



identiFUEL™ System Overview

Fueling Automation System

Executive Summary

identiFUEL™ is a set of easy to integrate components for Fuel Management Systems (FMS), enabling fleet managers to monitor and control the fuel costs and billing of commercial fleet vehicles. FMS maintain customer databases, business rules, vehicle pump interfaces, record transactions etc. An FMS implements the identiFUEL RFID components to uniquely identify, authorized vehicles and drivers to dispense fuel.

Fuel Management Systems are specifically used for commercial vehicle fleets that are filled from dedicated fueling stations. For example:

- Airport maintenance and operation vehicles
- Mining or construction vehicles
- Bus coaches
- Etc.

An FMS ensures fuel is only dispensed to authorized vehicles and accurately charged to the correct account. Fueling is automatically suspended when the nozzle is removed to prevent fueling un-authorized vehicles or jerry cans. This is detected and controlled via RFID technology. For fleet refueling services, fleet managers gain better cost control and maximize savings with detailed reporting on fuel consumption and remote control of authorized vehicles and drivers accessing fuel.



In retail, an FMS can also be a strong customer loyalty driver, as vehicles equipped with this vehicle identification technology will buy fuel from corresponding RFID enabled stations to enjoy the benefits of cashless payment and speeding up the fueling process (just drive by and fill the car).



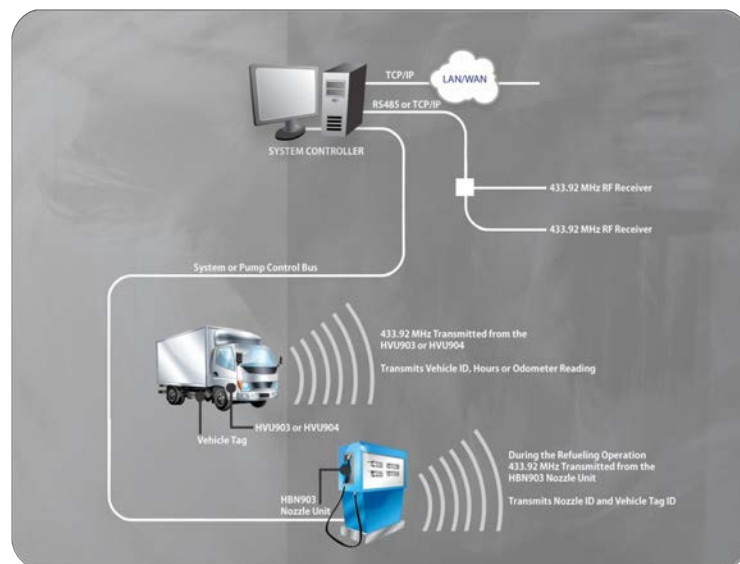
identiFUEL™ Components

identiFUEL consists of the following primary components, which represent the RFID front-end to be integrated into a partner's FMS:

- **Vehicle Tag:** Simplifies vehicle identification. The maintenance free, passive RFID tag is mounted on the vehicle in close proximity to the fuel filler pipe and uniquely identifies the vehicle to the Nozzle Unit. The tag can be programmed to contain specific product type information, e.g. Diesel, Petrol, etc. – therefore, allowing the system to prevent fuel contamination.
- **Nozzle Unit:** A robust RFID reader that is attached to the fuel dispensing nozzle. When the spout makes connection with the fuel filler pipe, the vehicle tag is read by the nozzle unit. Data is transmitted to the Wireless Controller via an UHF data link.
- **Wireless Controller:** Is a unit that receives data from identiFUEL™ Vehicle- or Nozzle Units and forwards this information to a central Fuel Management System (FMS). It also starts or stops fuel dispensation based on FMS business rule decisions.
- **Vehicle Unit:** Is an active unit (optional) that is installed in each fleet vehicle, connecting to odometer and ignition. The vehicle unit transmits relevant information to the Wireless Controller via the same encrypted UHF link as the nozzle unit. The unit reports on the distance driven since last fueling and the engine running time, which provides valuable input for central statistics on vehicle utilization.

The basic system described above, is authorized per transaction on the vehicle's identity. In addition, the system can be configured using the following more advanced operational modes:

- 1) Wireless Controller will only authorize a transaction if a vehicle unit and tag are present on the vehicle. Here, the tag and vehicle unit are programmed with the same information and only when the Wireless Controller sees (via a nozzle unit) identical corresponding data, will it authorize a transaction.
- 2) Instead of using a Nozzle Unit reader, RFID tags could be mounted on the nozzle and read by the Vehicle Unit which transmits the nozzle and vehicle data via the wireless controller to the FMS for fueling authorization and reporting.
- 3) Optionally, an RFID based driver ID e.g. in the form of an ISO card badge or keyfob may be added as additional authorization precondition on top of the vehicle ID.



