Orifice Plates 10, 20, 30, 40 50 mm (Restricts Cavity Aperture)	976-01-05
Carrying Case	931-22-64



The BB976 Portable Blackbody Calibration Source allows for calibration of non-contact infrared thermometers over the temperature range 30°C to 550°C.

It is suitable for use as a primary radiation source for infrared thermometers.

Laboratory performance and low uncertainty calibrations are ensured by the combination of high emissivity and excellent temperature uniformity.

The digital temperature controller allows the block temperature to be set to any value from 30°C to 550°C.

Traceability of the radiance temperature is established by a separate, built-in temperature indicator and included platinum resistance thermometer.

A three point traceable calibration certificate is included. UKAS calibration of the resistance thermometer is available, as is radiometric calibration.

Uniformity of the block is ensured by using distributed heating technology.

For the smallest of uncertainties the BB976 may be used with ITS-90 Fixed Point Cells, Gallium 29.7646°C, Indium 156.5985°C, Tin 231.928°C and Zinc 419.527°C. The cells are provided with a certificate of metal purity.

Issue B - Sept 17
Specifications subject to change without notice

BB982

Blackbody Source

- High performance blackbody calibration source for infrared temperature sensors
- Adjustable temperature setpoint -10°C to 80°C
- Very high emissivity > 0.995
- 50 mm cavity diameter

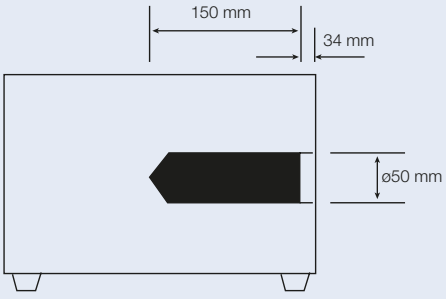
GENERAL SPECIFICATIONS

Temperature Range	-10°C to 80°C
Emissivity	Greater than 0.995
Stability	±0.1°C
Display Resolution	0.01°C
Heating Time	45 minutes to 80°C
Cooling Time	45 minutes to -10°C
Aperture Diameter	50 mm
Cavity Depth	150 mm
PC Interface	Included
Power	200 W typical
Voltage	100-130 or 208-240 V AC
Dimensions	H 310 mm, W 265 mm, D 200 mm
Weight	10 kg

OPTIONS

Orifice Plates 10, 20, 30, 40 50 mm (Restricts Cavity Aperture)	812-01-06
Carrying Case	931-22-64

BB982



The BB982 Portable Blackbody Calibration Source allows for calibration of non-contact infrared thermometers over the temperature range -10°C to 80°C.

It is suitable for use as a primary radiation source for infrared thermometers from sub zero to 80°C.

Laboratory performance and low uncertainty calibrations are ensured by the combination of high emissivity and excellent temperature uniformity.

The digital temperature controller allows the block temperature to be set to any value from -10°C to 80°C.

Traceability of the radiance temperature is established by a separate, built-in temperature indicator and included platinum resistance thermometer.

A three point traceable calibration certificate is included. UKAS calibration of the resistance thermometer is available, as is radiometric calibration.

Uniformity of the block is ensured by distributed thermoelectric heat pumps with the benefit of solid state vibration-free cooling.

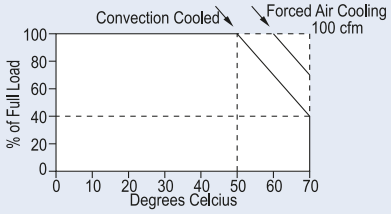
32000 Series

Open Frame AC/DC Regulated Linear Power Supplies

GENERAL SPECIFICATIONS

A.C. Input	100/120/220/240 V AC +10%, -12%, 47 to 60 Hz
D.C. Output	See Voltage/Current Rating Chart. Adjustment range ±5% minimum.
Line Regulation	±0.05% for a 10% line change.
Load Regulation	±0.05% for a 50% load change.
Output Ripple	2 V to 15 V units: 5.0 mV PK-PK maximum 20 V to 28 V units: 0.02% PK-PK maximum
Transient Response	50 µs for a 50% load change
Short Circuit and Overload Protection	Automatic current limit/foldback
Overvoltage Protection	Built-in on all 5 V outputs. Set at 6.2 V ±0.4 V Other models use optional overvoltage protection. See Option 3 overleaf
Remote Sensing	Provided on most models, open sense load protection built in.
Stability	±0.3% for 24 hour period after 1 hour warm-up
Temperature Rating	Standard Range: 0°C to +50°C full-rated, derated linearly to 40% at 70°C Extended Range: -40°C to +50°C full-rated, derated linearly to 40% at 70°C

