

# Temperature Measuring Equipment

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**thermo-electra**

measurement and control technics



### **Thermo-Electra b.v.**

The company was established in 1962 and concentrated on temperature sensor manufacturing. It has grown into a young modern company with expertise for the application required.

Today we offer a complete range, from the temperature sensor, to cable and connector systems, including instrumentation.

All components needed for accuracy and speed are available.

For many applications sensor design can be discussed with the client, to satisfy his exact requirements.

Purpose built products exactly fitting the applications are one of our strengths and give a major benefit to the end users.

Thermo-Electra offers, together with more than 25 sales channels throughout the world, a reliable production with technical support and service.





## **Applications**

The choice of having the right type of sensor for the right application, is extremely important. The lifetime depends on many factors, such as environment and temperature.

To suit almost every application from  $-200^{\circ}\text{C}$  up to  $+2000^{\circ}\text{C}$  it is essential to use the right sensor and protection tube, in combination with the correct connection box type.

Our experience is available to solve many temperature measuring problems using a correct and reliable system.

## **Quality**

ISO 9002 is the standard to which we are qualified, and our products are made to international standards such as ITS 90, DIN, ANSI and BS.

Our products can be supplied with internationally recognized certificates for material and quality, and also for accuracy.

Our products are used by many clients, international oil companies, chemical factories, machine builders, food industries, shipbuilders and brick manufacturers, to list just a few.

We're not only exporting to European countries, but also to the Middle East, the Far East, Africa, Canada and the U.S.A.

## High velocity and pressure sensors

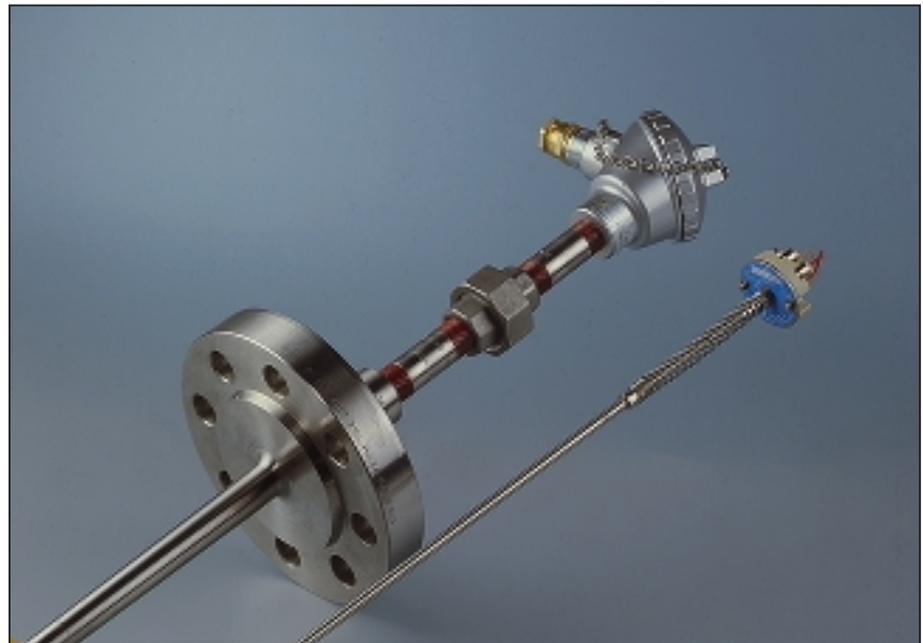
Chemical and petrochemical plants often have hazardous areas, where Cenelec approved assemblies are needed.

Thermocouple and resistance thermometer assemblies for these categories are available in EExe, EExi and EExd.

These assemblies can be supplied with a whole range of high pressure and high velocity resistant protection tubes or solid drilled and machined thermowells.

Our engineers are also able to calculate for applications where vibrations and high velocity can form problems, also coatings for chemical resistance are possible like teflon and halar.

To achieve abrasion resistance we can treat the thermowells with stellite and we can assist with the choice of material.

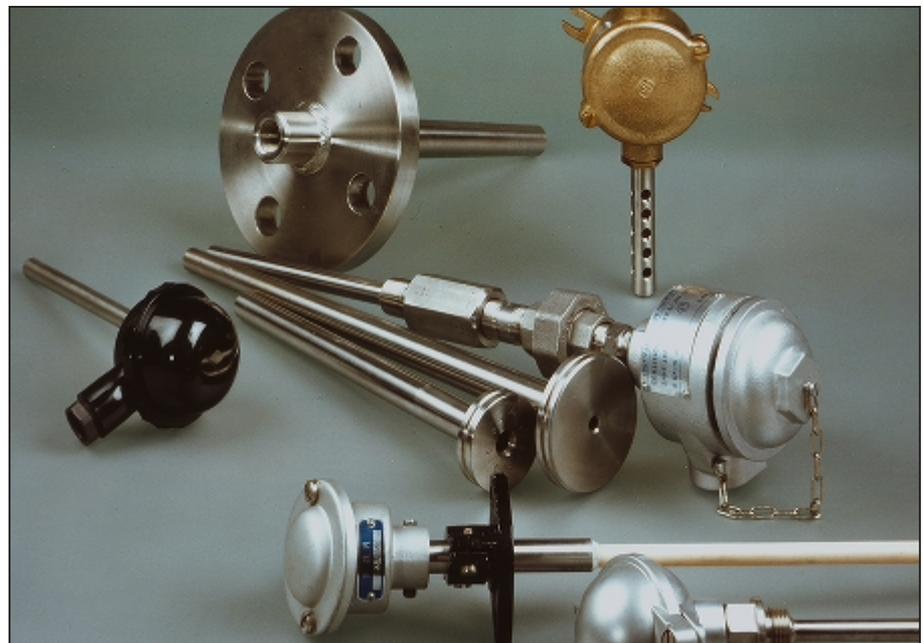


## Industrial sensors

Thermo-Electra has a complete line of sensors for all kinds of industrial use, such as ceramic tube insulated thermocouples for glass, metal and brick making.

