

## BENEFITS OF MODERN OVERFILL PREVENTION SYSTEM

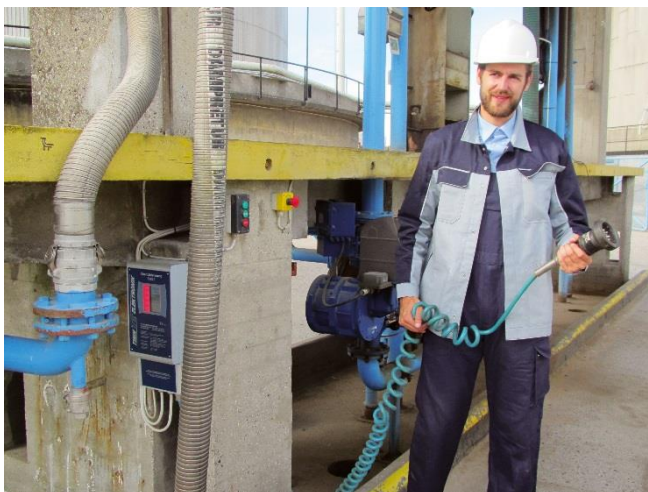
### OPTIMIZE PROCESSES WITH REGARDS TO TIME, SAFETY & COSTS

#### PRACTICAL EXPERIENCES

Bottom loading for petroleum tank vehicles has proven to be a reliable and efficient technology for over 50 years. It enables for high-speed filling with typically 2300 l/min of various products simultaneously, increases work safety for truck drivers and protects the environment by means of a vapour recovery system. The technology is primarily standardized based on API RP 1004<sup>1</sup> and further specified by international standards, e.g. European Standards. Essential to bottom loading applications is the overfill prevention system with the main processing unit, the overfill prevention controller.

Even though bottom loading is used worldwide as industrial practice, several inefficiencies and potential endangerments still arise by using inadequate equipment or misguided processes. With relation to the crucial overfill prevention system, the following practical experiences describe daily situations on loading terminals:

1. The truck driver does not get a permissive when connecting the overfill prevention system, the loading bay is blocked and the supervisor must rush to the bay in order to get the situation solved. In this case it would be essential to give the truck driver immediate information to enable him to solve the problem on his own. Besides, all relevant data from the installed equipment should be available at the supervisor's control room, so that he can assess the situation and dispatch required action. When considering to operate a terminal complete manless, full data transfer is a compulsory premise.
2. Very often poor maintained or manipulated tank vehicles put the whole terminal at a risk. Obviously such vehicles should be banned from loading, but not every overfill prevention installation is capable to detect common inadequateness like for instance faulty/bridged level sensors or not wired earthing connections. Even worse, some installations invite to ignore maintenance lags or to do manipulations by offering a bypass to override any detected inadequacy.
3. The truck driver is in a hurry and forgets to release the truck connector plug of the overfill prevention system. A drive-away with attached connection results into a dangerous situation



Truck driver operating at bottom loading

and goes along with costly damages at the loading gantry and a long term breakdown. Even when the truck driver loosens the connection correctly, it often happens that the plug drops to the ground and not stored at a safe position. When the next truck runs over the connecting cable, in most cases the cable will break and needs to be replaced. Until the cable will be replaced, the loading gantry cannot be used.

Modern overfill prevention controllers help to improve situations described above and increase safety and efficiency of loading terminals.

<sup>1</sup> American Petroleum Institute Recommended Practice for Bottom Loading and Vapour Recovery