TEMPERATURE DERATING CURVE



Temperature Coefficient	±0.03%/°C maximum
Efficiency (typical)	5V unit: 45%; 12 V and 15 V units: 55%; 24 V units: 60%
Isolation	Input to ground: 3750 V AC min. Input to output(s): 3750 V AC min. Output to ground: 500 V AC min. Leakage current (live to ground): 5 µA max.
RoHS Compliant	Yes

These high quality linear regulated power supplies provide outstanding value and are designed for ease of application and long trouble-free life. They will accommodate AC inputs from 100 V to 240 V and provide a wide range of DC outputs with very low ripple.

All 32000 series power supplies are built around industry-standard case sizes to simplify installation and a 3.75 kV isolation safety transformer. For additional safety the transformer primary is protected from thermal overloads by a thermal fuse. This fuse will blow if a transformer temperature of 130°C is exceeded. Every unit incorporates a safety earth tag.

All models are fitted with automatic foldback current limiting. An overvoltage protection (OVP) circuit protects sensitive loads against excessive voltage such as in TTL logic. OVP is a standard feature of all 5 V output units and an option on all other units.

The remote sensing feature, included in almost all 32000 series power supplies, may be used to compensate the voltage drop across the load lines. All dual-output power supplies feature a unique anti-latch circuit to minimise common mode latch up.

SINGLE OUTPUT MODELS

Model	Output Voltage Volts	Output Current Amps	Case
32005AR 32005BR 32005CR 32005DR	5 5 5 5	3.0 6.0 9.0 12.0	A B C D
32012AR 32012BR 32012CR 32012DR 32012ER	12 to 15 12 to 15 12 to 15 12 to 15 12 to 15	1.7 3.4 5.1 6.8 10.2	A B C D E
32024AR 32024BR 32024CR 32024DR 32024ER 32024ER/10	24 to 28 24 to 28 24 to 28 24 to 28 24 to 28 24 to 28	1.2 2.4 3.6 4.8 7.2 10.0	A B C D E E
32048AR*	48	0.5	A
32150AR	120 to 200	0.150**	A

* No remote sensing

** Output current from 180 to 200V falls linearly from 150mA to 125mA

OVP SELECTION CHART

	Case	OVP Model Required
Single Output	A/B/C/D	32901AR
	E	32901BR
Dual Output	AA/BB/CC	32901AR, protects both outputs
	E	32901BR, protects both outputs
Triple Output	AA/AAA/D	32901AR, protects dual outputs
	BBB/131	OVP built-in on 5 V outputs

DUAL OUTPUT MODELS

Model	Output 1		Output 2		Case
	Voltage Volts	Current Amps	Voltage Volt	Current Amps	
32212AR	12 to 15	1.0	-12 to -15	1.0	AA
32212BR	12 to 15	1.7	-12 to -15	1.7	BB
32212CR	12 to 15	3.4	-12 to -15	3.4	CC

TRIPLE OUTPUT MODELS

Model	Output 1		Output 2		Output 3		Case
	Voltage Volts	Current Amps	Voltage Volts	Current Amps	Voltage Volts	Current Amps	
32305AR	5*	2.0	9 to 15*	0.4	-9 to -15*	0.4	AA
32305BR	5	3.0	12 to 15	1.0	-12 to -15	1.0	AAA
32305DR	5	6.0	12 to 15	1.7	-12 to -15	1.7	BBB
32305ER	5	8.0	12 to 15	1.7	-12 to -15	1.7	BBB
32305FR	5	12.0	12 to 15	1.7	-12 to -15	1.7	DBB

