



Thermal and Cable Solutions



About The Company

Tempsens Instruments (I) Pvt. Ltd. is a part of the diversified manufacturing group of companies of PYROTECH Group, which was established in 1976 by four tech-savvy technocrats. TEMPSENS has carved its niche in bringing technology and engineering together in the field of temperature measurement applications. We offer thermal engineering and cable solutions in industrial markets around the world.

Besides the headquarter and manufacturing facilities in India, Tempsens has broadened its horizon with manufacturing facilities in Germany and Indonesia besides sales offices in UAE and USA.

After the initial beginning with Thermocouples and RTDs, Tempsens has continuously focused on the manufacturing and supply of high quality thermal engineering products, accessories and services; built to specific customer needs. The company is involved in manufacturing of Thermocouple Nickel Alloys, Thermocouples, RTDs, Thermowells, Cables & Wires, Non-Contact Pyrometers, Heaters, Furnaces and Calibration equipments etc. with covered area of 2,70,000 sq. ft. Tempsens is an ISO 9001:2015, ISO 14001:2015, OHSAS 18001 certified company with NABL Accredited Laboratories.

Tempsens has earned the customer reputation worldwide of being a Preferred Vendor for its innovative solutions, quick delivery, high technical standards and outstanding quality.

Our mission is to lead the Thermal and Cable industry with Passion, Innovation, Intelligence & Reliability.



Tempsens Instruments U# I



Tempsens Instruments U# II



Marathon & AST Plant



Tempsens Instruments U# II Cable Plant



Tempsens Instruments GmbH - Germany



Pt. Tempsens Asia Jaya- Indonesia

About The Company

600
EMPLOYEES

OVER
6500
CUSTOMERS

40+
YEARS
EXPERIENCE

SALES IN OVER

75
COUNTRIES
AROUND THE GLOBE

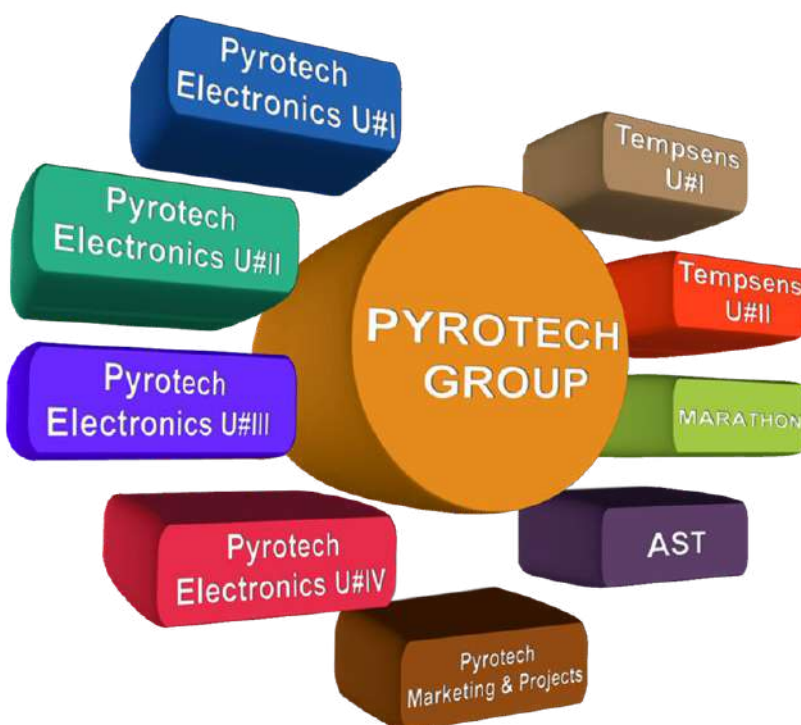
5 GLOBAL
LOCATIONS

5 PATENTS
APPLIED

~25%
YOY GROWTH



PYROTECH GROUP



Since 1976, Pyrotech Group is leader in Automation & Control Equipments with highly diversified products range manufactured in different divisions- Panels, Enclosures, LVS, LIR/LIE, LED Lightening, Electronic products, Temperature Sensors and Modular furniture.

Facilities



WELDING AND BRAZING

- Laser Welding Machines
- Programmable Micro Plasma Welding Machines
- TIG Welding Machines with Pulse Modulation And Rotary Positioner
- Induction Brazing Machines
- Resistance Welding Machines
- Brazing Sets (Oxy-Acetative)
- Deep Penetration Welding Machines
- Capacitive Discharge

CABLE PLANT MACHINERY

- FEP/PFA Extrusion Lines
- PVC/XLPE Extrusion Lines
- Silicon Extrusion Line
- Armoring Lines
- Laying Lines
- Copper Drawing Plant
- Conductor Stranding Machines
- Braiding Machines - High Speed and Regular
- Vertical Lapping Machines & Stranding Machines
- Tape Wrapping Machines
- PTFE Extrusion and Tape Roll Down Plant
- Buncher Machines
- Spark Tester & Diameter Testers

NICKEL ALLOY PLANT

- Vacuum Induction Furnace
- Pit Annealing Furnace
- Buel Block Drawing
- Nickel alloy multi die drawing machine
- Bright Annealing Machine

MACHINING

- CNC Turning Centers
- Turn Mill Centers
- VMC Machines
- Deep Hole Drilling Machines upto 1500mm Drilling Capacity
- Milling Centers
- Manual Lathe Machines

HEATER PLANT

- Swaging Machines
- Laser Marking Machines
- Laser Cutting Machine
- Bright Annealing Machine
- Engraving Machines
- Coil Making Machines
- High Frequency Annealing Machines
- MgO Filling Towers
- Rolling Machine & Skinning Machines
- Vacuum Presses
- CNC Breeding Machines

MI CABLE PLANT

- Draw Bench 50 meters
- Annealing Furnaces
- MI Polishing Machines
- MgO Plant
- Polishing Machine

TESTING AND CALIBRATION

- NABL Accredited Calibration Lab -196°C to 1600°C for Contact and upto 2900°C for Non Contact Sensors
- NABL Accredited Testing Centre for cables & wires.
- Computerized Calibration System
- Fixed Point Cells-TPW, Ga, Sn, Zn, & Al and AC Bridge for Primary Standards
- Digital Radiography Setup for Junction Integrity
- PMI Setup for Chemical Analysis of Alloys
- Pressure Test Setup
- Helium & Nitrogen Leak Detector
- Profile Projector
- Dye Penetration Test Setup for Weld Joints
- Microscopic Junction Check
- Auto Clave Testing
- Response Time Test, least count 1 msec.
- Ultrasonic Thickness Test
- Giga Ohm Insulation Resistance Testers
- Mechanical checks - lengths, gauges, concentricity checks
- Conductor Resistance Test
- Test for thickness of Insulation and Sheath
- Physical test for Insulation and Outer Sheath
- High Voltage Test Sets
- Flammability Test & Tensile Testers

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Contact Temperature Sensors



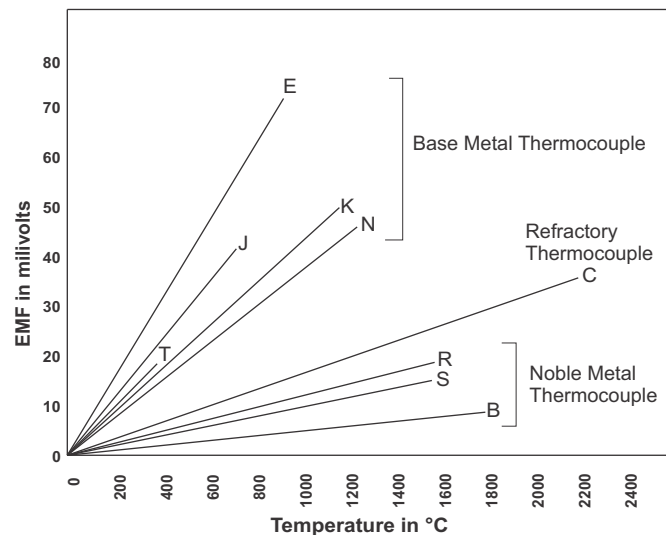
Thermal and Cable Solutions



Basics of Thermocouples & RTDs

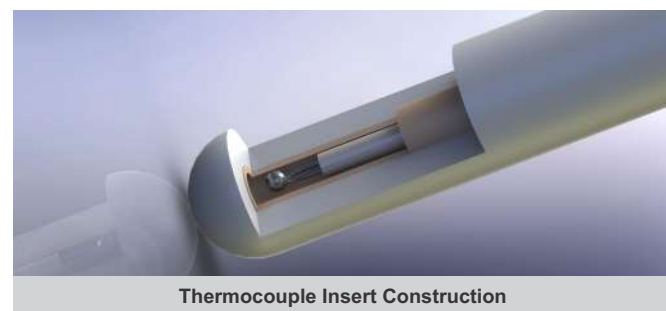
Thermocouples

Thermocouples are pairs of dissimilar metal wire joint at one end, which generate a net thermoelectric voltage between the open pair according to temperature difference between the ends.



Tolerance Table for Type of Thermocouples

| Type of T/C | Material (+ & -) | Temp. Range(°C) | Tolerance Grade | |
|-------------|--|-----------------|------------------|-----------------|
| | | | Standard | Special |
| T | Copper & Constantan | -200 to 370°C | ±1.0°C or ±0.75% | ±0.5°C or ±0.4% |
| J | Iron & Constantan | 0 to 760°C | ±2.2°C or ±0.75% | ±1.1°C or ±0.4% |
| E | Chromel & Constantan | -200 to 870°C | ±1.7°C or ±0.5% | ±1.0°C or ±0.4% |
| K | Chromel & Alumel | -200 to 1260°C | ±2.2°C or ±0.75% | ±1.1°C or ±0.4% |
| N | Nicrosil & Nilil | -200 to 1260°C | ±2.2°C or ±0.75% | ±1.1°C or ±0.4% |
| S | 90% Platinum+10% Rhodium & Platinum | 0 to 1450°C | ±0.5°C or ±0.25% | ±0.6°C or ±0.1% |
| R | 87% Platinum+13% Rhodium & Platinum | 0 to 1450°C | ±0.5°C or ±0.25% | ±0.6°C or ±0.1% |
| B | 70% Platinum + 30% Rhodium & 94% Platinum + 6% Rhodium | 800 to 1700°C | ±0.5% | --- |
| C | 95% Tungsten+5% Rhenium & 74% Tungsten+26% Rhenium | 0 to 2320°C | 4.5°C or ±1.0% | --- |



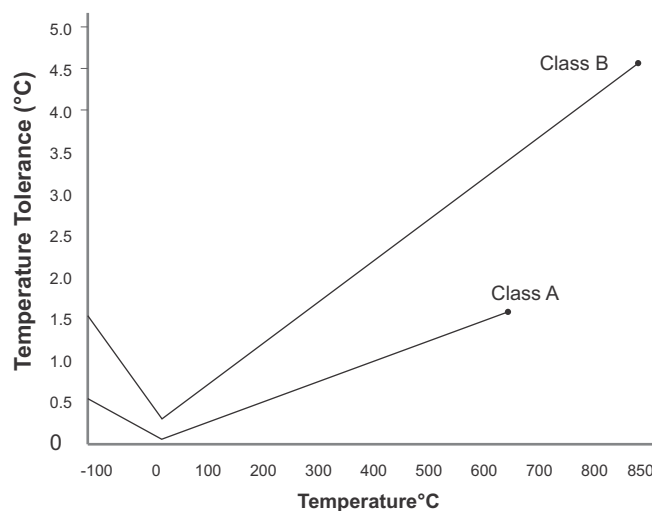
RTD

Resistance thermometer use metals that alter their electric resistance when heated.

Platinum is the most commonly used material for industrial RTD. However Copper and Nickel are also used for some applications.

The resistance at 0°C is called R_0 and it is an important parameter to be defined. The most commonly used RTD element is of platinum with resistance of 100 Ω at 0 °C. Thus named as Pt 100.

Platinum RTD are suitable for temperature range -200 to 850°C. Normally, Industrial RTD's are used at temperature range upto 400°C.