Equipment Installation

Installation of nozzle unit at each refueling point



Figure 1: HBN905 nozzle unit base (top), ZVA SL2 Nozzle (middle), HBN905 nozzle unit lid and 5 screws (bottom)



Figure 2: Insert ZVA SL2 into HBN905 base



Figure 3: Place lid on base and insert and tighten 5 screws, DONE



Figure 4: Completed Installation

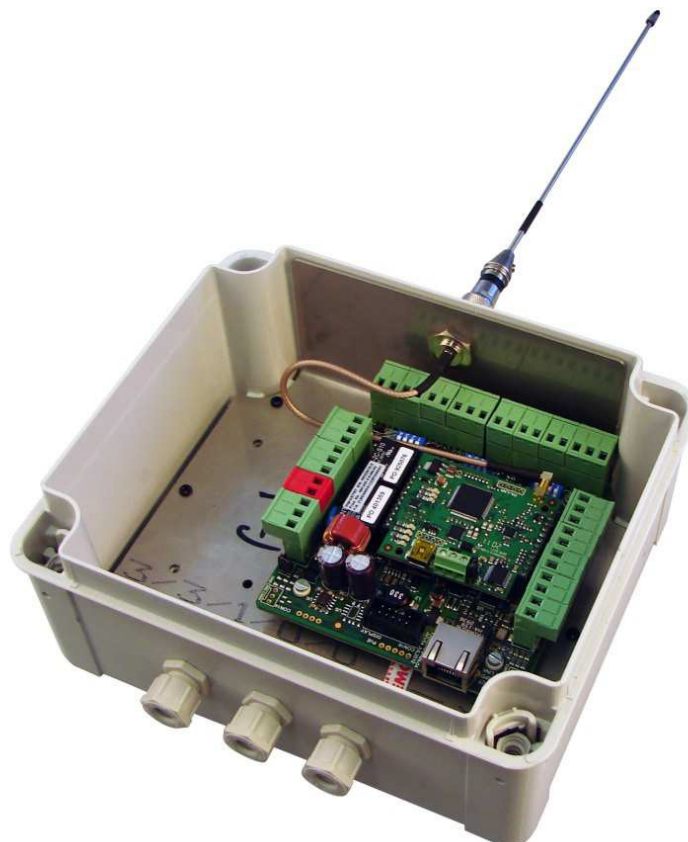
Nozzle Unit Benefits

- Simple installation on various standard nozzle models
- Fully encapsulated
- ATEX/IECEX compliant
- Long battery life-time (approx. 3 years with 200 min. activity per day)
- Completely wireless operation
- Automated activation / deactivation through motion sensor
- LED shows device ready or reading status
- Proven robust, fuel resistant, anti-static housing

Wireless Controller (site receiver)



Figure 5: Wireless Controller (receiver) in optional plastic housing



The Wireless Controller receives via a proprietary encrypted 433.92 MHz wireless data link the transmissions from the nozzle or vehicle units at the fueling site. Installation occurs in an appropriate position within the site office and required proximity of the interface to the third party system through RS232 / RS485 / USB / Ethernet.

The Wireless Controller verifies vehicle data prior to authorizing a transaction. If the information is correct, the transaction is authorized through a “Nozzle In” event which is sent to the FMS. The FMS will then apply further authorization decisions based on whether the vehicle is authorized in a database.

When the nozzle is removed from the inlet, the nozzle reader will not be able to read the tag anymore and report a connectivity change to the Wireless Controller. The Wireless Controller then issues a “Nozzle Out” event to the FMS. Thus the system is able to prevent fuel from going into an unauthorized vehicle or jerry can.

Requirements & Specifications

- Requires DC power supply.
- Supplied with an optional waterproof IP67 enclosure.
- Four (4) holes need to be drilled to fix affix this unit to the surface of installation.
- A variety of antennas are offered with the Wireless Controller. The installation site may dictate an optional antenna using a 10m low loss coaxial cable for a more optimal antenna positioning if needed.
- An optional LF RFID or Magstripe reader may be connected to verify a driver’s or fueling attendant’s badge for additional authorization and reporting.