OPTIONS

1 Tropicalisation – suffix code 'T'

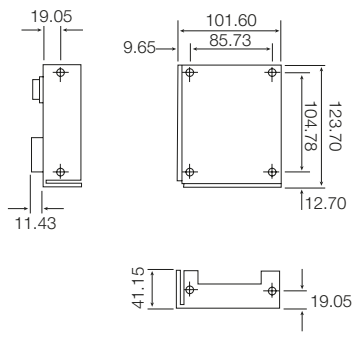
2 Low temperature operation -40°C to +50°C – suffix code 'LT'

3 Overvoltage Protection Modules – These optional Overvoltage Protection Modules are available for use with any power supply NOT supplied with built-in OVP. Each is adjustable from 6.4V to 34V and should be used when maximum load protection is of prime importance. Response time is 1 ms. Mounting holes are provided on the chassis for these modules, which mount within the specified outline dimensions of each power supply.

32000 SERIES - GENERAL DIMENSIONS

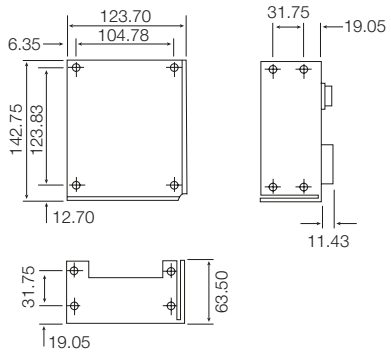
All dimensions are in mm

A Case
Weight: 0.9kg



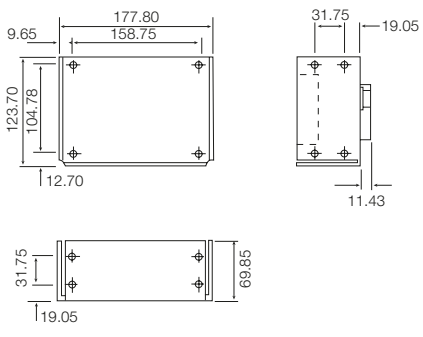
Mounting holes 4.77mm diameter
Fuse at: 0.5/0.25 Amps for 100-120/220-240 VAC

B Case
Weight: 1.8kg



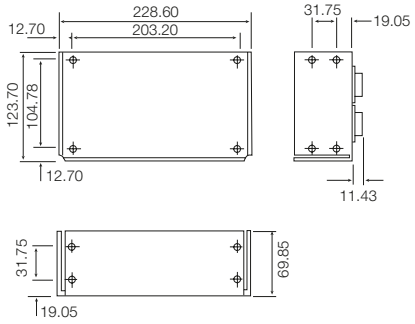
Mounting holes 4.77mm diameter
Fuse at: 1.0/0.5 Amps for 100-120/220-240 VAC

C Case
Weight: 2.7kg



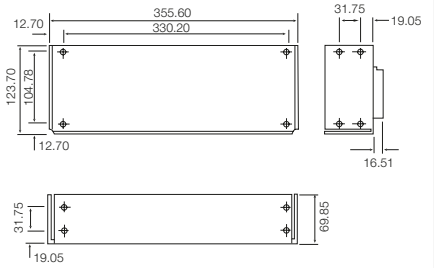
Mounting holes 4.77mm diameter
Fuse at: 2.0/1.0 Amps for 100-120/220-240 VAC

D Case
Weight: 3.4kg



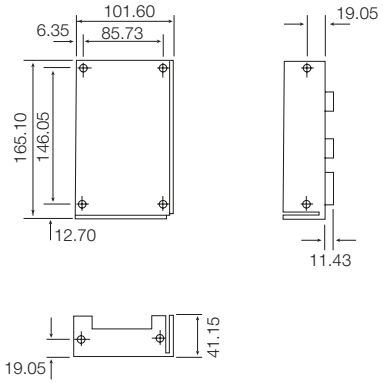
Mounting holes 4.77mm diameter
Fuse at: 2.0/1.0 Amps for 100-120/220-240 VAC

