

# **Vehicle Telematics Computer**

VTC 1020 (PKBX5331/-1/-2/-3)  
VTC 1020-PA (PKBX5332/-2/-3)  
VTC 1020-DA (PKBX5332-1/-4/-5)  
nROK 1020-A (PKBX5620)

## **User Manual**

Published July 2017

# CONTENTS

## Preface

|                                        |     |
|----------------------------------------|-----|
| Copyright .....                        | v   |
| Disclaimer .....                       | v   |
| Acknowledgements .....                 | v   |
| Regulatory Compliance Statements ..... | v   |
| Declaration of Conformity .....        | v   |
| RoHS Compliance .....                  | vi  |
| Warranty and RMA .....                 | vii |
| Safety Information .....               | ix  |
| Installation Recommendations .....     | ix  |
| Safety Precautions .....               | x   |
| Technical Support and Assistance ..... | xi  |
| Conventions Used in this Manual .....  | xi  |
| Ordering Information .....             | xiv |

## Chapter 1: Product Introduction

|                              |   |
|------------------------------|---|
| Physical Features .....      | 1 |
| VTC 1020 Front View .....    | 1 |
| VTC 1020 Rear View .....     | 1 |
| Physical Features .....      | 2 |
| VTC 1020-PA Front View ..... | 2 |
| VTC 1020-PA Rear View .....  | 2 |
| Physical Features .....      | 3 |
| nROK 1020 Front View .....   | 3 |
| nROK 1020 Rear View .....    | 3 |

|                                |    |
|--------------------------------|----|
| VTC 1020 Overview .....        | 4  |
| VTC 1020 Key Features .....    | 4  |
| VTC 1020-PA Overview .....     | 5  |
| VTC 1020-PA Key Features ..... | 5  |
| nROK 1020 Overview .....       | 6  |
| nROK 1020 Key Features .....   | 6  |
| Hardware Specifications .....  | 7  |
| Mechanical Dimensions .....    | 13 |
| VTC 1020 .....                 | 13 |
| VTC 1020-PA .....              | 14 |
| nROK 1020 .....                | 15 |
| Connector Numbering .....      | 16 |
| VTC 1020 Front View .....      | 16 |
| VTC 1020 Rear View .....       | 16 |
| VTC 1020-PA Front View .....   | 17 |
| VTC 1020-PA Rear View .....    | 17 |
| nROK 1020 Front View .....     | 18 |
| nROK 1020 Rear View .....      | 18 |

## Chapter 2: External Connectors Pinout Description

|                          |    |
|--------------------------|----|
| VGA Connector .....      | 19 |
| Reset Switch .....       | 19 |
| Dual USB 3.0 Ports ..... | 20 |
| HDMI .....               | 20 |
| LED Indicators .....     | 21 |
| Power Button .....       | 21 |

|                                                     |    |
|-----------------------------------------------------|----|
| SIM Card Slot .....                                 | 22 |
| LVDS Connector (VTC 1020-PA).....                   | 22 |
| Front Audio-Out 2 & 3 Connectors (VTC 1020-PA)..... | 23 |
| DC Power Input (nROK 1020).....                     | 23 |
| Audio Connector (nROK 1020) .....                   | 24 |
| M12 LAN Port (nROK 1020).....                       | 24 |
| DC Power Input .....                                | 25 |
| 12V DC Output .....                                 | 25 |
| Multi Port Connector.....                           | 26 |
| COM Connector.....                                  | 26 |
| LAN Port.....                                       | 27 |
| Rear Audio-Out 1 Connector.....                     | 27 |
| Rear Audio-In 1 Connector.....                      | 28 |

## Chapter 3: Jumpers and Connectors

|                                                        |    |
|--------------------------------------------------------|----|
| Before You Begin .....                                 | 29 |
| Precautions .....                                      | 29 |
| Jumper Settings.....                                   | 30 |
| Locations of the Jumpers and Connectors.....           | 31 |
| Top View.....                                          | 31 |
| Bottom View.....                                       | 32 |
| Connector Pin Definitions .....                        | 33 |
| CMOS Clear Switch.....                                 | 33 |
| GPIO Pull High Switch .....                            | 33 |
| WWAN Module Selector                                   |    |
| (For Wake-Up & Voice Functions on Mini-PCIe CN10)..... | 34 |
| RTC Battery Connector.....                             | 35 |
| Debug 80 Port Connector .....                          | 35 |
| SATA Power Connector .....                             | 36 |
| SATA Connector.....                                    | 36 |
| MCU Debug Port .....                                   | 37 |

|                                              |    |
|----------------------------------------------|----|
| MCU Download Port.....                       | 37 |
| GPS Connector .....                          | 38 |
| GPS DR Connector .....                       | 38 |
| Mini-PCIe Connector for PCIe/USB/mSATA ..... | 39 |
| Mini-PCIe Connector for WWAN Module .....    | 40 |

## Chapter 4: System Setup

|                                   |    |
|-----------------------------------|----|
| Opening the Enclosure .....       | 41 |
| Installing a SO-DIMM.....         | 42 |
| Installing the mSATA Module ..... | 42 |
| Installing the WWAN Module.....   | 43 |
| Installing a SSD/HDD Drive .....  | 43 |

## Appendix A: Software Demo Utility for I/O Ports of Function Control

|                   |    |
|-------------------|----|
| Menu Screen ..... | 45 |
| Config1 .....     | 45 |
| Config2.....      | 45 |
| 1. Config1 .....  | 46 |
| 2. Config2 .....  | 47 |
| 3. Config3 .....  | 48 |
| 4. G-Sensor ..... | 49 |
| 5. Tracker .....  | 50 |

## Appendix B: GPS Feature

|                               |    |
|-------------------------------|----|
| uBlox-NEO M8N Overview .....  | 53 |
| Technical Specifications..... | 53 |

## Appendix C: GPS with Dead Reckoning Feature

|                               |    |
|-------------------------------|----|
| uBlox-NEO M8L Overview .....  | 55 |
| Technical Specifications..... | 56 |

## **Appendix D: Signal Connection of Programmable DI/DO**

|                                     |    |
|-------------------------------------|----|
| Multi Port Pinout Description ..... | 58 |
| GPIO and CAN Terminal Setting ..... | 58 |
| Digital Input.....                  | 59 |
| Digital Output.....                 | 60 |

## **Appendix E: Vehicle Power Management Setup**

|                                            |    |
|--------------------------------------------|----|
| Entering BIOS Menu.....                    | 61 |
| Startup and Shutdown Voltage Setting ..... | 61 |
| Power-on Delay Setting.....                | 63 |
| Power-off Delay Setting .....              | 65 |

## **Appendix F: Power Consumption .....67**



# PREFACE

## Copyright

This publication, including all photographs, illustrations and software, is protected under international copyright laws, with all rights reserved. No part of this manual may be reproduced, copied, translated or transmitted in any form or by any means without the prior written consent from DELTA COMPONENTS GmbH.

## Disclaimer

The information in this document is subject to change without prior notice and does not represent commitment from DELTA COMPONENTS GmbH. However, users may update their knowledge of any product in use by constantly checking its manual posted on our website: <http://www.delta-components.de>.

DELTA COMPONENTS GmbH shall not be liable for direct, indirect, special, incidental, or consequential damages arising out of the use of any product, nor for any infringements upon the rights of third parties, which may result from such use. Any implied warranties of merchantability or fitness for any particular purpose is also disclaimed.

## Acknowledgements

VTC 1020 and nROK 1020 series are trademarks of DELTA COMPONENTS GmbH. All other product names mentioned herein are registered trademarks of their respective owners.

## Regulatory Compliance Statements

This section provides the FCC compliance statement for Class A devices and describes how to keep the system CE compliant.

## Declaration of Conformity

### FCC

This equipment has been tested and verified to comply with the limits for a Class A digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area (domestic environment) is likely to cause harmful interference, in which case the user will be required to correct the interference (take adequate measures) at their own expense.

### CE

The product(s) described in this manual complies with all applicable European Union (CE) directives if it has a CE marking. For computer systems to remain CE compliant, only CE-compliant parts may be used. Maintaining CE compliance also requires proper cable and cabling techniques.

## RoHS Compliance



### **DELTA COMPONENTS GmbH RoHS Environmental Policy and Status Update**

DELTA COMPONENTS GmbH is a global citizen for building the digital infrastructure. We are committed to providing green products and services, which are compliant with European Union RoHS (Restriction on Use of Hazardous Substance in Electronic Equipment) directive 2011/65/EU, to be your trusted green partner and to protect our environment.

RoHS restricts the use of Lead (Pb) < 0.1% or 1,000ppm, Mercury (Hg) < 0.1% or 1,000ppm, Cadmium (Cd) < 0.01% or 100ppm, Hexavalent Chromium (Cr6+) < 0.1% or 1,000ppm, Polybrominated biphenyls (PBB) < 0.1% or 1,000ppm, and Polybrominated diphenyl Ethers (PBDE) < 0.1% or 1,000ppm.

In order to meet the RoHS compliant directives, DELTA COMPONENTS GmbH has established an engineering and manufacturing task force to implement the introduction of green products. The task force will ensure that we follow the standard DELTA COMPONENTS GmbH development procedure and that all the new RoHS components and new manufacturing processes maintain the highest industry quality levels for which DELTA COMPONENTS GmbH are renowned.

The model selection criteria will be based on market demand. Vendors and suppliers will ensure that all designed components will be RoHS compliant.

### **How to recognize DELTA COMPONENTS GmbH RoHS Products?**

For existing products where there are non-RoHS and RoHS versions, the suffix (LF) will be added to the compliant product name.

All new product models launched after January 2013 will be RoHS compliant. They will use the usual DELTA COMPONENTS GmbH naming convention.

# Warranty and RMA

## DELTA COMPONENTS GmbH Warranty Period

DELTA COMPONENTS GmbH manufactures products that are new or equivalent to new in accordance with industry standard. DELTA COMPONENTS GmbH warrants that products will be free from defect in material and workmanship for 2 years, beginning on the date of invoice by DELTA COMPONENTS GmbH. HCP series products (Blade Server) which are manufactured by DELTA COMPONENTS GmbH are covered by a three year warranty period.

## DELTA COMPONENTS Return Merchandise Authorization (RMA)

- Customers shall enclose the DELTA COMPONENTS GmbH RMA Service Form with the returned packages.
- Customers must collect all the information about the problems encountered and note anything abnormal or, print out any on-screen messages, and describe the problems on the DELTA COMPONENTS GmbH RMA Service Form for the RMA number apply process.
- Customers can send back the faulty products with or without accessories (manuals, cable, etc.) and any components from the card, such as CPU and RAM. If the components were suspected as part of the problems, please note clearly which components are included. Otherwise, DELTA COMPONENTS GmbH is not responsible for the devices/parts.
- Customers are responsible for the safe packaging of defective products, making sure it is durable enough to be resistant against further damage and deterioration during transportation. In case of damages occurred during transportation, the repair is treated as Out of Warranty.

- Any products returned by DELTA COMPONENTS GmbH to other locations besides the customers' site will bear an extra charge and will be billed to the customer.

## Repair Service Charges for Out-of-Warranty Products

DELTA COMPONENTS GmbH will charge for out-of-warranty products in two categories, one is basic diagnostic fee and another is component (product) fee.

### System Level

- Component fee: DELTA COMPONENTS GmbH will only charge for main components such as SMD chip, BGA chip, etc. Passive components will be repaired for free, ex: resistor, capacitor.
- Items will be replaced with DELTA COMPONENTS GmbH products if the original one cannot be repaired. Ex: motherboard, power supply, etc.
- Replace with 3rd party products if needed.
- If RMA goods can not be repaired, DELTA COMPONENTS GmbH will return it to the customer without any charge.

### Board Level

- Component fee: DELTA COMPONENTS GmbH will only charge for main components, such as SMD chip, BGA chip, etc. Passive components will be repaired for free, ex: resistors, capacitors.
- If RMA goods can not be repaired, DELTA COMPONENTS GmbH will return it to the customer without any charge.

## Warnings

Read and adhere to all warnings, cautions, and notices in this guide and the documentation supplied with the chassis, power supply, and accessory modules. If the instructions for the chassis and power supply are inconsistent with these instructions or the instructions for accessory modules, contact the supplier to find out how you can ensure that your computer meets safety and regulatory requirements.

## Cautions

Electrostatic discharge (ESD) can damage system components. Do the described procedures only at an ESD workstation. If no such station is available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the computer chassis.

## Safety Information

Before installing and using the device, note the following precautions:

- Read all instructions carefully.
- Do not place the unit on an unstable surface, cart, or stand.
- Follow all warnings and cautions in this manual.
- When replacing parts, ensure that your service technician uses parts specified by the manufacturer.
- Avoid using the system near water, in direct sunlight, or near a heating device.
- The load of the system unit does not solely rely for support from the rackmounts located on the sides. Firm support from the bottom is highly necessary in order to provide balance stability.
- The computer is provided with a battery-powered real-time clock circuit. There is a danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

## Installation Recommendations

Ensure you have a stable, clean working environment. Dust and dirt can get into components and cause a malfunction. Use containers to keep small components separated.

Adequate lighting and proper tools can prevent you from accidentally damaging the internal components. Most of the procedures that follow require only a few simple tools, including the following:

- A Philips screwdriver
- A flat-tipped screwdriver
- A grounding strap
- An anti-static pad

Using your fingers can disconnect most of the connections. It is recommended that you do not use needle-nose pliers to disconnect connections as these can damage the soft metal or plastic parts of the connectors.

## Safety Precautions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a stable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection to protect the equipment from overheating. **DO NOT COVER THE OPENINGS.**
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Place the power cord in a way so that people will not step on it. Do not place anything on top of the power cord. Use a power cord that has been approved for use with the product and that it matches the voltage and current marked on the product's electrical range label. The voltage and current rating of the cord must be greater than the voltage and current rating marked on the product.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:
  - a. The power cord or plug is damaged.
  - b. Liquid has penetrated into the equipment.
  - c. The equipment has been exposed to moisture.
  - d. The equipment does not work well, or you cannot get it to work according to the user's manual.
  - e. The equipment has been dropped and damaged.
  - f. The equipment has obvious signs of breakage.
15. Do not place heavy objects on the equipment.
16. The unit uses a three-wire ground cable which is equipped with a third pin to ground the unit and prevent electric shock. Do not defeat the purpose of this pin. If your outlet does not support this kind of plug, contact your electrician to replace your obsolete outlet.
17. **CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER. DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.**

## Technical Support and Assistance

1. For the most updated information of DELTA COMPONENTS products, visit DELTA COMPONENTS website at [www.delta-components.de](http://www.delta-components.de)
2. For technical issues that require contacting our technical support team or sales representative, please have the following information ready before calling:
  - Product name and serial number
  - Detailed information of the peripheral devices
  - Detailed information of the installed software (operating system, version, application software, etc.)
  - A complete description of the problem
  - The exact wordings of the error messages

### Warning!

1. Handling the unit: carry the unit with both hands and handle it with care.
2. Maintenance: to keep the unit clean, use only approved cleaning products or clean with a dry cloth.
3. CFast: Turn off the unit's power before inserting or removing a CFast storage card.

## Conventions Used in this Manual



### Warning:

Information about certain situations, which if not observed, can cause personal injury. This will prevent injury to yourself when performing a task.



### Caution:

Information to avoid damaging components or losing data.



### Note:

Provides additional information to complete a task easily.

## Ordering Information

The following information below provides ordering information for the VTC 1020 and nROK 1020 series.

### **VTC 1020 (PKBX5331)**

Intel Atom x5-E3930 DualCore 1.8GHz  
2GB DDR3L, 1x VGA, 1x HDMI, 7x COM, 1xCAN

### **VTC 1020 (PKBX5331-1)**

Intel Atom x5-E3930 DualCore 1.8GHz  
4GB DDR3L, 1x VGA, 1x HDMI, 7x COM, 1xCAN

### **VTC 1020 (PKBX5331-2)**

Intel Atom x5-E3930 DualCore 1.8GHz  
8GB DDR3L, 1x VGA, 1x HDMI, 7x COM, 1xCAN

### **VTC 1020-PA (PKBX5332)**

Intel Atom x5-E3930 DualCore 1.8GHz  
2GB DDR3L, 1x VGA, 1x HDMI, 1x LVDS, 7x COM, 1x CAN, 3x Audio

### **VTC 1020-PA (PKBX5332-2)**

Intel Atom x5-E3930 DualCore 1.8GHz  
4GB DDR3L, 1x VGA, 1x HDMI, 1x LVDS, 7x COM, 1x CAN, 3x Audio

### **VTC 1020-PA (PKBX5332-3)**

Intel Atom x5-E3930 DualCore 1.8GHz  
8GB DDR3L, 1x VGA, 1x HDMI, 1x LVDS, 7x COM, 1x CAN, 3x Audio

### **VTC 1020-DA (PKBX5332-1)**

Intel Atom x5-E3930 DualCore 1.8GHz  
2GB DDR3L, 1x VGA, 1x HDMI, 1x LVDS, 7x COM, 1x CAN, 3x Audio

### **VTC 1020-DA (PKBX5332-4)**

Intel Atom x5-E3930 DualCore 1.8GHz  
4GB DDR3L, 1x VGA, 1x HDMI, 1x LVDS, 7x COM, 1x CAN, 3x Audio

### **VTC 1020-DA (PKBX5332-5)**

Intel Atom x5-E3930 DualCore 1.8GHz  
8GB DDR3L, 1x VGA, 1x HDMI, 1x LVDS, 7x COM, 1x CAN, 3x Audio

### **nROK 1020-A (PKBX5620)**

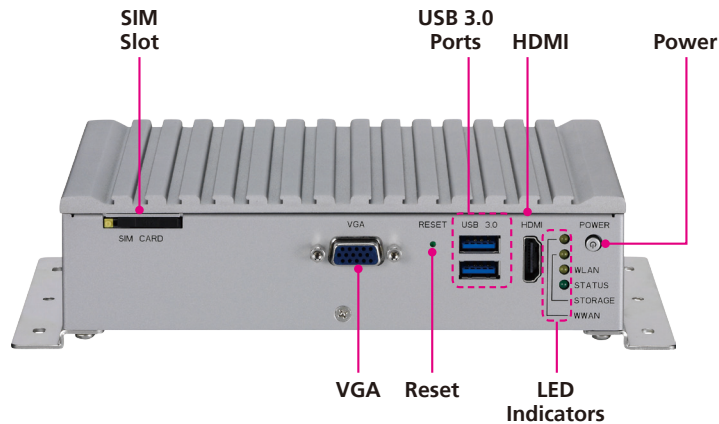
Intel Atom x5-E3930 1.8GHz, 5x RS232 + 2x RS485  
2GB DDR3L, 1x VGA, 1x HDMI



