



Between tank, tanker entrance and terminal

Operating and monitoring systems in tank farm management

by Horst Friedrich



Figure 1: Tank filling operation in a tank farm

Numerous operations are recorded and handled on local operator interfaces in tank farms. A large volume of input information must be transferred to higher-level systems for processing. This also includes safety precautions such as, permitting access operations once central databases have been checked. R. STAHL's operator interfaces provide convenient, flexible data acquisition and display functions for this purpose. They can be closely linked to the operating and control level by means of the non-proprietary OPC software interface. Security and safety functions, from simple access control systems to comprehensive, detailed electronic logging of all operator actions, can be implemented using a newly developed OPCOM-FDA server.

Operating and monitoring systems can be found at many stations in tank farms. They display operating modes, provide a clear picture of the filling levels of tanks, display measured flow rates, and provide information on ambient conditions such as, variations in temperature, in sensitive installation areas. They are also used for various monitoring activities such as, enabling filling of a road tanker and then authorizing it to exit the site. Loads are booked in and out with batch and quantity information, and storage periods or sales order details, such as deadlines and destinations, are polled, displayed or entered in operator interfaces. The operating and monitoring technology must not only provide flexible functions but must also quite often be designed as explosion-protected; particularly in tank farms handling flammable and combustible substances that may form an explosive atmosphere. It has long been known that hazardous substances in this sense not only include crude petroleum and raffinates for the chemical and petrochemical industry but also many basic materials for pharmaceutical products stocked in pressurized tanks. Even the food and beverage industry uses a number of hazardous substances, some of which may include the risk of explosion when handled.

Appropriate design of HMI solutions

Protection level aside, one of the key criteria for the decision in favour of an operator interface is the required performance, which may differ greatly depending on the application profile. Not every application requires colour changes, animations or other complex visualization features. In many cases, a simple bar graph with a few

indices or key figures will suffice to obtain the required overview quickly and to allow simple operating steps to be performed. It must also be noted that costs can be cut at many locations outside the hazardous zones by installing standard-version operator interfaces in the safe areas. However, neither explosion protected and non-explosion protected systems nor operator interfaces with differing levels of performance should differ so greatly in the way they operate, that using several types alongside one another becomes complex and entails major consequential costs. Explosion protected and non-explosion protected operating and monitoring systems from R. STAHL HMI Systems are therefore built on a common hardware and software basis. This ensures uniform programming, parameter assignment and operation throughout.

Typical tank farm operator interface

The Exicom ET-125 (Figure 3) is ideally suited for most of the typical applications between tank, tanker, entrance, and terminal. Its display has capacity for up to eleven lines of text or bitmap graphics. The display is legible even from a large distance at loading and unloading docks, for instance, thanks to up to 30 mm-high symbols and selectable backlighting. The ET-125 is suitable for outdoor installation even under extreme climatic conditions, since the device can be operated easily at temperatures between -20 °C and +70 °C. The front panel consists of plastic with a polyester film and glass (IP 65). In addition to an alphanumeric keyboard, the operator interface features 24 keys, 12 of which have LEDs. 25 dynamic elements can be displayed per page. The device even displays floating- →

