

# TANK GAUGING THE SAAB WAY



CUSTODY TRANSFER ACCURACY TANK GAUGING SYSTEMS.  
FROM THE WORLD LEADER IN RADAR TECHNOLOGY.

# MORE THAN 40 000 SAAB TANKRADAR UNITS ARE IN SUCCESSFUL OPERATION WORLDWIDE

*Backed by over 20 years of aerospace and industrial experience, today the Saab TankRadar L/2 system is the preferred choice of tank gauging for the petroleum industry, worldwide. Its superior reliability, certified accuracy and maintenance-free operation will provide safe and cost-saving inventory management far into the next millennium.*

- Problem-free installation**
- Compact and lightweight design
  - Installs on existing manways
  - No need to empty a tank before installation
  - Existing field cabling can be used
  - Self-instructing start-up

- Custody transfer accuracy**
- Measurement accuracy  $\pm 0.5$  mm ( $\pm 1/32$ " )
  - Fully digital signal processing and reference
  - FMCW radar system
  - Temperature-controlled electronics
  - Patented Low Loss Mode maintains accuracy in still pipes

- Superior reliability, maintenance-free**
- Non-contact measurement
  - No moving parts
  - Heavy-duty antennas with no horizontal surfaces
  - Digital, continuous re-calibration
  - Polarized radar signals eliminate false echoes
  - 65 years MTBF (Mean Time Between Failure)

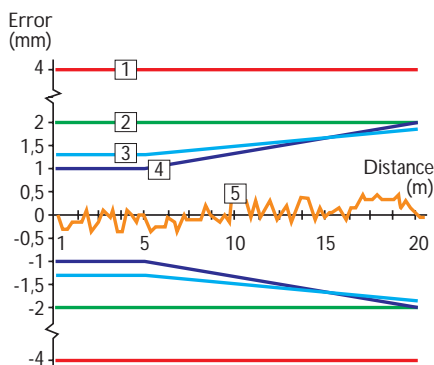
- Complete tank gauging**
- Integrated measurement of level, temperature, pressure and water interface
  - Operator and configuration software available in stand-alone and network versions
  - Inventory and custody transfer software packages available for net volume and mass calculations, etc.
  - Protocols available for interfacing to virtually any type of computer host



**" WE WANTED CUSTODY  
TRANSFER ACCURACY.  
SO WE DIDN'T NEED TO  
THINK TWICE. "**



*DIETER GERSTENKORN is Technical Manager of MUT (Magdeburger Umschlag und Tanklager KB), one of Germany's most modern tank terminals that turns over more than 6,500 cubic meters of fuel and diesel oil per day. The oil products from major oil companies like BP and Shell arrive by tanker barge and train. Before onward transport by tanker truck the oil is pumped over one of the terminal's 10 cisterns, which have a total capacity of 65,000 cubic meters.*



The Saab TRL/2 accuracy compared with the custody transfer requirements in some important countries (accuracy within a 0-20 m range).

1. SIM, France: Field accuracy
2. PTB, Germany: Field accuracy
3. NMI, Netherlands: Lab transfer accuracy
4. OIML: Lab transfer accuracy
5. Saab TankRadar L/2 RTG 2930

### Highest measurement accuracy

At MUT, 20–30 custody transfer operations are made on a daily basis. The high turnover speed in such an operation demands rational and automated handling where the measuring equipment must ensure the highest possible accuracy combined with minimal service requirements.

To approve custody transfer, PTB (the German regulatory authority) require that the oil level in the tanks can be measured to an accu-

acy better than  $\pm 2$  mm. MUT selected radar-based tank gauging equipment from Saab Tank Control as its obvious choice. Since 1993, 10 Saab TankRadar L/2 units have been installed.



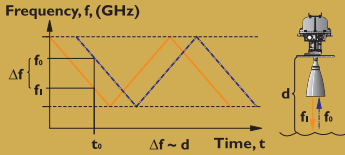
MUT is located more than 200 km inland, but using the Elbe river deliveries can be made by tanker barges.

### "No problem"

The authorities check the accuracy of measuring equipment every other year. In addition MUT carry out an internal inspection every quarter. No corrections have been required.

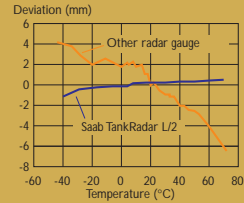
"Zero-tolerance is no problem with Saab" says Herr Gerstenkorn.

# " STATE OF THE ART "



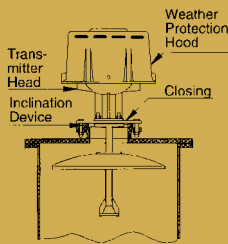
## Lightning strike protection

The Saab TRL/2 system can withstand substantial influence from lightning strikes. Both power supply and signal handling are galvanically insulated from the field cables. Filters, varistors and fuses protect the electronics from overloading.



## FMCW technology

Saab have developed FMCW (Frequency Modulated Continuous Wave) technology for level measurement applications to ensure highest measurement accuracy, regardless of the height of the tank. The radar signal frequency varies the whole time in linear sweeps. The frequency difference that occurs between the radar signal and the radar echo is proportional to the distance to the surface of the liquid.