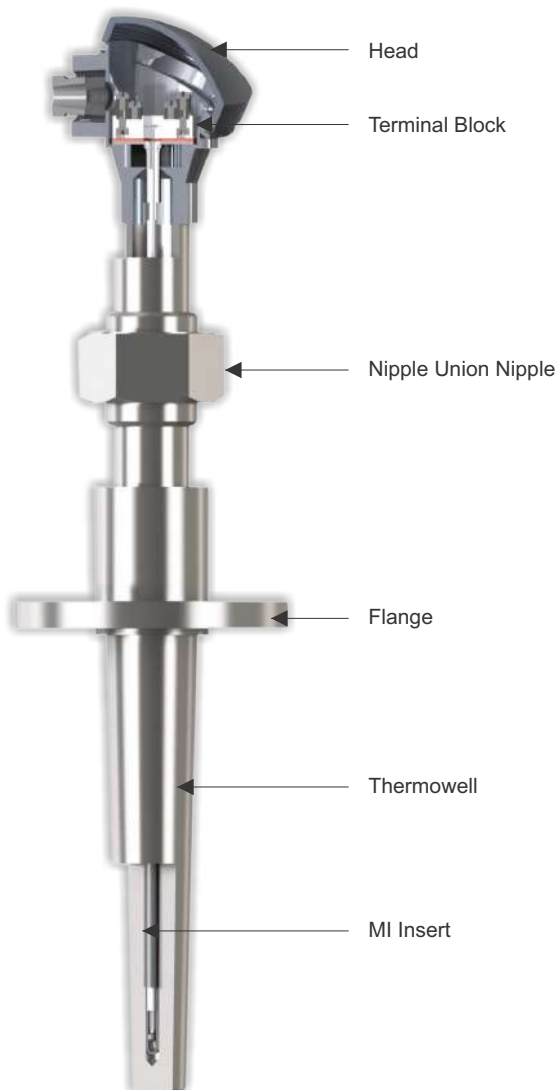


Tolerance Table for Type of RTD(as per IEC 751) Pt100

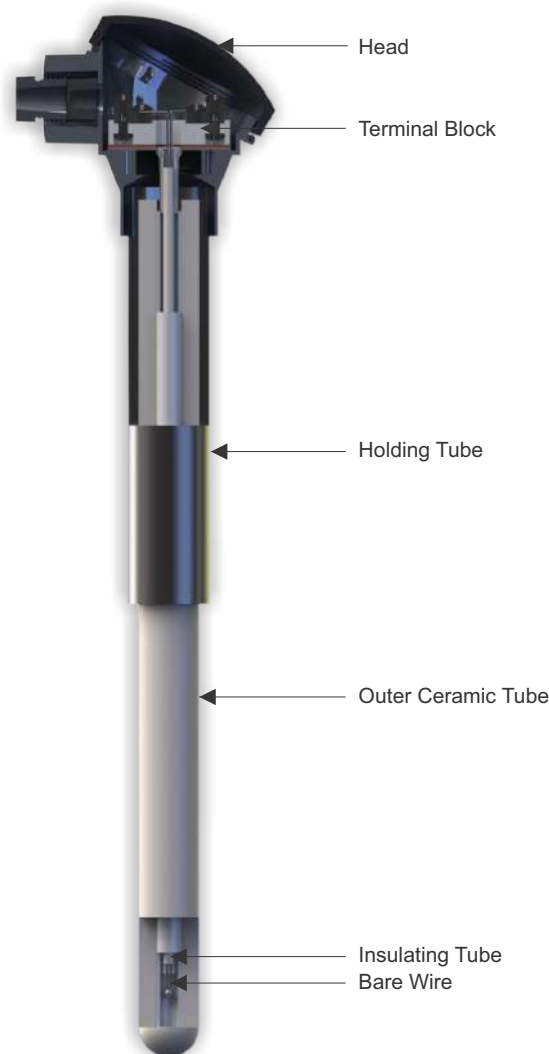
| Temperature | Class A (±) | Class B (±) |
|-------------|-------------|-------------|
| -200°C | 0.55°C | 1.3°C |
| -100°C | 0.35°C | 0.8°C |
| 0°C | 0.15°C | 0.3°C |
| 100°C | 0.35°C | 0.8°C |
| 200°C | 0.55°C | 1.3°C |
| 300°C | 0.75°C | 1.8°C |
| 400°C | 0.95°C | 2.3°C |
| 500°C | 1.15°C | 2.8°C |
| 600°C | 1.35°C | 3.3°C |
| 700°C | - | 3.8°C |
| 800°C | - | 4.3°C |
| 850°C | - | 4.6°C |



Basics of Thermocouples & RTDs



MI Construction



Non MI Construction

Metallic Protection Tubes

| Sr. No. | Material | Max./Operating Temp(°C) | Feature |
|---------|-------------|-------------------------|--|
| 1 | 304 S.S. | 980°C | Common against heat and corrosion. |
| 2 | 321 S.S. | 980°C | Higher corrosion resistance. |
| 3 | 316 S.S. | 980°C | Excellent resistance to corrosives, heat, acids and alkalis. |
| 5 | 310 S.S. | 1,000°C | Good high temperature strength with resistance to oxidation. |
| 6 | 446 S.S. | 1,050°C | Excellent resistance to oxidizing and reducing flames containing sulphur. |
| 7 | Inconel 800 | 1000°C | Excellent to high temperature oxidizing atmosphere and thermal shock. |
| 8 | Inconel 600 | 1,050°C | Excellent resistance at high temperature, Avoid sulphurous atmospheres |
| 9 | Platinum | 1,650°C | Well suited for use at extremely high temperature specially for molten glass |
| 10 | Titanium | Oxi. 250, Red. 1000°C | Superior corrosion resistance in cryogenic temperature. |
| 11 | Tantalum | Oxi. 300, Red. 2200°C | Suitable for inert & vacuum applications |
| 12 | Molybdenum | Oxi. 400, Red. 2000°C | Suitable for inert, vacuum & reducing applications |

Ceramic Protection Tubes

| Sr. No. | Material | Max./Operating Temp(°C) | Feature |
|---------|---|-------------------------|--|
| 1 | Recrystallised Alumina 99.7% purity (C-799) | 1750°C | Good resistance to chemical attack, mechanically strong but avoid severe thermal shock |
| 2 | Ceramic 60% Alumina (C-610) | 1500°C | Sintered alumina, used in heating furnaces, regenerators etc. |
| 3 | Nitride Bonded Silicon Carbide | 1500°C | Good resistance, mechanically strong, unsuitable for oxidizing atmosphere but resist fluxes. |
| 4 | Silicon Nitride | 1350°C | Excellent thermal shock resistance, most suitable for molten aluminium |
| 5 | Recrystallised Silicon Carbide | 1500°C | Excellent thermal shock resistance |
| 6 | Tungsten Carbide | 350°C | Good mechanical strength and high abrasion resistance |

Thermocouples

Base Metal Thermocouples With Thermowells / Protection Tubes

Base Metal Thermocouple types are composed of common, inexpensive metals such as nickel, iron and copper. The thermocouple types E, J, K, N and T are of this group and are the most commonly used type of thermocouple.



| | |
|----------------------------|--|
| Type | J, K, T, E, N |
| Element Size (MI) | 3.0, 4.5, 6.0, 8.0 mm, Other sizes on request |
| (Non-MI) | 1.2, 1.6, 2.0, 2.5, 3.2 mm, Other sizes on request |
| Protection Sheath Material | SS304, SS321, SS316, SS310 |
| Thermowell Material | HRS 446, INCONEL-600/601/ 800, Nickel, Hastalloy Titanium, Tantalum Sleeve, Ceramic 610 & C -799, Silicon Carbide, Monel etc |
| Configuration | Simplex/ Duplex/ Multipoint |

Thermocouples

MI Thermocouples

Mineral Insulated Thermocouples, commonly referred to as MgO (Magnesium Oxide) thermocouples, are used in many process and laboratory applications. They are available in all thermocouple element types and a wide variety of sheath diameters and materials. They are rugged in nature and bendable, and their fairly high temperature ratings make MI thermocouples a popular choice for a multitude of temperature measuring applications.



| | |
|--------------------------|--|
| Type | J, K, T, E, N, R, S |
| Element Size (MI) | 0.25, 0.5, 1.0, 1.5, 3.0, 4.5, 6.0, 8.0 mm, Other sizes on request |
| Sheath Material | SS321, SS316, SS310, HRS 446, Inconel 600, Nimonic, Pyrosil, Platinum etc |
| Configuration | Simplex/ Duplex/ Multipoint |
| Configuration | <ul style="list-style-type: none">• Miniature Thermocouples with minimum 0.25 mm Dia• Swaged Tip Thermocouples• Tube Temperature Skin Type Thermocouples• Special Sensors as per ASTM-E235 for critical application• High Wall Thickness |

Thermocouples

Noble Metal Thermocouples

Noble Metal Thermocouples are manufactured with precious or noble metals like Platinum and Rhodium. Noble Metal Thermocouple must be used with ceramic protection tube surrounding the thermocouple element. These are normally used for high temperature applications.



| | |
|----------------------------|--|
| Type | R, S, B |
| Element Diameter | 0.30, 0.35, 0.4, 0.45, 0.5 mm Other sizes on request |
| Protection Sheath Material | Recrystallized Alumina Ceramic(C-799), 610, Inconel, Silicon Carbide, Platinum etc |
| Configuration | Simplex/Duplex/Multipoint |
| Special | <ul style="list-style-type: none">• Hot Blast & Stove Dome Thermocouples• Tri Level Thermocouples• Crown Thermocouples |

Thermocouples

Refractory Thermocouples

Refractory Metal Thermocouples are manufactured from exotic metals Tungsten and Rhenium. These metals are expensive, difficult to manufacture and are brittle. These are used for high temperature, reducing or vacuum atmosphere conditions.



| | |
|----------------------------|--|
| Type | G, C, D (operating temperature upto 2300°C) |
| Sheath Material | Tantalum, Molybdenum, Inconel 600, Ceramic etc |
| Sheath Diameter | 1.6, 3.2, 6.4, 8.0 mm |
| Standard Transition Sleeve | SS316 or INCONEL |
| Insulation Material | Magnesium Oxide, Aluminium Oxide, Beryllium Oxide, Hafnium Oxide |

Resistance Temperature Detectors

RTDs With Thermowells/ Protection Tubes

RTDs for corrosive, high pressure, fast flowing medium with Thermowell.



| | |
|----------------------------|--|
| Type | Pt 100, 200, 500, 1000 etc. |
| Element size (MI) | Wire wound ceramic encapsulated, Wire wound glass encapsulated, Thin film ceramic encapsulated |
| Connection | 2, 3, 4 Wire |
| Protection Sheath Material | SS304, SS321, SS316, SS310, Inconel 600/800, HRS 446, Hastalloy, Monel |
| Configuration | Simplex/ Duplex/ Others |

Resistance Temperature Detectors

Mineral Insulated RTDs

Mineral Insulated Resistance Thermometers are made with Platinum-measuring resistors Pt100Ω to DIN IEC 751. The measuring resistor will be connected to the inner conductors, is also embedded and is surrounded by the metal sheath to form a hermetically sealed assembly.



| | |
|------------------|--------------------------------------|
| Type | Pt 100, 200, 500, 1000 cu-50, 53 etc |
| Connection | 2, 3, 4 wire |
| Element Diameter | 1.5, 3.0, 4.5, 6.0, 8.0 mm |
| Configuration | Simplex/ Duplex/ Others |

Special RTDs

- Slide shoe bearing RTDs
- Vibration proof RTDs for Bearing & DG sets
- Motor & Transformer winding temperature RTDs
- Handheld & Probe in various designs
- RTDs with IBR approved Thermowells
- Strap on RTDs for nuclear application
- High Temperature RTDs upto 1/10 DIN
- Semi Standard PRTs with NABL Certificate calibrated at Fixed points suitable up to 661°C
- Autoclave Thermocouple & RTD for Validation.

Thermowells And Protection Tubes

Thermowells

Thermowell is a tube, closed at one end, which protects the probe and allows its removal without breaking the liquid seal. Many materials and styles are available to match application requirements. Thermowells drilled from solid bar stock provide the highest pressure ratings, and welded models are also available.



| | |
|---------------------------|---|
| Material | SS304, SS316, SS316L, SS321, SS310, HRS446, INCONEL 600/800/601 Hastalloy, Monel, Titanium etc |
| Type | Drilled Barstock, Fabricated |
| Construction | Tapered, Straight, Helical |
| Process Connection | Screwed, Flanged |
| Certification | IBR certification on request, Radiography, PMI, Pressure test etc. Calculation as per PTC 19.3 can be provided |

Thermowells And Protection Tubes

Special Thermowells /Protection Tubes



| | |
|---|---|
| • | Metal Thermowells with Tungsten Carbide/ Ceramic/ PTFE/ PVDF/ PFA/ Starlite/ Zirconium coatings |
| • | Solid Sintered Tungsten Carbide |
| • | Silicon Carbide(Recrystallised & Nitride Bonded) |
| • | Platinum Thimble |
| • | Tantalum, Titanium, Nickle Cladding |
| • | Tantalum Tungsten (Ta10W) Alloy |
| • | Graphite |
| • | Silicon Nitride |
| • | Other materials in various sizes available on request |

Protection Tubes



| | |
|-------------------------|---|
| Material | Recrystallised Alumina 99.7% |
| Type | KER 710(C-799) Open Ended, Close Ended |
| Length | 350, 530, 600, 650, 740, 900, 1030, 1200, 1430 mm etc. |
| OD x ID | 6x4, 8x5, 10x6, 12x8, 15x10, 20x15, 24x18mm etc. High wall thickness tubes available |
| Insulating Tubes | 2/4/6 Holes etc. |
| OD | 1.5, 2.8, 3.5, 5.5, 8.5 etc. |

Gauges

Temperature Gauges



| | |
|------------------------------|--|
| Sensing Elements | Bi-Metal, Liquid Filled, Gas Filled |
| Dial Size | 63, 80, 100, 150, 250 mm |
| Stem Dia | 6, 8, 10, 12 mm |
| Range | Min. -40°C, Max. 650°C |
| Accuracy | Class 1 as per EN13190 |
| Standard | EN13190/IS13211 |
| Enclosure Protection | IP-55, IP-65 (Filled) |
| Connection | 1/8", 1/4", 3/8", 1/2" BSP/NPT (M/F) |
| Mounting | Center Back, Bottom Direct, Every Angle Mounting |
| Over-Range Protection | 30% above FSD |