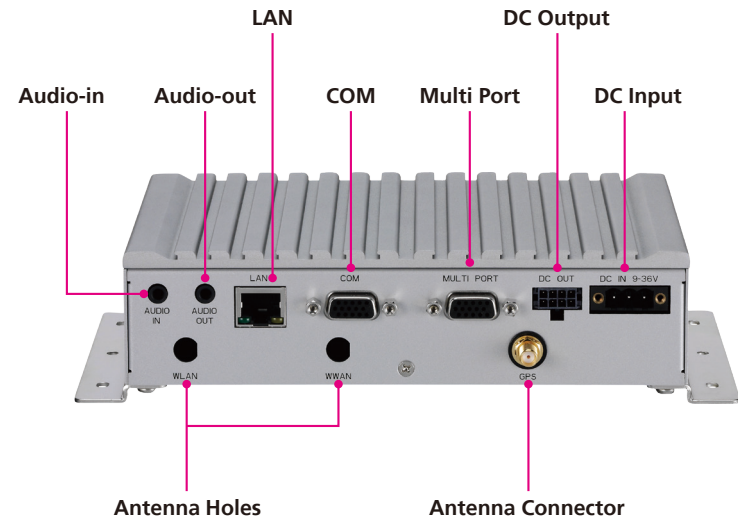
# CHAPTER 1: PRODUCT INTRODUCTION

## Physical Features

### VTC 1020 Front View

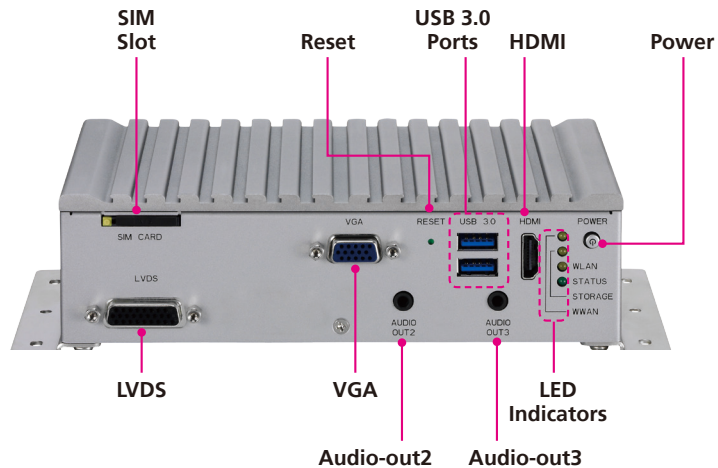


### VTC 1020 Rear View

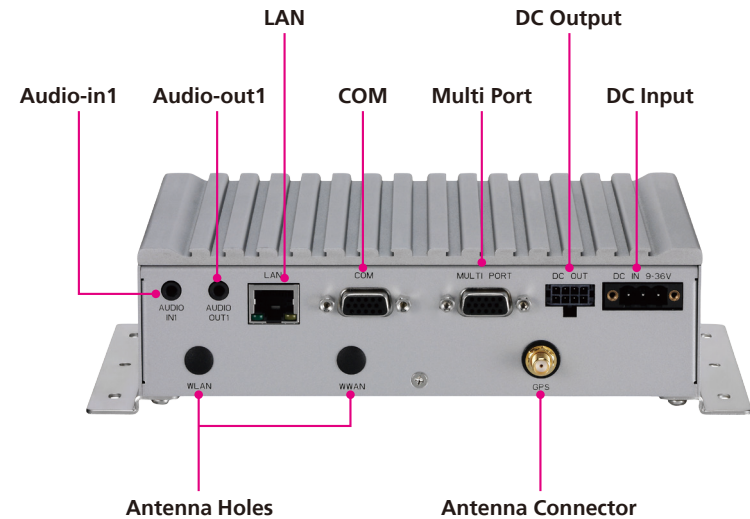


## Physical Features

### VTC 1020-PA Front View

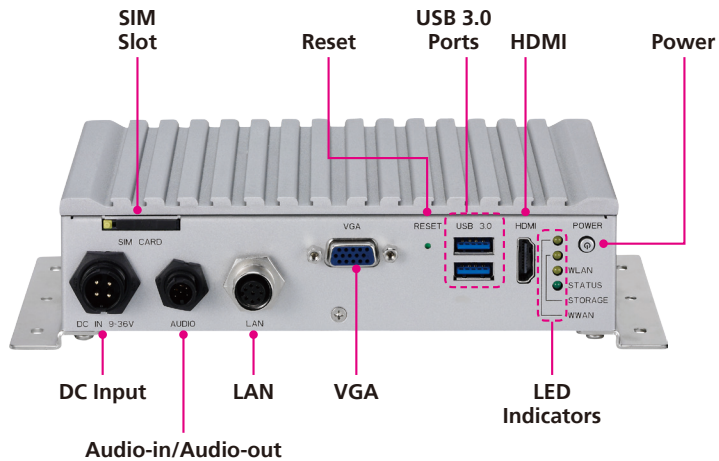


### VTC 1020-PA Rear View

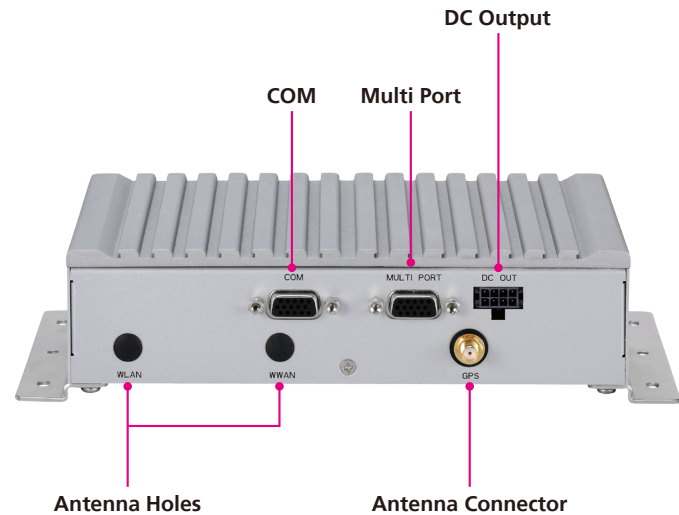


## Physical Features

### nROK 1020 Front View



### nROK 1020 Rear View



## VTC 1020 Overview

VTC 1020, a compact, rugged and entry-level vehicle computer with Intel® Atom™ x5-E3930 processor dual core 1.8GHz, is designed for the harsh in-vehicle environment. Because of the compact design, it is especially for the vehicles with limited space to locate the computer system, but without compromising with its space to sacrifice its features.

VTC 1020 has onboard CAN 2.0B and optional OBD interface (SAE J1939) for vehicle diagnostics and driver behavior management. An advanced GPS receiver supports GPS/Gloness/QZSS/Galileo/Beidou and optional dead reckoning module is also available. VTC 1020 features WLAN and WWAN wireless data and voice connectivity. With external SIM socket, it allows user to access SIM card conveniently. 12VDC output can be provided for external display with easy power wire arrangement. VTC 1020 keeps the flexibility to meet different demands for telematics applications, such as infotainment, fleet management and patching system.

## VTC 1020 Key Features

- Compact and fanless design
- Built-in GPS receiver with optional dead reckoning function
- Variety of wireless communication options
- Built-in CAN bus 2.0B. Optional CAN/SAE J1939/J1708 function
- Wide range DC input from 9~36V
- Smart power management with Ignition on/off delay via software control and low voltage protection
- Certified by CE/FCC/E13 mark
- 5 x RS232 and 2 x RS485

## VTC 1020-PA Overview

VTC 1020-PA, a compact, rugged and entry-level vehicle computer with Intel® Atom™ x5-E3930 processor dual core 1.8GHz, is dedicated for public transportation application in harsh in-vehicle environment. Because of the compact design, it is especially for the vehicles with limited space to locate the computer system, but without compromising with its space to sacrifice its features.

VTC 1020-PA has 1 Audio-in and 3 Audio-out switchable that can be used as public announcement function, such as for driver, internal passengers and external passengers. Since it has 3 independant video ouput, it is flexible to provide different video conent in PIS application. VTC 1020-PA has on board CAN 2.0B and optional CAN/SAE J1939/J1708 for vehicle diagnostics and driver behavior management. An advanced GPS receiver supports GPS/ Gloness/QZSS/Galileo/Beidou and optional dead reckoning module is also available. VTC 1020-PA features WLAN and WWAN wireless data and voice connectivity. With external SIM socket, it allows user to access SIM card conveniently. 12VDC output can be provided for external display with easy power wire arrangement. VTC 1020-PA is very suitable for public transportation application, such as local bus, shuttle bus, tour bus and highway bus.

## VTC 1020-PA Key Features

- Compact and fanless design
- Built-in GPS receiver with optional dead reckoning function
- Variety of wireless communication options
- Built-in CAN bus 2.0B. Optional CAN/SAE J1939/J1708 function
- Smart power management with Ignition on/off delay via software control and low voltage protection
- Wide range DC input from 9~36V
- Certified by CE/FCC/E13 mark
- 5 x RS232 and 2 x RS485
- 1 x Audio-in and 3 x Audio-out switchable
- 3 x Independent video ouput (VGA + HDMI + LVDS) simultaneously

## nROK 1020 Overview

nROK 1020, a compact, rugged and entry-level railway computer with Intel® Atom™ x5-E3930 processor dual core 1.8GHz, is designed for the harsh railway related applications. Because of the compact design, it is easy to be located without compromising its features.

Adopting lock concept, LAN, Power-in and Audio, are all designed against vibration and shock impact. An advanced GPS receiver supports GPS/Gloness/QZSS/Galileo/Beidou and optional dead reckoning module is also available. Thanks to 2 mini-PCIe socket, nROK 1020 is perfectly suited for wireless applications, such as WLAN and WWAN data and voice transmission. With external SIM socket, it allows users to access SIM card conveniently. 12VDC output can be provided for external display with easy power wire arrangement. nROK 1020 is very suitable for Passenger Information System, Automatic Fare Collections and digital radio data/voice transmission applications.

## nROK 1020 Key Features

- Compact and fanless design
- Built-in GPS receiver with optional dead reckoning function
- Variety of wireless communication options
- Smart power management with Ignition on/off delay via software control and low voltage protection
- 24VDC EN50155 Class TX conformity
- 5 x RS232 and 2 x RS485

# Hardware Specifications

## VTC 1020

### CPU

- Intel® Atom™ x5-E3930 processor dual core 1.8GHz

### Memory

- 1x 204-pin DDR3L SO-DIMM socket support 1867MHz up to 8GB.  
Default 2GB

### Expansion

- 1x mini-PCle socket (USB)
- 1x mini-PCle socket (PCIe + USB + mSATA)

### Function

- 1x u-blox NEO-M8N module (support GPS/Gloness/QZSS/Galileo/Beidou) or optional module with Dead Reckoning
- Built-in G-sensor
- Built-in TPM

### I/O Interface-Front

- 1x power button
- 4x LED indicators for Status (programmable), Storage, WLAN and WWAN
- 1x system reset button
- 2x type A USB 3.0 compliant host, supporting system boot up
- 1x DB-15 VGA
- 1x HDMI
- 1x external SIM card socket

### I/O Interface-Rear

- 1x 9~36VDC input with Ignition and 20W typical power consumption

- 1x 12V/2A DC output, SMBus, power button
- 1x RJ45 with LEDs for 10/100/1000Mbps Ethernet
- 1x Audio-in, 1x Audio-out
- 1x DB9 COM port for 4x RS232 Tx/Rx and 2x RS485
- 1x DB15 for multi port
  - 1x CAN2.0 (optional SAE J1939)
  - 1x RS232 Tx/Rx
  - 1x odometer and direction for optional DR
  - 5x programmable DIO
    - Input voltage (sink type): 5VDC TTL (default)
    - Input voltage (source type): 3~24VDC
    - Digital output (sink type): 5VDC TTL (default), max current: 20mA
    - Digital output (source type): 3~24VDC
- 3x Antenna holes for SMA-type antenna (WWAN/WLAN/GPS)

### Expandable Storage

- 1x 2.5" SSD SATA 3.0
- 1x mSATA

### Operating System

- Windows 10
- Linux YOCTO (by request)

### Power Management

- Selectable boot-up & shut-down voltage for low power protection
- HW design ready for 8-level delay time on/off at user's self configuration
- Power on/off ignition, software detectable
- Support S3, S4 suspend mode

### Dimensions

- 185mm (W) x 120mm (D) x 45mm (H) (7.3" x 4.7" x 1.8")
- 1kg (2.20lbs)

## Construction

- Aluminum top case with sheet metal

## Environment

- -40°C to 70°C (w/ industrial SSD) with air flow
- Storage temperatures: -40°C to 85°C
- Relative humidity: 10% to 90% (non-condensing)
- Vibration (SSD):  
Vibration (random): 2g @5~500 Hz  
Operating: MIL-STD-810F, Method 514.5, Category 20, Ground Vehicle – Highway Truck  
Storage: MIL-STD-810F, Method 514.5, Category 24, Integrity Test
- Shock (SSD):  
Operating: MIL-STD-810F, Method 516.5, Procedure I, Trucks and semi-trailers=20g  
Crash hazard: MIL-STD-810F, Method 516.5, Procedure V, Ground equipment=75g

## Standards/Certifications

- CE approval
- FCC Class A
- E13 mark



## VTC 1020-PA

### CPU

- Intel® Atom™ x5-E3930 processor dual core 1.8GHz

### Memory

- 1x 204-pin DDR3L SO-DIMM socket support 1867MHz up to 8GB.  
Default 2GB

### Expansion

- 1x mini-PCIe socket (USB)
- 1x mini-PCIe socket (PCIe + USB + mSATA)

### Function

- 1x u-blox NEO-M8N module (support GPS/Gloness/QZSS/Galileo/Beidou) or optional module with Dead Reckoning
- Built-in G-sensor
- Built-in TPM

### I/O Interface-Front

- 1x power button
- 4x LED indicators for Status (programmable), Storage, WLAN and WWAN
- 1x system reset button
- 2x type A USB 3.0 compliant host, supporting system boot up
- 1x DB-15 VGA
- 1x HDMI
- 1x external SIM card socket
- 1x DB26 LVDS interface with 12VDC, USB 2.0 and power button
- 2x Audio-out

### I/O Interface-Rear

- 1x 9~36VDC input with Ignition and 20W typical power consumption

- 1x 12V/2A DC output, SMBus, power button
- 1x RJ45 with LEDs for 10/100/1000Mbps Ethernet
- 1x Audio-in, 1x Audio-out
- 1x DB15 COM port for 4x RS232 Tx/Rx and 2x RS485
- 1x DB15 for multi port
  - 1x CAN2.0 (optional SAE J1939)
  - 1x RS232 Tx/Rx
  - 1x odometer and direction for optional GPS DR
  - 5x programmable DIO
- Input voltage (sink type): 5VDC TTL (default)  
Input voltage (source type): 3~24VDC  
Digital output (sink type): 5VDC TTL (default), max current: 20mA  
Digital output (source type): 3~24VDC
- 3x Antenna holes for SMA-type antenna (WWAN/WLAN/GPS)

### Expandable Storage

- 1x 2.5" SSD SATA 3.0
- 1x mSATA

### Operating System

- Windows 10
- Linux YOCTO (by request)

### Power Management

- Selectable boot-up & shut-down voltage for low power protection
- HW design ready for 8-level delay time on/off at user's self configuration
- Power on/off ignition, software detectable
- Support S3, S4 suspend mode

### Dimensions

- 185mm (W) x 120mm (D) x 50mm (H) (7.3" x 4.7" x 1.96")
- 1.1kg (2.42lbs)

## Construction

- Aluminum top case with sheet metal

## Environment

- -40°C to 70°C (w/ industrial SSD) with air flow
- Storage temperatures: -40°C to 85°C
- Relative humidity: 10% to 90% (non-condensing)
- Vibration (SSD):  
Vibration (random): 2g @5~500 Hz  
Operating: MIL-STD-810F, Method 514.5, Category 20, Ground Vehicle – Highway Truck  
Storage: MIL-STD-810F, Method 514.5, Category 24, Integrity Test
- Shock (SSD):  
Operating: MIL-STD-810F, Method 516.5, Procedure I, Trucks and semi-trailers=20g  
Crash hazard: MIL-STD-810F, Method 516.5, Procedure V, Ground equipment=75g

## Standards/Certifications

- CE approval
- FCC Class A
- E13 mark

## nROK 1020

### CPU

- Intel® Atom™ x5-E3930 processor dual core 1.8GHz

### Memory

- 1x 204-pin DDR3L SO-DIMM socket support 1867MHz up to 8GB.  
Default 2GB

### Expansion

- 1x mini-PCIe socket (USB)
- 1x mini-PCIe socket (PCIe + USB + mSATA)

### Function

- 1x u-blox NEO-M8N module (support GPS/Gloness/QZSS/Galileo/Beidou) or optional module with Dead Reckoning
- Built-in G-sensor
- Built-in TPM

### I/O Interface-Front

- 1x power button
- 4x LED indicators for Status (programmable), Storage, WLAN and WWAN
- 1x system reset button
- 2x type A USB 3.0 compliant host, supporting system boot up
- 1x DB-15 VGA
- 1x HDMI
- 1x external SIM card socket
- 1x circular connector for 9~36VDC input with ignition and 20W typical power consumption
- 1x circular connector for Audio-In and Audio-Out
- 1x M12 connector for 10/100/1000Mbps Ethernet

### I/O Interface-Rear

- 1x 12V/2A DC output, SMBus, power button
- 1x DB15 COM port for 4x RS232 Tx/Rx and 2x RS485
- 1x DB15 for multi port
  - 1x CAN2.0
  - 1x RS232 Tx/Rx
  - 1x odometer and direction for optional DR
  - 5x programmable DIO
- Input voltage (sink type): 5VDC TTL (default)  
Input voltage (source type): 3~24VDC  
Digital output (sink type): 5VDC TTL (default), max current: 20mA  
Digital output (source type): 3~24VDC
- 3x Antenna holes for SMA-type antenna (WWAN/WLAN/GPS)

### Expandable Storage

- 1x 2.5" SSD SATA 3.0
- 1x mSATA

### Operating System

- Windows 10
- Linux YOCTO (by request)

### Power Management

- Selectable boot-up & shut-down voltage for low power protection
- HW design ready for 8-level delay time on/off at user's self configuration
- Power on/off ignition, software detectable
- Support S3, S4 suspend mode