## Modular design

All the electronics in the Saab TRL/2 are mounted in the transmitter head so they are easy to replace. There are no electronics in the tank atmosphere, only the robust antenna itself.

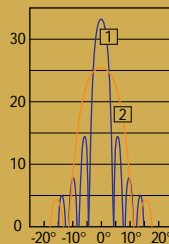


Parabolic antenna still working after use in heavily contaminating double blown bitumen with temperatures over 220 °C (430 °F).

## Optimal frequency

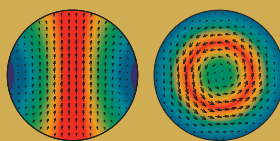
The lower the radar frequency the wider the radar beam, and the greater the measurement interference. The higher the radar frequency the greater the sensitivity for condensation and coatings on the antenna. Saab uses the 10 GHz frequency to provide an optimal balance between beam angle and contamination sensitivity.

1. Diameter 450 mm antenna
2. Diameter 200 mm antenna



## Antenna gain

The larger the diameter of the antenna, the stronger the radar signal. Saab's 450 mm parabolic antenna sends a concentrated radar signal which gives a strong effective echo and dependable measurement. Even in liquids with low reflective capacity, such as aromatic hydrocarbons during agitation.



Left: Still pipe seen from above, with the normal mode of a circular waveguide.

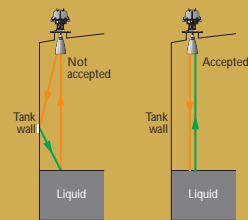
Right: Saab's patented Low Loss Mode concentrates the microwaves to the center of the pipe, away from rust and deposits.

## Low Loss Mode

The interiors of existing still pipes are often coated with rust and deposits that degrade the radar signal. Saab's patented solution, Low Loss Mode, concentrates the radar signal to the center of the still pipe for maximum accuracy.

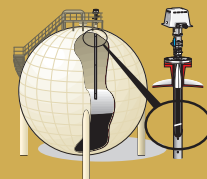
## Temperature deviation

In some other types of gauges, the ambient temperature can affect measurement accuracy and decrease the lifetime of the electronics. But the Saab TRL/2 system, with continuous digital calibration and a temperature-controlled transmitter head, is designed to provide precise and problem-free operation regardless of climate.



## Microwave polarization

On many other types of radar tank gauges, echoes from the tank wall degrades measurement accuracy, so they have to be located far away from the tank walls. The Saab solution is to polarize the radar signals to ensure that the tank wall echo is ignored by the sensor.

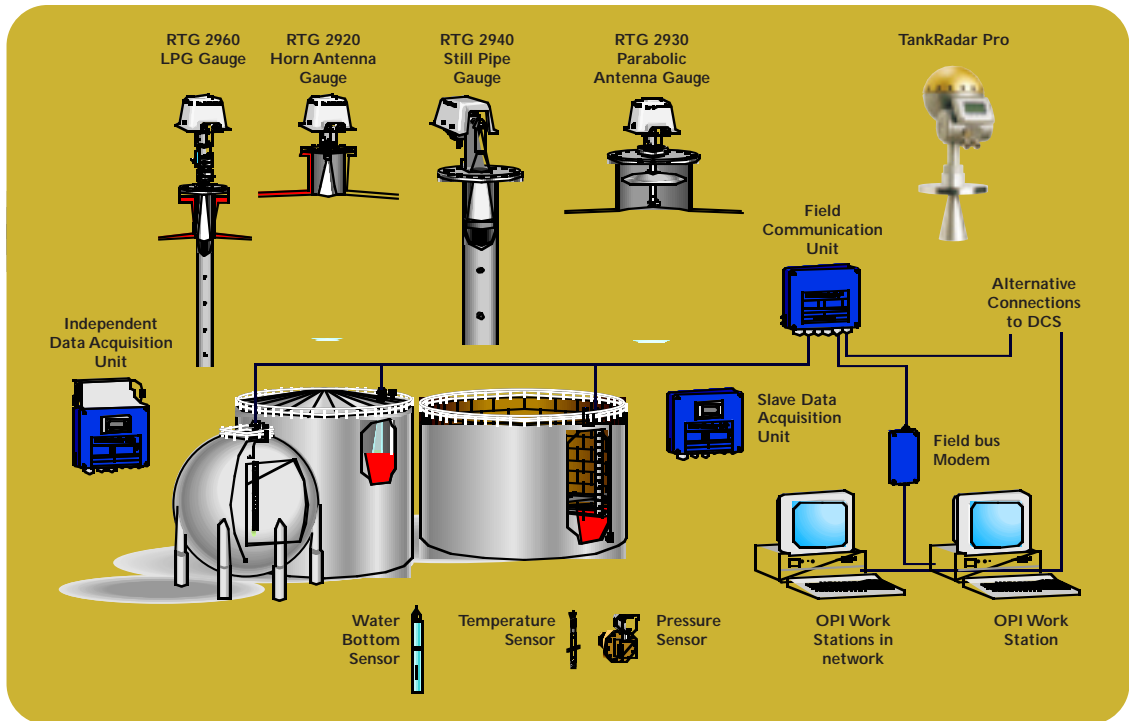


## Reference pin

In pressurized tanks, such as LPG tanks, the accuracy of the gauge cannot be verified by hand dipping. Saab's patented solution is to install a reference pin at a fixed point in the still pipe. The gauge value can then be verified by comparison with the reference pin, also when the tank is closed.

