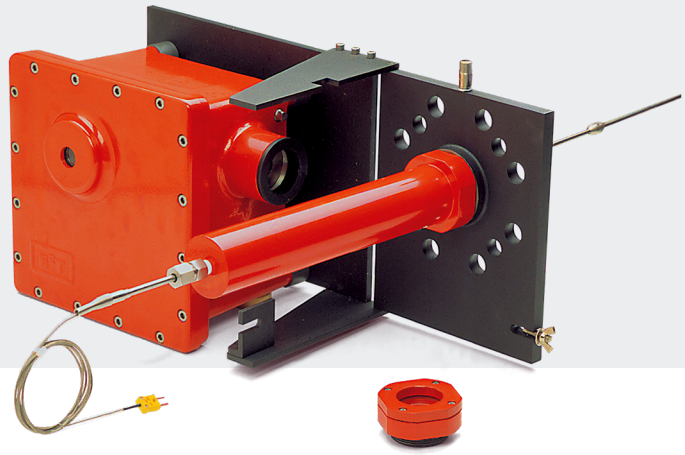
E²T PULSAR 4 AND PULSAR 4 ADVANCED

Infrared thermometry for sulfur reactors and other high temperature furnaces between 350 and 2000°C (662 and 3632°F).



The E²T Pulsar 4 Advanced measures two wavelengths for continuous and instantaneous measurement of refractory temperature (RT), gas temperature (GT) and integrated temperature (FF), reporting both readings simultaneously in one instrument. The Pulsar 4 is a single channel option for direct replacement of older Pulsar II products.

PRODUCT HIGHLIGHTS

- Single-channel standard model programmable for gas or refractory measurement
- Two-channel advanced model with simultaneous measurement of refractory and gas temperatures
  - Separate channel analog outputs and alarm relay set points
  - Instant or average readings
- Smart FMA™ Flame Measurement Algorithm (Pulsar 4 Advanced only)
- Explosion-proof certification II 2G Ex db IIB +H2 T4, IECEx, ATEX, FM (US and CDN) plus additional regional certifications
- Integrated power supply, capable of operating with 24 VDC/120/230 VAC
- RS485 Interface, HART protocol (Pulsar 4 Advanced Only)

TYPICAL APPLICATIONS

- Sulfur recovery unit (SRU) monitoring
- Thermal oxidizer monitoring
- Petrochemical emissions monitoring

AT A GLANCE

Temperature Range

350 to 2000°C (662 to 3632°F)

Measurement Uncertainty

±0.3% oR or 3°C +1 digit, whichever is greater

Repeatability

0.1% of full scale span

Analog Outputs

Pulsar 4:
2 identical analog outputs
4 to 20 mA, linear
Select one (RT, GT, or FF)

Pulsar 4 Advanced:
2 analog outputs 4 to 20 mA, linear
Outputs assigned to RT, GT, or FF

Digital Interfaces

RS485 addressable

Pulsar 4 Advanced:
HART Rev. 7 interface

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OVERVIEW

Complex Processes

Optimal operation of Sulfur Recovery Unit (SRU), Sulphur Burner, and Thermal Oxidizer furnaces require accurate process Gas (Flame) measurement and accurate Refractory measurement for operational safety (high temperature alarms).

Of particular importance is control of the furnace process temperatures to prevent damage to the furnace refractory and assurance that reaction or destruction temperatures are reached and maintained.

The Problem

Thermocouple measurement of acid processes either fail prematurely or are protected by multiple thermo wells and sweep air systems that make thermal transmission to the actual thermocouple inaccurate or slow and only provides a refractory measurement not useful for process control.

Typical single channel infrared pyrometers do not compensate for changing flame transparencies and only provide one wavelength measurement. Clients must settle for either a Gas (Flame) or Refractory measurement or make multiple installations requiring multiple ports and hardware installations.

Changing flame transparency is a common issue that affects typical infrared pyrometer measurements. Combustion changes in the processes changes the Gas (Flame) transparency and affects the Gas and Refractory IR measurements. A clean burning flame becomes transparent to the IR Gas measurements. The transparency of the gases will cause the Gas IR Measurement to see the cooler refractory and include this into the gas measurement, which results in a lower than actual temperature measurement. The opposite happens for a dirty burning flame that will limit the refractory measurement from seeing through the dirty flame and adding this flame influence to the refractory measurement.

