
# ADLINK ROS 2 Solution

ADLINK
LEADING EDGE COMPUTING

NVIDIA PREFERRED PARTNER

# Table of Contents

# The Future of AMRs Now Wide Open

The future of Automated Mobile Robots (AMRs) is now wide open, as they are due to revolutionize every sector. These intelligent machines can autonomously navigate and adapt to dynamic environments, performing tasks like material handling, package delivery, lawn mowing, and more. With proven value in enhancing productivity and safety, AMRs will become even smarter and more adaptable further down the road, expanding their applications to sectors beyond imaginable. Embrace AMRs and automation technologies, and you are in for a transformational treat in the coming years.

Discover Our

# ROS 2 Robotic Controllers

The robotic controller is crucial in enabling an AMR to operate independently. Since it has to combine sensor data, decision-making algorithms, and task execution logic to navigate, interact with its environment, and carry out assigned tasks efficiently and safely, its effectiveness directly impacts the AMR system's overall performance, reliability, and adaptability. Hence, ADLINK has created the ROScube, a highly versatile and modular ROS 2 robotic controller family, and here are the three main series of ROScube:


## ROScube–Pico TGL

Compact robotic controller powered by Intel® CPU for quick and easy development

## ROScube–X

AI robotic controller powered by NVIDIA® Jetson™ for real-time Sensor Fusion

## ROScube–I

Intelligent robotic controller powered by Intel® CPU for complex data processing

# Solution Stack

The ROScube family is specially designed to seamlessly integrate with ROS 2 and its ecosystem.
This guarantees a smoother development process and improved synergy between hardware and software.

## ROS 2 Robotic Controller
Hardware


RQX-59 Series


RQX-580/58G


NPN-1B/2B


RQP-T33/35/37


RQI-53/55/57/58

## ROS 2
Software

### AI Accelerator SDK
- Intel OpenVino
- NVIDIA TensorRT

### ROS-Compatible Add-Ons & SDK
- Remote Control: EdgeGo
- Motion Control: SuperCat
- Protocol: Zenoh, Cyclone DDS
- Security: Trusted OS, TPM

### Integrated Development Utilities
NAV2, MoveIt2, GAZEBO, RQT, RQT_Graph, RViz

**OS – ROScube BSP - Ubuntu Linux Kernel**

## Partners

**Solution Partners**: FARobot, TIER IV, The Autoware Foundation

**Sensor Partners**
- Camera: TIER IV, StereoLabs*, eYeBrite, LEOPARD
- LiDAR: OUSTER

ADLINK's products and services

# Accelerate Your Success with ADLINK ROS 2 Solution

## Benefits

We have years of experience in system and sensor integrations.

We are experts in edge AI platform and BSP customization.

Our strategic partnerships with leading sensor brands enable us to provide reliable robotic solutions.

## Service Flow

In-depth discussion over project details and requirements

Recommending a suitable edge AI platform (robotic controller)