E Case
Weight: 4.5kg



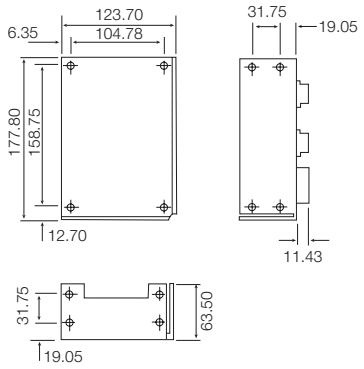
Mounting holes 4.77mm diameter
Fuse at: 3.0/1.5 Amps for 100-120/220-240 VAC

AA Case
Weight: 0.9kg



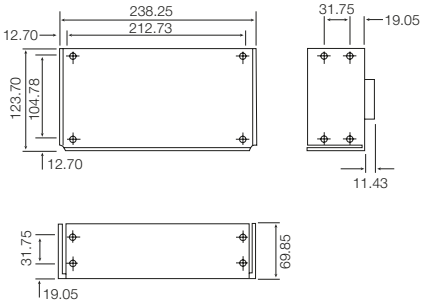
Mounting holes 4.77mm diameter
Fuse at: 0.5/0.25 Amps for 100-120/220-240 VAC

BB Case
Weight: 1.8kg



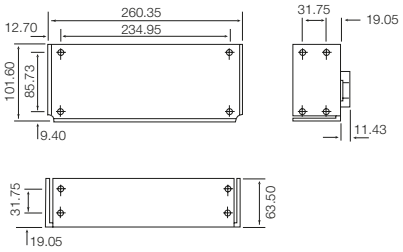
Mounting holes 4.77mm diameter
Fuse at: 2.0/1.0 Amps for 100-120/220-240 VAC

CC Case
Weight: 3.2kg



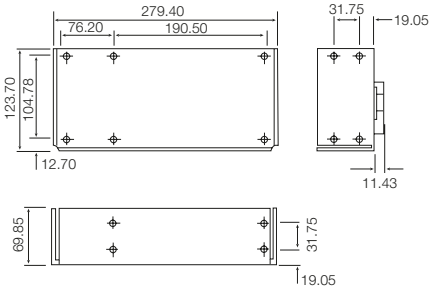
Mounting holes 4.77mm diameter
Fuse at: 2.0/1.0 Amps for 100-120/220-240 VAC

AAA Case
Weight: 2.3kg



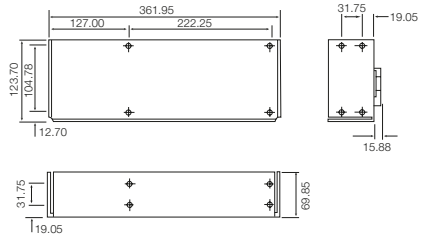
Mounting holes 4.77mm diameter
Fuse at: 1.0/0.5 Amps for 100-120/220-240 VAC

BBB Case
Weight: 3.6kg



Mounting holes 4.77mm diameter
Fuse at: 2.0/1.0 Amps for 100-120/220-240 VAC

DBB Case
Weight: 5.0kg

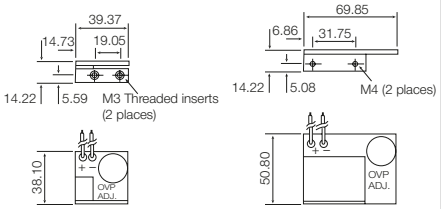


Mounting holes 4.77mm diameter
Fuse at: 3.0/1.5 Amps for 100-120/220-240 VAC

Overvoltage Protection Modules

OVP–12
32901A

OVP–24
32901B



41000 Series

DIN Rail Mounting Power Supplies for Instrumentation Applications

GENERAL SPECIFICATIONS

Input	115 V AC or 230 V AC (±10%) link selectable
DC Output	See model chart
Ripple & Noise	less than 5 mV rms.
Output Voltage Tolerance	±0.5% max.
Load Regulation	±0.2% for 50% load change
Line Regulation	±0.05% for 10% line change
Isolation: Input to output	3750 V AC min.
Temperature Rating	Standard Range: 0°C to +50°C full-rated, derated linearly to 40% at 70°C
Environmental Rating	IP20
Case Size	(l x w x h) 119.2 x 45 x 73.2 mm.
Case Material	Polycarbonate (self extinguishing to UL 94V-0)
Weight	0.37 kg 41245: 0.53 kg

