Preface

Audience
This guide is for the network or computer technician responsible for installing the Perle FN (FirstNet) IRG5541+ FN router. This router supports worldwide global coverage for LTE networks, integrated Wireless LAN 2.4/5 GHz capabilities as well as support for the First Responder Network Authority (FirstNet) network. Familiarly with LTE’s concepts and terminology, GNSS, Ethernet, and LAN (local area networks) are required.

Purpose
Perle routers provide users, networking equipment, as well as M2M & IoT appliances with network connectivity for fixed locations (i.e. buildings, POS, Kiosks, …etc.) and mobile (i.e. vehicle, trains, robots) applications. In vehicular applications, the router provides connectivity and does not interact with the vehicle’s operation or vehicle operators. The router provides full support for LTE network band 14 in compliance with the First Responder Network Authority (FirstNet) network. This document describes the hardware and physical characteristics of the Perle 5541+ FN router. It covers hardware features as well as installation and operation. This document does not cover how to configure your Perle 5541+ FN router. Information to configure your router can be found in the Perle IRG5000 Series Router User’s Guide and the Perle IRG5000 Series Router CLI Reference Guide located on the Perle website. Quick Start information can be found in the 5541+ FN Cellular LTE Router Quick Start Guide (QSG) that came with your product.

Key Features
- Supports bridging/switching, and routing
- LTE coverage spanning 30 frequency bands for global coverage
- Support for FirstNet network band 14
- Fully automatic network switching supporting dual network SIMs
- Routing with Primary/Backup route
- LTE and VPN Fail-over
- Provides network connectivity via LTE, Ethernet and USB-C
- Active GPS for tracking equipment
- Low voltage Standby function to prevent battery drain
- One GPIO pin for remote monitoring/control and one IGN (Ignition) pin
- Two digital Inputs and one Relay contact
- RS485 half-duplex capabilities
- Wireless LAN 2.4/5 GHz
- Security via remote authentication (RADIUS and TACACS+)
- Processor Power Saving Mode – this feature optimizes idle power consumption, saving energy by reducing performance where possible
- Power Saving Features including; LED power saving mode, Smart Standby Mode, Power saving strategies such as turning off unused interfaces (USB, Serial, Ethernet), turning off GPS and adjusting the Ethernet rate
- FirstNet Ready™
- Meets industry-grade certifications
Additional Documentation

<table>
<thead>
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<tbody>
<tr>
<td>Perle IRG5000 Series Router User’s Guide</td>
<td>User guide explaining how to configure the IRG5541+ FN features using the Web Manager application. New users should use this method to configure the router.</td>
</tr>
<tr>
<td>Perle IRG5000 Series Router CLI Reference Guide</td>
<td>Command Line Interface Reference Guide using CLI commands to configure the IRG5541+ FN (this is an advanced way to configure the router).</td>
</tr>
</tbody>
</table>

Document Conventions

This document contains the following conventions:

Most text is presented in the typeface used in this paragraph. Other typefaces are used to help you identify certain types of information. The other typefaces are:

**Note:** Means reader take note: notes contain helpful suggestions.

**Caution:** Means reader be careful. In this situation, you might perform an action that could result in equipment damage or loss of data.

**Warning:** IMPORTANT SAFETY INSTRUCTIONS
Means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

**Important Notice**
Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when cellular devices such as the Perle IRG5541+ FN router is used in a normal manner with a well-constructed network. The Perle IRG5541+ FN router should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Perle accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using our products.

**Safety and Hazards**
The driver or operator of any vehicle should not operate the IRG5541+ FN router while in control of a vehicle. Doing so will detract from the driver or operator's control and operation of that vehicle. The IRG5541+ FN is Listed to UL121201 and CSA C22.2 No. 213 and are suitable for use in Class I, Division 2, Groups A, B, C and D Hazardous Locations.

The following warnings and instructions apply:

**Limitation of Liability**
The information in this manual is subject to change without notice and does not represent a commitment on the part of Perle for any and all direct, indirect, special, general, incidental, consequential, punitive or exemplary damages including, but not limited to loss of profits or revenue or anticipated profits or revenue arising out of the use or inability to use any Perle IRG5541+ FN routers even if Perle has been advised or the possibility of such damages or they are foreseeable or for claims by any
third party. Notwithstanding the foregoing, in no event shall Perle aggregate liability arising under or in connection with the Perle product, regardless of the number of events, occurrences, or claims giving rise to liability, be in excess of the price paid by the purchaser for the Perle product.

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General cautions and warnings

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<td>Caution, hot surface</td>
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<td>14</td>
<td>Refer to manual/safety</td>
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**Warning:** Power sources must be off prior to beginning the power connection steps. Read the installation instructions before you connect the unit to its power source.

**Avertissement:** Les sources d'alimentation doivent être éteintes avant de commencer les étapes de connexion d'alimentation. Veuillez lire les instructions d’installation avant de connecter l’appareil à sa source d’alimentation.

**Warning:** Ensure that the voltage and current ratings of the intended power source are appropriate for the IRG5541+ FN router as indicated on the product label.

**Avertissement:** Assurez-vous que les valeurs nominales de tension et de courant de la source d'alimentation prévue conviennent aux routeurs de la série IRG5541+ FN, comme indiqué sur l'étiquette du produit.

**Warning:** Ensure that the installation and electrical wiring of the equipment is performed by trained and qualified personnel and that the installation complies with all local and national electrical codes.

**Avertissement:** Assurez-vous que l'installation et le câblage électrique de l'équipement sont effectués par du personnel formé et qualifié et que l'installation est conforme à tous les codes électriques locaux et nationaux.

**Warning:** This equipment must be used in the matter specified by the manufacturer.

**Avertissement:** Cet équipement doit être utilisé dans les matières spécifiées par le fabricant.

**Warning:** In case of malfunction or damage, no attempts at repair should be made by the user. Do not dismantle this product. In case of malfunction or damage, contact Perle Technical support at [https://www.perle.com/support_services/support_request.aspx](https://www.perle.com/support_services/support_request.aspx) or email at [https://www.perle.com/support_services/support_request.aspx#form](https://www.perle.com/support_services/support_request.aspx#form)

**Avertissement:** En cas de dysfonctionnement ou de détérioration, aucune tentative de réparation ne doit être effectuée par l'utilisateur. Ne démontez pas ce produit. En cas de dysfonctionnement ou de dommage, contactez le support technique de Perle à l'adresse [https://www.perle.com/support_services/support_request.aspx](https://www.perle.com/support_services/support_request.aspx) ou par courrier électronique à [https://www.perle.com/support_services/support_request.aspx#form](https://www.perle.com/support_services/support_request.aspx#form)

**Warning:** If the ambient temperature is to exceed 50°C (122°F), the unit should be installed in a restricted access location where access can only be gained by service personnel or users who have been instructed about the reasons for the restrictions applied to the location and about any precautions.
that shall be taken; and access is through the use of a tool or lock and key, or any means of security, and is controlled by the authority responsible for the location.