Stainless steel protected sensors are most commonly used in laboratories, general machinery and food industry, and vibration resistant sensors for bearing measurements and diesel engines, these units can be supplied with a certificate from Lloyds, Rina, Buro Veritas etc.

Further a complete line of sensors with standard "DIN" constructions are made with an interchangeable insert, for easy replacement.



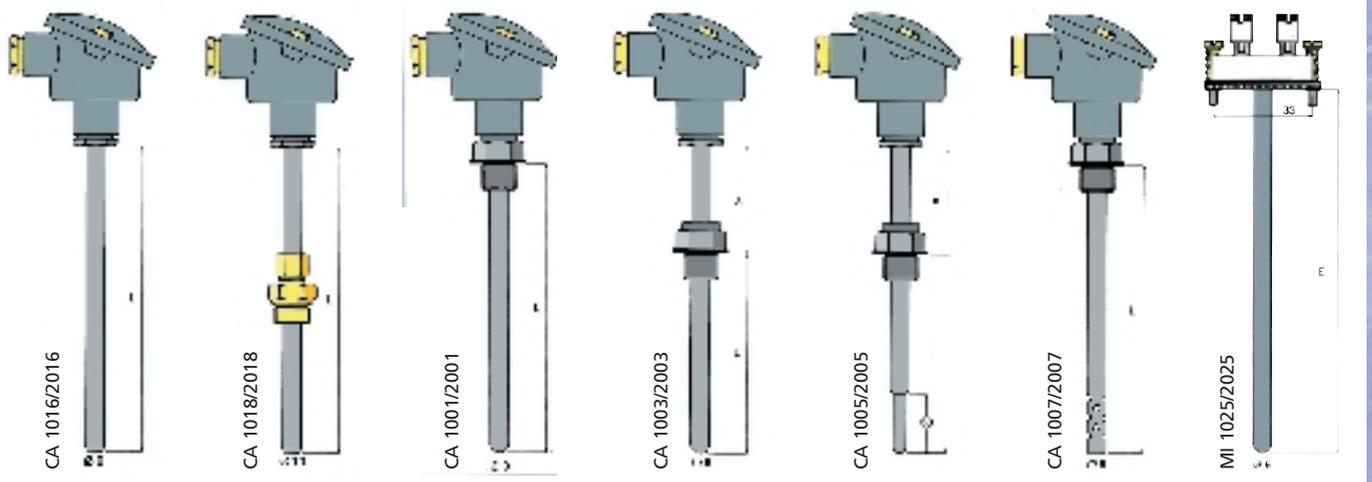
## Custom built sensors

Most temperature sensors made by Thermo-Electra are those made to suit customers demands.

These can be stationary types or handheld types in almost any configuration.

All custom built sensors are discussed directly with our experts or can be made according to clients own drawings.



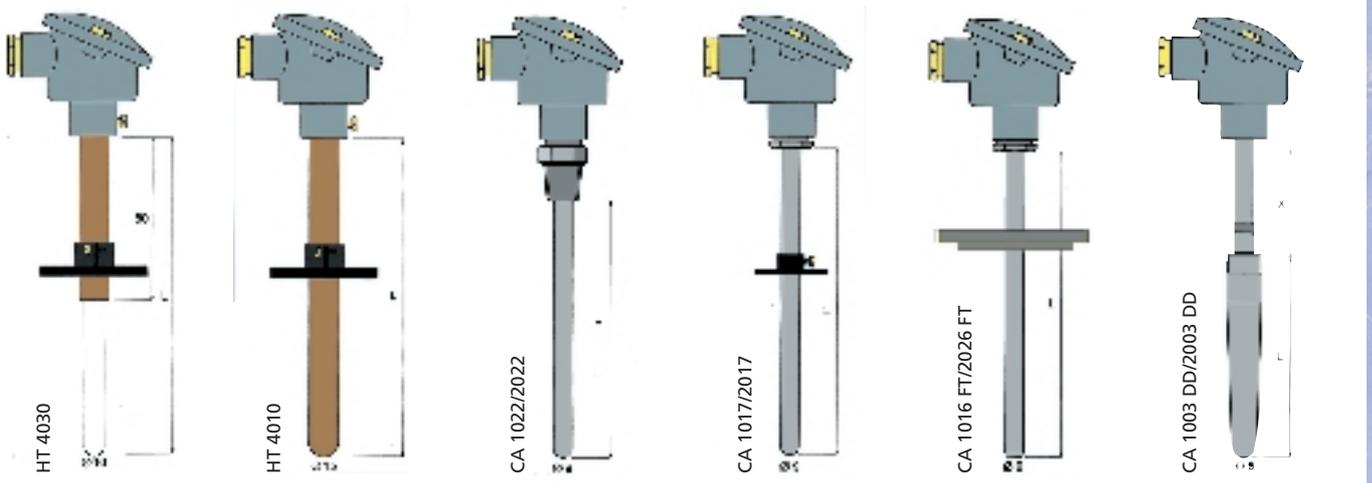


**Standard models**

Thermo-Electra offers a complete productline for temperature sensors. All common types are specified in our sensor catalogue.

For detailed information, or a datasheet of a particular model, you always can contact our factory/office or our local agent.

For a quick reference guidance we have made drawings of popular models and these are printed on this and other pages.