Pressure Gauges



| | |
|------------------------------|---|
| Sensing Elements | Bourdon Tube, Sealed Diaphragm, Compact Sealed Diaphragm, Schaffer Diaphragm, Capsule Diaphragm |
| Dial Size | 40, 50, 63, 80, 100, 150, 250 mm |
| Range | Vacuum, Compound, 0...1Kg/cm ² to 0...2100Kg/cm ² |
| Accuracy | ±1% FSD |
| Over-Range Protection | 30% above FSD |
| Standard | IS 3624, EN837 |
| Enclosure Protection | IP-55, IP-65 (Filled) |
| Connection | 1/8", 1/4", 3/8", 1/2" BSP/NPT (M/F) |
| Mounting | Bottom/Back Direct , Bottom Surface, Back Panel, Back Bracket Mounting |

Accessories

Temperature Indicators / Controllers

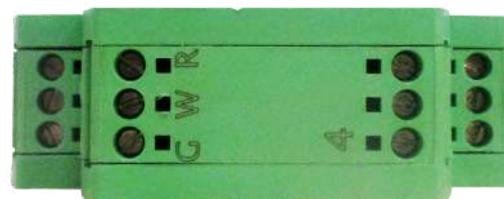


| | |
|---------------------|-----------------------------------|
| Input | mA, mV, J, K, E, T, N, Pt100 |
| Output | Relay, 4 - 20mA, (Retransmission) |
| Power Supply | 24VDC, 30mA or 230VAC |
| Range | -999 to 9999 |

Temperature Transmitters



Head Mounted Type

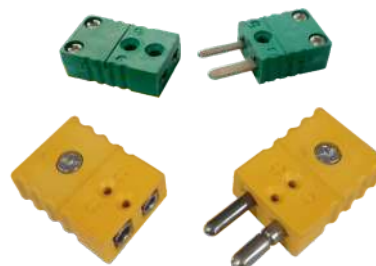


Din Rail Type

| | |
|----------------------|----------------------------------|
| Input type | RTD, TC, Ohm, mV |
| Output Signal | Analog 4 ~ 20mA, 2 wire / 4 wire |
| Communication | HART-protocol / USB |
| Power Supply | 7.5 to 45 VDC |

Connectors

- Plug and jack compensated for thermocouples.
J, K, N, R, S, B, T, E, C Types
- Standard, Miniature, Panel mounted, Simplex, Duplex
Material : Glass Filled Nylon and Ceramic
Colour Coding : Various Standards
- Lemo Connectors



Accessories

Hand Held Temperature Indicators

TEMPMET 05 - K TYPE THERMOCOUPLE

| | |
|--------------------------|--|
| Thermocouple | K |
| Dimensions | 162 X 76 X 38.5 mm |
| Measurement Range | -50 to 1300 °C |
| Accuracy | ± 2°C (-50 to 0°C), ±0.5% of reading + 1°C(0 to 1000°C), ±0.8% of reading + 1°C(1000 to 1300°C) |
| Unit | °C, F, K |
| Resolution | 1 °C/0.1°C |
| Power | Standard 9V battery |



TEMPMET 08 - THERMOCOUPLE & RTD

| | |
|---------------------|---|
| Thermocouple | B, C, D, E, J, K, N, R, S, T |
| RTD | Pt100, Pt50, Pt10, Pt200, Pt500, Pt1000 |
| Channels* | RTD - 1 No., T/C - 1 No. |
| Resolution | RTD - 0.01°C, T/C - 0.1°C |
| Accuracy | RTD - 0.3°C |

*2 Channel available on request



TEMPMET 09 - THERMOCOUPLE & RTD

| | |
|---------------------|---|
| Thermocouple | B, C, D, E, J, K, N, R, S, T |
| RTD | Pt100, Pt50, Pt10, Pt200, Pt500, Pt1000 |
| Channels | RTD - 1 No., T/C - 1 No. |
| Resolution | T/C - 0.01°C, RTD - 0.001°C |
| Accuracy | RTD - 0.05°C, T/C - 0.3°C |



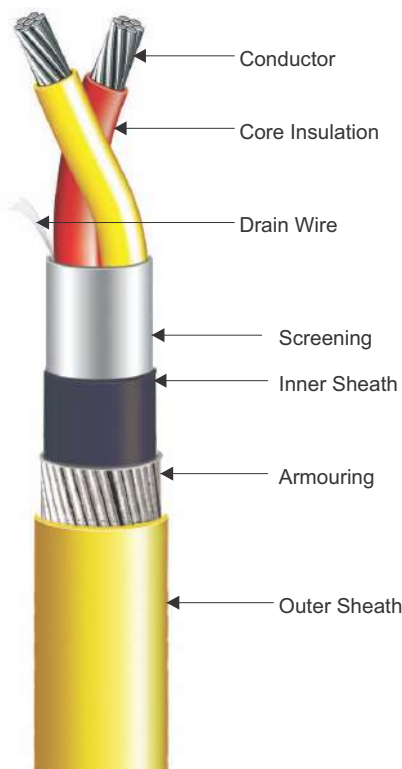
Cables & Wires



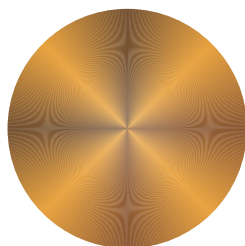
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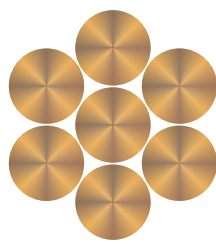
Cables



CONDUCTOR



Solid



Stranded

The center component of any cable is the conductor, which carries the signal or power through that cable. For signal & power transmission copper is the most commonly used conductor.

Copper Conductors

Annealed Bare Copper (ABC), Tinned Plated Copper (TPC), Nickel Plated Copper (NPC), Silver Plated Copper (SPC), NPC 27%

Thermocouple Conductors

Thermocouple grade conductor (TC)

Extension grade conductor (EX)

Compensating grade conductor (C)

Other Conductors

Pure Nickel Conductor (Ni),

Silver Plated High Strength Copper Alloy etc.



IS 694 : 2010
CML No. - 8400077612



IS 1554-1:1988
CML No. - 8400106609



IS 7098-1:1988
CML No. - 8400128712



NABL T-4096

INSULATION

Insulation refers to the layer of plastic, polymer or high temperature compound that is applied directly over the conductor. Tempsens provide variety of insulations along with wide temperature range from -267°C to 1200°C.

Insulation Type

Temperature range for various insulations are listed below :

| | | |
|----------------------|--------|--------|
| Alumina Fibre | -73°C | 1200°C |
| Ceramic Fibre/Silica | -73°C | 800°C |
| Fibre Glass | -73°C | 550°C |
| Polyimide | -267°C | 310°C |
| PTFE/PFA | -100°C | 260°C |
| PEEK | -60°C | 250°C |
| FEP | -80°C | 200°C |
| ETFE/ X-ETFE | -100°C | 200°C |
| SILICON | -50°C | 180°C |
| XLPE | -40°C | 150°C |
| XLPO | -40°C | 125°C |
| PVC | -30°C | 105°C |
| HDPE | -50°C | 80°C |
| PUR | -55°C | 80°C |
| LDPE | -50°C | 70°C |

SCREENING

Screening is applied for electromagnetic protection. Generally, two types of Screening are available :

- Aluminum Foil Type : - Screening is done by helically wound aluminum foil along with copper drain wire with 100 % coverage.
- Mesh Braided Type :- Screening is done by Copper wire (Bare Copper, Tinned Copper, Nickel Plated Copper, Silver Plated Copper). It is in mesh braided form with 70 % to 95% coverage area.

INNER SHEATH

PVC, Silicon, Teflon, Polyimide, PUR, HDPE, etc. (as listed in insulation type)

MECHANICAL PROTECTION

- G.I. Armouring (Round wire / Flat strip as per IS 3975:99)
- SS Braiding as per JSS 51038, BS 50288-7

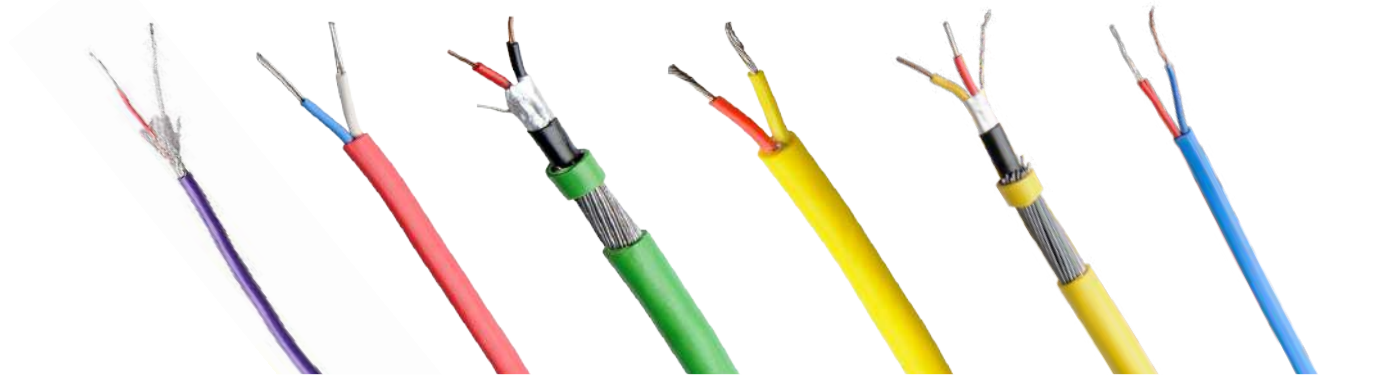
OUTER SHEATH

PVC, Silicon, Teflon, Polyimide, Fibre Glass, PUR, ETFE, XLPO etc. (as listed in insulation type)

Cables

Thermocouple Cables

Thermocouple Cables are used to measure the temperature directly. Thermocouple Extension or Compensating wires are only used to extend a thermocouple signal from a sensor to instrument for readings.



| | |
|----------------------------|---|
| Construction | Single or Multi pair |
| Voltage Grade | Up to 1.1 KV |
| Conductor | TC, EX, C (as per below table) |
| Type of Conductor | K, T, J, E, N, R, S, B, D, C |
| Conductor Size | AWG 12 to AWG 32 |
| Conductor Stranding | Solid or Multi strand |
| Core Insulation | PVC, XLPE, LSZH, PE, PTFE, FEP, PFA, PEEK, Silicon, ETFE, Polyimide, Fiber Glass, Ceramic Fiber |
| Screening | Aluminum Foil type/Mesh Braided type |
| Inner/Outer Sheath | PVC, LSZH, PTFE, FEP, PFA, ETFE, Silicon, Polyimide, Fiber Glass, Ceramic Fiber |
| Armouring | G.I. Armouring/ SS Braiding (For High Temperature Insulations) |
| Color Code | As per below table |
| Standards | ANSI MC 96.1, IEC 584.3, IS 8784 |

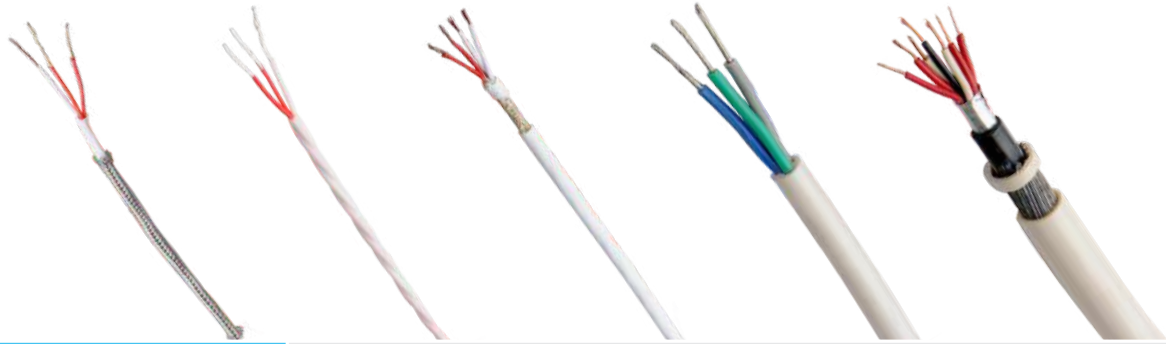
Colour Code & Accuracy of Thermocouple, Extension& Compensating Cables

