

Mobile Computing Solutions

VTC 6221 and nROK 6221 Series

PKBX5386

PKBX5630/-1/-2/5631/-1/-2

User Manual

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PREFACE

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Disclaimer

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Acknowledgements

VTC 6221, nROK 6221 and nROK 6221-IP are trademarks. 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 12 months, beginning on the date of invoice by DELTA COMPONENTS GmbH.

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 needlenose pliers to disconnect connections as these can damage the soft metal or plastic parts of the connectors.

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. CompactFlash: Turn off the unit's power before inserting or removing a CompactFlash storage card.
4. SIM: Do not insert or remove the SIM card when the **system** is **powered** on. Always **power** off the **system** before inserting or removing the SIM card.

Safety Precautions

- Read these safety instructions carefully.
- Keep this User Manual for later reference.
- Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
- For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
- Keep this equipment away from humidity.
- Put this equipment on a stable surface during installation. Dropping it or letting it fall may cause damage.
- Do not leave this equipment in either an unconditioned environment or in a above 40°C storage temperature as this may damage the equipment.
- The openings on the enclosure are for air convection to protect the equipment from overheating. DO NOT COVER THE OPENINGS.
- Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
- 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.
- All cautions and warnings on the equipment should be noted.
- If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
- Never pour any liquid into an opening. This may cause fire or electrical shock.
- Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
- 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.
- Do not place heavy objects on the equipment.
- 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.
- 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.
- The computer is provided with CD drives that comply with the appropriate safety standards including IEC 60825.

Technical Support and Assistance

1. For the most updated information of DELTA COMPONENTS products, visit DELTA COMPONENTS website at 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.

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.

VTC 6221 Package Contents

Before continuing, verify that the package that you received is complete.
Your package should have all the items listed in the following table.

Item	P/N	Name	Specification	Qty
1		PE Zipper Bag #8	170x240mm, w/China RoHS Symbol	1
2		PE Zipper Bag #3	100x70mm, w/China RoHS Symbol	1
3		I Head Bolts Screw Long Fei:I3x15.8 ISO NIGP	I3x5.8 Axis x 2.8mm Screw x 3mm	4
4		Damper Anti-vibrate Grommet Kang Yang:TGM-50G(B)	D7xH2.8mm TPE Color:Black	4
5		Terminal Blocks 3P Phoenix Contact:1777992	5.08mm Male DIP Green	1
6		Terminal Blocks 2x9 Dinkle:0159-0118-GN	3.5mm Female 180D Green	1
7		GPS Antenna ARKNAV:A-130 GPS Antenna 5M SMA180P R1 L3	For VTC 5M/SMA180P	1
8		Washer for SMA CONN Kang Yang:TW-181	13x1.8mm Nylon 66 Natural	10
9		Washer for SMA CONN Kang Yang:WS6-0.8(B)	12.8x6.4x0.8mm PC Black	10

nROK 6221 Package Contents

Before continuing, verify that the package that you received is complete.
Your package should have all the items listed in the following table.

Item	P/N	Name	Specification	Qty
1		PE Zipper Bag #8	170x240mm, w/China RoHS Symbol	1
2		PE Zipper Bag #3	100x70mm, w/China RoHS Symbol	1
3		I Head Bolts Screw Long Fei:I3x15.8 ISO NIGP	I3x5.8 Axis x 2.8mm Screw x 3mm	4
4		Damper Anti-vibrate Grommet Kang Yang:TGM-50G(B)	D7xH2.8mm TPE Color:Black	4
5		Power Cable ST:MD-5108077	Waterproof M12 A Cord 5-pin (Male) to Open L=300mm	1
6		Terminal Blocks 2x9 DINKLE:0159-0118-GN	3.5mm Female 180D Green	1
7		GPS Antenna ARKNAV:A-130 GPS Antenna 5M SMA180P R1 L3	FOR VTC 5M/SMA180P	1
8		Washer for SMA CONN Kang Yang:TW-181	13x1.8mm Nylon 66 Natural	13
9		Washer for SMA CONN Kang Yang:WS6-0.8(B)	12.8x6.4x0.8mm PC Black	13

nROK 6221-IP Package Contents

Before continuing, verify that the package that you received is complete.
Your package should have all the items listed in the following table.

Item	P/N	Name	Specification	Qty
1		PE Zipper Bag #8	170x240mm, w/China RoHS Symbol	1
2		PE Zipper Bag #3	100x70mm, w/China RoHS Symbol	1
3		I Head Bolts Screw Long Fei:I3x15.8 ISO NIGP	I3x5.8 Axis x 2.8mm Screw x 3mm	4
4		Damper Anti-vibrate Grommet Kang Yang:TGM-50G(B)	D7xH2.8mm TPE Color:Black	4
5		Power Cable ST:MD-5108077	Waterproof M12 A Cord 5-pin (Male) to Open L=300mm	1
6		Terminal Blocks 2x9 DINKLE:0159-0118-GN	3.5mm Female 180D Green	1
7		GPS Antenna ARKNAV:A-130 GPS Antenna 5M SMA180P R1 L3	For VTC 5M/SMA180P	1
8		Washer for SMA CONN Kang Yang:TW-181	13x1.8mm Nylon 66 Natural	13
9		Washer for SMA CONN Kang Yang:WS6-0.8(B)	12.8x6.4x0.8mm PC Black	13
10		SMA Washer Twin Adhesive for IP65 VER:A S.W.	Φ13 x Φ8.5mm 0.15T VHB 3M4914	13

Ordering Information

The following provides ordering information for VTC 6221, nROK 6221 and nROK 6221-IP.

PKBX5386

VTC 6221, w/ Intel Atom E3950 1.6GHz
4GB DDR3L, 2x VGA, 1x HDMI, 3x COM, 1x CAN

PKBX5630

nROK 6221-A Railway, 24/36VDC (9-48VDC) w/o isolation
Intel Atom E3950 1.6GHz, 4GB DDR3L, 2x VGA, 1x HDMI

PKBX5630-1

nROK 6221-AI Railway, 24VDC (16,8-31,2V) w/ isolation
Intel Atom E3950 1.6GHz, 4GB DDR3L, 2x VGA, 1x HDMI

PKBX5630-2

nROK 6221-FI Railway, 110VDC (40-160V) w/ isolation
Intel Atom E3950 1.6GHz, 4GB DDR3L, 2x VGA, 1x HDMI

PKBX5631

nROK 6221-IPAI Railway, 24VDC (16,8-31,2V) w/ isolation
Intel Atom E3950 1.6GHz, 4GB DDR3L, 2x VGA, IP65

PKBX5631-1

nROK 6221-IPA Railway, 24/36VDC (9-48V) w/o isolation
Intel Atom E3950 1.6GHz, 4GB DDR3L, 2x VGA, IP65

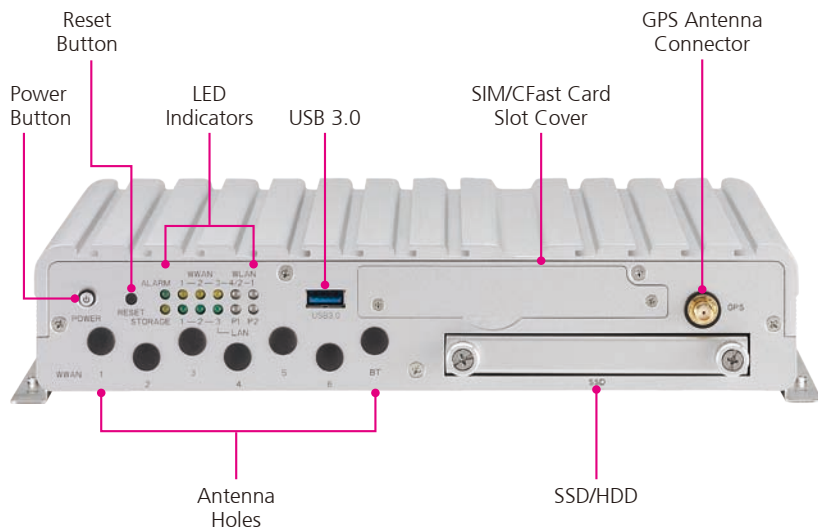
PKBX5631-2

nROK 6221-IPFI Railway, 110VDC (40-160V) w/ isolation
Intel Atom E3950 1.6GHz, 4GB DDR3L, 2x VGA, IP65

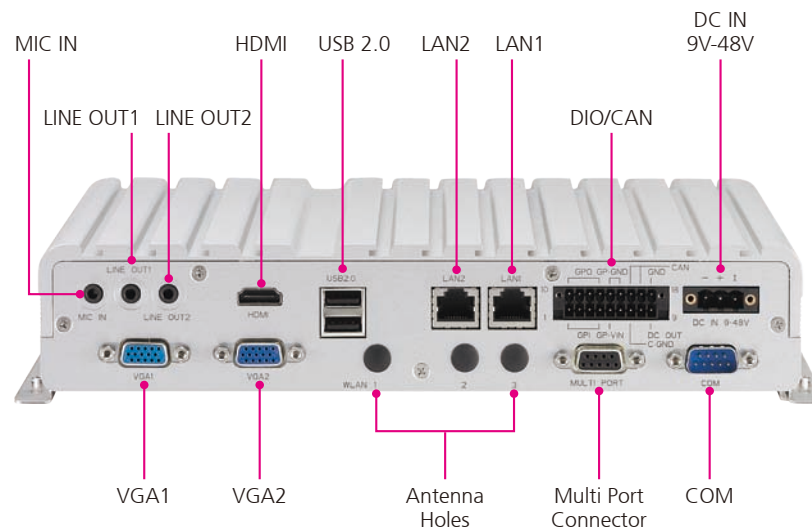
CHAPTER 1: PRODUCT INTRODUCTION

VTC 6221 Physical Features

Front View



Rear View



Overview

VTC 6221, based on Intel® Core™ quad core processor E3950 (up to 2.0GHz), is specifically comply with stringent E mark standard in rugged, fanless and compact mechanism. VTC 6221 provides complete communication capability between vehicle and computer with built-in CAN Bus 2.0B interface. VTC 6221 features rich WLAN and WWAN wireless connectivity. With dual SIM cards per modem support, VTC 6221 allows six SIM cards backup each other for a better connectivity quality by software. In addition, six SIM cards and three WWAN modules architecture can increase the bandwidth for a faster data transmission speed. Equipped with intelligent power management, VTC 6221 can be waked on by ignition, RTC timer or SMS message remotely. By integrating the variety of I/O ports and 3 x mini-PCle, 2 x M.2 sockets expansibility, up to three screens via VGA and HDMI connections, VTC 6221 keeps the flexibility to meet the demand for different vehicle applications, such as infotainment, dispatching system, cellular/wireless network connectivity, and video surveillance. The design of mini-PCle slots x 3 can solve the potential request from the market when needed.

Key Features

- Intel Atom® processor quad core E3950, up to 2.0GHz
- Six SIM cards + three WWAN modules support
- Built-in u-blox-M8 GPS
- Built-in CAN Bus 2.0B
- 1 x External storage (compatible with 9mm disk)
- E mark conformity
- 3 x mini-PCle + 2 x M.2 socket expansion
- Wide voltage input 9~48 VDC
- Three video outputs, two VGA and one HDMI
- 1 x Mic-in, 2 x Line-out

VTC 6221 Hardware Specifications

CPU

- Intel Atom® processor E3950, up to 2.0GHz, 12W, 4 core

Memory

- 1 x 204-pin DDR3L SO-DIMM socket support 1866MHz up to 8GB, default 4GB

Video Output

- Chipset Intel® HD Graphics 505
- 1 x HDMI 1.4b up to 4096 x 2160 @30Hz
- 2 x VGA up to 1920 x 1200 @60Hz

Storage

- 1 x 2.5" SATA 3.0 external SSD (compatible with 9mm drive)
- 1 x CFast (externally accessible), optional mSATA

Expansion

- 1 x Full size mini-PCIe socket (USB 2.0) for LTE module with 2 x external SIM
- 1 x Full size mini-PCIe socket (USB 2.0, PCIe 2.0), BOM optional full size mini-PCIe socket (USB 2.0) for LTE module with 2 x external SIM
- 1 x Full size mini-PCIe socket (USB 2.0, PCIe 2.0)
- 1 x M.2 3042 Key B socket (USB 2.0, USB 3.0) for LTE/5G NR module with 2 x external SIM
- 1 x M.2 3042/3050/3052 Key B (USB 2.0, USB 3.0, PCIe 2.0 [BOM optional]) for LTE/5G NR module with 2 x external SIM

GNSS and Onboard Sensor

- 1 x Default U-blox NEO-M8N GNSS for GPS/Glonass/QZSS/Galileo/Beidou
- Optional M8U modules with dead reckoning available
- G Sensor (3-axis, 10-bit resolution)

LAN and Power over Ethernet

- 2-Port LAN, 10/100/1000 Mbps I210-IT GbE, optional 3-port LAN

Security

- TPM 2.0: Infineon SLB9665TT2.0FW5.62 (BOM optional)

I/O Interface-Front

- 12 x LED indicators (including 2 x programmable LEDs)
- 6 x Externally accessible SIM card sockets with cover
- 1 x 2.5" removable SSD tray
- 1 x Externally accessible CFast card socket with cover
- 1 x Reset button
- 1 x Power button
- 1 x USB 3.0 type A (5V/0.9A)
- 8 x SMA antenna

I/O Interface-Rear

- 1 x 3-pin terminal block for 9V~48 VDC
- 2 x USB 2.0 type A (5V/0.5A)
- 2 x RJ45 LAN port, 10/100/1000 Mbps
- 1 x Mic-in, 2 x Line-out
- 2 x VGA
- 1 x HDMI 1.4b

- 1 x DB9 (COM) full RS-232
- 3 x SMA antenna
- 1 x DB9 (Multi Port) for RS-232 TX/RX, RS-485, USB 2.0
- 1 x 18-pin terminal block
 - 1 x CAN Bus 2.0B (onboard)
 - 4 x DI
 - 4 x DO
 - Vin, GND for GPIO

Power Management & Software Support

- Power input 9~48 VDC
- Selectable boot-up & shut-down voltage for low power protection by software
- Setting 8-level power on/off delay time by software
- Support S3/S4 suspend mode
- 10~255 seconds WDT support, setup by software
- SDK (Windows/Linux) including utility and sample code

Operating System

- Windows 10/Linux

Dimensions

- 260mm (W) x 196mm (D) x 50mm (H) (10.24" x 7.71" x 1.97")

Weight

- 2.5kg

Environment

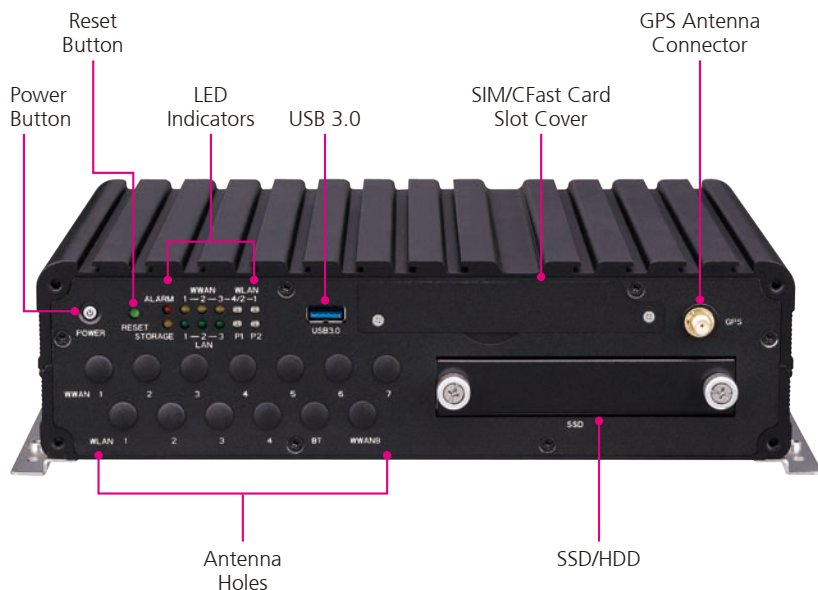
- Operating temperatures:
 - -40°C to 70°C (w/ industrial SSD) with air flow
- Storage temperatures: -40°C to 80°C
- Relative humidity: 10% to 90% (non-condensing)
- Vibration (SSD)
 - Operating: MIL-STD-810G, Method 514.6, Category 4, common carrier US highway truck vibration exposure
 - Storage: MIL-STD-810G, Method 514.6, Category 24, minimum integrity test
- Shock (SSD)
 - Operating: MIL-STD-810G, Method 516.6, Procedure I, functional shock=40g
 - Non-operating: MIL-STD-810G, Method 516.6, Procedure V, crash hazard shock test=75g

Standards/Certifications

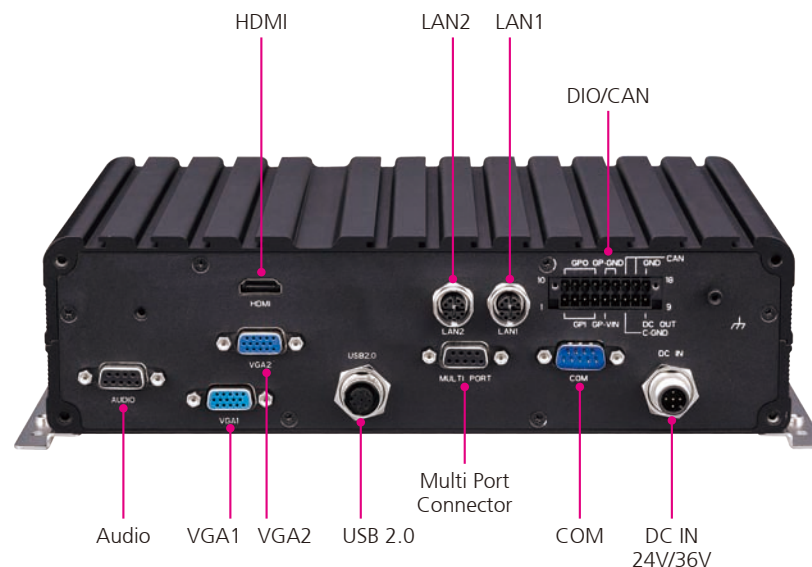
- CE
- FCC Class A
- E13 mark

nROK 6221 Physical Features

Front View



Rear View



Overview

nROK 6221, based on Intel® Core™ quad core processor E3950 (up to 2.0GHz), is specifically comply with stringent EN50155 standard in rugged, fanless and compact mechanism. nROK 6221 provides complete communication capability between train and computer with built-in CAN Bus 2.0B interface. nROK 6221 features rich WLAN and WWAN wireless connectivity. With dual SIM cards per modem support, nROK 6221 allows six SIM cards backup each other for a better connectivity quality or extra bandwidth by software. In addition, six SIM cards and three WWAN modules architecture can increase the bandwidth for a faster data transmission speed. Equipped with intelligent power management, nROK 6221 can be waked on by ignition, RTC timer or SMS message remotely. By integrating the variety of I/O ports, 3 x mini-PCle, 2 x M.2 sockets expansibility, up to three screens via VGA and HDMI connections, nROK 6221 keeps the flexibility to meet the demand for different rolling stock applications, such as infotainment, dispatching system, cellular/wireless network connectivity, and video surveillance. The design of mini-PCle slots x 3 can solve the potential request from the market when needed.