### Dimensions

- 185mm (W) x 120mm (D) x 45mm (H) (7.3" x 4.7" x 1.8")
- 1kg (2.20lbs)

## Construction

- Aluminum top case with sheet metal

## Environment

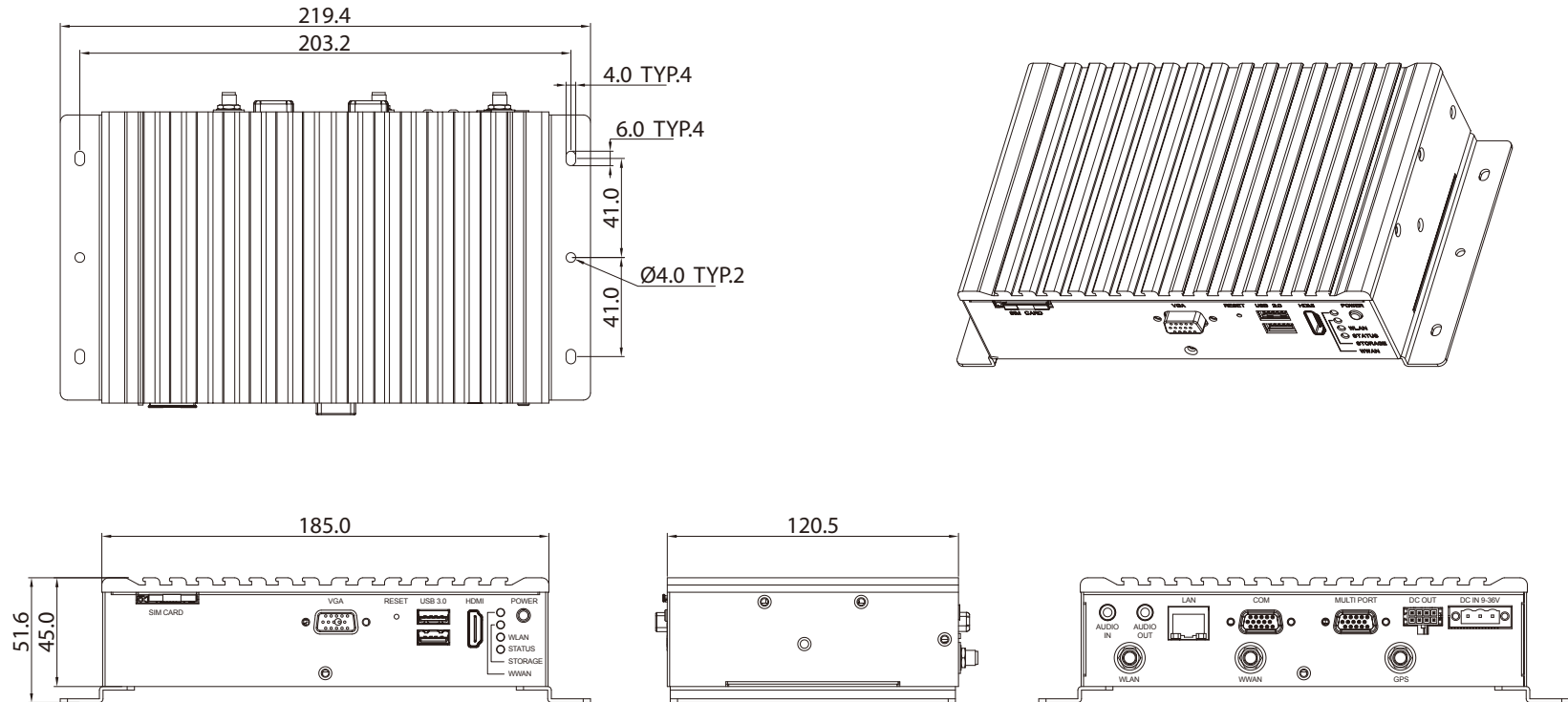
- Storage temperatures: -40°C to 85°C
- Relative humidity: 10% to 90% (non-condensing)
- Vibration:
  - Vibration (random): 2g @5~500 Hz
  - Operating: MIL-STD-810F, Method 514.5, Category 20, Ground Vehicle – Highway Truck
  - Storage: MIL-STD-810F, Method 514.5, Category 24, Integrity Test
- Shock:
  - Operating: MIL-STD-810F, Method 516.5, Procedure I, Trucks and semi-trailers=20g
  - Crash hazard: MIL-STD-810F, Method 516.5, Procedure V, Ground equipment=75g

## Standards/Certifications

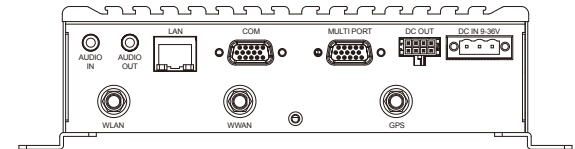
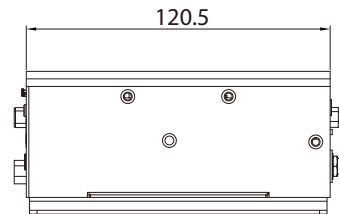
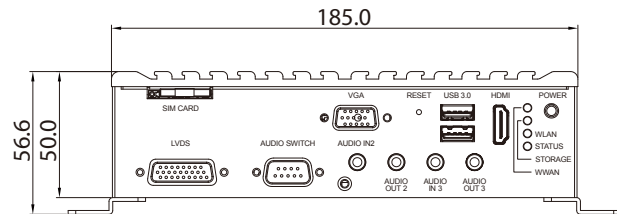
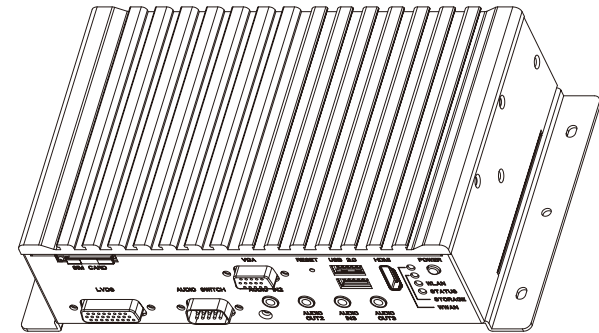
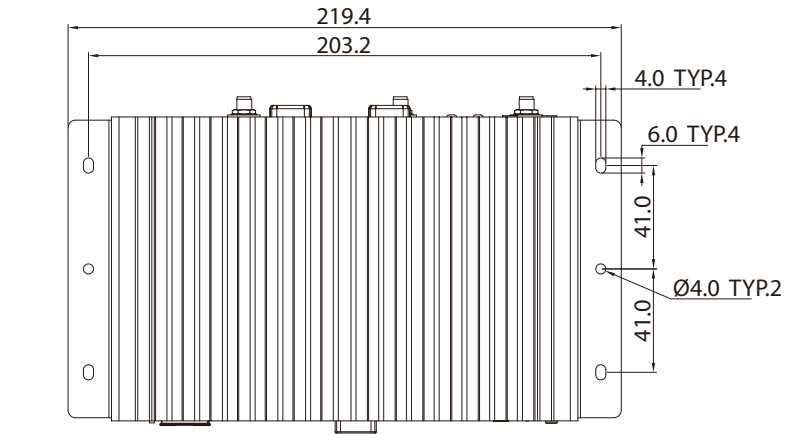
- CE approval
- FCC Class A
- 24VDC EN50155 Class TX conformity

# Mechanical Dimensions

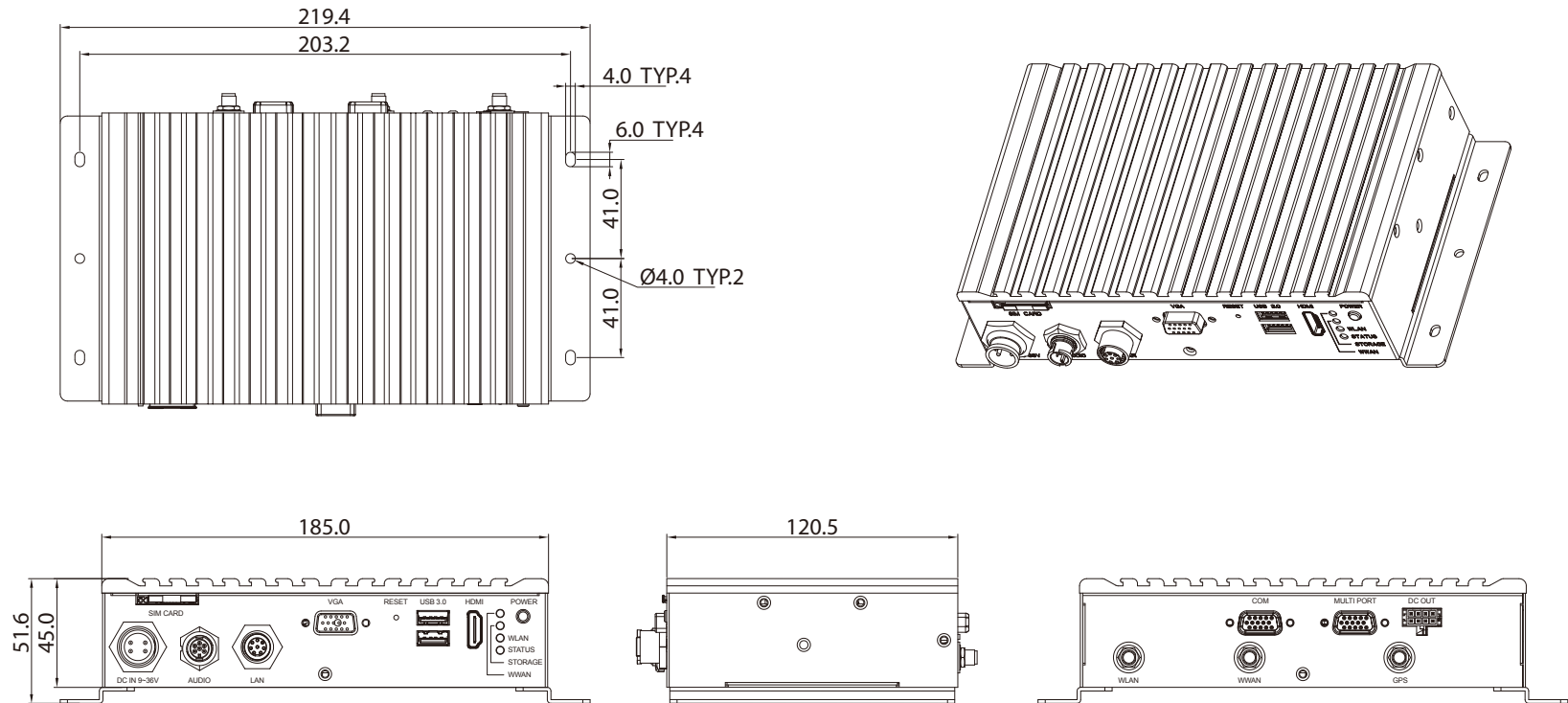
## VTC 1020



## VTC 1020-PA



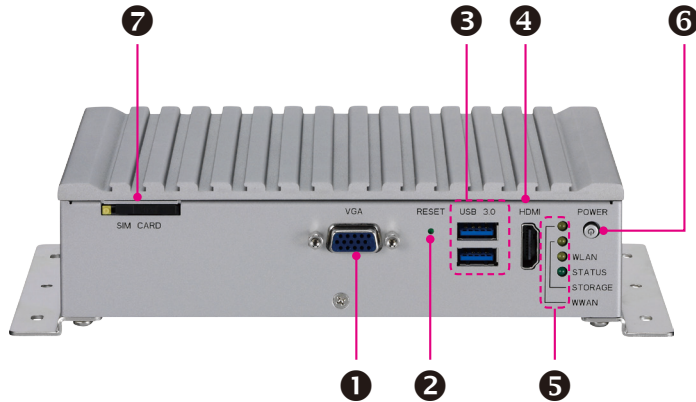
## nROK 1020



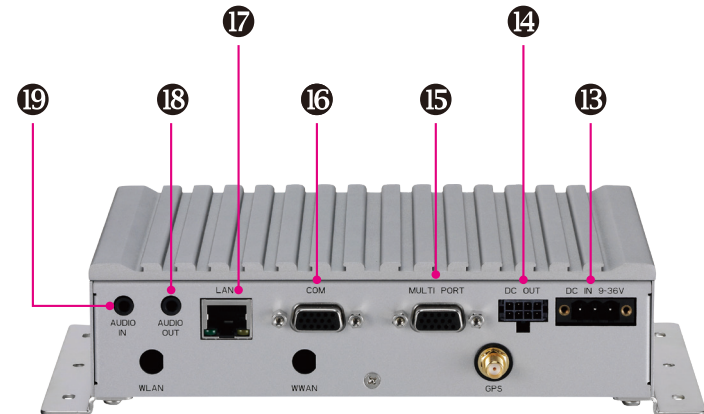
## Connector Numbering

The following diagrams indicate the numbers of the connectors. Use these numbers to locate the connectors' respective pinout assignments on chapter 2 of the manual.

### VTC 1020 Front View

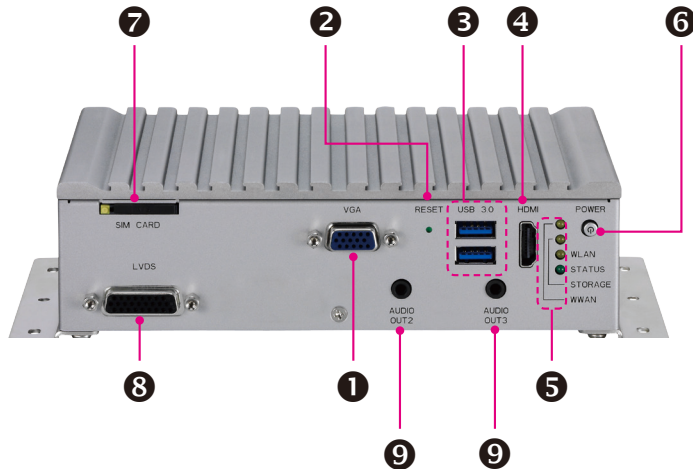


### VTC 1020 Rear View

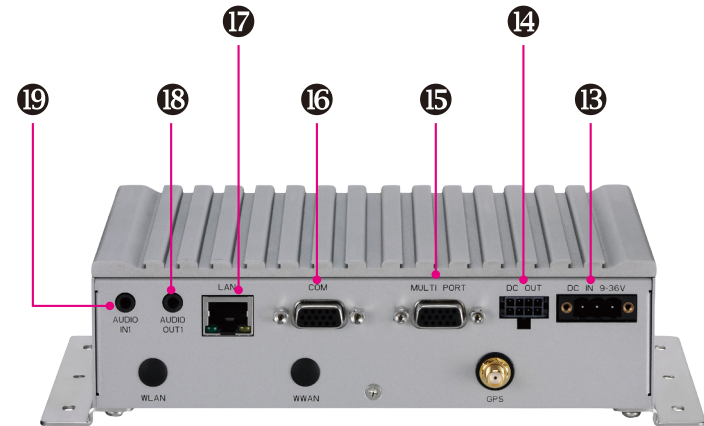




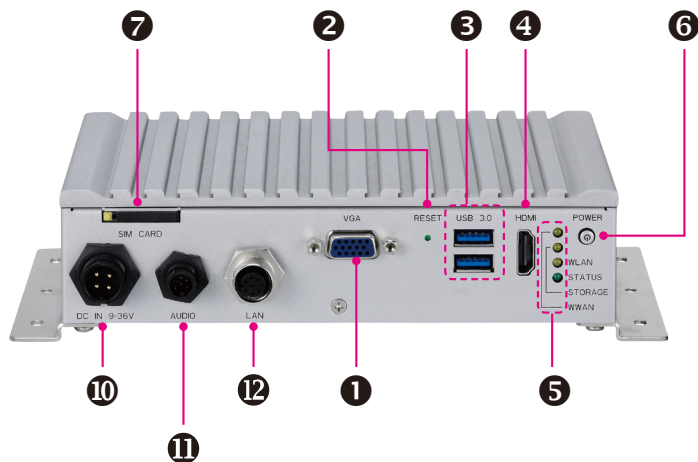
VTC 1020-PA Front View



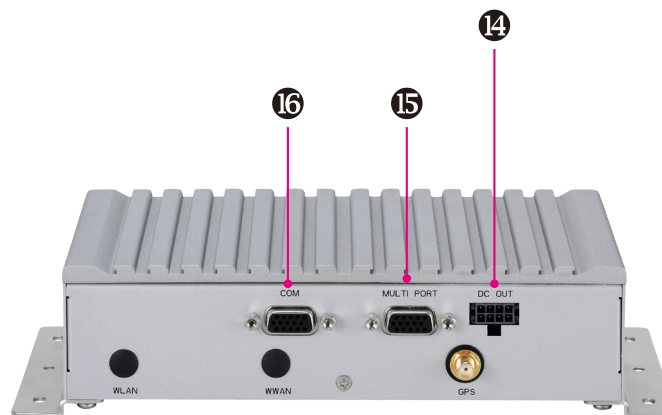
VTC 1020-PA Rear View



**nROK 1020 Front View**



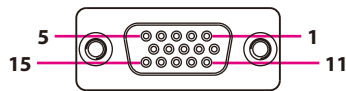
**nROK 1020 Rear View**



# CHAPTER 2: EXTERNAL CONNECTORS PINOUT DESCRIPTION

## VGA Connector

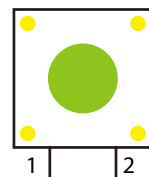
Connector number: 1



| Pin | Definition   | Pin | Definition   |
|-----|--------------|-----|--------------|
| 1   | VGA_RED      | 2   | VGA_GREEN    |
| 3   | VGA_BLUE     | 4   | CH7517_SPC_R |
| 5   | GND          | 6   | GND          |
| 7   | GND          | 8   | GND          |
| 9   | VGA_+5V      | 10  | GND          |
| 11  | CH7517_SPD_R | 12  | VGA_DATA     |
| 13  | VGA_HS       | 14  | VGA_VS       |
| 15  | VGA_CLK      |     |              |

## Reset Switch

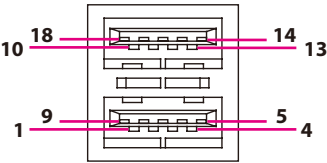
Connector Number: 2



Press this button to restart the system.

