SWD® Starter Kit

For AGV & AMR

ez-Way
The Smart Navigation
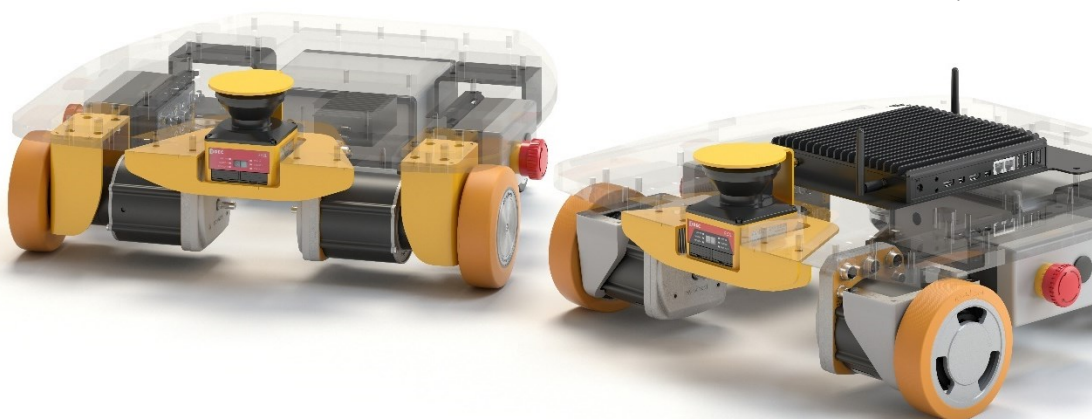
ez-Wheel®
A brand of the **IDEC Corporation Group**

Table of Contents

Appendices

Table of figures

1. <u>Preamble</u>

1.1. Who is this manual for?

This manual is intended for software developers and skilled robotics integrators.
Skills in automation, functional safety, and robotics are recommended.

The *SWD® Starter Kit* ROS version (EW2A-SK000A) saves a lot of development time, but needs competencies in:
- Embedded Linux, Python and C++
- ROS development environment

The *SWD® Starter Kit ez-Way®* (EW2A-SK125A) saves a lot of development time, but needs competencies in:
- MQTT
- VDA5050

1.2. Terminology

The terms used in this manual are related to the technical field of industrial machinery and more particularly to driverless industrial trucks and drive systems controlled by the field bus.
For a precise reading of the manual, a good knowledge of the following standards is recommended:
- Machinery Directive (2006/42/EC)
- Safety requirements for driverless industrial trucks and their systems (ISO 3691-4)
- Variable speed power electric drives (EN 61800-5)
- CANopen Application Profile for Motor Drives (CiA 402)

Dictionary of acronyms:

AGV:	Automatic Guided Vehicle
AGC:	Automatic Guided Cart
AMR:	Autonomous Mobile Robot
CAN:	Controller Area Network
LiDAR:	Light Detection And Ranging
OSSD:	Output Signal Switching Device
SBC:	Safe Brake Control
SBU:	Safe Brake Unlock
SDI[p/n]:	Safe Direction Indication [positive/negative]
SLAM:	Simultaneous Localization And Mapping
SLS:	Safety Limited Speed
SLSa:	Safety Limited speed asymmetric
SMS:	Safe Maximum
SRDO:	Speed Safety-Relevant Data Objects
STO:	Safe Torque Off

1.3. Additional resources

The *SWD® Starter Kit* uses *SWD®* safety drives, the following *SWD®* documents are available from ez-wheel.com:
- *SWD®* datasheets
- *SWD®* full Range Brochure Safety Wheel Drive Series Overview
- 2D and 3D mechanical plans of the *SWD®*
- *SWD® Safety Hub* manual instruction
- *ez-Way®* software manual instruction

1.4. Declarations of conformity

SWD® products are developed in accordance with legal requirements applicable in the European Union.
SWD® declarations of conformity (DoC) are established by IDEC.

1.5. Important information about the manual

⚠	Important information – Read carefully
🗎	Parameterizable value
ℹ	Additional information

1.6. Disclaimer

The technical information included in this manual is subject to change without prior notice. No responsibility is assumed for the completeness, up-to-date or accuracy of the data and illustrations provided.
The textual and visual data included in this manual are the property of **APEM SAS** *company of* **IDEC Corporation**.
The trademarks ez-Wheel and SWD Safety Wheel Drive are registered.
Designations may be trademarks and/or copyrights of their respective manufacturers, the use of which by third parties for their own purposes could infringe the rights of such owners.

2. Safety Instructions – *SWD® Starter Kit* Precautions

⚠	Do not open.
	Do not expose the product to a heat source.
	Do not expose the product to fire.
	Do not insert metal parts into the connectors.
	Under no circumstances should the product receive any modifications not authorized by IDEC.
	Do not attempt to modify the technical performance of the product.
	The product must not be used for use beyond the technical performance specified by IDEC.
	Inappropriate use results in the cancellation of the warranty.
	Opening the product results in the cancellation of the warranty.

3. Description

3.1. General information
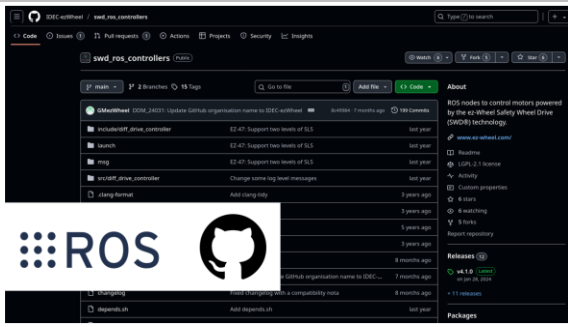
The **SWD® Starter Kit** is designed to facilitate and accelerate the development of AGVs and AMRs using ez-Wheel's exclusive SWD® Safety Wheel Drive technology.

/!\ This Starter Kit is not a complete, fully functional AMR but it includes all the basics to build a mobile robot application. It is provided as partly completed machinery to be integrated as final machinery as per the Machinery Directive. Please refer to the Declaration of Incorporation.

Pre-assembled with a safety scanner, an on-board computer and a 24V rechargeable battery, the Starter Kit platform is ready to use.

The Starter Kit offers all the exclusive safety features of the SWD® Safety Wheel Drive range such as SIL2 / PLd certified motion control, ensuring development in accordance with the ISO 3691-4 driverless truck standard.
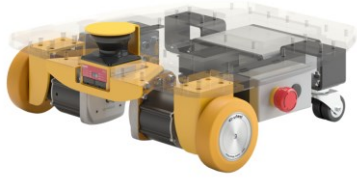
Two versions of Sarter Kit are available: a version with ROS open-source middleware and differential drivers for controlling the platform and a version with ez-Way® software for navigation and mission management.

SWD® Starter Kit with ROS [EW2A-SK000A]	SWD® Starter Kit with ez-Way® [EW2A-SK125A]
• ROS and ROS2 available • Linux and Pre-installed ROS environment • SWD® Core motorization for maximum flexibility	• Ready to use ez-Way® software • VDA 5050 compatibility • SWD® 125 Wheel Drive ready to carry load
✓ Open-source software ✓ Technical resources for installation, use and set-up example ✓ GitHub community ✓ Drivers for differential kinematic robots	✓ Intuitive graphical user interface ✓ Software for controlling the robot and managing missions ✓ Mobile robot management, robot localization, navigation, and mission execution
This Starter Kit includes: ✅ Differential driver ✅ Mapping driver ❌ Navigation system	This Starter Kit includes: ✅ ez-Way® navigation system ✅ VDA 5050 compliant ❌ Fleet management

3.2. Complete toolkit - ready to use

The *SWD® Starter Kit* is made of combinable, modular devices for mobile robotics. It introduces key technologies for mobile robots' development:

- *SWD® Safety Wheel Drive*: the world's first drive with embedded safe motion control
- *IDEC* Safety Laser Scanner: the smallest laser scanner for safety critical applications
- Setting and control modes options:
  - ROS (Robot Operating System): the reference open-source middleware for robotics
  - *ez-Way®* navigation software featuring autonomous navigation and mission management
- A 24 VDC rechargeable battery
- A chassis and complete wiring with two E-Stops