Key Features

- Intel Atom® processor quad core E3950, up to 2.0GHz
- Six SIM cards + three WWAN modules support
- Built-in u-blox-M8N GPS
- Built-in CAN Bus 2.0B
- 1 x External storage (compatible with 15mm disk)
- EN50155 conformity
- 3 x mini-PCle + 2 x M.2 socket expansion
- Wide voltage input 9~48 VDC
- 1 x DB9 for 1 x Mic-in, 2 x Line-out
- Three video outputs, two VGA and one HDMI

nROK 6221 Hardware Specifications

CPU

- Intel Atom® processor E3950, up to 2.0GHz, 12W, 4 core

Memory

- 1 x 204-pin DDR3L SO-DIMM socket support 1866MHz up to 8GB, default 4GB

Video Output

- Chipset Intel® HD Graphics 505
- 1 x HDMI 1.4b up to 4096 x 2160 @30Hz
- 2 x VGA up to 1920 x 1200 @60Hz

Storage

- 1 x 2.5" SATA 3.0 external SSD (compatible with 15mm drive)
- 1 x CFast (externally accessible), optional mSATA

Expansion

- 1 x Full size mini-PCIe socket (USB 2.0) for LTE module with 2 x external SIM
- 1 x Full size mini-PCIe socket (USB 2.0, PCIe 2.0), BOM optional full size mini-PCIe socket (USB 2.0) for LTE module with 2 x external SIM
- 1 x Full size mini-PCIe socket (USB 2.0, PCIe 2.0)
- 1 x M.2 3042 Key B socket (USB 2.0, USB 3.0) for LTE/5G NR module with 2 x external SIM
- 1 x M.2 3042/3050/3052 Key B socket (USB 2.0, USB 3.0, PCIe 2.0 [BOM optional]) for LTE/5G NR module with 2 x external SIM

GNSS and Onboard Sensor

- 1 x Default U-blox NEO-M8N GNSS for GPS/Glonass/QZSS/Galileo/Beidou
- Optional M8U modules with dead reckoning available
- G Sensor (3-axis, 10-bit resolution)

LAN and Power over Ethernet

- 2-Port LAN, 10/100/1000 Mbps I210-IT GbE, optional 3-port LAN

Security

- TPM 2.0: Infineon SLB9665TT2.0FW5.62 (BOM optional)

I/O Interface-Front

- 12 x LED indicators (including 2 x programmable LEDs)
- 6 x Externally accessible SIM card sockets with cover
- 1 x 2.5" removable SSD tray
- 1 x Externally accessible CFast card socket with cover
- 1 x Reset button
- 1 x Power button
- 1 x USB 3.0 type A (5V/0.9A)
- 14 x SMA antenna

I/O Interface-Rear

- 1 x Circle type DC input with ignition
 - 24/36 VDC (9~48 VDC), non-isolation
- 1 x M12 with two USB 2.0
- 2 x M12 X-coded LAN port, 10/100/1000 Mbps
- 1 x DB9 (AUDIO), female for 1 x Mic-in, 2 x Line-out

- 2 x VGA
- 1 x HDMI 1.4b
- 1 x DB9 (COM) full RS-232 (isolation)
- 1 x DB9 (MULTI PORT) for RS232 TX/RX, RS485 (all w/ isolation), USB 2.0
- 1 x 18-pin terminal block
 - 1 x CAN Bus 2.0B (onboard)
 - 4 x DI with isolation
 - 4 x DO with isolation
 - Vin, GND for GPIO

Power Management & Software Support

- Power input 24/36 VDC w/o isolation
- Selectable boot-up & shut-down voltage for low power protection by software
- Setting 8-level power on/off delay time by software
- Support S3/S4 suspend mode
- 10~255 seconds WDT support, setup by software
- SDK (Windows/Linux) including utility and sample code

Operating System

- Windows 10/Linux

Dimensions

- 260mm (W) x 196mm (D) x 70mm (H) (10.24" x 7.79" x 2.75")

Weight

- 2.8kg

Environment

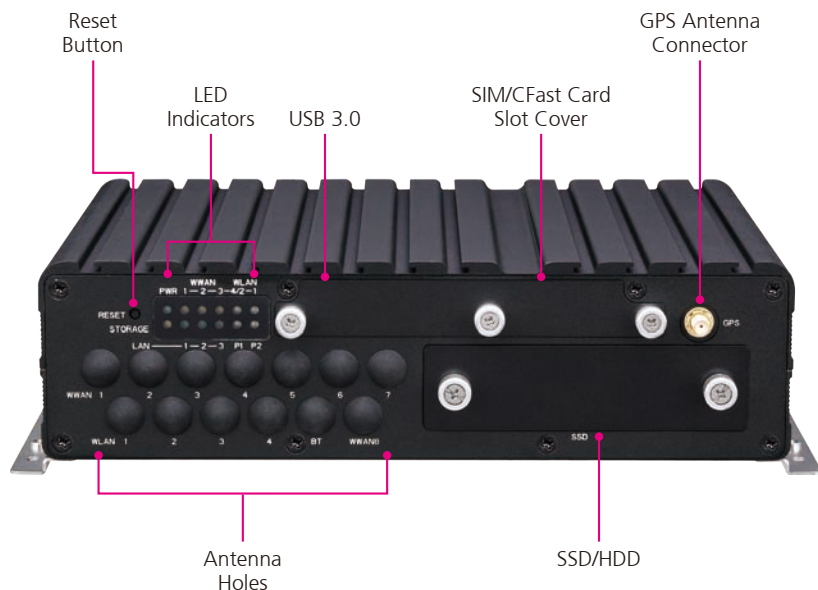
- Operating temperatures: EN 50155, class OT4 (-40~70°C), 85°C for 10 minutes (w/ industrial SSD) with air flow
- Storage temperatures: -40°C to 80°C
- Relative humidity: 10% to 90% (non-condensing)
- Vibration (SSD)
 - Operating: MIL-STD-810G, Method 514.6, Category 4, common carrier US highway truck vibration exposure
 - Storage: MIL-STD-810G, Method 514.6, Category 24, minimum integrity test
- Shock (SSD)
 - Operating: MIL-STD-810G, Method 516.6, Procedure I, functional shock=40g
 - Non-operating: MIL-STD-810G, Method 516.6, Procedure V, crash hazard shock test=75g

Standards/Certifications

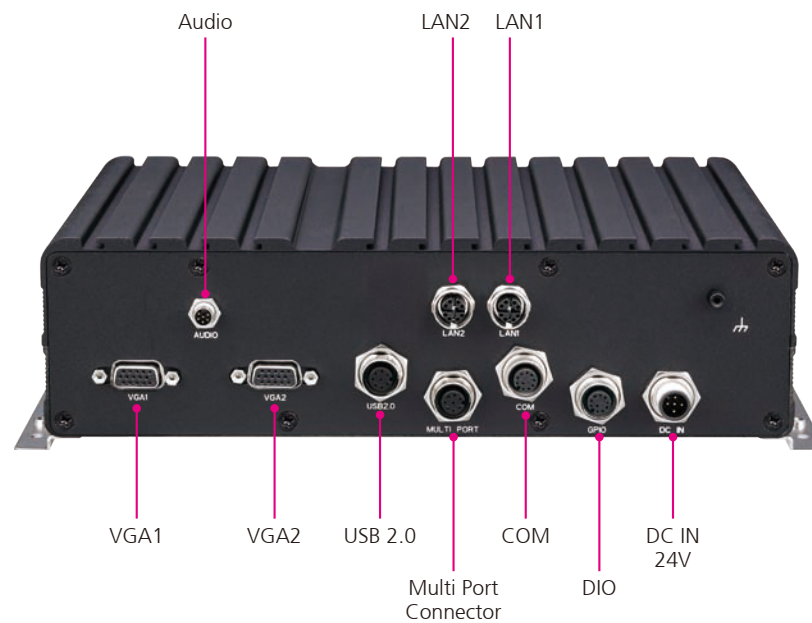
- CE
- FCC Class A
- EN 50155: 2017
 - Ambient temperature EN 50155, Class OT4 (-40~70°C), 85°C for 10 minutes
 - Interruptions of voltage supply class S1
 - Supply change over class C1, C2
 - EMC EN 50121-3-2: 2016
 - Environment EN 60068-2-1, EN 60068-2-2, EN 60068-2-30
 - Shock and vibration IEC 61373 Class B
 - Protective coating class PC1 (PC2, by request)
- EN 45545-2: 2013+A1:2015

nROK 6221-IP Physical Features

Front View



Rear View



Overview

nROK 6221-IP, based on Intel Atom® quad core processor E3950 (up to 2.0GHz), is specifically comply with stringent EN50155 standard in rugged, fanless and compact mechanism. nROK 6221-IP provides complete communication capability between train and computer with built-in CAN Bus 2.0B interface. nROK 6221-IP features rich WLAN and WWAN wireless connectivity. With dual SIM cards per modem support, nROK 6221-IP allows six SIM cards backup each other for a better connectivity quality by software. In addition, six SIM cards and three WWAN modules architecture can increase the bandwidth for a faster data transmission speed. Equipped with intelligent power management, nROK 6221-IP can be waked on by ignition, RTC timer or SMS message remotely. By integrating the variety of I/O ports, 3 x mini-PCle, 2 x M.2 sockets expansibility, up to two screens via VGA connections and waterproof IP65 rating, nROK 6221-IP keeps the flexibility to meet the demand for different rolling stock applications, such as infotainment, dispatching system, cellular/wireless network connectivity, and video surveillance. The design of mini-PCle slots x 3 can solve the potential request from the market when needed.

Key Features

- Intel Atom® processor quad core E3950, up to 2.0GHz
- Six SIM cards + three WWAN modules support
- Built-in u-blox-M8N GPS
- Built-in CAN Bus 2.0B
- 1 x External storage (compatible with 15mm disk)
- EN50155 conformity
- 3 x mini-PCle + 2 x M.2 socket expansion
- 4 x DI + 4 x DO w/ isolation
- 2 x RS232 + 1 x RS485 w/ isolation
- 2.5KVDC power isolation protection
- IP65 rating for waterproof
- Two VGA video outputs

nROK 6221-IP Hardware Specifications

CPU

- Intel Atom® processor E3950, up to 2.0GHz, 12W, 4 core

Memory

- 1 x 204-pin DDR3L SO-DIMM socket support 1866MHz up to 8GB, default 4GB

Video Output

- Chipset Intel® HD Graphics 505
- 2 x VGA up to 1920 x 1200 @60Hz

Storage

- 1 x 2.5" SATA 3.0 external SSD (compatible with 15mm drive)
- 1 x CFast (externally accessible), optional mSATA

Expansion

- 1 x Full size mini-PCIe socket (USB 2.0) for LTE module with 2 x external SIM
- 1 x Full size mini-PCIe socket (USB 2.0, PCIe 2.0), BOM optional full size mini-PCIe socket (USB 2.0) for LTE module with 2 x external SIM
- 1 x Full size mini-PCIe socket (USB 2.0, PCIe 2.0)
- 1 x M.2 3042 Key B socket (USB 2.0, USB 3.0) for LTE/5G NR module with 2 x external SIM
- 1 x M.2 3042/3050/3052 Key B socket (USB 2.0, USB 3.0, PCIe 2.0 [BOM optional]) for LTE/5G NR module with 2 x external SIM

GNSS and Onboard Sensor

- 1 x Default U-blox NEO-M8N GNSS for GPS/Glonass/QZSS/Galileo/Beidou
- Optional M8U modules with dead reckoning available
- G Sensor (3-axis, 10-bit resolution)

LAN and Power over Ethernet

- 2-Port LAN, 10/100/1000 Mbps I210-IT GbE, optional 3-port LAN

Security

- TPM 2.0: Infineon SLB9665TT2.0FW5.62 (BOM optional)

I/O Interface-Front

- 12 x LED indicators (including 2 x programmable LEDs)
- 6 x Externally accessible SIM card sockets with cover
- 1 x 2.5" removable SSD tray
- 1 x Externally accessible CFast card socket with cover
- 1 x Reset button
- 1 x Power button
- 1 x USB 3.0 type A (5V/0.9A)
- 14 x SMA antenna

I/O Interface-Rear

- 1 x Circle type DC input with ignition
 - 24 VDC (16.8~31.2V), w/ 2.5KVDC isolation
- 1 x M12 (COM) A-coded full RS-232 (isolation)
- 1 x M12 with two USB 2.0
- 2 x M12 X-coded LAN port, 10/100/1000 Mbps

- 1 x M8 (AUDIO) for 1 x Mic-in, 1 x Line-out
- 2 x VGA
- 1 x M12 (MULTI PORT) A-coded RS-232 TX/RX, RS-485, CAN Bus 2.0B (all w/ isolation)
- 1 x M12 (GPIO) A-coded GPIO
 - 4 x DI with isolation
 - 3 x DO with isolation

Power Management & Software Support

- Power input 24 VDC w/ isolation
- Selectable boot-up & shut-down voltage for low power protection by software
- Setting 8-level power on/off delay time by software
- Support S3/S4 suspend mode
- 10~255 seconds WDT support, setup by software
- SDK (Windows/Linux) including utility and sample code

Operating System

- Windows 10/Linux

Dimensions

- 260mm (W) x 196mm (D) x 70mm (H) (10.24" x 7.79" x 2.75")

Weight

- 3.0kg

Environment

- Operating temperatures: EN 50155, class OT4 (-40~70°C), 85°C for 10 minutes (w/ industrial SSD) with air flow
- Storage temperatures: -40°C to 80°C
- Relative humidity: 10% to 90% (non-condensing)
- Vibration (SSD)
 - Operating: MIL-STD-810G, Method 514.6, Category 4, common carrier US highway truck vibration exposure
 - Storage: MIL-STD-810G, Method 514.6, Category 24, minimum integrity test
- Shock (SSD)
 - Operating: MIL-STD-810G, Method 516.6, Procedure I, functional shock=40g
 - Non-operating: MIL-STD-810G, Method 516.6, Procedure V, crash hazard shock test=75g

