

# Tank and Terminal Management

Tank management solutions for custody transfer, inventory control and business administration







## Endress+Hauser – Working with you every step of the way

Endress+Hauser is a major supplier of measurement instrumentation and inventory control systems for monitoring and controlling liquids during processing, transportation and storage. At your terminal or tank farm, this includes design, production, installation and servicing of instrumentation, data acquisition as well as integration. With more than 50 years of experience in Tank Gauging and Automation Solutions, Endress+Hauser has the largest installed base of instrumentation throughout terminals and tank farms worldwide.

Loading, off-loading and storage of liquids at port terminals require detailed information on quantities and mass. Endress+Hauser offers state-of-the-art measurement instruments. However, to obtain standard volume or even to compare mass figures easily, temperature, crude oil density, strapping tables, expansion functions and other items should be considered. Endress+Hauser can assist you in engineering a system that maximizes the productivity, safety and accuracy of your tank farm.

# Tank Gauging

Endress+Hauser offers a complete choice of technologies so that you are able to decide on the right Tank Gauging system for your individual application. You may decide to maintain your current system or embark on a step-by-step migration path to newer technologies. Endress+Hauser can offer the products, spare parts, service or advice to help you achieve what is right for you.

## Tank depot monitoring

**For tank depots, the simplest solutions are often the most effective ones**

When you need to keep track of how much raw material you have on site and how much storage space you have available, you need reliable data presented in an instantly readable graphic format. Making this information accessible through your web browser, you actively monitor reserves to reduce your inventory, lower operating costs and improve your control mechanisms.

Endress+Hauser will work with you to select the most appropriate measuring instruments from a comprehensive range, taking into account the tank environment and relevant safety considerations.

Endress+Hauser's Tankvision is a robust and reliable web server that enables monitoring data from the installed instruments via Ethernet TCP/IP. You can distribute this data wherever and whenever you need the information.

Tankvision will provide reliable monitoring of your tank or silo contents and can be set to suit your needs, whether you require pure visual readings or organized reports.

The final element is to give you access to your data, from beyond the web server view through to the export to external business tools like MS Excel in the \*.csv format. This data can be periodically exported or sent via an embedded email server.

For ultimate monitoring and control, Endress+Hauser's Tankvision inventory system delivers accessible inventory data, resulting in improved material availability and significantly increased safety. With extensive network capabilities, real-time data is available at any connected location, allowing product movements to be monitored and controlled.



## Optimizing the world of tank depot monitoring is as easy as 1, 2, 3

### 1 Multiuser interface

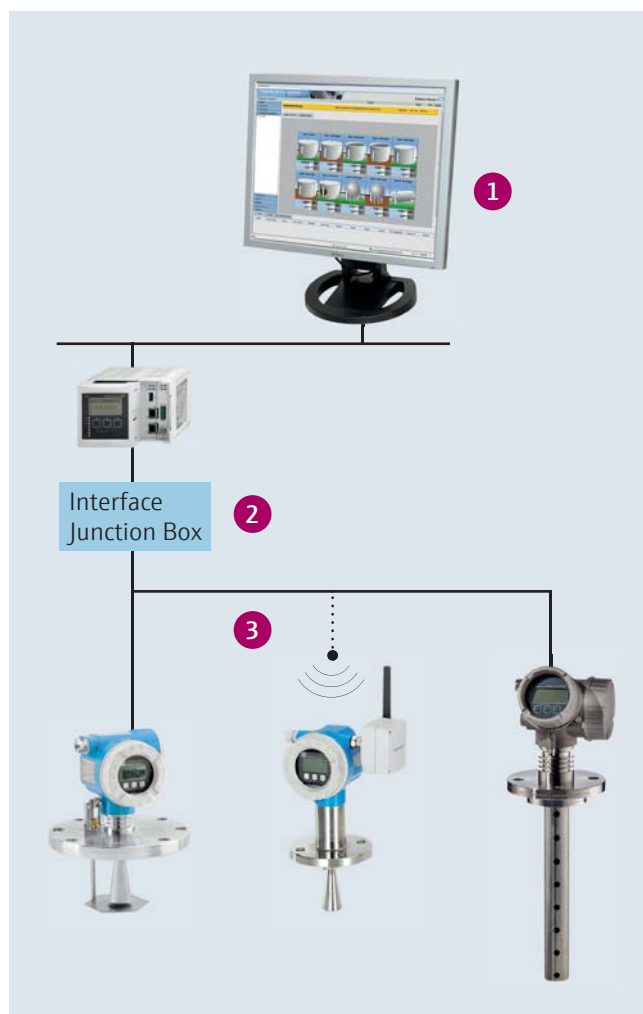
Tankvision is a state-of-the-art tank inventory system with unique features, making your inventory data easier to access. Based on web server technology, Tankvision allows access from any PC within your network. This allows multiuser view and monitors the inventory data without requiring costly software licenses.

### 2 Flexible network interface

The network interface is the method of transferring data from primary measurement into volume and mass information for inventory purposes. Both HART® and Modbus offer the simplest wiring in a multi-drop mode while remote I/O could also be considered. In some cases, wires are not feasible and then a wireless solution can be a viable option.

### 3 Easily selectable field instrumentation

Endress+Hauser is one of the leading suppliers of field instrumentation worldwide. The level portfolio offers a broad range of choices. Our mission is to select the instrument which fits best to your application.



### Tank depot monitoring:

- Simply installed and commissioned devices
- Standardized HART®, Modbus or wireless data collection
- Intuitive display showing you what is needed



## Tank farm monitoring

### Meeting the challenges of tank farm management

Today, productivity and increasing yields are fundamental demands from every business. Therefore, every single site needs to provide maximum storage space at the lowest costs with the highest safety standards. In addition, an increase of the worldwide consumption of oil products is recognized and leads to a higher turnover of media, on the one hand, but also to a higher need of buffering peaks and establishing reserves, on the other hand.

The increased demand pushes prices up and the need for a more accurate way of assessing tank inventories is intensified.

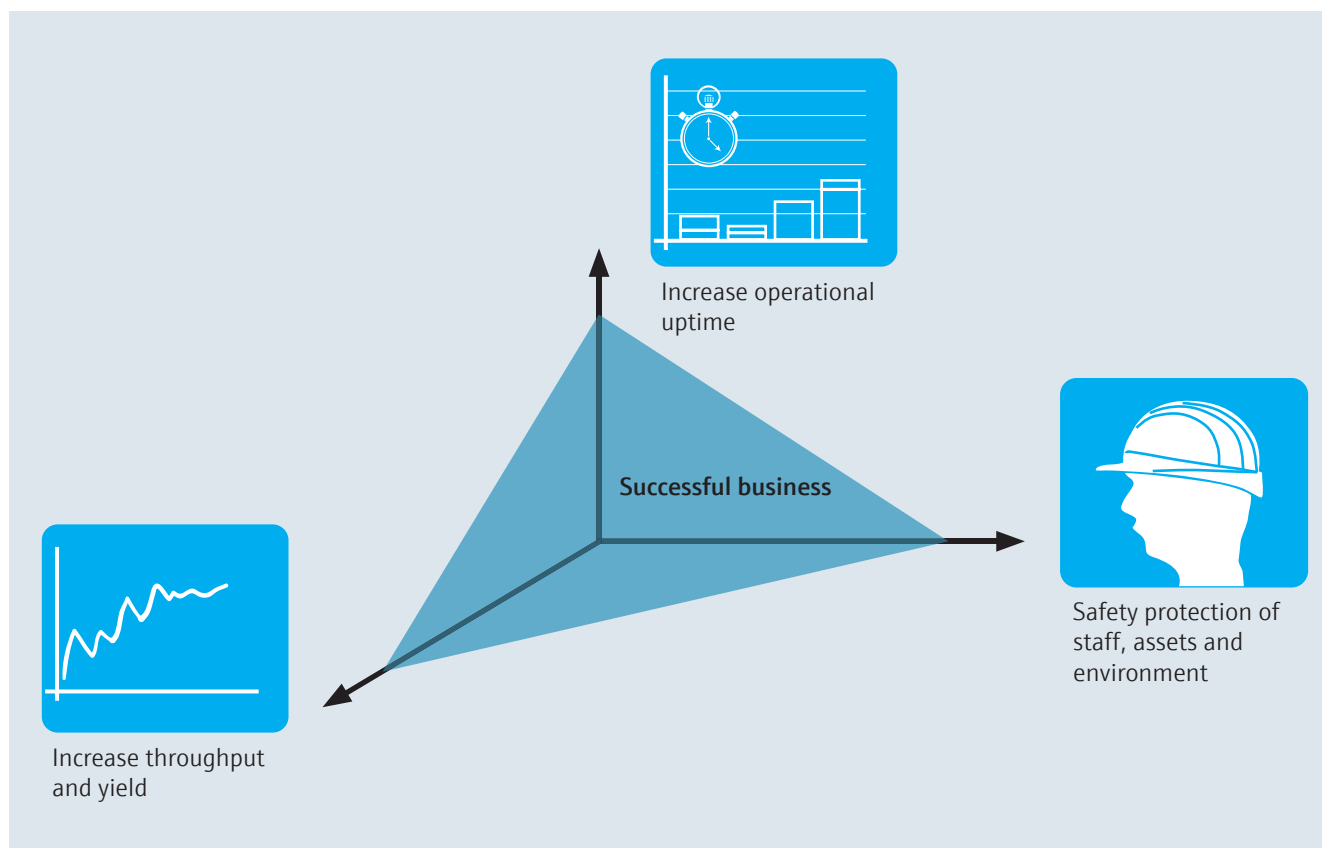
A lot of these highly valuable liquids – be it oils, refined products, alcohols or chemicals – are subject to Weights & Measures regulations with some special requirements. But usually not every stored product is governed by these rules and the question arises how the different requirements can be combined in one system.

Especially after the Buncefield (UK) incident, safety regulations got even stricter and new recommendations how to operate a fuel storage site were published in past years. For instance, the recommendations released by the Buncefield Major Incident Investigation Board provide clear advice for the design of safety systems and also for Tank Gauging systems.

Also environmental regulations need to be taken into account. Apart from productivity, safety and environmental issues, other market trends need to be considered:

- Different company departments require live inventory data.
- Information from multiple sites has to be consolidated.
- Reliable data is a precondition for Vendor Managed Inventory.
- Existing architecture grown over the years poses a big challenge for design or upgrade phases.

For all of these challenges, Endress+Hauser is your partner and Tankvision, the inventory management system for Tank Gauging, can support you to overcome these challenges.