Rear view   Side view   Front view

Battery

125mm Wheel   E-Stop ON/OFF   Rear caster

SE2L   SWD® Right   SWD® Left
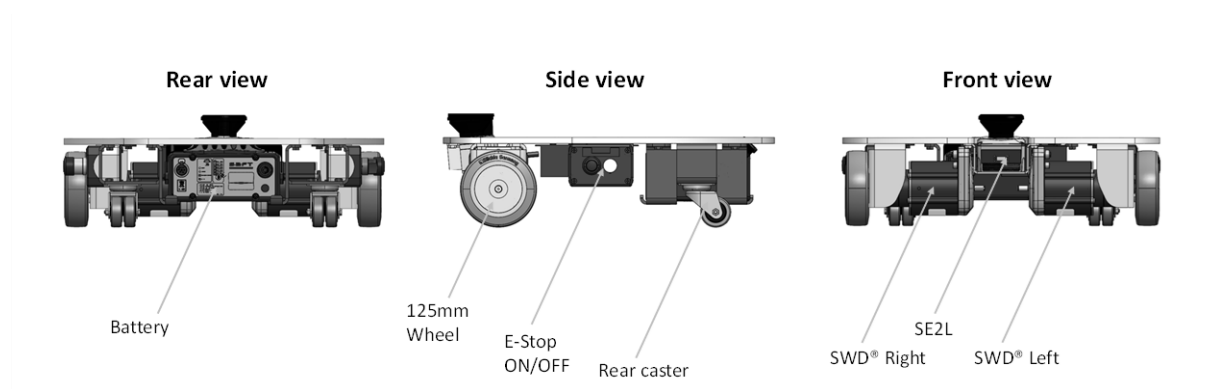
3.3. Applications

The *SWD® Starter Kit* is intended for the development of mobile robotics applications such as:

- Industrial AGVs, AGCs and AMRs
- Logistics AGVs, AGCs and AMRs
- Cobots and mobile robot arms
- Mobile platforms
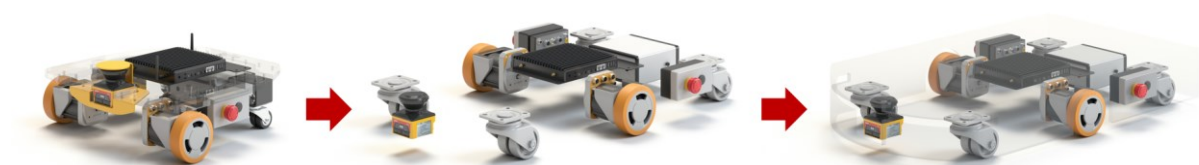
3.4. Integrated Safety
3.4.1. General information

The **SWD® Starter Kit** provides the simplest AGV/AMR safety architecture ever:

- **SWD®** integrates motor drivers.
- Unique, fully certified safe motion features
- Safety encoder integrated into **SWD®**

SWD® motorization
Drives with integrated Safety.
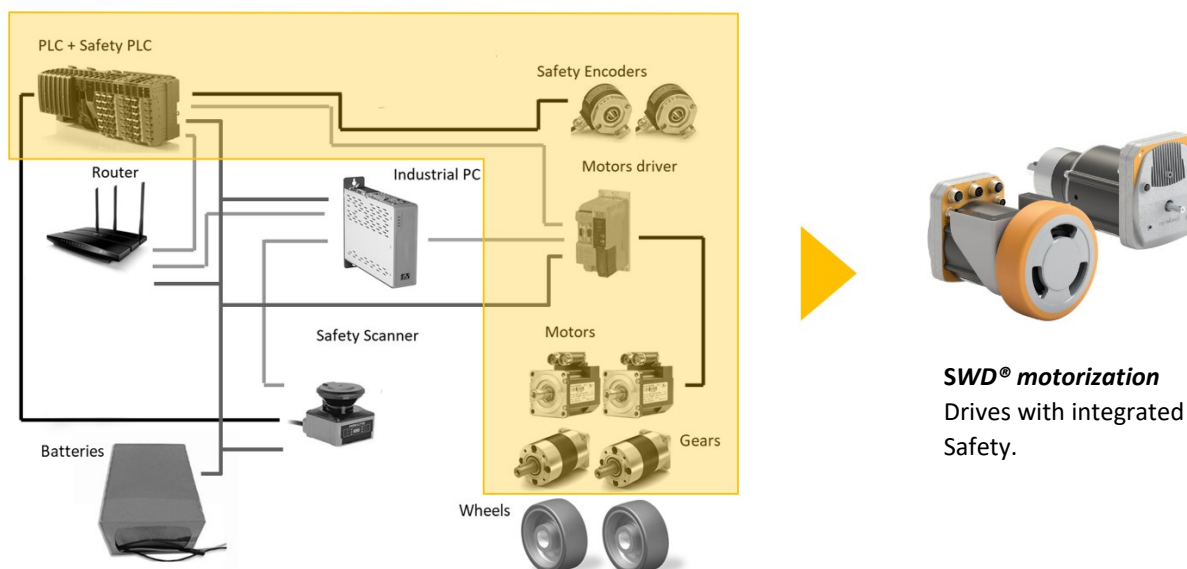
The robot architecture is therefore extremely simplified compared to conventional AGVs or AMRs:

- ✓ Drives interfaced directly with safety laser scanners.
- ✓ Replaces safety encoders, PLCs, and motor drivers.
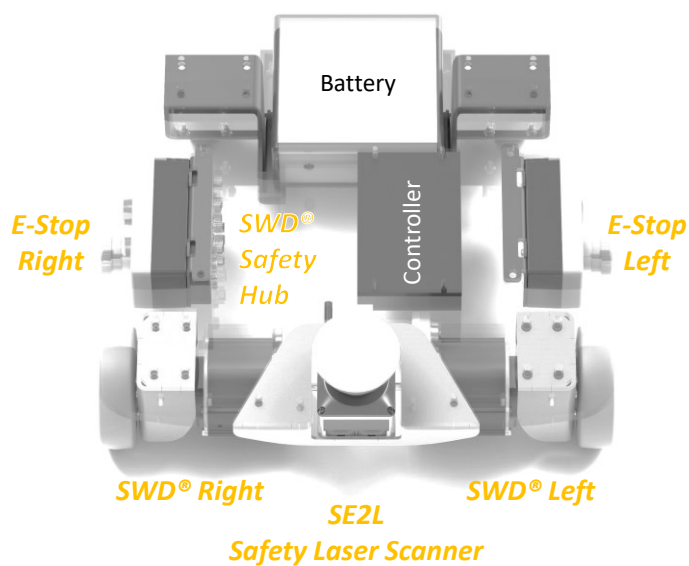
3.4.2. SIL2/PLd Safety features

Motor disconnection	STO with E-Stops buttons
Motion control	SMS (Safe Maximum Speed), SLS (Safe Limited Speed), SLSa (Safe Limited Speed asymmetric), SDI (Safe Direction)
Braking	SBC (Safe Brake Control), SBU (Safe Brake Unlock, i.e. free wheel mode)

3.5. Conditions of Use

Temperatures	0 to +40°C
IP index	IP66 for *SWD®* electronic unit IP65 for safety laser scanner IP54 for battery NC for others
Maintenance period	5 years

3.6. Product Label
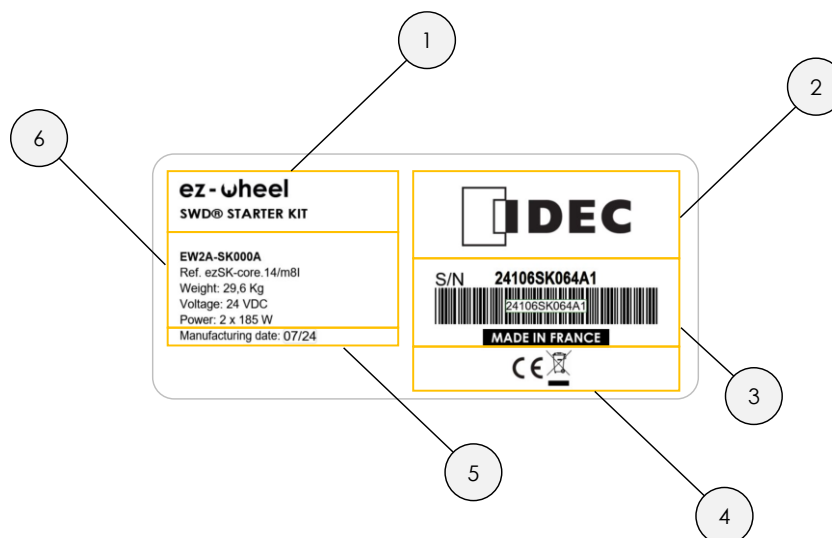
1	Product Family and Range Identification
2	Manufacturer and trademark identification
3	Serial Number / Item code Geographical origin of the product
4	Regulatory pictogram
5	Manufacturing date
6	Commercial reference Product information Product performance