**Warning:** The working voltage inputs are designed for operation with Safety extra low Voltage (SELV). Connect only to SELV circuits with voltage restrictions in line with IEC/EN 62368-1.

**Avertissement:** Les entrées de tension sont conçues pour fonctionner avec une tension de sécurité très basse (SELV). Connectez uniquement aux circuits SELV avec des restrictions de tension conformes à IEC / EN 62368-1.

**Warning:** For equipment installed within the same end-product enclosure ensure leads are segregated or insulated the leads from different circuits.

**Avertissement:** Pour les équipements installés dans le même boîtier de produit final, assurez-vous que les conducteurs sont séparés ou isolés des conducteurs de circuits différents.

### Hazardous Location Warnings

#### Specific Conditions of Use

1. The IRG5541+ FN router is intended for installation into an IECEx/ATEX certified and IP54 minimum rated enclosure in accordance with IEC/EN 60079-0 and accessible only by the use of a tool. Les modèles de routeurs IRG5541+ FN sont destinés à être installés dans un boîtier certifié IECEx/ATEX qui conforme à la norme IP54 conformément à la norme IEC/EN 60079-0 et accessible uniquement à l’aide d'un outil.

2. The equipment shall only be used in an area of not more than pollution degree 2, as defined in IEC/EN 60664-1. L'équipement ne doit être utilisé que dans une zone où le degré de pollution n'est pas supérieur à 2, tel que défini dans la IEC/EN 60664-1.

**Warning:** These devices are open-type devices that are to be installed in an enclosure with tool removable cover or door, suitable for the environment.

**Avertissement:** Ces périphériques sont des périphériques de type ouvert à installer dans un boîtier avec un couvercle ou une porte amovible pour outils, adapté à l'environnement.

**Warning:** This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D, or only non hazardous locations.

**Avertissement:** Cet équipement est adapté à une utilisation dans les zones non dangereuses de classe I, division 2, groupes A, B, C, D

**Warning:** WARNING-EXPLOSION HAZARD - Do not connect or disconnect equipment unless power has been removed or the area is known to be non-hazardous.

**Avertissement:** DANGER D'EXPLOSION ET D'AVERTISSEMENT - Ne pas connecter ou déconnecter l’équipement tant que l’alimentation n’est pas débranchée ou que la zone n’est pas dangereuse.
Warning: WARNING-EXPLOSION HAZARD - Substitution of any components on this unit may impair suitability for Class I, Division 2.

Avertissement: DANGER DANGER D’EXPLOSION - La substitution de tout composant de cet appareil peut compromettre l’adéquation à la Classe I, Division 2.

Warning: Power supply of the equipment must be rated appropriately (see Appendix for specifications) with limited power. Limited power means complying with one of the following requirements.
Class 2 circuit according to Canadian Electrical Code, Part 1, C22.1
Class 2 circuit according to National Electrical Code, NFPA-70
Limited Power Supply (LPS) according to EN/IEC 60950-1;
Limited-energy circuit according to EN/IEC 61010-1

Avertissement: l'alimentation de l'équipement doit être correctement dimensionnée (voir annexe pour les spécifications) avec une puissance limitée. Une puissance limitée signifie que vous vous conformez à l'une des exigences suivantes.
Circuit de classe 2 selon le code électrique Canadien, partie 1, C22.1
Circuit de classe 2 selon le code électrique national NFPA-70
Alimentation électrique limitée (LPS) selon EN / IEC 60950-1;
Circuit à énergie limitée selon EN / IEC 61010-1

Warning: If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Avertissement: Si cet équipement est utilisé d'une manière non spécifiée par le fabricant, la protection fournie par l'équipement peut être altérée.

Warning: In case of malfunction or damage, no attempts at repair should be made. Do not dismantle the product. All repairs need to be made by a qualified Perle representative. Contact Perle Systems Technical support at https://www.perle.com/support_services/support_request.aspx or email at https://www.perle.com/support_services/support_request.aspx#form

Avertissement: En cas de dysfonctionnement ou de dommage, aucune tentative de réparation ne doit être effectuée. Ne démontez pas le produit. Toutes les réparations doivent être effectuées par un représentant qualifié de Perle. Contactez le support technique de Perle Systems à l’adresse https://www.perle.com/support_services/support_request.aspx ou par courrier électronique à https://www.perle.com/support_services/support_request.aspx#form

Warning: This router is not intended for use close to the human body. The unit should be mounted in such that Antennas are at least 20cm (8 inches) away from any person.

Avertissement: Ce routeur n’est pas destiné à être utilisé à proximité du corps humain. L’appareil devrait être monté de façon à ce que les antennes soient à au moins 20 cm (8 po) de toute personne.

Warning: Explosion hazard. Do not connect or disconnect while the circuit is live or unless the area is free of ignitable concentrations.

Avertissement: Risque d'explosion. Ne pas connecter ou déconnecter le circuit est sous tension ou à moins que la zone ne présente aucune concentration inflammable.

Warning: Do not use the USB connector unless the area is free of ignitable concentrations.

Avertissement: N'utilisez pas le connecteur USB à moins que la zone ne soit exempte de
concentrations inflammables.

**Warning**: Do not use the reset button unless the area is free of ignitable concentrations.

**Avertissement**: N'utilisez pas le bouton de réinitialisation à moins que la zone ne soit exempte de concentrations inflammables.

**RF Exposure**

In accordance with FCC/IC requirements of human exposure to radio frequency fields, the radiating element shall be installed such that a minimum separation distance of 20 cm should be maintained from the antenna and the user's body.

Conformément aux exigences de la FCC/IC relatives à l’exposition humaine aux champs de radiofréquences, l’élément de rayonnement doit être installé de manière à ce qu’une distance de séparation minimale de 20 cm soit maintenue par rapport à l’antenne et au corps de l’utilisateur.

THE SPECIFICATIONS AND INFORMATION REGARDING THE PRODUCTS IN THIS GUIDE ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS GUIDE ARE BELIEVED TO BE ACCURATE BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. USERS MUST TAKE FULL RESPONSIBILITY FOR THEIR APPLICATION OF ANY PRODUCTS.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the 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 this hardware guide may cause harmful interference to radio communications.

Modifications to this product not authorized by Perle could void the FCC approval and negate your authority to operate the product.

Perle reserves the right to make changes without further notice, to any products to improve reliability, function, or design.

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## Publishing History

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<td>May 2021</td>
<td>A.03.05.2021</td>
<td>Initial release.</td>
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Overview
The IRG554x router is a compact, rugged, fully featured communications platform for real-time wireless capabilities. It has multiple communication ports including Serial, Ethernet, and a USB port that can be used as a console port or as an additional Ethernet port. It supports LTE/4G wireless solutions for both fixed and mobile applications (IoT). The IRG5541+ FN LTE/4G router supports Cat-12 technology with peak download rates of 600 Mbps and uploads speeds of 150 Mbps. It offers global coverage of frequency bands, supports Cat-12 technology with automatic fall-back to 3G (HSPA+, UMTS) networks, and is FirstNet Ready™. The IRG5540+/5541+ also includes integrated GNSS receiver (GPS, GLONASS, Beidou and Galileo) satellite support.