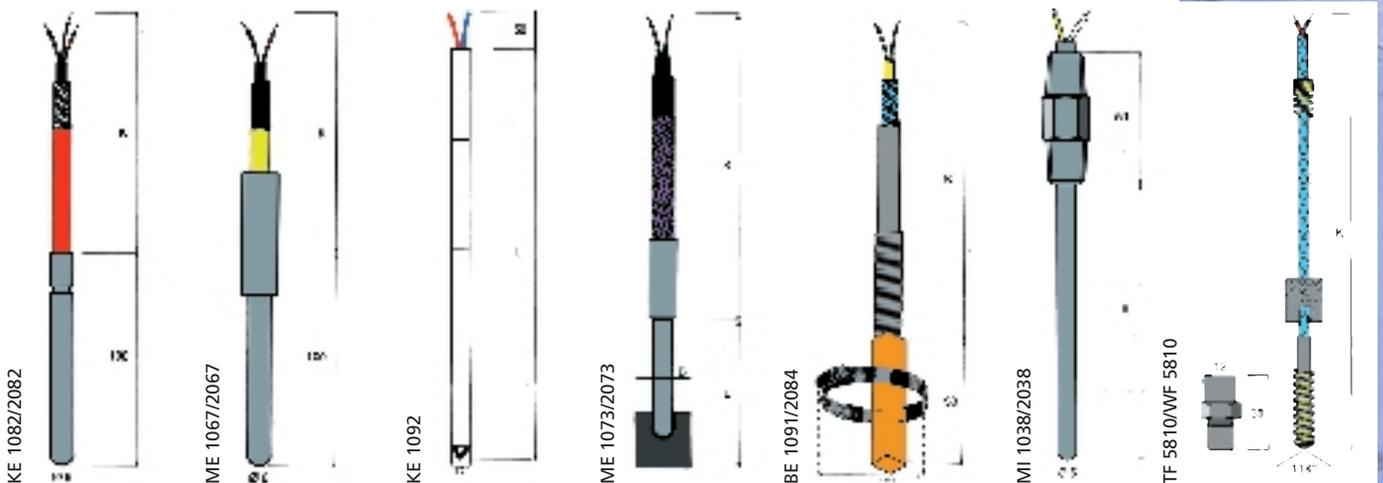


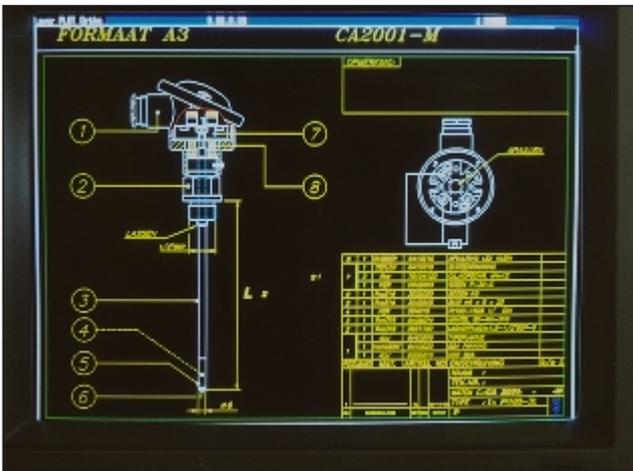
**Mineral insulated**

Sensors having internal mineral insulation offer a sealed rugged enclosure capable of withstanding not only very high temperatures, but also excessive vibration without adverse effect on the accuracy of its measurement.

The most commonly used thermocouple types are available in this construction, such as K,T,J,E,R,S,T and N, and are made with all kinds of electrical connection systems, such as plug, jack, or directly connected a sealed cable etc.

Due to its nature the sensors feature a flexible system, and are available as of 0,25 mm for thermocouple sensors and as of 1,0 mm for RTD (Pt100) sensors.