## Tankvision for small-scale and distributed systems

### Tankvision Tank Scanner

Tankvision Tank Scanner is ideally suited for small tank farms with few tanks, but can also be applied in larger distributed systems. It is fully based on web server technology offering:

- Open connectivity, based on LAN (Ethernet) and XML
- PC operating system (Windows & Linux) independency
- Total webpage-based user interface (HTML) – any browser (Internet Explorer, Netscape, Opera) can access data
- No software to be installed
- No limitation to PCs on the network
- Local & remote connectivity is possible – if company policy and firewall permit this
- All of the configuration is done via web pages
- Simultaneous multiple users permitted

Tankvision Tank Scanner connects multiple tank gauges via one field loop which typically comprises 10 to 15 tanks. Several field protocols are supported:

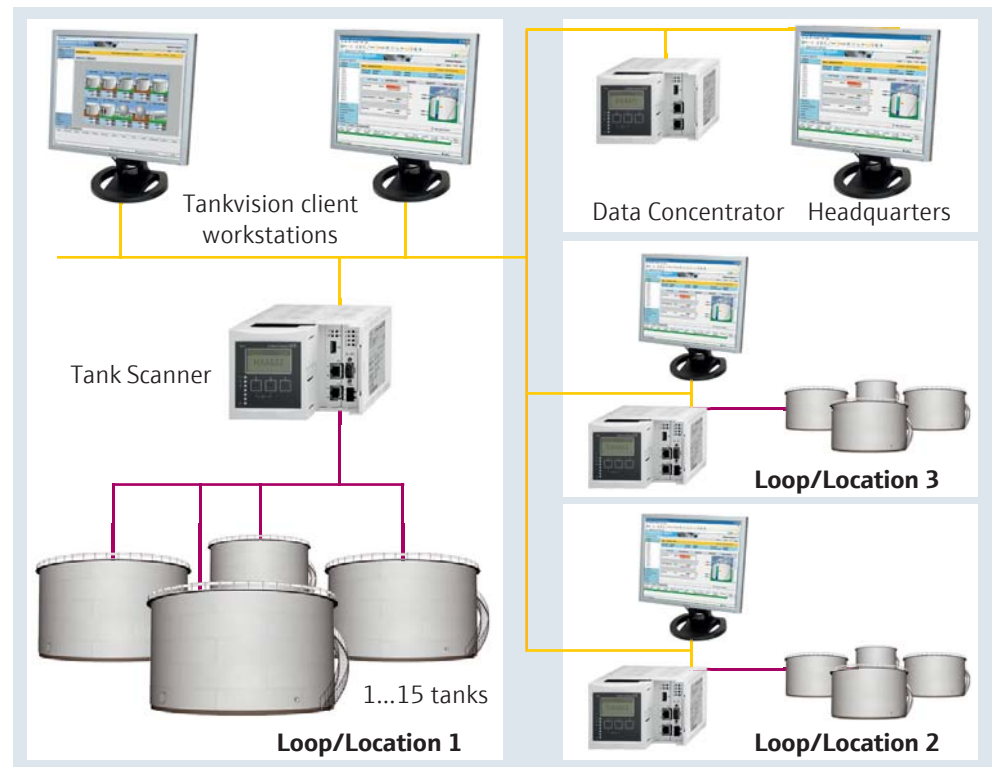
- Serial Modbus
- Sakura V1
- Whessoematic 550
- SAAB TRL/2\*
- Enraf BPM | |\*
- HART® (in preparation)

\* via Field Link

Tank Scanner is equipped with a full set of tank inventory calculations. The calculations are based on various international standards such as API, ASTM, IP, OIML and many others. Full conversion is available from level and volume (e.g. TOV, GOV, NSV, etc.) through to weight and mass with many special corrections such as sediment and water (S&W), thermal tank shell expansion (CTSh), floating roof, etc.

In addition, Tank Scanner is suitable and approved for Weights & Measures applications by NMI and PTB.

Tank Scanner can be used as a stand-alone system for small tank farms and/or integrated into a larger systems via Tankvision Professional and/or Tankvision Data Concentrator. Tankvision Data Concentrator collects the data of several Tank Scanners, totalizes tank data of several or all tanks and acts as a single point of access to the tanks.



#### Tankvision Tank Scanner:

- Connects 10-15 tanks via one field loop
- Up to 90 tanks per network
- Full set of tank inventory calculations
- Approved for Weights & Measures (PTB+NMI)
- Alarming, reporting & archiving direct from the box





## Tankvision for large-scale and customized applications

### Tankvision Professional

Tankvision Professional is a Tank Gauging and inventory management system for small to large-scaled sites and/or operations needing a high degree of customization. Applications range from small authorized distributors through to the largest storage terminals and refineries.

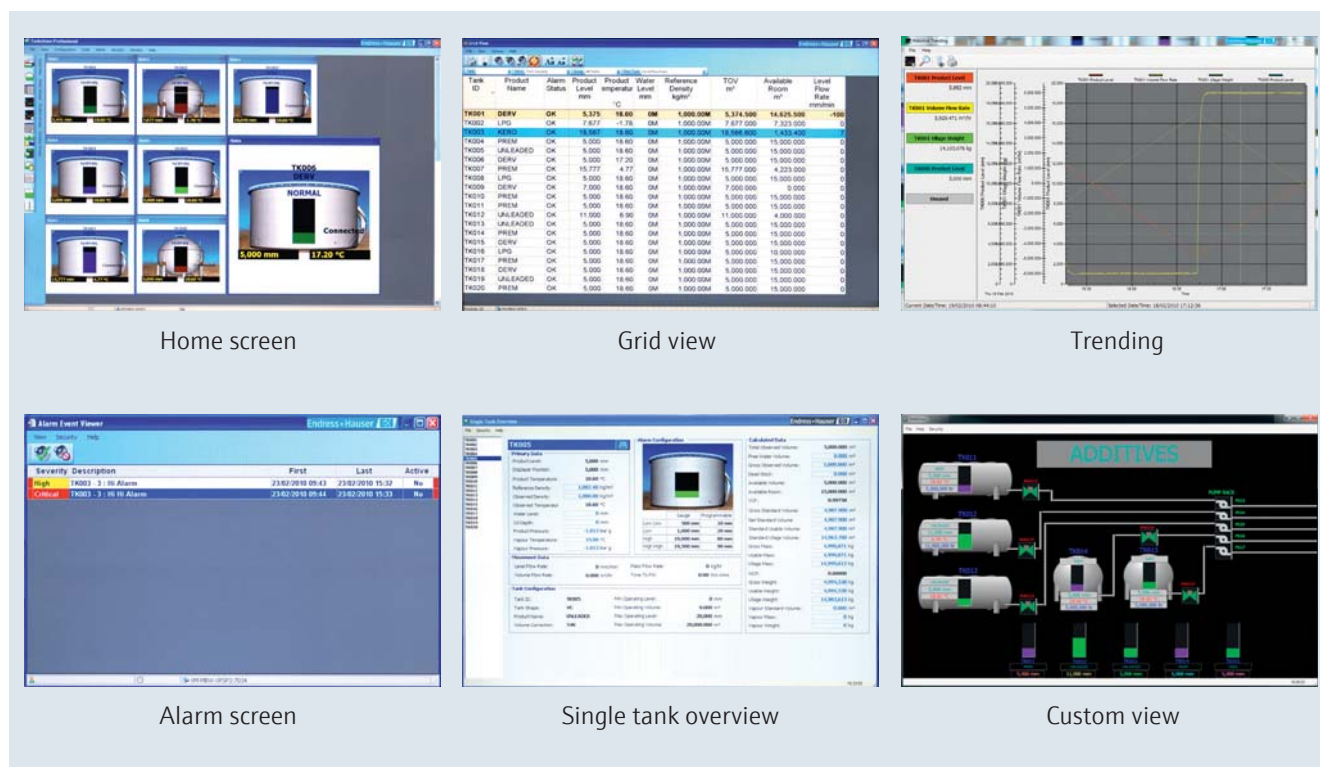
Tankvision Professional visualizes Tank Gauging information both in graphical and/or numerical displays. Up to 400 tanks are supported (200 in a fully redundant mode).

Tank gauges are integrated via hardware interfaces such as Tankvision Tank Scanner, Tankvision Multi Scan, or other third-party units. Tankvision Professional offers all volume calculations according to international standards (API, ASTM).

Tankvision Professional offers numerous visualizations of tank inventory data, e.g. a complete overview of connected tanks in a graphical or grid view, real-time or historical trending and some more specialized views. Most of these screens can be customized to user requirements. In addition, Tankvision Professional offers SCADA

functionality to create screens according to user requirements including some elements frequently found in Tank Gauging like valves, pipes, pumps and motors. Tankvision Professional can be provided with a comprehensive suite of tools to monitor and facilitate partial automation of product movements – enabling users to monitor loading and unloading of products to and from a variety of vessels. It provides alarms and warnings of planned and unplanned events and reports and archives data in a movement log.

The system is available as a single stand-alone operator station, full client/server system as well as redundant configurations. The stand-alone version also offers a multiuser interface via web server technology to view tank inventory. In the client/server architecture, the server takes over the collection of data and makes it available to a number of client operator workstations. The client workstations offer the same functionality as the stand-alone version. The system is designed to run on standard PCs with Windows XP, Vista or Windows7 operating systems and Windows server (e.g. 2005, 2008) platforms.



Home screen

Grid view

Trending

Alarm screen

Single tank overview

Custom view



### Tankvision Professional:

- Up to 400 tanks
- Highest degree of customization
- Visualization of tank inventory data
- SCADA functionality
- Stand-alone or client/server system available



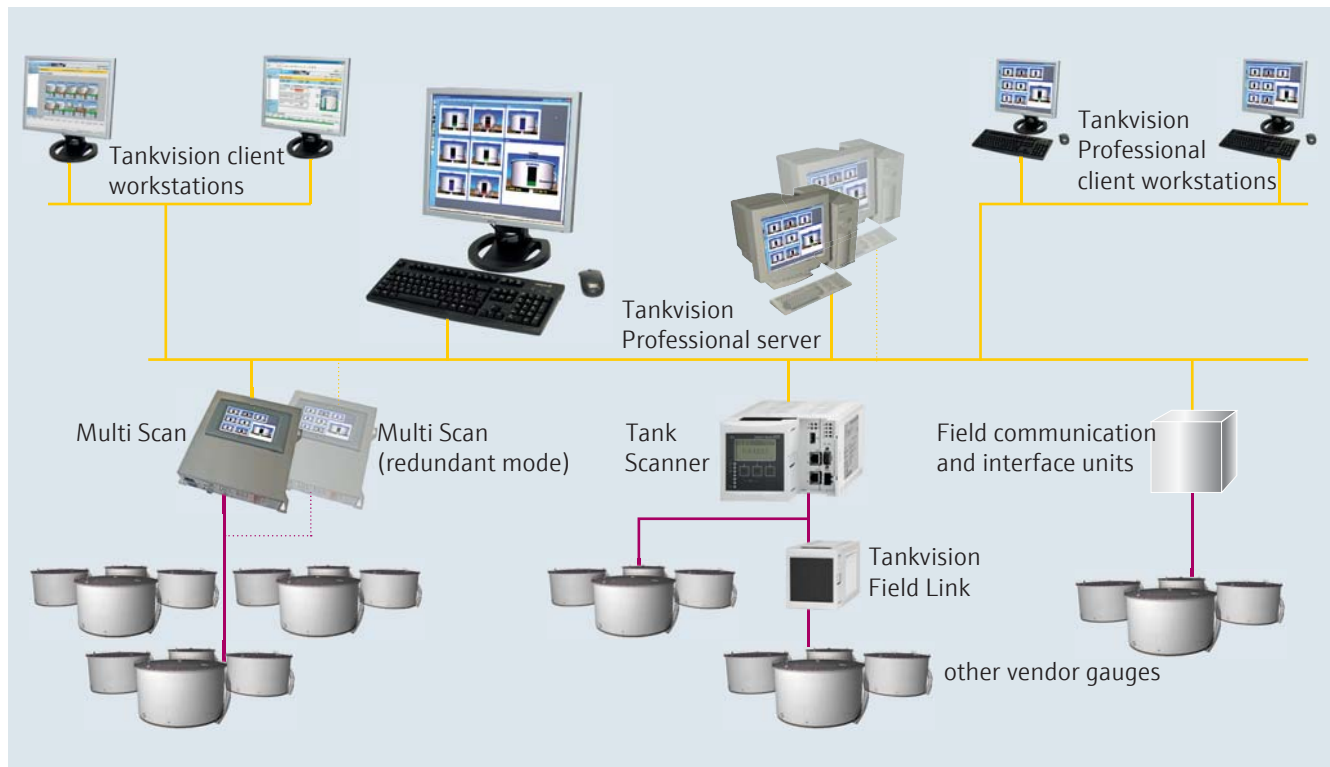
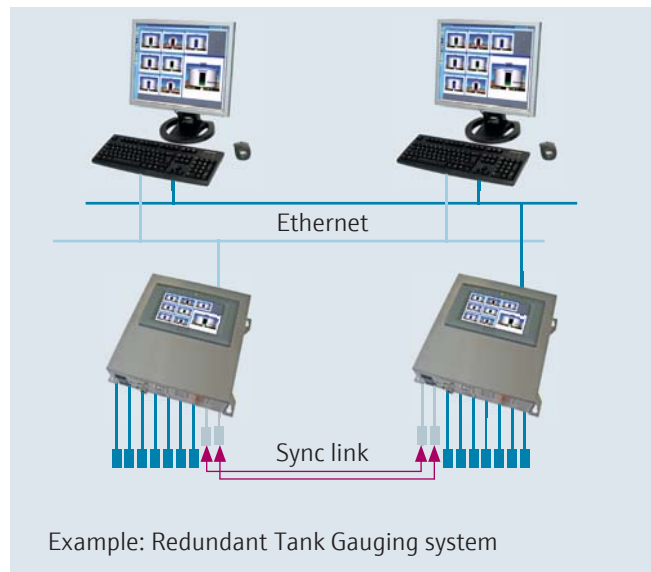
## Tankvision for all Tank Gauging applications

The Endress+Hauser Tankvision platform is built on hardware for interfacing and software for data management. Tankvision Tank Scanner, Multi Scan and Field Link family of products can act alone or as part of the connection from the field to Tankvision Professional. This flexible connectivity provides an extended life of the installed base and handles the “integration” of “legacy” equipment.