Since flame transparency varies with the process feeds to the furnaces, the transparency effect on the IR measurements is a variable factor used to correct measurements in these applications.

The Solution

A single system installation with two independent IR filtered detectors that provides both Gas (Flame) and Refractory measurements simultaneously. The innovative Smart FMA™ Flame Measurement Algorithm allows for accurate real-time flame transparency compensation and correction. Applying the flame transparency calculation with FMA removes the flame transparency errors due to the Gas (Flame) temperature, providing the highest accuracy in process temperatures.

Both Gas and Refractory measurements are critical to the furnace operations. The Gas (Flame) measurement is used by the operator to detect thermal events before IR energy is absorbed by the refractory, creating a refractory thermal event. This method of early warning by use of the Gas (Flame) temperatures, allows added time for operators to make process changes and reduce potential Refractory thermal events before they can become critical by triggering a high level alarm system based on the Refractory temperature measurements set point.

TECHNICAL DATA

Measurement Specifications	
Temperature Range	350 to 2000°C (662 to 3632°F)
Emissivity Adjustment	0.100 to 1.000 digital on both channels when in standard mode
Transmittance Adjustment	0.100 to 1.000 digital on both channels when in standard mode
Alpha Adjustment	Pulsar 4 Advanced: 0.050 to 1.000 aLP when in FMA mode on GT channel (when in FMA mode)
Measurement Uncertainty ($\varepsilon = 1$, $t_{90} = 1$ s, $T_{amb.} = 25°C$)	±0.3% of reading or 3°C + 1 digit, whatever is greater
Repeatability ($\varepsilon = 1$, $t_{90} = 1$ s, $T_{amb.} = 25°C$)	0.1% of full scale span
Response Time t_{90}	Pulsar 4: Programmable from 0.05 to 120 sec
	Pulsar 4 Advanced: Programmable from 0.05 to 120 sec. When FMA mode is on: 0.5 to 120 sec.
Focusing Range	500 mm to infinity
Distance Ratio (Target Size)	160:1 Standard resolution, (distance/target size)

Electrical	
Power Supply	24 V (18 to 30 VDC), 0.2 A maximum; 3.5 A with heater
	115 VAC ±10%, 47 to 63 Hz; 230 VAC ±10%, 47 to 63 Hz
Power Consumption	Max 90 W (with heater)
Fusing	(F1) 1.6A, 'T' Time-Lag 5x20 mm; (F2) 1.25A, 'T' Time-Lag 5x20mm; (F3) 1A,'T' Time-Lag 5x20 mm
Load	Pulsar 4: 0 to 600 Ω (mA output)
	Pulsar 4 Advanced: 0 to 600 Ω (mA output); 230 to 600 Ω (mA output with HART)

Environmental Specifications	
Protection Class	CE 2809 Ex II 2G, Ex db IIB +H2 T4 Gb FM14ATEX0004X IECEx FME 14.0001X Class I, Div. 1, Groups B, C & D, T4 Ta = -40 to 60°C IP66 NEMA "Type 4X" classification FM C US APPROVED
Ambient Temperature Limits	-40 to 60°C
Torque Spec, Lid Bolts	5.5 nm
Air	View port purge: 1.4 bar min, 1.7 m^3/h (@ standard conditions)
	Combustion purge: 1.4 bar min, 17 m^3/h (@ standard conditions)

Communication		
Analog Output	Pulsar 4: 2 identical analog outputs 4 to 20 mA, linear, Select one of RT, GT or FF Corresponding to NAMUR NE43	Pulsar 4 Advanced: 2 analog outputs 4 to 20 mA, linear, Outputs can be assigned to RT, GT or FF Corresponding to NAMUR NE43
Digital Interface	Pulsar 4: RS485 addressable (half-duplex) Baud rate: 1.2 to 115.2 kBd	Pulsar 4 Advanced: RS485 addressable (half-duplex) Baud rate: 1.2 to 115.2 kBd HART Rev. 7 interface
Relay Alarm	30 VDC / 1A max; Resistive	
	Configuration of alarm: no alarm; alarm, if temperature > setpoint; alarm, if temperature < setpoint	