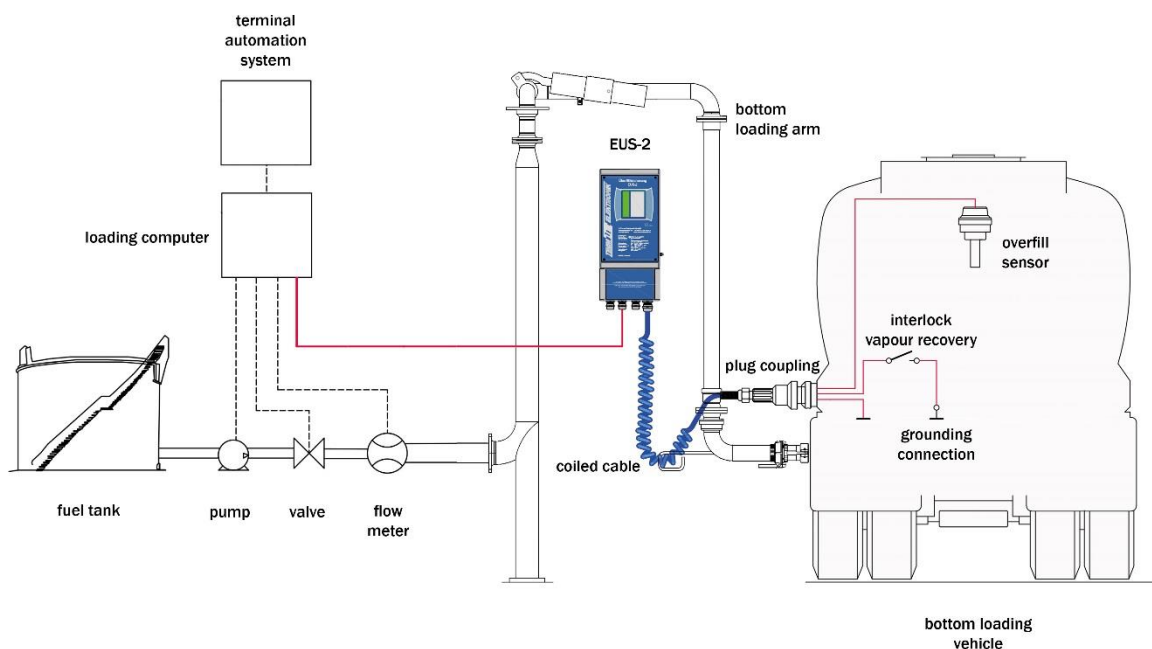
## ABOUT OVERFILL PREVENTION

When liquids are loaded into tank vehicles, the mass flow to each tank compartment is controlled by a preset loading meter. When the preset quantity is accomplished, the loading meter actuates a control valve to stop loading. To disarm situation like the following:

- False determination of the residual filling capacity
- Operating errors by the truck driver at the loading computer
- Technical errors on the loading preset or the primary shutoff valve

an independent secondary shutoff control system is mandatory at bottom loading gantries. The main tasks of this so called Overfill Prevention System is to prevent that the maximum filling level of a tank compartment gets exceeded and to avoid a product spill and subsequent dangerous situations.

Worldwide overfill prevention installations on tank trucks and loading gantries for bottom loading are mostly standardized according to either EN 13922 (European standard) or API RP 1004 (American standard). Besides monitoring the safe filling of liquid fuels, this system conducts the electrostatic grounding and assures a proper connection to the vapour recovery system during the loading process. Level sensors inside the compartments on top of the truck are connected to the overfill prevention controller, that monitors the filling by a standard plug and socket connection between truck and stationary controller located directly at the filling gantry. The level sensors inside the compartments are positioned in such way that once a sensor gets activated, product flow stops before a compartment gets overfilled with liquid, which would risk a spillage of the liquid into the environment or even worse, cause the compartment to burst. When a sensor senses liquid, the controller automatically shuts down the filling process for all compartments to prevent possible hazards or any harm to the truck and the loading bay.



Scheme of an overfill prevention system

The existing standards require the overfill prevention controller to be wired to the loading computer/bay control system by simple binary contact outputs stating “permissive” or “non-permissive” for the loading process. The failure proof permissive signal is given only, when all level sensor are dry, the electrostatic grounding is established and a vapour recovery hose interlock switch is attached.

In case of an overfilling, the display of the overfill prevention controller indicates which compartment is overfilled. Consecutive to the basic standards, the requirements by tank farm operators have progressed towards more sophisticated features of overfill prevention controllers, to ease installation and maintenance procedures, to improve the management of the facility and to make loading bay operations much easier.

