

Storage Tank Measurement



Temperature Gauging Systems



Enraf



"The Tank Gauging People"

Accurate temperature gauging pays back very quickly!

Enraf introduced a line of very rigid and accurate temperature gauging devices.

- The Multiple Thermo sensor Thermometer
- The Spot temperature thermometers **)

Temperature changes in liquid alter level, volume and density. These potential changes make temperature gauging very important. For example each 1 °C (1.8 °F) uncertainty causes a deviation of more than 0.1 %. For a storage tank holding 50,000 m³ (300,00 bbl) this results in an uncertainty of 50 m³ (300 bbl).

Enraf temperature measurement is the result of almost 40 years of innovation.

Continuous development means:

- Innovative temperature measurement technology
- Maintenance-free temperature gauges
- Solutions for any application

Characteristics MTT

Measuring range :
up to 40,000 mm (131 ft)

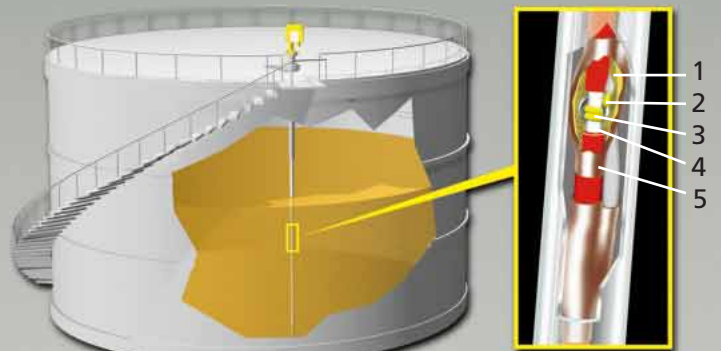
Instrument accuracy :
Temperature < 0.1 °C (0.04 °F) *)

Housing material :
Nylon, Rilsan® # 11
Stainless Steel AISI 316 L, corrugated tube

Operating temperature :
Standard:
range -55 °C to +135 °C (-65 °F to +275 °F)
High temperature:
range -55 °C to +200 °C (-65 °F to +390 °F)
Low temperature:
range -200 °C to +70 °C (-330 °F to +160 °F)

Mounting :
In 2", 150 lb or other
From tank roof or side mounted

*) under reference conditions
**) through Enraf from third party



- 1 compound
- 2 copper (Cu)
- 3 solder connection
- 4 constantan (CuNi)
- 5 shrink sleeve

Reliable sealed temperature detectors

The answer to complete liquid temperature information

Enraf temperature measuring systems make use of proven technology and offer the highly efficient temperature parameter for total inventory control. Our Multiple Thermo Sensor Thermometer (MTT) provides:

- Accurate product temperature
- Accurate vapor temperature
- Temperature profiles

In combination with SmartRadar and Servo level gauges, and as part of Hydrostatic gauging systems, we provide you with accurate on-line information including:

- Liquid levels
- Water/product interface level
- Volume
- Mass
- Alarms

All measured and calculated data and parameters are available to higher level systems (DCS, SCADA, MIS, etc.) by means of an extended number of communication protocols.

Outstanding accuracy

The inventive use of thermosensors, in combination with a high class reference resistance, provides outstanding accurate measurements. Temperature measurements ensure that temperature differences can be detected to within 0.1 °C (0.18 °F).

Weights & Measures

Enraf developed its temperature gauging systems in full compliance with international standards. MTT has received full certification from Custody & Excise and official Weights & Measures authorities. It meets all international requirements for custody transfer.

Unique safety features

Enraf MTTs are approved and meet all international safety standards for use in hazardous areas. Among its many safety features is a unique lightning protection system to avoid damage during thunderstorms.