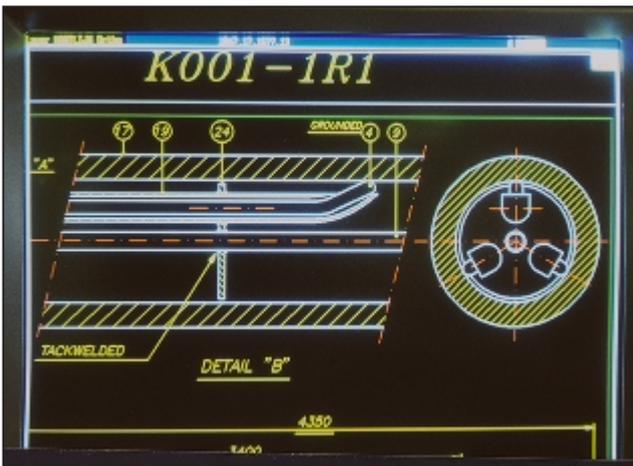




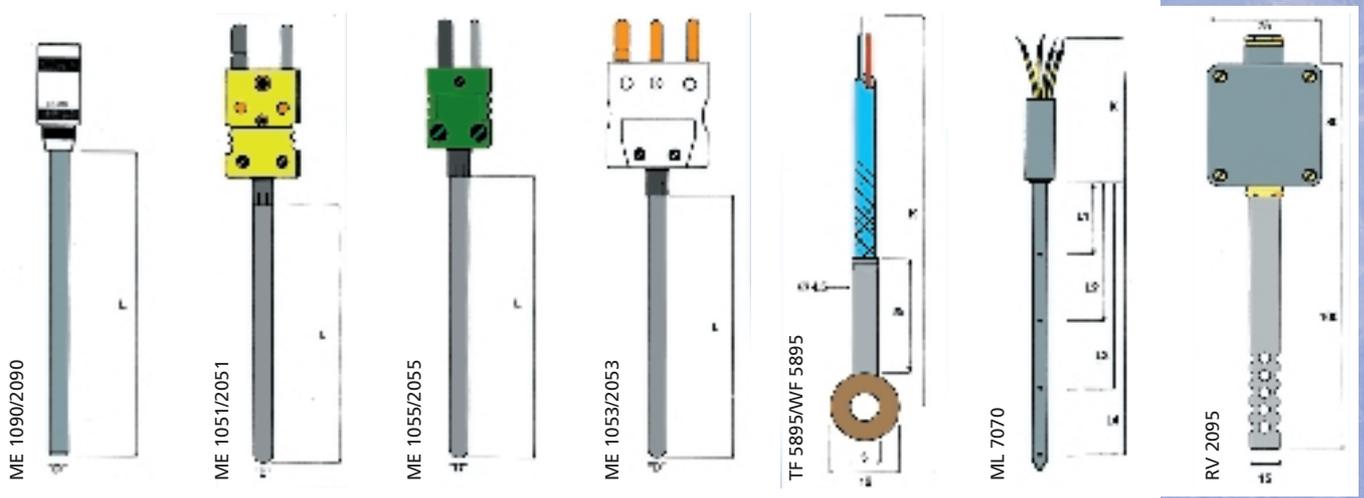
### Drawings

Our engineers are not only capable of making calculations for pressure and vibrations, but they can also make proposal drawings, with Autocad, for client approval. This step is to make sure that whatever the applications, the sensor shall be manufactured according to the demands, sizes and tolerances you require.

All components are listed and our unique product/ drawing code guarantees the supply of spare parts or complete sensors even after many years of usage.



Detailed assembly drawings can be produced showing exploded views which fully illustrate the construction of important items, including springloaded sensors and tubes of special manufacture.



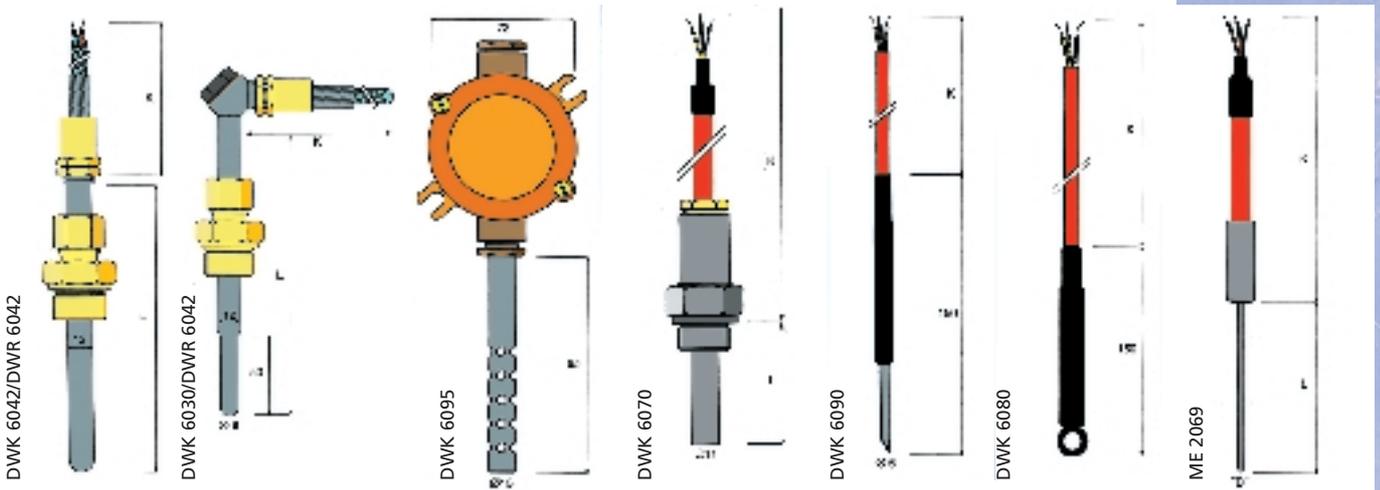
**Multipoint sensors**

For refinery, but also for laboratory use, we manufacture multipoint sensors to measure at several points over the length of the probe.

The smallest sensor we manufactured, had 12 measuring points and a diameter of only 3 mm.

The biggest sensor we manufactured, had 32 measuring points and a length of 38 meters.

For your application, please contact our office or local agent.



**Sensors for ships**

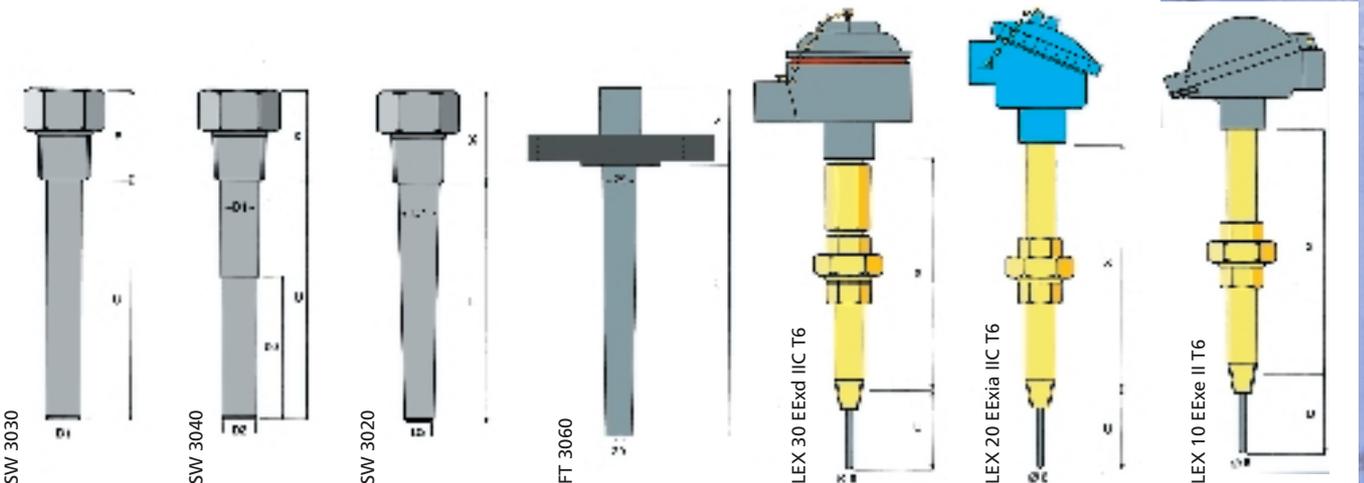
Above drawings show standard sensors in Pt100 or thermocouple, which can have an international approval such as Lloyds Register. They are used for engine bearings, exhaust gasses and turbo measurement, and also for cargo measurement.