## BENEFITS OF MODERN OVERFILL PREVENTION SYSTEM

### 1. CONNECTING BOTTOM LOADING VEHICLES TO OVERFILL PREVENTION SYSTEMS



Connected bottom loading equipment

Bottom loading vehicles according to European Standard EN 13922 or American Standard API RP 1004 are in the field using tanks with up to 8 or 12 compartments. For detecting an overfilling each compartment has one sensor or sensor circuit separately. Type of sensors are NTC (negative temperature coefficient) thermistor sensors, optical sensors or other compatible devices which provide a state signal to the overfill prevention controller. Wiring of the sensor system may be a 5-wire or a 2-wire connection to a standardized interface socket onboard of the vehicle to connect to the overfill prevention system. This interface socket has 10 or 6 electrical pins, depending on the applied overfill prevention standard. In

addition, bottom loading vehicles shall provide a vapour recovery hose interlock switch as well as a fail-safe earth static bonding connection from the vehicle chassis to the interface socket.

#### **Solution by EUS-2 Overfill Prevention Controller by Timm Elektronik:**

Provides an automatic detection of the vehicle installation, wiring of sensor system and type of sensors as well as state of sensors, earth static grounding and vapour recovery interlock switch without any need of adjustment by the truck driver.

### 2. DATA COMMUNICATION TO PROCESS CONTROL SYSTEM

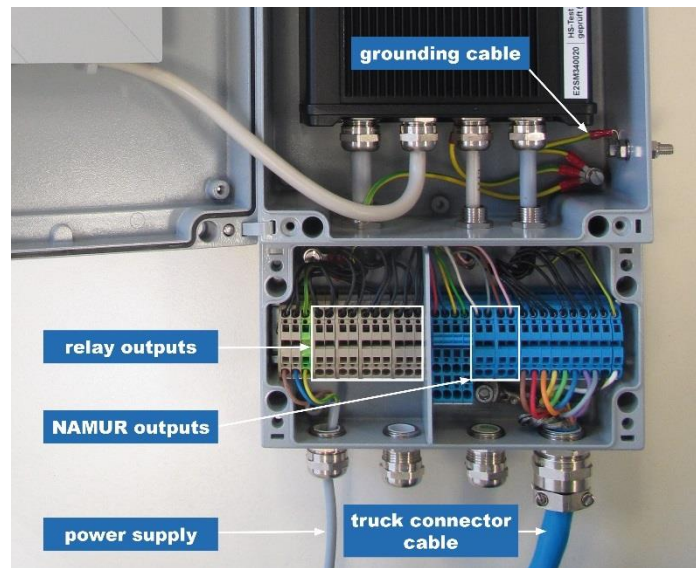
An overfill prevention unit provides analog signals (e.g. "permissive" to permit or "non-permissive" to stop bottom loading) to the process control system and optical indicators to operators. To obtain a safe loading/unloading process a normally open output contact shall be non-permissive and switches to permissive only when all input conditions are correct (earth static bonding verified, all sensors dry, no overfill prevention system malfunction). Analog interfaces must be explosion proof for gas hazardous areas as well as additional network data interfaces to transmit information to terminal management software. In order to achieve highest levels of safety and efficiency in the loading processes, the integration of overfill prevention controllers to process control systems with suitable network data communication is recommended.



## Solution by EUS-2:

### Analog Communication

EUS-2 uses different types of control outputs (relays and NAMUR-signals) to provide information about grounding, filling process, overfilling and parking position. A special feature to increase the level of safety when transmitting information from the overfill prevention controller to the loading control system are NAMUR output signals. The NAMUR outputs are two-wire transmitting a status signal by using a current value of over 0.4 mA, which correlates with specific values of current and voltage. Advantage of using NAMUR-signals is given by the ability to identify a faulty cable connection as this lead to current values out less than 0.4 mA. Any broken or short-cutted connection can be detected.