INSTALLATION PRINCIPLES

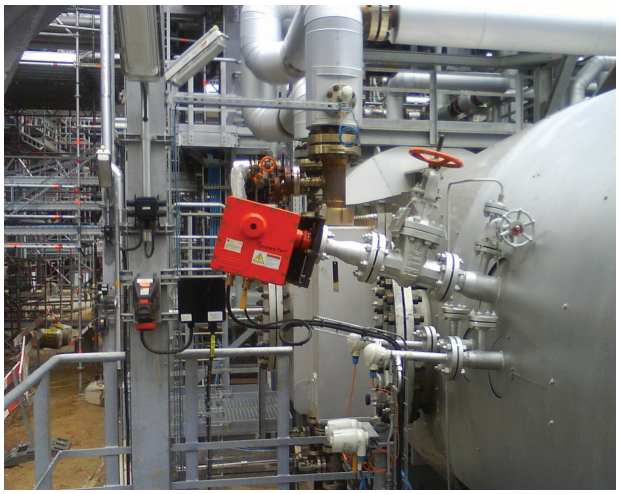
Location on Furnace

Utilization of the different temperature measurement systems depends upon the feed gases and burner design of the reactor. If you burn simple acid gas with combustion air, the Pulsar 4 should be installed two-thirds of the way downstream from the burner to the waste heat boiler. If there is a checker wall or choke ring, installation at Locations 2 and 3 (shown in the diagram below) is recommended.

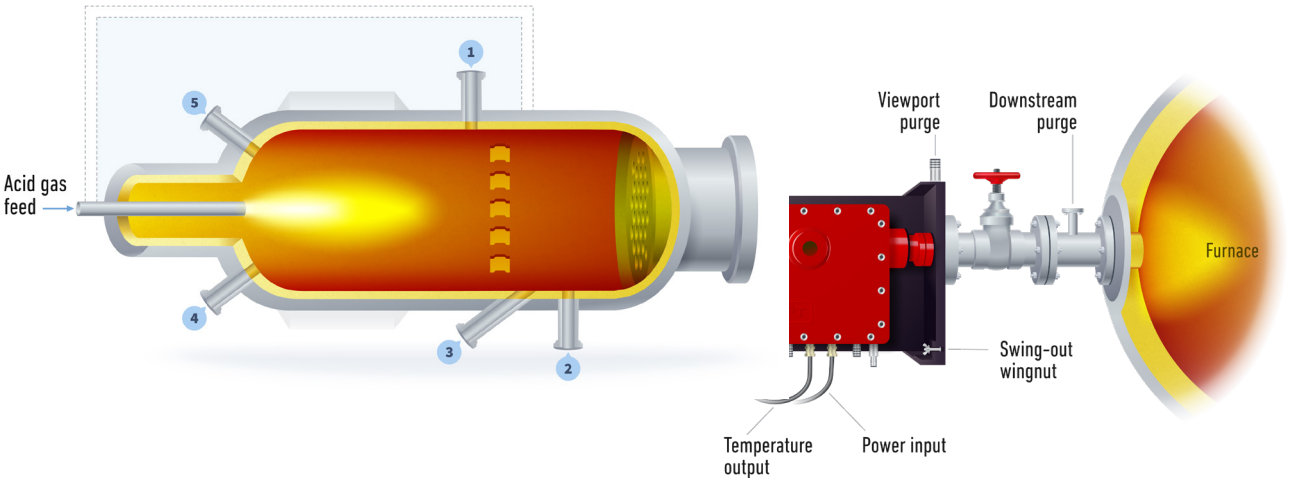
With oxygen-enrichment, refractory integrity is critically important. Burner design and location become paramount in determining the placement of the IR thermometer. The RT Refractory Temperature should be installed aimed at the area where the designers anticipate the highest refractory temperatures. For example, Location 1 is recommended for checker wall protection and Location 4 for tube sheet monitoring. Temperatures at the tube sheet are especially critical since the ferrules and ceramic tube-to-metal junctions may face potential excessive temperature excursions as a result of oxygen-enrichment operations.

Mounting to the Furnace

The E²T Pulsar 4 should be mounted on the horizontal diameter (no greater than ±15°) perpendicular to the vessel sighting on refractory, or adjacent to the burner sighting on the checker wall or tube sheet.



The SOF-8 Swing-out Fixture mounts to a 3-inch 150 or 300 pound ball valve connected to the furnace via a customer-supplied downstream purge connection. Minimum purge rates for downstream and viewport is 17 m3/h (@ standard conditions) SCFM. Client-supplied sealed flex lines should be used for power input and signal output in accordance with local codes for hazardous environments.