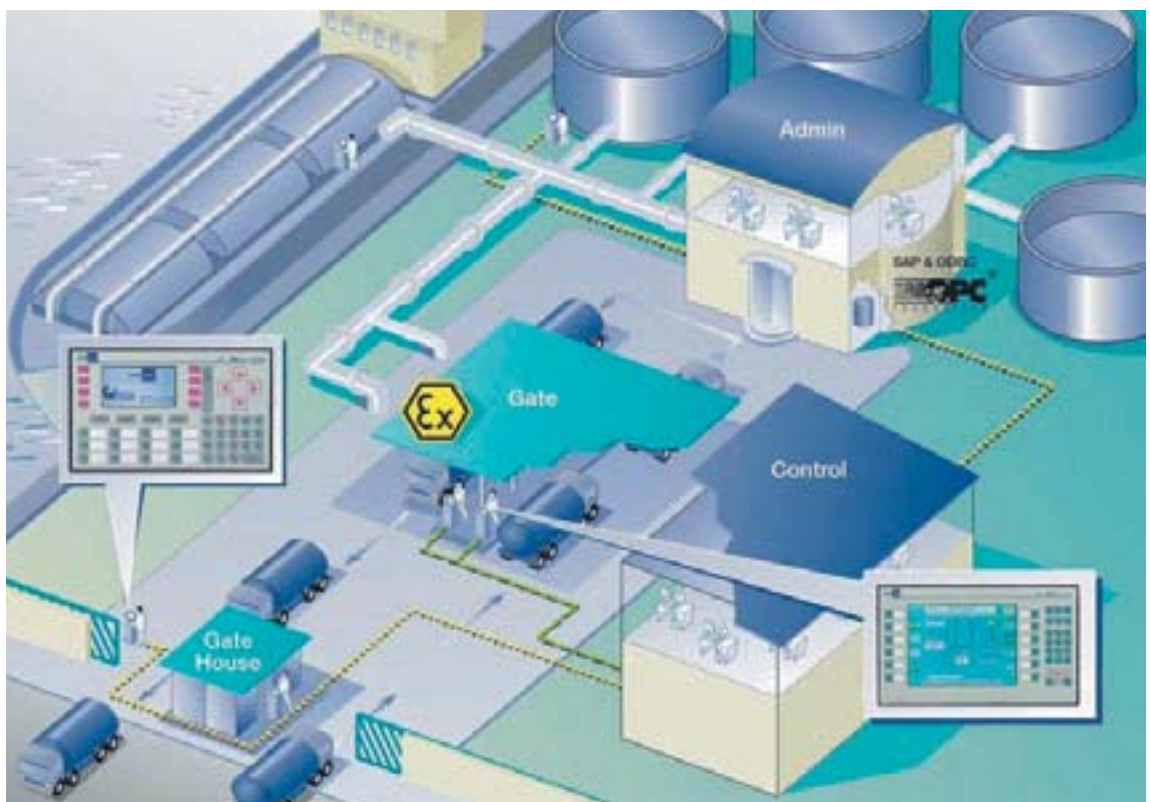


Figure 2: Operating and monitoring interfaces are used at many points between tank, tanker, entrance and terminal in tank farm management



Figure 3: The explosion-protected Exicom ET-125 graphic operator interface is available with card reader and other features

point numbers, which are particularly important for control-loop displays. The ET-125 features a real-time clock, a histogram memory for a maximum of 1,000 entries, and an integrated alarm management system for up to 512 faults. It can handle project planning for 100 process pages in three languages. The ET-125 complies with the requirements of ATEX Directive 94/9/EC for Category 2 equipment for hazardous areas due to flammable gases and combustible dusts with marking II 2G/D EEx ia T4 and FM Class 1 Div 1. If necessary, it can be equipped with shielded, protected cabling and installed in a field cabinet. In addition, special peripherals ranging from explosion protected heaters through to various intrinsically safe barcode and magnetic card readers or radio transponder receivers are available for the ET-125, as is the case for all other STAHL explosion protected device types.

Data for all levels

Ease of handling aside, the efficiency of local operator interfaces primarily depends on how they interact with higher-level systems. Speed, reliability and completeness of data transfer have a direct or indirect impact on virtually all operational workflow. It has long been recognised, for instance, that local operator actions are not only relevant to load handling in the case of inward and outward goods transfers, but that the relevant input data must also be available in full, and at short notice at other locations in the company. The more seamless the data alignment with the control level, the faster the billing can be performed, and the more precise and up-to-date the key figures and indices will be concerning stock levels, utilisation of capacities, processing times, and defect frequencies. Operator interfaces should therefore also create alarm logs, message logs and event logs for their installation areas and transfer them to process control systems in an appropriate format, in addition to recording the actual handling information.