4. Synoptic

4.1. Safety and Control synoptics of the product
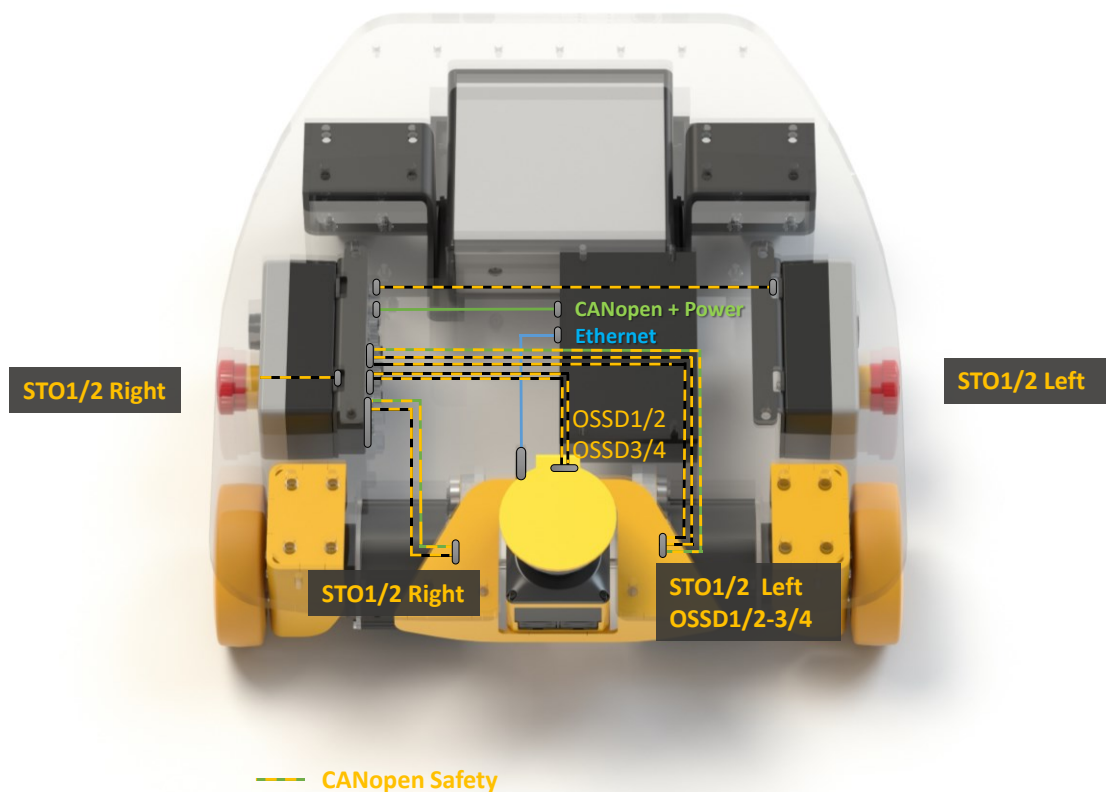
Figure 1 - Safety & communication synoptic

ℹ️ The pinout of the adapter for 12/17 points wiring is available on the appendix.

4.1.1. Safety

Direct connection of safety sensors and switches to *SWD®* safe inputs:
- Emergency Stop Left ➔ *SWD®* Left - STO inputs.
- Emergency Stop Right ➔ *SWD®* Right - STO inputs.
- Safety laser scanner OSSD outputs ➔ SWD® left - Safety inputs

ℹ️ CANopen Safety communication between *SWD®* Left and Right is used to give the information of the safety inputs triggered from one *SWD®* to the other one.

4.1.2. Control

ℹ️ CANopen from IPC to *SWD®* Left and Right, uses CiA 402 velocity control mode for speed and direction control. Ethernet from safety laser scanner to IPC, is used to get data for SLAM and ROS-based algorithms.

ℹ️ CANopen and CANopen Safety frames are transmitted on the same physical CAN bus.

4.2. Power supply

GND/24V

Battery On

ON/OFF

GND/24V

GND/24V

GND/24V   GND/24V
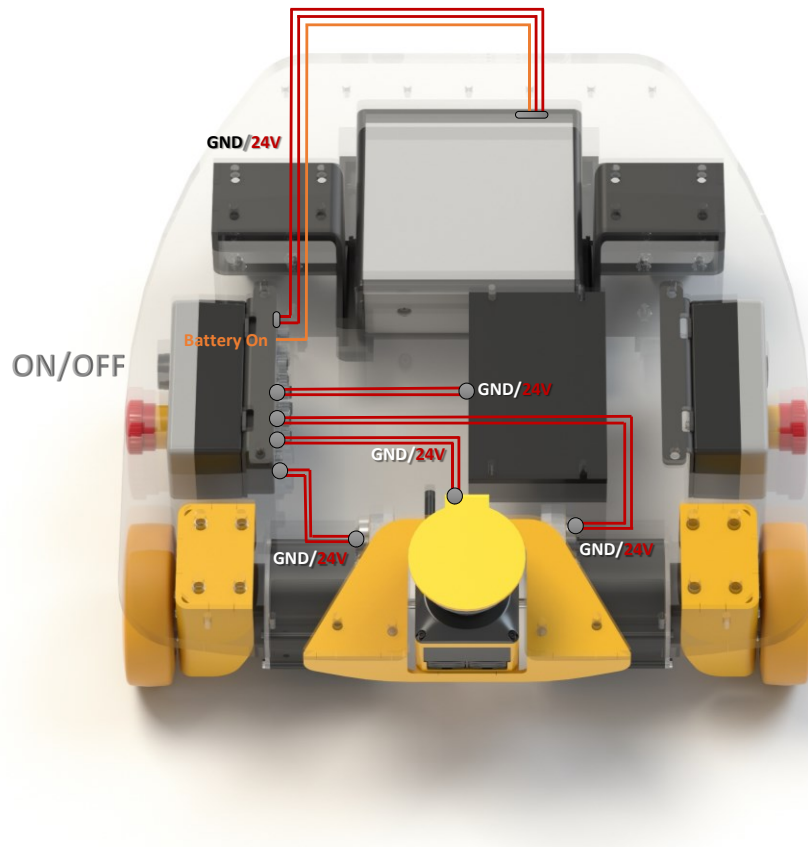
Figure 2 - Power supply synoptic

- All devices powered by Ni-MH 24V / 9Ah battery.
- Battery to junction box
- Junction box to *SWD®* Left, *SWD®* Right, safety laser scanner and IPC
- Activation signal, from the ON/OFF button to the activation input of the battery

4.3. Charging

The external charger can be directly connected to the battery panel connector:

5. Interfaces

5.1. Overview

The *SWD® Starter Kit* is using the *SWD® Safety Hub* interface to centralize the connections of all devices and facilitate the overall wiring.
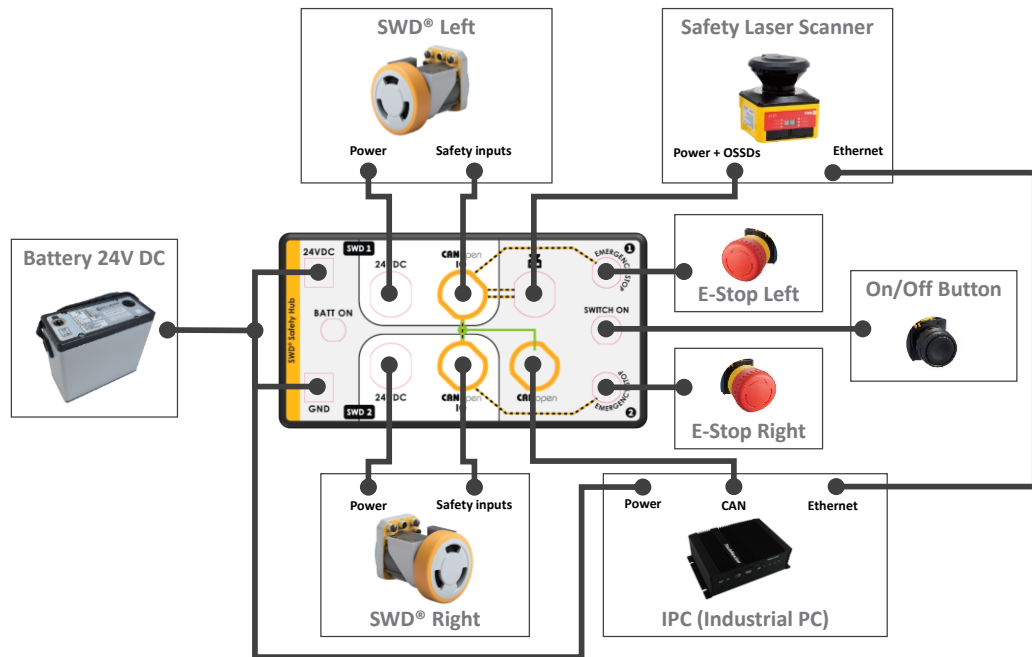
Figure 3 - Wiring synoptic, SWD® Safety Hub before July 2022
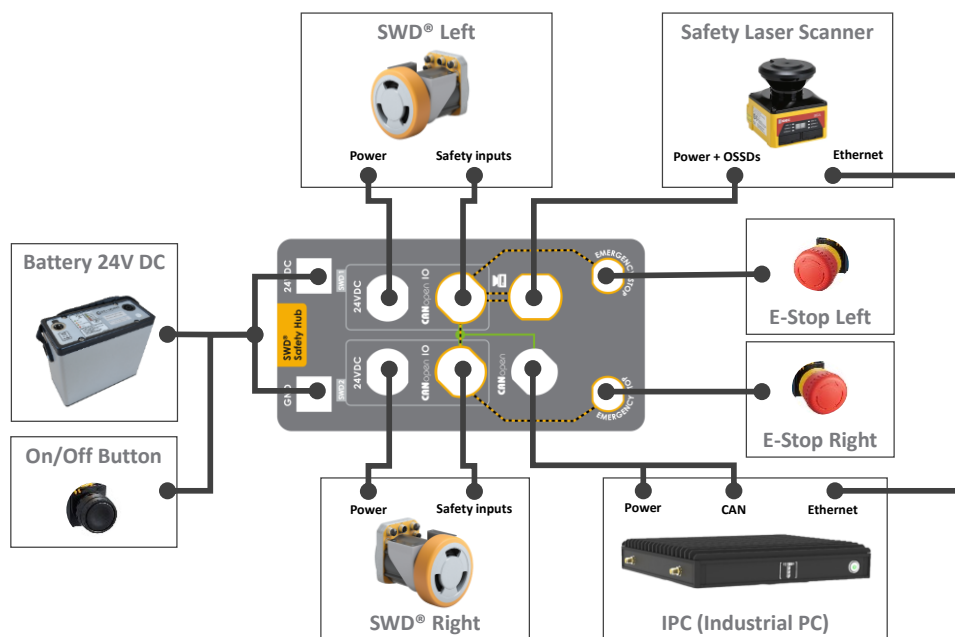
Figure 4 - Wiring synoptic, SWD® Safety Hub after July 2022

5.2. *SWD®* connectors

The I/O connector and 24 VDC connector of the *SWD®* are used in the *SWD® Starter Kit.*
The other connectors (CAN, USB, Ethernet, and Brake) are not used.

- The I/O connector is used for the CAN interface between the drives and the IPC, and for the safety inputs from the safety laser scanner and the E-Stops.
- The 24 VDC power connector is used to supply the power to the *SWD®*.

ℹ️ Please refer to the Instruction Manual of the *SWD®* for the details on the connectors.

5.3. Safety Laser Scanner connectors

The Power + OSSDs and Ethernet connectors of the safety laser scanner are used in the *SWD® Starter Kit.*
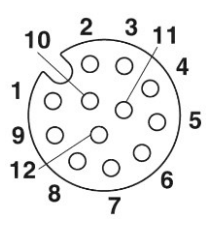
⚠️ The original connector of the safety laser scanner has been replaced by an M12 Power + OSSD connector to get homogeneous connections with the *SWD® products*.

ℹ️ The same connector types and pin numbers are used in the safety laser scanner, and the associated connection featured on the *SWD® Safety Hub*. The following pinout description is therefore valid for both.

ℹ️ Please refer to the safety laser scanner User Manual for details on the complete connections of the product.
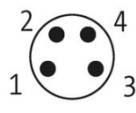
5.3.1. Power + OSSD adapter (if any)

After July 2022, an adapter might be used for Power + OSSD of the safety scanner. The connector is of type M12 - 12 pin A-coded. It is used for safety loops going to the *SWD®*.

Pin #	Designation
1	24 VDC
2	GND
3	OSSD1
4	OSSD2
5 … 8	NC
9	OSSD3
10	OSSD4
11-12	NC

5.3.2. Ethernet connector

The Ethernet connector is an M8 4-pin A-coded. It is used to exchange non-safe data between the safety laser scanner and the IPC.

Pin #	Designation
1	TD+
2	RD+
3	RD-
4	TD-

5.4. IPC connectors

The following connectors are used in the SWD® Starter Kit: **Power, CAN and Ethernet.**

	IPC model	Starter kit version	Products connection information
	iMX6 TechNexion	ROS version	**TEK3-IMX6 BOX PC**
	iMX8 Compulab	🐳 ROS running in a docker	**COMPULAB IOT-GATE-iMX8**
	Tensor-I22 Compulab	ez-Way® version	**TENSOR-I22** *TENSOR-I22-C1145-D8-TPM-N256-W*2-XL-TI-P56-FJ-FQ-FS-FV*

5.4.1. Power connector
It is used to bring power to the IPC.

- For the iMX6 version, the connector is a Molex 43025-0200 (2-pin Micro-Fit 3.0).

Pin #	Designation	
1	GND	
2	DC Voltage input (8-36 VDC)	

- For the iMX8 version, the connector is a DC Power Jack.

Pin #	Designation	
1	DC Voltage IN (8-36 VDC)	
2	GND	
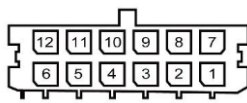
- For the Tensor-I22 version, the connector is a MINIFIT JR 6

Pin #	Designation	
1-2-3	DC Voltage IN (12-56V)	
4-5-6	GND	

5.4.2. CAN connector
It is used to connect the CANopen interface between the drives and the IPC.
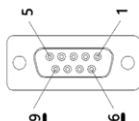
- For the iMX6 version, the connector is a Molex 43025-1200 (12-pin Micro-Fit 3.0).

Pin #	Designation	
1	Ground for CAN	
2	NC	
3	CAN Bus 1A high	
4	CAN Bus 1A low	
5 … 12	NC	

- For the iMX8 version, the connector is a Kunacon PDFD25420500K (20-pin dual-raw plug with push-in spring connections).

Pin #	Designation
1	NC
2	ISO GND A
3 … 6	NC
7	CAN High
8	ISO GND B
9	CAN Low
10 … 19	NC
20	ISO GND C

- For the Tensor-I22 version, the connector is a D-Sub

Pin #	Designation
1	NC
2	CAN Low
3 … 6	NC
7	CAN High
8-9	NC
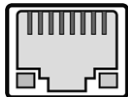
5.4.3. Ethernet

It is used to exchange non-safe data between the safety laser scanner and the IPC. This data is processed by the PC to create a map of the environment and perform SLAM for instance.

The Ethernet connector is a standard RJ45 for 10/100 Mbps transmission.
The 100 / 1000Mbps Ethernet ports are RJ45 connectors.
ETH1 (1000 Mbps port) is used to exchange non-safe data between the safety laser scanner and the iMX8.

Pin #	Designation
1	TD+
2	TD-
3	RD+
4-5	NC
6	RD-
7-8	NC

5.4.4. Serial Debug connector (iMX8 only)

The serial debug console via UART-to-USB bridge is a micro-USB connector.
It can be used to open a serial connection between your local PC (e.g. laptop) and the iMX8.

NB: Baud Rate speed is 115200.

5.4.5. USB

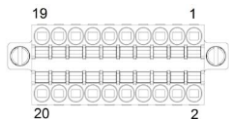An additional Wi-Fi USB dongle is provided with the iMX8 **SWD**® StarterKit, thus it is possible to connect the Kit to a Guest Wi-Fi for example. Consequently you can access and download resources from the internet, directly from the Wi-Fi.

A USB-A female connector is mounted on the side of the **SWD® Starter Kit**, next to the emergency button.

NB: You can use the second Ethernet port of the iMX8, to connect the robot to your own network.
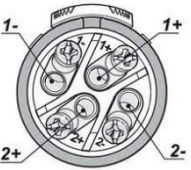
5.5. Battery connectors

The Power connector and Charger connector of the Mobility Module battery are used in the **SWD® Starter Kit.**

⚠ Please refer to the Mobility Module User Manual for details on the complete connections of the product.