Application uses:
• Remotely monitoring and controlling equipment on pipelines, meters, pumps and valves in any energy, utility, or industrial application
• Tracking the location of heavy equipment and assets in the field
• For use with FirstNet Ready™ networks
• Providing reliable Internet access to a mobile workforce

What’s Included
The following components may be included with your product. Components will vary depending for each model. See the Perle website for updates.
• The router
• Quick Start Guide
• 2 LTE SMA antenna pack (#08000120)
• 2 Wi-Fi antennas (#08000140)
• GPIO Cable with 4 pin plug (#2500468)
• GPIO Cable with 8 pin plug (#2500476)
• 12VDC/2A 4 pin (NA-#08000150, EU #08000160, UK #08000170, #08000180) power supply
• GNSS PASV RP-Antenna SMA/CA (#08000130) passive or active antenna (order-able from Perle #08000130)

What You Need to Supply
Before you can begin, you need to have the following:
• A SIM card/s (provided by your mobile network operator)
• #1 Phillips screwdriver (if you are installing the SIM card)
• Computer or laptop computer with Ethernet interface and cable
• An Ethernet CAT5e or CAT6 10/100/1000BASE-T cable/to connect the router to the network
## Hardware

### Front View

![Front View Image]

### LEDs

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<th>Function</th>
<th>Normal</th>
<th>Low Power Mode</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Power</td>
<td>Off</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boot</td>
<td>Red—solid</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Green—Blip</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Powering up</td>
<td>Amber—flashing</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal Operation</td>
<td>Green—solid</td>
<td>Green—blip starting after a boot is complete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal operation but no config</td>
<td>Green—flashing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fatal error</td>
<td>Red—solid</td>
<td>Red—solid</td>
<td></td>
</tr>
<tr>
<td>Hardware Setup Mode</td>
<td>Amber—solid</td>
<td>Amber—solid</td>
<td>When you press and hold the reset button for 15 seconds during operational mode. The solid Amber LED indicate the time to release to initiate Setup Mode.</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Factory Reset</td>
<td>Red—solid</td>
<td>Red—solid</td>
<td>Press and hold the reset button for 20 seconds during power up. The solid Red LED indicates the time to release for Reset to Factory.</td>
<td></td>
</tr>
<tr>
<td>Overheat Standby</td>
<td>Red—blip</td>
<td>Red—blip</td>
<td>Overheat causes the unit to go into Standby Mode. The router will restart when the temperature is below the threshold.</td>
<td></td>
</tr>
<tr>
<td>No Config</td>
<td>Green—flashing</td>
<td>N/A</td>
<td>Unit has powered up normally—unit has no config. Unit is in Safe Mode or Factory default Mode.</td>
<td></td>
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</table>

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<th>Serial Function</th>
<th>Normal</th>
<th>Low Power Mode</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disabled or not in use</td>
<td>Off</td>
<td>Off</td>
<td>Always off in power saving mode.</td>
</tr>
<tr>
<td>Serial port/s TX/RX</td>
<td>Green—flashing</td>
<td>Off</td>
<td></td>
</tr>
</tbody>
</table>

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<tr>
<th>WWAN Function</th>
<th>Normal</th>
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<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disabled</td>
<td>Off</td>
<td>Off</td>
<td></td>
</tr>
</tbody>
</table>
|                | **Connected—good signal** | **Color—solid** | **Off—once connection is established, it will come on for 5 secs then go off** | **Colour will depend on signal strength.**
Green = Good signal—\(\geq -80\text{dBm}\)
Amber = Fair signal—\(-94\text{dBm} < -80\text{dBm}\)
Red = Poor signal—\(\leq -94\text{dBm}\)  |
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</thead>
<tbody>
<tr>
<td><strong>Connection in progress</strong></td>
<td>Green, Amber or Red flashing</td>
<td>Off</td>
<td><strong>Signal strength flash.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Not connected or not connecting</strong></td>
<td>Green, Amber, or Red blips</td>
<td>Off</td>
<td><strong>Signal strength blip.</strong></td>
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<tr>
<td></td>
<td><strong>Meaning</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disabled</td>
<td>Off</td>
<td>Off</td>
<td>No GPS activated or in power saving mode.</td>
</tr>
<tr>
<td></td>
<td>Initializing</td>
<td>Green—blip</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attempting to get a fix or unable to get a fix</td>
<td>Amber—flashing</td>
<td>Amber—blip</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GPS fix</td>
<td>Green—solid</td>
<td>Off—Green solid for 5 seconds then off</td>
<td></td>
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</table>

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<th><strong>WLAN</strong></th>
<th><strong>Function</strong></th>
<th><strong>Normal</strong></th>
<th><strong>Low Power Mode</strong></th>
<th><strong>Meaning</strong></th>
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</thead>
<tbody>
<tr>
<td></td>
<td><strong>Meaning</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.0GHz</td>
<td>Green—solid</td>
<td>Off</td>
<td>Client mode connected—AP Radio mode.</td>
</tr>
<tr>
<td></td>
<td>5.0 TX/RX</td>
<td>Green—flashing</td>
<td>Off</td>
<td>Client or AP activity.</td>
</tr>
<tr>
<td></td>
<td>2.4GHz</td>
<td>Amber—solid</td>
<td>Off</td>
<td>Client mode connected—AP-radio active.</td>
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<tr>
<td></td>
<td>2.4 TX/RX</td>
<td>Amber—flashing</td>
<td>Off</td>
<td>Client or AP activity.</td>
</tr>
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<td>Internet</td>
<td>Function</td>
<td>Low Power Mode</td>
<td>Meaning</td>
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<td>----------------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>No connection</td>
<td>Off</td>
<td>Off</td>
<td>Client mode—no connection; AP mode not enabled.</td>
<td></td>
</tr>
<tr>
<td>Disconnected</td>
<td>Off</td>
<td>Off</td>
<td>No connection by intention</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• disabled or radio off</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• disconnect requested</td>
<td></td>
</tr>
<tr>
<td>Connected</td>
<td>Green—solid</td>
<td>Off</td>
<td>LTE primary if no WAN</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Primary connection if WAN</td>
<td></td>
</tr>
<tr>
<td>Backup mode</td>
<td>Amber—solid</td>
<td>Off</td>
<td>Backup connection if WAN.</td>
<td></td>
</tr>
<tr>
<td>Connection failure</td>
<td>Red—solid</td>
<td>Red—blip</td>
<td>A connection was attempted, but it failed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• APN incorrect</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• SIM card missing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• insufficient signal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• no service</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• modem failure</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• data connection failed—waiting to retry</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• PIN incorrect SIM blocked, bad unlock code</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• SIM locked</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• SIM blocked, unlock code incorrect</td>
<td></td>
</tr>
</tbody>
</table>
SIM Card/s
The router supports two SIM cards. See *Inserting the SIM card* for the installation procedure.