### Dual USB 3.0 Ports

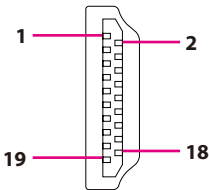
Connector number: 3



| Pin | Definition | Pin | Definition |
|-----|------------|-----|------------|
| 1   | 5V         | 2   | USB_ON     |
| 3   | USB_OP     | 4   | GND        |
| 5   | USB3_TX0_N | 6   | USB3_TX0_P |
| 7   | GND        | 8   | USB3_RX0_N |
| 9   | USB3_RX0_P | 10  | 5V         |
| 11  | USB_1N     | 12  | USB_1P     |
| 13  | GND        | 14  | USB3_TX1_N |
| 15  | USB3_TX1_P | 16  | GND        |
| 17  | USB3_RX1_N | 18  | USB3_RX1_P |

### HDMI

Connector number: 4



| Pin | Definition  | Pin | Definition   |
|-----|-------------|-----|--------------|
| 1   | HDMI_TX2P_L | 2   | GND          |
| 3   | HDMI_TX2N_L | 4   | HDMI_TX1P_L  |
| 5   | GND         | 6   | HDMI_TX1N_L  |
| 7   | HDMI_TX0P_L | 8   | GND          |
| 9   | HDMI_TX0N_L | 10  | HDMI_CLK_P_L |
| 11  | GND         | 12  | HDMI_CLK_N_L |
| 13  | NC          | 14  | NC           |
| 15  | HDMI_SCL    | 16  | HDMI_SDA     |
| 17  | GND         | 18  | HDMI_P5V     |
| 19  | HDMI_HPD    |     |              |

## LED Indicators

Connector number: 5

 **WWAN**

 **Storage**

 **WLAN**

 **Status**

| LED     | Description                   |
|---------|-------------------------------|
| WWAN    | Blinking: Active              |
| Storage | Light On: HDD/SSD Active      |
| WLAN    | Blinking: Active              |
| Status  | Programmable. Power On: Green |

## Power Button

Connector number: 6



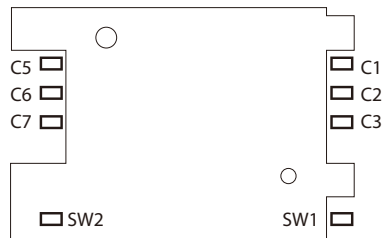
| 1 x R/B Bi-color LED |             |
|----------------------|-------------|
| LED Status           | Description |
| Off                  | Power off   |
| Blue                 | Power good  |
| Red                  | Power fail  |

When the ignition is from “low” to “high”, the system will turn on automatically. When the ignition is “high”, press the power button to turn on/off the system.

When the ignition is from “high” to “low”, the system will turn off automatically. When the ignition is “low”, pressing the power button will not turn on the system.

## SIM Card Slot

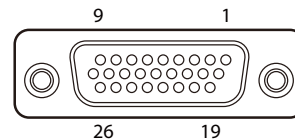
Connector number: 7



| Pin | Definition | Pin | Definition |
|-----|------------|-----|------------|
| C1  | UIM_PWR    | C2  | UIM_RST    |
| C3  | UIM_CLK    | C5  | GND        |
| C6  | NC         | C7  | UIM_DATA   |
| SW1 | SIM2_DET#  | SW2 | GND        |

## LVDS Connector (VTC 1020-PA)

Connector number: 8



| Pin | Definition    | Pin | Definition           |
|-----|---------------|-----|----------------------|
| 1   | Panel_EN      | 2   | Panel_control        |
| 3   | VDD           | 4   | VDD                  |
| 5   | LCDD09(OUT3)  | 6   | LCDD01(OUT0)         |
| 7   | LCDD08(OUT3#) | 8   | LCDD00(OUT0#)        |
| 9   | LCDD_GND      | 10  | LCDD_GND             |
| 11  | LCDD07(CLK)   | 12  | LCDD03(OUT1)         |
| 13  | LCDD06(CLK#)  | 14  | LCDD02(OUT1#)        |
| 15  | LVDS_GND      | 16  | LCDD_GND             |
| 17  | LCDD05(OUT2)  | 18  | Power on push button |
| 19  | LCDD04(OUT2#) | 20  | Panel_backlight      |
| 21  | LCDD_GND      | 22  | Panel-Gnd            |
| 23  | USB_0#        | 24  | Contact_DET#         |
| 25  | USB_0         | 26  | USB_VCC              |

Front Audio-Out 2 & 3 Connectors (VTC 1020-PA)

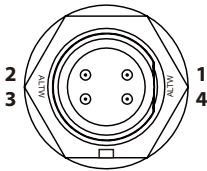
Connector number: 9



| Pin | Definition   | Pin | Definition    |
|-----|--------------|-----|---------------|
| 1   | Left channel | 2   | Jack detect   |
| 3   | NC           | 4   | Right channel |
| 5   | GND          | 6   | GND           |

DC Power Input (nROK 1020)

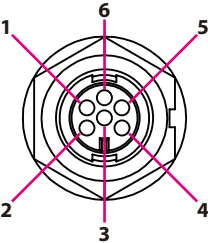
Connector number: 10



| Pin | Definition   | Pin | Definition |
|-----|--------------|-----|------------|
| 1   | POWER (+)    | 2   | GND (-)    |
| 3   | IGNITION (I) | 4   | NC         |

### Audio Connector (nROK 1020)

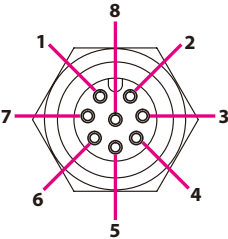
Connector number: 11



| Pin | Definition    | Pin | Definition |
|-----|---------------|-----|------------|
| 1   | SURR_OUT_L_CA | 2   | SURR_JD    |
| 3   | SURR_OUT_R_CA | 4   | MIC_OUT-R  |
| 5   | MIC_JD        | 6   | C_GND      |

### M12 LAN Port (nROK 1020)

Connector number: 12



| Pin | Definition   | Pin | Definition   |
|-----|--------------|-----|--------------|
| 1   | LAN_MDI_0P_R | 2   | LAN_MDI_0N_R |
| 3   | LAN_MDI_1P_R | 4   | LAN_MDI_1N_R |
| 5   | LAN_MDI_2P_R | 6   | LAN_MDI_2N_R |
| 7   | LAN_MDI_3P_R | 8   | LAN_MDI_3N_R |



### DC Power Input

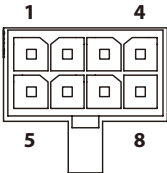
Connector number: 13



| Pin | Definition |
|-----|------------|
| 1   | GND_IN     |
| 2   | V_IN       |
| 3   | IGNITION   |

### 12V DC Output

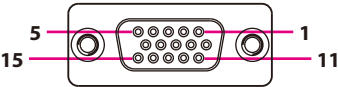
Connector number: 14



| Pin | Definition        | Pin | Definition |
|-----|-------------------|-----|------------|
| 1   | NC                | 2   | NC         |
| 3   | GND               | 4   | GND        |
| 5   | BAT_DAT           | 6   | BAT_CLK    |
| 7   | Push button input | 8   | +V12S      |

### Multi Port Connector

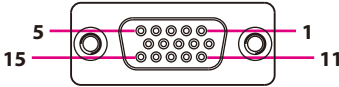
Connector number: 15



| Pin | Definition | Pin | Definition |
|-----|------------|-----|------------|
| 1   | DIRECTION  | 2   | RXD3_R     |
| 3   | GPIO1      | 4   | GPIO4      |
| 5   | GND        | 6   | 1PPS       |
| 7   | TXD3_R     | 8   | CAN1_L     |
| 9   | GPIO3      | 10  | GND        |
| 11  | ODOMETER   | 12  | CAN1_H     |
| 13  | GPIO2      | 14  | GPIO5      |
| 15  | GND        |     |            |

### COM Connector

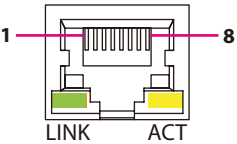
Connector number: 16



| Pin | Definition | Pin | Definition |
|-----|------------|-----|------------|
| 1   | RXD_R_D    | 2   | TXD2_R     |
| 3   | RXD1_R     | 4   | RS485B_-   |
| 5   | GND        | 6   | TXD_R_D    |
| 7   | TXD_R_B    | 8   | TXD1_R     |
| 9   | RS485A_+   | 10  | GND        |
| 11  | RXD_R_D    | 12  | RXD2_R     |
| 13  | RS485A_-   | 14  | RS485B_+   |
| 15  | GND        |     |            |

## LAN Port

Connector number: 17



| Pin | Definition | Pin | Definition |
|-----|------------|-----|------------|
| 1   | MDI0P      | 2   | MDI0N      |
| 3   | MDI1P      | 4   | MDI2P      |
| 5   | MDI2N      | 6   | MDI1N      |
| 7   | MDI3P      | 8   | MDI3N      |
| 9   | LED2-      | 10  | LED2+      |
| 11  | LED1-      | 12  | LED1+      |

## Rear Audio-Out 1 Connector

Connector number: 18



| Pin | Definition   | Pin | Definition    |
|-----|--------------|-----|---------------|
| 1   | Left channel | 2   | Jack detect   |
| 3   | NC           | 4   | Right channel |
| 5   | GND          | 6   | GND           |

## Rear Audio-In 1 Connector

Connector number: 19



| Pin | Definition   | Pin | Definition    |
|-----|--------------|-----|---------------|
| 1   | Left channel | 2   | Jack detect   |
| 3   | NC           | 4   | Right channel |
| 5   | GND          | 6   | GND           |

# CHAPTER 3: JUMPERS AND CONNECTORS

This chapter describes how to set the jumpers and connectors on the VTC 1020 and nROK 1020 series motherboard.

## Before You Begin

- Ensure you have a stable, clean working environment. Dust and dirt can get into components and cause a malfunction. Use containers to keep small components separated.
- Adequate lighting and proper tools can prevent you from accidentally damaging the internal components. Most of the procedures that follow require only a few simple tools, including the following:
  - A Philips screwdriver
  - A flat-tipped screwdriver
  - A set of jewelers screwdrivers
  - A grounding strap
  - An anti-static pad
- Using your fingers can disconnect most of the connections. It is recommended that you do not use needle-nosed pliers to disconnect connections as these can damage the soft metal or plastic parts of the connectors.
- Before working on internal components, make sure that the power is off. Ground yourself before touching any internal components, by touching a metal object. Static electricity can damage many of the electronic components. Humid environments tend to have less static electricity than

dry environments. A grounding strap is warranted whenever danger of static electricity exists.

## Precautions

Computer components and electronic circuit boards can be damaged by discharges of static electricity. Working on computers that are still connected to a power supply can be extremely dangerous.

Follow the guidelines below to avoid damage to your computer or yourself:

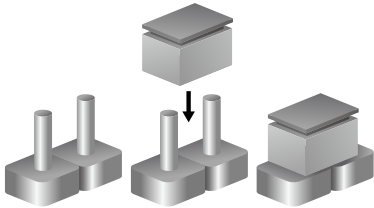
- Always disconnect the unit from the power outlet whenever you are working inside the case.
- If possible, wear a grounded wrist strap when you are working inside the computer case. Alternatively, discharge any static electricity by touching the bare metal chassis of the unit case, or the bare metal body of any other grounded appliance.
- Hold electronic circuit boards by the edges only. Do not touch the components on the board unless it is necessary to do so. Don't flex or stress the circuit board.
- Leave all components inside the static-proof packaging that they shipped with until they are ready for installation.
- Use correct screws and do not over tighten screws.

## Jumper Settings

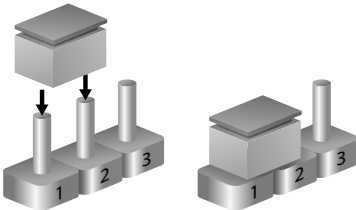
A jumper is the simplest kind of electric switch. It consists of two metal pins and a cap. When setting the jumpers, ensure that the jumper caps are placed on the correct pins. When the jumper cap is placed on both pins, the jumper is short. If you remove the jumper cap, or place the jumper cap on just one pin, the jumper is open.

Refer to the illustrations below for examples of what the 2-pin and 3-pin jumpers look like when they are short (on) and open (off).

Two-Pin Jumpers: Open (Left) and Short (Right)



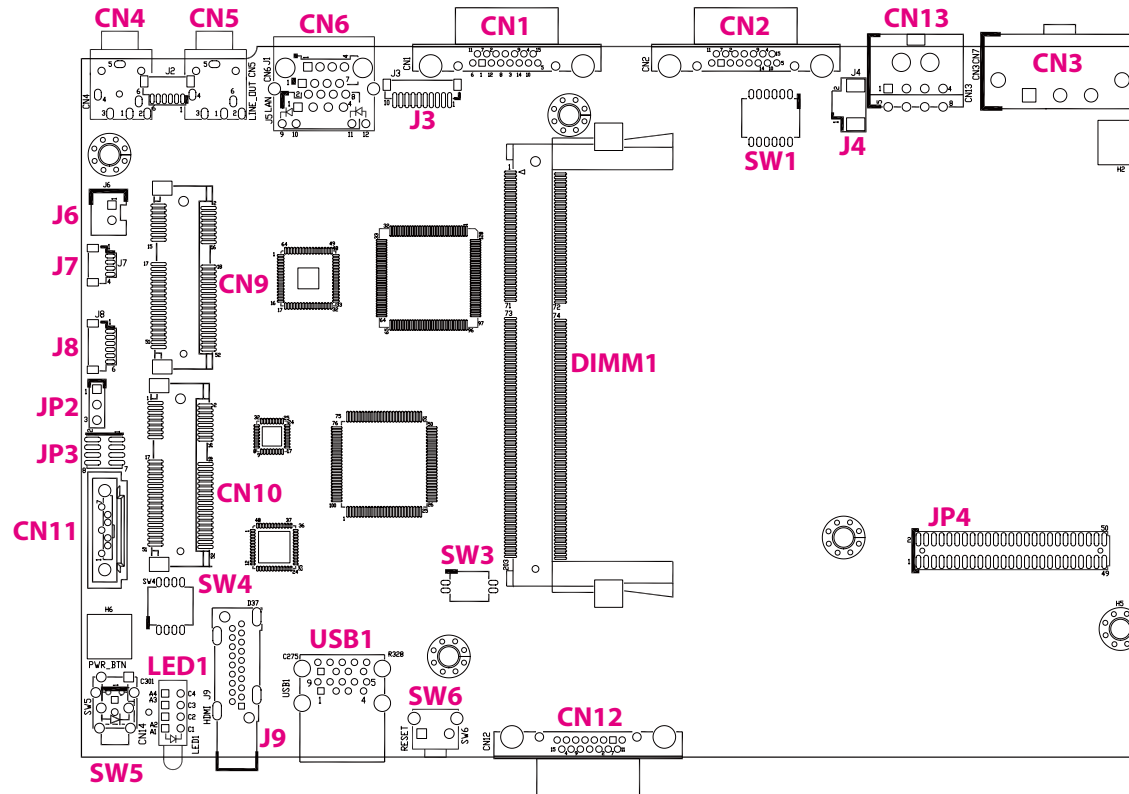
Three-Pin Jumpers: Pins 1 and 2 are Short



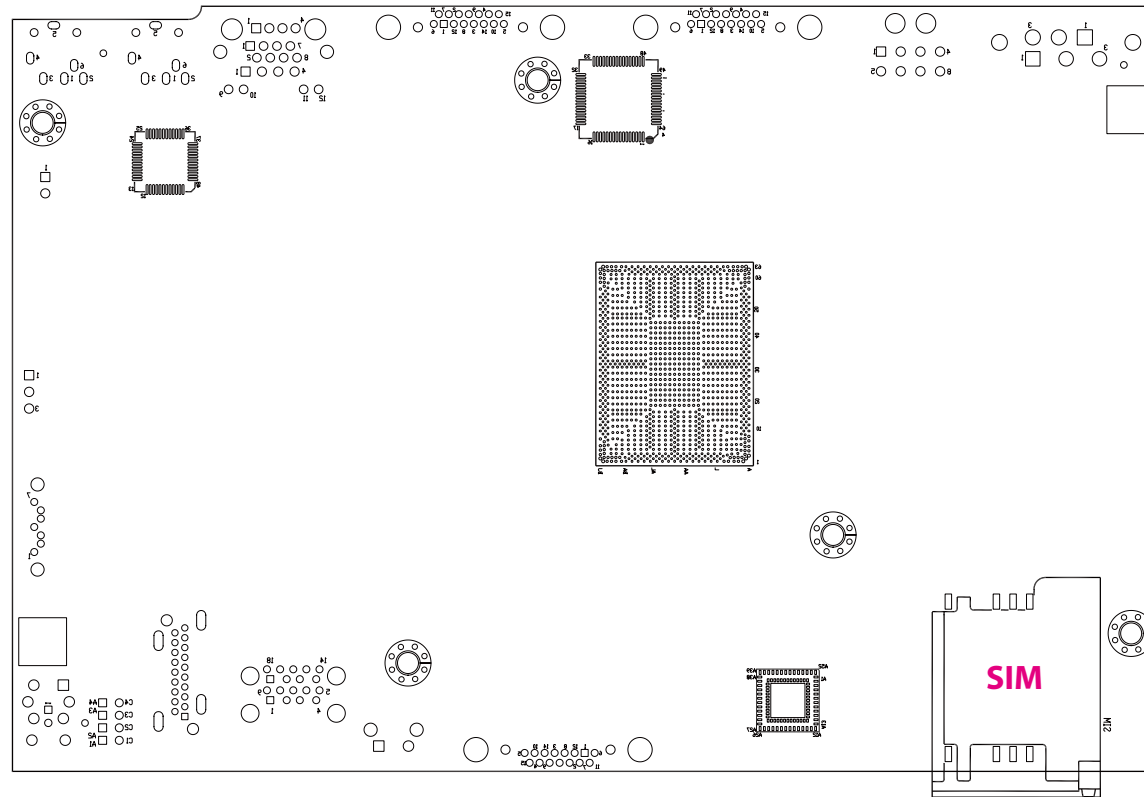
## Locations of the Jumpers and Connectors

This chapter lists the location and pinout assignment of the jumpers and connectors on the VTC 1020 and nROK 1020 series motherboard.