Model	Output Voltage Volts	Output Current mA
41052 41055	5 5	200 500
41121 41122 41124	12 12 12	100 200 400
41151 41153	15 15	100 300
41241 41242 41245	24 24 24	100 200 500

The 41000 Series range of power supplies are designed for quick and trouble-free installation onto 35mm profile DIN rails. With outputs ranging from 5V to 24V and maximum current capabilities from 100mA to 500mA, these units are ideal for most instrumentation and control systems.

Every model in the range is provided with output current foldback limiting and is fully short-circuit protected. Great attention has been taken to usability and safety. The double insulated housing protects users without the need for earthing. A green “supply on” LED is provided to clearly indicate the presence of power, and link selection allows the use of 110 or 230V supplies without derating.

52000 Series

Chassis Mounting AC/DC Single/Dual Output Linear Power Supplies

GENERAL SPECIFICATIONS

AC Input	216 to 264 V AC, 47 to 60 Hz
Temperature Rating	0 to +50°C (fixed-voltage units) -25 to +50°C (adjustable-voltage units)
Overall Dimensions	(l x w x h) 160 x 100 x 57 mm

SINGLE FIXED OUTPUT REGULATED MODELS

Model *	Output Voltage Volts	Output Current Amps	Line Regulation mV	Load Regulation mV	Output Ripple mV
52012	12	1.0	120	120	30
52024	24	0.5	500	500	30
52048	48	0.25	500	500	30

SINGLE ADJUSTABLE OUTPUT REGULATED MODELS

Model *	Output Voltage Volts	Output Current Amps	Line Regulation mV	Load Regulation mV	Output Ripple mV
52008A	4 to 12	1.0	120	30	6
52015A	10 to 20	0.5	20	30	10
52024A	18 to 30	0.25	25	30	15

DUAL ADJUSTABLE OUTPUT REGULATED MODEL

Model *	Output Voltage Volts	Output Current Amps	Line Regulation mV	Load Regulation mV	Output Ripple mV
52212A	± 10 to 15	0.5	10	20	5

* For RoHS compliant version, add suffix 'R' to model number

These high quality linear regulated power supplies provide outstanding value and are designed for ease of application and long trouble free life.

Different models are available with fixed or adjustable outputs. There is also a model with adjustable dual outputs.

The 52000 Series uses rugged screw terminal blocks for input and output connections. Those models with adjustable outputs can be set via an easily accessible potentiometer.

The metal case used on all models provides screening, and threaded inserts allow these supplies to be mounted on the insulated base or on the side.

Adjustable output models are short circuit protected. Fixed voltage models can have their outputs short circuited for a maximum of three minutes.

Issue F - Sept 17
Specifications subject to change without notice

Emissivity

What it is and why it matters

What is emissivity?

All surfaces emit infrared radiation. The amount of energy they emit depends on their temperature and emissivity.

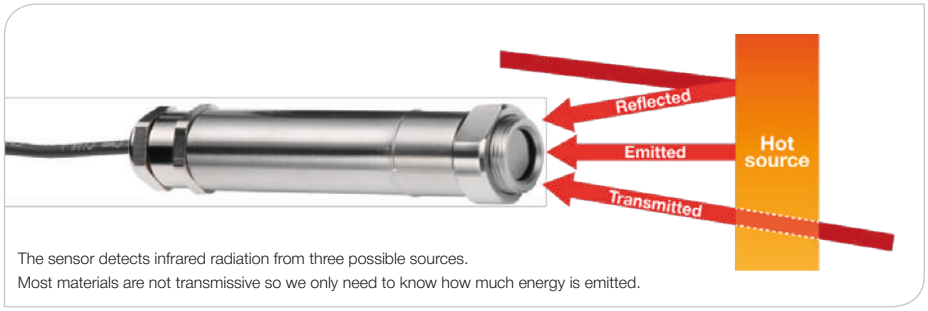
To accurately measure the temperature of a surface, the infrared sensor needs to know how much of the energy it is "seeing" has been emitted from the surface as a result of the object's temperature, and not reflected from the surface, or transmitted through it.