Fueling Wireless Controller Benefits

- Simple installation
- Outdoor environment resistant housing
- Multitude of connectivity options
- Triggers fuel dispersion based on FMS decision
- Encrypted communication to Vehicle - and Nozzle Units
- In-field firmware upgradeable

Vehicle Tags



Figure 6: identiFUEL RFID vehicle tags

Multiple passive LF RFID vehicle tags are available to cater a variety of application conditions. There are a number of fastening options available.

- 1) Pop-rivet
- 2) Screw
- 3) Adhesive
- 4) Adhesive tape

It is intended that the tag is installed in close proximity to the fuel filler pipe of a vehicle and positioned for easy readability by the nozzle unit during fueling. The data on the tag identifies the vehicle and the type of fuel needed.

Tags are available in destructible formats. The tag is destroyed if removed after installation.

Vehicle Tag Benefits

- Compact design
- Maintenance free passive RFID technology
- Anti-tamper function - destruct if removed
- ATEX/IECEX compliant
- Variety of form factors to fit all vehicles types
- Rugged, waterproof and fuel resistant
- Simple installation
- 10 byte programmable storage, proprietary encoded
- Data validation through parity and 2 byte CRC
- On- and off-metal options

Vehicle Units (HVU)



Two vehicle unit options are available. Although functionally identical, the one option is more robust designed for harsher environments and is housed in an extruded aluminum housing and encapsulated in polyurethane. Second option, is a lower cost unit with custom plastic injection molded housing.

The installation details depend on how the unit is intended to operate.

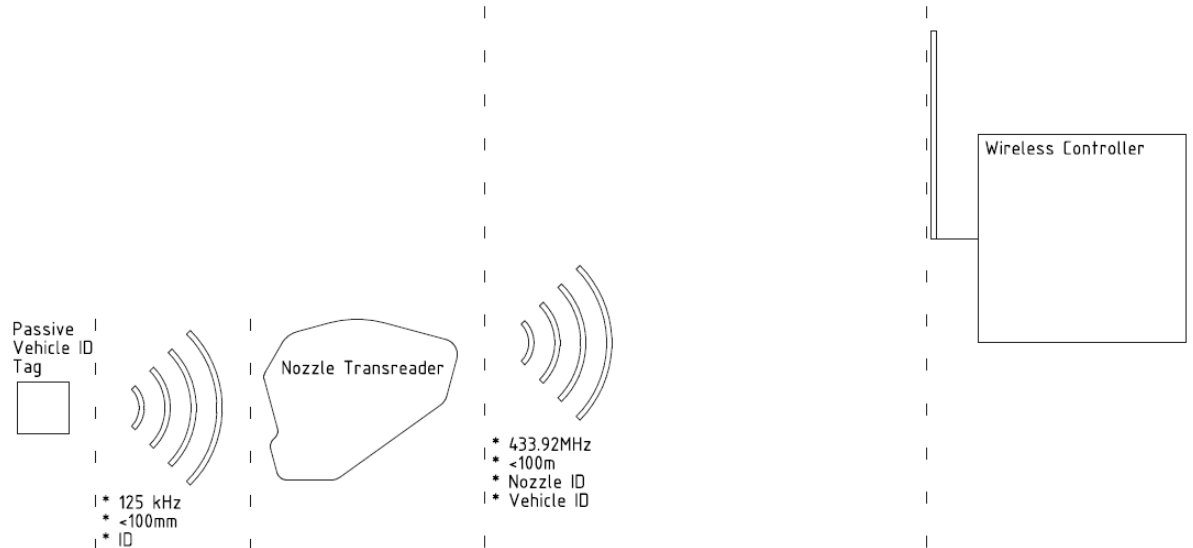
- 1) The most basic operation requires connection to power (12V or 24V) and ground, plus an engine-on signal for timing of the engine running hours.
- 2) An optional odometer pulse input is provided as a valuable option. An odometer pulse signal is obtained from existing vehicle electronics or a pulser unit powered by the vehicle unit may be provided. There are a variety of pulser options available, but the most simple to install is a magnetic probe to pick up the presence of magnets that are installed on a rotating shaft. Using this option will enable the vehicle unit to automatically report on the distance driven since the last fueling stop.
- 3) A further installation option allows connecting an antenna on the driver's cabin to read a driver's RFID badge.