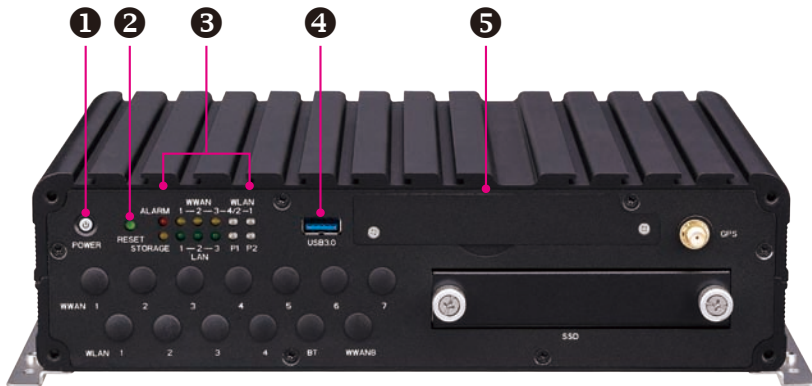
Standards/Certifications

- CE
- FCC Class A
- EN 50155: 2017
 - Ambient temperature EN 50155, Class OT4 (-40~70°C), 85°C for 10 minutes
 - Interruptions of voltage supply class S1
 - Supply change over class C1, C2
- EMC EN 50121-3-2: 2016
- Environment EN 60068-2-1, EN 60068-2-2, EN 60068-2-30
- Shock and vibration IEC 61373 Class B
- Protective coating class PC1 (PC2, by request)
- EN 45545-2: 2013+A1:2015

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.

nROK 6221 Front View



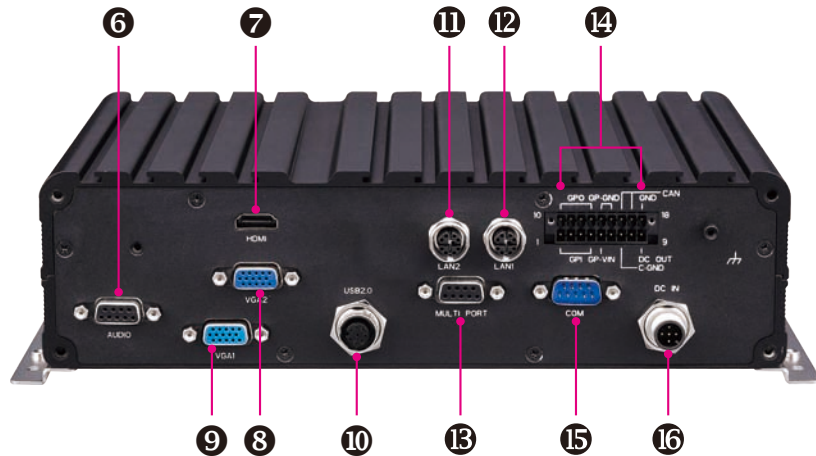
nROK 6221-IP Front View



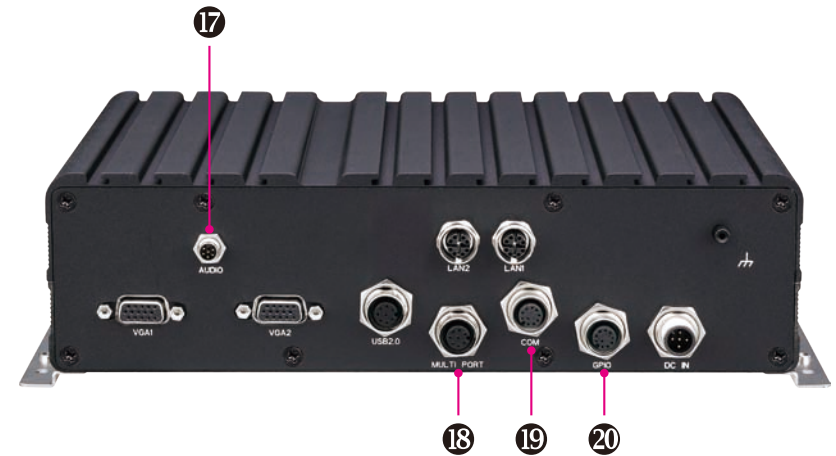
VTC 6221 Front View



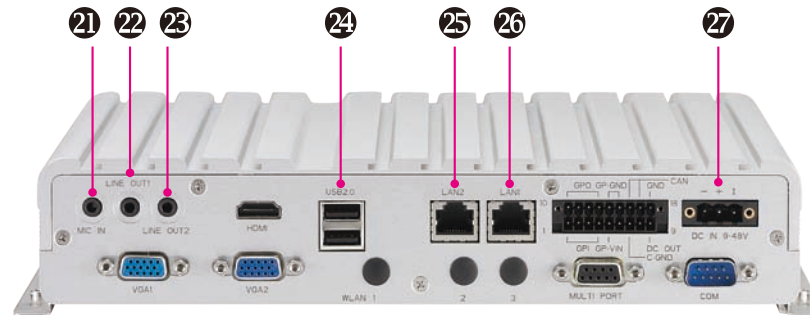
nROK 6221 Rear View



nROK 6221-IP Rear View



VTC 6221 Rear View



CHAPTER 2: EXTERNAL CONNECTORS PINOUT DESCRIPTION

Power Button

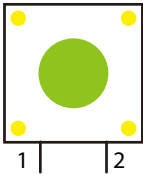
Connector number: 1



LED Color	Description
Red	Power failure
Blue	Power on and ready
Blinking	Low vehicle battery level
Off	Power off

Reset

Connector Number: 2



Pin	Definition
Open	Normal (Default)
Short	Reset

Alarm (Power)/Storage LED Indicators

Connector Number: 3

ALARM



STORAGE

LED & LED Color	Description
Alarm: Steady Red	Alarm triggered
Alarm: Steady Green	Power on
Storage: Blinking Yellow	Storage access

WWAN1/LAN1 LED Indicators

Connector Number: 3

WWAN



LAN

LED & LED Color	LED Behavior
WWAN1: Steady Yellow	WWAN1 active
LAN1: Steady Green	LAN1 active
LAN1: Blinking Green	LAN1 activity

WWAN2/LAN2 LED Indicators

Connector Number: 3

WWAN



LAN

LED & LED Color	LED Behavior
WWAN2: Steady Yellow	WWAN2 active
LAN2: Steady Green	LAN2 active
LAN2: Blinking Green	LAN2 activity

WWAN3/LAN3 LED Indicators (Optional)

Connector Number: 3

WWAN

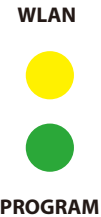


LAN

LED & LED Color	LED Behavior
WWAN3: Steady Yellow	WWAN3 active
LAN3: Steady Green	LAN3 active
LAN3: Blinking Green	LAN3 activity

WLAN2/Program1 LED Indicators

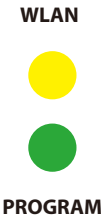
Connector Number: 3



LED & LED Color	LED Behavior
WLAN2: Steady Yellow	WLAN2 active
PROGRAM1: Green/Yellow	User programmable

WLAN1/Program2 LED Indicators

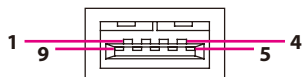
Connector Number: 3



LED & LED Color	LED Behavior
WLAN1: Steady Yellow	WLAN1 active
PROGRAM2: Green/Yellow	User programmable

USB 3.0 Port

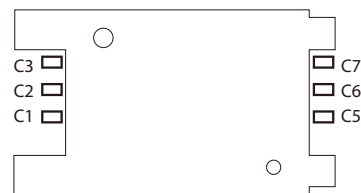
Connector Number: 4



Pin	Definition	Pin	Definition
1	5V	2	USB_1N
3	USB_1P	4	GND
5	USB3_RX0_N	6	USB3_RX0_P
7	GND	8	USB3_TX0_N
9	USB3_TX0_P		

SIM1-1/1-2 to SIM4-1/4-2 Micro-SIM Sockets

Connector number: 5



SIM1-1/1-2 to SIM4-1/4-2

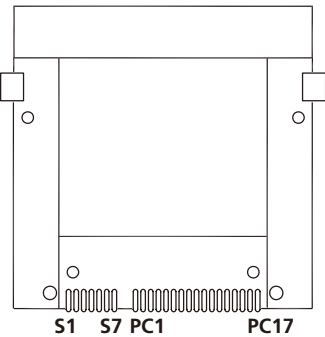
Pin	Definition	Pin	Definition
C1	UIM_PWR	C5	NC
C2	UIM_RST	C6	UIM_DAT
C3	UIM_CLK	C7	NC



Note: SIM4-1/4-2 (BOM optional)

CFast Card Slot

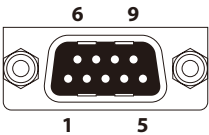
Connector number: 5



Pin	Definition	Pin	Definition
S1	GND	S2	SATA_TX1P
S3	SATA_TX1N	S4	GND
S5	SATA_RX1N	S6	SATA_RX1P
S7	GND	PC1	CFAST_CDI
PC2	GND	PC3	NC
PC4	NC	PC5	NC
PC6	NC	PC7	GND
PC8	CFAST_LED1	PC9	CFAST_LED2
PC10	NC	PC11	NC
PC12	NC	PC13	CFAST_VCC3
PC14	CFAST_VCC3	PC15	GND
PC16	GND	PC17	CFAST_CDO

Audio Port (nROK 6221)

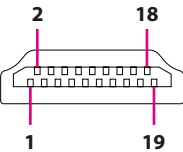
Connector Number: 6



Pin	Definition	Pin	Definition
1	MIC_AGND	2	MIC_L
3	MIC_IN_JD	4	SURR_OUT_JD
5	SURR_OUT_L	6	SURR_OUT_R
7	FRONT_OUT_JD	8	FRONT_OUT_L
9	FRONT_OUT_R		

HDMI Connector (VTC 6221 and nROK 6221)

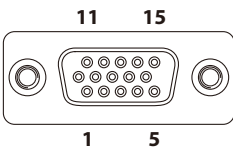
Connector number: 7



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		

VGA2

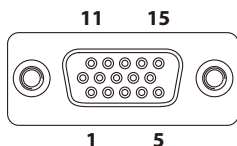
Connector Number: 8



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		

VGA1

Connector Number: 9



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		

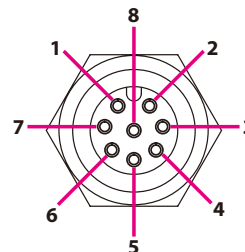


Note:

The VGA connector should be plugged when booting. No video signal will be available if the VGA connector is not plugged during boot up.

M12 USB 2.0 Connector (nROK 6221/6221-IP)

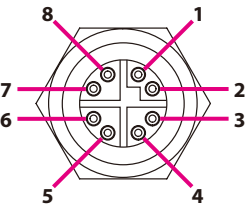
Connector Number: 10



Pin	Definition	Pin	Definition
1	USB1_N	2	USB1_P
3	USB1_VCC5	4	USB1_GND
5	USB2_N	6	USB2_P
7	USB2_VCC5	8	USB2_GND

M12 LAN2 Connector (nROK 6221/6221-IP)

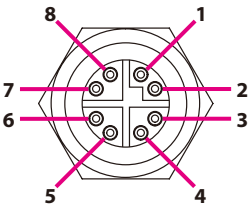
Connector Number: 11



Pin	Definition	Pin	Definition
1	MDI0P	2	MDI0N
3	MDI1P	4	MDI1N
5	MDI2P	6	MDI2N
7	MDI3P	8	MDI3N

M12 LAN1 Connector (nROK 6221/6221-IP)

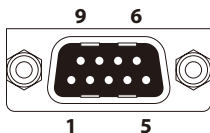
Connector Number: 12



Pin	Definition	Pin	Definition
1	MDI0P	2	MDI0N
3	MDI1P	4	MDI1N
5	MDI2P	6	MDI2N
7	MDI3P	8	MDI3N

Multi Port (VTC 6221 and nROK 6221)

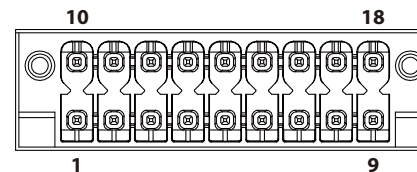
Connector Number: 13



Pin	Definition	Pin	Definition
1	RS485-1+	2	RS232_RXD
3	RS232_TXD	4	RS485-1-
5	ISO_GND	6	GND
7	USBHUB_3P_C	8	USBHUB_3N_C
9	USB1_POWER		

GPIO/CAN Connector (VTC 6221 and nROK 6221)

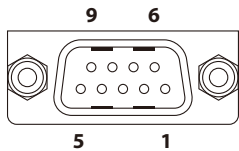
Connector Number: 14



Pin	Definition	Pin	Definition
1	CON_GPI1	2	CON_GPI3
3	CON_GPO1	4	CON_GPO3
5	VIN-GPIO	6	NC
7	CANISO_GND	8	CAN_H
9	+V12S	10	CON_GPI2
11	CON_GPI4	12	CON_GPO2
13	CON_GPO4	14	ISO_GND
15	ISO_GND	16	NC
17	CAN_L	18	GND

RS232 COM Port (VTC 6221 and nROK 6221)

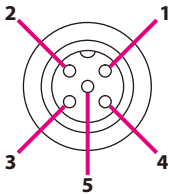
Connector Number: 15



Pin	Definition	Pin	Definition
1	DCD	2	RXD
3	TXD	4	DTR
5	ISO_GND	6	DSR
7	RTS	8	CTS
9	RI		

DC Input (nROK 6221/6221-IP)

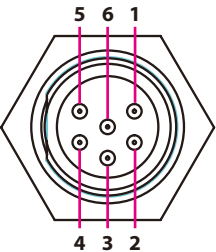
Connector Number: 16



Pin	Definition	Pin	Definition
1	DC IN +	2	DC IN +
3	DC IN -	4	DC IN -
5	IGNITION		

M12 Audio Connector (nROK 6221-IP)

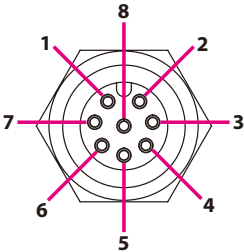
Connector Number: 17



Pin	Definition	Pin	Definition
1	FRONT_OUT_L	2	FRONT_OUT_JD
3	FRONT_OUT_R	4	MIC_L
5	MIC_JD	6	MIC_AGND

M12 Multi Port (nROK 6221-IP)

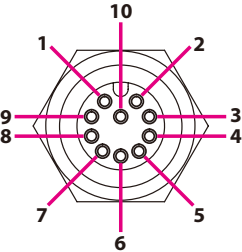
Connector Number: 18



Pin	Definition	Pin	Definition
1	RS485-1+	2	RS232_RXD
3	RS232_TXD	4	RS485-1-
5	ISO_GND	6	CAN_ISO_GND
7	CAN_L	8	CAN_H

M12 COM Port (nROK 6221-IP)

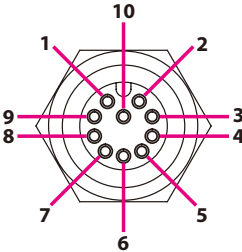
Connector Number: 19



Pin	Definition	Pin	Definition
1	DCD	2	RXD
3	TXD	4	DTR
5	ISO_GND	6	DSR
7	RTS	8	CTS
9	RI		

M12 GPIO Port (nROK 6221-IP)

Connector Number: 20



Pin	Definition	Pin	Definition
1	GPI1	2	GPI2
3	GPI3	4	GPI4
5	GPO1	6	GPO2
7	GPO3	8	GPO4
9	VIN_GPIO	10	GND

Mic-in Connector (VTC 6221)

Connector Number: 21



Pin	Definition	Pin	Definition
1	MIC_R	2	MIC_JD
3	NC	4	MIC_L
5	AGND	6	AGND

Line-out1 Connector (VTC 6221)

Connector Number: 22



Pin	Definition	Pin	Definition
1	SURR_OUT_R_CA	2	SURR_JD
3	NC	4	SURR_OUT_L_CA
5	AGND	6	AGND

Line-out2 Connector (VTC 6221)

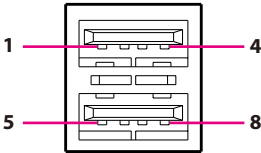
Connector Number: 23



Pin	Definition	Pin	Definition
1	SURR_OUT_R_CA	2	SURR_JD
3	NC	4	SURR_OUT_L_CA
5	AGND	6	AGND

USB 2.0 Ports (VTC 6221)

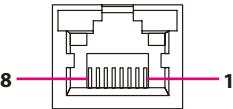
Connector Number: 24



Pin	Definition	Pin	Definition
1	5V	2	USBHUB_1N
3	USBHUB_1P	4	GND
5	5V	6	USBHUB_2N
7	USBHUB_2P	8	GND

LAN2 Port (VTC 6221)

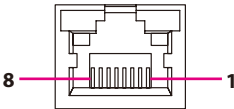
Connector number: 25



Pin	Definition	Pin	Definition
1	LAN(3-2)_MDI0P	2	LAN(3-2)_MDI0N
3	LAN(3-2)_MDI1P	4	LAN(3-2)_MDI2P
5	LAN(3-2)_MDI2N	6	LAN(3-2)_MDI1N
7	LAN(3-2)_MDI3P	8	LAN(3-2)_MDI3N
MH1	REAR_CGND	MH2	REAR_CGND