The emissivity of a surface is a measure of how effectively a surface emits infrared radiation.
The sensor's emissivity setting should be set to match the emissivity of the target surface for maximum accuracy.

Transmissive materials

Most materials do not transmit any infrared radiation, so we can assume all the energy the sensor detects has been either emitted or reflected.

Transmissive materials are a special case. See below for more information.



The sensor detects infrared radiation from three possible sources.
Most materials are not transmissive so we only need to know how much energy is emitted.

How to adjust the emissivity setting

The emissivity setting can be adjusted in a different way for each type of sensor:

PyroMini and FibreMini
Via the touch screen, Modbus, or two rotary switches in the electronics module, depending on the model.

PyroEpsilon
Via the 4-20 mA input.

PyroUSB and PyroMiniUSB
Via USB using the included cable and software.

PyroBus and PyroMiniBus
Via the Modbus Master.

ExTemp
Via the optional USB adapter and software.

PyroCouple
The emissivity setting is fixed at 0.95 and cannot be adjusted.

PyroNFC
Via NFC using the smartphone app

PyroCube
Via the optional PM030 touch screen module or Modbus

PyroCAN
Via CAN Bus

High emissivity materials

e.g. painted or very dirty surfaces, food, rubber, thick plastics, paper, glue, asphalt

A surface with a high emissivity is easy to measure with a low-cost, general-purpose sensor. In this case, reflections are minimal.

Note: The colour of a surface does not usually affect the emissivity much.

Up to 1000°C: Low-cost 8 to 14 µm sensors such as the PyroCouple and PyroMini give good results.

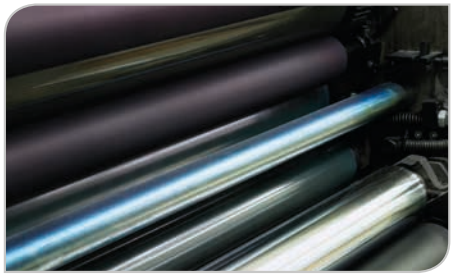
It is also possible to use a 2.2 µm sensor such as the PyroUSB 2.2 above 45°C.

Low emissivity materials

e.g. clean, bare, reflective metal surfaces including iron and steel

Reflective surfaces have a low emissivity and are more difficult to measure accurately.

If the emissivity is known, it is possible to achieve a good reading from a bare metal surface using a short-wavelength sensor.



If it is possible to paint the surface, you can use a low-cost 8 to 14 µm sensor such as the PyroCouple, PyroNFC or PyroMini.

Otherwise, try a short-wavelength sensor such as the PyroUSB 2.2 or PyroMini 2.2.

Some metals, most commonly aluminium and copper, are very difficult to measure. Contact Calex for advice.

Transmissive materials

e.g. thin film plastics, silicon

A small number of materials, such as thin film plastics and silicon, transmit most wavelengths of infrared energy. If the plastic film is thinner than about 1-2 mm, general-purpose IR sensors could "see" through it.

Transmissive materials are difficult to measure. A specialised sensor may be required to achieve a good reading.

Contact Calex for advice.

For more advice on emissivity, including how to measure the emissivity of a surface, see the Guide to Infrared Thermometry on our website, or contact us for help and guidance about a specific application.

Emissivity Table

To ensure an accurate temperature measurement, the emissivity setting of the sensor must match the emissivity of the target surface.
Emissivity can depend on temperature, material and surface finish. The values in this emissivity table should be used as a guide and a starting point only, and you may find that further emissivity adjustment is required.
If accuracy is critical, we recommend reading the guide “Understanding and Using the Infrared Thermometer”. Contact us to obtain a copy.