EUS-2 control outputs

### Network Data Communication

In addition, EUS-2 offers an intrinsically safe data bus interface to receive/transmit information to a terminal management software or external process control system. This allows for an intelligent central control as well as an efficient failure diagnosis to identify sources of error in the bottom loading process (e.g. missing vapour recovery or overfilled compartment) by remote control. Thereby tracing the particular number of overfilled compartment is possible. In addition, EUS-2 transmits type and status of all level sensors, total number of compartments of the connected tank truck and operational mode or error messages. The intrinsically safe data bus system is also capable to interconnect with other devices like card readers and terminals and brings this communication to a single connecting interface for the Terminal Automation System.



Intrinsically safe data bus interface

## 3. INSTALLATION OPTIONS

For maximum efficiency, the installation of the overfill prevention controller must meet the requirements of the operator. There are different opportunities for installing the overfill prevention controller at the loading bay.

### 3.1. INSTALLATION ON LOADING RACK

This is a simple and budget-friendly solution where the truck connector cable is directly connected to the device.

**Solution by EUS-2:** The terminal box is integrated into the overfill prevention controller, therefore no additional terminal box is needed.

### 3.2. INSTALLATION ON LOADING RACK WITH BREAKAWAY COUPLING

For easy changing of cables and prevention of extensive damages on loading racks caused by moving tank trucks still attached to the overfill prevention controller, a disconnecter socket junction box is recommended. The truck connector cable detaches from its junction box. The rack can still kept operating while repairing broken connections. The junction box is directly connected to the overfill prevention controller and includes a disconnecter socket for flexible changing of truck connector cables.

**Solution by EUS-2:** Optionally, the disconnecter junction box is also available with a so called “parking socket” – a park position detector for the truck connector plugs. This feature was invented to help prevent “drive-away” incidents. As soon as the truck connector plug is connected to the parking socket, the device is able to signal the release by e.g. a connected signal light and/or a bay barrier. There is not only prevention of extensive damages, if a connected truck drives away, but also a preventive measure in the form of signals for the truck driver.

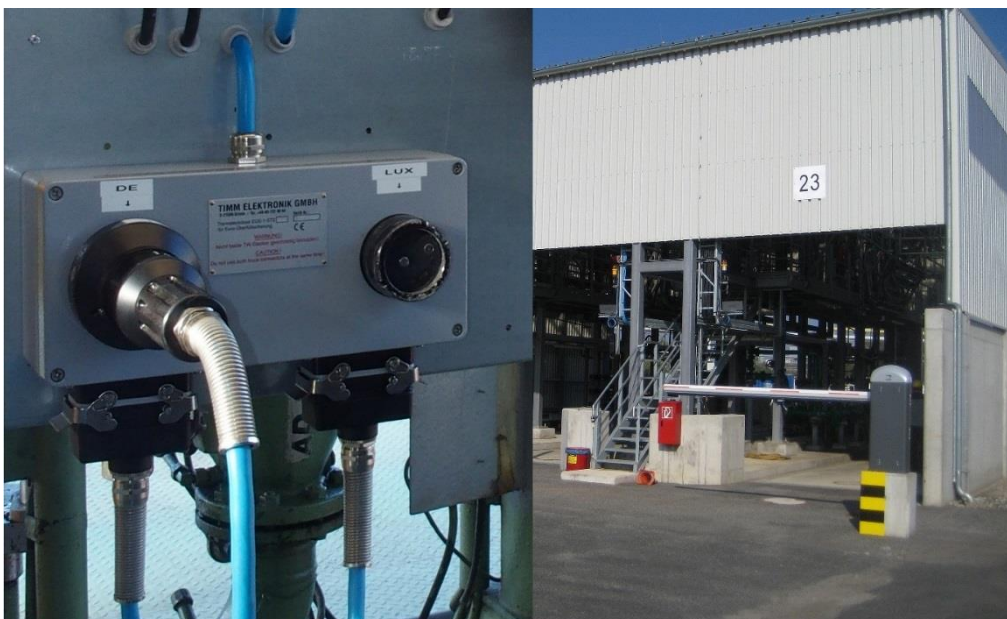


Disconnecter junction box with parking socket

### 3.3. INSTALLATION FOR DIFFERENT OVERFILL PREVENTION VEHICLES

On smaller facilities (depots) with irregular loading patterns and different kinds of overfill prevention vehicles (acc. to European Standard EN 13922 or American Standard API RP 1004) an overfill prevention controller is recommended, that fits and detects both standards.