Customer testing and feedback

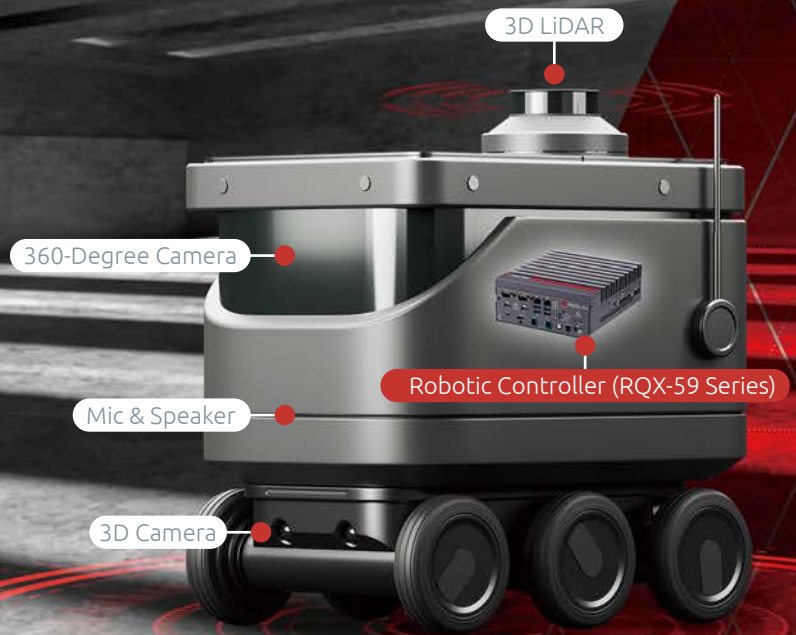
Quick PoC and implementation

# Key Components of a Sensor Fusion System

**A sensor fusion system combines data from multiple sensors to provide an accurate understanding of the environment.**

## Key components of such a system include

- Crucial sensors: Cameras, LiDAR, radar, and more, capturing different types of data.
- Data preprocessing: Cleaning and organizing data for further processing.
- Sensor calibration: Ensuring proper alignment and synchronization.
- Sensor data fusion algorithms: Combining data and extracting valuable information using techniques such as Kalman filtering and particle filtering.
- Edge perception units and/or computational platforms: Effectively processing large amounts of data and flawlessly executing fusion algorithms.




ADLINK's ROScube robotic controller is known for its outstanding performance and power efficiency. The RQX-59 Series is the perfect edge perception system that offers Frame Sync for GMSL2 and FPD-Link III cameras, as well as customized BSPs. It has a comprehensive I/O interface and uses the Jetson AGX Orin module, designed to process sensor fusion data and execute fusion algorithms seamlessly.

RQP-T37

ROX-59F

# *Unleashing the Power of AMRs with ADLINK ROS 2 Solution*

## Forklift Robot

### Challenges & Requirements

- Covering a wide geographic area and transporting heavy goods over long distances.
- Must maintain daily productivity with limited staff resources.

### Solution & Insight

- ADLINK's RQX-59F can support various types of LiDAR and up to 8 FPD-Link III cameras. It processes sensor data in real-time and enables forklift robots to navigate safely in narrow spaces, even with big and heavy cargo.
- A forklift robot can do the work of several workers and never get tired, reducing labor costs yet improving work efficiency.