### Top View



## Bottom View

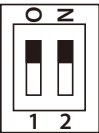




# Connector Pin Definitions

## CMOS Clear Switch

Connector type: DIP switch  
Connector location: SW2

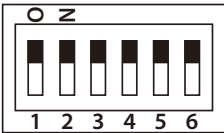


| Function      | Definition |
|---------------|------------|
| Clear CMOS/ME | 1-2 ON     |
| Normal        | *1-2 OFF   |

(\*) Default

## GPIO Pull High Switch

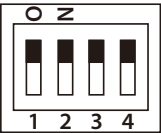
Connector type: DIP switch  
Connector location: SW1



| SW    | On (Default)             | Off                       |
|-------|--------------------------|---------------------------|
| SW1.1 | Pull up VCC5             | Don't care                |
| SW1.2 | Pull up VCC5             | Don't care                |
| SW1.3 | Pull up VCC5             | Don't care                |
| SW1.4 | Pull up VCC5             | Don't care                |
| SW1.5 | Pull up VCC5             | Don't care                |
| SW1.6 | Enable terminal resistor | Disable terminal resistor |

**WWAN Module Selector**  
**(For Wake-Up & Voice Functions on Mini-PCle CN10)**

Connector location: SW4



|                    | WWAN<br>HE910/LE910<br>Wake-Up & Voice* | WWAN<br>SIM5360E<br>Wake-Up & Voice | WWAN<br>MC7304/MC7354<br>Wake-Up & Voice |
|--------------------|-----------------------------------------|-------------------------------------|------------------------------------------|
| SW4.1              | On                                      | Off                                 | Off                                      |
| SW4.2              | Off                                     | On                                  | On                                       |
| SW4.3              | Off                                     | On                                  | On                                       |
| SW4.4              | On                                      | Off                                 | Off                                      |
| Digital<br>Voice** | HE910 (I2S)                             | PCM                                 | MC73xx(PCM)                              |

\*Default Settings  
\*\*Digital voice is selectable in BIOS.

## RTC Battery Connector

Connector type: 1x2 2-pin header, 1.25mm pitch

Connector location: J4



| Pin | Definition |
|-----|------------|
| 1   | GND        |
| 2   | VBAT1      |

## Debug 80 Port Connector

Connector type: 1x10 10-pin header, 1.0mm pitch

Connector location: J3



| Pin | Definition | Pin | Definition |
|-----|------------|-----|------------|
| 1   | GND        | 2   | PCIRST#    |
| 3   | 33M_CLK    | 4   | LPC_FRAME# |
| 5   | LPC_AD3    | 6   | LPC_AD2    |
| 7   | LPC_AD1    | 8   | LPC_AD0    |
| 9   | VCC3       | 10  | VCC3       |

SATA Power Connector

Connector type: 1x2 2-pin header, 2.5mm pitch  
Connector location: J6



| Pin | Definition |
|-----|------------|
| 1   | VCC5       |
| 2   | GND        |

SATA Connector

Connector type: Standard Serial ATA 7P (1.27mm, SATA-M-180)  
Connector location: CN11



| Pin | Definition | Pin | Definition |
|-----|------------|-----|------------|
| 1   | GND        | 2   | SATA_TXP0  |
| 3   | SATA_TXN0  | 4   | GND        |
| 5   | SATA_RXN0  | 6   | SATA_RXP0  |
| 7   | GND        |     |            |

MCU Debug Port

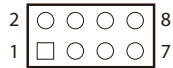
Connector type: 1x3 3-pin header, 2.54mm pitch  
Connector location: JP2



| Pin | Definition |
|-----|------------|
| 1   | DEBUG_TX   |
| 2   | DEBUG_RX   |
| 3   | GND        |

MCU Download Port

Connector type: 2x4 8-pin header, 1.27mm pitch  
Connector location: JP3



| Pin | Definition | Pin | Definition |
|-----|------------|-----|------------|
| 1   | V3.3ALW    | 2   | MCU_RST    |
| 3   | MCU_TRST   | 4   | MCU_TDI    |
| 5   | MCU_TCK    | 6   | MCU_TMS    |
| 7   | MCU_TDO    | 8   | GND        |

## GPS Connector

Connector type: 1x6 6-pin header, 1.0mm pitch  
Connector location: J8



| Pin | Definition | Pin | Definition |
|-----|------------|-----|------------|
| 1   | GPS_BAT    | 2   | GPS_LED    |
| 3   | CTX        | 4   | CRX        |
| 5   | GND        | 6   | VCC3_GPS   |

## GPS DR Connector

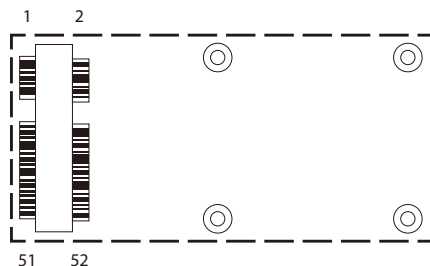
Connector type: 1x4 4-pin header, 1.0mm pitch  
Connector location: J7



| Pin | Definition | Pin | Definition |
|-----|------------|-----|------------|
| 1   | GND        | 2   | 1PPS       |
| 3   | ODOMETER   | 4   | DIRECTION  |

## Mini-PCIe Connector for PCIe/USB/mSATA

Connector location: CN9

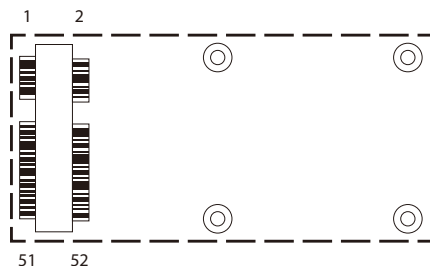


| Pin | Definition  | Pin | Definition     |
|-----|-------------|-----|----------------|
| 1   | WAKE#       | 2   | +V3.3_MINI_3   |
| 3   | NC          | 4   | GND            |
| 5   | NC          | 6   | +V1.5S_MINI_3  |
| 7   | CLKREQ      | 8   | NC             |
| 9   | GND         | 10  | NC             |
| 11  | REFCLK-     | 12  | NC             |
| 13  | REFCLK+     | 14  | NC             |
| 15  | GND         | 16  | NC             |
| 17  | NC          | 18  | GND            |
| 19  | NC          | 20  | MINICARD3_DIS# |
| 21  | GND         | 22  | WLAN_RESET#    |
| 23  | SATA_RXP0_C | 24  | +V3.3_MINI_3   |
| 25  | SATA_RXN0_C | 26  | GND            |

| Pin | Definition   | Pin | Definition    |
|-----|--------------|-----|---------------|
| 27  | GND          | 28  | +V1.5S_MINI_3 |
| 29  | GND          | 30  | SMBCLK        |
| 31  | SATA_TXN0_C  | 32  | SMBDAT        |
| 33  | SATA_TXP0_C  | 34  | GND           |
| 35  | GND          | 36  | USB_D-        |
| 37  | GND          | 38  | USB_D+        |
| 39  | +V3.3_MINI_3 | 40  | GND           |
| 41  | +V3.3_MINI_3 | 42  | WWAN_LED#     |
| 43  | GND          | 44  | NC            |
| 45  | NC           | 46  | NC            |
| 47  | NC           | 48  | +V1.5S_MINI_3 |
| 49  | NC           | 50  | GND           |
| 51  | CTRL0        | 52  | +V3.3_MINI_3  |

## Mini-PCle Connector for WWAN Module

Connector location: CN10



| Pin | Definition    | Pin | Definition    |
|-----|---------------|-----|---------------|
| 1   | MINI_MIC_P    | 2   | +V3.3A_MINI_4 |
| 3   | MINI_MIC_N    | 4   | GND           |
| 5   | MINI_SPK_PRR  | 6   | NC            |
| 7   | U_GND         | 8   | UIM_PWR2      |
| 9   | GND           | 10  | UIM_DAT2      |
| 11  | VCC_MSM26_DIG | 12  | UIM_CLK2      |
| 13  | NC            | 14  | UIM_RST2      |
| 15  | GND           | 16  | NC            |
| 17  | NC            | 18  | GND           |
| 19  | NC            | 20  | 3.5G_DIS#     |
| 21  | GND           | 22  | 3.5G_RST#     |
| 23  | NC            | 24  | +V3.3A_MINI_4 |
| 25  | NC            | 26  | GND           |

| Pin | Definition    | Pin | Definition    |
|-----|---------------|-----|---------------|
| 27  | GND           | 28  | NC            |
| 29  | GND           | 30  | NC            |
| 31  | NC            | 32  | SMS_RI_3.5G_R |
| 33  | UMTS_RESET#_R | 34  | GND           |
| 35  | GND           | 36  | USB-          |
| 37  | GND           | 38  | USB+          |
| 39  | +V3.3A_MINI_4 | 40  | GND           |
| 41  | +V3.3A_MINI_4 | 42  | 3.5G_LED#_R   |
| 43  | GND           | 44  | NC            |
| 45  | PCM_CLK       | 46  | NC            |
| 47  | PCM_RX        | 48  | NC            |
| 49  | PCM_TX        | 50  | GND           |
| 51  | PCM_SYNC      | 52  | +V3.3A_MINI_4 |



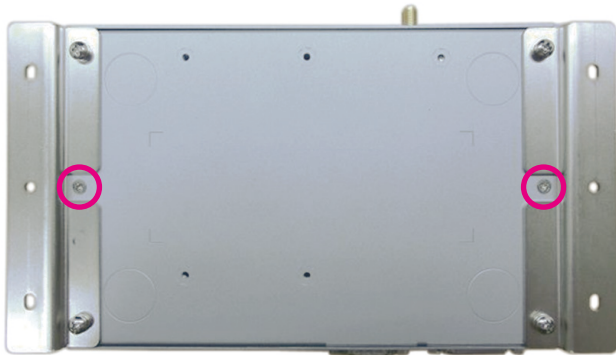
# CHAPTER 4: SYSTEM SETUP

## Opening the Enclosure



Prior to removing the chassis cover, make sure the unit's power is off and disconnected from the power sources to prevent electric shock or system damage.

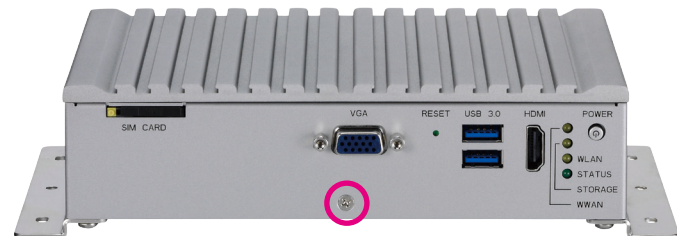
1. Remove the screws on the bottom of the enclosure.



2. Remove the screw on the front panel.

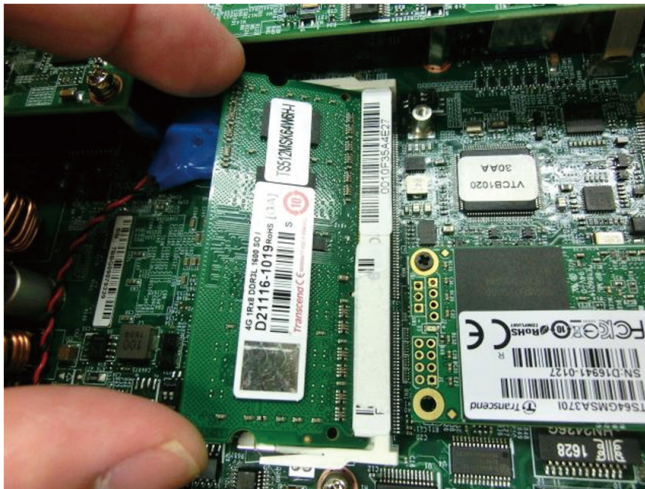


3. Remove the screw on the rear panel.



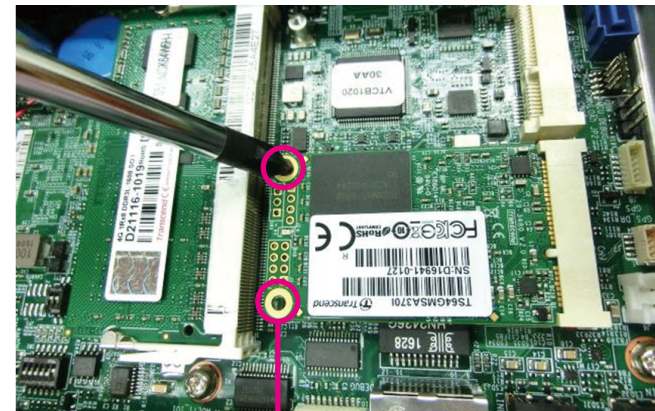
## Installing a SO-DIMM

1. Push the ejector tabs which are at the ends of the socket outward. Then insert the module into the socket at an approximately 30 degrees angle. Apply firm even pressure to each end of the module until it slips down into the socket. The contact fingers on the edge of the module will almost completely disappear inside the socket.



## Installing the mSATA Module

1. Locate the Mini PCI Express slot (CN9). Insert the mSATA module into the Mini PCI Express slot at a 45 degrees angle until the gold-plated connector on the edge of the module completely disappears inside the slot. Then fasten screws into the mounting holes to secure the module.



Mounting  
screws

## Installing the WWAN Module

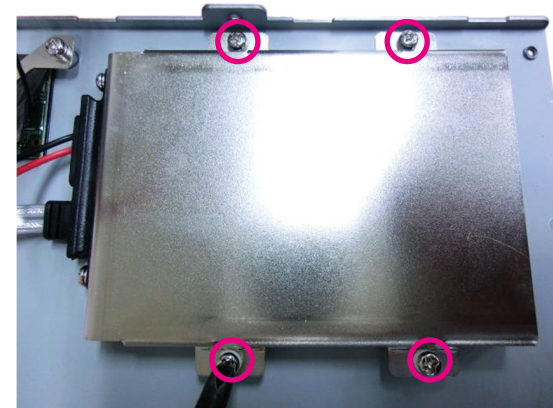
1. Locate the WWAN Mini PCI Express slot (CN10). Insert the module into the Mini PCI Express slot at a 45 degrees angle until the gold-plated connector on the edge of the module completely disappears inside the slot. Then fasten screws into the mounting holes to secure the module.



**Mounting  
screws**

## Installing a SSD/HDD Drive

1. Loosen the mounting screws on the hard drive bracket and remove it from the bottom cover.



2. Insert the hard drive into the hard drive bracket. Align the hard drive's mounting holes with the mounting holes on the hard drive bracket, and use the provided screws to secure the hard drive in place.



# APPENDIX A:

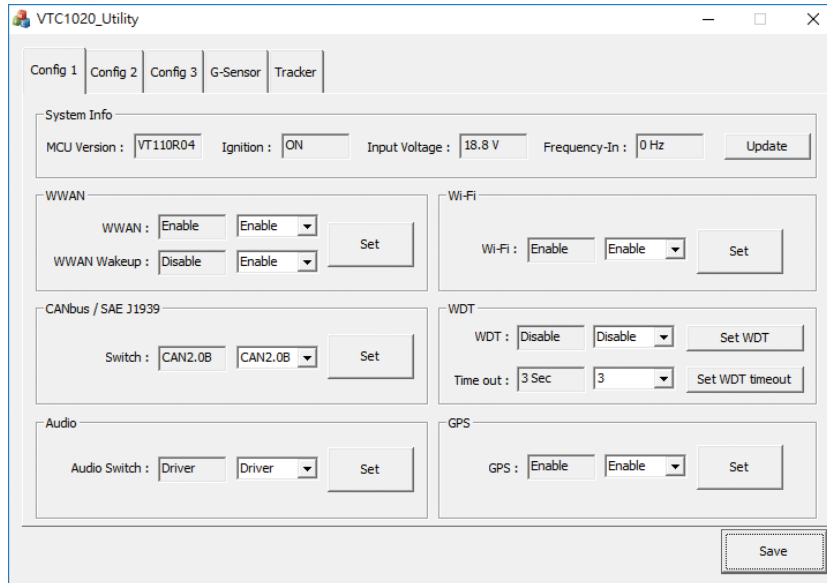
## SOFTWARE DEMO UTILITY FOR I/O PORTS OF FUNCTION CONTROL

NEXCOM's software demo utility enables users to test and control different I/O port functions on the VTC 1020 and nROK 1020 series. This document shows how to use the utility.

There are also source code files of the utility in the CD. Users can refer to the source codes to develop their applications.

## Menu Screen

### Config1

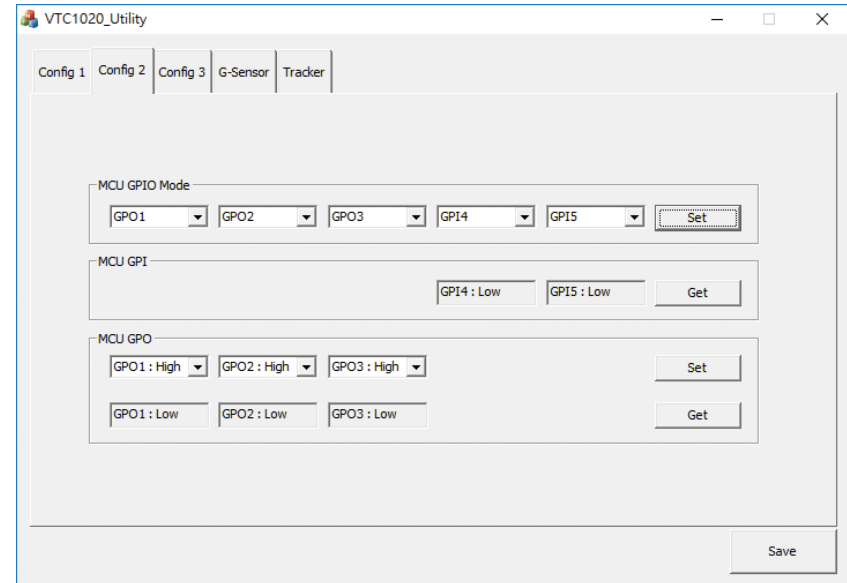


The Config1 screen of the VTC1020\_Utility software shows various system configuration options. It includes tabs for Config 1, Config 2, Config 3, G-Sensor, and Tracker. The main area is divided into several sections:

- System Info:** Displays MCU Version (VT110R04), Ignition (ON), Input Voltage (18.8 V), and Frequency-In (0 Hz). An Update button is present.
- WWAN:** Includes WWAN (Enable/Disable) and WWAN Wakeup (Disable/Enable) settings with a Set button.
- Wi-Fi:** Includes Wi-Fi (Enable/Disable) settings with a Set button.
- CANbus / SAE J1939:** Includes a Switch (CAN2.0B) setting with a Set button.
- WDT:** Includes WDT (Disable/Enable) and Time out (3 Sec) settings with Set WDT and Set WDT timeout buttons.
- Audio:** Includes an Audio Switch (Driver) setting with a Set button.
- GPS:** Includes GPS (Enable/Disable) settings with a Set button.

A Save button is located at the bottom right of the screen.