FERROUS AND NON FERROUS METALS

Alloys	T (°C)	T (°F)	Emissivity
20-Ni, 24-CR, 55-FE, Oxidized	200	392	0.90
20-Ni, 24-CR, 55-FE, Oxidized	500	932	0.97
60-Ni, 12-CR, 28-FE, Oxidized	270	518	0.89
60-Ni, 12-CR, 28-FE, Oxidized	560	1040	0.82
80-Ni, 20-CR, Oxidized	100	212	0.87
80-Ni, 20-CR, Oxidized	600	1112	0.87
80-Ni, 20-CR, Oxidized	1300	2372	0.89
Haynes Alloy C, Oxidized	316-1093	600-2000	.90-.96
Haynes Alloy 25, Oxidized	316-1093	600-2000	.86-.89
Haynes Alloy X, Oxidized	316-1093	600-2000	.85-.88
Inconel Sheet	538	1000	0.28
Inconel Sheet	649	1200	0.42
Inconel Sheet	760	1400	0.58
Inconel X, Polished	24	75	0.19
Inconel B, Polished	24	75	0.21
Iron			
Oxidized	100	212	0.74
Oxidized	499	930	0.84
Oxidized	1199	2190	0.89
Unoxidized	100	212	0.05
Red Rust	25	77	0.70
Rusted	25	77	0.65
Liquid	1516-1771	2760-3220	.42-.45
Cast Iron			
Oxidized	199	390	0.64
Oxidized	599	1110	0.78
Unoxidized	100	212	0.21
Stong Oxidation	40	104	0.95
Strong Oxidation	250	482	0.95
Liquid	1535	2795	0.29
Wrought Iron			
Dull	25	77	0.94
Dull	349	660	0.94
Smooth	38	100	0.35
Polished	38	100	0.28
Lead			
Polished	38-260	100-500	.06-.08
Rough	38	100	0.43
Oxidized	38	100	0.43
Oxidized at 593°C	38	100	0.63
Gray Oxidized	38	100	0.28
Steel			
Cold Rolled	93	200	.75-.85
Ground Sheet	938-1099	1720-2010	.55-.61
Polished Sheet	38	100	0.07
Polished Sheet	260	500	0.10
Polished Sheet	538	1000	0.14
Mild Steel, Polished	24	75	0.10
Mild Steel, Polished Smooth	24	75	0.12
Mild Steel, Liquid	1599-1799	2910-3270	0.28
Steel, Unoxidized	100	212	0.08
Steel Oxidized	25	77	0.80
Steel Alloys			
Type 301, Polished	24	75	0.27
Type 301, Polished	232	450	0.57
Type 301, Polished	949	1740	0.55
Type 303, Oxidized	316-1093	600-2000	.74-.87
Type 310, Rolled	816-1149	1500-2100	.56-.81
Type 316, Polished	24	75	0.28
Type 316, Polished	232	450	0.57
Type 316, Polished	949	1740	0.66
Type 321	93-427	200-800	.27-.32
Type 321 Polished	149-816	300-1500	.18-.49
Type 321 w/BK Oxide	93-427	200-800	.66-.76
Type 347, Oxidized	316-1093	600-2000	.87-.91
Type 350	93-427	200-800	.18-.27
Type 446, Polished	149-816	300-1500	.15-.37
Type 17-7PH	93-316	200-600	.44-.51
Type 17-7PH Polished	149-816	300-1500	.09-.16
Type C1020, Oxidised	316-1093	600-2000	.87-.91
Type PH-15-7 MO	149-649	300-1200	.07-.19
Titanium			
Alloy C110M, Polished	149-649	300-1200	.08-.19
Alloy C110M, Oxidised at 538°	93-427	200-800	.51-.61
Alloy T1-95A Oxidised at 538°	93-427	200-800	.35-.48
Anodized onto SS	93-316	200-600	.96-.82

OTHER MATERIALS

Adobe	20	68	0.90
Asphalt, pavement	38	100	0.93
Asphalt, tar paper	20	68	0.93
Basalt	20	68	0.72
Brick			
Red, rough	21	70	0.93
Gault Cream	1371-2760	2500-5000	.26-.30
Fire Clay	1371	2500	0.75
Light Buff	538	1000	0.80
Lime Clay	1371	2500	0.43
Fire Brick	1000	1832	.75-.80