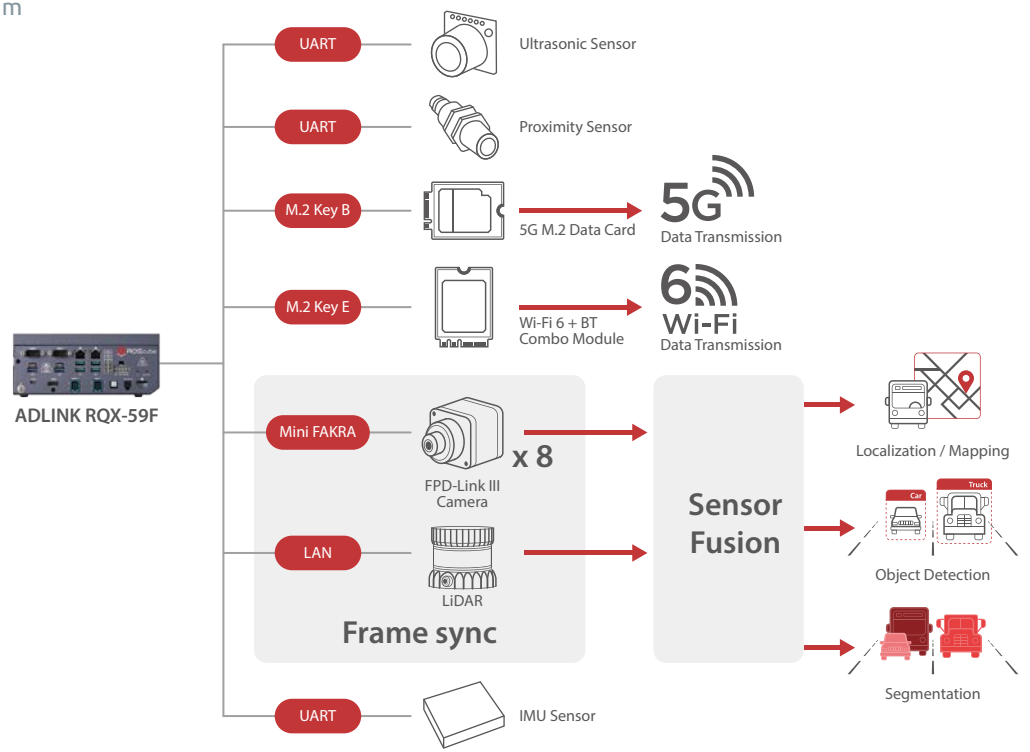
Use Case

# Next-Gen Logistics Automation

### Project Purpose

- Growing demand for smarter and more flexible AGV systems.
- AMRs offering efficient solutions amid rising labor costs.
- Minimizing workplace injuries caused by incorrect machine handling.

Diagram



## Delivery Robot

### Challenges & Requirements

- Ensuring safe and reliable automated navigation in dynamic and unpredictable environments.
- Designing and integrating robust sensor systems for accurate perception and obstacle avoidance.

### Solution & Insight

- ADLINK's RQX-59G supports the integration of various sensors, such as cameras and LiDAR, and effectively collects and processes sensor fusion data for reliable navigation and obstacle detection in dynamic environments.
- ADLINK's RQX-59G has a wide temperature operating range, ensuring performance and reliable operation in summer heat.

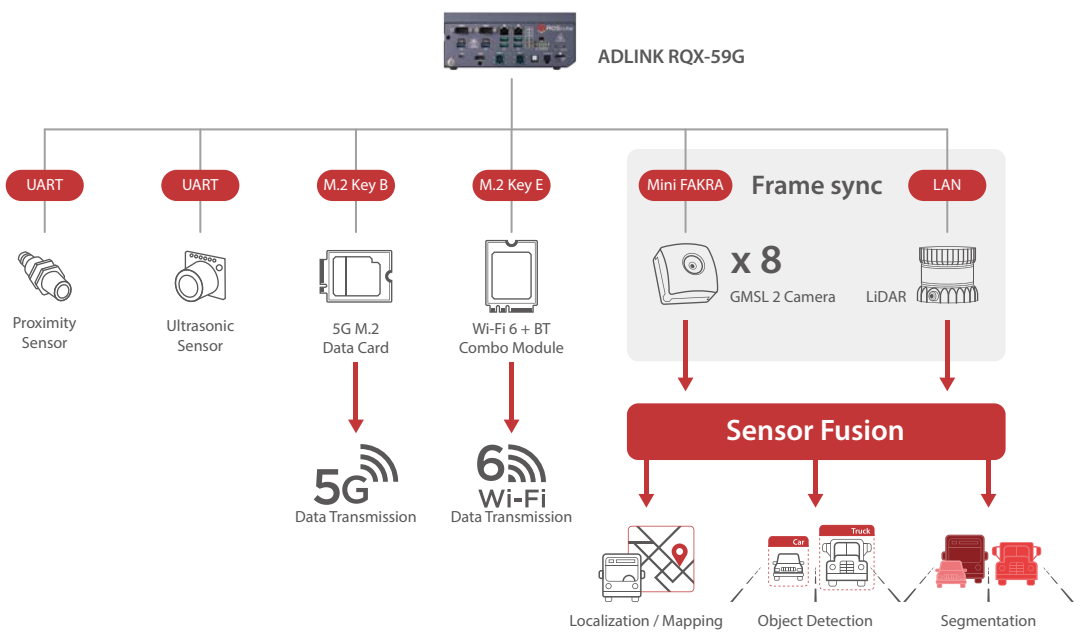
Use Case

# 24/7 Automated Delivery Service

### Project Purpose

- Increasing demand for contactless, efficient delivery.
- Fulfilling 24/7 delivery services while addressing labor shortages in the delivery industry.
- Cost-effective alternative to traditional delivery services.