Temperature at any level

Features	Your Benefits !
Sturdy construction	<i>Efficient, and reliable</i>
Electronic element selector and digital conversion	<i>Very vast and reliable information</i>
No moving parts	<i>No maintenance costs</i>
Versatile mounting configuration	<i>A solution for every mounting situation</i>
Nylon or Stainless steel	<i>Preserves life of instrument</i>
Two wire interface to level gauge	<i>Minimal cabling and wiring</i>
Compact and lightweight	<i>Easy to install</i>
Galvanic lightning protection	<i>Safe and reliable in all weather conditions</i>
Sixteen measuring points	<i>Average temperature, profiling and vapor temperature</i>
Platinum RTD	<i>Accurate differential measurement</i>



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INDUSTRIAL TEMPERATURE MEASUREMENT?

Temperature measurement is particularly important for facilities that store liquids and want stock quantification either by volume or by mass. Automatic temperature gauging is safe and labor cost saving.

How to measure temperature?

There are several systems for temperature measurement available.

- Spot temperature measurement

Spot or single point, temperature measurement is commonly done with an RTD probe of a defined insertion length mounted from the tank wall. A spot element is, in many cases, able to do the job. The position for a single point temperature probe is very important for registering the true average product temperature in a tank.

- Average temperature measurement *)

For the volume calculation, it is necessary to know the average temperature of the product's total volume.

Because most stored liquids do not have homogenous temperatures, a more sophisticated measuring system is required.

For example, products loaded into the tank in different batches can have a difference in temperature.

With the new Multiple Thermosensor Thermometers (MTT), Enraf supplies a robust and reliable instrument. It makes use of the most robust thermocouples available.

A unique differential measuring technique

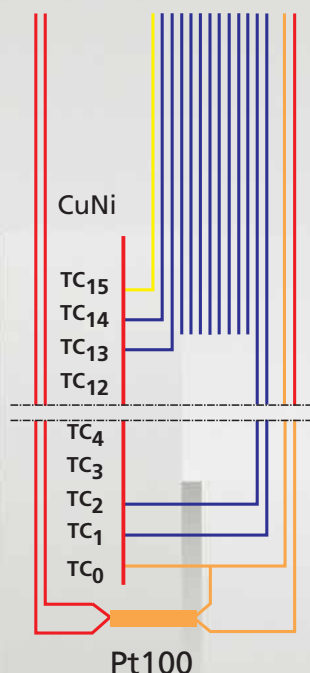
The accuracy of the MTT is assured by a unique differential measuring technique. Instead of measuring the absolute temperature, Enraf's MTT measures the difference compared with a precision reference platinum RTD located near the bottom of the assembly. As a result we achieve a measuring accuracy better than $\pm 0.1^\circ\text{C}$ (0.18°F).

Each MTT incorporates 16 equally spaced temperature detectors which, combined with the multiple temperature interface and selector, provide a true average temperature. As a unique feature, determination of temperature profiles is possible! The MTT also provides the temperature of the vapor area which can be useful in case of gas storage.