### Redundancy options

Tankvision Professional can be used in conjunction with Tankvision Multi Scan allowing a full hot standby for standard protocols or even third-party interfaces.

Tankvision Multi Scan can also work independently and directly oriented to a DCS or upper layer system. Even in this configuration, the web server function can allow local or distributed access while retaining security.



### Tankvision Multi Scan:

- Up to 8 field loops
- Up to 90 tanks
- Full hot standby redundancy
- Input for Modbus, V1, WM550, third-party, etc.
- Output with Modbus Serial / TCP, OPC
- Direct link to Tankvision Professional



### Tankvision Field Link:

- Protocol gateway for one protocol into Modbus Serial
- Options of Enraf BPM and Saab TRL/2
- Isolation of field loops

## Tankvision for Liquid Natural Gas (LNG)

### Tankvision LMS

Tankvision LMS is the state-of-the-art measuring system for Liquefied Natural Gases (LNG). A typical LNG tank has a wide range of instruments to measure liquid level, liquid density, liquid and vapor temperature, liquid and vapor pressure, skin temperature and much more.

Operator screens present live measured and calculated values in easy-to-read formats, for the most efficient and effective control room comprehension.

Apart from the common functionality of a Tank Gauging system like volume calculations or trending, Tankvision LMS offers some special functionalities for LNG applications:

- Stratification
- Rollover
- Skin temperature measurement

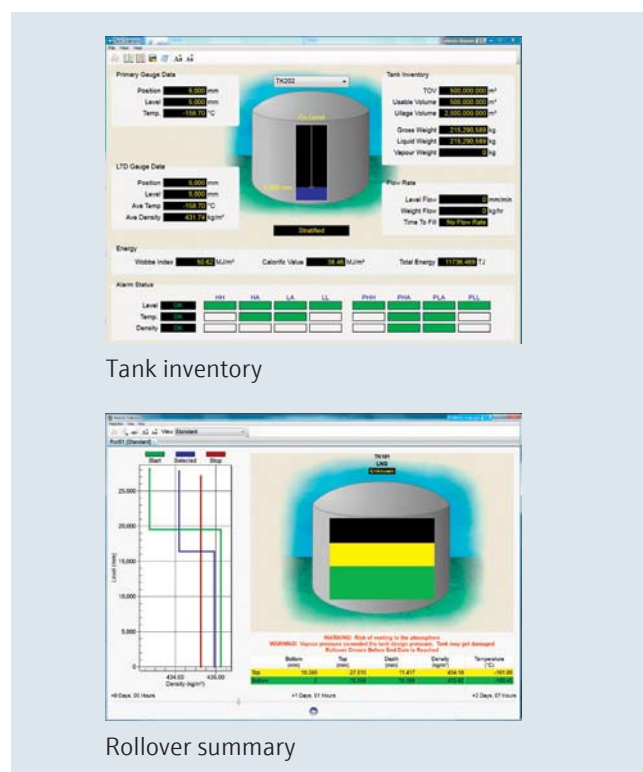
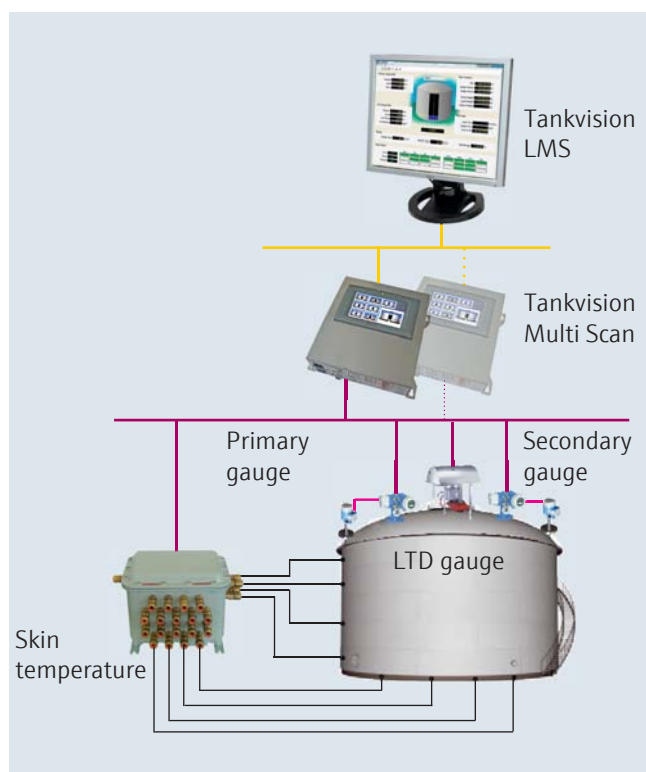
A significant safety concern in the storage of LNG is a phenomenon known as “rollover”.

Rollover occurs under certain conditions as stratified LNG comes to an equilibrium. Stratification occurs when the product in the tank forms layers of different densities and different temperatures.

The rollover prediction model of Tankvision LMS visualizes the evolution of temperature, density, boil-off and layer thickness of stratified layers within an LNG tank. If the model predicts a potential rollover, the model will display the time to the rollover as a rollover alarm.

A unique feature of the rollover prediction model is its ability to infer heat and mass transfer coefficients from real-time LTD profiles.

The rollover prediction is sensitive to heat and mass transfer coefficients that control mass and energy transfers between stratified layers.



### Tankvision LMS:

- Visualization of tank inventory data
- Rollover prediction and alarm
- Stratification visualization
- Skin temperature measurement



## Legacy and migration

Upgrading of sites with an existing architecture accumulated over the years has its difficulties. When a complete overhaul is not possible due to budget restrictions, a gradual upgrading strategy has to be applied. Since open protocols were not common for Tank Gauging applications some years ago, a multiplicity of vendor-specific proprietary protocols are in place. If a complete change of the infrastructure is not possible, you are tied to one supplier in most cases which limits your freedom. The Endress+Hauser inventory management can help you to overcome these challenges.

The data usually does not stop at the Tank Gauging system - higher level systems like Distributed Control Systems (DCS) or Enterprise Resource Planning (ERP) systems obtain information from the Tank Gauging system.

### Integration into PLC/DCS systems

Tankvision provides host communication from every component. Tankvision Tank Scanner (via Tankvision Host Link), Tankvision Multi Scan, Tankvision Professional and Tankvision LMS provide the following interfaces:

- Modbus RTU (RS232 or RS485)
- Modbus TCP
- OPC server.

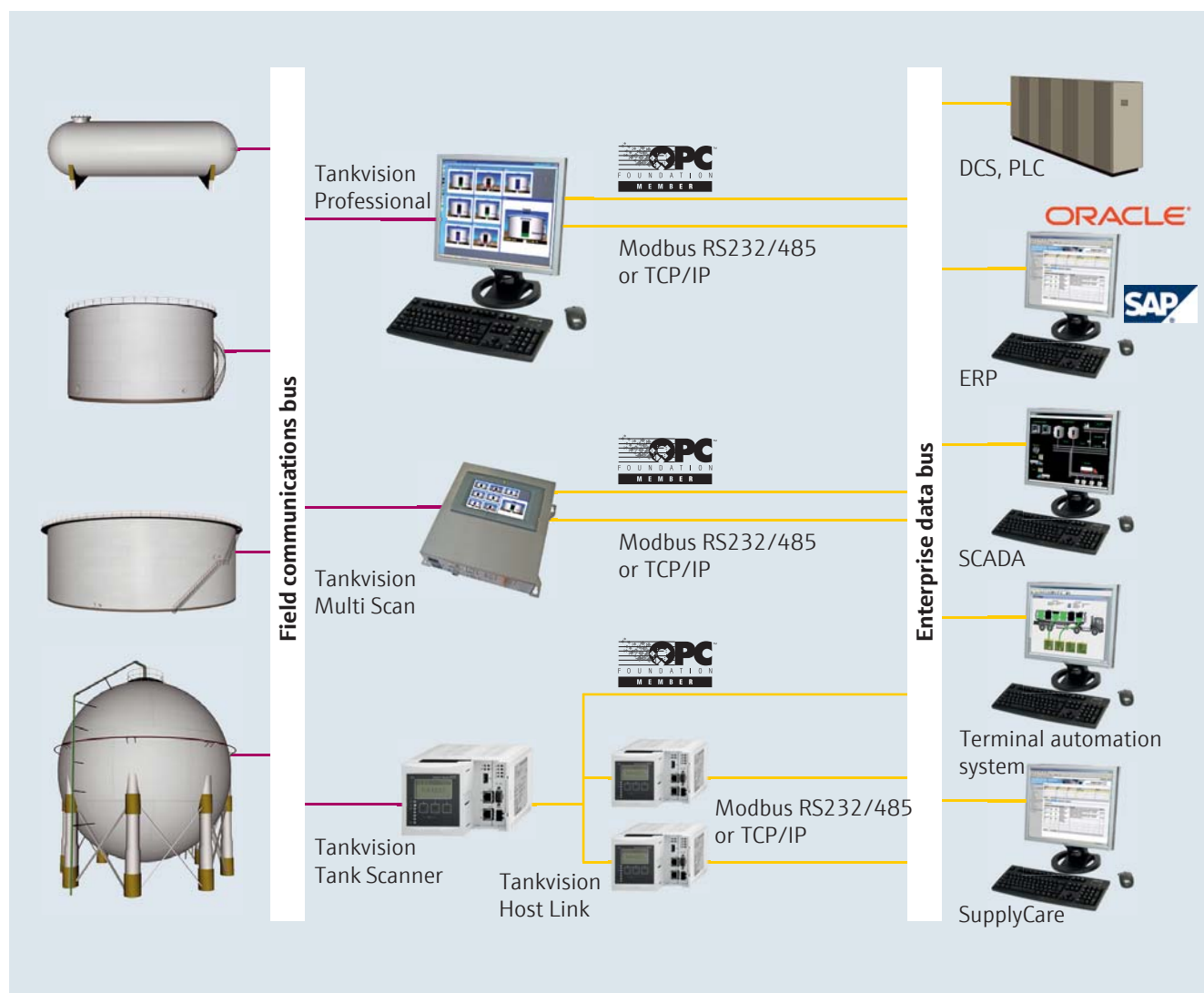
Tankvision is tested with the most common systems, e.g. ABB, Emerson, Honeywell, Siemens, Rockwell, Yokogawa, etc.