Vehicle Unit Benefits

- Ultra-rugged and low cost versions available
- Unit parameters configurable through serial interface
- Reporting of unit data through RF link
- Reports odometer reading per odometer pulser input
- Reports minutes of operation per vehicle ignition input
- Dual RFID readers allow multiple topologies of operation
- Automotive power supply allows both 12V and 24V operation

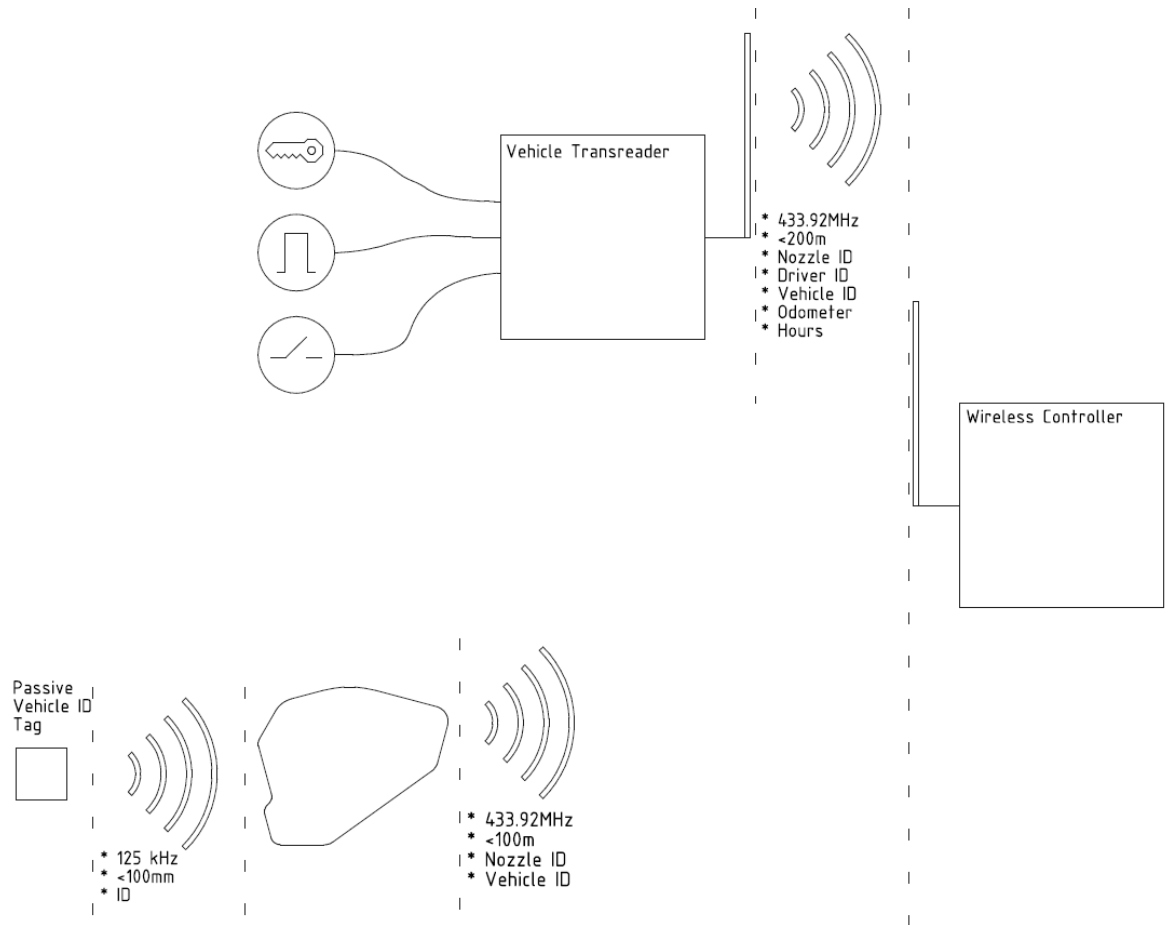
System options and information flow

Option 1: Passive Vehicle Tag Only



- 1) The nozzle unit fitted to the filling nozzle reads the 125 kHz passive RFID vehicle tag when the nozzle is inserted into the fuel filler pipe.
- 2) The nozzle unit then sends the tag info along with unit info (ID, status, etc.) over a 433.92 MHz encrypted proprietary RF data link to the Wireless Controller.
- 3) If the front end validation passes, the Wireless Controller sends authorization information and a “Nozzle In” condition, to the Fuel Management System (FMS) which is then responsible for checking whether the vehicle is valid or not according to predefined business rules. It then interacts with the dispensing systems to allow fueling to start.
- 4) If the nozzle is removed, the unit will not be able to read the vehicle tag anymore and send the appropriate information to the Wireless Controller.
- 5) The Wireless Controller interprets this as a “Nozzle Out” condition and sends a message to the FMS. The FMS will then be able to stop fuel dispersion, complete the fueling process and record a completed transaction.