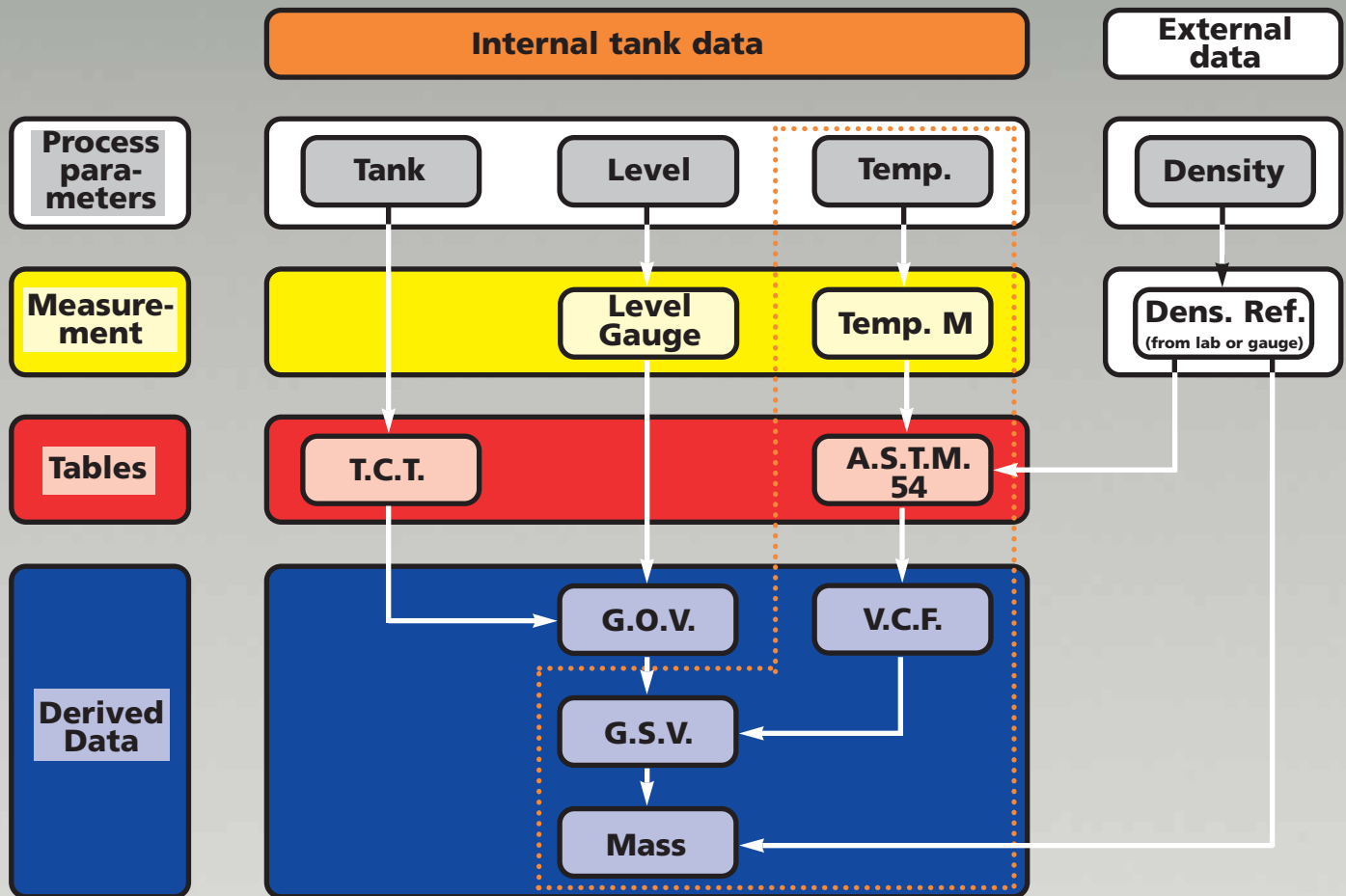
Sturdy nylon (Polyamide) or corrugated stainless steel protection tubes with special top and bottom fittings seal the temperature detectors completely from the atmosphere.

Advanced techniques continuously monitor and/or correct for the influence of terminal and resistance changes, thermal voltages and temperature drift.

A unique measuring principle



Temperature an important parameter



Level based Stock Inventory

It is important to understand how the **Gross Observed Volume** of the product is determined in a level based tank gauging system, although temperature information is also an important parameter in Enraf's hydrostatic tank gauging systems.

Starting with level, the **Gross Observed Volume** of the product is determined by utilizing **Tank Calibration Tables** which relate liquid level to liquid volume.

Combining the Gross Observed Volumetric quantity with the liquid temperature measurement, a **Gross Standard Volume** can be calculated. The Gross Standard Volume is the volume at a reference temperature.

From the Gross Standard Volume the **Mass** can be calculated by introducing the Reference Density. In general, Volume multiplied by density equals its mass.

Installation

Mechanical

A two inch entry in the tank is sufficient for the installation. The MTT can be installed either suspended in the tank secured by means of an anchor weight or in a two inch thermowell. For pressurised applications, a non-slotted thermowell is recommended. For caverns, we supply special MTTs adapted to your application.

Electrical

An average temperature gauging loop consists of an MTT connected to a Multi-element Interface Thermosensor converter (MIT) in most cases mounted in the MTT. The MIT is in turn connected via one twisted pair with a temperature processing board in a Enraf Servo tank gauge, a SmartRadar level gauge or a Field Display & Interface (FDI).