### Reconciliation with terminal automation software

Tankvision can be connected to terminal automation systems like Endress+Hauser Terminalvision Professional for reconciliation.

### Vendor Managed Inventory

Inventory data can be automatically transmitted to a supplier who assumes full responsibility for the inventory.





## Tank and Terminal Automation

Loading, off-loading and storage of liquids at tank farms require detailed information on quantities and mass. In order to acquire accurate values, it is necessary to measure level, flow, pressure and temperature, and to consider strapping tables, expansion functions and other factors. Endress+Hauser provides flow measurement and Tank Gauging systems that work together to allow you to manage and optimize your inventory. In addition, it is important to control and protect the pumps and valves that keep products flowing through the facility. Endress+Hauser can integrate equipment into your terminal automation system that provides conductive limit detection and dry run protection for your pumps.

### Safety

**Ensuring site safety and preventing environmental damage from spills are matters of common sense, as well as legal requirements**

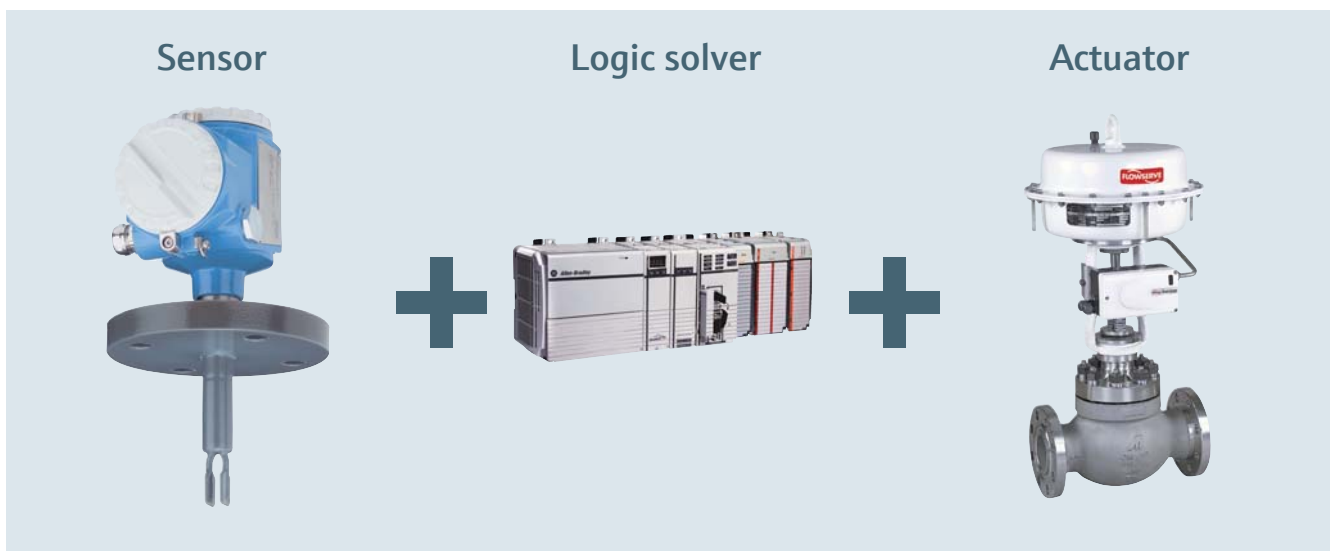
No matter what you are storing, Endress+Hauser has the experience to ensure that your site and personnel stay safe and that you meet all necessary regulatory requirements. The consideration of the properties of the liquid being stored as well as the tank type is an important task to ensure that the most suitable measuring devices are installed. Coping with potential corrosion or product buildup while the instruments are in service has to be considered too.

The incorporation of technology that is capable of producing enhanced diagnostic information ensures that reliability and measurement integrity are maintained. This is the best way to reduce unscheduled maintenance and ensure that safety requirements are completely met. Automatic level switches, electronic gauges and high-level alarms are designed to fail to a safe condition ensuring an immediate alert in the event of a potential problem.

Endress+Hauser goes further than simply supplying the instruments you need to prevent overflow incidents. The entire safety loop system including measuring, controlling and correcting elements are provided from one source in order to ensure that you remain protected. Endress+Hauser systems include alarm panels, designed and built to meet exact requirements. If necessary, also the arrangement for SIL, safety audits can be carried out that take into account your complete operational processes.



### Complete evaluation of a safety function (safety loop)



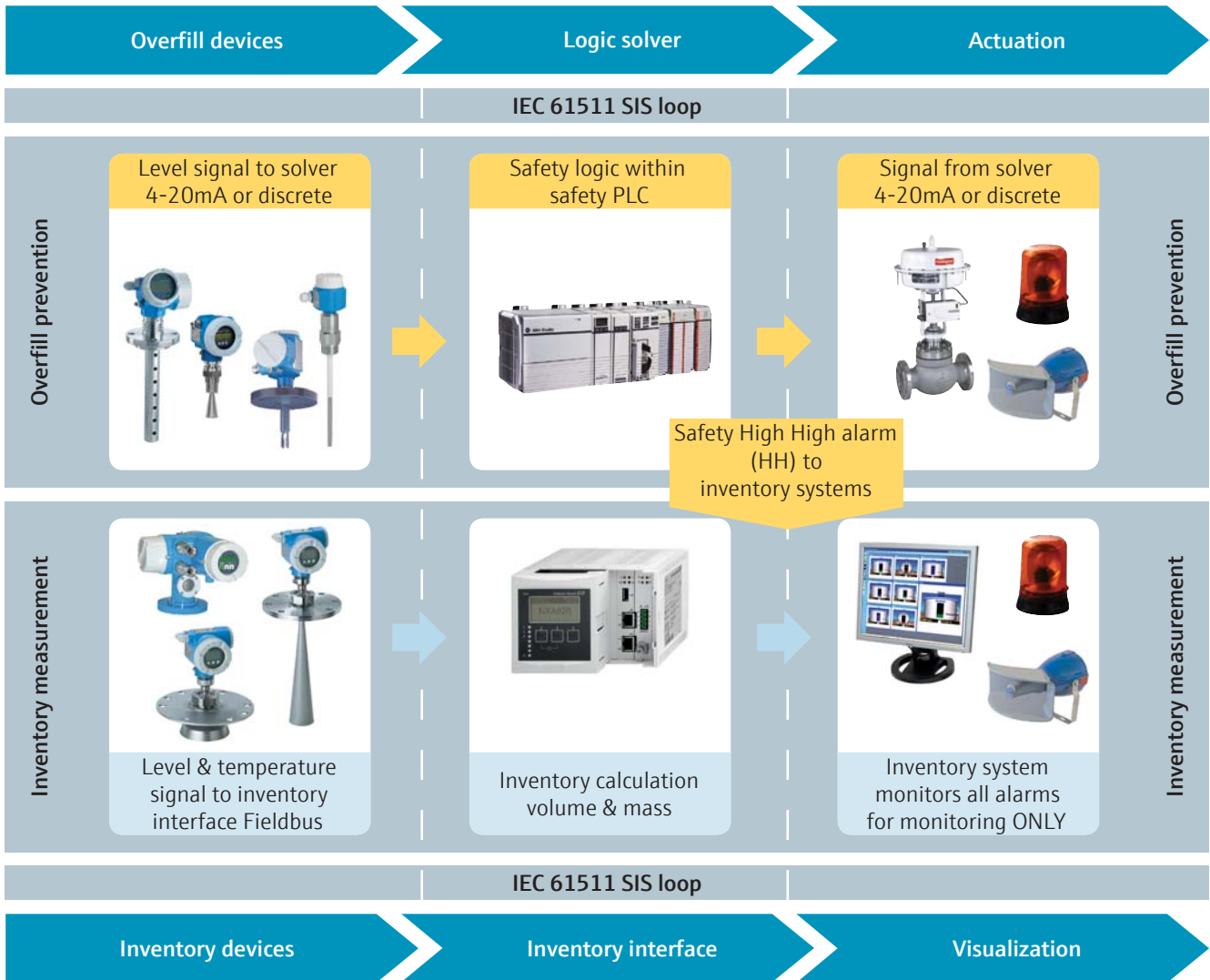
#### ✓ Safety solutions should consider:

- Easy to operate and maintain devices
- Consider proof testing from the beginning
- For optimum safety consider all components in the loop
- Document your actions and findings

**Requirements for independent overflow supervision**

**Systems independence**

The independence of systems should really be physically and electrically separated. This provides the highest benefit in eliminating any systemic error. The staff on site will also enjoy the highest degree of available information for intelligent decisions.



**Safety solutions should consider:**

- Independent & diverse measurement between primary level and overflow monitoring
- Independent of primary or secondary level
- Separate level and safety signals are recommended
- Proof test and record regularly



**Requirement for diverse and independent measurement**

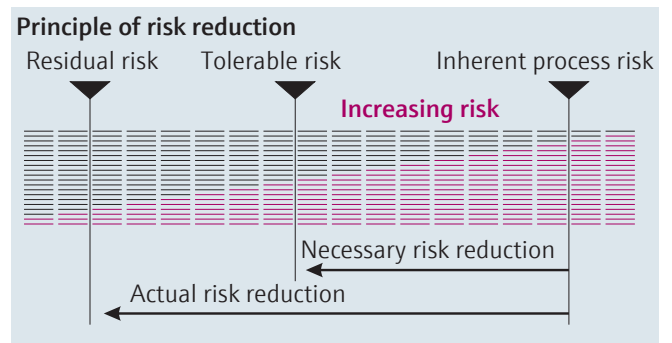
Due to recent activities around the world related to industrial accidents, special investigations and reports have been issued such as API2350 and Buncefield HSE. These guidelines have been published to help operators and designers of fuel storage and distribution facilities to increase their safety coverage. All of these reports indicate a common thread. When monitoring storage tanks containing either hazardous or flammable products, design and maintenance should consider the damage which could be caused to the environment, facilities or people by “overfilling”.

This consideration carries the responsibility of providing protection by the most appropriate means. The key to this is a design based on a reliable primary level and overflow monitoring of tank inlets. When selecting the level & overflow monitoring devices, the guidelines drive the choice to “diverse” measurement to remove the change of any systematic error. Furthermore, the “primary level” and “overflow prevention” devices should be electrically and mechanically separated.



**The theory of proof testing**

Proof testing is the key to maintain your overflow monitoring. The reality is that immediately after a test the chance of failure increases, hence regular proof testing is fundamental. Proof testing should also have the minimum impact on operations to avoid any shortcuts. In addition to the proof test, a document system should record what was done and when it was done.



**Inventory & overflow devices**

When considering the measurement combination, this chart may offer some quick indicators.



**Endress+Hauser overflow prevention – SIL ready**

	Vibronic fork	Radar custody	Radar inventory	Servo	Guided wave	Capacitive probe
Radar custody	✓	—	✗	✓	✓	✓
Radar inventory	✓	✗	✗	✓	✓	✓
Servo	✓	✓	✓	✗	✓	✓
Guided wave	✓	✓	✓	✓	✗	✓
Capacitive probe	✓	✓	✓	✓	✓	✗

✓ Recommended      — Not in accordance to API2350 and Buncefield recommendations      ✗ Unacceptable

## Movements and transfer

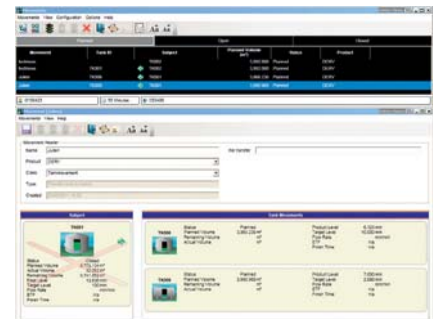
**Loading, off-loading and storage of liquids at tank farms and terminals require accurate and detailed information to ensure a safe, reliable process**

Successful tank farm control relies on accurate and reliable process measurements such as level and flow. From high accuracy Tank Gauging through to the transfer of highly viscous products, Endress+Hauser is the perfect partner to help you select the most appropriate device. But process measurement is only the start.