SIM/s Interface 1.8V/3V

Back View

Antenna/s
The router has five SMA antenna connectors Main, Diversity, GNSS, WLAN-1 and WLAN-2. For more information on connecting the antennas see *Connecting the Antenna/s*.

USB-C Port
In console mode, the router’s USB port provides direct access to the CLI (Command Line Interface) as well as statuses, logging, and troubleshooting information. Alternatively, this port can be set as an Ethernet over USB port.
See *Connecting to the USB-C port in Console Mode* and *Connecting to the USB-C port as an Ethernet over USB Port*.
Ethernet LAN Ports
Once the ports are connected and the link is established, the speed LED turns on. The LED indicates a 10, 100, or 1000 Mbps link on the Ethernet port/s.

Ethernet Link Status

<table>
<thead>
<tr>
<th>Link/Speed Indicator</th>
<th>Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Left LED Green</td>
<td>Link + Flashing with activity</td>
<td>1000 Mbps</td>
</tr>
<tr>
<td>Both LEDs</td>
<td>Link + Flashing with activity</td>
<td>100 Mbps</td>
</tr>
<tr>
<td>Right LED Green</td>
<td>Link + Flashing with activity</td>
<td>10 Mbps</td>
</tr>
<tr>
<td>Off</td>
<td>Off</td>
<td>No LAN connected</td>
</tr>
</tbody>
</table>

GNSS Connector
GPS+GLONAS+GAILEO
Passive Antenna—SMA(M) straight connector

Connecting the Power
Models can be shipped with a DC power cable or a pigtail cable depending on the model. The GPIO connector can be configured as a high side pull-up/dry contact digital input, analog input, low side current sink output, digital output/open drain, or pulse counter depending on your application. Pin 3—IGN can be configured as vehicle ignition sense or as analog input.

Warning: Before servicing this product ensure the power source has been disconnected.
Note: Use copper conductors only.
The AUX/IO connector allows a connection for an RS485 device, 2 digital input devices (A and B), and 1 normally open (NO) relay contact.

### AUX /IO

The AUX/IO connector allows a connection for an RS485 device, 2 digital input devices (A and B), and 1 normally open (NO) relay contact.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Associated DC Cable Wire color</th>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
</table>
| 1   | Power | Red                           | Main power supply for device  
Note: *If you want to turn the router on/off using a control line, such as a vehicle ignition line, we recommend that you connect the control/ignition line to Pin 3 and apply continuous power On Pin 1* | PWR |
| 2   | Ground | Black                         | Main device ground | GND |
| 3   | IGN   | White                         | Connect to the vehicle ignition or an external switch. This input can be configured to put the router into a Standby Mode when the signal goes low and take it out of Standby Mode when it goes high. Alternatively it can be used simply as an analog input. | IGN |
| 4   | GPIO  | Green                         | User configurable digital input/output for analog voltage sensing input. Connect to switch, relay, or external device. | GPIO |

**Note:** *Use copper conductors only.*

### Hardware

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin Descriptions</td>
<td>RS485 -</td>
<td>GND</td>
<td>Input B</td>
<td>Relay NO (normally open)</td>
</tr>
<tr>
<td>Pin Number</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Pin Descriptions</td>
<td>RS485 +</td>
<td>GND</td>
<td>Input A</td>
<td>Relay NO (normally open)</td>
</tr>
</tbody>
</table>

**Warning:** Before connecting wiring, ensure the power source has been disconnected.

For application examples see --> *AUX I/O*
Relay Alarm
The router has one Normally Open (NO) relay (Pin 5 and Pin 1) switch. The relay switch can be connected to an external powered device such as a siren or light for visual or audible notification of an alarm status.
Ensure the power source is off prior to connection.
For application example see --> Relay Alarm

Installation
The steps for a typical installation are:
1. Inserting the SIM card/s. See Inserting the SIM card.
2. Connecting the antenna/s. See Connecting the Antenna/s.
5. Connecting to the Console Port in Console Mode. See Connecting to the USB-C port in Console Mode.
6. Using the Console port as a virtual Ethernet port. See Connecting to the USB-C port as an Ethernet over USB Port.
7. Connecting the power. See Connecting the Power.
8. Logging into the router5541+ FN. See Fast Setup or Connecting to the USB-C port in Console Mode.

Inserting the SIM card
The router comes with two SIM sockets for mini-SIM (2FF) cards.
Note: Ensure the power is disconnected before you insert the SIM card/s.
1. Using your Phillips screwdriver, removed the two screws from the panel covering the SIM slots. Gently pry the cover loose from the opening.
2. Align the SIM card so that the SIM card slides into the top slot (slot#1). Each SIM card has a notched corner for orientation and the SIM card can only be inserted the correct way. You will hear an audible click when the SIM is inserted correctly. Always populate slot#1 first. Add a second SIM card if your network setup requires it.
3. Align the SIM cover plate and secure the plate with the screws.

Note: Do not force the SIM(s) card in or you may damage the card or your IRG554x router.
Connecting the Antenna/s

The router has these connectors:
- Main Cellular female antenna connector
- Rx Diversity female antenna connector
- GNSS female antenna connector
- WLAN-1
- WLAN-2

1. Connect your cellular antenna to the SMA cellular antenna connector labeled Main.
2. Connect your GPS antenna to the SMA GPS antenna connector labeled GNSS.
3. Mount the GPS antenna where it has a good view of the sky (at least 90°).
4. Connect the diversity antenna to the SMA diversity antenna labeled Diversity.
5. Connect the WLAN antennas to WLAN-1 and WLAN-2.

**Warning:** For Zone 2 and/or Class I, Division 2 hazardous location applications. Antennas intended for use with the product must be installed within the end use enclosure. For remote mounting of the antennas in unclassified or classified locations, routing and installation of the antennas shall be in accordance with the appropriate location regulations.

**Note:** When attaching the antennas to the SMA connectors hand tighten only (do not use tools to tighten (maximum torque is 7Kgf-cm/1.1 N-m(10 in-lb)).

Connecting to the Ethernet Ports

The Ethernet RJ45 ports provide the standard Ethernet interface speeds of 10/100/1000 Mbps through twisted pair (UTP) cables of up to 100 meters (328ft) in length. Cat5e or Cat6 cables are recommended for 1000 Mbps connections.

Connecting to the Serial Port

The serial port has a 9-pin female port connector allowing you to directly connect to most computers or devices with a standard serial straight-through cable. It is used for:
- Connecting a serial device
- Connecting as a console port
- As a GNSS output device
Connecting to the USB-C port in Console Mode

By default, the USB-C port is set to console mode. In this mode, the USB-C port acts as a console port.