5.5.1. Power connector
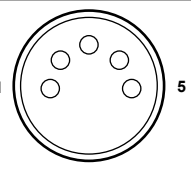
The Power connector is a Neutrik Speak on 4-pin. It is used to power the kit and to turn ON and OFF the battery.

Pin #	Designation
1+	24 VDC
2+	GND
1-	RD+ / BPCI*
2-	ON signal

*BPCI = Battery Protection & Communication Interface

5.5.2. Charger connector

The Charger connector is a Neutrik XLR 5-pin. It is used to connect the charger to the battery.

Pin #	Designation
1	Charger+
2	NC
3	NC
4	NC
5	GND

6. Mechanical assembly

6.1. Dimensions of the packaging and contents of the pack

The **SWD® Starter Kit** is packed within its original cardboard box and is protected by a half-pallet size wood box.

Cardboard box dimensions	555 (l) x 545 (p) x 220 (h) mm
Half-pallet size wood box dimensions	800 (l) x 600 (p) x 380 (h) mm

⚠ For all logistics operations on the gearmotor alone, preferably use the original packaging.
⚠ Countersunk wood screws 4mm x L 30mm were used to close the box cover
  Please use a screwdriver PZ2 for screwing

6.2. Overall dimensions and weight

EW2A-SK000A version   *EW2A-SK125A version*
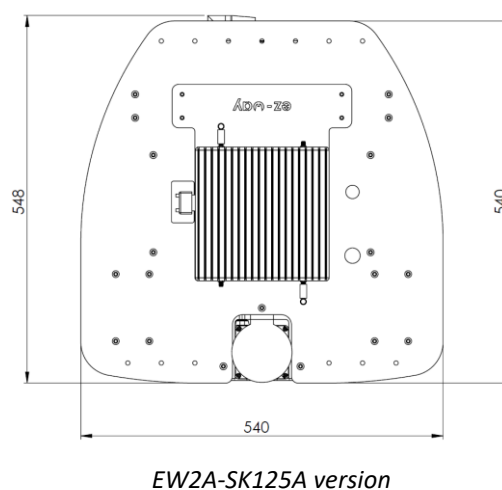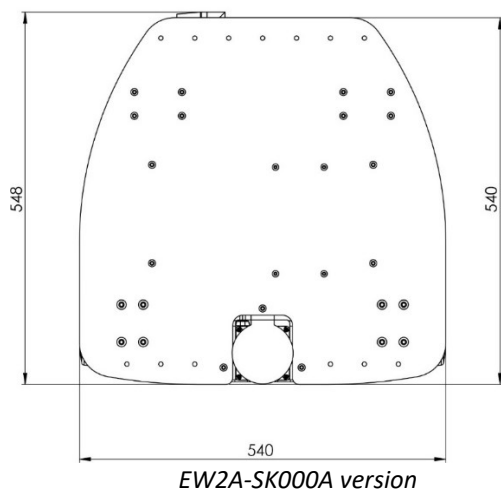
Figure 5 - Overall dimensions, top view

EW2A-SK000A version *EW2A-SK125A version*
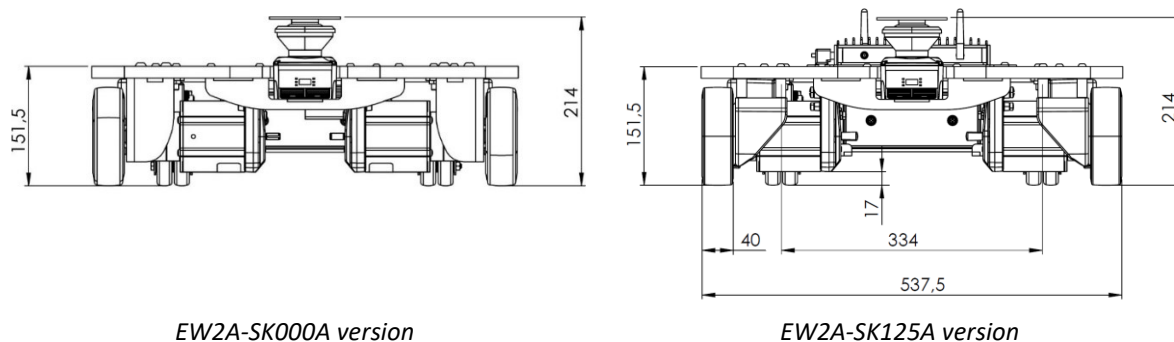
Figure 6 - Overall dimensions, front view

Product version (Part number)	Total weight
SWD® Starter Kit ROS (EW2A-SK000A)	29,5 Kg
SWD® Starter Kit ez-Way® (EW2A-SK000A)	31 Kg

6.3. Mechanical specifications

The casters are designed to support a maximum load of 40 kg per caster, but the plastic chassis, for demonstration purposes only, is not designed to carry load.

⚠ **Do not step or put loads on the chassis of the Starter Kit!**
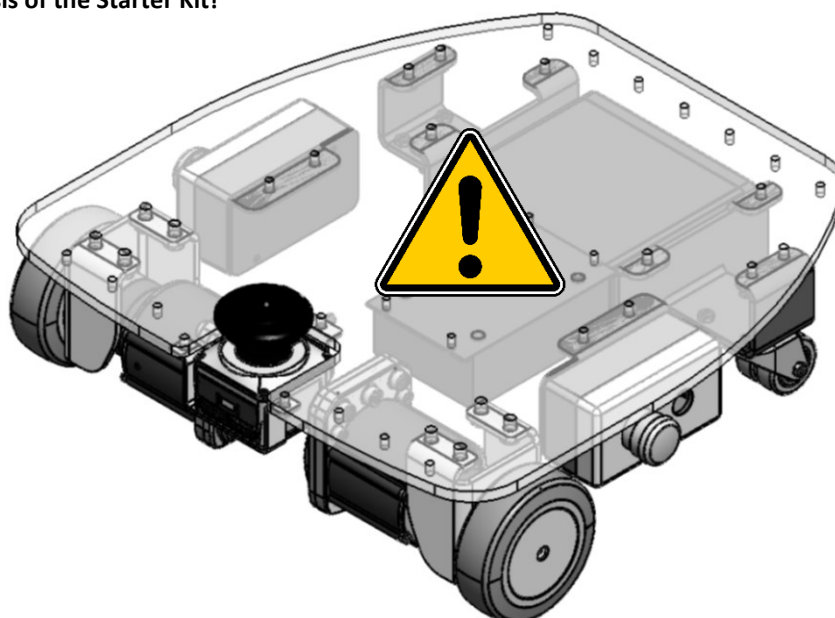
7. Safety features

ⓘ Please, refer to the Instruction Manual of the **SWD®** to get all details of available safety features.

7.1. Use of the *SWD® S*afety features in the *SWD® Starter Kit*

Emergency Stops

E-Stops on each side of the kit, for stopping the motors (STO: Safe Torque Off function)

STO

When one **SWD®** reads the STO signal from an E-Stop button, it sends the STO message to the other drive through the CANopen Safety

Safety fields and Safe Motion

Close obstacle: when the safety laser scanner detects an obstacle in the close range (<1m forward), the speed limit (SLS: Safely Limited Speed function) is engaged on the **SWD®**, limiting the speed at 0.3 m/s.

SLS

Collision risk: when the safety laser scanner detects an immediate risk of collision (<50cm forward), the direction limit (SDI: Safe Direction function) is engaged on the **SWD®**, prohibiting forward direction.