| T/CTYPE | CONDUCTOR | | CONDUCTOR COMBINATIONS | | COLOR CODE | | TOLERANCE CLASS AS PER IEC 584.3 | | CABLE TEMP. RANGE°C |
|----------|-----------------|--------------------|------------------------|-------------------------|---------------|-------------|----------------------------------|----------------------|---------------------|
| | EXTENSION CABLE | COMPENSATING CABLE | +LEG | -LEG | IEC 5843:1989 | ANSI/MC96.1 | CLASS 1 | CLASS 2 | |
| K | | | CHROMEL | ALUMEL | | | ±1.5°C or 0.4% of T | ±2.5°C or 0.75% of T | 0°C TO +1100°C |
| | KX | | CHROMEL | ALUMEL | | | ±1.5°C | ±2.5°C | -25°C TO +200°C |
| | | KCA | IRON | CONSTANTAN | | | - | ±2.5°C | 0°C TO +150°C |
| | | KCB | COPPER | CONSTANTAN | | | - | ±2.5°C | 0°C TO +100°C |
| T | | | COPPER | CONSTANTAN | | | ±0.5°C or 0.4% of T | ±1.0°C or 0.75% of T | -185°C TO +300°C |
| | TX | | COPPER | CONSTANTAN | | | ±0.5°C | ±1.0°C | -25°C TO +100°C |
| J | | | IRON | CONSTANTAN | | | ±1.5°C or 0.4% of T | ±2.5°C or 0.75% of T | +20°C TO +700°C |
| | JX | | IRON | CONSTANTAN | | | ±1.5°C | ±2.5°C | -25°C TO +200°C |
| N | | | NICROSIL | NISIL | | | ±1.5°C or 0.4% of T | ±2.5°C or 0.75% of T | 0°C TO +1100°C |
| | NX | | NICROSIL | NISIL | | | ±1.5°C | ±2.5°C | -25°C TO +200°C |
| E | | | CHROMEL | CONSTANTAN | | | ±1.5°C or 0.4% of T | ±2.5°C or 0.75% of T | 0°C TO +800°C |
| | EX | | CHROMEL | CONSTANTAN | | | ±1.5°C | ±2.5°C | -25°C TO +200°C |
| R | | RCA | COPPER | COPPER LOW VALUE NICKEL | | | - | ±2.5°C | 0°C TO +100°C |
| S | | SCA | COPPER | COPPER LOW VALUE NICKEL | | | - | ±2.5°C | 0°C TO +100°C |
| B | | BC | COPPER | COPPER | | | - | | 0°C TO +100°C |
| D | | DC | ALLOY 203* | ALLOY 225* | | | - | ±4.5°C | 0°C TO +100°C |
| C | | CC | ALLOY 405* | ALLOY 426* | | | - | ±4.4°C | 0°C TO +100°C |

Cables

RTD Triad Cables

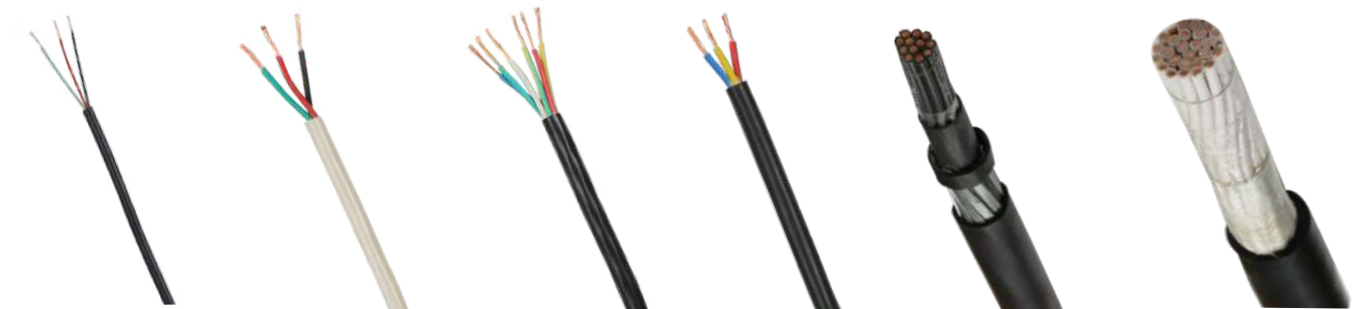
RTD triad cables are used to carry the RTD signals to the control room or field mounted instruments.



| | |
|----------------------------|--|
| Construction | Single / Multi Triads |
| Voltage Grade | Up to 1.1 KV |
| Conductor | Electrolytic Grade Bare Copper/ Tinned Copper/ SPC/ NPC |
| Conductor Size | 0.50, 0.75, 1.0, 1.5 Sq. mm up to 48 triad |
| Conductor Stranding | Solid or Multi Strand |
| Core Insulation | PTFE, FEP, Silicon, PFA, PVC, PE, XLPE, LSZH Polymer etc. |
| Screening Method | Individual and Overall/Overall Shield |
| Screening | Aluminum Foil type/Mesh Braided type |
| Inner/Outer Sheath | PTFE, FEP, Silicon, PFA, PVC, LSZH Polymer etc. |
| Armoring | G.I. Armouring/ SS Braiding (For High Temperature Insulations) |
| Standards | As per BS 5308 Part 1 and Part 2, IS 1554, EN 50288-7, IS 7098, DIN 43760, JSS 51038 |

LT Control & Power Cables

Control & Power cable up to 1.1 KV voltage grade with variety of insulations.

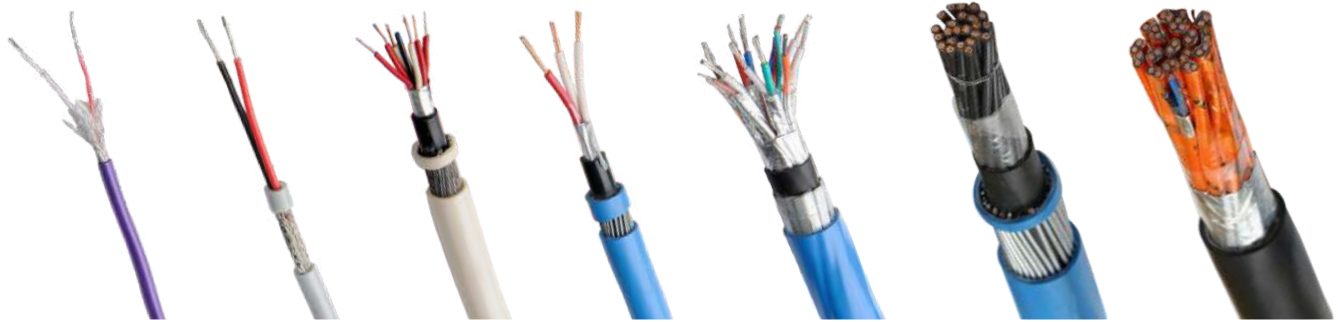


| | |
|----------------------------|---|
| Construction | Single / Multi Core |
| Voltage Grade | Up to 1.1 KV |
| Conductor | Electrolytic Grade Bare Copper/ Tinned Copper |
| Conductor Size | 0.50, 0.75, 1.0, 1.5, 2.5, 4.0, 6.0, 10.0, 16.0, 25.0, 35.0 upto 300 Sq. mm |
| Conductor Stranding | Solid or Multi Strand |
| Core Insulation | PVC, HR PVC, PE, XLPE, LSZH Polymer, FR PVC, FRLS PVC, XLPO etc. |
| Screening | Aluminum Foil type/Mesh Braided type |
| Inner/Outer Sheath | PVC, HR PVC, PE, LSZH Polymer, FR PVC, FRLS PVC, PUR, XLPO etc. |
| Armoring | G.I. Round Wire / Flat Strip Armouring(As per IS 3975 : 99) |
| Standards | As per IS 694, IS 1554, IS 7098, IEC 60227, IEC 60502-1, IEC 60332 |

Cables

Instrumentation Signal Cables

Instrumentation Signal Cables minimize noise and signal interference, delivering clean signals in harsh environments and general manufacturing operations. These cables are designed for use in communication and instrumentation.



| | |
|----------------------------|---|
| Construction | Single / Multi, Pair / Triads |
| Voltage Grade | Up to 1.1 KV |
| Conductor | Electrolytic Grade Bare Copper/ Tinned Copper |
| Conductor Size | 0.50, 0.75, 1.0, 1.5, 2.5 Sq. mm upto 48 pairs |
| Conductor Stranding | Solid or Multi strand |
| Core Insulation | PVC, HR PVC, PE, XLPE, LSZH Polymer, FR, FRLS PVC, XLPO etc. |
| Screening Method | Individual and Overall(F type)/Overall Shield (G type) |
| Screening | Aluminum Foil with Drain Wire/Mesh Braided |
| Inner/ Outer Sheath | PVC, HR PVC, PE, LSZH Polymer, FR PVC, FRLS PVC, PUR, XLPO etc. |
| Armoring | G.I. Round Wire / Flat Strip Armouring |
| Standards | As per BS 5308 Part 1 and Part 2, IS 1554, EN 50288-7, IS 7098 |

Fire Survival Cables

Fire Survival Cables are used in the installations where vital circuits are required to continue operation under fire conditions. In all disaster, fire smoke head & toxic fumes are the main obstacles to safe evacuation of a building area. A major contribution towards overcoming these hazards is the use of fire survival cables & halogen free cables.

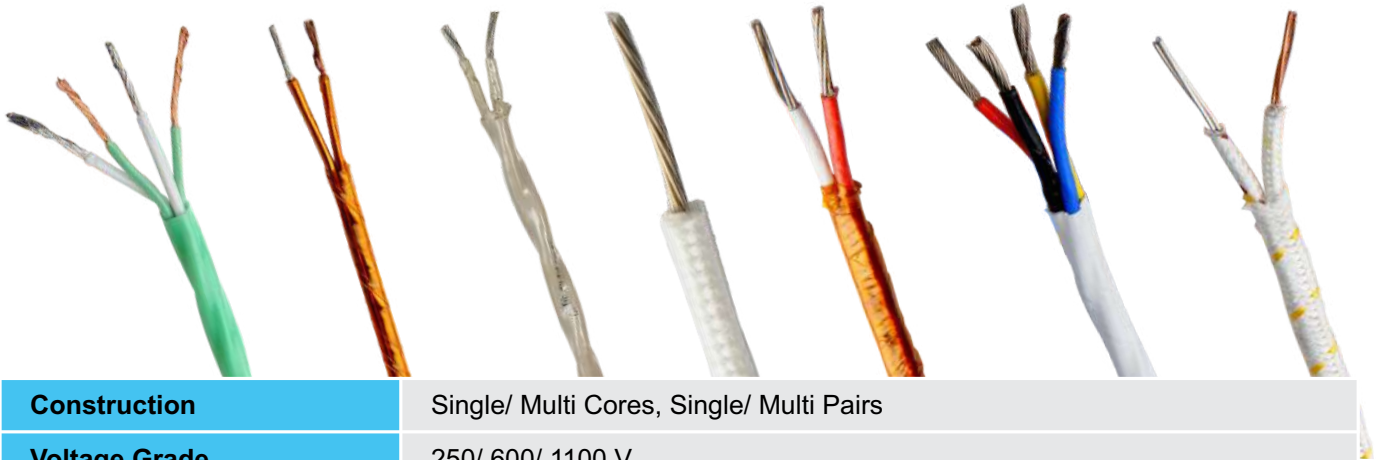
| | |
|---------------------------------|---|
| Conductor | Electrolytic Grade Bare Copper/Tinned Copper |
| Fire Resist Heat Barrier | Glass Mica Heat Barrier Tape |
| Insulation | XLPE/ SILICON |
| Screening | Al-myler/Metal braided |
| Inner/Outer Sheath | Halogen Free Low Smoke Polymeric compound |
| Armouring | G.I. Round Wire / G.I. Flat Strip |
| Standard | IEC 60331, IEC 60332, IEC 60754, BS 6387, EN 50290-2-27, BS 7655, BS 7629-1, IS 7098, IS 9968 |



Cables

High Temperature Cables

High Temperature Cables are used in areas where both working temperature and ambient temperature are too high. A variety of high temperature insulations such as alumina yarn, ceramic yarn, fibre glass, fluoroplastic polymers and elastomer to perform in continuous temperature up to 1200°C.



| | |
|-------------------------------------|---|
| Construction | Single/ Multi Cores, Single/ Multi Pairs |
| Voltage Grade | 250/ 600/ 1100 V |
| Conductor Type | Annealed Bare Copper, Tinned Copper, Silver Plated Copper, Nickel Plated Copper, Pure Nickel, NPC 27%, High Strength Copper Alloy |
| Conductor Size | From 0.22 Sq. mm to 240 Sq. mm |
| Heat Barrier Tape (Optional) | Glass Mica Tape, Polyimide Tape |
| Core Insulation | FEP, PTFE, PEEK, PFA, Silicon, PEEK, ETFE/ X-ETFE, Polyimide, Fibre Glass, Ceramic Fibre, Alumina Fibre |
| Screening Method | Individual and/or Overall |
| Screening | Aluminum Foil with Drain Wire/ Mesh Braided |
| Inner/ Outer Sheath | FEP, PTFE, PEEK, PFA, Silicon, PEEK, ETFE/ X-ETFE, Polyimide, Fibre Glass, Ceramic Fibre, Alumina Fibre |
| Armouring | Stainless Steel Wire Braiding |
| Generally Confirm to | JSS 51034, JSS 51038, JSS 51037, ASTM B298, ASTM B355, MIL 81381, MIL-DTL-27500H, MIL 16878, IS 9968, VDE 207 Part 6 |

DC Solar Photovoltaic Cables

DC Solar Cable are single core copper cables each for +ve and -ve, They are insulated with cross linkable Low Smoke Zero Halogen compound and sheathed with Low Smoke Zero Halogen compound (Conforming to BS EN 50618:2014 Standard)

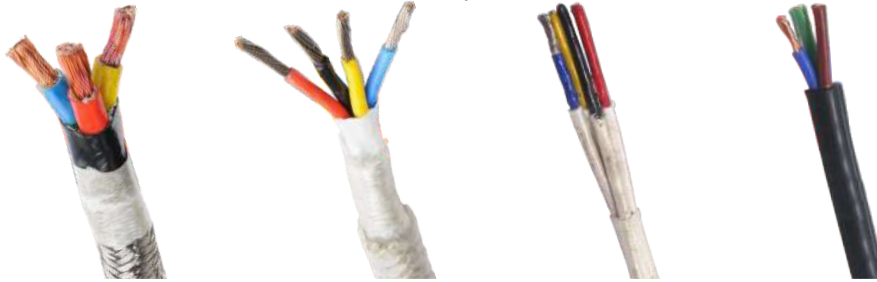
- Lasts up to 30 years even under tough external conditions.
- Annealed Tinned Copper Conductor (Class 5 as per IEC-60228).
- Resists extreme temperatures (-40°C to 120°C maximum at the core) and ozone resistant.
- Full protection against ultraviolet rays.
- Low smoke emission & low toxicity / corrosivity during fire.
- Flame retardant, fire retardant.
- Fast & Easy installation with color identification.
- In accordance with new environmental regulations.
- Suitable to common connector types.