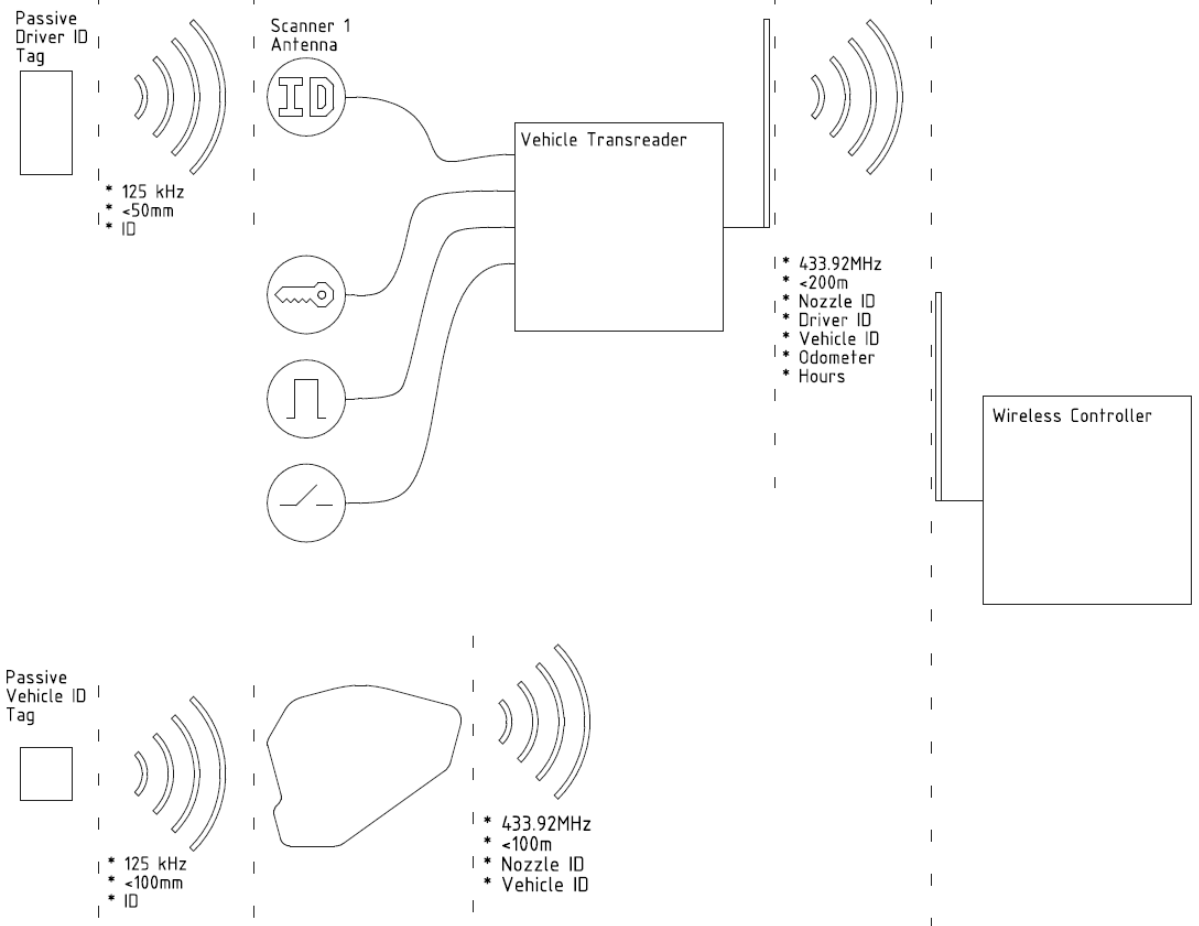
Option 2: Active Vehicle Unit and Passive Vehicle Tag



- 1) The passive vehicle tag and vehicle unit are paired by programming each with identical data
- 2) The vehicle unit transmits information over the same RF channel as the nozzle unit, including ID and other useful data, like vehicle odometer and engine running hours to the Wireless Controller.
- 3) The Wireless Controller authorizes each transaction when it sees information from both the nozzle unit which has read the vehicle tag and the vehicle unit.

“Nozzle In” and “Nozzle Out” will work the same as in Option 1. This system option allows the FMS to track the vehicle usage parameters.

Option 3: Active Vehicle Unit, Passive Vehicle Tag and Driver Tag



In addition to the features and functionality described in the preceding sections, the third system option adds an extra level of security and monitoring by requiring that the vehicle driver presents his personal RFID tag (badge or keyfob) in order to authorize the transaction.

This tag is presented to an optional antenna that is installed into the vehicles cab and read by an RFID scanner built into the vehicle unit.

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