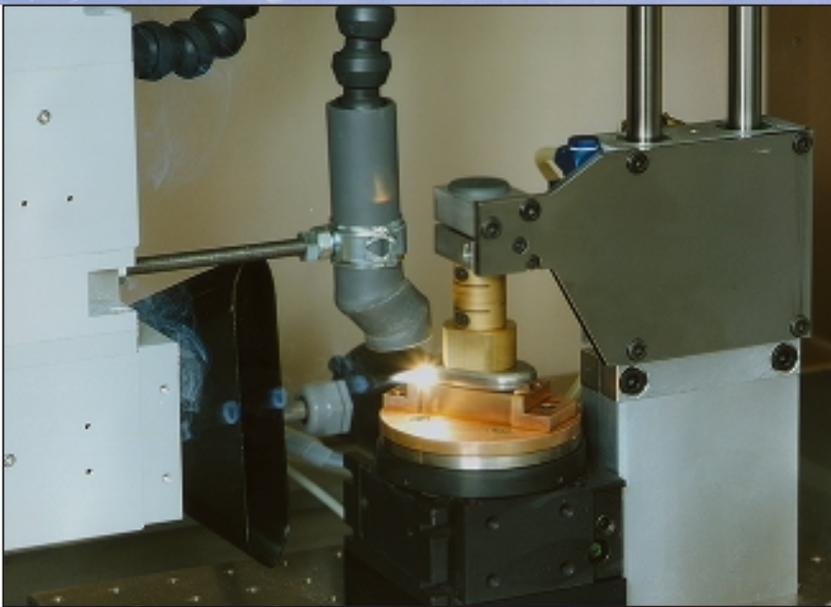
**Hazardous area sensors**

The drawings below show some standard thermowells and sensors, for use in explosion proof atmospheres.

They are available with Cenelec approval EExi, EExe and EExd and can be fitted with a headmounted certified or standard transmitter.

Connection heads are available in dye cast aluminium, plastic, cast iron and stainless steel.





## **Welding**

Thermocouples, Pt100 detectors and other platinum resistance detector assemblies need a high standard of welding, not only to prevent contamination, but also to ensure secure joints which satisfy all temperatures requirements and which are in line with the design parameters of the assembly.

Thermo-Electra has equipment for this standard of welding, such as a laser, welding device. Argon Arc, CO<sub>2</sub>, microplasma, TIG and ultrasonic are other inhouse possibilities for welding of protection tubes, flanges etc. Our welders are qualified and for all kinds of materials we can give a PQR and WPS.



## **Machining**

Based on the products, machinery is used such as CNC turning machines for thermowells, they can produce large quantities with fully identical shapes and close tolerances.

Thermowells can be made from various types of materials including stainless steel and corrosion resistant steel.

Drilled thermowells up to 1400 mm long are fabricated from barstock.

All kinds of tests including dye penetrant, X-ray testing, high pressure leakage testing etc., are possible "inhouse".



## **Protection tubes and thermowells**

Thermo-Electra produces the protection built-up tubes, or solid drilled and machined thermowells, depending on application with screw, flange or weld-in construction for easy mounting at site.

Depending on the velocity and pressure they are machined from one piece, or are fabricated.

Most commonly used are protection built-up from tube, and having a welded end for general applications, with low pressure and velocity.

Material certificates as per DIN 50049-3.1.A, -3.1.B or -3.1.C are possible and can be supplied with each thermowell.

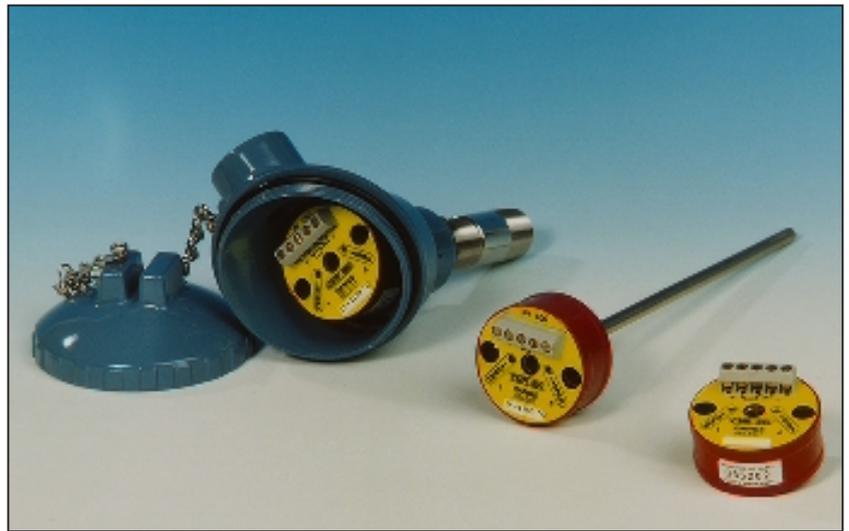
Restamping by Lloyds or Stoomwezen can be done for each unit at extra charge.

## Temperature transmitters

Headmounted types are made by Thermo-Electra in different styles. They are available for thermocouples and Pt100 sensors, with linearised output or signal linear output, and isolation option.

Furthermore some types can be calibrated at site, so you can always scale to other ranges. EExi certified transmitters according to Cenelec are also available.

All headmounted transmitters have a loop powered system, with 4-20 mA output.



## Transmitters and alarm units

For DIN rail mounting a full line of transmitters has been produced for thermocouple or Pt100 inputs. They are available with only analogue output, or only trip alarm functions with relay output, but also in combination, so you can have a 4-20 mA output with 1 or 2 individual adjustable setpoints.