Diagram



## Robotic Lawn Mower

### Challenges & Requirements

- A reliable edge AI platform to control the robot and process sensor data in real-time.
- 360-degree perception to navigate optimally through different terrains and environments.

### Solution & Insight

- The RQX-59F with Jetson AGX Orin enhances the robotic mower's precision by detecting and avoiding obstacles through powerful AI performance.
- The RQX-59F supports up to 8 FPD-Link III cameras to ensure 360-degree image coverage, with internal IMU sensors also helping with navigation.

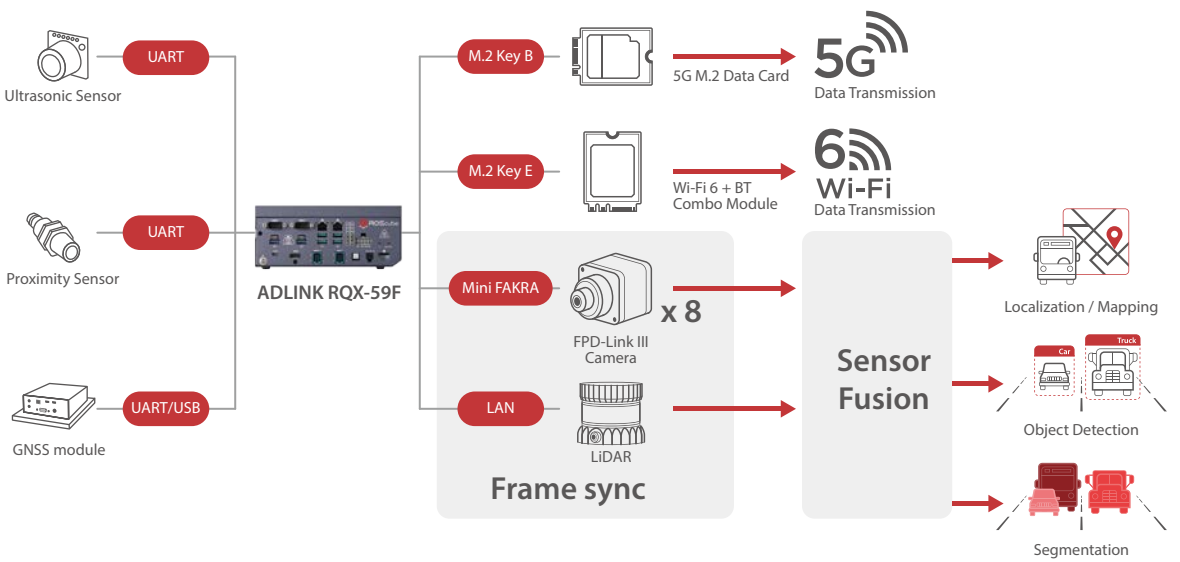
Use Case

# Effortless Lawn Care

### Project Purpose

- Robotic lawn mowers can be equipped with automated safety features for emergencies to prevent accidents and injuries caused by human errors.
- Effortless lawn maintenance and consistent results are achieved as the robotic mower handles cutting, trimming, and mulching, leading to a well-maintained lawn year-round.

Diagram



## Security Robot

### Challenges & Requirements

- The robots should be able to issue visual, audio, and smoke warnings to suspicious individuals and apprehend perpetrators.
- The robot should be able to patrol public areas and address potential threats automatically. Plus, it should be able to react quickly.