LAN1 Port (VTC 6221)

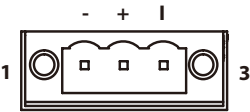
Connector number: 26



Pin	Definition	Pin	Definition
1	LAN(3-2)_MDI0P	2	LAN(3-2)_MDI0N
3	LAN(3-2)_MDI1P	4	LAN(3-2)_MDI2P
5	LAN(3-2)_MDI2N	6	LAN(3-2)_MDI1N
7	LAN(3-2)_MDI3P	8	LAN(3-2)_MDI3N
MH1	REAR_CGND	MH2	REAR_CGND

DC Input 9V-48V (VTC 6221)

Connector Number: 27



Pin	Definition
1	GND_IN
2	V_IN
3	IGNITION

CHAPTER 3: JUMPERS AND CONNECTORS

This chapter describes how to set the jumpers on the VTC 6221 and nROK 6221 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 environment 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 the 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:

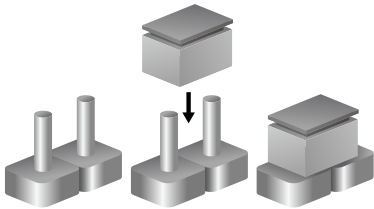
- Always disconnect the unit from the power outlet whenever you are working inside the case.
- If possible, wear a grounded wrist strap when you are working inside the computer case. Alternatively, discharge any static electricity by touching the bare metal chassis of the unit case, or the bare metal 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

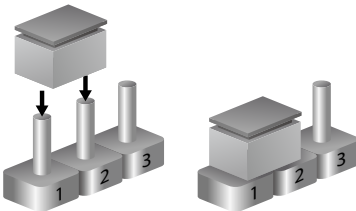
A jumper is the simplest kind of electric switch. It consists of two metal pins and a cap. When setting the jumpers, ensure that the jumper caps are placed on the correct pins. When the jumper cap is placed on both pins, the jumper is short. If you remove the jumper cap, or place the jumper cap on just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



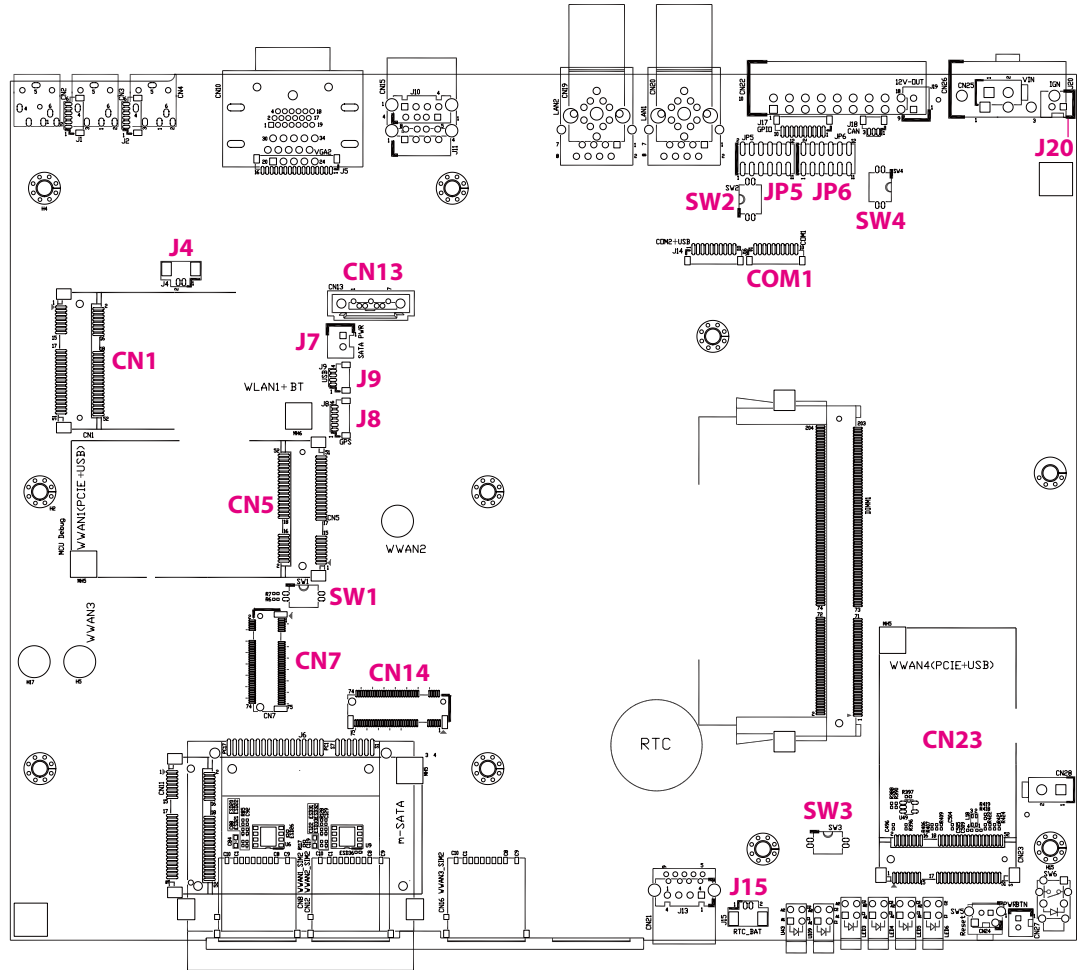
Three-Pin Jumpers: Pins 1 and 2 are Short



VTC 6221 and nROK 6221 Series Connector Specification & Jumper Setting

VTC 6221 and nROK 6221 Series Carrier Board Placement

The figure on the right is the carrier board used in the VTC 6221 and nROK 6221 system. It shows the locations of the jumpers and connectors.

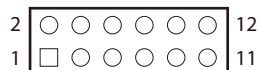


Jumper and DIP Switch Settings

GPIO Voltage Setting

Connector type: 2x6 12-pin header, 2.0mm pitch

Connector location: JP5 and JP6



JP5 Connector Pin Definition

Pin	Definition
1-3 Short	GPI1 Activity Low (Default) Voltage by Vin
3-5 Short	GPI1 Activity High
9-7 Short	GPI2 Activity Low (Default) Voltage by Vin
9-11 Short	GPI2 Activity High
4-2 Short	GPI3 Activity Low (Default) Voltage by Vin
4-6 Short	GPI3 Activity High
10-8 Short	GPI4 Activity Low (Default) Voltage by Vin
10-12 Short	GPI4 Activity High

JP6 Connector Pin Definition

Pin	Definition
1-3 Short	GPO1 Pull High (Default) Voltage by Vin
3-5 Short	GPO1 Float
9-7 Short	GPO2 Pull High (Default) Voltage by Vin
9-11 Short	GPO2 Float
4-2 Short	GPO3 Pull High (Default) Voltage by Vin
4-6 Short	GPO3 Float
10-8 Short	GPO4 Pull High (Default) Voltage by Vin
10-12 Short	GPO4 Float

Input Voltage Selection Switch

Connector type: 2-pin DIP switch

Connector location: SW1



Pin	Definition
1 OFF, 2 OFF	12V
1 OFF, 2 ON	24V
1 ON, 2 ON	9-48V (Default)

RS485 Terminator Resistor Selection Switch

Connector type: 2-pin DIP switch

Connector location: SW2



Pin	Definition
1 ON, 2 ON	RS485 Terminator Resistor (Default)
1 OFF, 2 OFF	RS485 No Terminator Resistor

RTC Clear CMOS

Connector type: 2-pin DIP switch
Connector location: SW3



Pin	Definition
1 OFF, 2 OFF	RTC Normal (Default) ME Normal (Default)
1 ON, 2 ON	RTC Clear CMOS ME Clear

CAN Terminator Resistor Selection Switch

Connector type: 2-pin DIP switch
Connector location: SW4



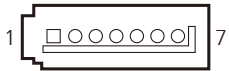
Pin	Definition
1 ON, 2 ON	CAN Terminator Resistor (Default)
1 OFF, 2 OFF	CAN No Terminator Resistor

Connectors

SATA Connector

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

Connector location: CN13

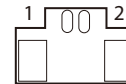


Pin	Definition	Pin	Definition
1	GND	2	SATA_TXP0
3	SATA_TXN0	4	GND
5	SATA_RXN0	6	SATA_RXP0
7	GND		

GPS Battery Connector

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

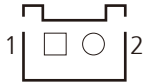
Connector location: J4



Pin	Definition
1	GPS_RTC
2	GND

SATA Power Connector

Connector type: 1x2 2-pin header, 2.5mm pitch
Connector location: J7



Pin	Definition
1	VCC5
2	GND

GPS Module Connector

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



Pin	Definition	Pin	Definition
1	GPS_BAT	2	GPS_LED
3	GPS_TXD	4	GPS_RXD
5	GND	6	VCC3_GPS

Internal USB Header

Connector type: 1x4 4-pin header, 1.0mm pitch
Connector location: J9



Pin	Definition	Pin	Definition
1	5V	2	USB_6N
3	USB_6P	4	GND

Ignition Detect Connector

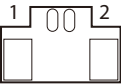
Connector type: 1x2 2-pin header, 2.5mm pitch
Connector location: J20



Pin	Definition
1	ISO_GND_IN
2	ISO_IGN_IN

RTC Battery Connector

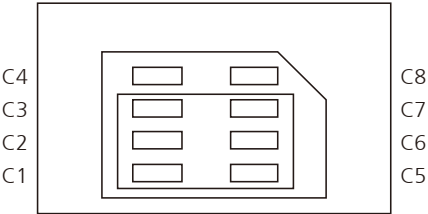
Connector type: 1x2 2-pin header, 1.25mm pitch
Connector location: J15



Pin	Definition
1	GND
2	VBAT1

SIM1-1/SIM1-2 to SIM4-1/SIM4-2 Micro-SIM Slots

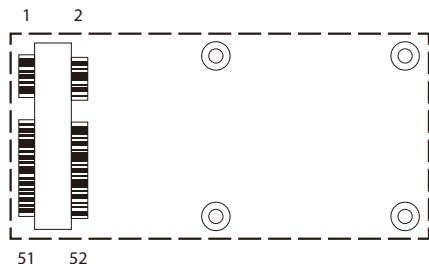
SIM1-1/SIM1-2 Connector location: CN32/CN8
SIM2-1/SIM2-2 Connector location: CN31/CN12
SIM3-1/SIM3-2 Connector location: CN30/CN16
SIM4-1/SIM4-2 Connector location: CN29/CN18 (BOM optional)



Pin	Definition	Pin	Definition
C 1	SIM_PWR	C 2	SIM_RST
C 3	SIM_CLK	C 4	NC
C 5	GND	C 6	NC
C 7	SIM_DAT	C 8	NC

Full Size Mini-PCle Socket (USB 2.0, PCIe 2.0)

Connector location: WLAN, CN1



Pin	Definition	Pin	Definition
1	PCIE_WAKE#2	2	+V3.3_MINI_2
3	NC	4	GND
5	NC	6	+V1.5S_MINI_2
7	CLKREQ#1	8	NC
9	GND	10	NC
11	PCIE_CLKN2	12	NC
13	PCIE_CLKP2	14	NC
15	GND	16	NC
17	NC	18	GND
19	NC	20	PCIE_DIS#2
21	GND	22	PCIE_RST#2
23	PE_RX2N	24	+V3.3_MINI_2
25	PE_RX2P	26	GND

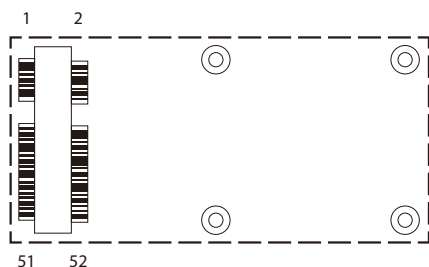
Pin	Definition	Pin	Definition
27	GND	28	+V1.5S_MINI_2
29	GND	30	NC
31	PE_TX2N	32	NC
33	PE_TX2P	34	GND
35	GND	36	USB_4N
37	GND	38	USB_4P
39	+V3.3_MINI_2	40	GND
41	+V3.3_MINI_2	42	NC
43	GND	44	PCIE_WLAN_LED#B
45	NC	46	NC
47	NC	48	+V1.5S_MINI_2
49	NC	50	GND
51	MBT_DIS#_R2	52	+V3.3_MINI_2

Full Size Mini-PCle Socket (USB 2.0, PCIe 2.0)

Connector location: WWAN4, CN23

SIM socket: SIM 4-1 (BOM optional)

SIM socket: SIM 4-2 (BOM optional)



Pin	Definition	Pin	Definition
1	PCIE_WAKE#1	2	+V3.3_MINI_1
3	NC	4	GND
5	NC	6	+V1.5S_MINI_1
7	CLKREQ#0	8	UIM_PWR
9	GND	10	UIM_DAT
11	PCIE_CLKN1	12	UIM_CLK
13	PCIE_CLKP1	14	UIM_RST
15	GND	16	NC
17	NC	18	GND
19	NC	20	PCIE_DIS#1
21	GND	22	PCIE_RST#1
23	PE_RX1N	24	+V3.3_MINI_1
25	PE_RX1P	26	GND

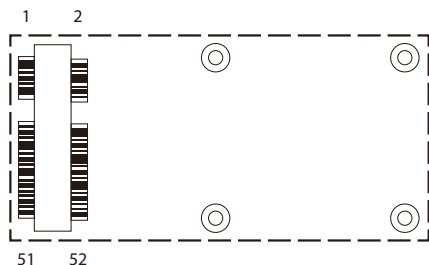
Pin	Definition	Pin	Definition
27	GND	28	+V1.5S_MINI_1
29	GND	30	NC
31	PE_TX1N	32	NC
33	PE_TX1P	34	GND
35	GND	36	USB_3N
37	GND	38	USB_3P
39	+V3.3_MINI_1	40	GND
41	+V3.3_MINI_1	42	WWAN4_LED
43	GND	44	PCIE_WLAN_LED#A
45	NC	46	NC
47	NC	48	+V1.5S_MINI_1
49	NC	50	GND
51	MBT_DIS#_R1	52	+V3.3_MINI_1

Full Size Mini-PCle Socket (USB 2.0) for LTE Module with 2 x External SIM

Connector location: WWAN1, CN5

SIM socket: SIM 1-1

SIM socket: SIM 1-2



Pin	Definition	Pin	Definition
1	NC	2	+V3.3_MINI_3
3	NC	4	GND
5	NC	6	+V1.5S_MINI_3
7	NC	8	UIM_PWR
9	GND	10	UIM_DAT
11	ASM_PCIE_CLKN1_C	12	UIM_CLK
13	ASM_PCIE_CLKP1_C	14	UIM_RST
15	GND	16	NC
17	NC	18	GND
19	NC	20	3.5G_DIS#_C
21	GND	22	3.5G_RST#_C
23	ASM_PCIE_RXN1	24	+V3.3_MINI_3
25	ASM_PCIE_RXP1	26	GND

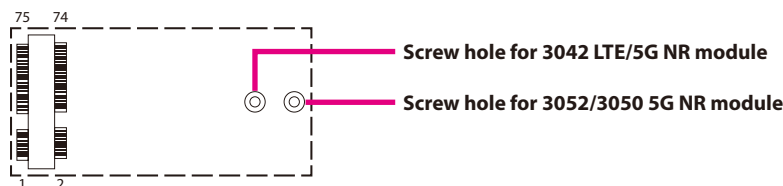
Pin	Definition	Pin	Definition
27	GND	28	+V1.5S_MINI_3
29	GND	30	NC
31	ASM_PCIE_TXN1	32	NC
33	ASM_PCIE_TXP1	34	GND
35	GND	36	USB_3N
37	GND	38	USB_3P
39	+V3.3_MINI_3	40	GND
41	+V3.3_MINI_3	42	WWAN3_LED#
43	GND	44	WLAN3_LED#
45	NC	46	NC
47	NC	48	+V1.5S_MINI_3
49	NC	50	GND
51	MBT_DIS#	52	+V3.3_MINI_3

M.2 3042/3050/3052 Key B Socket (USB 2.0, USB 3.0, PCIe 2.0 [BOM Optional]) for LTE/5G NR Module with 2 x External SIM

*** No 3G Voice/Remote Wakeup Support**

Connector location: WWAN3, CN7

SIM socket: SIM 3-1, SIM 3-2



Pin	Definition	Pin	Definition
1	CONFIG_3	2	V3.5G_P_A
3	GND	4	V3.5G_P_A
5	GND	6	POWER_OFF#
7	USB_OP	8	W_DISABLE1#
9	USB_ON	10	3.5G_LED#_A
11	GND	12	KEY(Notch location)
13	KEY(Notch location)	14	KEY(Notch location)
15	KEY(Notch location)	16	KEY(Notch location)
17	KEY(Notch location)	18	KEY(Notch location)
19	KEY(Notch location)	20	PCM_CLK
21	CONFIG_0	22	PCM_RX
23	WAKE#_3G	24	PCM_TX
25	NC	26	W_DISABLE2#
27	GND	28	PCM_SYNC
29	USB3_RX1N	30	UIM_RST_A
31	USB3_RX1P	32	UIM_CLK_A
33	GND	34	UIM_DAT_A
35	USB3_TX1N	36	UIM_PWR_A
37	USB3_TX1P	38	NC