### Config2



The Config2 screen of the VTC1020\_Utility software shows MCU GPIO configuration options. It includes tabs for Config 1, Config 2, Config 3, G-Sensor, and Tracker. The main area is divided into several sections:

- MCU GPIO Mode:** Includes dropdown menus for GPIO1, GPIO2, GPIO3, GPI4, and GPI5, along with a Set button.
- MCU GPI:** Includes GPI4 : Low and GPI5 : Low settings with a Get button.
- MCU GPO:** Includes dropdown menus for GPO1 : High, GPO2 : High, and GPO3 : High, along with a Set button. Below these are GPO1 : Low, GPO2 : Low, and GPO3 : Low settings with a Get button.

A Save button is located at the bottom right of the screen.

# 1. Config1

## 1.1 System Info

MCU Version: Shows the MCU Version.

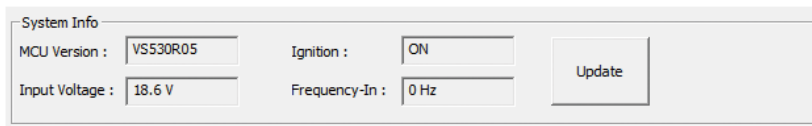
Ignition: Shows the signal of ignition.

ON: Signal of ignition is high.

OFF: Signal of ignition is low.

Input Voltage: Shows the voltage level of power-in.

Frequency-In: Shows the frequency of speed pulse signal.



System Info

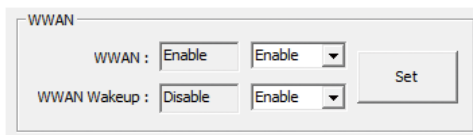
|                 |          |                |      |        |
|-----------------|----------|----------------|------|--------|
| MCU Version :   | VS530R05 | Ignition :     | ON   | Update |
| Input Voltage : | 18.6 V   | Frequency-In : | 0 Hz |        |

## 1.2 WWAN

Enables or disables the WWAN function on CN10 Mini-PCle socket.

Enables or disables the WWAN wakeup function on CN10 Mini-PCle socket.

The setting can also be cleared by the Set button.



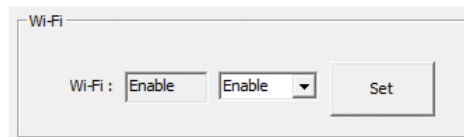
WWAN

|               |         |        |     |
|---------------|---------|--------|-----|
| WWAN :        | Enable  | Enable | Set |
| WWAN Wakeup : | Disable | Enable |     |

## 1.3 Wi-Fi

Enables or disables the Wi-Fi module function on CN9 Mini-PCle socket.

The setting can also be cleared by the Set button.

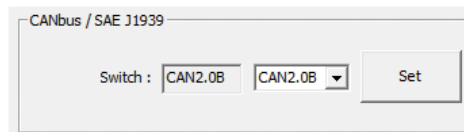


Wi-Fi

|         |        |        |     |
|---------|--------|--------|-----|
| Wi-Fi : | Enable | Enable | Set |
|---------|--------|--------|-----|

## 1.4 CANbus/SAE J1939

Selects CAN Bus or SAE J1939 function. CAN Bus is default setting. If SAE J1939 is supported (BOM option), SAE J1939 has to be selected.



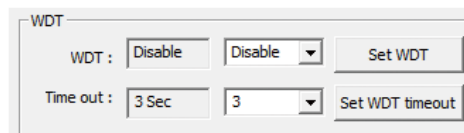
CANbus / SAE J1939

|          |         |         |     |
|----------|---------|---------|-----|
| Switch : | CAN2.0B | CAN2.0B | Set |
|----------|---------|---------|-----|

## 1.5 WDT

Enables or disables the WDT function. There are several selections of time.

The timer of WDT can also be cleared by the Set WDT Timeout button.



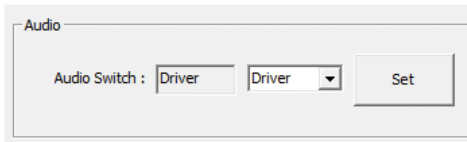
WDT

|            |         |         |                 |
|------------|---------|---------|-----------------|
| WDT :      | Disable | Disable | Set WDT         |
| Time out : | 3 Sec   | 3       | Set WDT timeout |

## 1.6 Audio

This function is for VTC 1020-PA only.

The Audio-In signal can be connected with following Audio-Out:  
Audio-Out, Audio-Out2, Audio-Out3.

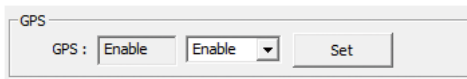


Audio

Audio Switch :

## 1.7 GPS

Enables or disables the GPS function.



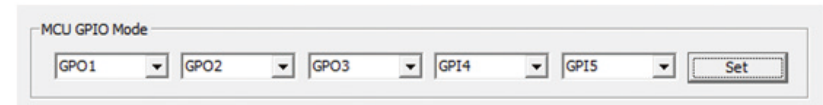
GPS

GPS :

## 2. Config2

### 2.1 MCU GPIO Mode

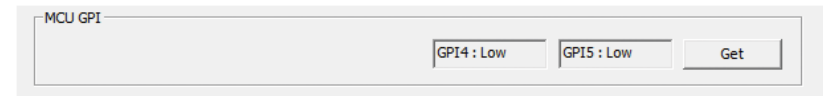
Defines GPIO port as GPO or GPI.



MCU GPIO Mode

### 2.2 MCU GPI

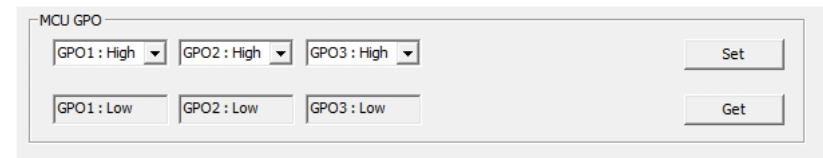
Reads the status of GPI.



MCU GPI

### 2.3 MCU GPO

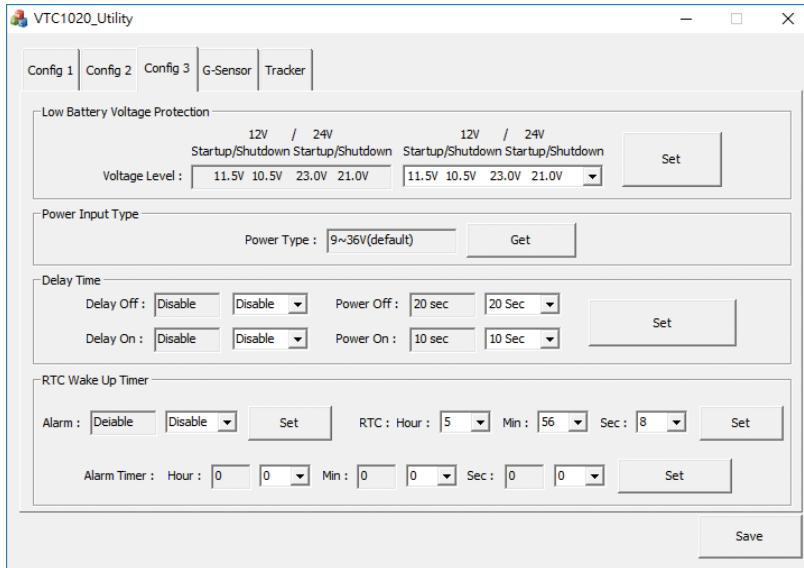
Selects the GPO ports and makes the output low or high.



MCU GPO

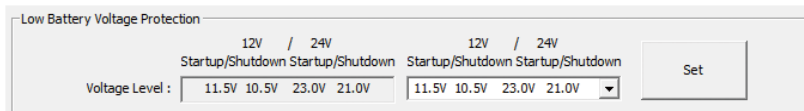


### 3. Config3



#### 3.1 Low Battery Voltage Protection

Sets the Low Battery Voltage Protection Startup/Shutdown voltage level during 12V/24V.



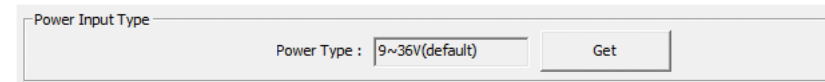
#### 3.2 Power Input Type

Shows the setting of input voltage in SW1 DIP switch.

If the setting is 12V: 12V is shown.

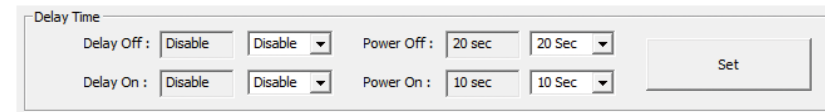
If the setting is 24V: 24V is shown.

If the setting is 9V~36V: 9V~36V is shown.



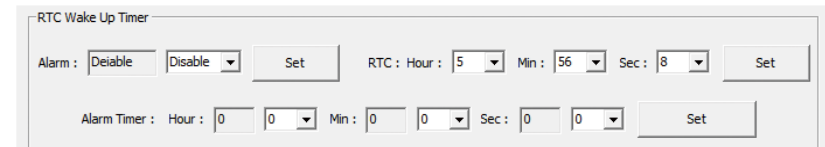
#### 3.3 Delay Time

Enables or disables the delay time function. There are several selections of delay time.



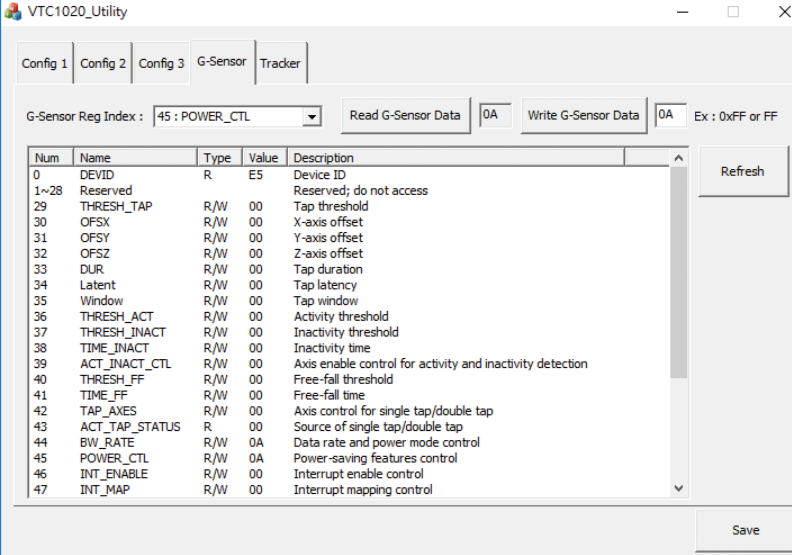
#### 3.4 RTC Wake Up Timer

Enables or disables the RTC wake up function. The timer setting of RTC and Alarm Timer can be configured.





## 4. G-Sensor



VTC1020\_Utility

Config 1 | Config 2 | Config 3 | **G-Sensor** | Tracker

G-Sensor Reg Index : 45 : POWER\_CTL

Read G-Sensor Data 0A Write G-Sensor Data 0A Ex : 0xFF or FF

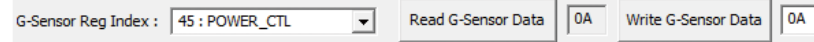
| Num  | Name           | Type | Value | Description                                               |
|------|----------------|------|-------|-----------------------------------------------------------|
| 0    | DEVID          | R    | E5    | Device ID                                                 |
| 1~28 | Reserved       |      |       | Reserved; do not access                                   |
| 29   | THRESH_TAP     | R/W  | 00    | Tap threshold                                             |
| 30   | OF SX          | R/W  | 00    | X-axis offset                                             |
| 31   | OF SY          | R/W  | 00    | Y-axis offset                                             |
| 32   | OF SZ          | R/W  | 00    | Z-axis offset                                             |
| 33   | DUR            | R/W  | 00    | Tap duration                                              |
| 34   | Latent         | R/W  | 00    | Tap latency                                               |
| 35   | Window         | R/W  | 00    | Tap window                                                |
| 36   | THRESH_ACT     | R/W  | 00    | Activity threshold                                        |
| 37   | THRESH_INACT   | R/W  | 00    | Inactivity threshold                                      |
| 38   | TIME_INACT     | R/W  | 00    | Inactivity time                                           |
| 39   | ACT_INACT_CTL  | R/W  | 00    | Axis enable control for activity and inactivity detection |
| 40   | THRESH_FF      | R/W  | 00    | Free-fall threshold                                       |
| 41   | TIME_FF        | R/W  | 00    | Free-fall time                                            |
| 42   | TAP_AXES       | R/W  | 00    | Axis control for single tap/double tap                    |
| 43   | ACT_TAP_STATUS | R    | 00    | Source of single tap/double tap                           |
| 44   | BW_RATE        | R/W  | 0A    | Data rate and power mode control                          |
| 45   | POWER_CTL      | R/W  | 0A    | Power-saving features control                             |
| 46   | INT_ENABLE     | R/W  | 00    | Interrupt enable control                                  |
| 47   | INT_MAP        | R/W  | 00    | Interrupt mapping control                                 |

Refresh

Save

### 4.1 G-Sensor Registers

Selects the registers inside G-Sensor to read or write the data.



G-Sensor Reg Index : 45 : POWER\_CTL

Read G-Sensor Data 0A Write G-Sensor Data 0A

### 4.2 Register Table

Shows the value of all registers in G-Sensor, once the Refresh Button is pressed.

| Num  | Name           | Type | Value | Description                                               |
|------|----------------|------|-------|-----------------------------------------------------------|
| 0    | DEVID          | R    | E5    | Device ID                                                 |
| 1~28 | Reserved       |      |       | Reserved; do not access                                   |
| 29   | THRESH_TAP     | R/W  | 00    | Tap threshold                                             |
| 30   | OF SX          | R/W  | 00    | X-axis offset                                             |
| 31   | OF SY          | R/W  | 00    | Y-axis offset                                             |
| 32   | OF SZ          | R/W  | 00    | Z-axis offset                                             |
| 33   | DUR            | R/W  | 00    | Tap duration                                              |
| 34   | Latent         | R/W  | 00    | Tap latency                                               |
| 35   | Window         | R/W  | 00    | Tap window                                                |
| 36   | THRESH_ACT     | R/W  | 00    | Activity threshold                                        |
| 37   | THRESH_INACT   | R/W  | 00    | Inactivity threshold                                      |
| 38   | TIME_INACT     | R/W  | 00    | Inactivity time                                           |
| 39   | ACT_INACT_CTL  | R/W  | 00    | Axis enable control for activity and inactivity detection |
| 40   | THRESH_FF      | R/W  | 00    | Free-fall threshold                                       |
| 41   | TIME_FF        | R/W  | 00    | Free-fall time                                            |
| 42   | TAP_AXES       | R/W  | 00    | Axis control for single tap/double tap                    |
| 43   | ACT_TAP_STATUS | R    | 00    | Source of single tap/double tap                           |
| 44   | BW_RATE        | R/W  | 0A    | Data rate and power mode control                          |
| 45   | POWER_CTL      | R/W  | 0A    | Power-saving features control                             |
| 46   | INT_ENABLE     | R/W  | 00    | Interrupt enable control                                  |
| 47   | INT_MAP        | R/W  | 00    | Interrupt mapping control                                 |

Refresh

## 5. Tracker

VTC1020\_Utility

Config 1Config 2Config 3G-SensorTracker

WWAN APN :internetinternet

WWAN DNS1 :8.8.8.88 . 8 . 8 . 8

WWAN DNS2 :8.8.4.48 . 8 . 4 . 4

Server IP :59.120.0.3659 . 120 . 0 . 36

Server Port :12001200

Machine Name :VTC1020VTC1020

Phone Number :01

SMS :DisableDisableSMS Coding Type :ASCII CodeASCII

SMS Content :HelpHelp

Tracker :DisableDisable

Tracker Mode :EventEvent

Activation Time :10 Second1 min

Send Period :1 min1 min

Acceleration Force :8 g4 g

Tilt Angle :30°30°

IMEI :

Set

Get

Save

### 5.1 Network Settings

Configures the network settings for the server.

WWAN APN :internetinternet

WWAN DNS1 :8.8.8.88 . 8 . 8 . 8

WWAN DNS2 :8.8.4.48 . 8 . 4 . 4

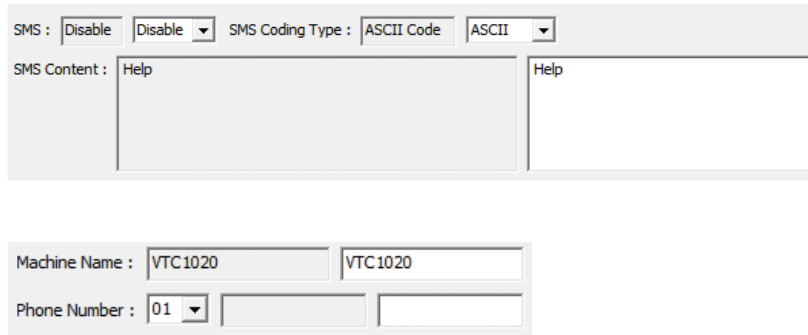
Server IP :59.120.0.3659 . 120 . 0 . 36

Server Port :12001200

- APN:** internet (default). It can be adjusted based on users' situation.
- DNS1:** 8.8.8.8 (default). It can be adjusted based on users' situation.
- DNS2:** 8.8.4.4 (default)
- Server IP:** 59.120.0.36 (default). It can be adjusted based on users' situation.
- Server Port:** 1200 (default). It can be adjusted based on users' situation.

## 5.2 SMS and Phone Number

Configures the SMS content and phone numbers for delivering SMS message.



SMS :   SMS Coding Type :

SMS Content :

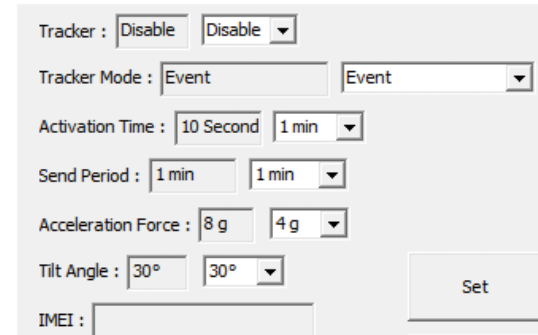
Machine Name :

Phone Number :

If SMS Control is enabled, once event is triggered (defined by Acceleration Force & Tilt Angle), SMS Message will be sent to the phone numbers that are registered automatically. There are up to 10 phone numbers that can be registered. SMS Content can be defined inside the text field.

## 5.3 Tracker Settings

Configures settings for the tracker.



Tracker :

Tracker Mode :

Activation Time :

Send Period :

Acceleration Force :

Tilt Angle :

IMEI :

If Tracker function is "Enable" and Tracker Mode is "Event", once event is triggered (defined by Acceleration Force & Tilt Angle), following information will be sent to server.

