Petards Rail
intelligent train technology

Automatic Selective Door Operation (ASDO)

Increase safety and minimise dwell time

Automatic Selective Door Operation solution

Ensure the safe operation of passenger doors at short platforms with our Automatic Selective Door Operation solution.

ASDO refers to Automatic Selective Door Operation. The Petards Rail ASDO is **not just a door system; it's a smart solution** that anticipates and adapts to the unique characteristics of each station platform.

By harnessing advanced Global Navigation Satellite Systems (GNSS), odometry technologies and real-time data analysis, **ASDO ensures that the correct door pattern is released at each platform**. This precision in-door control enhances overall efficiency during boarding and alighting, ensuring the safety of passengers.

In essence, ASDO is the key to harmonising the variation between train door positions and station platforms, offering a level of automation that goes beyond traditional door systems.

How it works

There are different ways to develop ASDO functionality. Most utilise a balise to determine when a train is passing through a station, from what direction and the platform it is arriving at. Petards Rail's system does not require physical balise, so no trackside equipment is required however, it can be integrated with existing track infrastructure. Using multiple sources of GPS and odometry readouts the position can be determined accurately and meet Safety Integrity Level 2 (SIL 2) requirements.

Key benefits

Optimise passenger flow and minimise delays.	Adaptable to routes and train configurations.	Reduce dwell time.	Enhance passenger safety.	Adhere to safety compliance.	Cost saving solution.

Safety Integrity Level (SIL)

Petards Rail has solutions up to SIL 2 for ASDO and Driver Controlled Operation (DCO) systems. Petards Rail also achieves RIS-2747-RST by the RSSB.

What Safety Integrity Level means

The overarching standard is IEC 61508 which is a general SIL standard designed to cover critical safety systems. For the rail industry a series of sub standards were produced based off the original IEC 61508.

- EN 50126 - Reliability, Availability, Maintainability and Safety (known as RAMS)

- EN 50128/EN 50716 - SIL requirements for software

- EN 50129 - SIL requirements for hardware, installation and overall system.

By meeting these rail standards the IEC 61508 standard is also met.

Application

SIL is identified for critical safety functions. For train operations a wide range of SIL levels can be identified from SIL 1 to SIL 4 where a level 4 is given to only the highest critical to safety functions. SIL 2 results in a function availability of 99 to 99.9%. In all cases a comprehensive risk analysis should be performed to identify the correct level for the application. As SIL levels increase the demand for higher protection increases due to the risks associated with the function or process. The SIL approach is a methodology for addressing risk and as such can be applied to many applications.

Main focus points

These are some of the main points for a SIL project to demonstrate competency in the development of the system – all of which our ASDO meets!

- Organisational structure

- Personnel competency

- Lifecycle and product development

- Verification and validation testing

- Quality assurance

- Change management

- Integration requirements

- Quality Management System (QMS)

- Safety Management System (SMS)

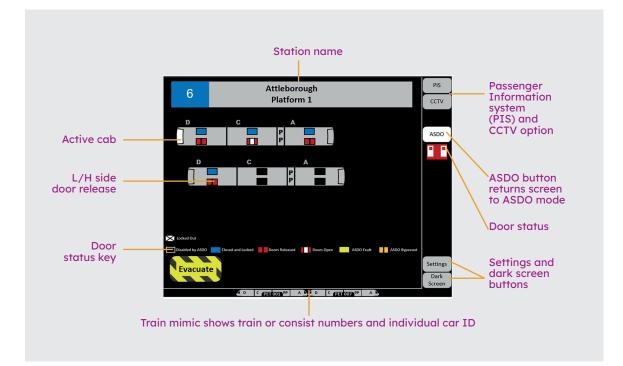| SIL	Frequency of a dangerous failure of safety function per hour
SIL 4	$\geq 10^{-9}$ to $< 10^{-8}$
SIL 3	$\geq 10^{-8}$ to $< 10^{-7}$
SIL 2	$\geq 10^{-7}$ to $< 10^{-6}$
SIL 1	$\geq 10^{-6}$ to $< 10^{-5}$

We are happy to work or consult with you on other safety critical applications, simply get in touch: rail@petards.com

Correct Side Door Enable

Correct Side Door Enable (CSDE) complements functionality of the base ASDO system. Where ASDO focuses on the door release based off platform vs the train length, CSDE focuses on enabling the correct side of the train for the arrival platform.