### Solution & Insight

- The RQP-T37 enables complex tasks like facial recognition and object detection and can also facilitate real-time data processing for quick decision-making.
- The RQP-T37 is a compact and energy-efficient device that significantly reduces power consumption in security robots.

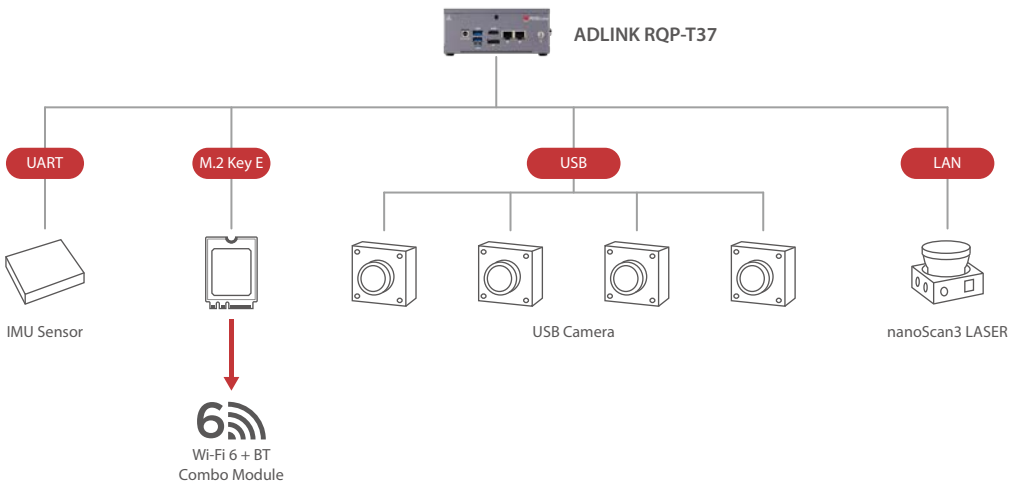
Use Case

# Automated Public Safety Patrol

### Project Purpose

- Security robots can be programmed to follow specific routes and protocols, ensuring reliable coverage without distractions or human errors.
- Security robots can handle real-time threats using the processed data received from various sensors, replacing human guards in hazardous environments.

Diagram



## Autonomous Vehicle

### Challenges & Requirements

- Seamless integration of hardware and software components with robust middleware.
- Achieving precise synchronization between LiDAR and multiple automotive cameras is crucial.
- Advanced computing is necessary for safety measurements and monitoring.

### Solution & Insight

- TIER IV has implemented an Edge Perception Development Kit for self-driving buses at airports and in crowded cities.
- The Edge Perception Development Kit includes ADLINK's ROScube RQX-58G controller and TIER IV's C1/C2 cameras.
- ADLINK's RQX-58G excels in supporting sensor fusion data processing and simultaneously supporting up to 8 automotive GMSL2 cameras.

Note: To learn more about the Edge Perception Development Kit, please visit: https://www.adlinktech.com/en/autonomous-driving-visual-perception-tier-iv. We highly recommend upgrading the RQX-58G to the latest RQX-59G model for 8X stronger AI performance with the Jetson Orin module.