	T (°C)	T (°F)	Emissivity
Magnesite, Refractory	1000	1832	0.38
Gray Brick	1100	2012	0.75
Silica, Glazed	1093	2000	0.88
Silica, Unglazed	1093	2000	0.80
Sandlime	1371-2760	2500-5000	.59-.63
Carbon			
Lampblack	25	77	0.95
Unoxidized	25	77	0.81
Unoxidized	100	212	0.81
Unoxidized	500	932	0.79
Candle Soot	121	250	0.95
Filament	260	500	0.95
Graphitized	100	212	0.76
Graphitized	300	572	0.75
Graphitized	500	932	0.71
Carborundum	1010	1850	0.92
Ceramic			
Alumina on Inconel	427-1093	800-2000	.69-.45
Earthenware, Glazed	21	70	0.90
Earthenware, Matte	21	70	0.93
Greens No. 5210-2C	93-399	200-750	.89-.82
Coating No. C20A	93-399	200-750	.73-.87
Porcelain	22	72	0.92
White Aluminium Oxide	93	200	0.90
Zirconia on Inconel	427-1093	800-2000	.62-.45
Clay			
Clay Fired	70	158	0.91
Clay Tiles, Red	1371-2760	2500-5000	.40-.51
Concrete			
Rough	0-1093	32-2000	0.94
Tiles, Brown	1371-2760	2500-5000	.87-.83
Tiles Black	1371-2760	2500-5000	.94-.91
Cotton Cloth	20	68	0.77
Glass			
Convex D	100	212	0.80
Convex D	316	600	0.80
Convex D	500	932	0.76
Nonex	100	212	0.82
Nonex	316	600	0.82
Nonex	500	932	0.78
Smooth	0-93	32-200	.92-.94
Gypsum	20	68	.80-.90
Ice, Smooth	0	32	0.97
Ice Rough	0	32	0.96
Lacquer			
Black	93	200	0.96
White	93	200	0.95
Lime Mortar	38-260	100-500	.90-.92
Limestone	38	100	0.95
Marble, White	38	100	0.95
Marble, Smooth, White	38	100	0.56
Marble, Polished Gray	38	100	0.75

Paints	T (°C)	T (°F)	Emissivity
Blue, Cu_2-O_3	24	75	0.94
Black, CuO	24	75	0.96
Green, Cu_2O_3	24	75	0.92
Red, Fe_2O_3	24	75	0.91
White Al_2-O_3	24	75	0.94
White Y_2O_3	24	75	0.90
White ZnO	24	75	0.95
White $MgCO_3$	24	75	0.91
White, ZrO_2	24	75	0.95
White ThO_2	24	75	0.90
White MgO $_2$	4	75	0.91
White $PbCO_3$	24	75	0.93
Yellow, PbO	24	75	0.90
Yellow $PbCrO_4$	24	75	0.93
Paints, Oil			
All colours	93	200	.92-.96
Quartz, Rough, Fused	21	70	0.93
Glass, 1.96 mm	282	540	0.90
Glass, 1.96 mm	838	1540	0.41
Glass, 6.88 mm	282	540	0.93
Glass, 6.88 mm	838	1540	0.47
Opaque	299	570	0.92
Opaque	838	1540	0.68
Red Lead	100	212	0.93
Rubber, Hard	23	74	0.94
Sand	20	68	0.76
Sandstone	38	100	0.67
Sandstone Red	38	100	.60-.83
Sawdust	20	68	0.95
Silicon Carbide	149-649	300-1200	.83-.96
Silk Cloth	20	68	0.78
Soil			
Surface	38	100	0.95
Soot			
Acetylene	24	75	0.97
Camphor	24	75	0.94
Candle	121	250	0.95
Coal	20	68	0.95
Stonework	38	100	0.93
Water	38	100	0.97
Waterglass	20	68	0.96
Wood	Low	Low	0.95

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