The transfer of hazardous or expensive products not only needs reliable measurements but also a correctly designed and implemented control system to ensure the safe and timely transfer of liquids. Following detailed discussions with your plant engineers and operators, a functional design specification is produced that forms the basis of the system. A PLC- based control system is implemented allowing for the integration of many pumps, valves and interlocks.

A supervisory control and data acquisition (SCADA) system using customized graphical display screens provides the control interface along with alarming, reporting and archiving of data for all aspects of the transfer process. The programmable nature of the system enables additions or changes to be implemented at any time.

Being fully supported by Endress+Hauser's highly trained application and project engineers, your tank farm control system will provide safe and efficient product transfer while meeting local and international safety, quality and operational standards.

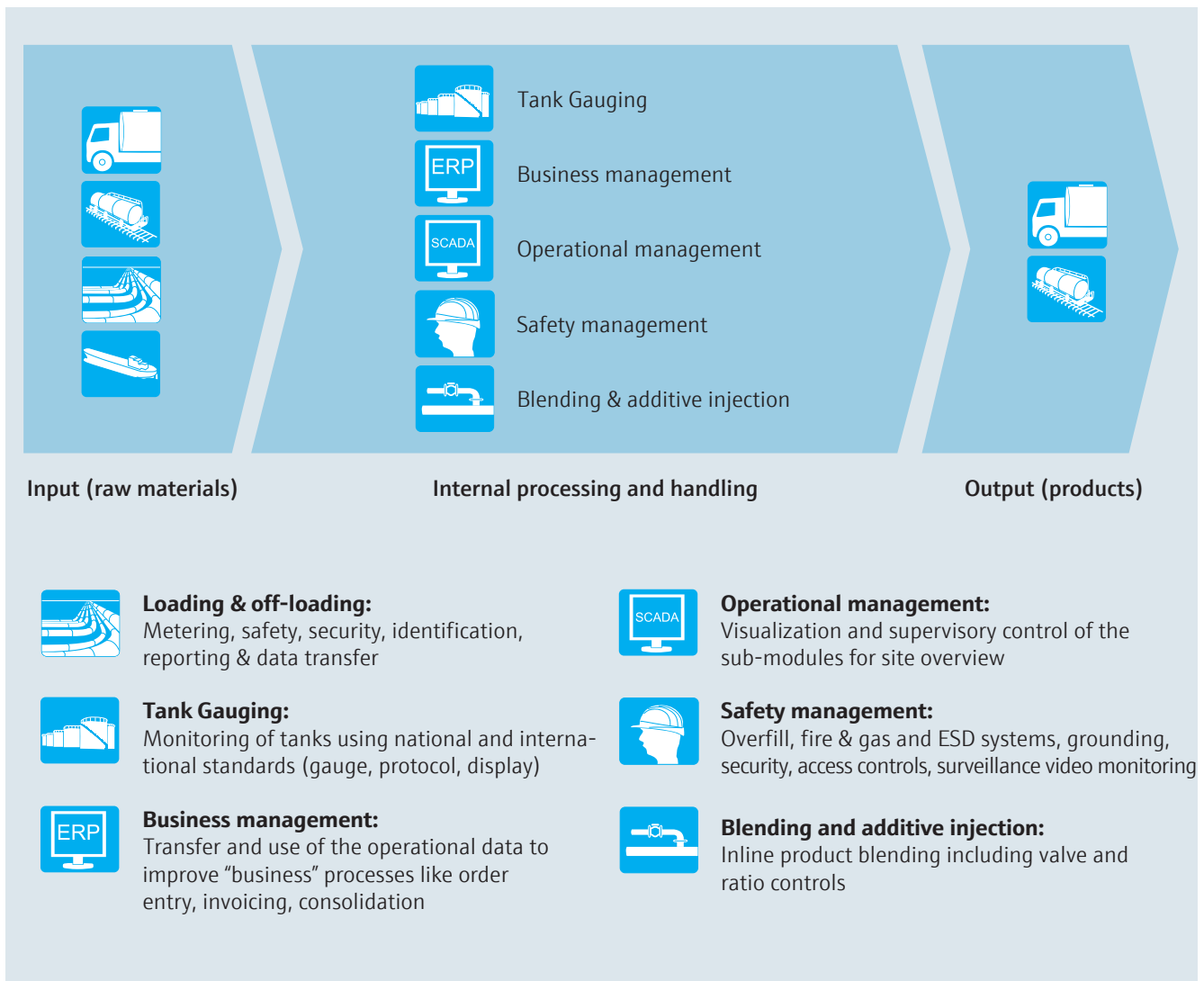


# Terminal management

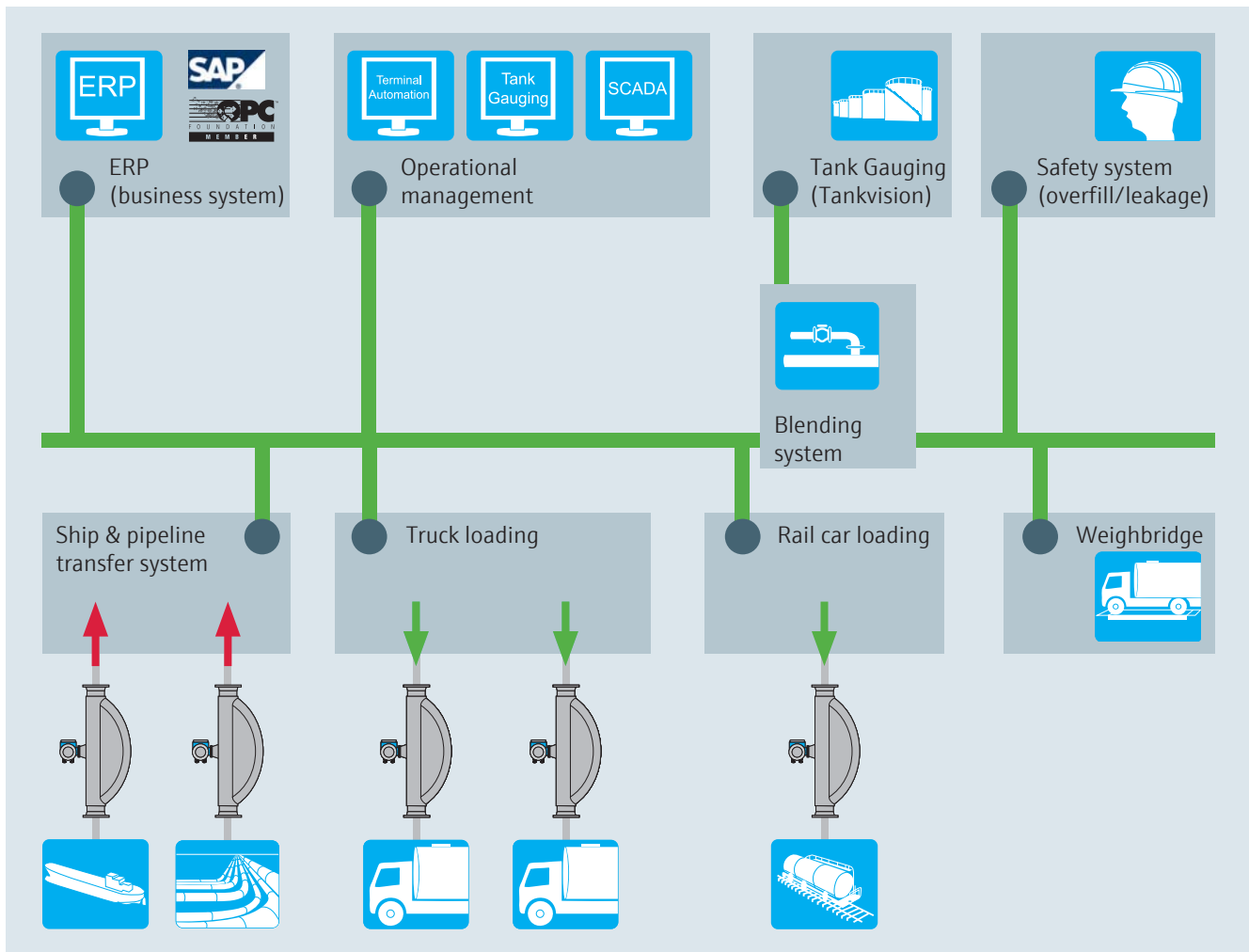
Terminal automation systems manage the distribution of products such as oil, gas, chemicals, renewable fuels and alcohols. The primary tasks of an effective terminal automation system include the simple, quick and secure collection and transfer of data throughout the facility.

Endress+Hauser offers terminal management by utilizing Terminalvision which is a Windows-based total terminal management system designed to handle all of the requirements of road, rail, and barge loading depots and terminals. It is also an open system designed to interface most vendor devices used for access control, rack loading computers and weighbridges. The system has been

designed to be totally configurable so that it can accommodate different workflow procedures, for example whether access control is present or not, whether PIN entry is required or not, the sequence of steps to complete a load etc. Loading control and authorization can be handled at the loading computer or by the automation server depending on customer requirements.



## Terminal processes



### Terminal management and automation

More than ever before, the importance of terminal automation is increasing. This is due to changes in markets, competition, the regulatory and social environment. Even with the knowledge of these demands, many smaller petroleum product terminals sustain their relatively low level of automation and many of the larger operations continue suffering because of disconnected and fragmented systems. With the increase of mergers, acquisitions and site expansions many terminal owner-operators find themselves with different systems (or at best different versions of the same systems) to be handled across their sites. This constitutes a large task to coordinate activities, collect the required information, avoid incidents, educate operators and support the aging systems architecture. All in all, this is very challenging.

When selecting your potential path for the future, consider how and what direction you should take. Your partner should be well-established in the world of inventory handling and have strong links to multiple system integration.

Some questions to consider:

- Do I want to upgrade totally or in steps?
- Do I want full or partial automation?
- Who needs what data and in what form?
- Can or do I want to maintain the site with my team?
- How do I balance safety with operational uptime?

These questions and many others should be considered to assist you in making educated decisions on the best way to handle the requirements of your constantly evolving facility.