SDI

Breaking required
➔ STO/SBC

Hazardous zone
➔ SLS

Head-on obstacle
➔ SDI
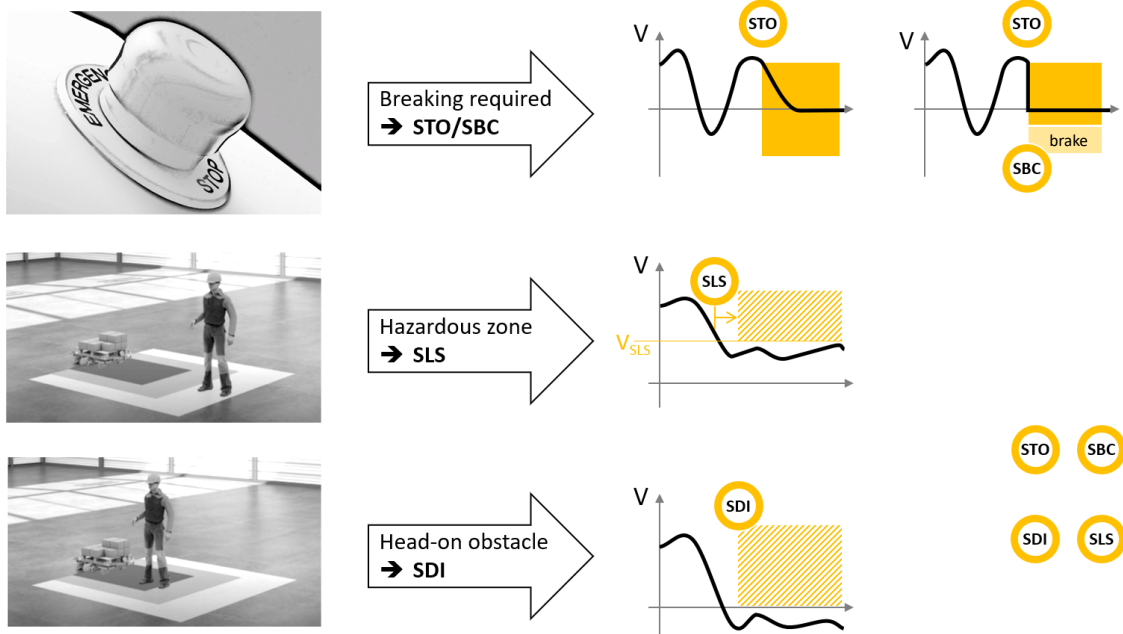
Figure 7 - Use of Safety Features

7.2. Safety fields configuration

The default configuration of safety fields in the safety laser scanner is set as follows:

Close obstacle

- Area 70cm width x 1m forward
- Routed to OSSD 3/4 outputs of safety laser scanner.

Collision risk

- Area 50cm width x 50cm forward
- Routed to OSSD 1/2 outputs of safety laser scanner.

Figure 8 - Safety fields of the safety laser scanner

ℹ️ To edit and customize the safety fields of the SE2L, use the software provided by IDEC laser scanner:
   o SLS Project Designer software available from the website .
   o Video tutorial available online
   NB: For updating the configuration of the laser, disconnect its ethernet cable.

7.3. Safety loops configuration

The safety loops of the *SWD® Starter Kit* are set up as follows:

- Emergency Stop Left ➔ *SWD®* Left - STO inputs.
- Emergency Stop Right ➔ *SWD®* Right - STO inputs.
- Safety laser scanner OSSD outputs ➔ SWD® left - Safety inputs
- CANopen Safety communication between *SWD®* Left and Right is used to give the information of the safety inputs triggered from one *SWD®* to the other one.
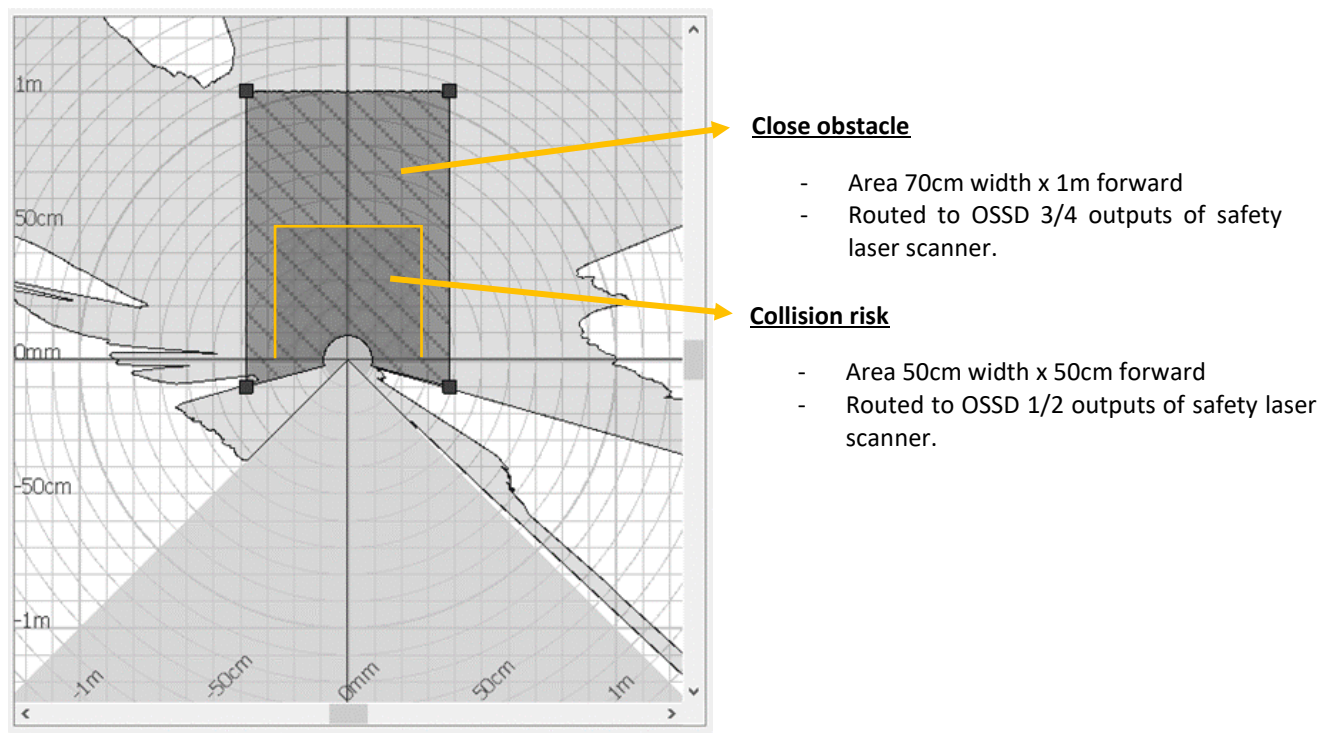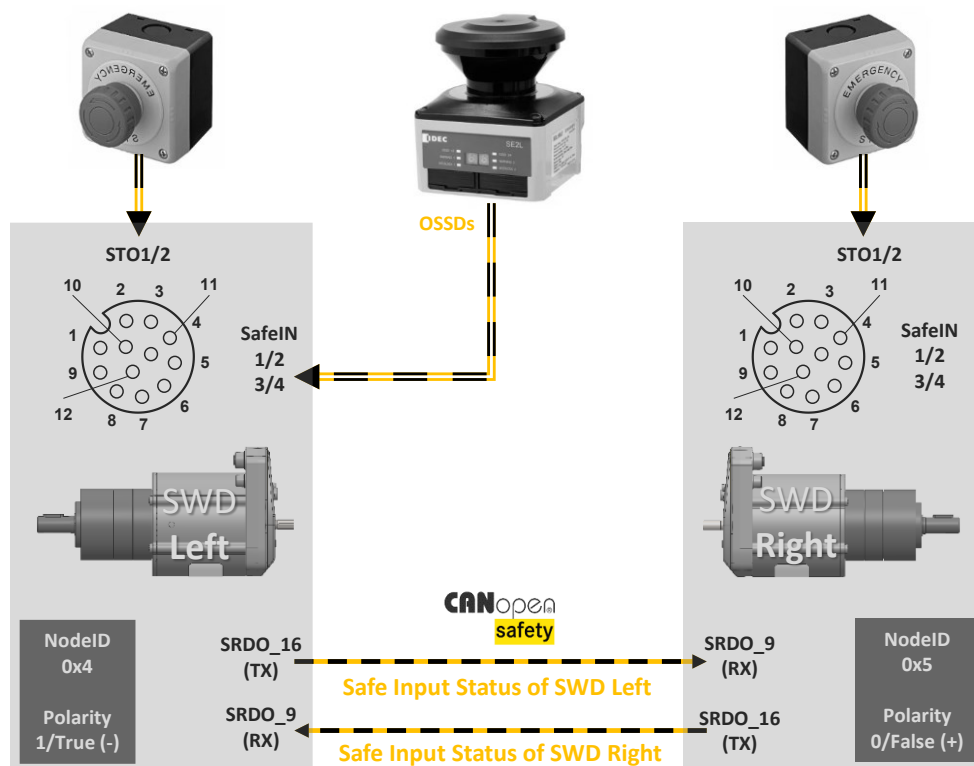

Figure 9 - Synoptic of safety with SWD®

ⓘ The drives configuration is done by CANopen messages. Scripts are available to commission the drives on IDEC ez-Wheel GitHub: IDEC-ezWheel/swd-starter-kit-config.