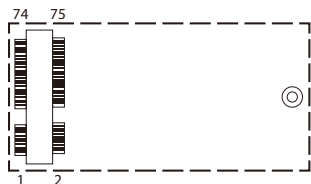
Pin	Definition	Pin	Definition
39	GND	40	NC
41	3G A_PCIE_RXN1_C	42	UIM2_DAT_A
43	3G A_PCIE_RXP1_C	44	UIM2_CLK_A
45	GND	46	UIM2_RST_A
47	3G A_PCIE_TXN1_C	48	UIM2_PWR_A
49	3G A_PCIE_TXP1_C	50	NC
51	GND	52	NC
53	3G A_PCIE_CLKN_C	54	NC
55	3G A_PCIE_CLKP_C	56	NC
57	GND	58	NC
59	NC	60	NC
61	NC	62	NC
63	NC	64	NC
65	NC	66	NC
67	W_RESET#	68	NC
69	CONFIG_1	70	V3.5G_P_A
71	GND	72	V3.5G_P_A
73	GND	74	V3.5G_P_A
75	CONFIG_2		

M.2 3042 Key B Socket (USB 2.0, USB 3.0) for LTE/5G NR Module with 2 x External SIM

* **No 3G Voice**

Connector location: WWAN2, CN14

SIM socket: SIM 2-1, SIM 2-2



Pin	Definition	Pin	Definition
1	CONFIG_3_B	2	V3.5G_P_B
3	GND	4	V3.5G_P_B
5	GND	6	PWR_OFF#_B
7	USB_1P_M	8	W_DISABLE1#_B
9	USB_1N_M	10	3.5G_LED#_B
11	GND	12	KEY(Notch location)
13	KEY(Notch location)	14	KEY(Notch location)
15	KEY(Notch location)	16	KEY(Notch location)
17	KEY(Notch location)	18	KEY(Notch location)
19	KEY(Notch location)	20	NC
21	CONFIG_0_B	22	NC
23	NC	24	NC
25	NC	26	W_DISABLE2#_B
27	GND	28	NC
29	USB3_RX2N	30	UIM_RST_B
31	USB3_RX2P	32	UIM_CLK_B
33	GND	34	UIM_DAT_B
35	USB3_TX2N	36	UIM_PWR_B
37	USB3_TX2P	38	NC

Pin	Definition	Pin	Definition
39	GND	40	NC
41	NC	42	UIM2_DAT_B
43	NC	44	UIM2_CLK_B
45	GND	46	UIM2_RST_B
47	NC	48	UIM2_PWR_B
49	NC	50	NC
51	GND	52	NC
53	NC	54	NC
55	NC	56	NC
57	GND	58	NC
59	NC	60	NC
61	NC	62	NC
63	NC	64	NC
65	NC	66	NC
67	W_RESET#_R_B	68	NC
69	CONFIG_1_B	70	V3.5G_P_B
71	GND	72	V3.5G_P_B
73	GND	74	V3.5G_P_B
75	CONFIG_2_B		

CHAPTER 4: SYSTEM SETUP

Removing the Chassis Cover



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. The screws on the front, rear and bottom are used to secure the cover to the chassis. Remove these screws and put them in a safe place for later use. With the screws removed, pull up the bottom cover to remove it.



Bottom View



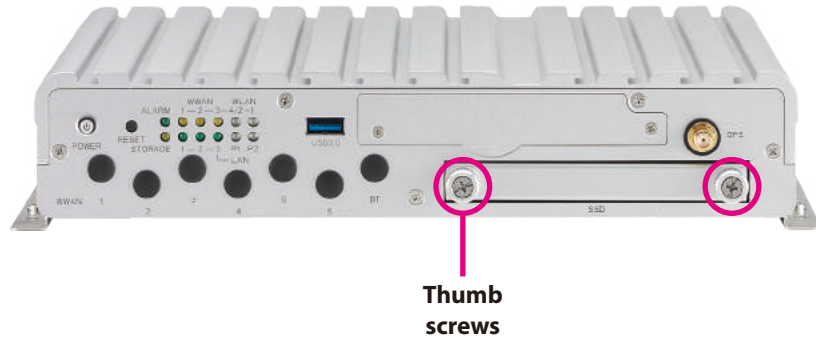
Front View



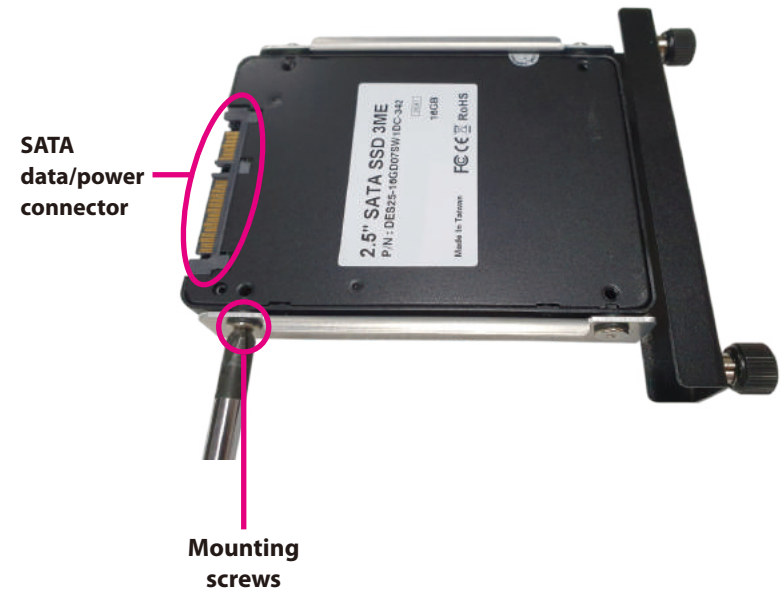
Rear View

Installing a SSD/HDD Drive

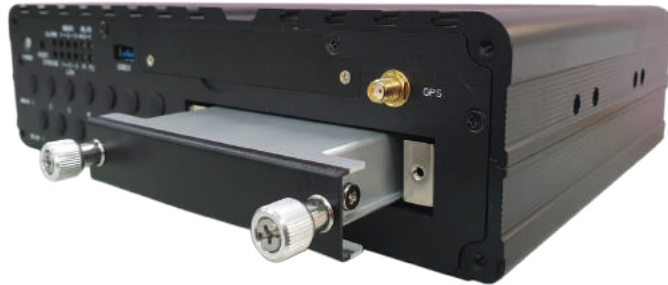
1. Loosen the thumb screws on the SSD/HDD drive bay and slide the drive bay out.



2. Insert the storage drive into the drive bay with the SATA data and power connector facing towards the end. Align the storage drive's mounting holes with the mounting holes on the drive bay, and use the provided screws to secure the storage drive in place.

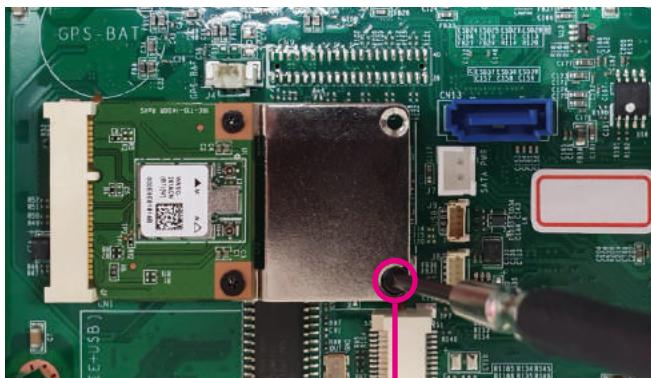


3. Insert the drive bay back in the SSD/HDD slot and tighten the thumb screws to secure it in place.



Installing a WLAN Module

1. Locate the WLAN mini PCI Express slot (CN1). 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 a screw into the mounting hole to secure the module.



Mounting
screw

Installing a WWAN Module

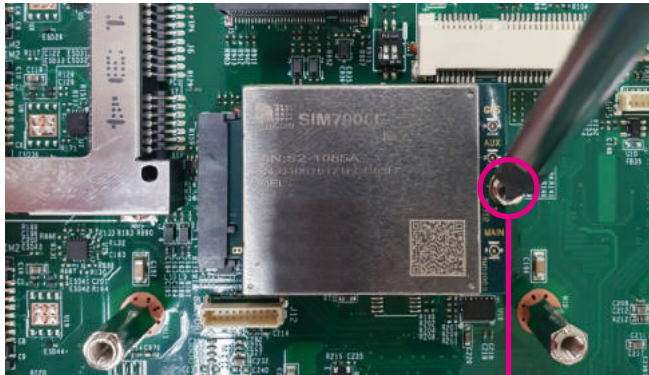
1. Locate the WWAN mini PCI Express slot (CN5). Insert the module into the mini PCI Express slot at a 45 degrees angle until the gold-plated connector on the edge of the module completely disappears inside the slot. Then fasten a screw into the mounting hole to secure the module.



Mounting
screw

Installing a WWAN Module (M.2 Slot)

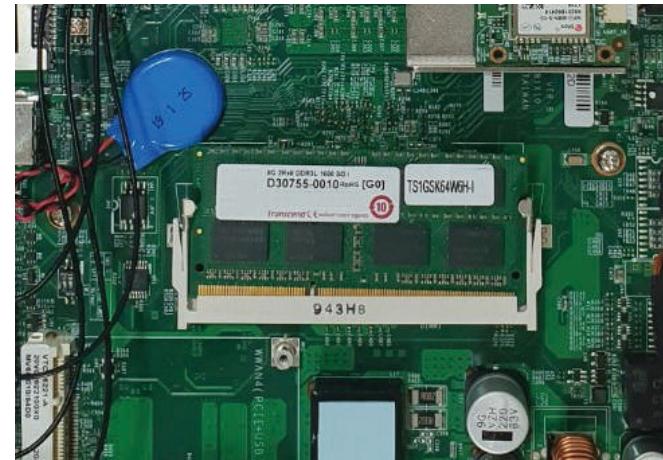
1. Locate the WWAN M.2 slot (CN14). Insert the module into the M.2 slot at a 45 degrees angle until the gold-plated connector on the edge of the module completely disappears inside the slot. Then fasten a screw into the mounting hole to secure the module.



**Mounting
screw**

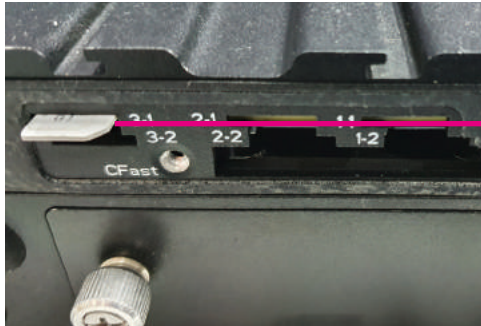
Installing a SO-DIMM Memory Module

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.



Inserting SIM Cards

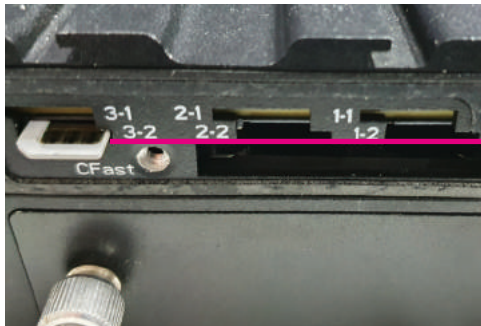
1. Remove the SIM card cover on the front panel and insert the SIM cards.
Please take note of the SIM card installation direction as shown in the following pictures.



**Installation direction
for top slot**



Micro-SIM



**Installation direction
for bottom slot**



Micro-SIM

Rackmount Brackets

The rackmount brackets provide a convenient and economical way of mounting the system. Two ways of mounting the system are supported – horizontal mounting and vertical mounting.

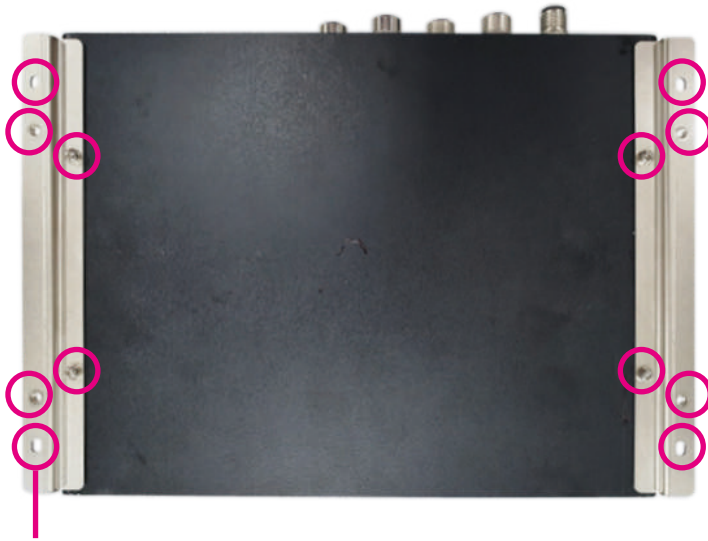


Horizontal Mounting



Vertical Mounting

1. The mounting holes are located at the bottom of the system. The rackmount brackets are pre-installed on the system. Please mount the system by fastening screws through the mounting holes of the rackmount brackets.



Mounting holes of the rackmount brackets
Screw type is #6-32

APPENDIX A:

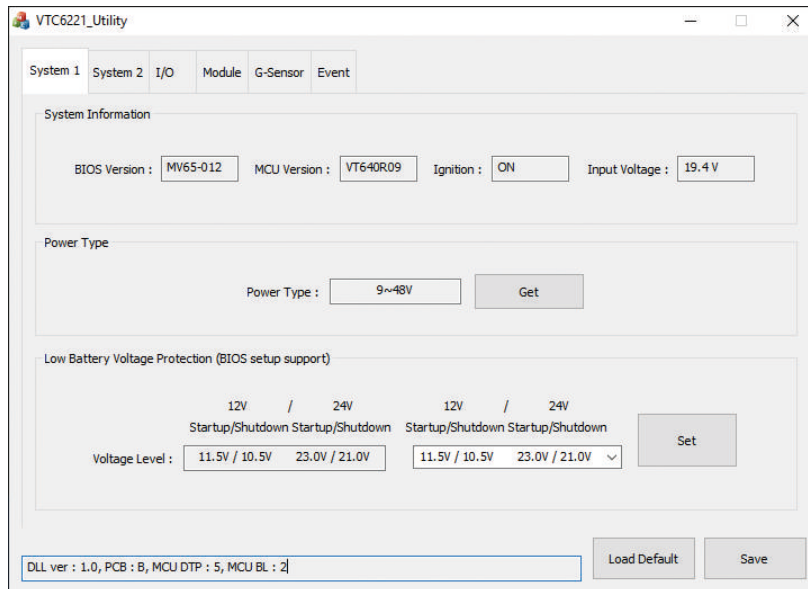
SOFTWARE DEMO UTILITY FOR I/O PORTS OF FUNCTION CONTROL

software demo utility enables users to test and control different I/O port functions on VTC 6221, nROK 6221 and nROK 6221-IP. 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

1. System 1



1.1 System Information

Displays basic information of the system.

BIOS Version: Shows the BIOS version.

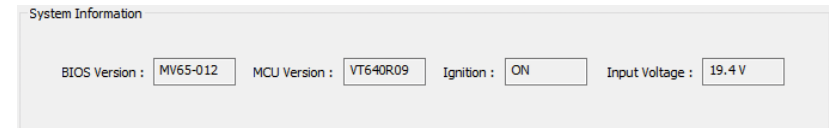
MCU Version: Shows the MCU version.

Ignition: Shows the signal of ignition.

– ON: Signal of ignition is high.

– OFF: Signal of ignition is low.

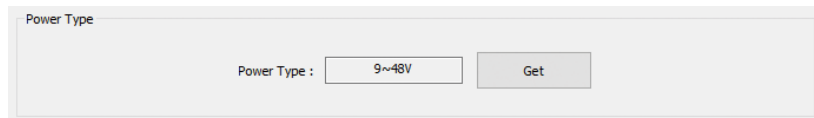
Input Voltage: Shows the voltage level of power-in.



1.2 Power Type

Shows the input voltage setting in the SW DIP switch.

- If the setting is 12V: 12V is shown.
- If the setting is 24V: 24V is shown.
- If the setting is 9V~48V: 9V~46V is shown.