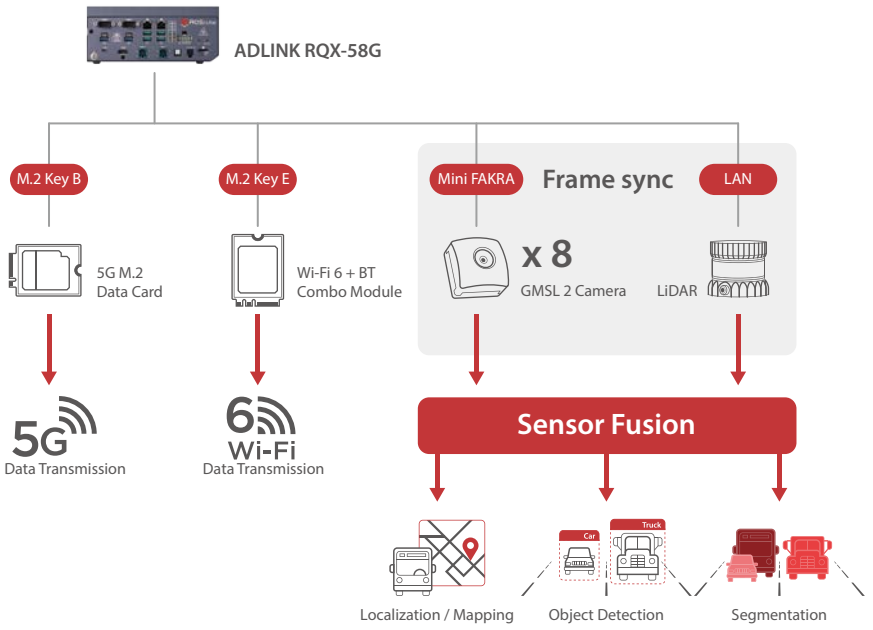
Use Case

# The Future of Public Transit

### Project Purpose

- Autonomous vehicles are equipped with advanced sensors and artificial intelligence, reducing human errors and accidents caused by distractions, fatigue, or impaired driving.
- Autonomous vehicles can communicate with each other and optimize traffic flow, leading to smoother and more efficient transportation systems.

Diagram



# Product Selection Guide

| Model Name | | RQX-59 Series | | |
|---|---|---|---|---|
| NVIDIA® or Intel® | | NVIDIA® Jetson AGX Orin™ | | |
| GMSL2 / FPD-Link III enabled | | GMSL2 x 8 /FPD-Link III x 8 | | |
| Frame Sync and Time Sync | | Yes | | |
| Validated Sensors | Brands | GMSL2 Camera | FPD-Link III Camera | LiDAR |
| | TIER IV | Automotive HDR camera C1/C2 | - | - |
| | StereoLabs | ZED-X/ ZED-X mini | - | - |
| | oToBrite | oToCAM264ISP | oToCAM264ISP<br>oToCAM222<br>oToCAM251 (customized BSP) | - |
| | Leopard | LI-AR0233-GMSL2(non ISP) | - | - |
| | Ouster | - | - | OS1-32 |
| OS | | Jetpack 5.1.2 or above<br>Ubuntu 20.04 | | |
| I/O | | 4x USB3.2; 2 x lockable USB3.2; 1x Micro USB (OTG); 2 x GbE | | |
| Storage Device | | 1x M.2 Key M 2280 and 2242; 1x micro SD card slot | | |
| Expansion | | 1x M.2 Key E 1630/2230 for Wi-Fi 6/BT; 1x M.2 Key B 3042/3052 for 5G/LTE | | |
| Audio | | Input/ Output | | |
| CAN bus | | CAN FD | | |
| Dimensions (W x D x H) | | 190 x 210 x 80 mm, 7.48 x 8.27 x 3.149 in<br>With expansion: 322 x 210 x 80 mm, 12.68 x 8.27 x 3.149 in | | |
| Weight | | 3.4kg w/o expansion box<br>4.7kg w/ expansion box | | |

| Model Name | | RQX-580/58G | |
|---|---|---|---|
| NVIDIA® or Intel® | | NVIDIA® Jetson AGX Xavier™ | |
| GMSL2 / FPD-Link III enabled | | GMSL2 x 8 | |
| Frame Sync and Time Sync | | Yes | |
| Validated Sensors | Brands | GMSL2 Camera | LiDAR |
| | TIER IV | Automotive HDR camera C1/C2 | - |
| | oToBrite | oToCAM264ISP | - |
| | Leopard | LI-AR0233-GMSL2 (non ISP) | - |
| | Ouster | - | OS1-32 |
| OS | | Jetpack 4.6 or above Ubuntu 18.04 | |
| I/O | | 4x USB3.2; 2 x lockable USB3.2; 1x Micro USB (OTG); 2 x GbE | |
| Storage Device | | 1x M.2 Key M 2280 and 2242; 1x micro SD card slot | |
| Expansion | | 1x M.2 Key E 1630/2230 for Wi-Fi 6/BT; 1x mini PCIe socket for 4G/LTE | |
| Audio | | Input/ Output | |
| CAN bus | | CAN FD | |
| Dimensions (W x D x H) | | 190x 210x 80 mm (7.48 x 8.27 x 3.149 inch) With Expansion: 322 x 210 x 80 mm (12.68 x 8.27 x 3.149 inch) | |
| Weight | | 3.4kg w/o expansion box 4.7kg w/ expansion box | |