8. Starting the *SWD® Starter Kit [ROS version]*

8.1. Power on

- Put the kit on the floor on a stable and flat surface.
- Install and plug the battery power connector onto the rear side of the robot.
- Press the ON/OFF button on the side of the robot, near the Emergency Stop.

- ⓘ The IPC and safety laser scanner lights turn on, and the kit starts booting for a few ten seconds.
- ⓘ To start safely, you can engage one of the Emergency Stops while the robot is powering ON.
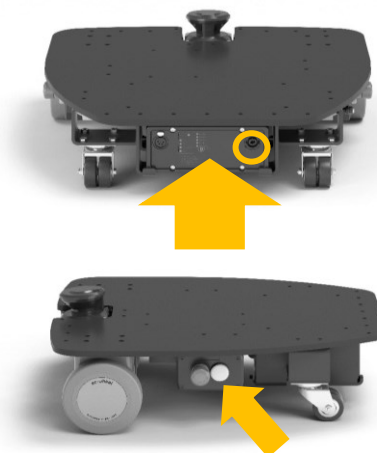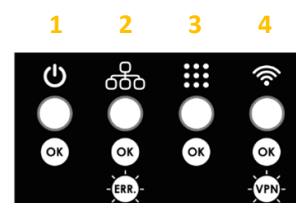
8.2. Display and status

8.2.1. iMX6 version

Display of the 4 LEDs - when the embedded IPC is powered:

1	Power	🟢	The battery power is available
2	Devices	🟢	The connection to the *SWD®* and to the safety laser scanner is active
		✳	The connection cannot be established
3	ROS	🟢	The ROS environment is active
4	Wi-Fi	🟢	The Internet connection is established
		✳	The VPN connection is activated (only for support)

8.2.2. iMX8 version

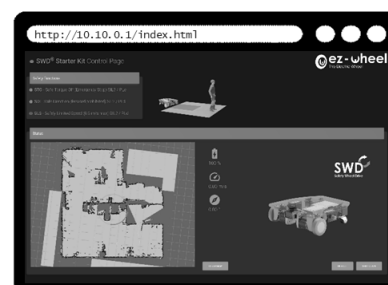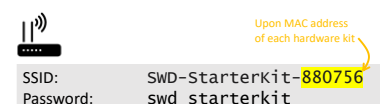|		iMX8 ON
Power Led State	Yellow	✓

8.3. Connection to Control Page

Connect your device to the *SWD® Starter Kit* thanks to its own Wi-Fi access point
- ⓘ SSID and initial password are indicated on the front plate beside the safety laser scanner or on the leaflet.
- ⓘ Once a PC or tablet is connected to the access point, a web page is available with any navigator by typing the webpage's address: **http://10.10.0.1**

- ⓘ **The SLAM algorithm used by default is Hector Slam available under ROS Noetic, but other algorithms such as LaMa or Gmapping could be used.**

Upon MAC address of each hardware kit

SSID: SWD-StarterKit-880756
Password: swd_starterkit

http://10.10.0.1/index.html

8.4. Safety features monitoring

The page is used to check the status of the safety features set up with the *SWD®* safety drives and the safety laser scanner and shows an example of a map built thanks to a ROS open-source SLAM algorithm using the data from the safety laser scanner

blinking green= connected; **blinking red = connection not established yet**

SWD® Starter Kit Control Page

Safety Functions

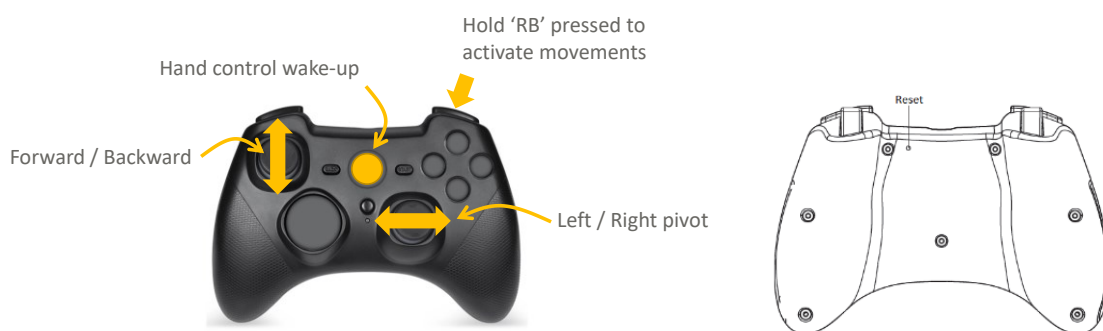- STO - Safe Torque Off (Emergency Stop) SIL3 / PLe
- SDI - Safe Direction (forward prohibited) SIL2 / PLd
- SLS - Safely Limited Speed (0.3 m/s max) SIL2 / PLd

● illuminated = activated

Illustration of activated safety feature

STO	●	when one of the two Emergency Stops is engaged, the motors are stopped (Safe Torque Off)
SDI	●	when the safety laser scanner detects an obstacle in the short perimeter (<50cm), the motors cannot go forward (Safe Direction)
SLS	●	when the safety laser scanner detects an obstacle in the nearby perimeter (<1m), the robot cannot exceed 0,3 m/s (Safely Limited Speed)

8.5. Hand control for teleoperation

The **SWD® Starter Kit** is delivered with a consumer type console joystick, for demonstration purposes only. The wireless joystick is directly connected to the embedded IPC and allows manual teleoperation of the machine.

ℹ️ The **SWD® Starter Kit** uses standard ROS Noetic packages (using *joy* and *teleop_twist_joy*) providing interfaces with a standard console joystick.

Hold 'RB' pressed to activate movements

Hand control wake-up

Forward / Backward

Left / Right pivot

Reset

ℹ️ To activate the hand controller, ROS packages must be started (It can take a few minutes at start-up).
ℹ️ The status of the ROS LED can be checked to confirm that ROS is active.

⚠️ If the motion control becomes jerky, the joystick might be discharged. Joy's LEDs should be blinking.
⚠️ If you unconfigured the original controller settings, you can press the 'Reset' button, on its rear.

8.6. Connection to the IPC
8.6.1. SSH

Host Name	10.10.0.1
User	swd_sk
Password	swd_sk

8.6.2. USB Serial (Only for iMX8 version)

You can open a serial connection using a micro-USB cable (not provided), with PuTTY for example with the following parameters:

Baud Rate	Data Bits	Stop Bits	Parity	Flow Control
115200	8	1	none	none

  ℹ️ Windows OS: you might have to download CP211x driver to see the serial port (COMx) on your host PC.

8.6.3. Remote Desktop protocol (Only for iMX8 version)

You can use the remote Desktop Protocol for graphical usage on your local PC:
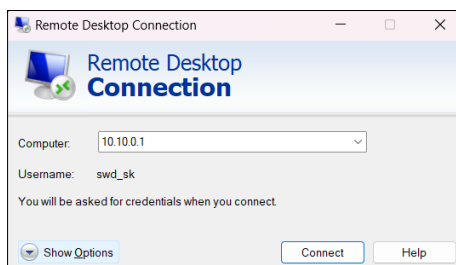
9. Starting the *SWD® Starter Kit with ez-Way®*

9.1. Power on

- Put the kit on the floor on a stable and flat surface.
- Install and plug the battery power connector onto the rear side of the robot.
- Press the ON/OFF button on the side of the robot, near the Emergency Stop

ℹ️ The computer and safety laser scanner lights turn on, and the kit starts booting. This process takes several seconds.

ℹ️ To start safely, you can engage one of the Emergency Stops while the robot is powering ON.

9.2. Wi-Fi connection to the Starter Kit

- Straighten the antennas
- Connect your device to the *SWD Starter Kit with ez-Way®* Wi-Fi access point

📶 AGV-'*3A68E8*'

ℹ️ SSID *<'3A68E8'> depends on your MAC address*
ℹ️ Click on "Log in with password" (instead of using a PIN code)

SSID	AGV-'*3A68E8*'
Type	WPA2 Personal
Password	!ez-Way!