**Solution by EUS-2:** A dual junction box directly connected to the overfill prevention controller can be fitted with two truck connector cables according to different standards (EN 13922 and API RP 2004). Optionally, the dual junction box is also available with breakaway coupling and parking socket (see [3.2.](#)).

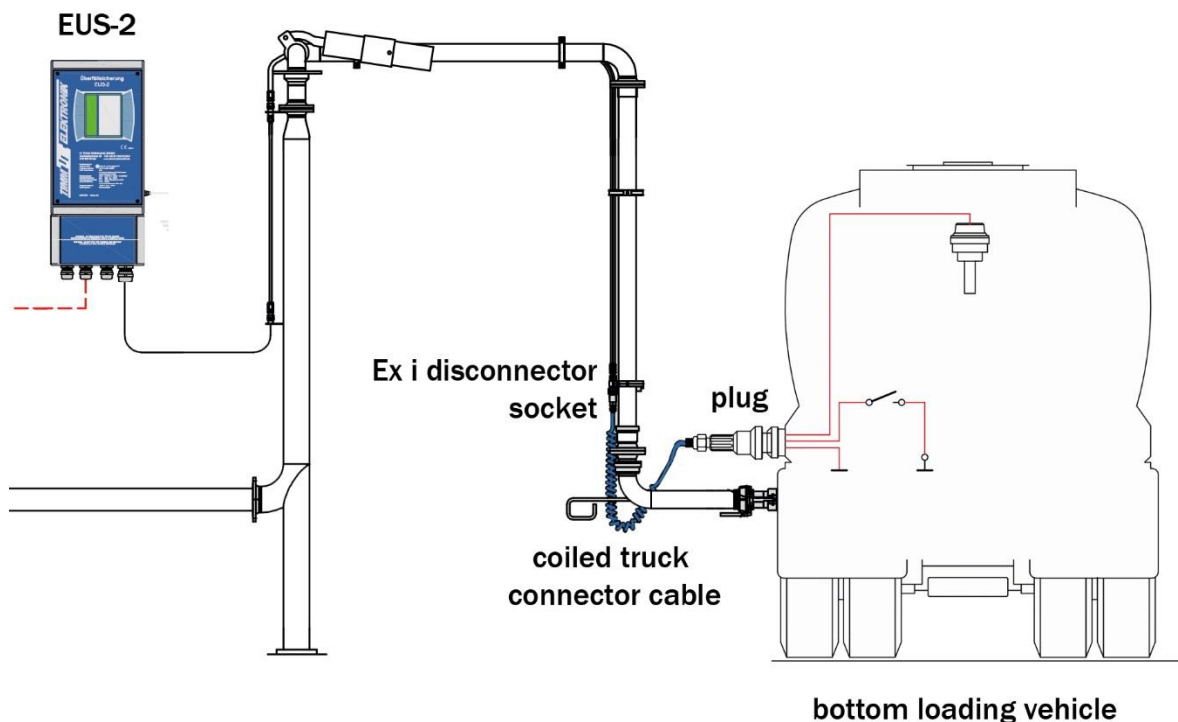


Parking socket next to barrier control

### 3.4. INSTALLATION ON VAPOUR RECOVERY ARM

The truck connector cable with truck connector plug can also be mounted on the vapour recovery arm (close to the coupling). Using this kind of installation you only need one move to get both, vapour recovery arm and truck connector cable. Moreover, there is a reduction of trip hazards, because the cable is directly mounted on the vapour recovery arm and doesn't lie on the floor between overfill prevention controller and vehicle. There is also the option to get this solution with an additional parking socket (e.g. for control of traffic lights or a barrier).

**Solution by EUS-2:** Disconnecter socket including vapour recovery installation set. Available with plug hanger or parking socket.