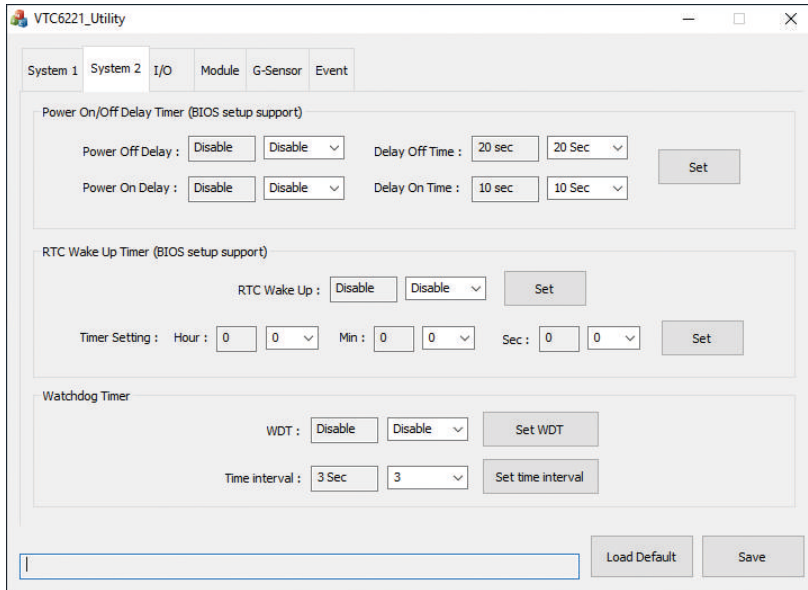

 A screenshot of the 'Power Type' configuration window. It features a label 'Power Type' followed by a text input field containing '9~48V' and a 'Get' button.

1.3 Low Battery Voltage Protection

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


 A screenshot of the 'Low Battery Voltage Protection (BIOS setup support)' configuration window. It displays two columns of settings for 12V and 24V. Each column has a 'Startup/Shutdown' label and a corresponding voltage range input field. The 12V field shows '11.5V / 10.5V' and the 24V field shows '23.0V / 21.0V'. A 'Set' button is located to the right of the input fields.

2. System 2



VTC6221_Utility

System 1 System 2 I/O Module G-Sensor Event

Power On/Off Delay Timer (BIOS setup support)

Power Off Delay : Delay Off Time :

Power On Delay : Delay On Time :

RTC Wake Up Timer (BIOS setup support)

RTC Wake Up :

Timer Setting : Hour : Min : Sec :

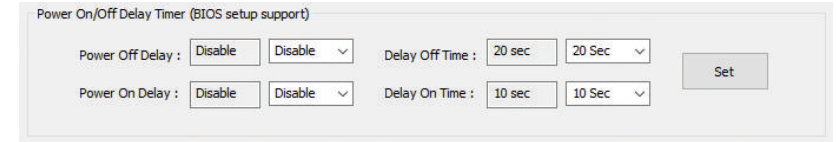
Watchdog Timer

WDT :

Time interval :

2.1 Power On/Off Delay Timer

Configures the power on/off delay timer. Click the Set button after configuration to apply the settings.



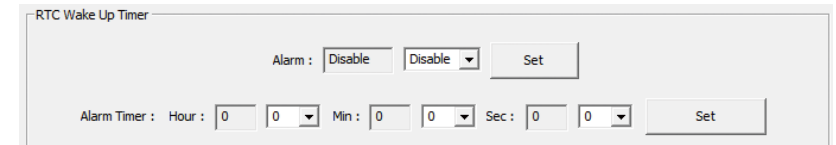
Power On/Off Delay Timer (BIOS setup support)

Power Off Delay : Delay Off Time :

Power On Delay : Delay On Time :

2.2 RTC Wake Up Timer

Enables or disables the Alarm Wake Up function. Once this function is enabled, the Alarm Timer can be configured.



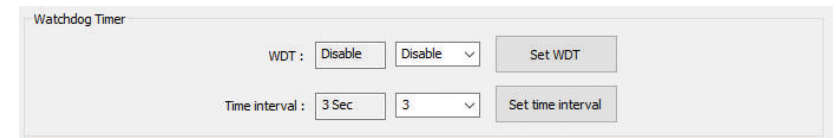
RTC Wake Up Timer

Alarm :

Alarm Timer : Hour : Min : Sec :

2.3 Watchdog Timer

Enables or disables the Watchdog Timer function. There are several selections of time. The timer of Watchdog Timer can also be cleared by the Set WDT button.

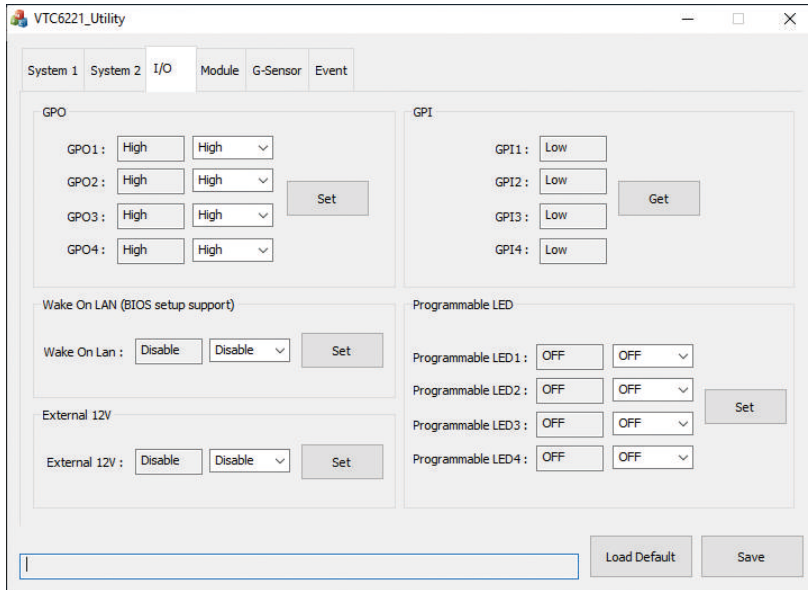


Watchdog Timer

WDT :

Time interval :

3. I/O



3.1 GPO

Configures GPO as high voltage level or low voltage level.



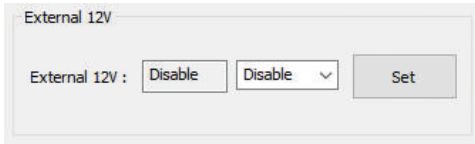
3.2 GPI

Reads the status (voltage level) of GPI.



3.3 External 12V

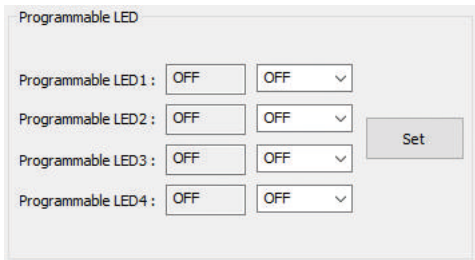
Enables or disables the External 12V function.



The screenshot shows a control panel titled "External 12V". It contains a label "External 12V :", followed by a text input field containing the word "Disable", a dropdown menu also displaying "Disable" with a downward arrow, and a "Set" button.

3.4 Programmable LED

Defines the Programmable LED as on or off.



The screenshot shows a control panel titled "Programmable LED". It contains four rows, each with a label "Programmable LED1:" through "LED4:", followed by a text input field set to "OFF" and a dropdown menu also displaying "OFF" with a downward arrow. A "Set" button is positioned to the right of the dropdown menus.

4. Module

VTC6221_Utility

System 1 System 2 I/O Module G-Sensor Event

WWAN (BIOS setup support)

WWAN1 (CN5) : Enable Enable ▾

WWAN2 (CN14) : Enable Enable ▾

WWAN3 (CN7) : Enable Enable ▾ Set

WWAN3 Wakeup : Disable Disable ▾

WWAN4 (CN23) : Enable Enable ▾

SIM Card

WWAN1 : SIM Card 1 SIM Card 1 ▾

WWAN2 : SIM Card 1 SIM Card 1 ▾

WWAN3 : SIM Card 1 SIM Card 1 ▾ Select SIM Card

WWAN4 : SIM Card 1 SIM Card 1 ▾

WiFi

WiFi 1 (CN1) : Enable Enable ▾

WiFi 2 (CN23) : Enable Enable ▾ Set

WiFi 3 (CN5) : Enable Enable ▾

Bluetooth

BT1 (CN1) : Enable Enable ▾

BT2 (CN23) : Enable Enable ▾ Set

BT3 (CN5) : Enable Enable ▾

GPS

GPS : Enable Enable ▾ Set

Load Default Save

4.1 WWAN

Enables or disables the WWAN1 function on CN5 mini-PCIe socket.
Enables or disables the WWAN2 function on CN14 M.2 socket.
Enables or disables the WWAN3 function on CN7 M.2 socket.
Enables or disables the WWAN3 wakeup function.
Enables or disables the WWAN4 function on CN23 mini-PCIe socket.
The setting can also be cleared by the Set button.

WWAN (BIOS setup support)

WWAN1 (CN5) : Enable Enable ▾

WWAN2 (CN14) : Enable Enable ▾

WWAN3 (CN7) : Enable Enable ▾ Set

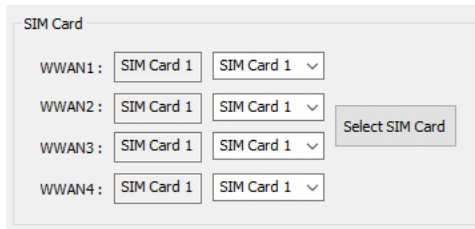
WWAN3 Wakeup : Disable Disable ▾

WWAN4 (CN23) : Enable Enable ▾

4.2 SIM Card

Selects the SIM card setting on WWAN1 is from SIM CARD1 or SIM CARD2.
 Selects the SIM card setting on WWAN2 is from SIM CARD3 or SIM CARD4.
 Selects the SIM card setting on WWAN3 is from SIM CARD5 or SIM CARD6.
 Selects the SIM card setting on WWAN4 is from SIM CARD7 or SIM CARD8.

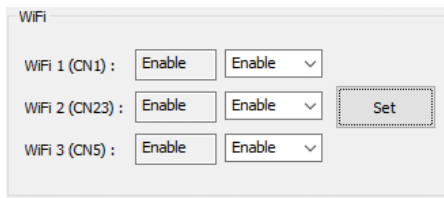
Click the Select SIM Card button after configuration to apply the settings.


 A screenshot of the 'SIM Card' configuration window. It contains four rows, each for a WWAN port (WWAN1 to WWAN4). Each row has two dropdown menus, both currently set to 'SIM Card 1'. To the right of these dropdowns is a button labeled 'Select SIM Card'.

4.3 WiFi

Enables or disables the Wi-Fi module function on CN1 mini-PCIe socket.
 Enables or disables the Wi-Fi module function on CN23 mini-PCIe socket.
 Enables or disables the Wi-Fi module function on CN5 mini-PCIe socket.

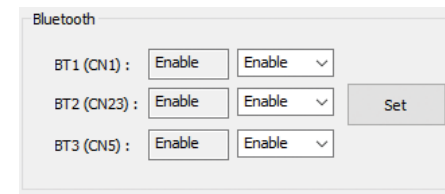
The setting can also be cleared by the Set button.


 A screenshot of the 'WiFi' configuration window. It contains three rows, each for a WiFi port (WiFi 1 (CN1), WiFi 2 (CN23), and WiFi 3 (CN5)). Each row has two dropdown menus, both currently set to 'Enable'. To the right of these dropdowns is a button labeled 'Set'.

4.4 Bluetooth

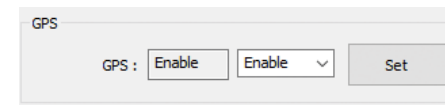
Enables or disables the BT1 (CN1) function.
 Enables or disables the BT2 (CN23) function.
 Enables or disables the BT3 (CN5) function.

The setting can also be cleared by the Set button.


 A screenshot of the 'Bluetooth' configuration window. It contains three rows, each for a Bluetooth port (BT1 (CN1), BT2 (CN23), and BT3 (CN5)). Each row has two dropdown menus, both currently set to 'Enable'. To the right of these dropdowns is a button labeled 'Set'.

4.5 GPS

Enables or disables the GPS function.


 A screenshot of the 'GPS' configuration window. It contains one row for the GPS port (GPS). It has two dropdown menus, both currently set to 'Enable'. To the right of these dropdowns is a button labeled 'Set'.

5. G-Sensor

VTC6221_Utility

System 1 System 2 I/O Module **G-Sensor** Event

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	OFSX	R/W	00	X-axis offset
31	OFSY	R/W	00	Y-axis offset
32	OFSZ	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

DATA : -1

DATA : 8

DATA : 245

Refresh

Get all Gsensor Data Success.

Load Default Save

5.1 G-Sensor Register Index

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

5.2 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	OFSX	R/W	00	X-axis offset
31	OFSY	R/W	00	Y-axis offset
32	OFSZ	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

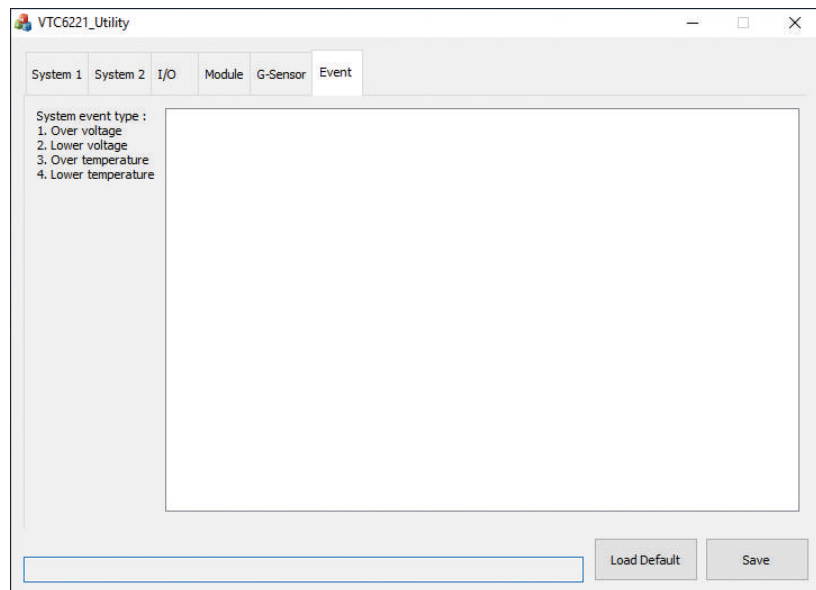
DATA : -1

DATA : 8

DATA : 245

Refresh

6. Event



The Event tab shows the following alarm messages:

1. Over voltage alarm
2. Lower voltage alarm
3. Over temperature alarm
4. Lower temperature alarm

(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.



APPENDIX B: GPS FEATURE

uBlox-NEO M8 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-M8M is optimized for cost sensitive applications, while NEO-M8N and NEO-M8Q provide best performance and easier RF integration. 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/Q 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

Features

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

Features cont.

Anti jamming	Active CW detection and removal. Extra onboard SAW band pass filter (NEO-M8N/Q)
Memory	ROM (NEO-M8M/Q) or Flash (NEO-M8N)
Supported antennas	Active and passive
Odometer	Travelled distance
Data-logger	For position, velocity, and time (NEO-M8N)

¹ For NEO-M8M/Q

Electrical data

Supply voltage	1.65 V to 3.6 V (NEO-M8M) 2.7 V to 3.6 V (NEO-M8N/Q)
Power consumption²	23 mA @ 3.0 V (continuous) 5 mA @ 3.0 V Power Save Mode (1 Hz, GPS only)
Backup Supply	1.4 to 3.6 V

² NEO-M8M

Interfaces

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

VIOB-GPS-02 Module Connector Pin Definitions



J2 (GPS Side)



J9 (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

J9 Pin Definition

Pin	Definition	Pin	Definition
1	GPS_BAT	2	GPS_LED#
3	GPS_TX	4	GPS_RX
5	GND	6	VCC3_GPS

COM Port for GPS: COM 4 Baud Rate: 9600

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-ready¹, 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 (I²C 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.

¹ With future flash firmware update.