Cenelec approved EExi transmitters are available.

Isolated versions are available and can have a 0-1 V, 0-10 V, 0-20 mA or 4-20 mA output.



## Probes

Our line of handheld probes for use in combination with portable thermometers are manufactured both as thermocouple and as a Pt100 sensor.

There are more than 50 models available and kept on stock.

The different models cover not only surface and immersion probes, but also magnetic probes, clamp-on probes and air probes.

A separate leaflet is available for our line of probes.





### **Thermocouple wire and cables**

Since 1962 Thermo-Electra has offered a full range of thermocouple wires and cables, manufactured under rigid quality controls.

The basic materials are available in several international standards and are available in the following thermocouple calibrations: K, T, J, E, N, U and L.

The wires are available as bare wire, or having a wire insulation, and overall jacket.

Thermocouple wires and cables are mainly supplied to companies who manufacture their own thermocouples, for use during production of materials, and by research and development departments of all kinds of industries and laboratories.

Thermo-Electra offers insulated wire with standard or close tolerance, and can be supplied in wire size from 0,02 mm up to 3 mm according to international standards, such as DIN-IEC, ANSI, BS and NF.

The insulation materials available are PVC, PE, Teflon, (PTFE, FEP, PFA), and silicon, but also high temperature asbestos free fibres, including glass fibre up to 650°C and ceramic fibre up to 1300°C.

### **Thermocouple extension wire cable**

Thermocouple extension wire has approximately the same characteristics as thermocouple wire, but its accuracy is guaranteed over a more limited range of temperatures.

Thermocouple extension wire can offer advantages in cost or mechanical properties when used for connections between thermocouple and instruments.

For base metal types of thermocouples, extension wire is of substantially the same composition as the corresponding thermocouple type.

For precious metal types, however, an entirely different alloy is formulated to match the noble metal characteristics over a specified temperature range. This is necessary due to the high cost of the precious metals, which would otherwise be necessary for the interconnection. The X in the IEC and ANSI code denotes extension grade wire.

Thermo-Electra offers several kinds of insulations and shielding types to deal with the requested application. The production is not only flexible for manufacturing standard type of cables, but also for manufacturing to customer demands.

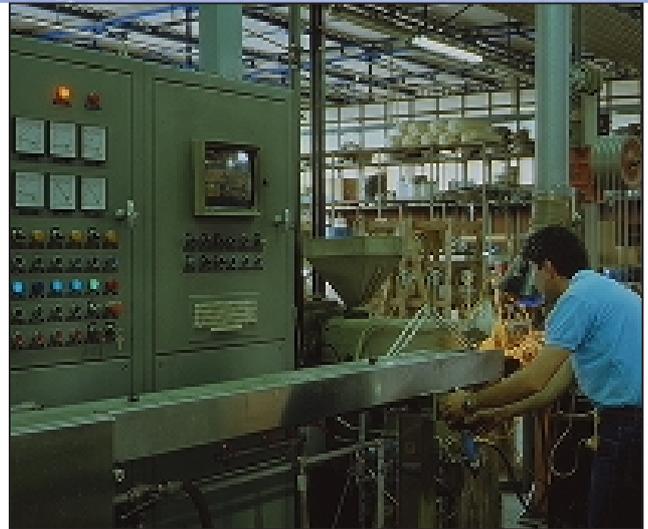
## Manufacturing

On this page you can see the production of wires and cables. The construction for thermocouple cables are standard up to 50 pairs, and instrument cables up to 36 triads.

All our cables are available with mechanical protection, such as:

- galvanized served steel wire armour SWA
- galvanized steel wire braid GSWB
- double overlapped galvanized steel tapes.

For "underground" applications we can offer a lead sheath feature, which protects the cable against corrosion and humidity.



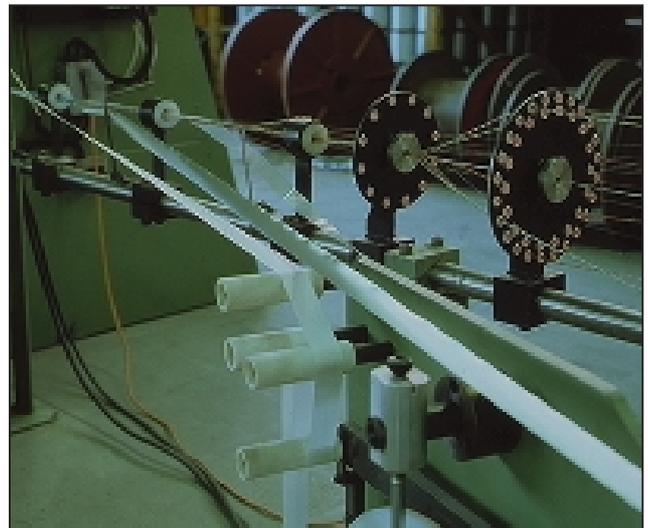
## Instrumentation cable

After being linearised and conditioned, all kinds of process measuring sensor systems need to be connected over a certain distance with normal copper cables to ensure correct signal transfer without interference.

In our program we have electrical screens, such as aluminium/polyester, copper braiding, or copper spiral.

Nowadays we even have this kind of cable including fibre optic consisting of a single cable enabling data transfer by light signals.