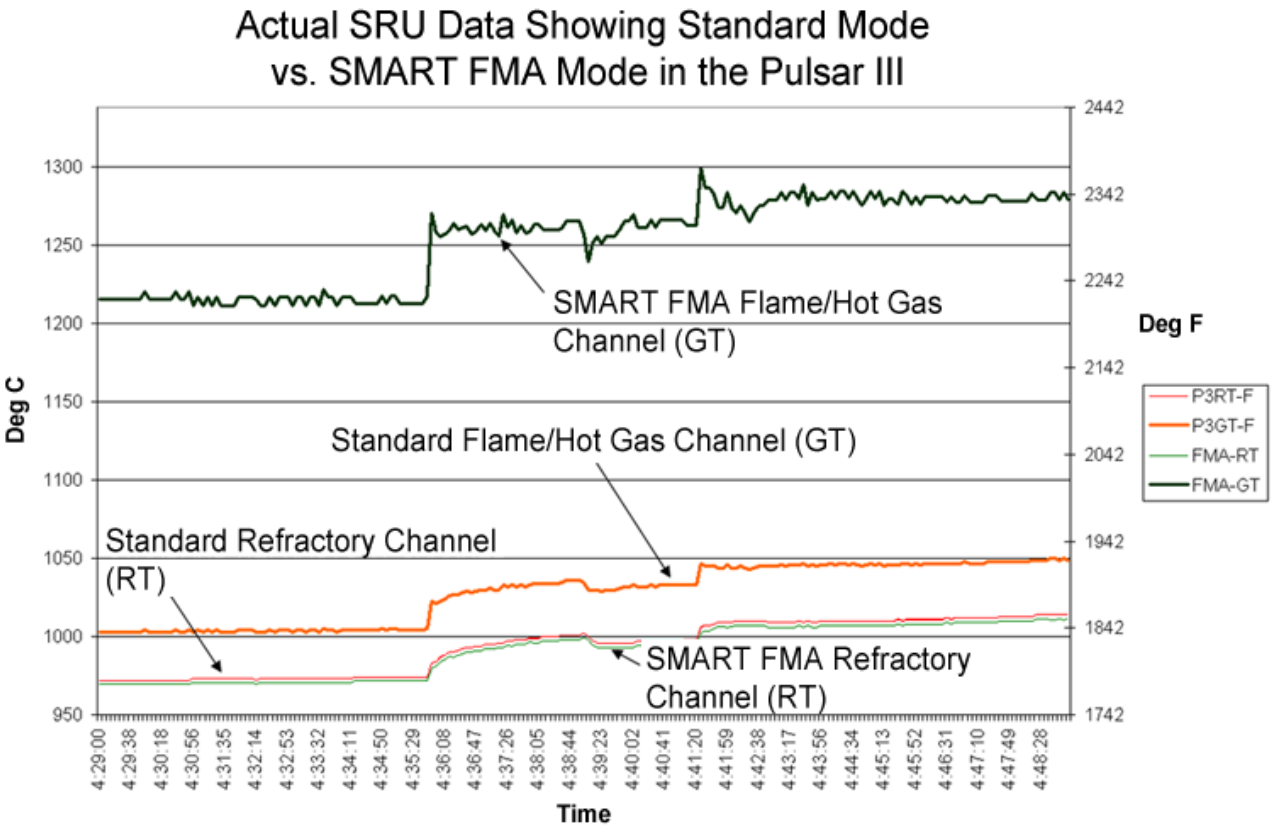


SMART FMA (PULSAR 4 ADVANCED ONLY)

The E²T Pulsar Advanced uses a unique method called Smart Flame Measurement Algorithm (Smart FMA™) to compensate for varying gas transparency and their effects on gas and refractory IR temperature measurements. In a normal situation, a dirty flame can increase the signal emitted from the refractory depending on the quality, quantity and absorption of the flame.

In a similar manner, some transparency of the flame or hot gas can cause refractory radiance to decrease the flame temperature. The FMA algorithm virtually removes these unwanted 'crosstalk' artifacts and solves for more meaningful refractory and flame/hot gas temperatures in real time.

The chart illustrates the difference between Standard operating mode and Smart FMA™ operating mode (field switchable). Note that as the flame intensity undergoes step changes, refractory (RT) and standard flame/ hot gas (GT) waveforms have dampened responses. This is expected on the refractory due to the thermal mass of the refractory, but not on the flame response. With Smart FMA™ activated, the hot gas channel (GT) displays a step change similar to the actual combustion air and gas flows into the SRU.