Cables

Heat Resistance Cables

A range of single & multi core Heat Resistance Cable for temperature range upto 800°C. Our Heat Resistance Power Cables are suitable to resist in chemical, fire and flame atmosphere.



| | |
|----------------------------|--|
| Construction | Single / Multi Cores |
| Voltage Grade | Up to 1.1 KV Grade |
| Conductor | ABC, NPC, NPC 27% |
| Conductor Size | 1.5, 2.5, 4.0, 6.0, 10.0, 16.0, 25.0, 35.0 Sq mm upto 240 sq. mm |
| Heat Barrier Tape | Polyimide Tape |
| Conductor Stranding | Multistrand as per IS 8130:84/IEC60228 |
| Core Insulation | PTFE, FEP, PFA, Silicon, Fibre Glass, Ceramic Fibre etc. |
| Isolator | Polyimide, Sintered PTFE Foil |
| Fire Barrier Tape | Glass Mica Tape |
| Screening | Mesh Braided(Overall) |
| Inner/Outer Sheath | Teflon, Fibre Glass, Ceramic Fibre etc. |
| Outer Braiding | Asbestos |
| Armouring | SS Braiding |
| Standards | As per IS 8130:84, JSS 51038, JSS 51037 |

Sleeves

Variety of sleeves suitable for wide temperature range with various insulation such as PTFE, FEP, Silicon, Fiber Glass, Stainless Steel wire, Polyamide & PVC.

| | |
|-----------------------|-----------------------------|
| Inner Diameter | 0.50 mm to 30 mm |
| Voltage Grade | Up to 4 KV |
| Color | As per Customer requirement |

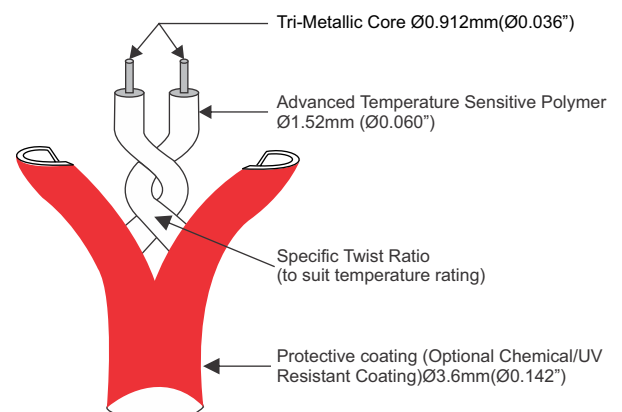


Other Special Cables

- Radiation Resistance Cable
- Automotive Wires & Cable
- Electron Beam Irradiated Cable
- RS-485 Cable
- Lance Cable
- Load Cell Cables
- Composite Cables
- Co-axial Cable
- Cat 5 & Cat 6 Cable



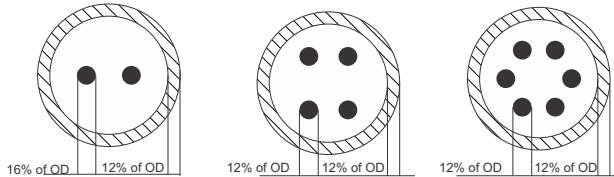
Digital Linear Heat Sensing Cables



Cables

Mineral Insulated Cables

Mineral insulated cables are designed for high-temperature applications and particularly strict requirements with regard to mechanical, chemical and electrical stability.



Mineral Insulated Thermocouple Cables

Mineral Insulated Thermocouple Cables Have Inner Conductors of Thermocouple Base Material As Per Standard ASTM E 585/585m and ASTM E 839.

| OD (MM) | TYPE | SHEATH | MGO GRADE | ACCURACY |
|---------|-------------|---|-------------------------------|----------------------------------|
| 1.5 | K - Simplex | 304 - SS304L 310 - Ss310 316 - SS316L 321 - Ss321 600 - INCONEL 600 | STANDARD (≥ 96% PURE) | CLASS 1 |
| 2.0 | KK - Duplex | | | |
| 2.2 | J - Simplex | | | |
| 2.2 | JJ - Duplex | | | |
| 3.0 | E - Simplex | | | |
| 3.0 | EE - Duplex | | | |
| 4.5 | N - Simplex | | | |
| 5.0 | NN - Duplex | | | |
| 6.0 | T - Simplex | | | |
| 8.0 | TT - Duplex | | | |
| 9.5 | R - Simplex | Note:- Diagonal Element Supplied Unless Specified | HIGH PURITY (≥ 99.4% PURE) | As per IEC 584-2 or ANSI MC 96.1 |
| 10.0 | RR - Duplex | | | |
| 10.0 | S - Simplex | | | |
| 12.7 | SS - Duplex | | | |

Mineral Insulated RTD Cables

Mineral insulated cables for RTDs have inner conductors of copper, copper-nickel alloys, nickel etc.

| OD (MM) | NO. OF CONDUCTOR | CONDUCTOR MATERIAL | SHEATH | MGO GRADE |
|---------|------------------|---|--|-------------------------------|
| 1.5 | 3 4 6 8 | Ni - Nickel Cu - Copper NiCu - Constantan | 304 - SS304L 316 - SS316L 321 - Ss321 600 - INC 600 | STANDARD (≥96% PURE) |
| 2.0 | | | | |
| 2.2 | | | | |
| 3.0 | | | | |
| 4.5 | | | | HIGH PURITY (≥ 99.4% PURE) |
| 5.0 | | | | |
| 4.8 | | | | |
| 6.0 | | | | |
| 8.0 | | | | |
| 9.5 | | | | |

Other Special Type of MI Cables

Mineral Insulated Heating Cables

Mineral Insulated Heating Cables are constructed with a solid resistor element embedded in highly compacted mineral insulation. MI cables are built to handle high temperature, high wattage applications.

Mineral Insulated Copper Cables (MI Power Cables)

Mineral Insulated Copper cable is used as an electric cable for critical areas of plant and follows standard of IEC/EN 60702 Part 1. It has two voltage grade 500V & 750V

Coaxial Cables/Triaxial Cables



Triaxial cable is a type of electrical cable similar to coaxial cable, but with the addition of an extra layer of insulation and a second conducting sheath. It provides greater bandwidth and rejection of interference than coaxial cable.

SPND's



Self-Powered Neutron Detectors are in-core flux monitors in nuclear power reactors. The typical SPND is a coaxial cable consisting of an inner electrode (the emitter), surrounded by insulation and an outer electrode (the collector).

Linear Heat Detector Cables

Linear heat detector cable is used to detect high temperature in critical equipments like engines etc.

They use a semiconductor as insulation, the resistance drops characteristic in high temperature condition.

Industrial Heaters



Thermal and Cable Solutions



Industrial Heaters

Component Heaters

Marathon offers Cartridge Heater, Strip Heater, Band Heater, Silicon Rubber Heater, Coil Heater and Customize Heating Solutions etc.

Cartridge Heaters



| | |
|--------------------------|---------------------------|
| Temperature Range | Up to 600°C |
| Material | SS304, SS316, Incoloy 600 |

Mica Band Heaters



Nickel/Chromium resistance wire evenly wound for uniform heat distribution and reliable accuracy. Highest grade mica provides excellent electrical insulation at high temperatures and is resistant to moisture.

Silicon Rubber Heaters



| | |
|--------------------------|---|
| Temperature Range | Up to 250°C |
| Applications | Good for heating drums, De-icing, Vending machines etc. |

Ceramic Band Heaters



Ceramic band heaters are medium-to-high temperature heaters that have 550°C as the maximum working temperature. Ceramic band heaters are available with different terminal styles, are fully flexible, and can accommodate holes and cut-outs.

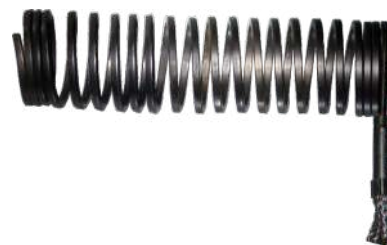
Bolt Heaters



Hot Bolt Heaters are used to preheat large, hollow holding bolts or studs where a high concentration of heat is critical for bolt expansion in a short period of time.

| | |
|------------------------|--|
| Heating Element | 80:20 NiCr Alloy resistance wire |
| Construction | Alloy sheath swaged tubular construction |

Coil Heaters



The basic construction of these heaters consist of compacted MgO, high temperature resistance wire and Chrome Nickel Steel tube. These heaters can be constructed with or without built in thermocouples.



Industrial Heaters

Process Heaters

Process Heating Systems consisting Heater Bundle, Vessel, Control Mechanism, Circulating Heater, Immersion Heaters, Air Heaters, Bundle Rod Heaters etc



| | |
|-------------------|--|
| Temperature Range | Upto 700°C |
| Pressure Range | Up to 500 bar |
| Heating Element | NiCr 80:20 with Mgo insulation |
| Material | SS/ Alloys/ CS |
| Application Areas | Oil and Gas, Refinery, Petrochemicals, Power, Marine, R&D and Nuclear, Chemical, Industrial Heating Applications |
| Certifications | ATEX, CCOE, IECEx, PED, CE etc. |



Industrial Heaters

Furnace Heaters

Bundle Rod Heaters



| | |
|-------------------|--------------------------|
| Temperature Range | Up to 1100°C |
| Heating Element | NiCr 80:20, FeCrAl alloy |

Silicon Carbide



| | |
|-------------------|-----------------------|
| Temperature Range | Up to 1600°C |
| Heating Element | SiC (Silicon Carbide) |

Edge Wound Heaters



| | |
|-------------------|--------------------------|
| Temperature Range | Up to 1100°C |
| Heating Element | NiCr 80:20, FeCrAl alloy |

Metallic Heating Elements



| | |
|--------------------------|--------------------------------------|
| Temperature Range | Up to 1100°C |
| Metallic Heating Element | Molybdenum, NiCr 80:20, FeCrAl alloy |

Bobbin Heaters



| | |
|-------------------|-------------|
| Temperature Range | Up to 800°C |
| Heating Element | NiCr 80:20 |

Accessories



Hangers



Radiant Tubes

| | |
|-----------------------|-------------------------|
| Radiant Tube Material | CastAlloy-HU, HK, SS316 |
| Hanger Material | N80, Incoloy 600 |



Underwriters
Laboratories



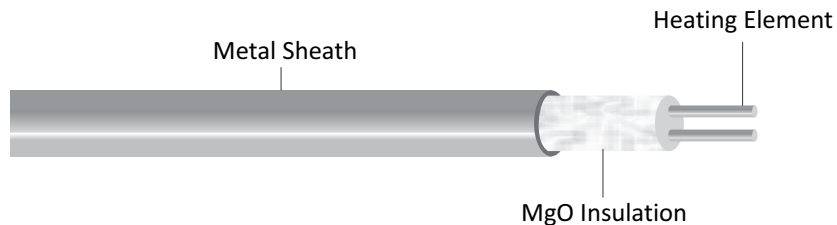
Marathon
TempSens

Industrial Heaters

Surface Heating Solutions

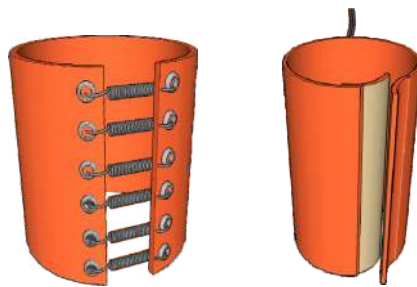
Marathon provide Surface Heating Solutions, Open Electric Heat Tracing MI Cable, Panel Type Hopper Heater, Silicon Rubber Heater which are used to maintain or raise the temperature of Pipes, Vessels and Hopper etc.