1. Connect the power. See Connecting the Power.
2. Allow the router to complete the boot up sequence.
3. Connect a USB cable to the PC’s USB port, then connect the other end of the cable to the router’s USB-C connector.
4. On the PC Choose Start -> Control Panel -> Hardware and Sound (or equivalent) on the Windows Operating System. Choose the Device Manager, and expand the Ports section. The assigned COM port can be identified.
5. Start a terminal emulation program (such as Putty or SecureCRT) on the com port where you have connected the cable to the PC.
6. Press the Enter key on the keyboard and the prompt displays.

See the Perle IRG5000 Series Router CLI Reference Guide for more information on using CLI commands.

Warning: If you connect or disconnect the console cable with the power applied to the router or any device on the network, an electrical arc can occur. This could cause an explosion when installed in a hazardous location. Ensure the power is removed from all devices prior to making any cable connections.

Warning: Do not use the USB port in a potentially explosive environment.

---

### Female Serial Pin out

<table>
<thead>
<tr>
<th>Name</th>
<th>Pin</th>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCD</td>
<td>1</td>
<td>Data Carrier Detect</td>
<td>OUT</td>
</tr>
<tr>
<td>TXD</td>
<td>2</td>
<td>Transmit Data</td>
<td>OUT</td>
</tr>
<tr>
<td>RXD</td>
<td>3</td>
<td>Receive Data</td>
<td>IN</td>
</tr>
<tr>
<td>DTR</td>
<td>4</td>
<td>Data Terminal Ready</td>
<td>IN</td>
</tr>
<tr>
<td>GND</td>
<td>5</td>
<td>Ground</td>
<td>GND</td>
</tr>
<tr>
<td>DSR</td>
<td>6</td>
<td>Data Set Ready</td>
<td>OUT</td>
</tr>
<tr>
<td>RTS</td>
<td>7</td>
<td>Request to Send</td>
<td>IN</td>
</tr>
<tr>
<td>CTS</td>
<td>8</td>
<td>Clear to Send</td>
<td>OUT</td>
</tr>
<tr>
<td>RI</td>
<td>9</td>
<td>Not Connected</td>
<td>-</td>
</tr>
</tbody>
</table>

---

Note: When connecting to a DCE device, a crossover cable is needed.
Connecting to the USB-C port as an Ethernet over USB Port
In this mode, the USB-C port behaves as if a PC is connected to the Ethernet port, allowing access to networks and the Internet.
See the Perle IRG5000 Series Router User’s Guide and the Perle IRG5000 Series Router CLI Reference Guide for more information on setting this parameter.

Connecting the Power
The wire colors shown are for the power/GPIO cable for the IRG554x. Other wiring setups may have different colors. See Appendix A—Technical Specifications.

If you are using a cable that is longer than two meters, we recommend the following:
Wire gages (AWG):
• 22 gauge wire or up to 4 meters (13ft)
• 20 gauge wire for up to 6 meters (20ft)
• 18 gauge wire for up to 12 meters (40ft)
Molex part number 2451320420 or equivalent
Rectangular socket to socket 6.56’ (2.00m)
Cable and connector must be rated for minimum 76°C (168.8°F)

Note: Before servicing this product ensure the power source has been disconnected. Electrical installations should be performed by personnel thoroughly trained in safe electrical wiring procedures.

Operation

Reset / Factory Default / Safe Mode
The table below shows how the reset button is used.

Reset Button
Managing the Router

**Fast Setup**

Fast Setup mode allow you to quickly configure basic operating parameters on your router.

Your Perle router is shipped to you in Factory Default mode. On power up, your router is in “Fast Setup” mode with the Power LED flashing green. Make a connection to your router via the console port or a Web browser, then answer basic setup operating parameters such as your initial user ID and password. To connect to the console port, follow the instructions provided in—[Connecting to the USB-C port in Console Mode](#).

To connect using a Web browser, connect your PC’s Ethernet cable directly to an Ethernet port on the router. Configure the PC to use DHCP for obtaining its IP address. The router will act as a DHCP server and assign an IP address to the PC. Next, launch the Web browser and browse to “http://192.168.0.1”. The Fast Setup screen appears.

Refer to the Quick Start Guide or the Perle IRG5000 Series Router User’s Guide for more information on setup instructions.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
<th>LEDs</th>
<th>System Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restart</td>
<td>Press and Release the Reset button when the router is running</td>
<td>Power LED will begin to blink Amber</td>
<td>Reboots. All configuration and files remain the same.</td>
</tr>
<tr>
<td>Factory Default</td>
<td>Press the Reset button and Hold for about 20 seconds when the router is running</td>
<td>LEDs flash Red</td>
<td>Reboots and resets the configuration to the Perle factory default configuration. All configuration, User IDs, passwords, and security certificates are deleted.</td>
</tr>
</tbody>
</table>
| Safe Mode       | Press the Reset button while powering up                         | All LEDs, except power blinking Amber          | • Saves the startup config  
• Boots with no config file  
• Allows you to do setup mode |

**Managing the Router**

The IRG5541+ FN can be configured, operated, and monitored using any of the following methods. See the Perle IRG5000 Series Router User’s Guide for more details on these methods.

**WebManager**

The Perle WebManager—an embedded Web based application that provides an easy-to-use browser interface for configuring and managing the IRG5541+ FN. The WebManager is accessible through any standard desktop web browser. You must have pre-configured a valid IP address on the IRG5541+ FN before connecting with the WebManager.
**CLI**

A text-based Command Line Interface based on industry standard syntax and structure. The CLI can be accessed from the console port. Once a valid IP address is configured on the IRG5541+ FN, you can Telnet or SSH to access the IRG5541+ FN for administration purposes. See the Perle IRG5000 Series Router CLI Reference Guide for more information.

**SNMP**

The IRG5541+ FN can be managed with an SNMP compatible management station that is running platforms such as HP Openview.

**Fast Setup Mode**

If your router is in “Factory Default” mode, when you first connect, you are in “Fast setup mode”. For more details, see—*Fast Setup*.

**PerleView**

A Windows server-based centralized management package that simplifies the configuration, administration, monitoring, and troubleshooting of Perle Managed Media Converters, Ethernet Copper Extenders, Industrial Switches, and the IRG Series of Perle Routers. Your Internet browser, can securely access PerleVIEW and manage 10’s, 100’s or 1000’s of Perle devices from a centralized server.
Power Management

Power Modes
The IRG5541+ FN has three operating power modes:
• Standard Mode
• Ignition Mode
• Smart Standby Mode

Standard Mode
When power is applied to the router, it powers up. Both GPIO and IGN power inputs are ignored. This is the default.

Ignition Mode
Configurable time delay for shutdown / start based on vehicle status.
This mode monitors the ignition input and goes in and out of Standby Mode based on the voltage of the ignition input. When the voltage on the ignition input goes below a set pre-defined threshold, the router will be powered down into Standby Mode. When the voltage on the ignition input goes above the router’s pre-defined value it will return to normal operating mode (Wakeup).