ASDO and CSDE share the same hardware technology. Both Petards Rail's ASDO and CSDE are configurable modules. If the CSDE is required, then we can enable the function on a software level.

Key benefits

- Shares benefits with the ASDO solution.

- Prevents accidents by disabling doors that are not platform facing.

- Built into the Petards Rail ASDO system so no additional equipment or software is required.

- CSDE warnings implemented when a hazard is detected.

Station name

6 Attleborough Platform 1

PIS
CCTV

Passenger Information system (PIS) and CCTV option

Active cab

ASDO

ASDO button returns screen to ASDO mode

L/H side door release

Door status

Locked Out

Door status key

Disabled by ASDO   Closed and Locked   Doors Released   Doors Open   ASDO Fault   ASDO Bypassed

Evacuate

Settings
Dark Screen

Settings and dark screen buttons

D   C   PET 001   PP   A   D   C   PET 007   PP   A

Train mimic shows train or consist numbers and individual car ID

Why choose the Petards Rail ASDO system?

Our eyeTrain technology is designed to rail group standards and incorporates the very latest in technology.

Our ASDO/CSDE solutions offer an innovative approach to solving the problem of wrong side door enable events by offering a fully automatic system approved to SIL 2. Our ASDO and CSDE solutions are modular by design and are adaptable to existing systems on your train or new route geography.

Providing a solution which requires minimal to no human input to function, or additional on track equipment, allows you to maximise your rolling stock availability and optimise your operations.

Petards Rail also achieves RIS-2747-RST which ensures functional requirements are met for ASDO and CSDE and offers guidance on human factors for easier implementation.

Find out more about our intelligent train technology, which is trusted by fleets throughout the UK: www.petardsrailsolutions.com

Key benefits

- **Shorter installation times - No trackside installations required including balise and minimal on-train equipment.**

- **Cost-effective – The lack of trackside installations and on-train equipment make this an economical solution.**

- **Increased safety - Autonomous solution reducing risk of human error.**

- **Fully configurable - Remote configurations through Petards Rail's eyeBOS back-office system to update train routes.**

- **Adaptable - Expand functionality with Correct Side Door Enable to automatically prevent wrong side door enable incidents.**

- **Certified solution - SIL 2 approved system. Allows for accreditation to RIS-2747-RST.**

- **Greater route viability – Allows for existing train configurations to safely operate on any station or platform. Not restricted by availability of station guards for door operation.**
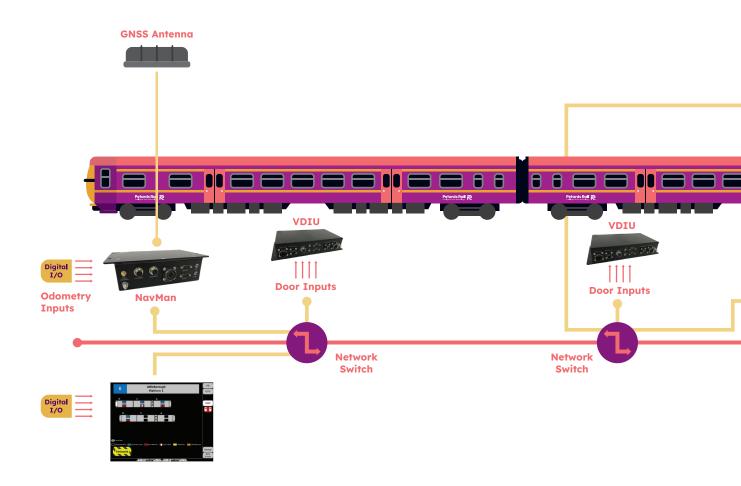
- **Independent or connected to the Train control & management system (TCMS) – Suitable for new and retrofit projects.**

An overview of the eyeTrain Modular ASDO system

At Petards Rail, we design our systems to be modular and adaptable to functions and integration requirements.