| Model Name | | RQP-T33/35/37 | | RQI-53/55/57/58 | |
|---|---|---|---|---|---|
| NVIDIA® or Intel® | | 11th Gen Intel® Core™ i7/i5/i3 | | 8/9th Gen Intel® Core™ i7/i5/i3 | |
| GMSL2 / FPD-Link III enabled | | USB camera | | USB camera | |
| Frame Sync and Time Sync | | Yes | | Yes | |
| Validated Sensors | Brands | USB camera | LiDAR | USB camera | LiDAR |
| | Intel® | RealSense™ Depth Camera D435 | - | RealSense™ Depth Camera D435 | - |
| | SICK | - | nanoScan3 | - | nanoScan3 |
| | Ouster | - | OS1-32 | - | OS1-32 |
| OS | | Compatible with Ubuntu 20.04 | | Compatible with Ubuntu 20.04 | |
| I/O | | 2x USB 3.2 Gen2 Type A port;2x USB 3.2 Gen2 Type C ports; COM 1: RS-232; COM 2: power management; 1x 1GbE, 1x 2.5GbE; 1x DP, 1x HDMI | | 4x GbE; COM 1/2: RS-232/422/485; 6 x USB 3.1 Gen 1 Type A; 4x USB 2.0 Type A | |
| Storage Device | | 1x M.2 Key-M for NVMe PCIe Gen4 x4 SSD | | 256GB mSATA SSD or 128GB mSATA SSD or 64GB mSATA SSD | |
| Expansion | | 1x M.2 Key-E 2230 for Wi-Fi | | 1 x Mini PCIe for CAN; 1 x Mini PCIe for WiFi or LTE; 1 x A+E key, 2230 for Wi-Fi | |
| Audio | | Input/ Output | | N/A | |
| CAN bus | | N/A | | CAN FD module (FARO-FP900) (optional) | |
| Dimensions (W x D x H) | | 140 x 110 x 63 mm | | w/o expansion box: 210 x 240 x 86 mm; w/ expansion box: 210 x 240 x 165 mm | |
| Weight | | 1,086g | | 3.6kg w/o expansion box 4.6kg w/ expansion box | |

Head Office

**ADLINK Technology, Inc.**

No. 66, Huaya 1st Rd., Guishan Dist., Taoyuan
City 333411, Taiwan
Tel : +886-3-216-5088
Fax: +886-3-328-5706

www.adlinktech.com

Worldwide Offices

### Ampro ADLINK Technology, Inc.

6450 Via Del Oro, San Jose, CA 95119-1208, USA Tel: +1-408-360-0200
Toll Free: +1-800-966-5200 (USA only) Fax: +1-408-360-0222
Email: info@adlinktech.com

### ADLINK Technology (China) Co., Ltd.

上海市浦东新区张江高科技园区芳春路 300 号 (201203)
300 Fang Chun Rd., Zhangjiang Hi-Tech Park Pudong New Area, Shanghai, 201203 China
Tel: +86-21-5132-8988
Fax: +86-21-5192-3588
Email: market@adlinktech.com