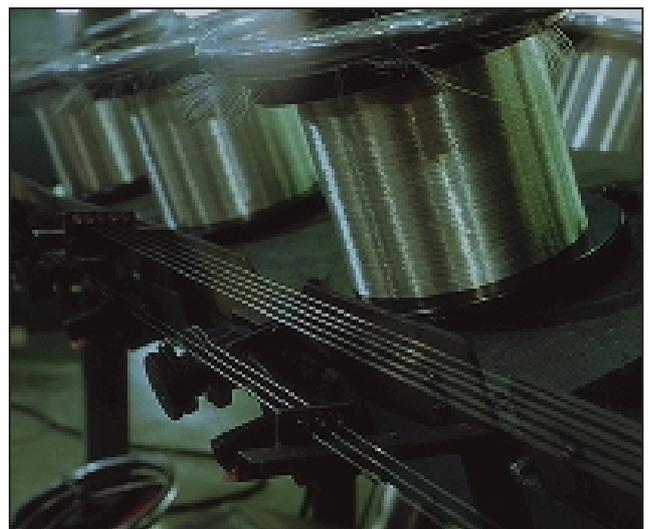
In short, we are the right partner for your cable needs.



## Insulations for thermocouple wire

Most common used insulations with temperature limit are listed below.

Material	Min. temp.	Max. temp.
PVC	- 50°C	+ 80°C (125°C)
Polyethylene	- 60°C	+ 70°C
Polypropelene	- 40°C	+ 105°C
Nylon	- 70°C	+ 120°C
Polyurethene	- 40°C	+ 80°C
Teflon *) FEP	- 80°C	+ 205°C
Teflon *) PTFE	- 80°C	+ 260°C
Tefzel *)	- 80°C	+ 155°C
Halar **)	- 60°C	+ 160°C
Silicon rubber	- 55°C	+ 230°C
Kapton *)	- 75°C	+ 200°C
Fibre glass	- 70°C	+ 650°C
Ceramic fibre	0°C	+1430°C



\*) Du Pont trademark

\*\*\*) Allied Chemical trademark



## Mineral insulated cable

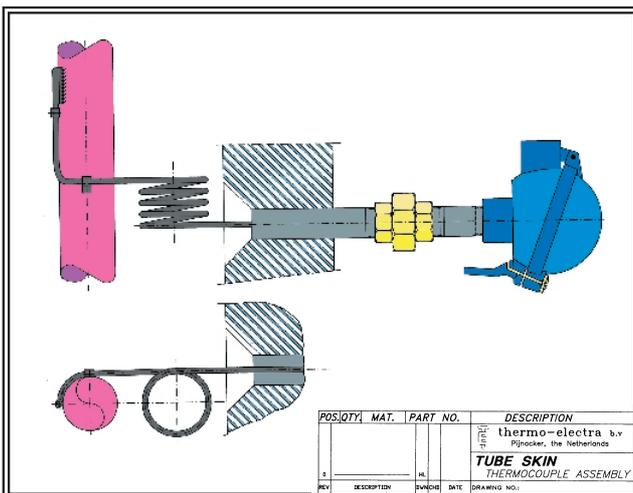
Because of its mineral insulation, thermocouples manufactured from this material provide a rugged enclosure withstanding very high temperatures and also excessive vibrations, with proven reliability, accuracy and sensitivity.

This type of mineral insulated cable is manufactured with all sorts of thermocouple calibrations and with nickel or copper conductors for use with platinum resistance temperature detectors.

The latest development in this cable is the type in which type N thermocouple forms the sensor and Nicrobell metal the sheath and is used in combination with fused aluminium oxide insulation. This type N combination gives a better longterm stability and reduces drift in calibration.

Due to the Nicrobell sheath material, which prevents contamination of thermocouple wires by manganese, the thermocouples are very suitable for use in oxidising and other industrial process atmospheres.

To offer the advantages of mineral insulated sensors Thermo-Electra stocks all popular sizes and calibrations in all types of sheath materials, meaning that we are able to serve your emergency and routine temperature sensing requirements.



## Tube skin thermocouples

Power stations, refineries and other industries are in need of a correct measuring system, measuring the temperature of tube walls.

These thermocouples are made with a weldable tip for easy welding at site to the pipe.

Different shapes and systems are available, including flame insulations with fibre fax to protect the sheath.

For special heater measurement applications Thermo-Electra offers sheathed mineral insulated cables with an outer diameter of 12,7 mm (1/2") with a sheath thickness of 3,18 mm (1/8") and wires size of 13 AWG \_ 10%. The hot junction can have a welding pad or V-type welding end.

The sheets are made from 310, 446 or Hastelloy.

Special materials are available on request.



## **Selection and use of thermocouple wire**

Thermocouple wire can be fabricated into accurate and dependable thermocouples by joining the thermoelements together at the sensing end.

Thermocouple wire must be used to extend the thermocouple to instruments where temperature limitations exceed that for use of TC extension wire.

The conditions of measurement determine the type of thermocouple wire and insulation to be used.

Temperature range, environment, protection, insulation requirements, response and service life should be considered.

Our specialists can advise for your particular application.



## **Stock**

Thermo-Electra stock the most commonly used thermocouple wires, thermocouple extension cables and instrument cables.

The length you require is available as a coil or on a cable drum.

The cable drum packing is available with sea-/airworthy, non returnable drum.

## **Special orders**

Multipair extension cable and instrument cable can be made to order with insulation to suit your application.

Please contact our sales department or agent for pricing and quantities.



## **Testing**

All cables are tested against the standards to which they are manufactured.

The picture shows a flame retardent test, which is performed into a vertical flame test chamber.

Tests carried out include: flame retardent test to BS 4066 part 1, IEC 332-1 and IEC 332-3 cat. C

Further tests are performed, such as smoke density to BS 6724 and corrosive acid test to BS 6424 part 1, and IEC 751-1 fire resistance to BS 66387 cat. C, W and Z.

## Connector systems

One of the most important parts of having a correct thermocouple measurement is using the right connector system.

Thermo-Electra offers miniature and standard connectors for all thermocouple calibrations.

They have a colour coded body according to the ASA or IEC thermocouple types, and are for use up to 205°C continuous and 260°C intermittent.

The hi-temp connectors are coloured red and can be used to 425°C continuous and 540°C intermittent, here the thermocouple type is engraved in the body.