FIELD CONFIGURABLE TO MULTIPLE TEMPERATURE COMBINATIONS

Pulsar 4

The Pulsar 4 has the capability to measure one selected temperature measurement. For example, the single channel can measure refractory wall temperature or measure hot combustion gas temperature. The dual channel measurements capability is not activated for the Pulsar 4. An optional product firmware upgrade can be purchased to activate the Pulsar 4 Advanced capabilities. The Pulsar 4 is intended as a direct single channel replacement for clients with Pulsar II equipment. Each Pulsar 4 provides two identical analog outputs, but No FMA capability.

Field Selectable measurements:

- RT — Refractory Temperature
- GT — Gas Temperature
- FF — Average Integrated Temperature

Pulsar 4 Advanced

The Pulsar 4 Advanced has been uniquely designed to have the ability to continuously measure two simultaneous temperatures. For example, one channel can measure refractory wall temperature while the second channel can measure hot combustion gas temperature. The dual channel measurements share the same optical path (viewport, isolation valve, etc.).

Each Pulsar 4 Advanced provides two analog outputs, FMA capability and when turned on, effect all outputs.

Field Selectable measurements:

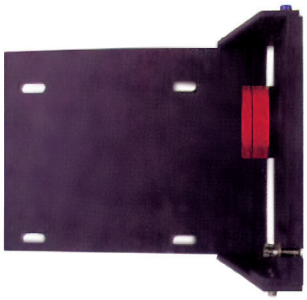
- RT — Refractory Temperature
- GT — Gas Temperature
- FF — Average Integrated Temperature
- FMA — Flame Measurement Algorithm

ACCESSORIES

Pulsar 4 Explosion-Proof Infrared Thermometer

CE 2809 Ex II 2G, Ex db IIB +H2 T4 Gb
FM14ATEX0004X IECEx FME 14.0001X
Class I, Div. 1, Groups B, C & D, T4
Ta = -40 to 60°C IP66
NEMA "Type 4X" classification
FM C US APPROVED

Model COP-10 Clean Out Rod for Clearing Sight-Port



Model SOF-8 SS Swing-Out Fixture for Sight-Port Access

Model BUP-10 Thermocouple and Adapter for Start-Up and Verification

REFERENCE NUMBERS

PN	Description
3 909 010	Pulsar 4 Advanced
3 909 020	Pulsar 4
3 909 030	Pulsar 4 Advanced Backup
3 909 040	Pulsar 4 Backup

ACCESSORIES

PN	Description
0 006 581	O-Ring EXP LID Pulsar 4
3 909 114	Front window gasket for Pulsar 4
3 909 800	Fuse set for Pulsar 4 (F1) 1.6A, (F2) 1.25A, and (F3) 1A
6 882 010	BUP-10; Backup TC probe and adapter
6 882 020	COP-10; 1 ea Model CRA Clean-Out-Ram assembly and model PAPG probe adapter with packing gland
6 882 030	BUP-10/COP-10; Backup thermocouple probe clean-out probe and single adapter for Pulsar 4
6 882 040	CRA Cleanout Ram; Includes: 1" and 1.5"; Heads (2.54 and 3.81 cm) and SS rod for Pulsar 4
6 884 060	VP-10P SST Viewport assembly with Pyrex® window, stainless steel
6 884 050	SOF-1, 2" 150lb swing out fixture, stainless steel, including VP-10P SST and mounting hardware kit
6 884 040	SOF-8-SS, 3" 150/300lb swing out fixture, stainless steel, and mounting hardware kit
6 882 350	TC-72; Thermocouple K, 6'(182.88 cm); with stop clamp, 1/4" dia.; stainless sheath
6 882 370	SST; stainless steel tag
6 882 400	Vortec air cooler for EXP housing
6 882 450	O-Ring large for VP-10
6 882 460	O-Ring small for VP-10
6 882 450	Mounting kit EXP to SOF-8
6 882 460	Mounting kit EXP to SOF-1

ABOUT ADVANCED ENERGY

Advanced Energy (AE) has devoted more than three decades to perfecting power for its global customers. AE designs and manufactures highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

AE's power solutions enable customer innovation in complex semiconductor and industrial thin film plasma manufacturing processes, demanding high and low voltage applications, and temperature-critical thermal processes.

With deep applications know-how and responsive service and support across the globe, AE builds collaborative partnerships to meet rapid technological developments, propel growth for its customers and power the future of technology.

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