# CONSIDER TANK GAUGING AS A SYSTEM SCIENCE

SAAB'S TANK GAUGING means a total tank management system. It provides the ultimate tool for inventory and custody transfer tank gauging as well as loss control and operational use. It includes level, temperature, pressure, mass, volume and water interface detection. The Saab solution integrates easily into your existing network, DCS or host computer system, giving you all the information you need, wherever you want it.



An overview of the Saab TankRadar L/2 System.



### TRL/2 Multi Spot or Average Thermometer

Designed for accurate temperature measurement in bulk storage liquids. The top-mounted sensor provides an accurate tank temperature profile and average temperature.

### TRL/2 Water Bottom Sensor

Provides on-line net inventory through continuous measurement of the water/oil interface. Must be integrated with the temperature sensor. Heavy-duty design without moving parts for maximum reliability.



### TRL/2 Pressure Transmitter

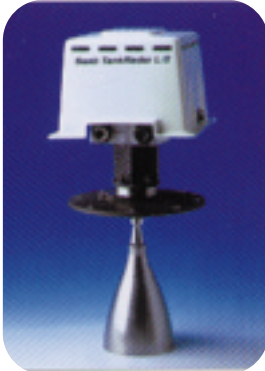
Pressure sensor with digital HART or analogue output. Provides data for density, mass and hybrid calculations. Installation is made in liquid and/or vapor space.



### TRL/2 Operator Interface Software

OPI is a PC-based software package for the TankRadar L/2 system. OPI makes it easy to handle level, temperature and pressure displays and to utilize all the features of the tank inventory management system. Functions include gross and net volume calculations according to API (American Petroleum Institute), custody transfer and inventory reports, graphics, event logging, configuration and service guidance, etc.

# FIXED ROOF, FLOATING ROOF OR PRESSURIZED TANKS



**Horn antenna gauge,  
RTG 2920**  
For installation in existing openings on fixed-roof tanks. The RTG 2920 can be used for most liquids, except asphalt and similar products where we recommend the RTG 2930 parabolic antenna gauge.



**Parabolic antenna gauge,  
RTG 2930**  
For mounting on all tanks with cone/fixed roof. The RTG 2930 can be used on all types of liquids, from light products to asphalt. The parabolic antenna is highly tolerant to viscous products and condensation.



**Still pipe gauge,  
RTG 2940**  
For tanks with still pipes, fixed roof tanks or floating roof tanks, with or without external roofs. The RTG 2940 uses Saab's patented Low Loss Mode to concentrate the radar beam to the center of the pipe. This is why we can achieve custody transfer accuracy even in existing pipes with rust and deposits.



**LPG/LNG gauge,  
RTG 2960**  
For any type of LPG/LNG tank. The RTG 2960 installs on a 4" still pipe to ensure a strong signal even from a boiling surface. A reference pin inside the tank makes it possible to verify the measurement without opening the tank.

## Specification all RTG's

<b>Instrument accuracy:</b>	±0,5 mm (±1/32")
<b>Ambient temperature:</b>	-40°C to +70°C (-40°F to +158°F)
<b>Power supply:</b>	115 or 230 VAC, 50-60 Hz
<b>Explosion protection:</b>	EEx d (ia) II B T4 (EN50014, EN50018 and EN50020 Europe) and Class 1, Div I Groups C and D (UL1203, UL913 USA)
<b>Total weight without flange:</b>	12 kg (26 lbs.)
<b>Antennas:</b>	All antennas are of drip-off type. Electronics and housing are common to all gauge types.

## PROVEN AND APPROVED WORLDWIDE



More than 40 000 Saab TankRadar are installed worldwide. The system is used by all the major oil companies on every continent. An impressive list of certificates relating to both custody transfer accuracy and electrical safety is available for inspection. The Saab TankRadar L/2 systems fully conform to the API tank gauging standard, Ch3.1b.

In addition, Saab Tank Control is AAA classified and fully certified according to ISO 9000 quality standards and ISO 14000 environmental standards.

But perhaps most important of all is Saab's more than 20 years of proven customer satisfaction.

ISO 14001



Environment

ISO 9001

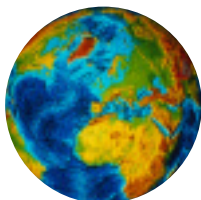


Quality

Triple A



Credit rating



### A global service organization

You are never far from your nearest Saab Tank Control representative. Saab subsidiaries and authorized dealerships are located worldwide ensuring customers professional service back-up from over 200 highly trained service engineers available in 80 countries. We also organize courses in service and system commissioning for our customers.

For further information and detailed technical descriptions, please contact your nearest Saab Tank Control representative:



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