Installation on vapour recovery arm

## 4. INTUITIVE HMI (HUMAN-MACHINE INTERACTION)



To ensure an optimized process flow at the loading gantry, modern overfill prevention systems can be operated intuitively through a plain text message display. With data bus linkage it is possible to set the display language individually and automatically correct for the operating truck driver. The release status can be identified quickly by clearly visible multicolor LEDs at the front of the overfill prevention controller. In case of failure the operator can read the auto-diagnosis information directly at the display.

**Solution by EUS-2:** The large graphic display and the joystick control inside the housing, easily accessible on the backside of the front cover, simplify the commissioning of the EUS-2 Overfill Prevention Controller. The main menu contains settings for language, values, relay outputs, interface, default, reset, system info and the display and can be operated intuitively.



## 5. MAINTENANCE

Efficient maintenance processes are especially important at loading terminals with high pass-through rates. Downtimes can upset the truck drivers' plans and lead to high costs.

### **Solution by EUS-2:**

The EUS-2 Overfill Prevention Controller is designed under the intelligent explosion protection concept (IEPC) that is unique to Timm Elektronik. It includes an intelligent combination of various protection methods. With no flame proof enclosure required, the device can be safely worked within the hazardous area for configuration, maintenance or changing of cables.

The EUS-2 is built as an intrinsically safe device, as opposed to traditional equipment that utilize Ex d enclosures. This eliminates the need to remove and replace numerous fasteners to access the (typically around 20 bolts) and reduces potential damage to flame paths and labor costs associated with mandatory hazardous area electrical inspections or replacement of broken truck connection cables.

The control unit is fully operational with the factory setting (delivered state from manufacturer). All configuration is optional.





Opened housing of EUS-2 Overfill Prevention Controller



## TECHNICAL DESCRIPTION:

## “EUS-2 OVERFILL PREVENTION CONTROLLER” BY TIMM ELEKTRONIK

Type of Protection:	According to ATEX-standards 2014/34/EU:  II 2 [1] G Ex e ib q [ia Ga] IIB T4 GB
EC Type Examination:	TÜV 13 ATEX 132121
Power Supply:	230 V AC $\pm$ 10 %, 50-60 Hz, ca. 25 VA type of protection “increased safety” Ex e
Output Circuits: Contact Circuits (K1 to K4)	Max.: 250 V AC, 3 A, 100 VA type of protection “increased safety” Ex e
Output Circuits: Electronical Outputs (E1, E2)	Max. values of the certified intrinsic circuits: $U_i = 15$ V; $I_i = 20$ mA, $P_o = 300$ mW Type of protection “intrinsic safety” Ex ib NAMUR compatible
Serial Data Interface:	Type of protection “intrinsic safety” Ex ib, TExi data bus
Level Sensor Circuits:	Type of protection “intrinsic safety” Ex ia
Truck Connector Cable:	PUR-special cable, blue, single shielding 10x 1 mm <sup>2</sup>
Truck Connector Plug:	Standard: 10-pole (according to EU-standard and API thermistor) Option: 7-pole (according to API standard “optical”)
Protection of Enclosure:	IP67
Operation Temperature:	- 40 °C / + 60 °C
Dimensions (W x L x H):	220 mm x 360 mm x 120 mm
Awards:	 Tank Storage Award 2017 in the category “Most invaluable product”





## ABOUT TIMM ELEKTRONIK

Timm Elektronik, located in the Northern Part of Germany, is a specialized developer and producer of electronic measurement and control devices for use in hazardous environments since 1963. We are the Global Leader for Grounding Control Devices. The intelligent explosion protection concept (IEPC), that is unique to Timm Elektronik, allows easy commissioning and maintenance while adhering to highest safety standards. Prevalent application areas are the petrochemical and chemical industry. Our products provide safe loading and unloading of inflammable liquids as well as qualified access control to hazardous areas.

Together with our global business partners we supply our products around the world by taking the individual requirements of our customers to achieve a suitable application solution.



Headquarters in Glinde (next to Hamburg)

## FOR MORE INFORMATION

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