If Tracker function is "Enable" and Tracker Mode is "Continue", following information will be sent to server, based on the interval time defined in Send Period.

**(Information)**

Date: YYMMDD

Time: HHMMSS

GPS Status: 0: Searching 1: Fixed

GPS Latitude

GPS Longitude

G Sensor X value: 0 ~ 65535

G Sensor Y value: 0 ~ 65535

G Sensor Z value: 0 ~ 65535

**Activation Time:** Define when tracker function starts after ignition signal becomes low.

**Send Period:** Define the interval time to send the information to server, when Tracker Mode is "Continue".

**Acceleration Force:** Define the value of G-sensor that triggers the event.

**Tilt Angle:** Define the value of tilt angle that triggers the event.

**IMEI:** IMEI of WWAN module will be shown.



Note:

It is required to press the Save Button for saving the settings made in the Utility.



# APPENDIX B: GPS FEATURE

## uBlox-NEO M8N Overview

The NEO-M8 series of standalone concurrent GNSS modules is built on the exceptional performance of the u-blox M8 GNSS (GPS, GLONASS, Galileo, BeiDou, QZSS and SBAS) engine in the industry proven NEO form factor.

The NEO-M8 series provides high sensitivity and minimal acquisition times while maintaining low system power. The NEO form factor allows easy migration from previous NEO generations. Sophisticated RF-architecture and interference suppression ensure maximum performance even in GNSS-hostile environments.

The NEO-M8 combines a high level of robustness and integration capability with flexible connectivity options. The future-proof NEO-M8N includes an internal Flash that allows simple firmware upgrades for supporting additional GNSS systems. This makes NEO-M8 perfectly suited to industrial and automotive applications.

The DDC (I2C compliant) interface provides connectivity and enables synergies with most u-blox cellular modules. For RF optimization the NEO-M8N features an additional front-end LNA for easier antenna integration and a front-end SAW filter for increased jamming immunity.

u-blox M8 modules use GNSS chips qualified according to AEC-Q100, are manufactured in ISO/TS 16949 certified sites, and fully tested on a system level. Qualification tests are performed as stipulated in the ISO16750 standard: "Road vehicles – Environmental conditions and testing for electrical and electronic equipment".

## Technical Specifications

**COM Port for GPS: COM 4**

**Baud Rate: 9600**

### Features

|                                     |                                                                                                                                            |           |          |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------|
| <b>Receiver type</b>                | 72-channel u-blox M8 engine<br>GPS/QZSS L1 C/A, GLONASS L10F, BeiDou B1<br>SBAS L1 C/A: WAAS, EGNOS, MSAS<br>Galileo-ready E1B/C (NEO-M8N) |           |          |
| <b>Nav. update rate<sup>1</sup></b> | Single GNSS: up to 18 Hz<br>Concurrent GNSS: up to 10 Hz                                                                                   |           |          |
| <b>Position accuracy</b>            | 2.0 m CEP                                                                                                                                  |           |          |
|                                     |                                                                                                                                            | NEO-M8N/Q | NEO-M8M  |
| <b>Acquisition</b>                  | Cold starts:                                                                                                                               | 26 s      | 27 s     |
|                                     | Aided starts:                                                                                                                              | 2 s       | 4 s      |
|                                     | Reacquisition:                                                                                                                             | 1 s       | 1 s      |
| <b>Sensitivity</b>                  | Tracking & Nav:                                                                                                                            | –167 dBm  | –164 dBm |
|                                     | Cold starts:                                                                                                                               | –148 dBm  | –147 dBm |
|                                     | Hot starts:                                                                                                                                | –156 dBm  | –156 dBm |
| <b>Assistance</b>                   | AssistNow GNSS Online<br>AssistNow GNSS Offline (up to 35 days)<br>AssistNow Autonomous (up to 6 days)<br>OMA SUPL & 3GPP compliant        |           |          |
| <b>Oscillator</b>                   | TCXO (NEO-M8N)                                                                                                                             |           |          |
| <b>RTC crystal</b>                  | Built-in                                                                                                                                   |           |          |
| <b>Noise figure</b>                 | Extra LNA for lowest noise figure (NEO-M8N)                                                                                                |           |          |

## Features cont.

|                           |                                                                               |
|---------------------------|-------------------------------------------------------------------------------|
| <b>Anti jamming</b>       | Active CW detection and removal. Extra onboard SAW band pass filter (NEO-M8N) |
| <b>Memory</b>             | Flash (NEO-M8N)                                                               |
| <b>Supported antennas</b> | Active and passive                                                            |
| <b>Odometer</b>           | Travelled distance                                                            |
| <b>Data-logger</b>        | For position, velocity, and time (NEO-M8N)                                    |

<sup>1</sup> For NEO-M8M/Q

## Electrical data

|                                      |                                                                                |
|--------------------------------------|--------------------------------------------------------------------------------|
| <b>Supply voltage</b>                | 2.7 V to 3.6 V (NEO-M8N)                                                       |
| <b>Power consumption<sup>2</sup></b> | 23 mA @ 3.0 V (continuous)<br>5 mA @ 3.0 V Power Save Mode<br>(1 Hz, GPS only) |
| <b>Backup Supply</b>                 | 1.4 to 3.6 V                                                                   |

<sup>2</sup> NEO-M8M

## Interfaces

|                          |                                                                                                    |
|--------------------------|----------------------------------------------------------------------------------------------------|
| <b>Serial interfaces</b> | 1 UART<br>1 USBV2.0 full speed 12 Mbit/s<br>1 SPI (optional)<br>1 DDC (I <sup>2</sup> C compliant) |
| <b>Digital I/O</b>       | Configurable timepulse<br>1 EXTINT input for Wakeup                                                |
| <b>Timepulse</b>         | Configurable 0.25 Hz to 10 MHz                                                                     |
| <b>Protocols</b>         | NMEA, UBX binary, RTCM                                                                             |

## VIOB-GPS-02 Module Connector Pin Definitions



J2 (GPS Side)



J8 (PC Side)

### J2 Pin Definition

| Pin | Definition | Pin | Definition |
|-----|------------|-----|------------|
| 1   | GPS_3V3    | 2   | GND        |
| 3   | GPS_TXD_M  | 4   | GPS_RXD_M  |
| 5   | NC         | 6   | +V3.3ALW   |

### J8 Pin Definition

| Pin | Definition | Pin | Definition |
|-----|------------|-----|------------|
| 1   | GPS_BAT    | 2   | GPS_LED    |
| 3   | CTX        | 4   | CRX        |
| 5   | GND        | 6   | VCC3_GPS   |

# APPENDIX C: GPS WITH DEAD RECKONING FEATURE

## uBlox-NEO M8L Overview

The NEO-M8L standalone concurrent GNSS module with 3D dead-reckoning (DR) is built on the exceptional performance of the u-blox M8 concurrent GNSS (GPS, GLONASS, Galileo-ready<sup>1</sup>, BeiDou, QZSS and SBAS) engine in the compact and industry proven NEO form factor.

The NEO-M8L delivers a complete, self-contained solution for road-vehicle Automotive Dead Reckoning (ADR) applications in an exceptionally compact 16 x 12 mm form-factor. The module combines information from GNSS, on-board 3-Dimensional inertial sensors, and speed data from the vehicle to deliver continuous navigation in road-vehicle applications. Its size and features make it suitable for aftermarket and first-fit navigation and Telematics applications. Position measurement rates of up to 2 Hz are available with optional extrapolation (based on vehicle dynamics) extending reporting rates to 20 Hz. Inertial sensor measurements are available to external applications at rates up to 10 Hz.

For ease of application, both hardware and message interfaces are supported for vehicle speed. u-blox' ADR and GNSS technologies deliver continuous and accurate positioning throughout the journey. u-blox' tightly-coupled navigation solution delivers significant improvements in navigation accuracy, especially in difficult urban environments. Dead reckoning sensors in conjunction with speed information from the vehicle also provide navigation before GNSS signals are acquired and during periods of complete signal loss. The introduction of three dimensional sensing and signal processing (for both acceleration and direction) extend accurate navigation to urban multi-level highways and car-parks as well as extending dead-reckoned range in tunnels and urban canyons. 3D sensing also enables flexibility in orientation of the receiver with respect to the vehicle frame.

The NEO form factor allows easy migration from previous NEO generations. Sophisticated RF architecture and interference suppression ensure maximum performance even in GNSS-hostile environments. The NEO-M8L module includes an internal Flash that allows simple firmware upgrades. These features make the NEO-M8L perfectly suited to industrial and automotive applications. UART, SPI and DDC (I<sup>2</sup>C compatible) interfaces provide connectivity and enable synergies with most u-blox cellular modules.

u-blox M8 modules use GNSS chips qualified according to AEC-Q100, and are manufactured in ISO/TS 16949 certified sites. Qualification tests are performed as stipulated in the ISO16750 standard: "Road vehicles - Environmental conditions and testing for electrical and electronic equipment".

u-blox' AssistNow Assistance services supply aiding information, such as ephemeris, almanac and time, reducing the time to first fix significantly and improving acquisition sensitivity. The u-blox M8 generation extends validities of AssistNow Offline data (up to 35 days) and AssistNow Autonomous data (up to 6 days), providing the benefits of faster acquisition for longer durations since last use.

---

<sup>1</sup> With future flash firmware update.

## Technical Specifications

COM Port for GPS: COM 4

Baud Rate: 9600

| Parameter                                                | Specification                                                                                                           |                                             |                  |            |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|------------------|------------|
| Receiver type                                            | 72-channel u-blox M8 engine<br>GPS L1C/A, SBAS L1C/A, QZSS L1C/A<br>GLONASS L1OF, BeiDou B1, Galileo E1B/C <sup>2</sup> |                                             |                  |            |
| GNSS                                                     |                                                                                                                         | GPS & GLONASS                               | GPS & BeiDou     | GPS        |
| Time-To-First-Fix <sup>3</sup>                           | Cold start                                                                                                              | 27 s                                        | 28 s             | 30 s       |
|                                                          | Hot start                                                                                                               | 1.5 s                                       | 1.5 s            | 1.5 s      |
|                                                          | Aided starts <sup>4</sup>                                                                                               | 4 s                                         | 6 s <sup>5</sup> | 3 s        |
| Sensitivity <sup>6</sup>                                 | Tracking & Navigation <sup>7</sup>                                                                                      | -160 dBm                                    | -160 dBm         | -160 dBm   |
|                                                          | Reacquisition                                                                                                           | -159 dBm                                    | -159 dBm         | -159 dBm   |
|                                                          | Cold start                                                                                                              | -147 dBm                                    | -147 dBm         | -147 dBm   |
|                                                          | Hot start                                                                                                               | -156 dBm                                    | -156 dBm         | -156 dBm   |
| Navigation                                               |                                                                                                                         | GPS & GLONASS                               | GPS & BeiDou     | GPS        |
| Horizontal Position accuracy <sup>8</sup>                | Autonomous                                                                                                              | 2.5 m                                       | 2.5 m            | 2.5 m      |
|                                                          | SBAS                                                                                                                    | 2.0 m                                       | 2.0 m            | 2.0 m      |
| Velocity accuracy <sup>9</sup>                           |                                                                                                                         | 0.05 m/s                                    | 0.05 m/s         | 0.05 m/s   |
| Heading accuracy <sup>9</sup>                            |                                                                                                                         | 0.3 degree                                  | 0.3 degree       | 0.3 degree |
| ADR position error <sup>10</sup>                         | Gyro + speed pulse + accelerometer                                                                                      | typ. 3 % of distance travelled without GNSS |                  |            |
| Frequency of time pulse signal                           |                                                                                                                         | 0.25 Hz ... 10 MHz                          |                  |            |
| Maximum navigation rate (High Rate output) <sup>11</sup> |                                                                                                                         | 20 Hz                                       |                  |            |

| Navigation                                                |          | GPS & GLONASS  | GPS & BeiDou               | GPS            |
|-----------------------------------------------------------|----------|----------------|----------------------------|----------------|
| Maximum navigation rate (Measurement rate)                |          |                | 2 Hz                       |                |
| Navigation latency <sup>12</sup>                          |          |                | 300 ms nominal             |                |
| Maximum sensor measurement message output rate            |          |                | 10 Hz                      |                |
| Sensor measurement message output bandwidth <sup>13</sup> |          |                | nominal 50% of output rate |                |
| Accuracy of time pulse signal                             | RMS 99%  | 30 ns<br>60 ns | 30 ns<br>60 ns             | 30 ns<br>60 ns |
| Operational limits                                        | Dynamics | ≤ 4G           |                            |                |
|                                                           | Altitude | 50,000m        |                            |                |
|                                                           | Velocity | 500 m/s        |                            |                |

<sup>2</sup> Ready to support Galileo E1B/C when available with a flash firmware update<sup>3</sup> All signals at - 130 dBm<sup>4</sup> Dependent on aiding data connection speed and latency<sup>5</sup> BeiDou assisted acquisition is not available<sup>6</sup> Demonstrated with a good external LNA<sup>7</sup> Optimized for best navigation performance with dead-reckoning<sup>8</sup> GNSS fix available, CEP, 50%, 24 hours static, -130dBm, > 6 SVs<sup>9</sup> GNSS fix available, 50% @ 30 m/s<sup>10</sup> Typical road and vehicle conditions<sup>11</sup> For update rates > 2 Hz, extrapolation techniques are applied.<sup>12</sup> Dependent on signal conditions but measurements are delivered with time-stamp corresponding to measurement time<sup>13</sup> Higher bandwidths are used for navigation<sup>14</sup> Assuming Airborne < 4 g platform



## Module Connector Pin Definitions



J3 (GPS Side)



J7 (PC Side)

### J3 Pin Definition

| Pin | Definition      | Pin | Definition      |
|-----|-----------------|-----|-----------------|
| 1   | DR_DIRECTIO_M_R | 2   | DR_ODOMETER_M_R |
| 3   | 1PPS_R          | 4   | GND             |

### J7 Pin Definition

| Pin | Definition    | Pin | Definition    |
|-----|---------------|-----|---------------|
| 1   | GND           | 2   | 1PPS          |
| 3   | DR_ODOMETER_M | 4   | DR_DIRECTIO_M |

## VIOB-GPS-02 Module Connector Pin Definitions



J2 (GPS Side)



J8 (PC Side)

### J2 Pin Definition

| Pin | Definition | Pin | Definition |
|-----|------------|-----|------------|
| 1   | GPS_3V3    | 2   | GND        |
| 3   | GPS_TXD_M  | 4   | GPS_RXD_M  |
| 5   | NC         | 6   | +V3.3ALW   |

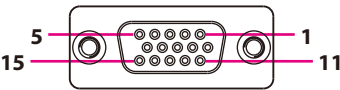
### J8 Pin Definition

| Pin | Definition | Pin | Definition |
|-----|------------|-----|------------|
| 1   | GPS_BAT    | 2   | GPS_LED    |
| 3   | CTX        | 4   | CRX        |
| 5   | GND        | 6   | VCC3_GPS   |

# APPENDIX D: SIGNAL CONNECTION OF PROGRAMMABLE DI/DO

## Multi Port Pinout Description

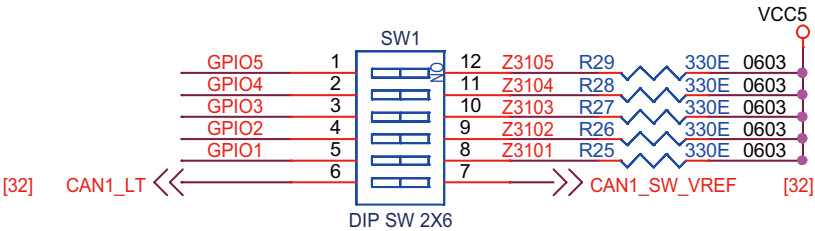
Connector location: CN2



| Pin | Definition | Pin | Definition |
|-----|------------|-----|------------|
| 1   | DIRECTION  | 2   | RXD3_R     |
| 3   | GPIO1      | 4   | GPIO4      |
| 5   | GND        | 6   | 1PPS       |
| 7   | TXD3_R     | 8   | CAN1_L     |
| 9   | GPIO3      | 10  | GND        |
| 11  | ODOMETER   | 12  | CAN1_H     |
| 13  | GPIO2      | 14  | GPIO5      |
| 15  | GND        |     |            |

## GPIO and CAN Terminal Setting

Connector location: SW1

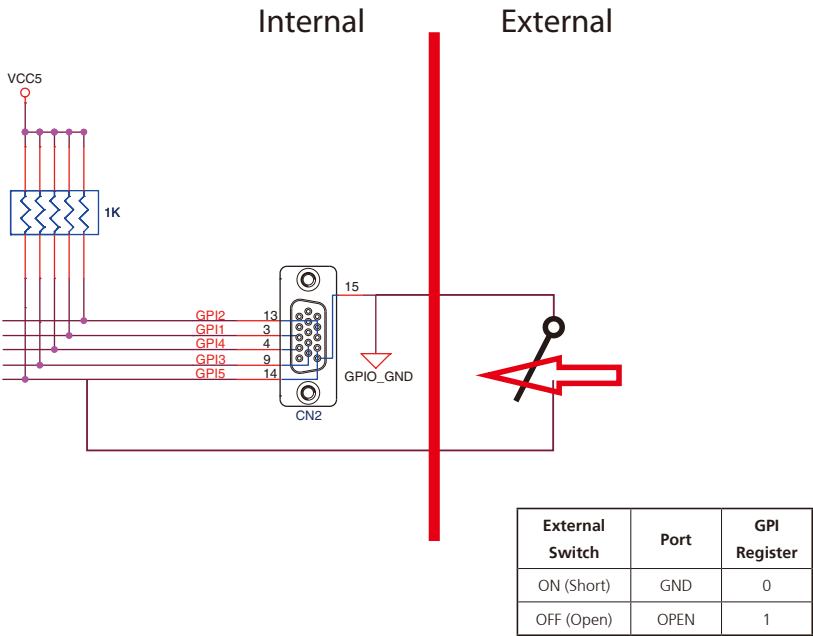


| SW    | On (Default)             | Off                       |
|-------|--------------------------|---------------------------|
| SW1.1 | Pull up VCC5             | Don't care                |
| SW1.2 | Pull up VCC5             | Don't care                |
| SW1.3 | Pull up VCC5             | Don't care                |
| SW1.4 | Pull up VCC5             | Don't care                |
| SW1.5 | Pull up VCC5             | Don't care                |
| SW1.6 | Enable terminal resistor | Disable terminal resistor |

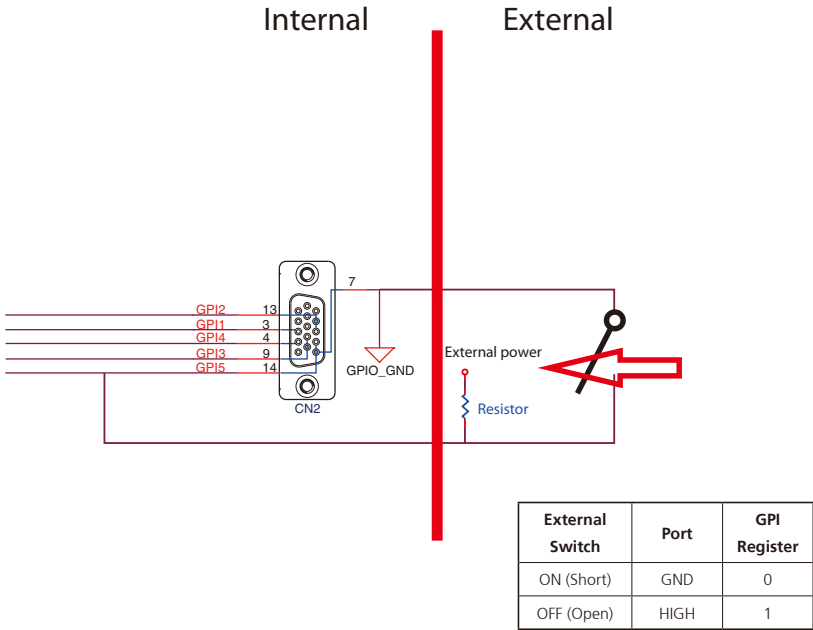
# Digital Input

Wet Contact (default)  
The GPI signals have a pull up resistor to 5V internally.

