



Cisco IR829 Industrial Integrated Services Router Hardware Installation Guide

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CHAPTER 1

Preface

This preface describes the objectives, audience, organization, and conventions of this guide and describes related documents that have additional information. It contains the following sections:

- [Preface, on page 1](#)

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It contains the following sections:

Objective

This guide provides an overview and explains how to install, connect, and perform initial configuration for the Cisco IR829. Previous versions contained additional configuration information which has now been relocated to the [Cisco IR800 Integrated Services Router Software Configuration Guide](#).

Audience

This guide is intended for people who have a high level of technical ability, although they may not have experience with Cisco software.

Conventions

This section describes the conventions used in this guide.

NOTE: Means reader take note. Notes contain helpful suggestions or references to additional information and material.

CAUTION: This symbol means reader be careful. In this situation, you might do something that could result in equipment damage or loss of data.

TIP: Means *the following information will help you solve a problem*. The tip information might not be troubleshooting or even an action, but could be useful information.

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. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device.

Safety Warnings

Warning	<p>This warning symbol 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. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071</p> <p>SAVE THESE INSTRUCTIONS</p>
Waarschuwing	<p>BELANGRIJKE VEILIGHEIDSINSTRUCTIES</p> <p>Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van de standaard praktijken om ongelukken te voorkomen. Gebruik het nummer van de verklaring onderaan de waarschuwing als u een vertaling van de waarschuwing die bij het apparaat wordt geleverd, wilt raadplegen.</p> <p>BEWAAR DEZE INSTRUCTIES</p>
Varoitus	<p>TÄRKEITÄ TURVALLISUUSOHJEITA</p> <p>Tämä varoitusmerkki merkitsee vaaraa. Tilanne voi aiheuttaa ruumiillisia vammoja. Ennen kuin käsittelet laitteistoa, huomioi sähköpiirien käsittelemiseen liittyvät riskit ja tutustu onnettomuuksien yleisiin ehkäisytapoihin. Turvallisuusvaroitusten käännökset löytyvät laitteen mukana toimitettujen käännettyjen turvallisuusvaroitusten joukosta varoitusten lopussa näkyvien lausuntonumeroiden avulla.</p> <p>SÄILYTÄ NÄMÄ OHJEET</p>
Attention	<p>IMPORTANTES INFORMATIONS DE SÉCURITÉ</p> <p>Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant entraîner des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers liés aux circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions des avertissements figurant dans les consignes de sécurité traduites qui accompagnent cet appareil, référez-vous au numéro de l'instruction situé à la fin de chaque avertissement.</p> <p>CONSERVEZ CES INFORMATIONS</p>

Warnung	<p>WICHTIGE SICHERHEITSHINWEISE</p> <p>Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu Verletzungen führen kann. Machen Sie sich vor der Arbeit mit Geräten mit den Gefahren elektrischer Schaltungen und den üblichen Verfahren zur Vorbeugung vor Unfällen vertraut. Suchen Sie mit der am Ende jeder Warnung angegebene Anweisungsnummer nach der jeweiligen Übersetzung in den übersetzten Sicherheitshinweisen, die zusammen mit diesem Gerät ausgeliefert wurden.</p> <p>BEWAHREN SIE DIESE HINWEISE GUT AUF.</p>
Avvertenza	<p>IMPORTANTI ISTRUZIONI SULLA SICUREZZA</p> <p>Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di intervenire su qualsiasi apparecchiatura, occorre essere al corrente dei pericoli relativi ai rischi elettrici e conoscere le procedure standard per la prevenzione di incidenti. Utilizzare il numero di istruzioni presente alla fine di ciascuna avvertenza per individuare le traduzioni delle avvertenze riportate in questo documento.</p> <p>CONSERVARE QUESTE ISTRUZIONI</p>
Advarsel	<p>VIKTIGE SIKKERHETSINSTRUKSJONER</p> <p>Dette advarselssymbolet betyr fare. Du er i en situasjon som kan føre til skade på person. Før du begynner å arbeide med noe av utstyret, må du være oppmerksom på farene forbundet med elektriske kretser, og følge de til standardprosedyrer for å forhindre ulykker. Bruk nummeret i slutten av hver advarsel for å finne den tilsvarende oversettelsen i de oversatte sikkerhetsadvarslene som fulgte med denne enheten.</p> <p>TA VARE PÅ DISSE INSTRUKSJONENE</p>
Aviso	<p>INSTRUÇÕES IMPORTANTES DE SEGURANÇA</p> <p>Este símbolo de aviso significa perigo. Você está em uma situação que poderá ser causadora de lesões físicas ou corporais. Antes de iniciar a utilização de qualquer equipamento, tenha conhecimento dos perigos envolvidos no manuseio de circuitos elétricos e familiarize-se com as práticas habituais de prevenção de acidentes. Utilize o número da instrução fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham este dispositivo.</p> <p>GUARDE ESTAS INSTRUÇÕES</p>
¡Advertencia!	<p>INSTRUCCIONES IMPORTANTES DE SEGURIDAD</p> <p>Este símbolo de aviso indica peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considere los riesgos de la corriente eléctrica y familiarícese con los procedimientos estándar de prevención de accidentes. Al final de cada advertencia encontrará el número que le ayudará a encontrar el texto traducido en el apartado de traducciones que acompaña a este dispositivo.</p> <p>GUARDE ESTAS INSTRUCCIONES</p>
Varning!	<p>VIKTIGA SÄKERHETSANVISNINGAR</p> <p>Denna varningssignal signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till de tillämpliga förfaranden för att förebygga olyckor. Använd det nummer som finns i slutet av varje varning för att hitta dess översättning i de översatta säkerhetsvarningar som medföljer denna anordning.</p> <p>SPARA DESSA ANVISNINGAR</p>