*) For installation already equipped with Multiple Resistance Thermometers (MRT) we will be glad to advise for a change to MTT.



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Your guarantee of accuracy and safety at your plant

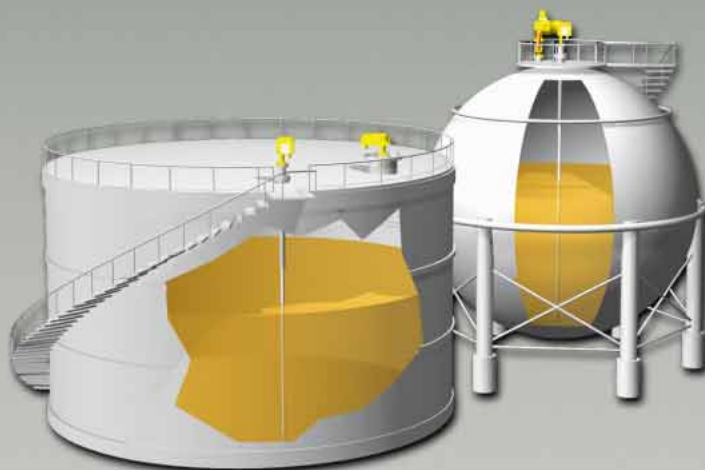
Enraf's temperature measuring systems are approved and fully certified by numerous organizations throughout the world, including Weight & Measures, Custody & Excise and Meteorological institutes. Enraf instruments also comply with regulations set by the worlds leading storage industry organizations.

Accreditation include:

CENELEC Europe
UL/FM USA
CSA Canada
BASEEFA United Kingdom
PTB Germany
SIM France
NMI the Netherlands
SEV Switzerland
BEV/TÜV Austria
KDB/Prochem Poland
SAA Australia
SAA Canada
SIRIM Malaysia
GOS Standard Russia
NEPSI China
CCE India
MIGAS Indonesia

OIML Organization International de Métrologie
Légale
API American Petroleum Institute
CEN Comité Européen de Normalisation
ISO International Standardization Organization
..... and many others

Enraf is an ISO 9001 certified company
Enraf products are Y2K compliant as is Enraf as a
supplier.



For a wide range of tanks an liquids

In use by companies all over the world

Enraf temperature gauging systems can be found on all types of bulk storage tanks, storing a huge variety of liquids. They are the first choice of many of the world's top companies, including:

Petrochemical industries
Refineries
Independent terminals
Marketing terminals
Pipeline terminals
Gas terminals
Chemical industries
Food and beverage industries
Aviation fuel supply companies
Utilities
Strategic oil & gas storage organizations

For more detailed Information

If you would like more information on the Enraf temperature gauging systems or any product from the Enraf range (a selection is shown opposite) please contact your nearest Enraf office. Full contact details are given on the overleaf.

The following Enraf Product Sheets are available on temperature gauging:

- Multiple Thermo sensor Thermometers (MTT)
- Spot temperature sensors



The complete system

Entis Pro

Enraf's new age Windows-NT based inventory systems provide superb data for effective tank farm management. With their latest technology they have gained official recognition from official measurement authorities.

Communication Interface Units

Enraf Communication Interface Unit CIU Plus and CIU Prime are the most powerful tank gauging data collecting, processing and communication units.

SmartRadar

A unique tank gauge with the newest radar technology is the most advanced development in non-intrusive level measurement. SmartRadar gives optimal measuring performance in any application.

Servo Gauges

An intelligent tank gauge for liquid storage tanks. The first automatic servo gauge to receive certification from leading weights & measures authorities. It is very compact and needs only a small mounting flange.