The figure below shows how to connect an external output source to one of the input channel.



Dry Contact:



## Digital Output

CN2 connector for GPO signal (digital signal output)

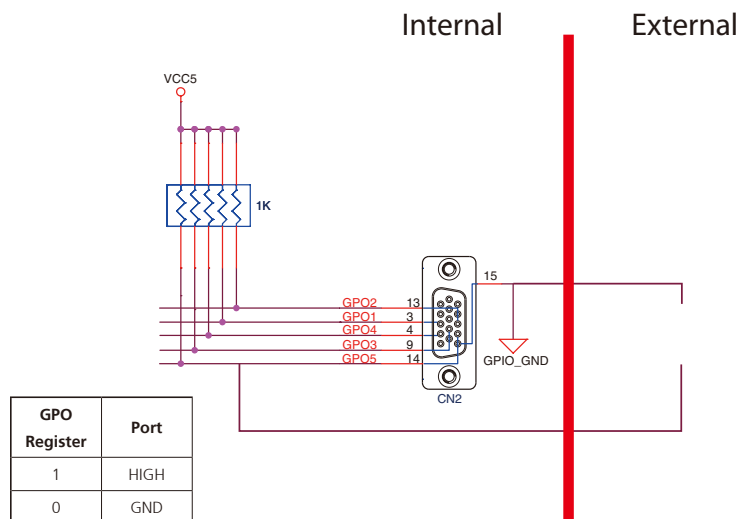
The CN2 connector has 4 digital output channels by default. The signal connection of CN2 support two connected methods for output signal type.

The output signal has two states, one is low level (driven to 0V from GPO signal) other is open (high voltage is provided from external device).

Wet Contact (default)

The SW1 needs to switch to "ON" state. The GPO signal will have a pull up resistor to 5V internally when you switch "SW1" to "ON" state. The output signal has two states, one is low level (driven to 0V from GPO signal) other is high level (driven to 5V from GPO signal).

The figure below shows how to connect an external input source to one of the output channel.

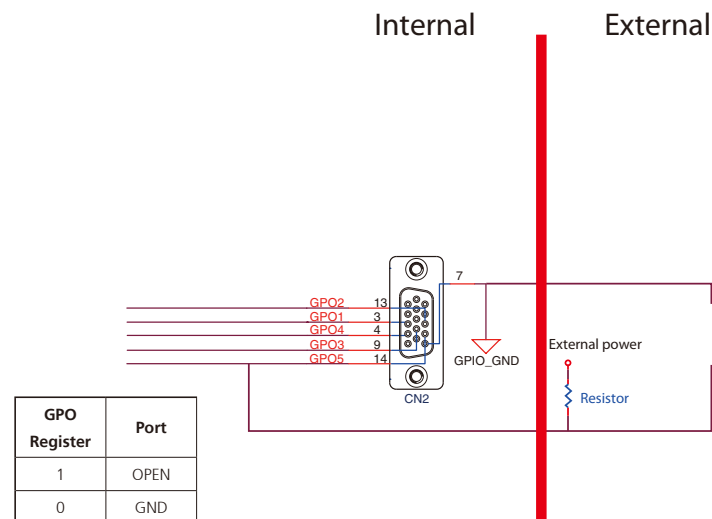


Dry Contact

Each channel can accept 3~18Vdc voltage. And it is able to drive 150mA current for low level.

The SW1 needs to switch to "OFF" state. The GPO signal will no have a pull up resistor internally when you switch "SW1" to "OFF" state.

The figure below shows how to connect an external input source to one of the output channel.



# APPENDIX E: VEHICLE POWER MANAGEMENT SETUP

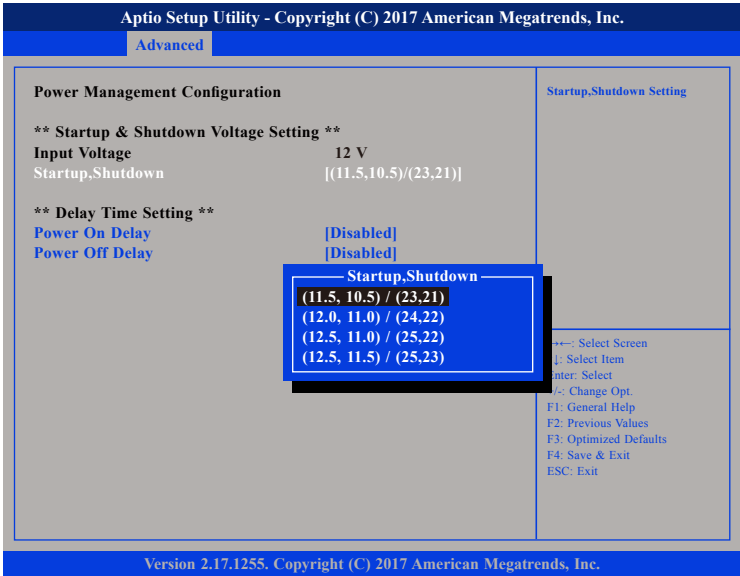
## Entering BIOS Menu

In the BIOS menu, go to **Advanced**→**Power Management Configuration**.



## Startup and Shutdown Voltage Setting

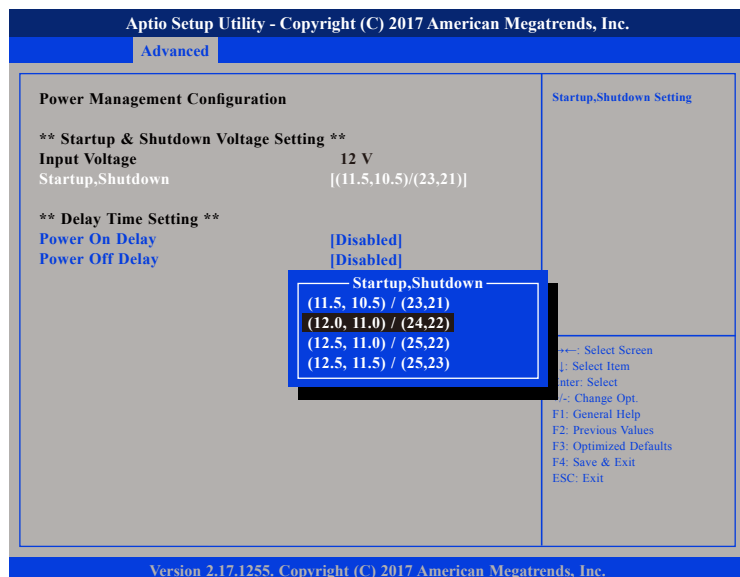
Set the startup voltage to 11.5V or 23V and the shutdown voltage to 10.5V or 21V  
If the input voltage is 12V: the startup voltage to 11.5V and the shutdown voltage to 10.5V.  
If the input voltage is 24V: the startup voltage to 23V and the shutdown voltage to 21V.



### Set the startup voltage to 12.0V or 24V and the shutdown voltage to 11.0V or 22V

If the input voltage is 12V: the startup voltage to 12V and the shutdown voltage to 11V.

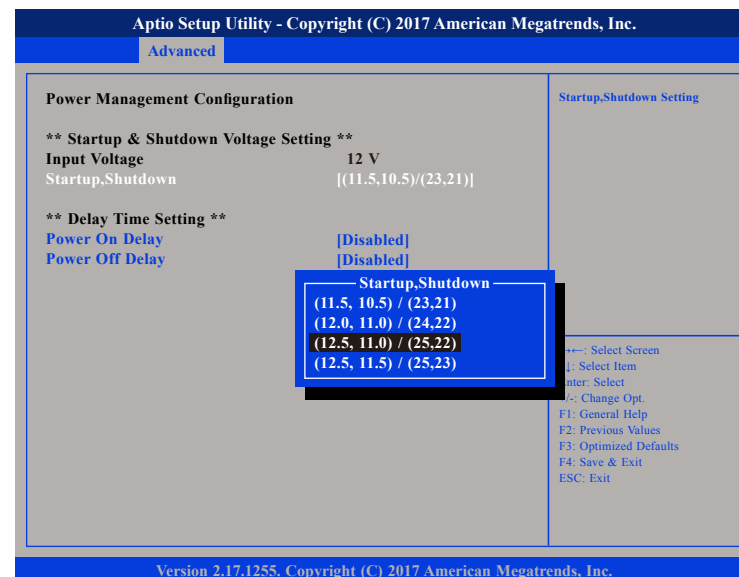
If the input voltage is 24V: the startup voltage to 24V and the shutdown voltage to 22V.



### Set the startup voltage to 12.5V or 25V and the shutdown voltage to 11.0V or 22V

If the input voltage is 12V: the startup voltage to 12.5V and the shutdown voltage to 11V.

If the input voltage is 24V: the startup voltage to 25V and the shutdown voltage to 22V.



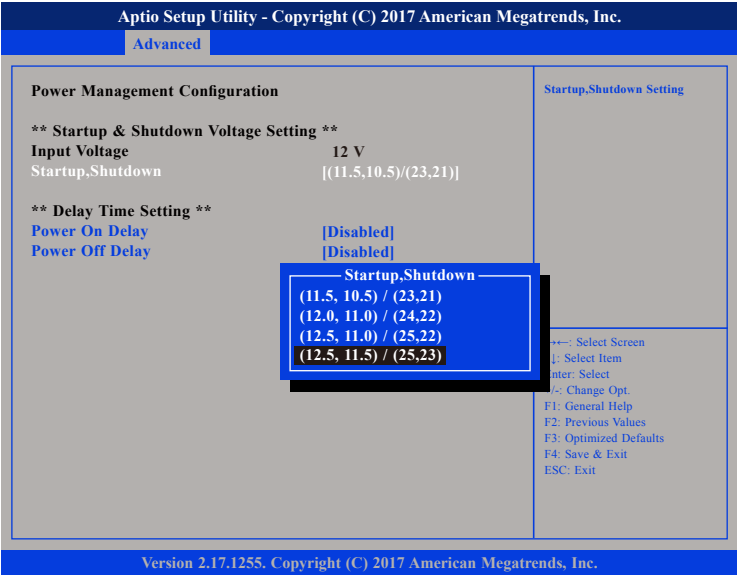
**Set the startup voltage to 12.5V or 25V and the shutdown voltage to 11.0V or 22V**

If the input voltage is 12V: the startup voltage to 12.5V and the shutdown voltage to 11.5V.

If the input voltage is 24V: the startup voltage to 25V and the shutdown voltage to 23V.

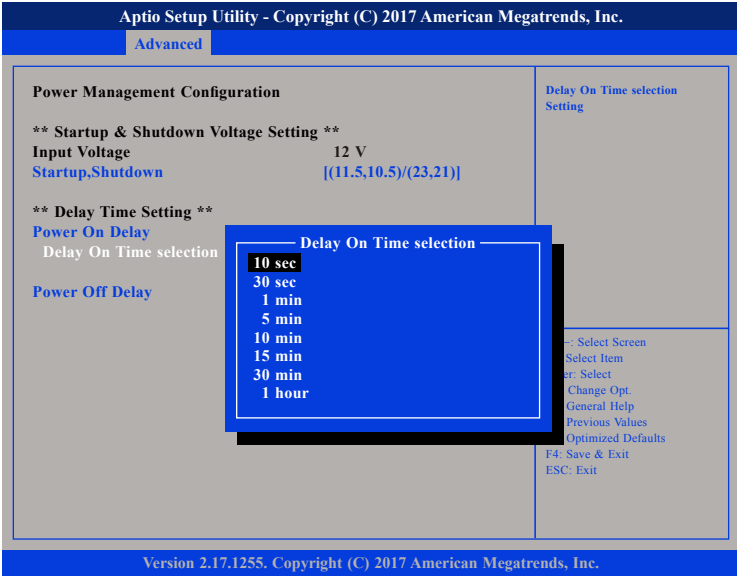
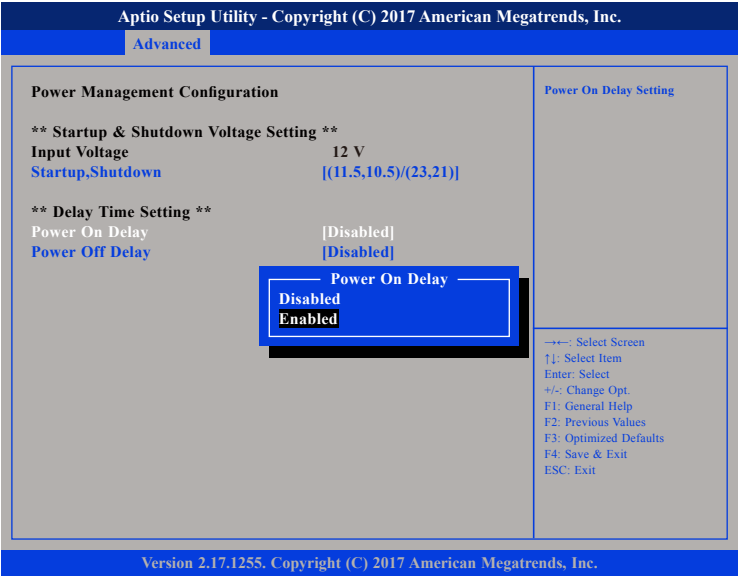
# Power-on Delay Setting

## Disable Power-on Delay



Enable Power-on Delay

Delay time can be set at 10sec/30sec/1min./5min./10min./15min./30min./1hour.





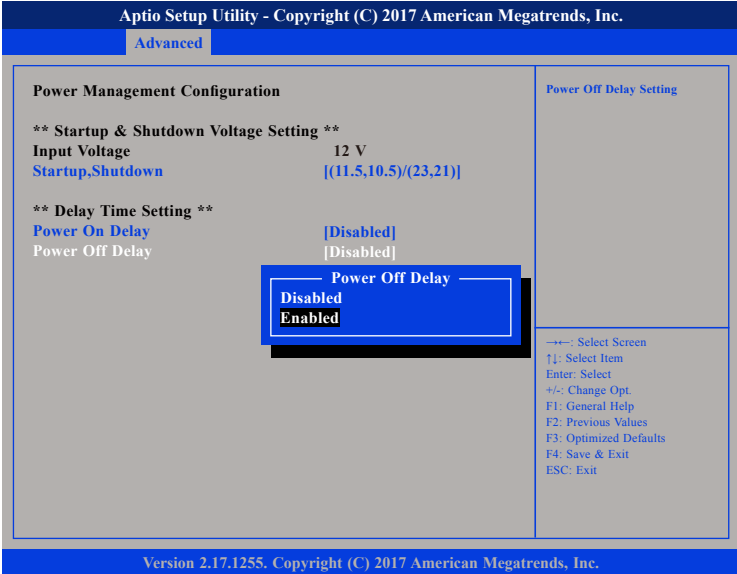
# Power-off Delay Setting

## Disable Power-off Delay



## Enable Power-off Delay

Delay time can be set at 20sec/1min./5min./10min./30min./1hour/6hour/18hour.





Aptio Setup Utility - Copyright (C) 2017 American Megatrends, Inc.

Advanced

Power Management Configuration

\*\* Startup & Shutdown Voltage Setting \*\*

Input Voltage12 V

Startup,Shutdown[(11.5,10.5)/(23,21)]

\*\* Delay Time Setting \*\*

Power On Delay

Power Off Delay

Delay Off Time selection

Delay On Time selection

20 sec

1 min

5 min

10 min

30 min

1 hour

6 hour

18 hour

Delay Off Time selection Setting

ESC: Exit

Version 2.17.1255. Copyright (C) 2017 American Megatrends, Inc.

# APPENDIX F: POWER CONSUMPTION

## VTC 1020/VTC 1020-PA/nROK 1020

**Idle:** Into OS + VGA/HDMI/LVDS display + Keyboard & Mouse + Speaker + mSATA

**Full State:** Run BURN-IN + VGA/HDMI/LVDS display + Keyboard & Mouse + Speaker (Sound volume max) +3D LINK (player Video) + mSATA + COM loopback + GPIO LED x5

**Full State + Loading:** Run BURN-IN + VGA/HDMI /LVDS display + Keyboard & Mouse + Speaker (Sound volume max) +3D LINK (player Video) + mSATA + COM loopback + GPIO LED x5 + load (12V/2A, 5V/0.5A, 5V/1A x2)

| Device   | Test Case            |     | Result     |         |
|----------|----------------------|-----|------------|---------|
|          |                      |     | Current(A) | Watt(W) |
| S0 State | Idle State           | 12V | 1.323      | 15.876  |
|          |                      | 24V | 0.689      | 16.536  |
|          |                      | 36V | 0.516      | 18.576  |
|          | Full State           | 12V | 1.733      | 20.796  |
|          |                      | 24V | 0.906      | 21.744  |
|          |                      | 36V | 0.701      | 25.236  |
|          | Full State + Loading | 12V | 5.107      | 61.284  |
|          |                      | 24V | 2.483      | 59.592  |
|          |                      | 36V | 1.688      | 60.768  |