<p>Figyelem</p>	<p>FONTOS BIZTONSÁGI ELOÍRÁSOK</p> <p>Ez a figyelmeztető jel veszélyre utal. Sérülésveszélyt rejtő helyzetben van. Mielott bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplő figyelmeztetések fordítása a készülékhez mellékelt biztonsági figyelmeztetések között található; a fordítás az egyes figyelmeztetések végén látható szám alapján kereshető meg.</p> <p>ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!</p>
<p>Предупреждение</p>	<p>ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ</p> <p>Этот символ предупреждения обозначает опасность. То есть имеет место ситуация, в которой следует опасаться телесных повреждений. Перед эксплуатацией оборудования выясните, каким опасностям может подвергаться пользователь при использовании электрических цепей, и ознакомьтесь с правилами техники безопасности для предотвращения возможных несчастных случаев. Воспользуйтесь номером заявления, приведенным в конце каждого предупреждения, чтобы найти его переведенный вариант в переводе предупреждений по безопасности, прилагаемом к данному устройству.</p> <p>СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ</p>
<p>警告</p>	<p>重要的安全性说明</p> <p>此警告符号代表危险。您正处于可能受到严重伤害的工作环境中。在您使用设备开始工作之前，必须充分意识到触电的危险，并熟练掌握防止事故发生的标准工作程序。请根据每项警告结尾提供的声明号码来找到设备的安全性警告说明的翻译文本。</p> <p>请保存这些安全性说明</p>
<p>警告</p>	<p>安全上の重要な注意事項</p> <p>「危険」の意味です。人身事故を予防するための注意事項が記述されています。装置の取り扱い作業を行うときは、電気回路の危険性に注意し、一般的な事故防止策に留意してください。警告の各国語版/各注意事項の番号を基に、装置に付属の「Translated Safety Warnings」を参照してください。</p> <p>これらの注意事項を保管しておいてください。</p>
<p>주의</p>	<p>중요 안전 지침</p> <p>이 경고 기호는 위험을 나타냅니다. 작업자가 신체 부상을 일으킬 수 있는 위험한 환경에 있습니다. 장비에 작업을 수행하기 전에 전기 회로와 관련된 위험을 숙지하고 표준 작업 관례를 숙지하여 사고를 방지하십시오. 각 경고의 마지막 부분에 있는 경고문 번호를 참조하여 이 장치와 함께 제공되는 번역된 안전 경고문에서 해당 번역문을 찾으십시오.</p> <p>이 지시 사항을 보관하십시오.</p>