Technical Specifications

Parameter	Specification				
Receiver type	72-channel u-blox M8 engine GPS L1C/A, SBAS L1C/A, QZSS L1C/A GLONASS L1OF, BeiDou B1, Galileo E1B/C ²				
GNSS		GPS & GLONASS	GPS & BeiDou	GPS	
Time-To-First-Fix³	Cold start	27 s	28 s	30 s	
	Hot start	1.5 s	1.5 s	1.5 s	
	Aided starts ⁴	4 s	6 s ⁵	3 s	
Sensitivity⁶	Tracking & Navigation ⁷	-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 accuracy⁸	Autonomous	2.5 m	2.5 m	2.5 m	
	SBAS	2.0 m	2.0 m	2.0 m	
Velocity accuracy⁹		0.05 m/s	0.05 m/s	0.05 m/s	
Heading accuracy⁹		0.3 degree	0.3 degree	0.3 degree	
ADR position error¹⁰	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)¹¹			20 Hz		
Navigation		GPS & GLONASS	GPS & BeiDou	GPS	
Maximum navigation rate (Measurement rate)			2 Hz		
Navigation latency¹²			300 ms nominal		
Maximum sensor measurement message output rate			10 Hz		
Sensor measurement message output bandwidth¹³			nominal 50% of output rate		
Accuracy of time pulse signal	RMS 99%	30 ns 60 ns	30 ns 60 ns	30 ns 60 ns	
Operational limits	Dynamics Altitude Velocity		≤ 4G 50,000m 500 m/s		

² Ready to support Galileo E1B/C when available with a flash firmware update

³ All signals at - 130 dBm

⁴ Dependent on aiding data connection speed and latency

⁵ BeiDou assisted acquisition is not available

⁶ Demonstrated with a good external LNA

⁷ Optimized for best navigation performance with dead-reckoning

⁸ GNSS fix available, CEP, 50%, 24 hours static, -130dBm, > 6 SVs

⁹ GNSS fix available, 50% @ 30 m/s

¹⁰ Typical road and vehicle conditions

¹¹ For update rates > 2 Hz, extrapolation techniques are applied.

¹² Dependent on signal conditions but measurements are delivered with time-stamp corresponding to measurement time

¹³ Higher bandwidths are used for navigation

¹⁴ Assuming Airborne < 4 g platform

VIOB-GPS-DR02/VTK-GPS-DR02 Module Connector Pin Definitions



J2 (GPS Side)



J5 (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

J5 Pin Definition

Pin	Definition	Pin	Definition
1	GPS_BAT	2	GPS_LED#
3	GPS_TX	4	GPS_RX
5	GND	6	VCC3_GPS

COM Port for GPS: COM 4
Baud Rate: 9600



J3 (GPS Side)



J4 (PC Side)

J3 Pin Definition

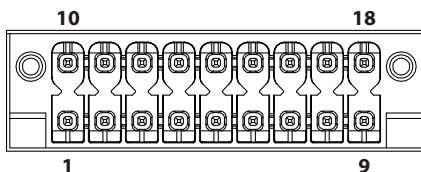
Pin	Definition	Pin	Definition
1	DR_DIRECTIO_M_R	2	DR_ODOMETER_M_R
3	1PPS_R	4	GND

J4 Pin Definition

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

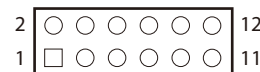
APPENDIX D: SIGNAL CONNECTION OF MCU DI/DO

GPIO Pinout Description



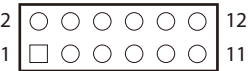
Pin	Definition	Pin	Definition
1	CON_GPI1	2	CON_GPI3
3	CON_GPO1	4	CON_GPO3
5	VIN-GPIO	6	
7		8	
9		10	CON_GPI2
11	CON_GPI4	12	CON_GPO2
13	CON_GPO4	14	ISO_GND
15	ISO_GND	16	
17		18	

GPIO Voltage Settings (JP5)



Pin	Definition
1-3 Short	GPI1 Activity Low/Internal Pull High (Default) Voltage by Vin
3-5 Short	GPI1 Activity High/External Pull High
9-7 Short	GPI2 Activity Low/Internal Pull High (Default) Voltage by Vin
9-11 Short	GPI2 Activity High/External Pull High
4-2 Short	GPI3 Activity Low/Internal Pull High (Default) Voltage by Vin
4-6 Short	GPI3 Activity High/External Pull High
10-8 Short	GPI4 Activity Low/Internal Pull High (Default) Voltage by Vin
10-12 Short	GPI4 Activity High/External Pull High

GPO Voltage Settings (JP6)



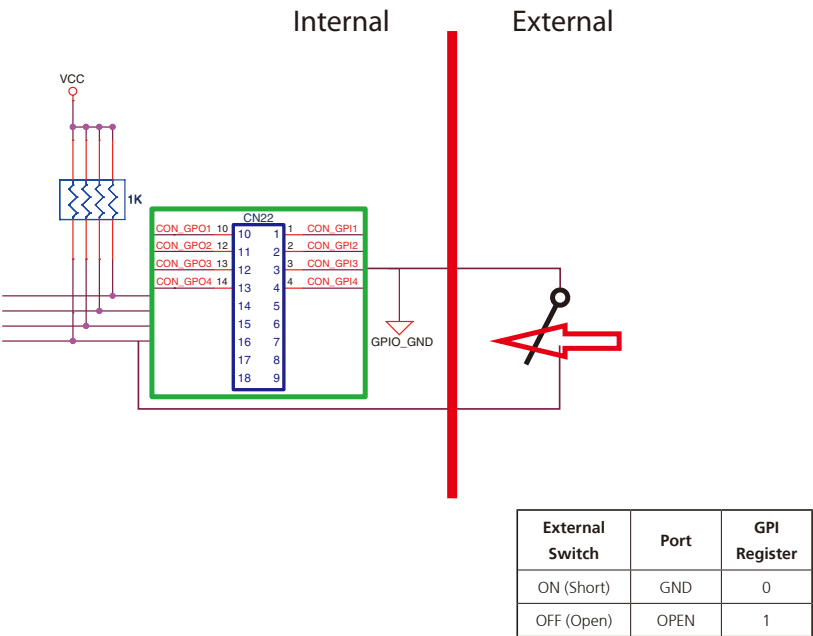
Pin	Definition
1-3 Short	GPO1 Pull High (Default) Voltage by Vin
3-5 Short	GPO1 Float
9-7 Short	GPO2 Pull High (Default) Voltage by Vin
9-11 Short	GPO2 Float
4-2 Short	GPO3 Pull High (Default) Voltage by Vin
4-6 Short	GPO3 Float
10-8 Short	GPO4 Pull High (Default) Voltage by Vin
10-12 Short	GPO4 Float

Digital Input

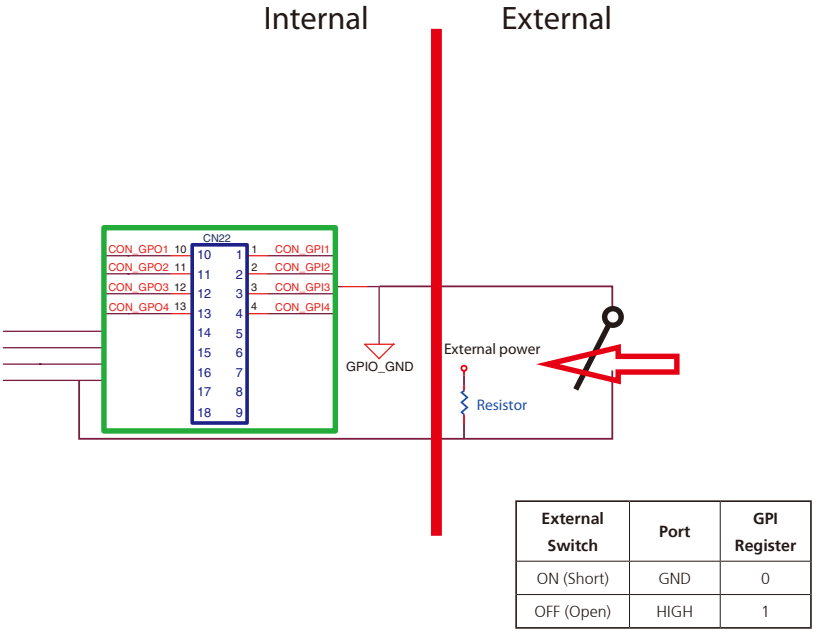
CN22 connector for GPI signal (digital signal input)
The CN22 has 4 digital input channels by default.

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

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



Dry Contact:



Digital Output

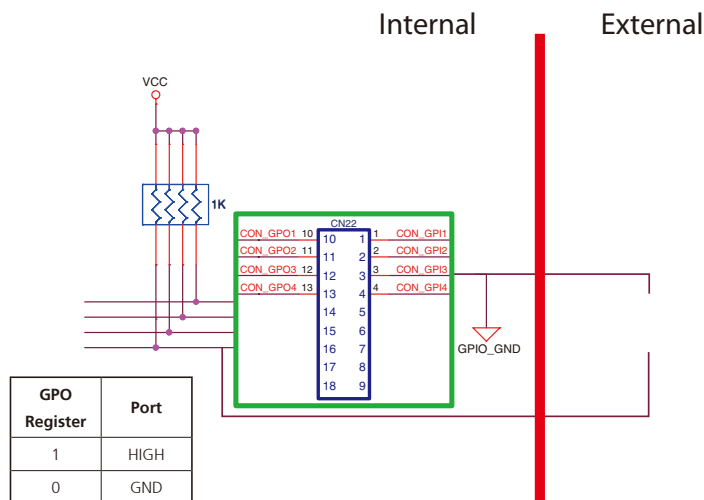
CN22 connector for GPO signal (digital signal output)
The CN22 connector has 4 digital output channels by default.

The signal connection of CN22 supports two connected methods for output signal type. The output signal has two states, one is low level (driven to 0V from GPO signal) while the other is open (high voltage is provided from external device).

Wet Contact (default)

The JP6 needs to switch to short 1-3, 7-9, 2-4 and 8-10 individually. The GPO signal will have a pull up resistor to Voltage internally. The output signal has two states, one is low level (driven to 0V from GPO signal) while the other is high level (driven to Vin Voltage).

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

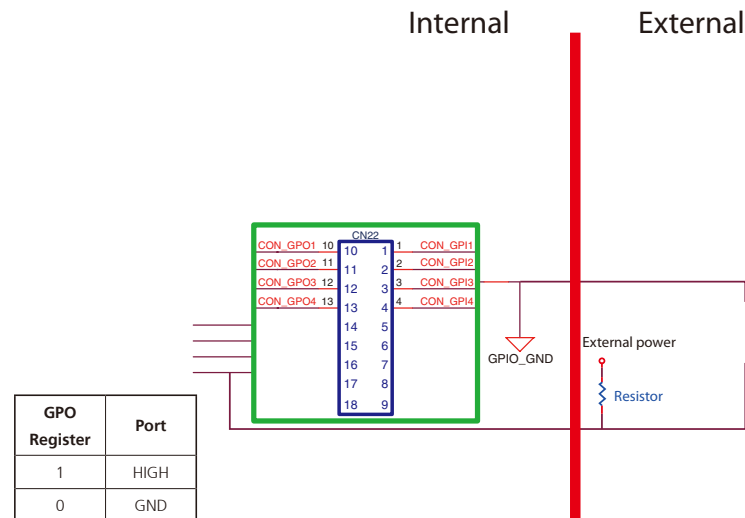


Dry Contact

Each channel can accept 9~48Vdc voltage. And it is able to drive 4.5~24mA current for low level.

The JP6 needs to short 3-5, 9-11, 4-6 and 10-12 individually. The GPO signal will not have a pull up resistor internally.

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



APPENDIX E: VEHICLE POWER MANAGEMENT SETUP

Startup and Shutdown Voltage Setting

Set the startup voltage to 11.5V or 23V and the shutdown voltage to 10.5V or 21V

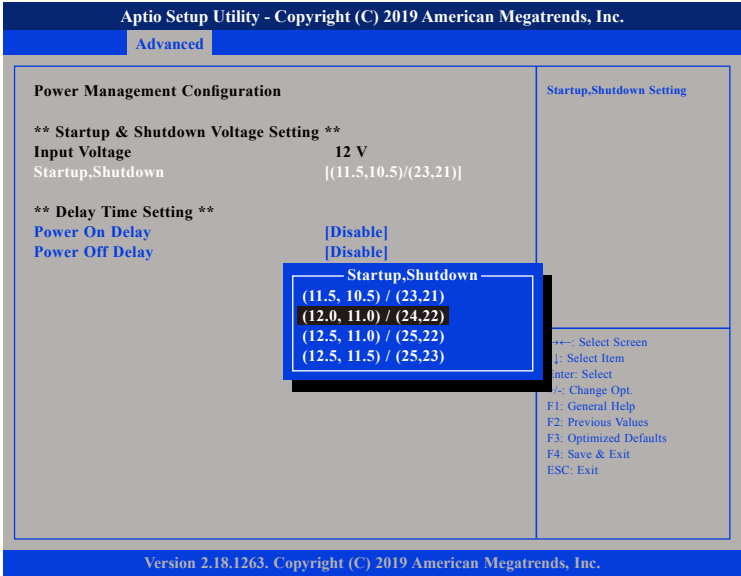
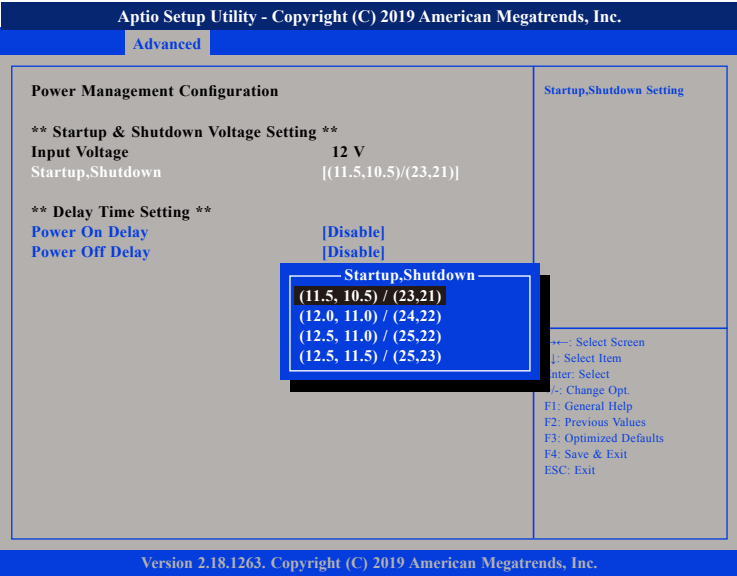
If the input voltage is 12V: the startup voltage to 11.5V and the shutdown voltage to 10.5V.

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.

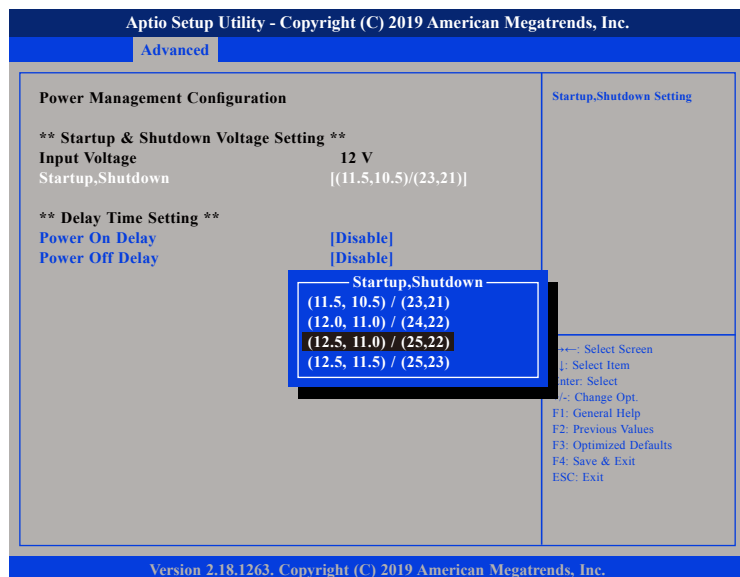
If the input voltage is 24V: the startup voltage to 24V and the shutdown voltage to 22V.



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.

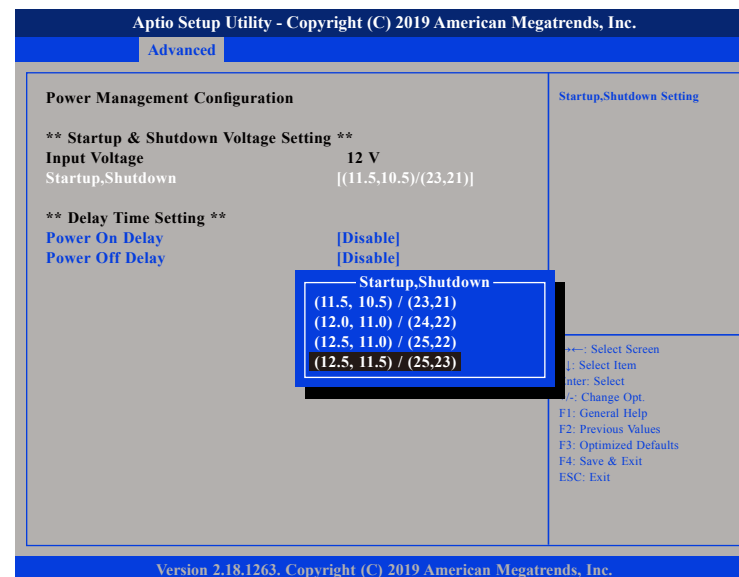
If the input voltage is 24V: the startup voltage to 25V and the shutdown voltage to 22V.