Smart Standby Mode
When in standby mode, the router is essentially powered off. The microprocessor runs to monitor the internal and external environment to determine when to power the router back up and take it out of Standby Mode. When the router is in Standby Mode, the System LED blips Amber. Pressing the reset button takes the router out of Standby Mode and powers it up.
Power Management

Power Saving Options

<table>
<thead>
<tr>
<th>Feature</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor power savings</td>
<td>This feature optimizes idle power consumption, saving energy by reducing performance where possible.</td>
</tr>
<tr>
<td>LED power savings</td>
<td>Minimize use of LEDs, showing only alerts.</td>
</tr>
<tr>
<td>USB power saving</td>
<td>USB shutdown.</td>
</tr>
<tr>
<td>Ethernet power savings</td>
<td>Ethernet port savings can be achieved by;</td>
</tr>
<tr>
<td></td>
<td>1) Lowering Ethernet speed.</td>
</tr>
<tr>
<td></td>
<td>2) Ensuring EEE (Energy Efficient Ethernet) is enabled.</td>
</tr>
<tr>
<td></td>
<td>3) Shutting down unused Ethernet ports.</td>
</tr>
<tr>
<td>Serial Power savings</td>
<td>Shutting down serial port if it is not being used.</td>
</tr>
<tr>
<td>GNSS power savings</td>
<td>Shutting down GNSS if it is not being used.</td>
</tr>
<tr>
<td>Ignition shutdown delay</td>
<td>When powered by battery (car battery), the router can use the ignition sense pin on the DC power cable to shutdown after a user configured delay (i.e. once the ignition is turned off)</td>
</tr>
<tr>
<td>Low voltage standby</td>
<td>The router will enter standby mode if the voltage reaches a user defined threshold. This is intended as a battery saving feature.</td>
</tr>
<tr>
<td>Standby</td>
<td>When the router is not required for a specific time period or when the analog/digital inputs are in a particular state, it can be put into standby where minimal power will be consumed. When these conditions change, the router will automatically wake up and resume normal operations.</td>
</tr>
</tbody>
</table>

Power Saving Scenarios

Idle Mode setup
- Cellular connected (no activity)
- Ethernet connected (no activity)
- Serial disabled
- USB connected (no activity)
- GPS enabled—active antenna
- CPU power savings mode disabled
- LED power savings mode disabled

Typical Mode setup
- Cellular connected
- Ethernet connected
- Wi-Fi active
- Serial disable
- USB enabled
- GPS enabled—active antenna
- CPU power savings mode disabled
- LED power savings mode disabled
Standby mode setup

- Cellular disconnected
- Ethernet disconnected
- Serial disabled
- USB disconnected
- GPS disconnected
- CPU power savings mode enabled
- LED power savings mode enabled

Power consumption was measured at 12 V.

Note: up to 0.08A 1W more in power savings can be achieved through shutting down the USB port, LEDs, GPS as well as turning down router processor speed.

Note: To configure Power Modes, more information can be found in the Perle IRG5000 Series Router User’s Guide found on the Perle website.

Low Voltage Standby

This feature is intended to monitor the voltage being provided to the router in order to avoid a depletion of the battery. Should the voltage go below a user defined threshold condition, the router enters Low Voltage Standby. When the voltage increases above the threshold, power is resumed. This is a battery protection feature and therefore overrides Ignition Mode and Smart Standby Mode. The feature can measure voltage either with the IGN pin or the GPIO (analog) pin. See the Perle IRG5000 Series Router User’s Guide on how to configure this feature.

Overheat Standby

The internal ambient temperature of the router is continuously monitored and if the temperature remains above the router’s primary high threshold alarm (default is 95°C/203°F) setting for 5 minutes, then your router enters into Standby Mode and remains in Standby Mode until the temperature returns to 5°C/9°F is below the primary high threshold value for 5 minutes. The high threshold can be configured within Alarm Manager /Primary/High Threshold menu.

Note: that any value below 60°C/140°F set for this threshold is ignored and the value of 60°C/140°F is used for the monitoring for Overheat Standby.

<table>
<thead>
<tr>
<th>Model</th>
<th>Idle Mode</th>
<th>Typical Use</th>
<th>Standby</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current (W)</td>
<td>Power (W)</td>
<td>Current (W)</td>
</tr>
<tr>
<td>IRG5521+ FN (2 Eth, LTE-A Pro, Wi-Fi)</td>
<td>0.36</td>
<td>4.37</td>
<td>0.40</td>
</tr>
<tr>
<td>IGR5541+ FN (4 Eth, LTE-A Pro, Wi-Fi)</td>
<td>0.39</td>
<td>4.67</td>
<td>0.42</td>
</tr>
</tbody>
</table>
Deployment Modes

Fixed Installation without I/O

For fixed installations, connect the wires as shown in the figure below. You configure Low Voltage Standby Mode (LVS) to force the IRG FN into Standby Mode when the voltage is low. Voltage is monitored on Pin 3 and 4.

- Pin 1 (Power)—Use the Red wire in the DC cable to connect Pin 1 to the power source. Include a 4.0A fast acting fuse to the input line. A continuous (unswitched) DC power source is recommended
- Pin 2 (Ground)—Use the Black wire in the DC cable to connect Pin 2 to Ground
- Pin 3 (IGN—Ignition)—Connect to Power for voltage sensing

Recommended Vehicle Installation (Ignition Mode)

For vehicle installations, connect the white IGN wire to the vehicle’s ignition switch as shown in the diagram below. This allows the router5541+ FN to operate with the vehicle. When the vehicle’s ignition is off the router5541+ FN enters Standby Mode. Configure a time delay between the vehicle’s ignition shuts off, and the time the router5541+ FN goes into Standby Mode. A delayed Standby is used if you want to maintain a network connection while the vehicle’s engine is shut off for short periods of time—such as in a delivery vehicle.

- Pin 1 (Power)—Use the Red wire in the DC cable to connect Pin 1 to the power source. Include a 4.0A fast acting fuse in the input power line. Continuous (unswitched) DC power source is recommended
- Pin 2 (Ground)—Use the Black wire in the DC cable to connect Pin 2 to Ground
- Pin 3 (IGN—Ignition)—It is recommended to use the IGN wire (Pin 3) to initiate standby mode on the router.
Fixed Installation with Analog Input

- Pin 1 (Power)—Use the Red wire in the DC cable to connect Pin 1 to the power source. Include a 4.0 fast acting fuse in the input power line. Continuous (unswitched) DC power source is recommended.
- Pin 2 (Ground)—Use the Black wire in the DC cable to connect Pin 2 to Ground
- Pin 3 (IGN—Ignition)—Connect to Power
- Pin 4 (GPIO)—In this example, the GPIO (green) is used as an analog input to enter and exit Standby Mode

For more information on configuring Standby Mode, Timed Standby Mode and Event Handling see the Perle IRG5000 Series Router User’s Guide.
I/O Configurations

GPIO can be used as a:
- Pulse counter
- Digital input
- High side pull-up/dry contact switch input
- Analog input
- Digital Output / Low Side Current Sink
- Digital Output/Open Drain

Pulse Counter / Digital Input

You can connect GPIO as:
- a pulse counter to monitor frequencies up to 512 Hz, with duty cycle between 25%–75%
- a digital input to detect the state of a switch
- a monitor to an external device such as a motion detector, a remote solar panel, or a remote camera.