Hydrostatic Tank Gauging

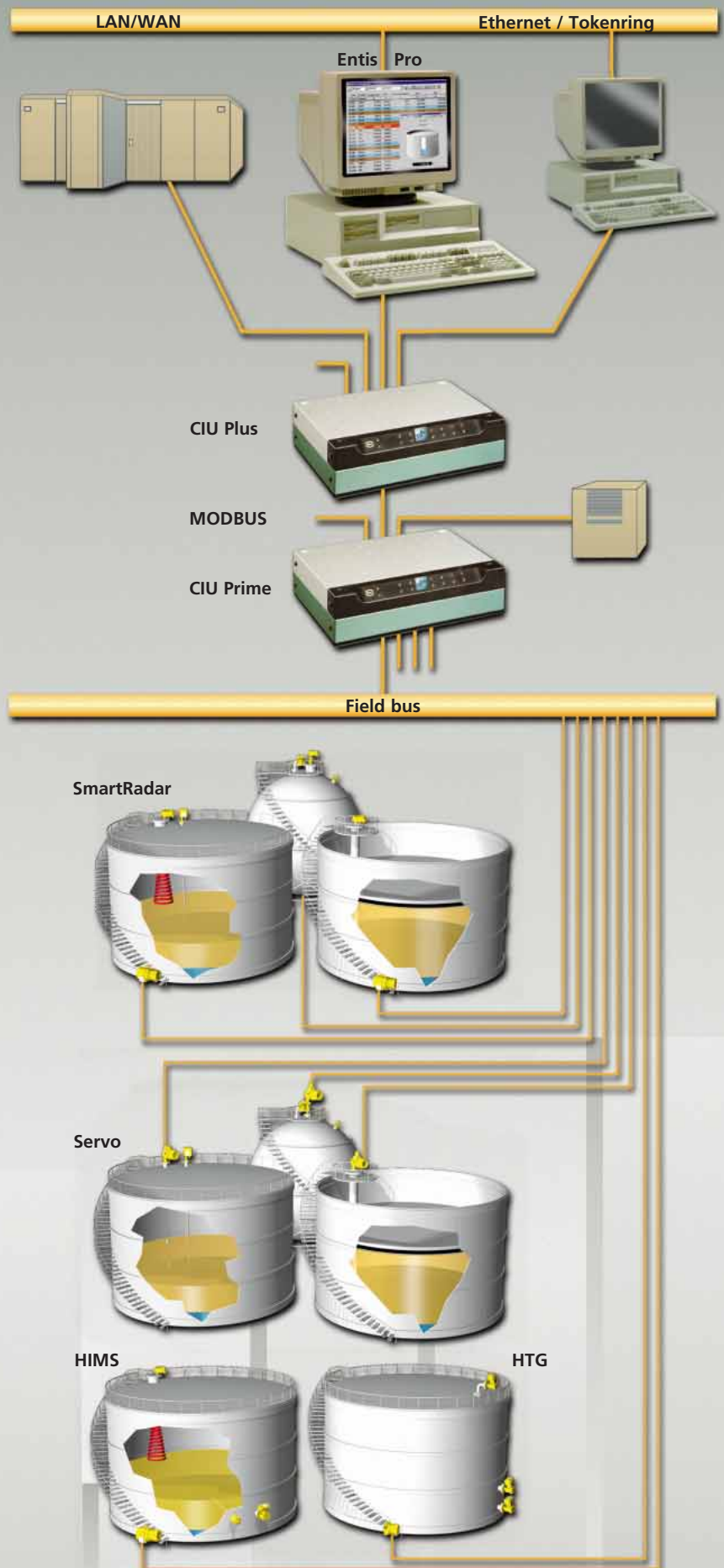
The Enraf HTG system is an example of trend-setting technology at its best, using high accuracy digital pressure transmitters. The best solution for direct mass measurement.

Hybrid Inventory Management Systems

The Hybrid Inventory Management System (HIMS) brings together the best of servo tank gauging or SmartRadar with digital pressure transmitter to provide maximum accuracy in level, mass, density and volume.

Other instruments in the Enraf range

- **WaterScout** for product/water interface measurement
- **Portable Enraf Terminal (PET)** for easy commissioning and field configuration
- **Indicators** – for data display in the field or any location
- **Securiterre** – for any grounding application as road trucks, trains, etc.
- **AlarmScout** – to prevent overfill and spills. It detects liquids, slurries, foam as well as interfaces (e.g. oil/water).





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