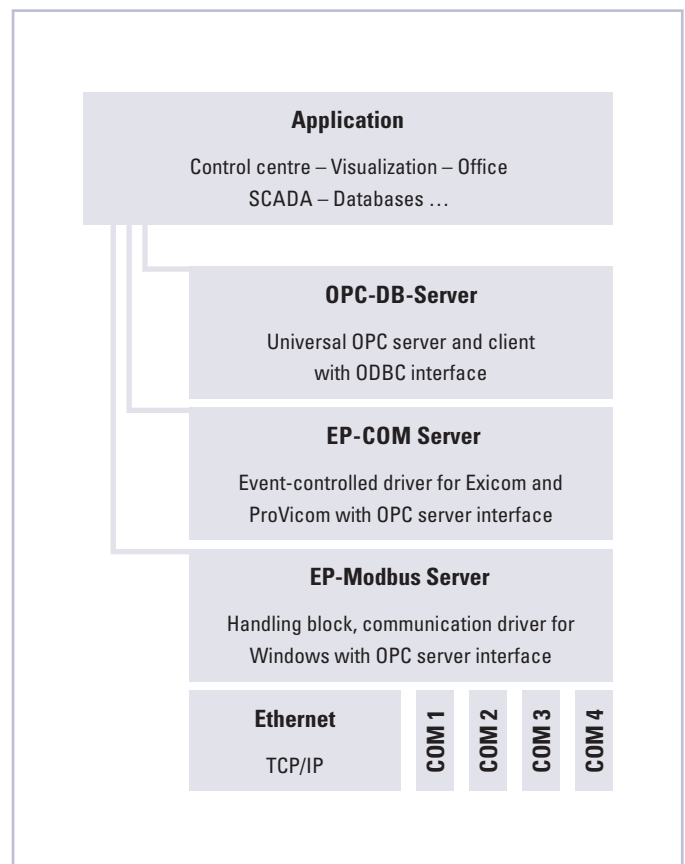
Fully networked via OPC

Exicom and ProVicom operator interfaces allow data exchange with SAP systems as well as interacting with ERP applications or databases via ODBC-API. The non-proprietary OPC software interface can be used for interacting with a wide variety of software applications – ranging from large database systems through to office applications, corporate management level or SCADA systems. OPC (OLE for Process Control) is based on the Microsoft COM and DCOM technologies for distributed applications within a computer or computer network. The OPCom package, which provides suitable drivers for all applications (Figure 4), is available as an add-on for R. STAHL's SPSPPlusWIN project planning software. This allows for a Modbus-OPC server, as required for many SCADA systems, to be set up and configured interactively with only a few clicks of the mouse.

Example: access control

One common tank farm application is access control: various areas are secured via operator interfaces where users must identify themselves. In addition to managing graded access authorisations, a SCADA system (Supervisory Control and Data Acquisition) also logs the actual access operations permitted. The screen layout and input masks for this are created using SPSPPlusWIN. An OPC server is used to ensure that data received via the keyboard, touch screen or card reader and initially saved in the operator interface can also be directly accessed from other points within the corporate IT system. In addition, the OPCom package also includes an OPC-DB server facilitating the interaction with database systems such as Oracle and MySQL. All OPC interfaces are configured and connected to the screen pages of the visualisation system in SPSPPlusWIN. After a project has been created with visualization for a target device, alarms and variables etc., it can be added to an OPC server project by dragging and dropping,

Figure 4: OPCom provides interfaces to the control level and allows comprehensive data exchange with software applications and databases



after assigning all required interfaces to the device project. All process connections configured on the operator interfaces are thus also available to other applications. The OPC server and OPCom, which handle communication in relation to access authorisation mean that there is no need for conventional links to the control centre or control room, such as VT-100-based connections.

FDA-compliant on request

In conjunction with a newly developed OPCom-FDA server and an appropriate database, the R. STAHL operator interfaces also support full, traceable and tamper-proof documentation of all operator actions. This means that the operator interfaces operate as closed systems as defined by Directive FDA 21 CFR, Part 11, which contains what is perhaps the most comprehensive documentation regulations for computer-aided automation in industrial applications. In parallel with the interface to the automation system, the HMI devices communicate directly with an OPC workstation in the network via Ethernet or via PLC. Access operations are authorised or electronic user signatures authenticated and logged, for instance in the network, via the OPCom-FDA server. The server accepts the entries at the operating terminals on the one hand, and consults the customer's own central user management system on the other. The ODBC interface is used to transfer both electronic signatures and complete electronic data records of a transaction - to an existing SQL database, for instance. The system thus guarantees an audit trail as defined by the FDA Standard.

Summary

Operator interfaces at access control points, output stations or in tank farm storage facilities not only need to acquire and display a great deal of operating and sales order information but must also be able to exchange this data with servers and software applications at the operating and control level, above all quickly, comprehensively and conveniently. The required, high-performance link between operator interfaces and the control level, and to management or security databases is established via the OPCom package for the SPSPlusWIN project planning software which creates a uniform OPC client-server architecture. Moreover, the operator interfaces are even suitable for installations, that require mandatory validation pursuant to the FDA Directive 21 CFR, Part 11, in conjunction with the optional OPC-FDA server.