A standalone ASDO system is shown in the diagram. Other functionality can be introduced to meet your requirements. This includes Driver Controlled Operation (DCO), saloon, forward facing, pantograph, track debris and PTeye cameras.

The system for ASDO shares functionality with the systems described, enabling simplified installation and upgrades over time. As a standalone system, or integrated into other train systems, the minimal equipment required to achieve a SIL 2 solution makes this is a cost-efficient solution for both new and old rolling stock.
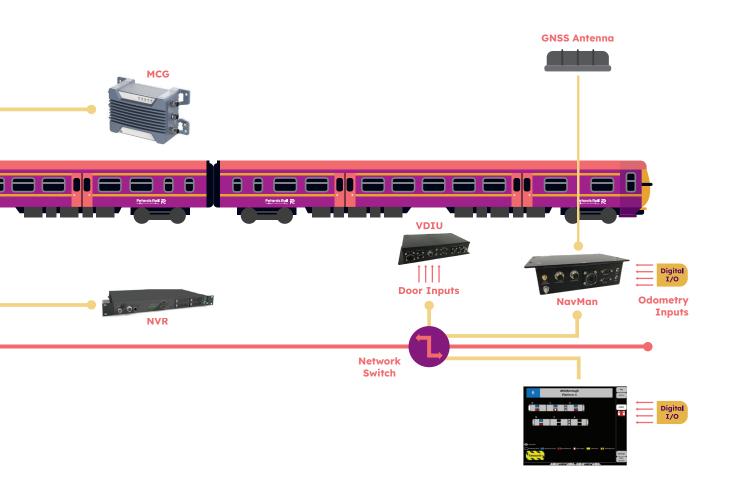
All the primary Line Replaceable Units (LRUs) are linked to a network switch either via Power over Ethernet (PoE), supplying both power and ethernet data connections up to 100Mbps, or from a data only ethernet connection.

GNSS Antenna

VDIU

VDIU

Digital I/O

Odometry Inputs

NavMan

Door Inputs

Network Switch

Door Inputs

Network Switch

Digital I/O

Shared components with other systems:

• NavMan and Antenna

• Network Switches

• Intelligent cab monitor (ICM)

• Network video recorder (NVR)

• Vehicle to door interface unit (VDIU)

Our ASDO system operates with our eyeBOS package allowing for remote access, from a central location to the ASDO configuration files and is protected with user permissions and access controls. Changes made can be published to the fleet. Learn more by contacting **rail@petards.com**

GNSS Antenna

MCG

VDIU

Door Inputs

NavMan

Digital I/O

Odometry Inputs

NVR

Network Switch

Digital I/O

Intelligent Cab Monitor (ICM)

A resistive, full colour, touchscreen display designed to present information in an interactive manner to train crew.

The Petards Rail system supports installation of multiple, synchronised ICM in each cab. The ICM can display video surveillance footage from any on-train networked camera. Connect it to third-party PIS to show passenger load data or to a TCMS, to display supplementary information and serve as a redundant TCMS monitor.

As a modular design the ICMs can be operated standalone and do not require TCMS integration as standard but configurable ports can allow for integration if needed for connections to PIS or to display TCMS information.

The ICM is a key component in all applications relating to Petards Rail's eyeTrain system. With a powerful AI capable processor, it can be adapted to control many functions with a history of operation across multiple fleets in the UK and abroad.

Specification

Dimensions:

12.1" display: 360mm (W) x 250mm (H) x 99.5mm* (D)

10.4" display: 264mm (W) x 219mm (H) x 99.5mm* (D)

* Depth may vary depending on mating connector

Weight: (approximated)

12.1" display: 5.5kg - 10.4" display: 2.5kg

Screen Resolutions:

800 x 600 SVGA - 1024 x 768 XGA

Power Supply:

10.4" display: PoE, IEEE802.3at Type 2

12.1" display: 110V DC

Power Consumption:

19W Typical, 30W Max

Temperature:

-25°C* to +55°C

* Optional storage temperature down to -40°C

IP Rating:

12.1" display: IP54 Front Face / IP2X Rear Face

10.4" display: IP65

Standards:

EN61373 - EN50155 - EN45545

EN50121-3-2 - EN60529

Related Functions:

CSDE - CCTV

Automatic passenger counting (APC)

Pantograph - DCO - PTeye

Network Video Recorder (NVR)

The NVR provides network storage to contain the log files of the Petards Rail ASDO/CSDE system.