# Terminalvision

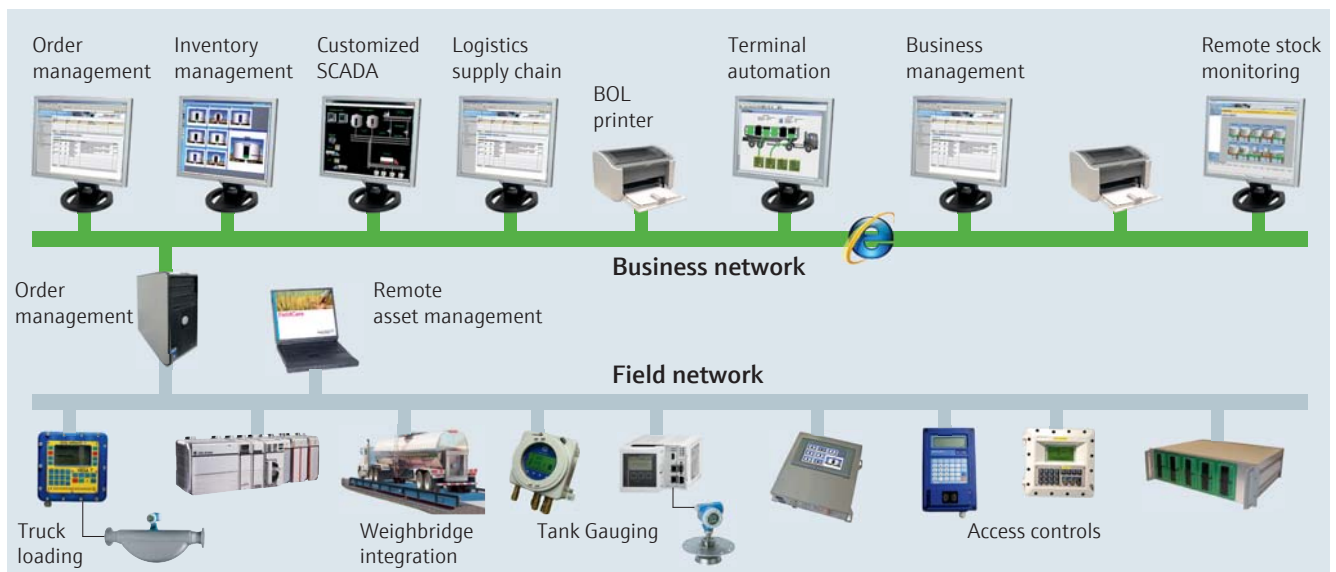
## Simple, quick and secure transfer of data with Terminalvision

Terminalvision covers of all the key areas of running and maintaining a terminal

### System architecture

The system can be provided as a simple stand-alone station for small depots or as a full client/server system for larger sites where multiple operator stations are required. The following illustration is a generalized architecture showing the capabilities of the system. In most cases, a high-availability back office server is used as an interface to the field

devices and host the database and the operator stations run as clients to the server. Printers can be distributed freely throughout the system; but typically would be placed within the terminal control room for internal reporting and control as well as at the exit gate for printing Bills of Lading.



## Terminalvision specifications

### Standard features

The system is designed to provide total control over product movement by:

- Maintaining a record of all vehicles and all persons entering or exiting the site
- Creating a record of all loading transactions
- Providing a comprehensive range of reports
- Printing Bills of Lading (BOL)
- Interfacing with the Tank Gauging system for real-time physical stock data
- Interfacing to a stock account management system for reconciling stock

### Database

The system uses the SQL server database capable of storing hundreds of thousands of records. The following types of data is typically stored for use with the system or linked to other business systems:

- Product transactions
- Orders
- Drivers
- Vehicles
- Companies
- Products
- Loading bay configuration
- Device/instrument configuration



### Terminalvision:

- Manages all aspects of terminal management
- Based on "standard" SQL database platform
- Integrates business and automation systems, i.e. SAP
- Tank Gauging systems link intuitively
- Management of Bills of lading

Other data is generally shared with the Tank Gauging system such as:

- Tanks
- Products
- Tank calibration tables
- Physical stock
- Bill of lading

## Linking the boundaries of terminal management

### Loading and off-loading

The system can interface to most types of loading computers. The loading process can be configured to follow a sequence customized to each site. Loads can be pre-authorized and entered into the system ahead of the driver/truck arriving at the terminal. In this case, the quantity and product for each truck compartment are entered into the system under a unique load/order number. On arrival at the site, the driver can select the order to be taken and all of the load details are downloaded to the loading computers to enable loading. This method reduces the burden on the driver and reduces the risk of loading incorrect quantities/products into the wrong compartments. Alternatively, loads can be created and authorized on demand by terminal operators as a truck/driver arrives at the site. A full log of all loading transactions is maintained by the automation system.

### Business management

Terminalvision also considers the demand and has been designed to interface with many business information and enterprise systems including SAP. In particular, the system is very closely integrated into SAP Business One which is suitable for smaller terminal operators and can offer them a totally integrated enterprise solution catering to all business and reporting needs. For example, all transactions can be linked to financial documents for invoicing, accounting, etc.

### Operational management

All transactions and audit trail records are stored in the Terminalvision SQL server database. The system provides a comprehensive query manager that allows users to produce very detailed reports including the ability to sort, filter and group information for statistical review by terminal managers. The system incorporates a number of simple statistical tools that can be used for analyzing records and forecasting parameters so that users can optimize the scheduling of receipts to replenish stocks.

### Safety management

Safety management incorporates many functions designed to enhance existing safety and environmental processes, for example:

- Overfill prevention systems - monitoring
- Leak detection
- Comprehensive alarm monitoring
- Site access controls
- Driver and vehicle authentications
- Site security

### Blending and additive injection

Blending and additive management is commonplace today and should be managed for different blending and additive strategies required for different companies. Blending and additives can be managed in several ways depending on the functionality of loading computers. If the loading computer supports additive and blending, the data is downloaded to the loading computer along with loading details which then takes care of everything else.



Truck status monitoring



Loading bay management



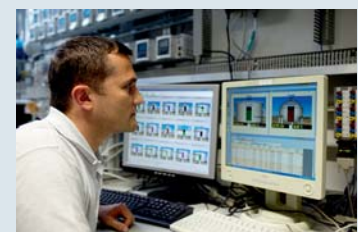
Performance reporting



Road & rail truck loading



SAP BO & high chart



Control and supervisory system



Metering and batch control



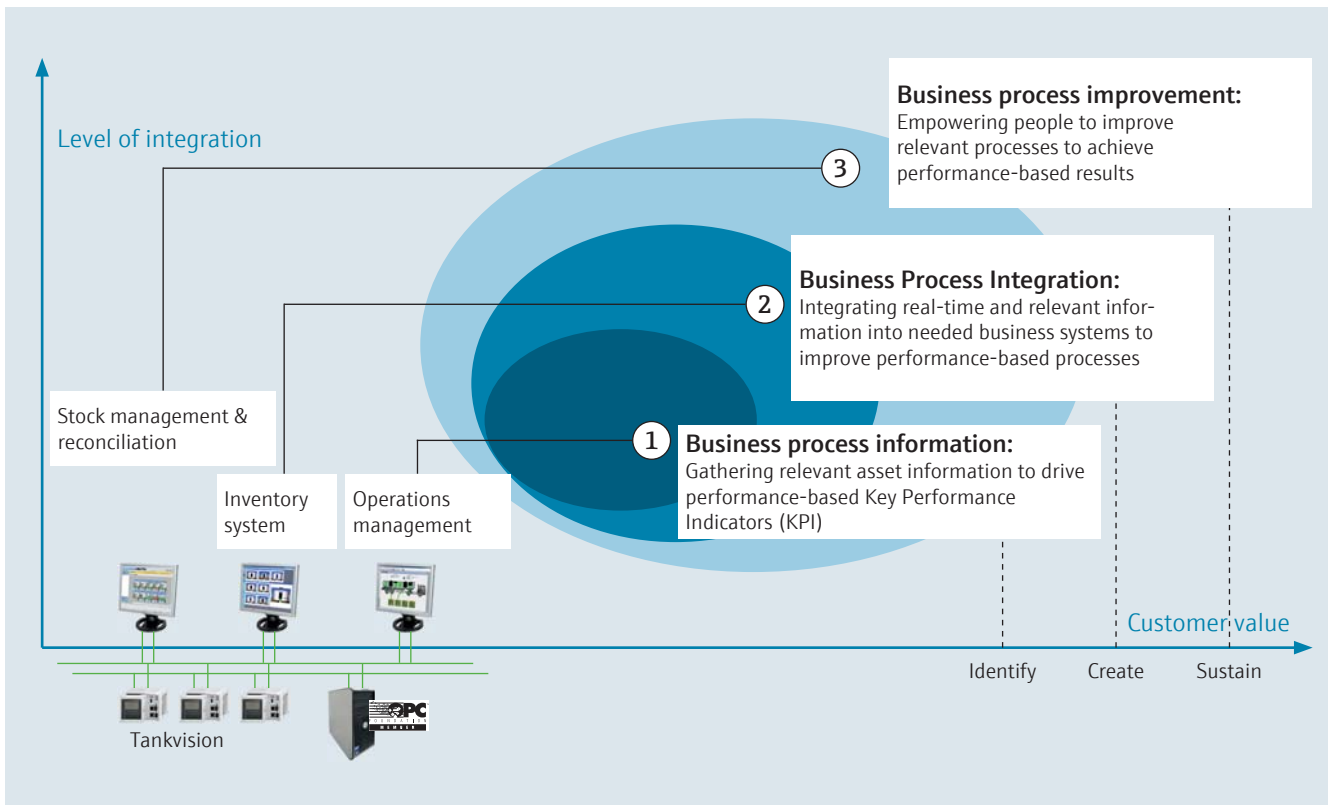


## Business Process Integration

The continually changing demands force companies more and more to get real-time data from the process floor to the administration areas. Different departments need up-to-the-moment information to forecast sales or to plan logistics. The administration groups tend to be less oriented to measurement and control but still need the data to improve their online field information.

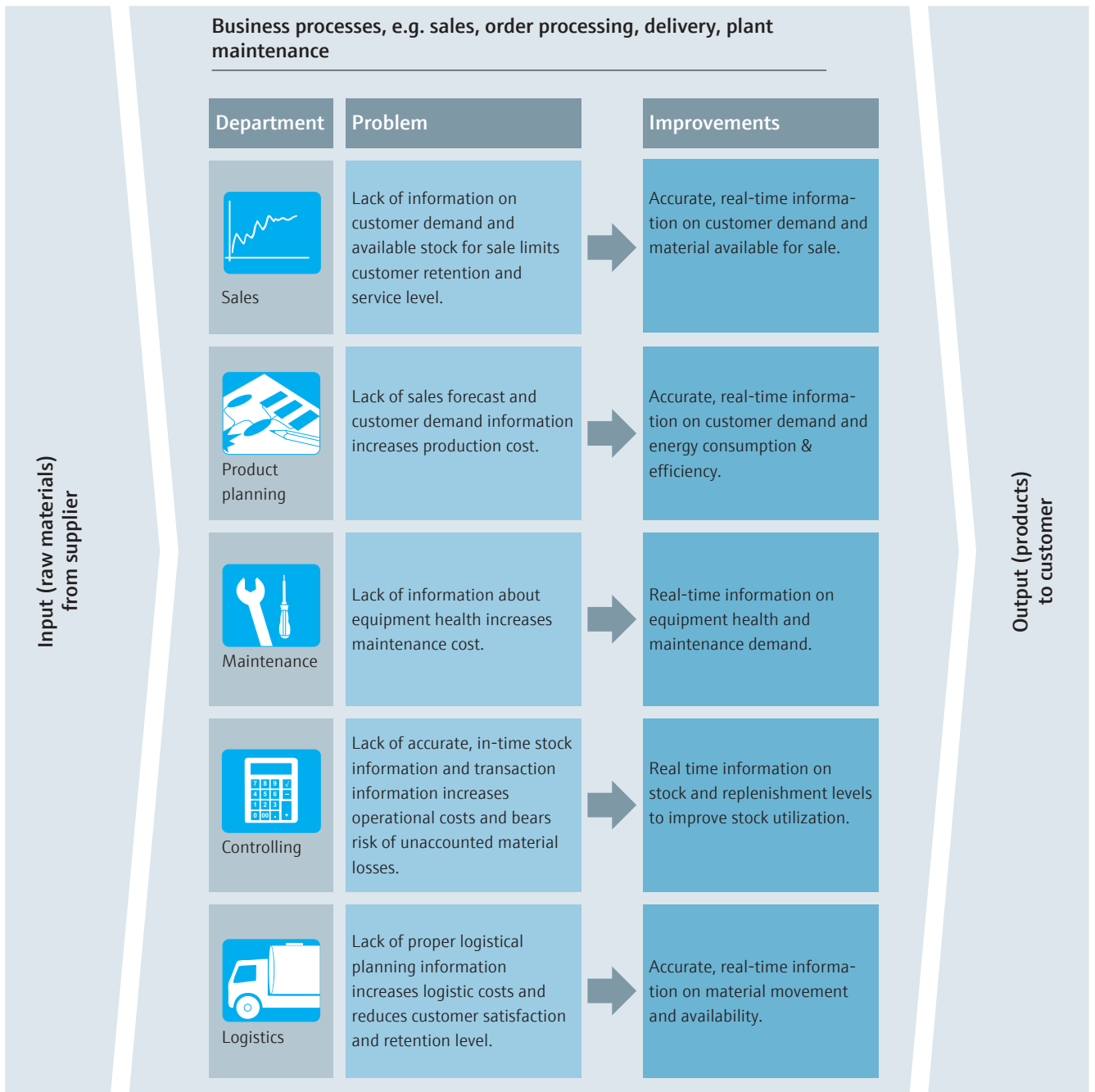
### Integration into Enterprise Resource Planning (ERP) systems

In various applications, data is distributed via networks to and from host computer systems allowing effective communication to management and enterprise level systems. Extensive network capabilities and real-time data is required at any connected location for administrative and accounting purposes. This facilitates complete monitoring and controlling of product movements from storage at tank farms through to truck, train or marine vessel loading at marketing terminals.