### ADLINK Technology Beijing

北京市海淀区上地东路 1 号盈创动力大厦 E 座 801 室 (100085)
Rm. 801, Power Creative E, No. 1 Shang Di East Rd. Beijing, 100085 China
Tel: +86-10-5885-8666
Fax: +86-10-5885-8626
Email: market@adlinktech.com

### ADLINK Technology Shenzhen

深圳市南山区科技园南区高新南七道数字技术园 A1 栋 2 楼 C 区 (518057)
2F, C Block, Bldg. A1, Cyber-Tech Zone, Gao Xin
Ave. Sec. 7 High-Tech Industrial Park S., Shenzhen, 518054 China
Tel: +86-755-2643-4858
Fax: +86-755-2664-6353
Email: market@adlinktech.com

### ADLINK Technology Singapore Pte. Ltd.

84 Genting Lane #07-02A, Axxel Innovation Centre, Singapore 349584
Tel: +65-6844-2261
Fax: +65-6844-2263
Email: singapore@adlinktech.com

### ADLINK Technology Singapore Pte Ltd. (Indian Liaison Office)

#50-56, First Floor, Spearhead Towers Margosa Main Road (between 16th/17th Cross) Malleswaram, Bangalore - 560 055, India
Tel: +91-80-42246107, +91-80-23464606
Fax: +91-80-23464606
Email: india@adlinktech.com

### ADLINK Technology Japan Corporation

〒 101-0045 東京都千代田区神田鍛冶町 3-7-4 ユニゾ神田鍛冶町三丁目ビル 4F
Unizo Kanda Kaji-cho 3 Chome Bldg. 4F, 3-7-4 Kanda Kajicho, Chiyoda-ku,
Tokyo 101-0045, Japan
Tel: +81-3-4455-3722
Fax: +81-3-5209-6013
Email: japan@adlinktech.com

〒 450-0002 愛知県名古屋市中村区名駅 5-31-10 リンクス名駅ビル 3F
LINKS Meieki Bldg. 3F, 5-31-10 Meieki, Nakamura-ku, Nagoya-city,
Aichi 450-0002, Japan
Tel: +81-52-589-9018
Fax: +81-52-583-2807
Email: japan@adlinktech.com

### ADLINK Technology Korea Ltd.

경기도 용인시 수지구 신수로 767 A 동 1503 호 ( 동천동 , 분당수지유타워 ) ( 우 ) 16827
A-1503, U-TOWER, 767 Sinsu-ro, Suji-gu,
Yongin-si, Gyeonggi-do, Republic of Korea, 16827 Toll Free:+82-80-800-0585
Tel: +82-31-786-0585
Fax: +82-31-786-0583
Email: korea@adlinktech.com

### ADLINK Technology, Inc. (Israel Liaison Office)

MIXER Herzliya (Building B, 9 Floor) 3 Arik Einstein st., Zip code 4610301 Herzliya, Israel, P.O.Box - 351
Tel: +972-54-632-5251
Fax: +972-77-208-0230
Email: israel@adlinktech.com

### ADLINK Technology GmbH

Hans-Thoma-Straße 11
D-68163 Mannheim, Germany
Tel: +49 621 43214-0
Fax: +49 621 43214-30
Email: germany@adlinktech.com

Ulrichsbergerstraße 17
D-94469 Deggendorf, Germany
Tel: +49 991 290 94–10
Fax: +49 991 290 94–29
Email: germany@adlinktech.com

### ADLINK Technology, Inc. (French Liaison Office)

Bâtiment Thalès - Parc des Algorithmes, Route de l'Orme des Merisiers, 91190 SAINT AUBIN, France
Tel: +33 (0) 1 60 12 35 66
Fax: +33 (0) 1 60 12 35 66
Email: france@adlinktech.com

### ADLINK Technology, Inc. (UK Liaison Office)

First Floor West Exeter House,
Chichester fields Business Park Tangmere, West Sussex, PO20 2FU, United Kingdom
Tel:+44-1243-859677
Email: uk@adlinktech.com