The NVR provides network storage to contain the log files of the Petards Rail ASDO/CSDE system. These log files are a record of events such as ASDO overrides alarm and warning events, and many others but also system diagnostics which all contain important meta data for review. From the log files, valuable insights into

operations and the overall health of the system can be gathered for data analysis and equipment monitoring. Data can either be accessed locally through a service port or transferred remotely to the wayside. Remote monitoring is possible through the network recording diagnostic information from other devices within the system.

The NVR also contains the configuration files for the ASDO system. Configuration files are the storage of train routes including stations and platforms and detail the length of the platforms, routes, and locations of waypoints.

Specification

Dimensions:

For depth only

482.8mm (W) x 43.6mm (H) x 302mm (D)

Including 20mm for connection ports

NVR is mounted in a 19" 1U rack

Weight: (approximated)

5.8kg

Power Supply:

PoE, IEEE802.3af Mixed DC & Data (Mode A)

Power Consumption

30W Max (PoE), 40W Max (110V)

Temperature:

-25°C to +55°C

IP Rating:

IP2X

Storage module caddy:

Either 1 or 4 storage module slots are available

Standards:

EN50155 - EN45545 - EN50121-3-2

EN60529 - EN61373

Related Functions:

CSDE - CCTV - APC - DC

PTeye - Pantograph

Vehicle to Door Interface Unit (VDIU)

The VDIU controls the 'Door Release Relay', the 'Door Out of Service Indicator' (DOSI) and provide diagnostic information to monitor door position.

In the operation of ASDO, the VDIU is allowed to inhibit the door release relay preventing the opening of the doors. The two input/outports are connected to the left and right door controls enabling the option of Correct Side Door Enable.

The VDIU is powered by a single PoE cable which minimises installation impact and interfaces with the Intelligent Cab Monitor (ICM) to receive commands for operation. A minimum of two inputs from the ICMs on the train is required. The VDIU validates these commands then acts upon them based off internal programming and majority rules.

Specification

Dimensions:

325mm[1] (W) x 66mm (H) x 180mm[2] (D)

1. Including 20mm each side for flanges

2. Including 20mm for connection ports

Weight:

4kg (Estimated depending on final configuration)

Power Supply:

PoE, IEEE802.3af Mixed DC & Data (Mode A)

Power Consumption:

4.5W (Estimated depending on final configuration)

Temperature:

-25°C to +55°C

IP Rating:

IP65

Standards:

EN 61373

EN50155

EN45545

EN50121-3-2

EN60529

Related Functions:

CSDE

Navigation Manager (NavMan) and Antenna

Accurate Global Positioning System (GPS) positional data from GNSS and odometry readings from vehicle tachometry to the Petards Rail system.

It records time synchronisation from the on-train GPS and feeds this into the ICM and NVR equipment for accurate metadata. Being directly fed into the onboard odometry readings the NVR can be notified of wheel slip/slide events and record this as an event within the CCTV system.

In ASDO systems at least two NavMan are provided for SIL 2 operation. The GPS and odometry readouts from both give various confidence levels of position and enables, or disables, certain aspects of ASDO depending on these levels.

The NavMan always monitors itself and reports any faults to the overall Petards Rail system. This information is then logged and can be transmitted off train via a remote wayside communication or local connection on train. The NavMan utilises Digital I/O, SMA, RS485, Odometer M12 8Way Code, RS232, and PoE M12 D-code connections for functionality.

Specification

Dimensions:

245mm (W) x 65mm (H) x 179mm* (D)

* 130mm additional clearance required

Weight:

4kg (Estimated depending on final configuration)

Power Supply:

PoE, IEEE802.3af Mixed DC & Data (Mode A)

Power Consumption:

5W (Estimated depending on final configuration)

Temperature:

-25°C* to +70°C

IP Rating:

IP65

Standards:

EN 61373

EN50155

EN45545

EN50121-3-2

EN60529

Petards Rail R.
intelligent train technology