ℹ️ Enter the password and Click on "Next"
ℹ️ Your device is now connected to the Wi-Fi access point

9.3. Connection to the Web pages

Two pages can now be accessed via the Starter Kit's hotspot connection.

	ez-Way® Config panel	ez-Way® Control panel
URL to be entered in your browser:	http://10.42.0.1:8081/	http://10.42.0.1:8082/
Use:	✓ Create & select missions ✓ Implement custom actions ✓ Select navigation modes	✓ Switch between modes ✓ Start a mission ✓ Check status and diagnostics ✓ Create a map
Login details:	Operator: ID: user1 Password: pass1	Integrator: ID: integrator Password: 868707	Administrator: ID: Administrator Password: 992617

Now, please refer to the ez-Way® instruction manual.

Appendices

1. **Quick Start for Starter Kit with ROS [EW2A-SK000A]**

2. **Quick Start for Starter Kit with ez-Way® [EW2A-SK125A]**

QUICK START

STARTER KIT WITH ROS [EW2A-SK000A]

1 **Power on**

- Put the kit on the floor on a stable and flat surface.
- Install and plug the battery power connector onto the rear side of the robot.
- Press the ON/OFF button on the side of the robot, near the Emergency Stop.

ⓘ The IPC and safety laser scanner lights turn on, and the kit starts booting for a few ten seconds.

ⓘ To start safely, you can engage one of the Emergency Stops while the robot is powering ON.
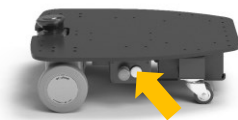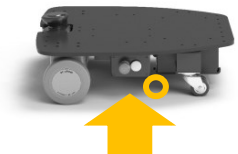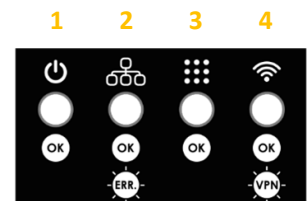
2 **Display and status**

iMX6 version

Display of the 4 LEDs - when the embedded IPC is powered:

1	**Power**	●	The battery power is available
2	**Devices**	●	The connection to the **SWD®** and to the safety laser scanner is active
		✳	The connection cannot be established
3	**ROS**	●	The ROS environment is active
4	**Wi-Fi**	●	The Internet connection is established
		✳	The VPN connection is activated (only for support)

iMX8 version

		iMX8 ON
Power Led State	Yellow	✓

3 **Connection to the web Control Page hosted on the embedded PC**

Connect your device to the **SWD® Starter Kit** thanks to its own Wi-Fi access point

ⓘ SSID and initial password are indicated on the front plate beside the safety laser scanner or on the leaflet.

ⓘ Once a PC or tablet is connected to the access point, a web page is available with any navigator by typing the webpage's address: **http://10.10.0.1**

ⓘ **The SLAM algorithm used by default is Hector Slam available under ROS Noetic, but other algorithms such as LaMa or Gmapping could be used.**

SSID: SWD-StarterKit-880756
Password: swd_starterkit

4 **Safety features monitoring**

The page is used to check the status of the safety features set up with the *SWD®* safety drives and the safety laser scanner and shows an example of map built thanks to a ROS open-source SLAM algorithm using the data from the safety laser scanner.

✹ **blinking green= connected;** ✹ **blinking red = connection not established yet**

SWD® Starter Kit Control Page

Safety Functions

● STO - Safe Torque Off (Emergency Stop) SIL3 / PLe

● SDI - Safe Direction (forward prohibited) SIL2 / PLd

● SLS - Safely Limited Speed (0.3 m/s max) SIL2 / PLd

● **illuminated = activated**

Illustration of activated safety feature

STO	●	when one of the two Emergency Stops is engaged, the motors are stopped (Safe Torque Off)
SDI	●	when the safety laser scanner detects an obstacle in the short perimeter (<50cm), the motors cannot go forward (Safe Direction)
SLS	●	when the safety laser scanner detects an obstacle in the nearby perimeter (<1m), the robot cannot exceed 0,3 m/s (Safely Limited Speed)

5 **Hand control for teleoperation (for demonstration)**

- ⓘ The wireless joystick is directly connected to the embedded IPC and allows manual teleoperation of the machine.
- ⓘ The *SWD® Starter Kit* uses standard ROS Noetic packages (using *joy* and *teleop_twist_joy*) providing interfaces with a standard console joystick.

To activate the hand controller, ROS packages must be started.

- ⓘ The status of the ROS LED can be checked to confirm that ROS is active.
- ⓘ Make sure you have released the emergency buttons.
- ⓘ If the motion control becomes jerky, then the joystick might be discharged. You should see joy's LEDs blinking.

Hold 'RB' pressed to activate movements

Hand control wake-up

Forward / Backward

Left / Right pivot

QUICK START

STARTER KIT WITH EZ-WAY® [EW2A-SK125A]

1 Power on

- Place the kit on the floor on a stable and flat surface.
- Install and plug the battery power connector to the rear side of the robot.
- Press the ON/OFF button on the side of the robot, near the Emergency Stop.

- [i] The computer and safety laser scanner lights turn on, and the kit starts booting. This process takes several seconds.
- [i] To start safely, you can engage one of the Emergency Stops while the robot is powering ON.

2 Wi-Fi connection to the Starter Kit

- Straighten the antennas
- Connect your device to the *SWD Starter Kit with ez-Way®* Wi-Fi access point

  📶 AGV-'*3A68E8*'

- [i] SSID <'*3A68E8*'> *depends on your MAC address*
- [i] Click on "Log in with password" (instead of using a PIN code)

SSID	AGV-'*3A68E8*'
Type	WPA2 Personal
Password	!ez-Way!

- [i] Enter the password and Click on "Next"
- [i] Your device is now connected to the Wi-Fi access point

3 Connection to the Web pages

Two pages can now be accessed via the Starter Kit's hotspot connection.

	ez-Way® Config panel		ez-Way® Control panel	
URL to be entered in your browser:	http://10.42.0.1:8081/		http://10.42.0.1:8082/	
Use:	✓ Create & select missions ✓ Implement custom actions ✓ Select navigation modes		✓ Switch between modes ✓ Start a mission ✓ Check status and diagnostics ✓ Create a map	
Login details:	Operator: ID: user1 Password: pass1	Integrator: ID: integrator Password: 868707	Administrator: ID: Administrator Password: 992617	

3. M12 Adapter 12 <-> 17 pin.

Pinout of the M12 connectors between the safety laser scanner (12 pin) and the *Safety Hub (17 pin):*

M12 male 17-pin, A-coded	Designation	Wire colour	M12 female 12-pin, A-coded
1	+24	Brown	1
2	GND	Blue	2
3	SWD1_SAFE_IN_1	White	3
4	SWD1_SAFE_IN_2	Green	4
5	-	-	5
6	SWD2_SAFE_IN_1	Yellow	6
7	SWD2_SAFE_IN_2	Black	7
8	-	-	8
9	SWD1_SAFE_IN_3	Red	9
10	SWD1_SAFE_IN_4	Violet	10
11	SWD2_SAFE_IN_3	Grey/Pink	11
12	SWD2_SAFE_IN_4	Red/Blue	12
13 … 17	-	-	-

4. Modification History

Revision	Release date	Changes
V0	19/11/2021	First Release First Development
V1	20/07/2022	Minor changes. Add Glossary and Quick Start procedure. Add joy documentation, *SWD®* safety certified.
V2	20/10/2022	Minor updates. Update Safety Hub's front panel. Add safety synoptic for 17 pin commissioning.
V3	10/01/2023	Minor updates. Update of the kit boxing. Add documentation for both types of commissioning (12 and 17 pin). Add documentation of adapter 12-17 pin. Add documentation about Safety Hub connectors. Fix mistake, STO activates SBC by default. Fix pinout and adapter wiring.
V4	31/10/2023	- Mention *SWD®* - Update Power Supply synoptic - Add release note - Add IPC version IMX8 - Add safety functions according to FW version 2.0
V5	04/04/2024	- Remove SICK scanner links - Fix inverted safe inputs no. 2 and 9 - Add button to hold for moving - Add indicative time before being able to run Starter Kit at startup
V6	16/12/2024	- Add link to Windows driver USB serial for iMX8 - Pins on iMX8 power jack connector specified - Illustration added for the RDP connection program - Document naming update - Update legal entity and trademark
V6-b	24/06/2025	- Remove Safety Hub connector doc, cf. dedicated documentation from this version - Remove commissioning 17 pin (same as 12 pin) - Rearrange connectors paragraphs and numeration - Formatting for adapter 12 <-> 17 pin
V7-a	25/08/2025	- Adding ez-Way® Starter Kit version - Remove *SWD®* Safety function explanations and refer to *SWD®* manual - Minor updates of figures, tables and syntax