Mineral Insulated Heating Cables



| | |
|--------------------------|--|
| Temperature Range | Up to 500°C |
| Sheath Material | SS304, SS316, SS321, Alloy 600 |
| Applications | Suitable for heating tanks, valves, pipes, pumps, tools and industrial process heating systems |

Silicon Rubber Heaters



| | |
|--------------------------|--|
| Temperature Range | Up to 200°C |
| Applications | Surface of drum or heating barrel, Surface of pipe heating |

Hopper Heating Modules

Marathon Hopper Heating Jackets are ideally suited to raise or maintain elevated temperatures of the contents in reaction vessels, storage tanks, tankers and process equipments in industries.



| | |
|--------------------------|--|
| Temperature Range | Up to 200°C |
| Applications | Hopper heating, Vessels, Storage Tanks etc |



Industrial Heaters

Customized Heating Elements



Infrared Heater



Barrel Heater



Thermo Cutter

Integrated Control Panel System

Marathon offer control panels that integrates temperature controllers, customer input and power control system into a complete package. This precise power control allows process temperature to be controlled to $\pm 1^{\circ}\text{C}$. We can offer customized panel sizes for unique applications.



Non-Contact Temperature Sensors



Thermal and Cable Solutions



Pyrometers

A pyrometer is a non-contacting device that intercepts and measures thermal radiation. This device can be used to determine the temperature of an object's surface without contact to the surface.

A+ Series

Focusable Pyrometers with Analog output, Digital interface, Laser targeting / Through the lens view finder / Video module sighting, Keypad for Parameterizing, Integrated OLED Display.

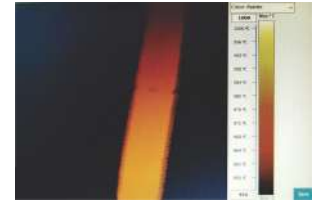
Special Pyrometer with thermal imager (A+450C TI)



OLED Display



Video Module



Thermal Image
(A+ 450C TI)

| Model | A+ 250 | A+ 450 | A+ 450C | A+ 450C TI |
|-----------------------------|-----------------------------------|-----------------|----------------------------------|------------|
| Temperature Range | 210°C...3000°C | 600°C...2500°C | 600°C...2500°C | |
| Emissivity | 0.1...1 adjustable | | | |
| Spectral Range | 1.6 μm | 1.0 μm | 0.7...1.15μm | |
| Distance to Spot Size Ratio | Focusable 75:1, 150:1, 300:1 | Focusable 300:1 | Focusable 150:1, 300:1 | |
| Response Time | 2msec. adjustable upto 10 sec. | | 20msec. adjustable upto 10 sec. | |
| Accuracy | ±0.3% of the measured value +1°C | | ±0.5% of the measured value +1°C | |
| Analog Output | 0-20mA, 4-20 mA (user selectable) | | | |
| Digital Output | RS-485 | | | |

A+ Series With Fiber Optics(A+FOPL)

Digital IR Fiber Optic Pyrometers with Mono Fiber Optic Cable (Single & Two Color Options Available).








| Model | A+250 FOPL | A+450 FOPL | A+450C FOPL |
|-----------------------------|-----------------------------------|--------------|-----------------------------------|
| Temperature Range | 250...2500°C | 600...2500°C | 800...3200°C |
| Emissivity | 0.1...1.0 adjustable | | 0.75 to 1.25 slope adjustable |
| Spectral Range | 1.6µm | 1.0µm | 0.7...1.15µm |
| Distance to Spot Size Ratio | 100:1, 200:1 | | |
| Response Time | 2msec adjustable upto 10 sec | | 20msec adjustable upto 10 sec |
| Accuracy | ±0.3% of measured value in °C+1°C | | ±0.5% of measured value in °C+1°C |
| Analog Output | 0-20mA, 4-20mA (user selectable) | | |
| Digital Output | RS-485 | | |

Pyrometers

A Series

Standard Industrial Pyrometers with single & two color models, Analog output, Digital interface, Bluetooth/USB communication, Laser targeting or Through the lens view finder



| Model | A250  | A450  | A250C  | A450C  | A150  |
|-----------------------------|--|--|---|---|--|
| Temperature Range | 210°C...3000°C | 600°C...2500°C | 350°C...1350°C | 600°C...2500°C | 75°C...700°C |
| Emissivity | 0.1...1 adjustable | | | | |
| Spectral Range | 1.6µm | 1µm | 1.5 µm/1.6 µm | 0.7...1.15 µm | 2...2.6 µm |
| Distance to Spot Size Ratio | 50:1 ,100:1, 200:1 | 200:1 | 100:1, 200:1 | | 40:1, 50:1 |
| Response Time | 2msec. adjustable upto 10 sec. | | 100msec. adjustable upto 10 sec. | 20msec. adjustable upto 10 sec. | 2msec. adjustable upto 10 sec. |
| Accuracy | ±0.3% of measured value +1°C | | ±0.5% of measured value +1°C | | above 400°C:0.5% of measured value in °C+1°C |
| Analog Output | 4 - 20mA / 0-20mA / 0-10V (optional) | | | | |
| Digital Output | USB 2.0 / Bluetooth, RS-232 or RS-485 (user selectable) | | | | |

*Specification are subject to change without prior notice.

A Series with Fiber Optics

Fiber Optic Pyrometers (optical head withstands ambient upto 250°C) with Single & Two Color Models, Mono Fiber Optic Cable, Laser Targeting, Digital Interface, Analog Output & Bluetooth / USB communication.



| Model | A250 FOPL | A450 FOPL | A250C FOPL | A450C FOPL |
|-----------------------------|--|---|--|--|
| Temperature Range | 250°C...1800°C | 600°C...2500°C | 350°C...1350°C | 800°C...3200°C |
| Emissivity | 0.1...1 adjustable | | 0.75...1.25 slope adjustable | |
| Spectral Range | 1.6 µm | 1µm | 1.5 µm / 1.6 µm | 0.71.15µm |
| Distance to Spot Size Ratio | 100:1(OH I), 200:1(OH II), 200:1(OH II V) | 100:1(OH I), 200:1(OH II), 200:1(OH II V) | 100:1(OH I), 200:1(OH II) | 100:1(OH I), 200:1(OH II) |
| Response Time | 2msec. Adjustable upto 10 sec. | | 100msec. adjustable upto 10 sec. | 20msec. adjustable upto 10 sec. |
| Accuracy | ±0.3% of the measured value +1°C | | ±0.5% of the measured value +1°C | |
| Analog Output | 4...20mA or (0-20mA/0-10V) user selectable | | 0-20mA, 4-20mA, 0-10V(user selectable) | 4...20mA, 0-20mA, 0-10V(user selectable) |
| Digital Output | USB 2.0/Bluetooth, RS-232 or RS-485 optional | | | |

Pyrometers

A Series with Thermopile (AL)

Pyrometers with Analog output, Digital interface, USB, Laser targeting light for temperature measurement.



| Model | AL30 | AL45 | AL514 | AL390 |
|-----------------------------|---|---|----------------------|----------------------|
| Application | Non-Metallic Surfaces, Painted, Coated or Anodized Metals | Flames and Combustion Gases that include Co2 | Glass Surface | Through Flame |
| Temperature Range | 0°C...1000°C | 400°C...1500°C | 300°C...2500°C | 300°C...1400°C |
| Emissivity | 0.1...1.2 adjustable | 0.1...1 adjustable | 0.1...1.2 adjustable | 0.1...1.2 adjustable |
| Spectral Range | 8...14 μm | 4.43 μm | 5.14 μm | 3.9 μm |
| Distance to Spot Size Ratio | 50 : 1, 100 : 1 | 40:1 | 50 : 1 | |
| Response Time | 60msec. adjustable upto 10 sec. | | | |
| Accuracy | T < 200°C : ±1.5%, T ≥ 200°C : ±1.0% | T < 500°C : ±1.5% of measured value, T ≥ 500°C : ±1.0% of measured value | | |
| Analog Output | 4...20mA / 0-20mA / 0-10V (user selectable) | | | |
| Digital Output | USB 2.0, RS-232 or RS-485 (user selectable). | | | |

IR CAST 2C

Special two color Pyrometer for Foundries



| Model | AST IR CAST 2C | IR CAST 2C+ |
|-----------------------------|--|--|
| Temperature Range | 700°C...1700°C | |
| Emissivity | 0.1...1 adjustable | |
| Spectral Range | 0.7...1.15 μm | |
| Distance to Spot Size Ratio | DV=166:1 (V=Vertical), DH=33:1 (H=Horizontal) | DV=250:1 (V=Vertical), DH=50:1 (H=Horizontal) |
| Response Time | 20msec. adjustable upto 10 sec. | |
| Accuracy | $\pm 0.5\%$ of measured value + 1°C | |
| Analog Output | 4...20mA or (0-20mA/0-10V) user selectable | |
| Digital Output | USB 2.0, RS-232 or RS-485 (user selectable) | |

Pyrometers

E Series

Economic Series Pyrometers with extended sensor head, Analog output, Digital interface, Relay output, USB Output, Inbuilt LCD, Laser Targeting & Keypad for parameterization.



| Model | AST E250 PL | AST E450 PL | AST E450C PL | AST EL50/EL50H |
|-----------------------------|---|----------------|----------------------------------|---|
| Temperature Range | 250°C...1800°C | 600°C...1900°C | 800°C...2500°C | 0°C...800°C |
| Emissivity | 0.1...1 adjustable | | | 0.1...1.2 adjustable |
| Spectral Range | 1.6 µm | 1µm | 0.7...1.15 µm | 8...14 µm |
| Distance to Spot Size Ratio | 20 : 1, 40 : 1, 80 : 1 | 80:1 | 80:1 | 2 : 1, 15 : 1 |
| Response Time | 2msec. adjustable upto 10 sec. | | 20 msec. adjustable upto 10 sec. | 20 msec. adjustable upto 10 sec. |
| Accuracy | ±0.3% of the measured value +1°C | | ±0.5% of the measured value +1°C | ±1.0% of the measured value or 3°C |
| Analog Output | 4...20mA / 0-20mA / 0-10V (user selectable) | | | 4...20mA / 0-20mA / 0-10V T/C type K or J(optional) |
| Digital Output | USB 2.0, RS-232/RS-485 user selectable | | | USB 2.0, RS-232/RS-485 (optional) |

*EL50H - sensor head 180°C

T3 Series

Pyrometers in 2 wire technology with Analog output, TTL output, USB interface and External Emissivity setting.



| Model | T3-250 | T3-450 | T3-390 | AST T3-514 | AST T3-814 |
|-----------------------------|---------------------------------|----------------|--|----------------|---|
| Temperature Range | 250°C...2500°C | 600°C...2500°C | 300°C...1400°C | 300°C...2500°C | 0°C...1000°C |
| Emissivity | 0.1...1.0 adjustable | | 0.1...1.2 adjustable | | |
| Spectral Range | 1.6 μm | 1 μm | 3.9 μm | 5.14 μm | 8...14 μm |
| Distance to Spot Size Ratio | 50:1, 100:1, 200:1 | 200:1 | 50 : 1 | | 50 : 1, 100 : 1 |
| Response Time | 10msec. adjustable upto 10 sec. | | 60msec...10sec adjustable | | |
| Accuracy | 0.3% of measured value or +1°C | | T<500°C, ±1.5% of measured value, T ≥ 500°C, ±1% | | ±2% of measured, value or ± 3°C, whichever is greater |
| Analog Output | 2 wire, 4-20 mA | | | | |
| Digital Output | TTL output | | | | |

Pyrometers

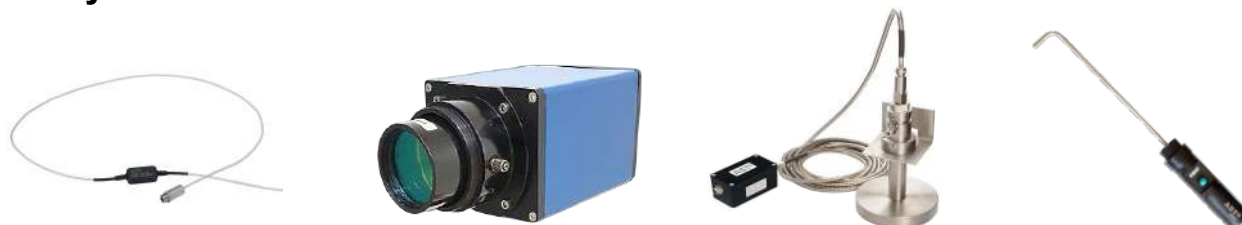
Portable Pyrometers

Portable Pyrometers with LCD display, Laser pointer/ Through the lens sighting, battery



| Model | TCT 500 | TI 750 | TI 1500 | TI 2400 | AST P250 | AST P450 | AST P450C |
|-----------------------------|--|----------------------|--------------------|--------------------|--|--------------------|---|
| Temperature Range | -60°C... 500°C | -60°C... 760°C | -60°C... 1500°C | 200°C... 2400°C | 210°C... 2500°C | 600°C... 3000°C | 600°C... 2500°C |
| Emissivity | 0.95 | 0.1...1.0 adjustable | | | 0.1...1.2 Adjustable | | |
| Spectral Range | 8...14µm | | | 1.1...3.7µm | 1.6µm | 1.0µm | 0.7...1.15µm |
| Distance to Spot Size Ratio | 12 : 1 | 12 : 1 | 50 : 1 | 100 : 1 | 100:1, 200:1, 400:1 | 400:1 | 200:1, 400:1 |
| Response Time | 1 sec. | | | | 5 msec in Numerical Mode, 10 msec in Graphical Mode, 10 msec (when data storage is ON) | | 25 msec in Numerical Mode,30 msec in Graphical Mode |
| Accuracy | +/-2% of reading or 2°C whichever is greater | | | | ± 0.3% of the measured value + 1°C | | ± 0.5% of measured value + 1°C |
| Analog Output | 20mA | | | | | | |
| Digital Output | USB 2.0 | | | | | | |