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

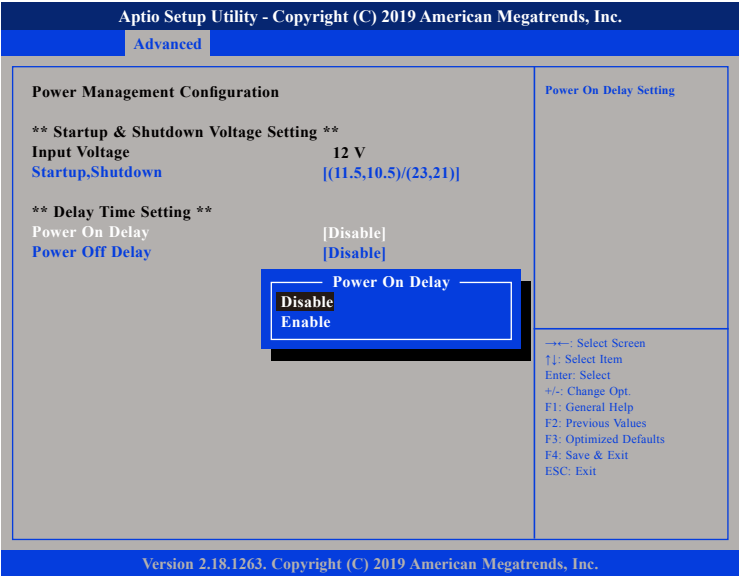
If the input voltage is 12V: the startup voltage to 12.5V and the shutdown voltage to 11.5V.

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



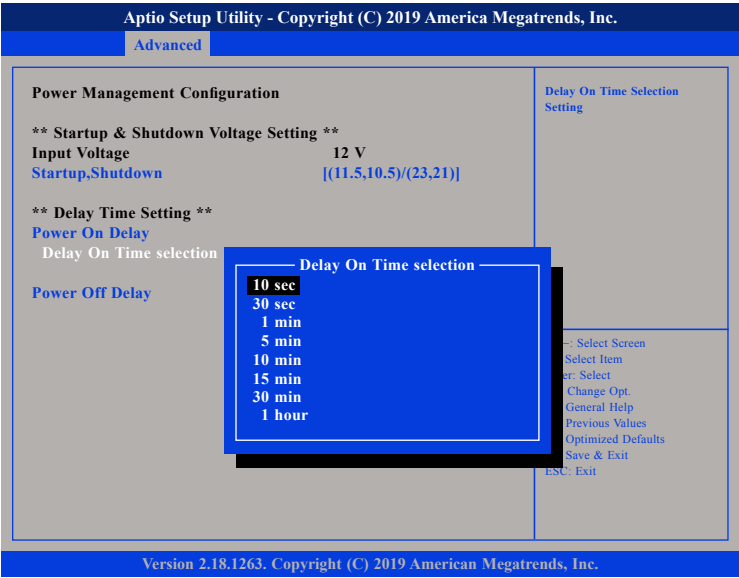
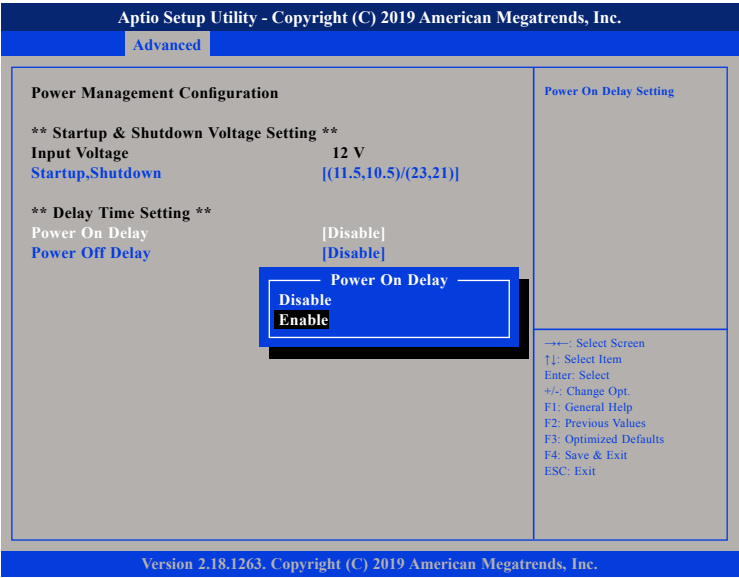
Power-on Delay Setting

Disable Power-on Delay



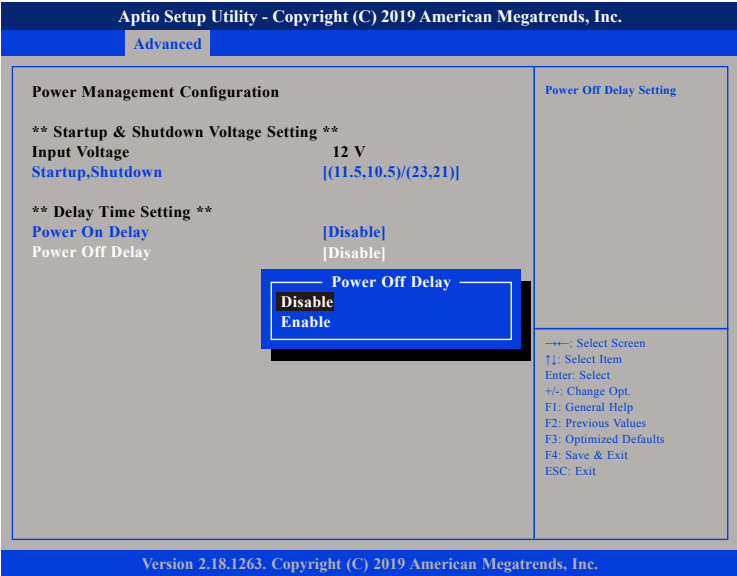
Enable Power-on Delay

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



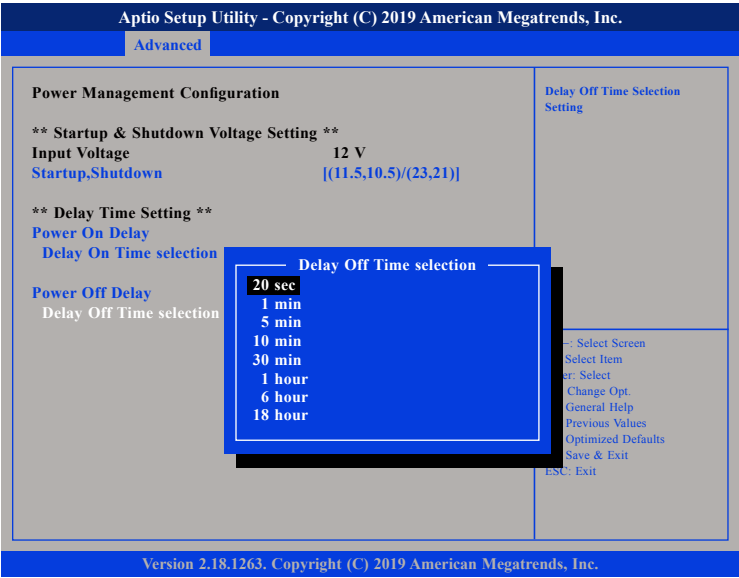
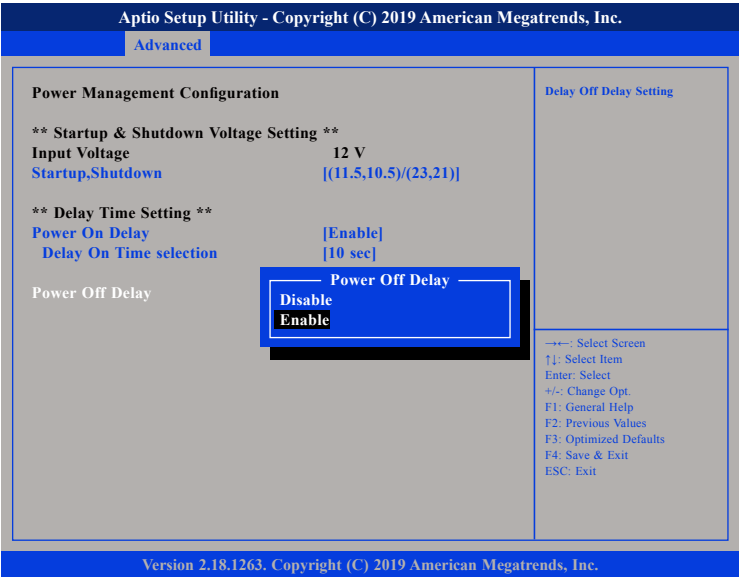
Power-off Delay Setting

Disable Power-off Delay

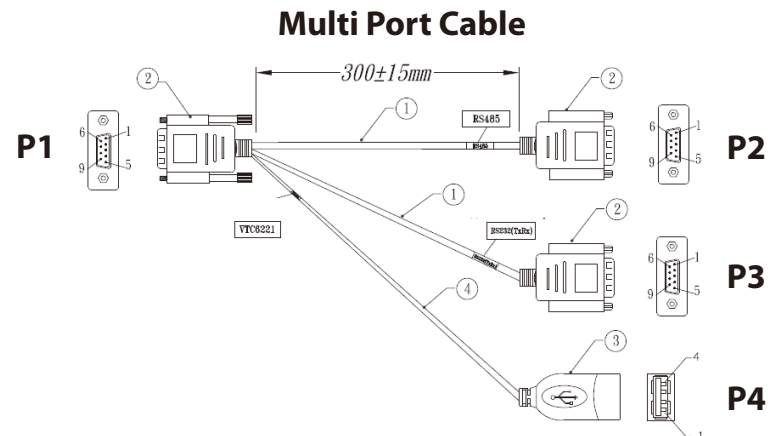


Enable Power-off Delay

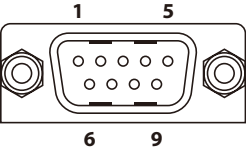
Delay time can be set at 20 sec/1 min./5 min./10 min./30 min./1 hour/6 hour/18 hour.



The multi port consists of a 9-pin male connector and multiple output connectors. The following tables in this appendix list the pin signals of the P1 connector and its corresponding pin signals to the output connectors.



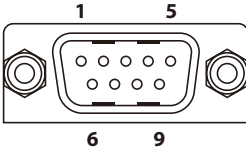
P1 Connector Pinout



Pin	Definition	Pin	Definition
1	RS485-1+	2	RS232_RXD
3	RS232_TXD	4	RS485-1-
5	ISO_GND	6	GND
7	USBHUB_3P_C	8	USBHUB_3N_C
9	USB_POWER		

P2 to P4 Connector Pinouts RS485 Connector

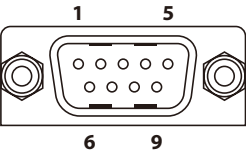
Connector location: P2



P1 Pin	P2 Pin	Definition
1	1	RS485-1+
4	2	RS485-1-
5	5	ISO_GND

RS232 Connector

Connector location: P3



P1 Pin	P3 Pin	Definition
2	2	RS232_RXD
3	3	RS232_TXD
5	5	ISO_GND

USB Connector

Connector location: P4



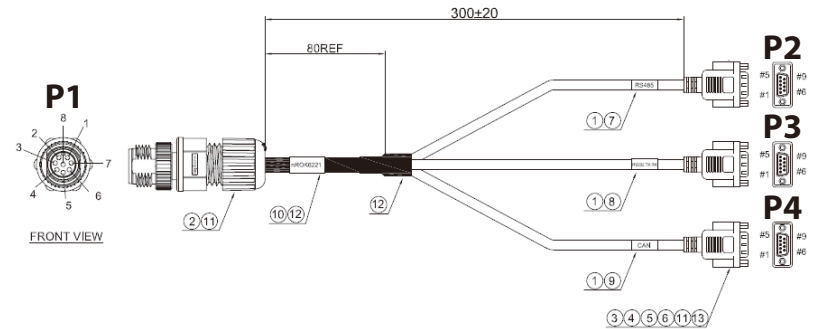
P1 Pin	P4 Pin	Definition
6	4	GND
7	3	USBHUB_3P_C
8	2	USBHUB_3N_C
9	1	USB1_POWER

The multi port consists of a 8-pin male M12 connector and multiple output connectors. The following tables in this appendix list the pin signals of the P1 connector and its corresponding pin signals to the output connectors.

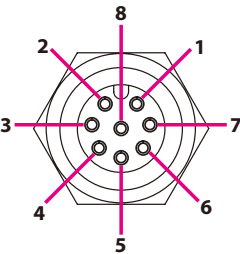
nROK 6221-IP



Multi Port Cable



P1 Connector Pinout

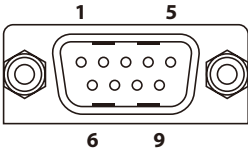


Pin	Definition	Pin	Definition
1	RS485-1+	2	RS232_RXD
3	RS232_TXD	4	RS485-1-
5	ISO_GND	6	CAN_ISO_GND
7	CAN_I	8	CAN_H

P2 to P4 Connector Pinouts

RS485 Connector

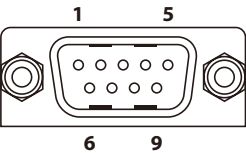
Connector location: P2



P1 Pin	P2 Pin	Definition
1	1	RS485-1+
4	2	RS485-1-
5	5	ISO_GND

RS232 Connector

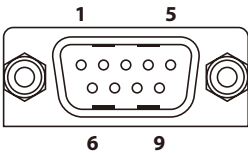
Connector location: P3



P1 Pin	P3 Pin	Definition
2	2	RS232_RXD
3	3	RS232_TXD
5	5	ISO_GND

CAN Connector

Connector location: P4



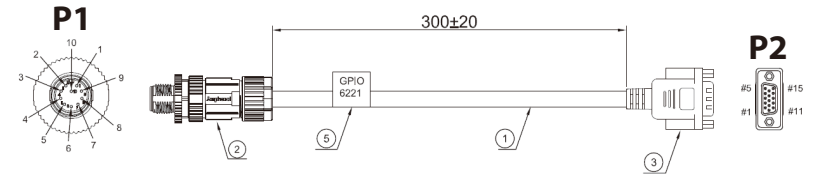
P1 Pin	P4 Pin	Definition
6	5	CAN_ISO_GND
7	2	CAN_L
8	1	CAN_H

The multi port consists of a 10-pin male M12 connector and multiple output connectors. The following tables in this appendix list the pin signals of the P1 connector and its corresponding pin signals to the output connectors.

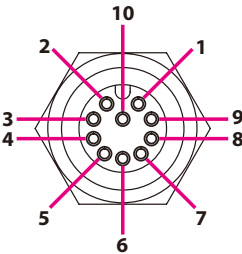
nROK 6221-IP



Multi Port Cable



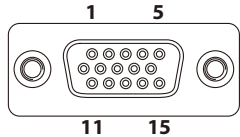
P1 Connector Pinout



Pin	Definition	Pin	Definition
1	GPI1	2	GPI2
3	GPI3	4	GPI4
5	GPO1	6	GPO2
7	GPO3	8	GPO4
9	VIN_GPIO	10	GND

GPIO Connector

Connector location: P2



P1 Pin	P2 Pin	Definition
1	1	GPI1
2	2	GPI2
3	3	GPI3
4	4	GPI4
5	5	GPO1
6	6	GPO2
7	7	GPO3
8	8	GPO4
9	9	VIN_GPIO
10	10	GND

APPENDIX G: POWER CONSUMPTION

OS: Windows 10

Burn-in Software:

Device:

Idle: Into OS + display x 3 + all module (unlink) + keyboard & mouse + audio

Full State: Burn-in 100% + mini PCIe dummy load + play video + keyboard & mouse + audio + COM trans + GPS link

Full State + Loading: Full state + USB load (5V/1A x 1, 5V/0.5A x 2) + DC out (12V/2A)

Item	Device	Test Case			Result	
					Current(A)	Watt(W)
1	S0 state	Idle State (Display x3 <VGA + VGA + HDMI>)	12V	100%=60w 60%=36w	1.75	21
			24V	100%=60w 60%=36w	0.87	20.88
			36V		0.7	25.2
			48V		0.53	25.44
		Full State	12V	100%=60w 60%=36w	3.21	38.52
			24V	100%=60w 60%=36w	1.68	40.32
			36V		1.16	41.76
			48V		0.96	46.08
		Full State + Loading	12V		6.19	74.28
			24V		3.18	76.32
			36V		2.16	77.76
			48V		1.63	78.24

Item	Device	Test Case		Result	
				Current(A)	Watt(W)
2	IGN OFF	Full State IGNITION OFF	12V	7mA	
			12V_WWAN1	9mA	
			24V	8mA	
			24V_WWAN1	10mA	
			36V	11mA	
			36V_WWAN1	12mA	
			48V	17mA	
			48V_WWAN1	18mA	