## Portable thermometers

Thermo-Electra offers a full line of portable thermometers for readings in °F or °C.

The ranges available are from -200 up to +1300°C. Our models are made for a Pt100, or a thermocouple sensor.

Due to an unique microprocessor design an accuracy of 0,5°C is reached over the entire range.

The portable thermometers are also available as a "private label" instrument.

Please contact our sales department or the local agent for a competitive quotation.



## Platinum resistance temperature detectors

Thermo-Electra offers a range of partially supported wire wound Pt100 detectors, and there is also a complete line of film detectors available for low cost applications.

The detectors are available according to the highest international standards, with accuracy to IEC 751 table below.

Special selected accuracies such as 1/5 of class A are possible to obtain the best possible detector grade.

### DIN IEC 751 table for Pt100 detectors.

Class	Range	Tolerance
A	-200 - + 650°C	0,15 + 0,002 (t)
B	-200 - + 850°C	0,3 + 0,005 (t)



## Calibration

As well as being a temperature equipment manufacturer we are able to support our products with a traceable Calibration Certificate.

The cooling and heating equipment available, cover a range from -50 to +1150°C, and the certificates we make are traceable to International standards.

It is our dedication to excell in pyrometric measurement, for this reason Thermo-Electra operates a state-of-the art temperature measurement and calibration laboratory.



## IEC 584-2 tolerances

The table gives you information about the maximum allowable tolerances of thermocouples.

Thermocouples are divided in 3 accuracy classes: 1, 2 and 3.

For the tolerance two values are given. One is a fixed, the other is a formula.

The largest of the two should be taken as real tolerance.

Type	Class	Temperature range	Fixed value °C	Tolerance to temp. t (°C)
T	1	- 40°C to + 350°C	± 0,5	± 0,004 · t
	2	- 40°C to + 350°C	± 1	± 0,0075· t
	3	- 200°C to + 40°C	± 1	± 0,015· t
E	1	- 40°C to + 800°C	± 1,5	± 0,004 · t
	2	- 40°C to + 900°C	± 2,5	± 0,0075· t
	3	- 200°C to + 40°C	± 2,5	± 0,015· t
J	1	- 40°C to + 750°C	± 1,5	± 0,004· t
	2	- 40°C to + 750°C	± 2,5	± 0,0075· t
	3	-	--	--
K and N	1	- 40°C to + 1000°C	± 1,5	± 0,004· t
	2	- 40°C to + 1200°C	± 2,5	± 0,0075· t
	3	- 200°C to + 40°C	± 2,5	± 0,015· t
R and S	1	0°C to + 1600°C	± 1,0	± [1+0,003·(t-1100)]°C
	2	0°C to + 1600°C	± 1,5	± 0,0025·t
	3	-	-	-
B	1	-	--	--
	2	+ 600°C to + 1700°C	± 1,5	± 0,0025·t
	3	+ 600°C to + 1700°C	± 4	± 0,005·t



Thermocouple	Conductors	International IEC584-3	American ANSI MC 96.1	German DIN 43710-4
T	Copper / constantan	Type TX		UX TX
J	Iron / constantan	Type JX		LX JX
R/S	Copper / copper nickel (compensating)	Type RC/SC		
N	Nickel chromium silicon / nickel silicon	Type NX		
K	Nickel chromium / nickel aluminium	Type KX		
K	KCB- Copper / constantan (compensating)	Type KCA/KCB		
	KCA- Iron / constantan (compensating)			
E	Nickel chromium / constantan	Type EX		

## DIN 43710 tolerances

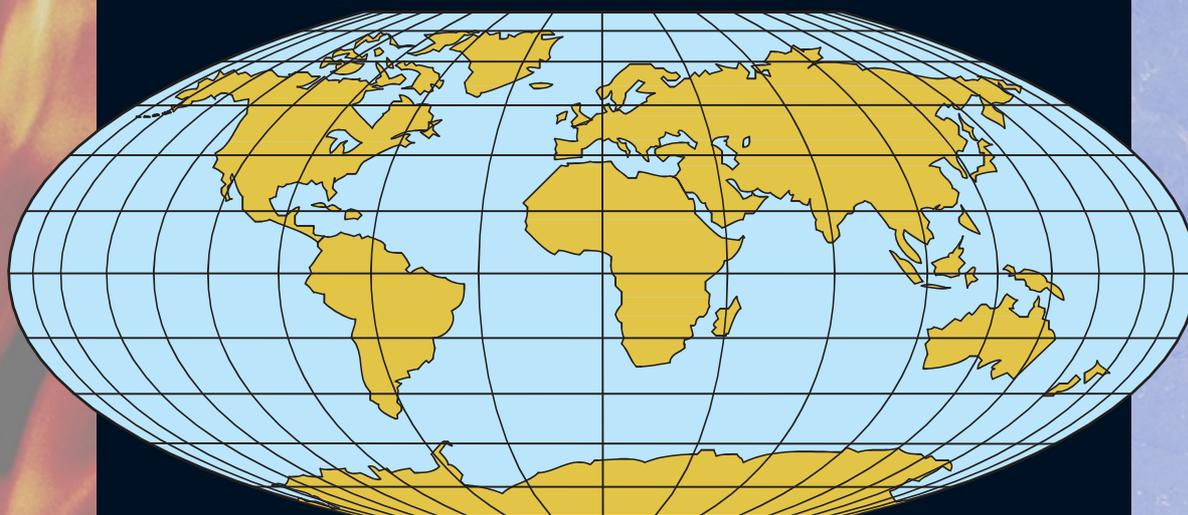
Type	Temperature range	Tolerance
U (Cu-CuNi)	50°C to + 400°C 400°C to + 600°C	± 3°C ± 0,75%
L (Fe-CuNi)	50°C to + 400°C 400°C to + 900°C	± 3°C ± 0,75%

← Colour codes for thermocouple extension cables (also available as sticker)



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