Special Pyrometer



| | | ALUMINIUM INDUSTRY | GLASS INDUSTRY | |
|-----------------------------|--|---|---|---|
| Model | ML - Series | A5 | AST 450G2 | PGM+ |
| Temperature Range | 0°C...1000°C | 300°C...2000°C | 600°C...1800°C | 250°C...600°C |
| Emissivity | 0.1...1.2 adjustable | 0.1...1.0 | 0.05...1 adjustable | 0.1...1 adjustable |
| Spectral Range | 8...14 μm | 1.3...1.6μm | 1.1...3.7μm | 1.6μm |
| Distance to Spot Size Ratio | 2 : 1, 15 : 1 | 100:1, 200:1 | 100 : 1 | - |
| Response Time | 60 msec adjustable upto 10 sec | Adjustable from 0.15 to 17 sec | 250msec. adjustable upto 10 sec. | 2msec adjustable upto 10 Sec |
| Accuracy | ± 2% of measured value or ± 3°C whichever is greater | ±1% | ±0.3% of measured value or 3°C which is greater | ±0.3% of measured value or 3°C which is greater |
| Analog Output | 2 wire 4 - 20mA, 0 - 10V/0 - 5V J & K type T/c | 4-20mA, 0-20mA, 0-10V, K Type T/C | 4...20mA | - |
| Digital Output | TTL Output | RS-232, RS-422, RSX-485, USB, Bluetooth | USB 2.0 | USB 2.0 |

Furnace Monitoring Cameras

Application

Steel, Cement, Power, Glass Industries



CCD Camera (Normal View)

| | |
|--------------|---------------------------|
| Image sensor | 1/3" Super HD CCD |
| TV Line | Black and White 650 lines |
| Illumination | 0.005Lux@F2.0 |
| Image | Manual adjustable |
| Video output | Composite 1 [Vp-p]@75(Ω) |
| Power | DC12V (±10%) |



Normal View

Pinhole Lens

| | |
|---------------|--------------------------------|
| Lens length | 820 mm & 1100 mm |
| Lens type | Straight or Elbow (45° or 60°) |
| Field of view | 67°(H)x 56°(V) x 81°(D) |
| Focus | Manual Adjustable |
| Length | 820 mm |

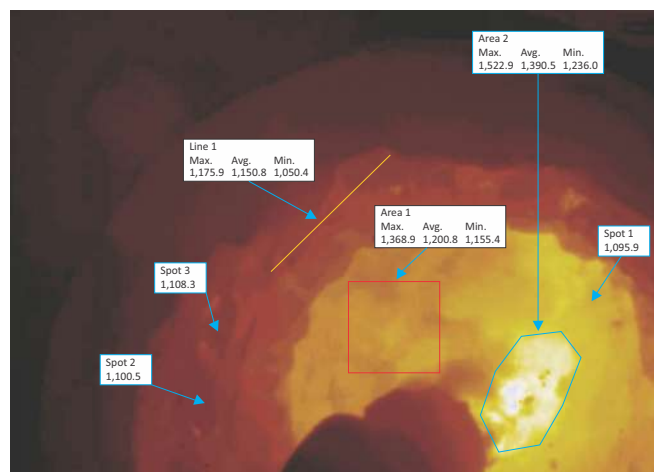
Features

- Water cooled lens tube, Vortex cooled camera chamber
- Auto retraction and shutter
- Pneumatic cylinder
- Air Purged
- Control panel with pneumatic system
- Software Infraview for Thermal camera
- Input/Output module

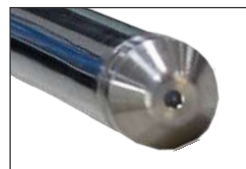
| Model | Specification |
|--------------------------|------------------------------|
| TFV-750/TFV-1100 | Straight View Visual Camera |
| TE-750/TE-1100 | Straight View Thermal Camera |
| TFV-750/OV & TFV-1100/OV | Elbow View Visual Camera |
| TE-750/OV & TE-1100/OV | Elbow View Thermal Camera |

Thermal Camera (Thermal View)

| | |
|-------------------|-------------------------------|
| Image Sensor | HD CMOS Sensor |
| Temperature Range | 700° C to 1800° C |
| Accuracy | ±0.3% of measure value + 1 °C |
| Resolution | 768 x 576 pixels |
| Frame rate | 25 Hz |
| Spectral Range | 0.85 to 1.1μm |
| Connectivity | Ethernet/USB |



Thermal View



Straight View



Oblique Angle View

Infraview Software (for Thermal Camera)

- Configurable ROI's : point, line, free shape
- Histogram and isotherm visualization
- Hot and cold spot detection
- Color pallet scaling
- Trend charts
- Alarm output
- Video and Image export
- Server client configuration

Thermal Imagers

ASTI /Tempsens develops Thermal imaging Camera for radiometric and security surveillance application.

TE-700



LTE-384



LTE-160



LTE-80

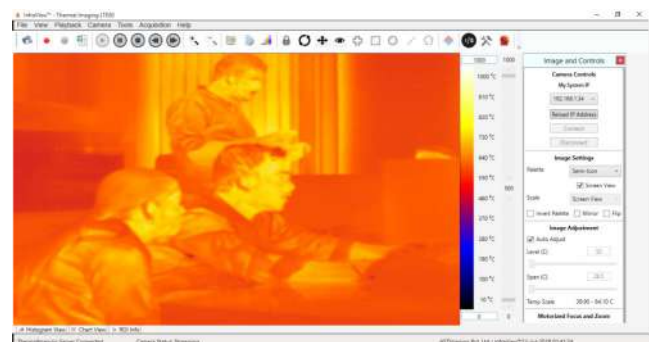


| Model | TE-700 | LTE-384 | LTE-160 | LTE-80 |
|------------------------------------|---|--|--|--|
| Description | High Resolution, High Temperature Infrared Camera | High Resolution, Long Wavelength Infrared Camera | Medium Resolution, Long Wavelength Infrared Camera | Medium Resolution, Long Wavelength Infrared Camera |
| Temperature Range | 700°C - 1800°C | -20°C - 120°C, 0°C - 500°C (Switchable) | 0°C – 500°C higher range upto 1000°C/optional | 0°C – 500°C higher range upto 1000°C/optional |
| FOV | 32° x 24°, 51° x 39°, 83° x 67° | 18.5° x 14.0° | 30.4° x 23.1° (Other FOV's also possible) | |
| Spectral Range | 0.85 - 1.1µm | 8 - 14µm | 8 - 14µm | 8 - 14µm |
| Detector | High Dynamic CMOS | Uncooled FPA detector | Uncooled FPA detector | Uncooled FPA detector |
| Optical IR Resolution / Frame Rate | 640 x 480 @ 25Hz | 384x288 @ 25Hz | 160x120 @ 30Hz | 80x64 @ 9Hz |
| Ambient Temperature | 0°C - 60°C | -10°C ~ +60°C | -10°C ~ +60°C | -10°C ~ +60°C |

Software Infraview

Thermal image processing software INFRAVIEW is customizable with Client- Server Architecture for catering to multiple clients at the same time. The modular windows software INFRAVIEW can be configured / customized to cater to application / solution requirements. AST INFRAVIEW Software allows you to control the camera; record, view, manipulate and store the captured video / image as well as measured temperature data. This software allows simple and fast parameterization of the temperature data for optimizing process control

- Configurable ROI's : point, line, free shape
- Histogram and isotherm visualization
- Hot and cold spot detection
- Color palette scaling
- Trend charts
- Alarm output
- Video and Image export



Calibration Equipments



Thermal and Cable Solutions



Calibration Equipments

Liquid Baths

Provide superior thermal environment for probe immersion as no air gap exist between the probe and the medium. The stirring results in very even heat distribution throughout the medium. Liquid Nitrogen is used for -196 to -80°C, Methanol for -80 to 0°C, Water from 0 to 80°C and Silicon Oil for up to 250°C.



CALsys -80/50



CALsys -35/200



CALsys 300SP



CALsys 250

| Models | CALsys -196/-80 | CALsys -80/50 | CALsys -40/50 | CALsys -35/200 | CALsys 250 |
|------------------------|-----------------|--------------------------|------------------------|--------------------------|------------------|
| Temperature Range | -196 to -80°C | -80 to 50°C | -40 to 50°C | -35 to 200°C | 50 to 250°C |
| Stability | ±0.1°C | ±0.05°C | ±0.05°C | ±0.06°C | ±0.05°C |
| Calibration Volume(mm) | Dia 24 x 300(D) | 100(L) x 130(W) x 200(D) | 90(L) x 90(W) x 150(D) | 105(L) x 105(W) x 150(D) | Dia 90 x 140 (D) |
| Medium | Liquid Nitrogen | Methanol | Methanol | Silicon Oil | Silicon Oil |

Calibration Equipments

Dry Blocks and Furnaces

Provides the most convenient, portable facilities for checking & calibrating industrial probes and they are usually reasonable rapid heating and cooling device. The unit consists of a special designed heating block which has located internal holes for the probes.



CALsys -30/110



CALsys 650



CALsys 1700

| Models | CALsys -30/110 (Peltier Dry Block) | CALsys 650 | CALsys 1200 | CALsys 1200L | CALsys 12003Z (3- Zone Furnace) | CALsys 1500L | CALsys 1700L |
|---------------------------------------|---------------------------------------|--|---|---|---|---|---|
| Temperature Range | -30 to 110°C | 50 to 650°C | 250 to 1200°C | 300 to 1200°C | 300 to 1200°C | 500 to 1500°C | 500 to 1700°C |
| Stability | ±0.07°C | ±0.07°C | ±0.3°C | ±0.35°C | ±0.35°C | ±1.0°C | ±1.5°C |
| Insert Construction (mm) Dia x Length | Dia 24 x 120(L), (3x6.0)holes 115 (D) | Dia 32 x 150(L), (4x6.5) holes 120 (D) | Dia 37 x 215(L), (2x6 & 2x8 holes) of 160 (D) | Dia 37 x 240(L), (2x6 & 2x8 holes) of 160 (D) | Dia 37 x 240(L), (2x6 & 2x8 holes) of 160 (D) | Dia 37 x 245(L), (2X6 & 2X8 holes) of 140 (D) | Dia 37 x 240 (L) (2x6 & 2x8 holes) of 225 (D) |

Calibration Equipments

Black Body Source

Black Bodies are reference sources used for testing infrared systems. They are required in industry for calibration of pyrometers, infrared line scanners or cameras. In laboratory, they are part of benches for characterization of complex optronic systems. Tempsens offers a wide range of black bodies to cover all customer's need.



CALsys 110BB



CALsys 1200BB



FastCAL 3000

| Models | CALsys 110BB | CALsys 500BB | CALsys 1200BB | CALsys 1500BB | CALsys 1700BB | Fast Cal 3000 |
|-----------------------|--------------|--------------|-----------------------|-----------------------|---------------------|---|
| Temperature Range | 10 to 110°C | 50 to 500°C | 300 to 1200°C | 500 to 1500°C | 500 to 1700°C | 600 to 3000°C |
| Stability | ±0.1°C | ±1.0°C | ±0.5°C | ±1.0°C | ±2.0°C | ±1.0°C |
| Emissivity | 0.95 | 0.95 | 0.99 | 0.99 | 0.97 | 0.99 |
| Calibration Area (mm) | Dia - 80mm | Dia - 100 mm | 40 mm x 85 mm (Depth) | 40 mm x 85 mm (Depth) | 29 mm, 235 mm depth | 25mm Dia & Depth 127 mm Graphite Cavity |

Master Pyrometers With Special Calibration

| | |
|-----------------|---------------|
| AST AL30 | 0 to 1000°C |
| AST A250 | 250 to 2500°C |

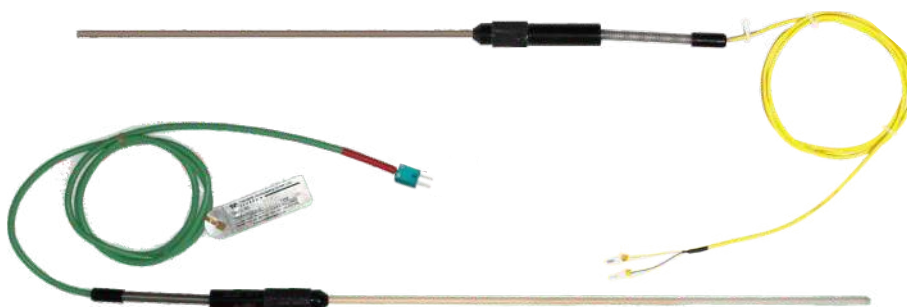


Master Pyrometer A250

Calibration Equipments

Master Sensors

Accurate Master Temperature Sensors in various configuration are available with Calibration certificate from our NABL Accredited Lab.



| | | |
|--------------|-------------------|--|
| SSPRT | Type | PT100/PT25 |
| | Temperature Range | 0 to 661°C |
| RTD | Type | PT 100 |
| | Accuracy | 1/10, 1/5, 1/3, 1/2 DIN, Class A |
| | Sheath Material | SS316, Inconel, Quartz |
| THERMOCOUPLE | Type | K/N/R/S |
| | Accuracy | Special, Class 1, with option cold junction compensation |
| | Sheath Material | Inconel/ Ceramic (KER710-C 799) |

Automatic Calibration System (Auto Cal)



- ✓ Software for automated temperature calibration process.
- ✓ In-Built High Resolution 6 ½ digit digital readout.
- ✓ 12 Channel 4 wire RTD and 12 Channel of Thermocouple input.
- ✓ Includes Easy to use Connectors.
- ✓ Facilities for Temperature Calculation & Error Calculation.
- ✓ internal CJC compensation.
- ✓ Facility for data saving.