Digital input can also be used with the Standby Timer.

### Input Range

<table>
<thead>
<tr>
<th>Input Range</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 1V</td>
<td>Low</td>
</tr>
<tr>
<td>2.7 - 36V</td>
<td>High</td>
</tr>
</tbody>
</table>

High Side Pull-up / Dry Contact Switch Input

The voltage on Pin 4 when the high side pull-up is enabled (depends on the Vin and power consumption.

<table>
<thead>
<tr>
<th>Source Current</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.6</td>
<td>1.1</td>
<td>3.5</td>
<td>mA</td>
</tr>
<tr>
<td>V_in = 7 V</td>
<td>V_in = 12 V</td>
<td>V_in = 36 V</td>
<td>mA</td>
<td></td>
</tr>
</tbody>
</table>
**Analog Input**

Connect the P4—GPIO to an analog source. The router monitors voltages from the input source and transform them into analog values. Pin 4 can detect inputs of 0.5–36 V referenced to ground. By transforming the voltages, with the user defined formulas, the GPIO pin can monitor measurements such as temperatures, sensors, or input voltages.

<table>
<thead>
<tr>
<th>State</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>On</td>
<td>200mA</td>
<td>500</td>
<td>850mA</td>
<td>I_Typical = 25°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>I_Min = 70°C,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>I_Max = -40°C</td>
</tr>
<tr>
<td>Off</td>
<td>——</td>
<td>0</td>
<td>——</td>
<td>V_in = 12</td>
</tr>
</tbody>
</table>
**Digital Output / Open Drain**

You can use Pin 4—GPIO as an open drain to drive an external digital device.

<table>
<thead>
<tr>
<th>Pull-up</th>
<th>State</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Off</td>
<td>Open Circuit</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Active Low</td>
<td></td>
<td>—</td>
<td>0.5</td>
<td>V</td>
</tr>
</tbody>
</table>

**AUX I/O**

The AUX/IO connector allows a connection for an RS485 device, 2 digital input devices (A and B), and 1 normally open (NO) relay contact.

**Warning:** Before connecting wiring, ensure the power source has been disconnected.
**Pulse Counter / Digital Input**
You can connect Pin 6 or Pin 2—AUX/Io to a pulse counter to monitor frequencies to 140 Hz, Duty cycle 20%–40%, digital input to detect the state of a switch such as a vehicle ignition, or to monitor an external device such as a motion detector, a remote solar panel, or a remote camera. Digital input can also be used with the Standby Timer.

![Pulse Counter Diagram]

<table>
<thead>
<tr>
<th>Pull-up</th>
<th>State</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Low</td>
<td>—</td>
<td>—</td>
<td>1.0</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>2.7</td>
<td>—</td>
<td>Vin</td>
<td>V</td>
</tr>
</tbody>
</table>

**High Side Pull-up / Dry Contact Switch Input**
Maximum current the voltage output can provide (depends on Vin)
The voltage on Pin 6 or Pin 2 when the high side pull-up is enabled (depends on the Vin and power consumption).

*Depending on the load, this value can range from Vin to Vin -2.5

<table>
<thead>
<tr>
<th>Source Current</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_out</td>
<td>V_in -2.5</td>
<td>—</td>
<td>V_in</td>
<td>V</td>
</tr>
<tr>
<td>Source Current</td>
<td>0.6</td>
<td>1.1</td>
<td>3.5</td>
<td>mA</td>
</tr>
<tr>
<td>V_in = 7 V</td>
<td></td>
<td>V_in = 12 V</td>
<td>V_in = 36 V</td>
<td></td>
</tr>
</tbody>
</table>

![High Side Pull-up Diagram]
Relay Alarm

normally open (NO) dry contact 1A@24VDC
# Appendix A—Technical Specifications

## Technical Specifications

<table>
<thead>
<tr>
<th>General</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power Requirements</strong></td>
<td>Input: VDC, 1000 mA max</td>
</tr>
</tbody>
</table>
| **Power Line Protection** | Fast transients 1.5KV (ENG61000-4-4 Criteria B)  
Surge 2KV (EN61000-4-5 common mode), 1.5KV (EN61000-4-5 differential and common modes) |
| **Power** | Built-in protection against voltage transient including 5 VDC engine cranking and +200 VDC load dump  
SAE J1455, MIL-STD-810G |

## Interfaces

<table>
<thead>
<tr>
<th>Ethernet Port</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4 Ethernet 10/100/1000 Auto-neg</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Isolation 1.5 kV</strong></td>
<td></td>
</tr>
<tr>
<td><strong>IEEE 802.3 for 10Base-T</strong></td>
<td></td>
</tr>
<tr>
<td><strong>IEEE 802.3u for 100Base-TX and 100Base-FX</strong></td>
<td></td>
</tr>
<tr>
<td><strong>IEEE 802.3ab for 1000Base-T</strong></td>
<td></td>
</tr>
<tr>
<td><strong>IEEE 802.3x for Flow Control</strong></td>
<td></td>
</tr>
</tbody>
</table>
| **USB** | 1  
Type USB 3.0 Type-C  
Can be used as a console or additional Ethernet port. |
| **SIM** | 2  
15*25mm (2FF) |

## Environmental Specifications

| Operating Temperature Ranges | -40°C to 70°C (40°F to 158°F) |
| Storage Temperature | -40°C to 85°C (40°F to 185°F) |
| Operating Humidity Ranges | 0% to 95% non-condensing |
| Storage Humidity Ranges | 0% to 95% non-condensing |
| Operating Altitude | Up to 3,048 meters (10,000 feet) |
| MTBF | 287,215 hours |

## Standards and Certifications

| Safety | UL/ULC/EN 62368-1 (previously 60950-1)  
CE Mark  
CAN/CSA-C22.2 No. 62368-1-14  
UL 61010-1 and 61010-2-201 |
## Technical Specifications