Improvements with Business Process Integration



**Business Process Integration:**




- Real-time process data can be used at enterprise systems
- Measurement information enriched with intelligence
- By having up to date inventory data you can effectively make operational and logistical decisions

# Products and Services




## Products

Endress+Hauser offers a comprehensive range of measurement instruments, with an instrumentation solution to suit every tank environment and accuracy level requirement. However, in order to reach standard volume or to compare mass figures, temperature, expansion functions easily, more aspects should be considered. An Endress+Hauser tank monitoring or gauging system includes all of the elements to allow you to manage and optimize your inventory accurately and safely. From consultation, planning and training through to service, repairs and spares, a comprehensive array of service solutions completes Endress+Hauser's customer-focused spectrum of activities.

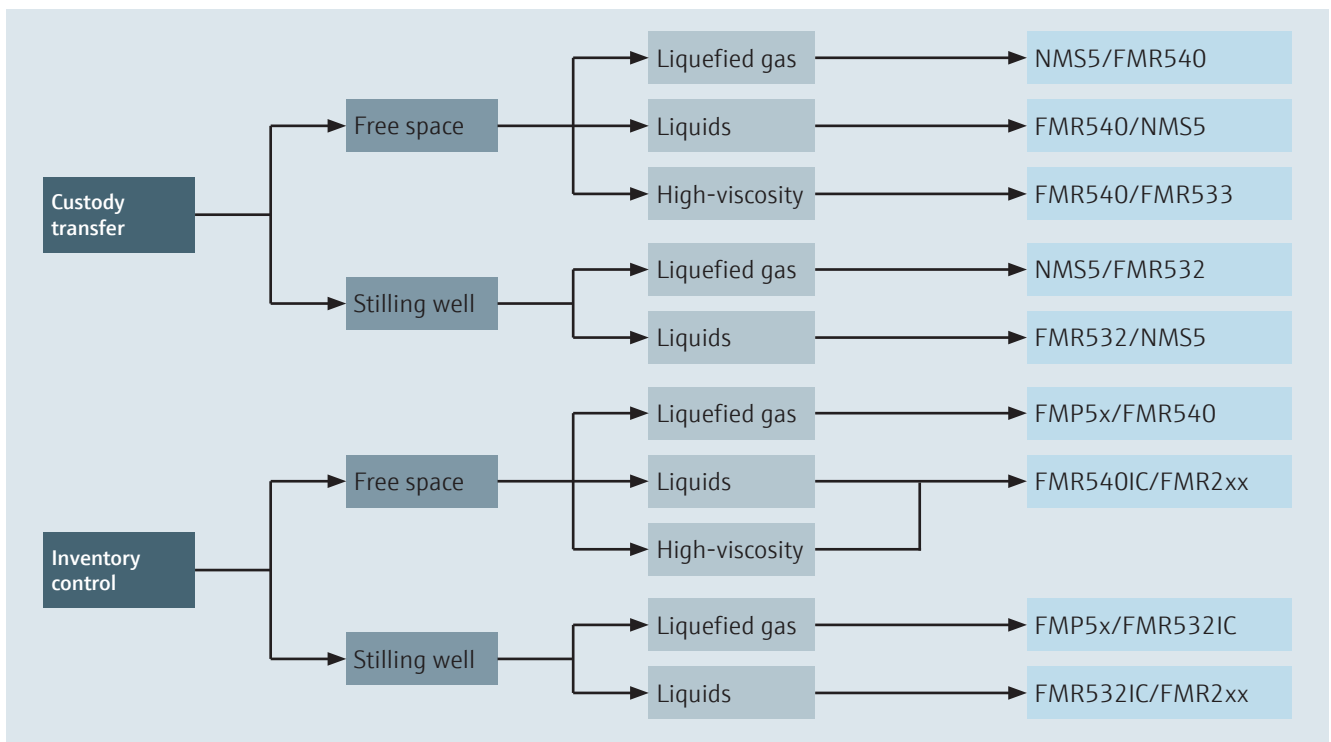
### Tank Gauging devices (custody transfer)

	<b>Radar (free space)</b> Micropilot S  FMR540	<b>Radar (stilling well)</b> Micropilot S  FMR532	<b>Servo</b> Proservo  NMS5
<b>Advantages</b>	<ul style="list-style-type: none"> <li>Unaffected by head pressure</li> <li>Unaffected by the viscosity of the media</li> </ul>	<ul style="list-style-type: none"> <li>Unaffected by head pressure</li> <li>Unaffected by the viscosity of the media</li> </ul>	<ul style="list-style-type: none"> <li>Level, density and interface with one device</li> <li>Unaffected by nozzle dimension and tank obstacles</li> <li>Unaffected by gas phase</li> <li>Unaffected by DK value</li> </ul>
<b>Application observations</b>	<ul style="list-style-type: none"> <li>Weights &amp; Measures approval</li> <li>Larger error caused by gas phase</li> <li>Low DK value (&lt;1.6)</li> <li>Close to tank wall installations</li> </ul>	<ul style="list-style-type: none"> <li>Weights &amp; Measures approval</li> <li>Larger error caused by gas phase</li> <li>Low DK value (&lt;1.6)</li> <li>Bad stilling well</li> <li>Large changes in stilling well cross section</li> <li>Stilling well 150mm</li> </ul>	<ul style="list-style-type: none"> <li>Weights &amp; Measures approval</li> <li>Turbulent surfaces during filling</li> <li>Highly viscous media</li> </ul>
	→ Check your local approvals (no NMI/PTB for liquefied gases) → Proservo	→ Check your local approvals (no NMI/PTB for liquefied gases) → Proservo	→ Check your local approvals
	→ Proservo	→ Proservo	→ Use guide wires/stilling well Micropilot S → Micropilot S
	→ Proservo/ Levelflex	→ Proservo/ Levelflex	
		→ Proservo/ Levelflex	




### Inventory devices

	<b>Guided radar</b> Levelflex  FMP5x	<b>Radar</b> Micropilot M  FMR2xx	<b>Average temperature</b> Prothermo  NMT539
<b>Advantages</b>	<ul style="list-style-type: none"> <li>Unaffected by nozzle dimensions and tank obstacles</li> </ul>	<ul style="list-style-type: none"> <li>Unaffected by head pressure</li> <li>Unaffected by the viscosity of the media</li> </ul>	<ul style="list-style-type: none"> <li>Unaffected by head pressure</li> <li>Unaffected by the viscosity of the media</li> </ul>
<b>Application observations</b>	<ul style="list-style-type: none"> <li>Gas phase error 0.7%/m</li> <li>Weights &amp; Measures approval</li> <li>Strong build-up formation, high-viscosity, crystallizing media</li> </ul>	<ul style="list-style-type: none"> <li>Weights &amp; Measures approval</li> <li>Larger error caused by gas phase</li> <li>Low DK value (&lt;1.4)</li> <li>Close to tank wall installations</li> </ul>	<ul style="list-style-type: none"> <li>Weights &amp; Measures approval</li> <li>Pressurized tanks</li> </ul>
	→ Proservo	→ Check your local approvals (no NMI/PTB for liquefied gases) → Proservo	→ Check your local approvals
	→ Check your local approvals (no NMI/PTB) → Micropilot S	→ Proservo	→ Use thermowells
		→ Proservo/ Levelflex	

### Application guideline for selecting the devices



### Inventory devices

	Guided radar Levelflex  FMP5x 	Radar Micropilot M  FMR2xx 	Vibronic Liquiphant  FTLxxx 
<b>Advantages</b>	<ul style="list-style-type: none"> <li>Unaffected by nozzle dimensions and tank obstacles</li> </ul>	<ul style="list-style-type: none"> <li>Unaffected by head pressure</li> <li>Unaffected by the viscosity of the media</li> </ul>	<ul style="list-style-type: none"> <li>Proven "active" technology by leading oil &amp; gas companies</li> <li>Easy and understandable proof testing (high coverage)</li> </ul>
<b>Application observations</b>	<ul style="list-style-type: none"> <li>Gas phase error 0.7%/m</li> <li>Weights &amp; Measures approval</li> <li>Strong build-up formation, high-viscosity, crystallizing media</li> </ul> <p>→ Proservo</p> <p>→ Check your local approvals (no NMI/PTB)</p> <p>→ Micropilot S</p>	<ul style="list-style-type: none"> <li>Weights &amp; Measures approval</li> <li>Larger error caused by gas phase</li> <li>Low DK value (&lt;1.4)</li> <li>Close to tank wall installations</li> </ul> <p>→ Check your local approvals (no NMI/PTB for liquefied gases)</p> <p>→ Proservo</p> <p>→ Proservo</p> <p>→ Proservo/Levelflex</p>	<ul style="list-style-type: none"> <li>SIL2 &amp; 3 applications</li> <li>Continuous monitoring diagnostics</li> <li>Diverse compared to radar</li> </ul> <p>→ SIL2 or SIL3 approved by TÜV</p> <p>→ Liquiphant &amp; Nivotester</p> <p>→ Liquiphant – Vibronic</p>



#### Devices fit for purpose:

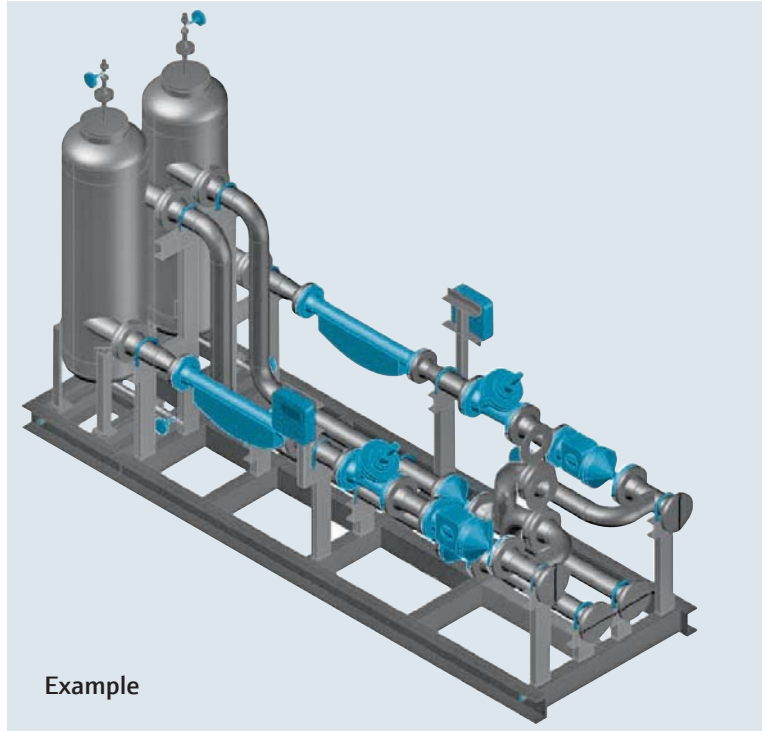
- Consider the best fit for the application

### Truck loading skids

Endress+Hauser partner for truck loading:  
 When considering truck or rail car loading, a skid is often the best option. Endress+Hauser has offered and installed many skids around the world based on our world-renowned Promass mass flowmeter.