Calibration Equipments

Reference Junction Units

Reference Junction eliminates old fashioned ice bath and are used in industries and laboratories.



| | |
|------------------|---------------------|
| Type | CALref 0, CALref 60 |
| Channel | 20, 24 |
| Ref. Temp | 0, 60 °C |
| Type of Junction | J,K,T,E,N,R,S,B |

CALSYS C-4004 (High Accuracy Digital Thermometer)



- High Stability of Temperature measurement (.098° C)
- High Accuracy of RTD Measurement (0.01° C)
- High Accuracy of Thermocouple Measurement (0.1° C)
- High Resolution
- 2 Measuring inputs
- 10 Thermocouple (B, C, D, E, J, K, N, R, S, T)
- 6 RTD's (PT-10, PT-50, PT-100, PT-200, PT-500, PT-1000)

Meters

TEMPMET 08 - THERMOCOUPLE & RTD



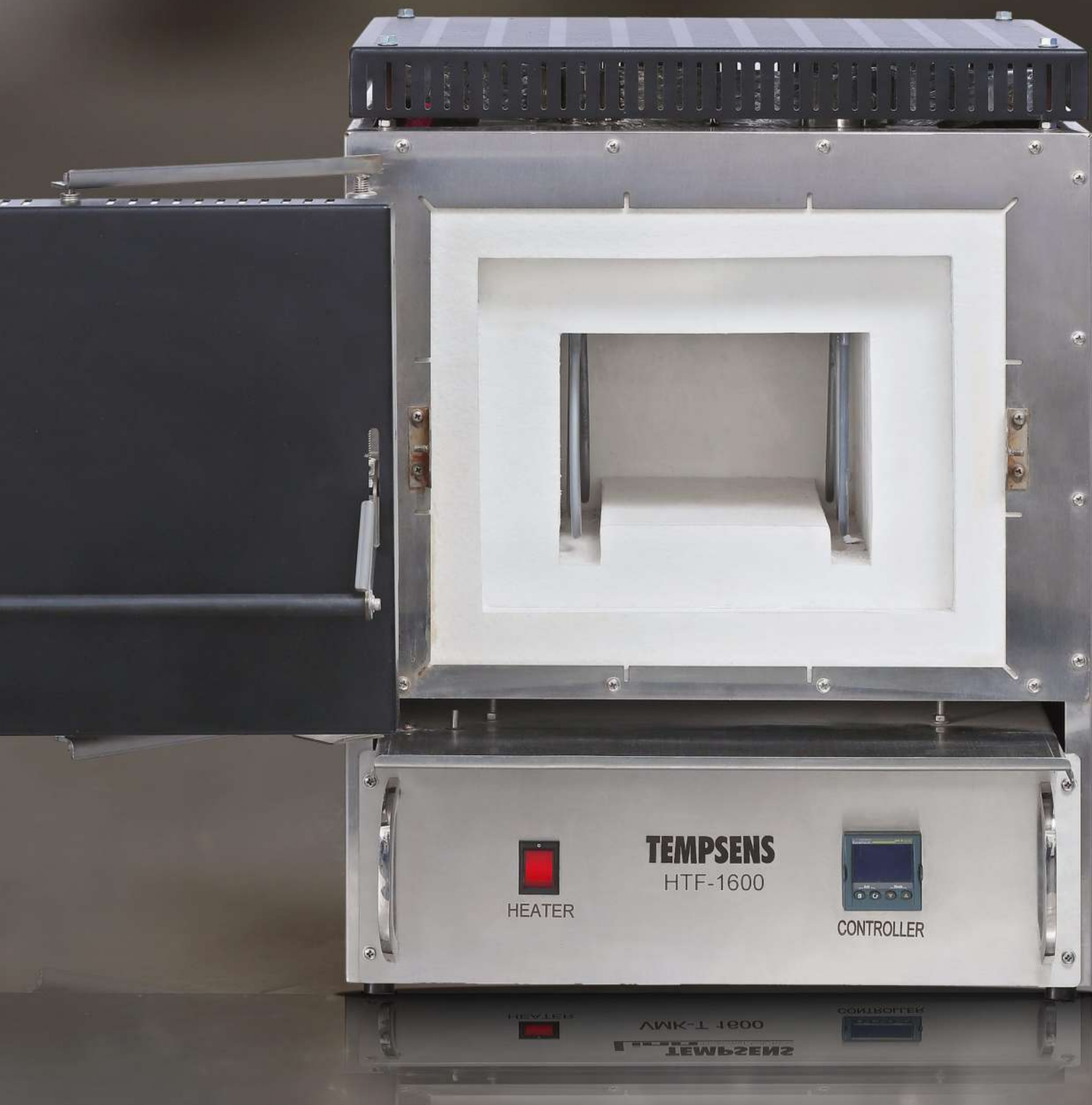
| | |
|------------|---|
| Inputs | B, C, D, E, J, K, N, R, S, T |
| | Pt100, Pt50, Pt10, Pt200, Pt500, Pt1000 |
| Resolution | RTD - 0.01°C, T/C - 0.1°C |
| Accuracy | RTD - 0.3°C |

TEMPMET 09 - THERMOCOUPLE & RTD



| | |
|------------|---|
| Inputs | B, C, D, E, J, K, N, R, S, T |
| | Pt100, Pt50, Pt10, Pt200, Pt500, Pt1000 |
| Resolution | T/C - 0.01°C, RTD - 0.001°C |
| Accuracy | RTD - 0.05°C, T/C - 0.3°C |

Furnaces



Thermal and Cable Solutions



Furnaces

Laboratory Furnaces

Laboratory Furnaces are a must for specific testing applications such as ashing, preheating , curing, annealing etc. We have models available in front entry, bottom entry, tubular furnace etc.



HTF - 1600



MF 312



TF - 1800 3Z



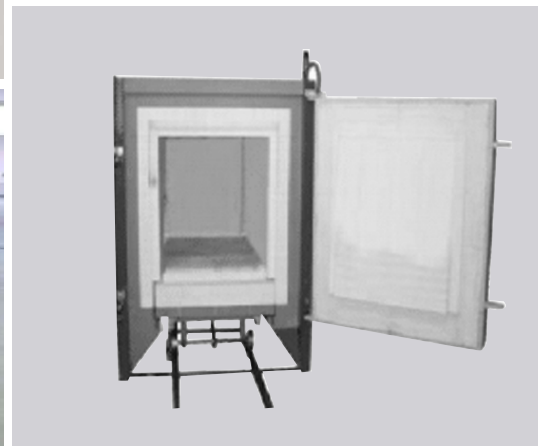
BLF 1800

| | |
|---------------------|--|
| Maximum Temperature | 500 °C - 1800°C |
| Heating Elements | Kanthal A1, Silicon Carbide, MoSi ₂ |
| Controlling Sensors | N, R, B, S |
| Power Rating | 2 - 8 KW |
| Volume(Ltrs.) | 1.5 - 18.5 |

Furnaces

Industrial Furnaces

Industrial Furnaces find applications in processes such as casting, calcination, tempering etc. We offer wide range of industrial furnaces such as Chamber / Box Furnace, Bogie Hearth Furnace, Bottom Loading Furnace, Annealing Furnace, Pit Type Electric Furnace and Electric Conveyor Mesh-Belt Furnace

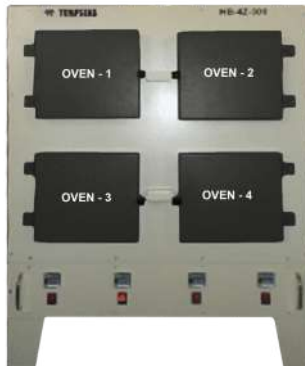


| | |
|------------------------|---|
| Maximum Temperature | 1100 °C - 1800°C |
| Heating Elements | Kanthal APM, Nichrome, Silicon Carbide, MoSi ₂ |
| Controlling Sensors | K, N, R, B |
| Power Control | Power control through thyristor or SSR unit. |
| Temperature Controller | Microprocessor Based PID Temperature Controller |

Furnaces

Laboratory / Industrial Ovens

Laboratory and Industrial Ovens Series offers a range of precision electric ovens. They are designed for low temperature thermal treatment such as drying, heating and thermal testing in an air-flow assisted environment.



| | |
|-------------------|-------------------------|
| Temperature Range | Upto 500°C |
| Capacity | 4 Liter to 14000 Liters |

Microwave Furnace

Microwave Furnaces represent a system that combines free radiating heating elements with a microwaves field. Key advantages include greater energy efficiency, faster sample heating, more uniform heating and improved material properties.



| | |
|-------------------|------------------------|
| Temperature Range | 1200°C (Max) |
| Heating System | Microwave by Magnetron |

Other Special Furnaces

- Hybrid-dual Mode Furnace (microwave & resistance heating).
- Special vacuum & gas atmosphere furnace.

Services

Calibration Services

Tempsens Calibration Center is an independent unit of Tempsens instruments (I) Pvt. Ltd, having laboratories at Udaipur, Vadodara & Bangalore. It is accredited for wide range of temperature calibration services.



C-0321
Udaipur
Lab

C-1155
Vadodara
Lab

C-1226
Bangalore
Lab

IN HOUSE CALIBRATION FACILITY

| Quality Measured/ Instruments | Temperature Range | Calibration & Measurement Capability |
|---|--|--|
| Contact Type RTD, Thermocouples, Thermometers | -196°C -80 to -38°C -38°C to 0°C >0°C to 140°C >140°C to 250°C >250°C to 650°C >650°C to 1200°C >1200°C to 1600°C | 0.05°C 0.03°C 0.03°C 0.04°C 0.04°C 0.12°C 1.30°C 2.60°C |
| Non Contact Type Pyrometer | 0°C to 250°C >250°C to 500°C >500°C to 1500°C >1500°C to 1700°C >1700°C to 2900°C | 1.5°C 2.4°C 2.5°C 3.2°C 4.0°C |



Tempsens is the only private sector Laboratory in the country with accredited Fixed Point Temperature calibration Facilities. The lab has highly stable calibration furnaces, measuring instruments and accurate master sensors traceable to National and International Standards.

ON SITE CALIBRATION FACILITY

| Quality Measured/ Instruments | Temperature Range | Calibration & Measurement Capability |
|---|---|--|
| Contact type RTD, Thermocouples, Thermometers | -25°C to 0°C >0°C to 140°C >140°C to 250°C >250°C to 650°C >650°C to 1200°C | 0.07°C 0.04°C 0.09°C 0.12°C 1.30°C |
| Non Contact Type Pyrometer | 0°C to 250°C >250°C to 500°C >500°C to 1200°C | 1.50°C 2.40°C 2.5°C |
| Multipoint Position Calibration of Chamber, Oven, Furnaces (Thermal Mapping(TUS)) | -80°C to 200°C >200°C to 1200°C | 2.8°C 4.1°C |

The calibration center functions as per ISO 17025 / NABL standards. Calibration of contact type sensors can be made in temperature range of -196°C to 1600°C and Calibration of non contact type sensors can be made in temperature range 0°C to 2900°C. Further the laboratory is accredited for onsite temperature calibration.

The lab offer both at Lab & On-Site Calibration of Furnace/Bath from -80°C to 1600°C and Black Body Calibration from 50°C to 1700°C.

Furnace/Chamber Calibration (TUS) with multiple sensors from -80°C to 1200°C is also in the scope of the lab.

PRIMARY TEMPERATURE CALIBRATION FACILITIES

| Quality Measured/ Instruments | Temperature Range | Calibration & Measurement Capability |
|--|---|--|
| Calibration of SPRT/PRTS/ thermocouple etc. | Triple Point of Water (0.01°C) Melting Point of Gallium (29.7646°C) Freezing Point of Tin (231.928°C) Freezing Point of Zinc (419.527°C) Freezing Point of Aluminum (660.323°C) | 0.0038°C 0.0065°C 0.0065°C 0.0071°C 0.0075°C |
| Calibration of Thermocouple at Secondary Fixed Point | Melting Point of Gold(1064.18 °C) Melting Point of Palladium(1554.8 °C) | 0.72°C 0.83°C |





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