### EMI/EMC
- FCC 47 Part 15, Subpart B, Class B
- ICES-003 Issue 6 Class B (Canada)
- EN302489 (Vehicle Installation)
- CISPR 32:2015/EN 55032:2015 (Class A)
- CISPR 25:2016/EN 55025
- CISPR 24:2010/EN 55024:2010
- CISPR 35:2016/EN 55035:2017
- EN 61000-3-2 Limits for Harmonic Current Emissions
- EN 61000-3-3 Limits of Voltage Fluctuations and Flicker
- EN 61000-4-2 (ESD): Contact:
  - EN 61000-4-3 (RS):
  - EN 61000-4-4 (EFT):
  - EN 61000-4-5 (Surge):
  - EN 61000-4-6 (CS):
  - EN 61000-4-8 (PFMF):
  - EN 61000-4-11
  - EN 61000-4-16
- ISO 7637-2:2004

### Hazloc
- ATEX Class 1 Zone 2
- ANSI/ISA 12.12.01, Class 1 Division 2, Group A, B, C, D

### Railway
- EN 50155:2017 Clause 4.3.6
- IEC 60571:2012 for Clause 12.2.8 and 12.2.9

### FirstNet Ready™

### GSM/UMTS certifications
- PTCRB, RED

### Environment Testing

#### Shock and Vibration
- SAE J1455 (Shock and Vibration)
- MIL-STD-810G
- EN 61373

#### IP rating
- Complaint to IP64

#### Drop
- ISTA 2A 2001, test categorizes 1, 4, 5, and 6

#### Power connector/AUX

#### Ignition Sense
- VDC voltage variation with on/Off and scheduling timer
  - Analog Input: 0.5V to 36V
## Technical Specifications

<table>
<thead>
<tr>
<th><strong>GPIO</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Input &amp; Pulse Counting VDC: 0 for ≤ 1V, 1 for ≥ 2.7V</td>
<td></td>
</tr>
<tr>
<td>Dry Contact Max Current range: min 0.6mA @ 7V and max 3.5mA @ 36V</td>
<td></td>
</tr>
<tr>
<td>Current Sink Output: 0.5A @ 12V</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Digital input and pulse counting</strong></th>
<th>Digital Input &amp; Pulse Counting VDC: 0 for ≤ 1V, 1 for ≥ 2.7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relay</strong></td>
<td>Normally Open (NO) dry contact 1A@24VDC</td>
</tr>
</tbody>
</table>

## GNSS

<table>
<thead>
<tr>
<th><strong>Frequency range</strong></th>
<th>GNSS: 1599-1606 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS: 1575.42 MHz</td>
<td></td>
</tr>
<tr>
<td>Galileo: 1575.42 MHz</td>
<td></td>
</tr>
<tr>
<td>BeiDou: 1561.098 MHz</td>
<td></td>
</tr>
<tr>
<td>GLONASS: 1602 MHz</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Bandwidth</strong></th>
<th>45 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Impedance</strong></td>
<td>50 Ohm</td>
</tr>
<tr>
<td><strong>VSWR</strong></td>
<td>2.0 Typical</td>
</tr>
<tr>
<td><strong>Gain</strong></td>
<td>RHCP</td>
</tr>
<tr>
<td><strong>Polarization</strong></td>
<td>4 dBi (typical)</td>
</tr>
<tr>
<td><strong>Axial Ratio at elevation</strong></td>
<td>5 dB (typical)</td>
</tr>
</tbody>
</table>

## Cellular

<table>
<thead>
<tr>
<th><strong>Cellular/Telecom Regulatory Approvals</strong></th>
<th>FCC/ICES, RED, PTCRB/CTIA, CE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carrier Certifications</strong></td>
<td>AT&amp;T, Verizon</td>
</tr>
</tbody>
</table>
## Technical Specifications

| Network Technology (LTE) | Band 1 | Band 2 | Band 3 | Band 4 | Band 5 | Band 7 | Band 8 | Band 9 | Band 12 | Band 13 | Band 14 | Band 18 | Band 19 | Band 20 | Band 26 | Band 29 | Band 30 | Band 32 | Band 41 | Band 42 | Band 43 | Band 46 | Band 48 | Band 66 | HSPA+, UMTS | Band 1 | Band 2 | Band 4 | Band 5 | Band 6 | Band 8 | Band 9 | Band 19 |
|-------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| IRG5541+ FN             |        |        |        |        | 2100   |        |        |        |        |        |        |        |        | 850    | 900    | 1800   | 700    | 700    | 700    | 850    | 850    | 850    | 800    | 800    | 700    | 700    | 2300   | 1500   | 2500   | 2300   | 3700   | 5200   | 3500   |
|                         |        |        |        |        | 1900   |        |        |        |        |        |        |        |        | 1800   | 1700   | 1700   | 850    | 800    | 900    | 900    | 800    | 900    | 900    | 1700   | 1700   | 1700   | 1700   | 1700   | 1700   | 1700   |

| Cellular                | EN 301 908-1, EN 301-908-2, EN 301 908-13 | EN 62311:2019 / IEC 62311 Ed. 1.0 b:2007 | EN 301 489-1 | EN 301 489-17 | EN 301 489-19 |
## Recommended Main/Diversity Antenna Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirements</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna System</td>
<td>(LTE/4G) External multi-band 2x2 MIMO, SMA connector antenna system</td>
<td>if Ant2 includes GNSS, then it must also satisfy these requirements.</td>
</tr>
<tr>
<td>Operating Bands - Frequency range</td>
<td>704-902-928-960 MHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1427.9-1575.42 MHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1710-2170 MHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2400-2480-2690 MHz</td>
<td></td>
</tr>
<tr>
<td>Impedance</td>
<td>50 OHM</td>
<td></td>
</tr>
<tr>
<td>Gain</td>
<td>2-3 dBi</td>
<td></td>
</tr>
<tr>
<td>VSWR of Ant 1 and Ant 2</td>
<td>&lt; 3.0</td>
<td>On all bands including Band edges.</td>
</tr>
</tbody>
</table>
Appendix B—Sample Label
Appendix C—Mounting the Router

Option 1
1. Attached the two DIN Rail screws to the holding plate. The DIN Rail can be positioned either with the connector in the down or up position on the holding plate.

2. Slide the two screws into the holding plate, then attach that holding plate to the router.

3. Position the router such that the top hooks of the DIN Rail clip attach into the top of the DIN Rail.
4. Rotate the bottom of the router towards the rail. This will snap the bottom hooks of the Din Rail clip onto the bottom of the DIN Rail.
Option 2

1. Attach the two DIN Rail screws to the holding plate. The DIN Rail can be positioned either with the connector in the down or up position on the holding plate.

2. Slide the two screws into the holding plate, then attach the holding plate to the router.

3. Position the router such that the top hooks of the DIN Rail clip attach onto the top of the DIN Rail.

4. Rotate the bottom of the router towards the rail. This will snap the bottom hooks of the DIN Rail clip into the bottom of the DIN Rail.
Appendix D—Mechanical
Appendix E—Maintaining and Troubleshooting

Maintaining

- Ensure easy access to the cables
- Ensure cables are not bent, constricted, close to high amperages, or exposed to extreme temperatures
- Check that the front panel LEDs are easily visible
- Wipe case clean with a dry cloth—do not use solvents or cleaning agents