As many products are transferred via mass to have a direct inline mass measure, this offers high performance and repeatability. But do not forget either that Promass also measures volume and temperature as well as density. Promass is also custody approved.

Skids comprise many components and variants. Our highly skilled and experienced teams at our Centers of Competence distributed around the world can handle all of them. Endress+Hauser is a partner that can offer the most effective combination of components from its own production and local requirements.



#### Devices used in truck loading & off-loading

Mass flowmeter Promass 84Fxxx		Batch controllers Vega T & II Vega T 329x & 429x		Additional components 3 <sup>rd</sup> Party	
<b>Advantages</b>	<ul style="list-style-type: none"> <li>No moving parts</li> <li>Multi parameter measurement</li> <li>Forward and backward flow totalizer</li> </ul>	<ul style="list-style-type: none"> <li>Unaffected by head pressure</li> <li>Unaffected by the viscosity of the media</li> </ul>	<ul style="list-style-type: none"> <li>Access controls units</li> <li>2-stage valve for improved batch control</li> <li>Analog valves offer improvement when used with liquefied gas loading</li> </ul>		
<b>Application observations</b>	<ul style="list-style-type: none"> <li>Mass for chemicals and LPG</li> <li>Custody approved for volume &amp; mass</li> <li>High-viscosity oils</li> </ul>	<ul style="list-style-type: none"> <li>Weights &amp; Measures approval with temperature compensation</li> <li>Valve and batch totalizer for batch management</li> </ul>	<ul style="list-style-type: none"> <li>Local selection is required for spares on site</li> <li>Sizing and application knowledge</li> </ul>		
	<ul style="list-style-type: none"> <li>→ Promass multiple options with 83 &amp; 84</li> <li>→ OIML R85 approval Promass 84</li> <li>→ No obstructions, reduced pressure drops</li> </ul>	<ul style="list-style-type: none"> <li>→ Vega II &amp; T</li> <li>→ Complete integration into Terminalvisionx</li> </ul>	<ul style="list-style-type: none"> <li>→ Local demands are fully considered and supported</li> <li>→ Specialist project engineers review and advise site engineers in the most effective selection</li> </ul>		

In addition to the indicated components above others may be required.

## Harmonized engineering processes

The project processes of Endress+Hauser have been designed to improve communication and collaboration, the quality of project results and, most important, customer satisfaction. Following a matrix structure, project resources are assigned to ensure that the right people are involved at the right time, utilizing flexible project teams that have clearly defined responsibilities.

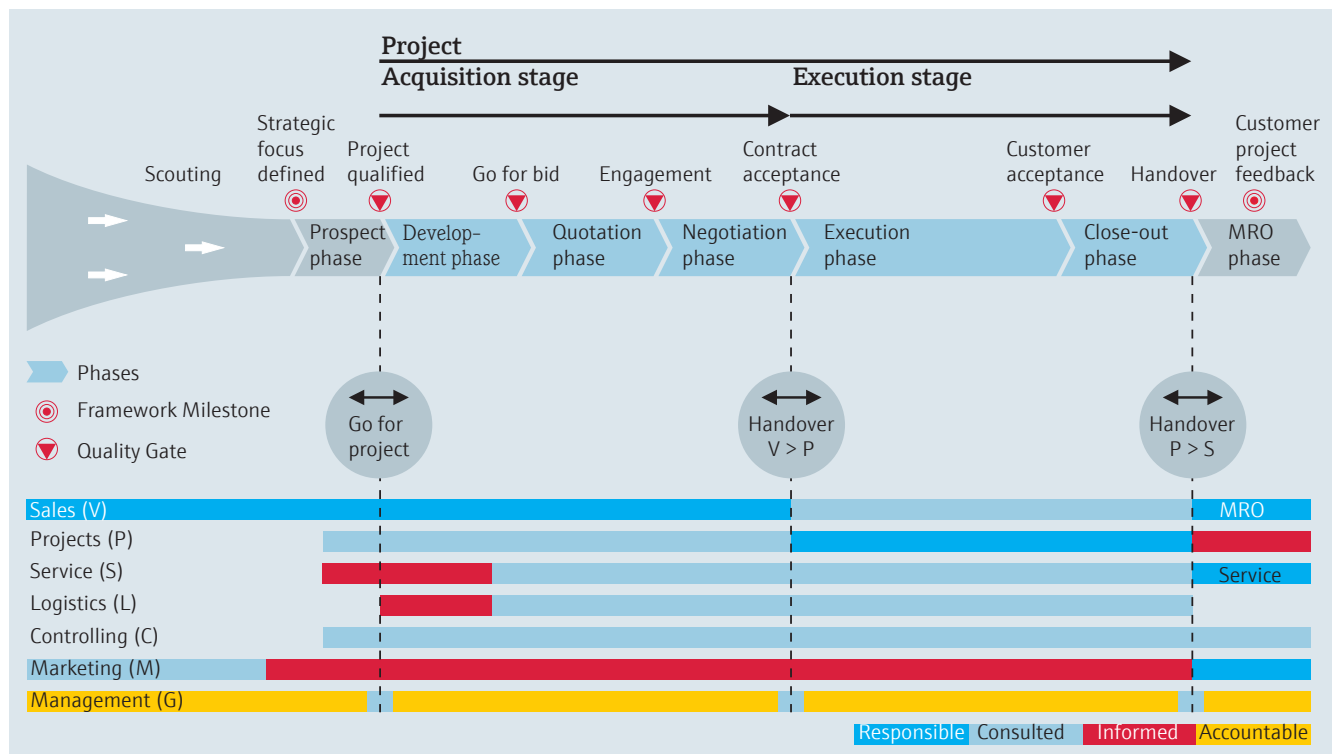
At the outset of a project, an accountable person is appointed to take ultimate responsibility for decisions, risk and quality management and to support the project manager. Then, at critical points in the project, additional risk management resources are introduced. Following a methodical process and involving the whole project team, the risk management process has four steps:

1. Risk identification
2. Risk analysis
3. Risk response planning (mitigation)
4. Risk monitoring and control

The system also utilizes a quality gate system, in which a verification checklist is agreed for each stage of the project. Fulfillment of each action on the checklist must be confirmed by the project manager and the accountable person before the project moves to the next phase.

### Endress+Hauser reduces your risk:

- The company is characterized by its highly stable, experienced workforce, who are true experts in their field.
- Harmonized standards that are used by Endress+Hauser worldwide.
- The flexibility to adapt services to enhance your business processes is a main skill.
- The high-level of collaboration and communication of information enables you to concentrate on your core business.



The Endress+Hauser project delivery methodologies (known as Standard 201), are standardized throughout the entire group, enabling the delivery of guaranteed quality from concept to completion, with reduced risk to you. In addition to this, Endress+Hauser engineers follow audited procedures that allow meeting ISO 9001 in standard project delivery for intelligent automation solutions.

### Customer benefits:

- Harmonized processes to deal with Endress+Hauser in project business.
- Clear communication and reliability.

- Doing the same things the same way, every time.

### Extract of accreditations:

- ISO 9001:2008 quality management system concerning design, manufacture, supply, service, maintenance, repair, calibration, supply of spares, associated equipment, accessories, project management of measurement instrumentation, automation instrumentation and intelligent automation systems for the process industries.
- OHSAS 18001 international occupational health and safety management system, embracing BS8800, AS/NZ 4801, NSAI SR 320 and a number of other publications.
- ISO 14001:2004 certification in recognition of our environmental management system.

# Centers of Competence

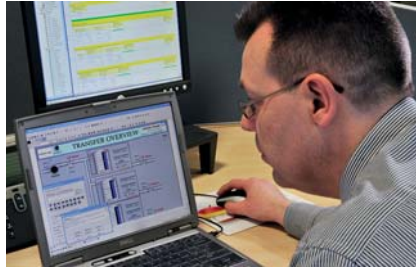
## Global hubs of industry and application expertise

Endress+Hauser has created a worldwide network of ten Centers of Competence, each specialized in one or two particular industries or applications.

### Endress+Hauser experts:



System engineers who fully understand your process automation requirements and can translate these into system designs that completely meet your needs.



Software engineers with a vast knowledge and experience in the most popular automation and control platforms used in the process industries.



Project managers to execute projects on time, on budget, safely, to your satisfaction, all in accordance with Endress+Hauser procedures and quality standards.



Project engineers who will design, test and commission engineered solutions that are specifically tailored to improve your automation and business processes.



Commissioning engineers who are fully trained and accredited to commission your projects safely and efficiently on-site, throughout all industries.



Design engineers and panel builders who work together to design, build and test the panels and enclosures that house our process automation equipment and networking components.



Highly experienced Tank Gauging specialists who spend considerable time in developing and improving professional training programs.



Engineers are fully qualified by Endress+Hauser's "Professional Master Class Qualification" program. This involves lectures based on traditional theory with practical exercises to reinforce the learning process.



## Service at all levels

The Endress+Hauser network of service engineers spans the globe ensuring that wherever you are based, you can benefit from our technical expertise and support. Service departments offer comprehensive maintenance contracts, Instrument Management Solutions (IMS), workshop repairs, spares management, on-site commissioning, trouble shooting, small installations and a technical service helpline providing telephone advice and support.



### Customer service at a glance

- Commissioning and installation
- Project management
- Preventive maintenance
- Spare part express service
- Training
- Helpdesk
- On-line documentation
- Asset management services
- Calibration services
- Verification

### Training: Investing in people

Specialized training provides your personnel with the required technical and functional knowledge. Endress+Hauser provides formal in-house training at our state-of-the-art classroom facilities, mobile training conducted at your location or distance learning courses and materials to suit your specific needs.



### Integration services

Regardless of your chosen solution, our support personnel are dedicated to solving complex problems with equipment and systems. Using this expertise, in open systems and proven technologies, Endress+Hauser provides you with the smooth integration of all hardware and software into your existing operations.

### Validation and calibration

Endress+Hauser provides regular maintenance, validation and calibration services from in-situ testing through to full, accredited factory calibration for all of your process variables.

## Life Cycle Management

### Installed base management

W@M – Life Cycle Management is an open and flexible information platform with on-site tools and services supporting you along the life cycle.

W@M provides up-to-date and complete information from engineering, procurement, commissioning through to operation, maintenance and the replacement of individual components.



## Endress+Hauser Tank and Terminal Management offers value to customers



Endress+Hauser provides a complete portfolio of instruments, systems and services for storage & distribution facilities. This is supported through our global network of specialist sales & services organizations.

Application knowledge and diverse integration capabilities enable Endress+Hauser to offer unique support concerning both legacy and migration requirements.

Investing steadily into tank management business we have been a reliable professional partner for our customers and will to continue in this way for another 50 years.

Endress+Hauser strives for high quality and value for the complete life cycle of projects and beyond.

[www.addresses.endress.com](http://www.addresses.endress.com)