Aviso	<p>INSTRUÇÕES IMPORTANTES DE SEGURANÇA</p> <p>Este símbolo de aviso significa perigo. Você se encontra em uma situação em que há risco de lesões corporais. Antes de trabalhar com qualquer equipamento, esteja ciente dos riscos que envolvem os circuitos elétricos e familiarize-se com as práticas padrão de prevenção de acidentes. Use o número da declaração fornecida ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham este dispositivo.</p> <p>GUARDE ESTAS INSTRUÇÕES</p>
Advarsel	<p>VIGTIGE SIKKERHEDSANVISNINGER</p> <p>Dette advarselssymbol betyder fare. Du befinder dig i en situation med risiko for legemeskade. Hvis du begynder arbejde på udstyr, skal du være opmærksom på de involverede risici, der er ved elektriske kredsløb, og du skal sætte dig ind i standardprocedurer til undgåelse af ulykker. Brug erklæringsnumrene efter hver advarsel for at finde oversættelsen i de oversatte advarsler, der fulgte med denne enhed.</p> <p>GEM DISSE ANVISNINGER</p>
تحذير	<p>إرشادات الأمان الهامة</p> <p>يوضح رمز التحذير هذا وجود خطر. وهذا يعني أنك متواجد في مكان قد ينتج عنه التعرض لإصابات. قبل بدء العمل، احذر مخاطر التعرض للصدمات الكهربائية وكن على علم بالإجراءات القياسية للحيلولة دون وقوع أي حوادث. استخدم رقم البيان الموجود في أخر كل تحذير لتحديد مكان ترجمته داخل تحذيرات الأمان المترجمة التي تأتي مع الجهاز. قم بحفظ هذه الإرشادات</p>
Upozorenje	<p>VAŽNE SIGURNOSNE NAPOMENE</p> <p>Ovaj simbol upozorenja predstavlja opasnost. Nalazite se u situaciji koja može prouzročiti ozbiljne tjelesne ozljede. Prije rada s bilo kojim uređajem, morate razumjeti opasnosti vezane uz električne sklopove, te biti upoznat sa standardnim načinima izbjegavanja nesreća. U prevedenim sigurnosnim upozorenjima, priloženima uz uređaj, možete prema broju koji nalazi uz pojedino upozorenje pronaći i njegov prijevod.</p> <p>SAČUVAJTE OVE UPUTE</p>
Upozornění	<p>DŮLEŽITÉ BEZPEČNOSTNÍ POKYNY</p> <p>Tento upozorňující symbol označuje nebezpečí. Jste v situaci, která by mohla způsobit nebezpečí úrazu. Před prací na jakémkoliv vybavení si uvědomte nebezpečí související s elektrickými obvody a seznamte se se standardními opatřeními pro předcházení úrazů. Podle čísla na konci každého upozornění vyhledejte jeho překlad v přeložených bezpečnostních upozorněních, která jsou přiložena k zařízení.</p> <p>USCHOVEJTE TYTO POKYNY</p>

Προειδοποίηση	<p>ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ</p> <p>Αυτό το προειδοποιητικό σύμβολο σημαίνει κίνδυνο. Βρίσκεστε σε κατάσταση που μπορεί να προκαλέσει τραυματισμό. Πριν εργαστείτε σε οποιοδήποτε εξοπλισμό, να έχετε υπόψη σας τους κινδύνους που σχετίζονται με τα ηλεκτρικά κυκλώματα και να έχετε εξοικειωθεί με τις συνήθεις πρακτικές για την αποφυγή ατυχημάτων. Χρησιμοποιήστε τον αριθμό δήλωσης που παρέχεται στο τέλος κάθε προειδοποίησης, για να εντοπίσετε τη μετάφρασή της στις μεταφρασμένες προειδοποιήσεις ασφαλείας που συνοδεύουν τη συσκευή.</p> <p>ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ</p>
אזהרה	<p>אזהרה בטיחות חשובות</p> <p>אזהרה זה מסמל סכנה. אתה נמצא במצב העלול לגרום לפציעה. לפני שתעבוד עם ציוד חשמלי, עליך להיות מודע לסכנות הכרוכות במגעלים חשמליים ולהכיר את הנהלים המקובלים. השתמש במספר ההוראה המסופק בסופה של כל אזהרה כדי לאתר את התרגום הרצוי. הבטיחות המתורגמת שמצורפת להתקן.</p> <p>הוראות אלה</p>
Opomena	<p>ВАЖНИ БЕЗБЕДНОСНИ НАПАТСТВИЈА</p> <p>Симболот за предупредување значи опасност. Се наоѓате во ситуација што може да предизвика телесни повреди. Пред да работите со опремата, бидете свесни за ризикот што постои кај електричните кола и треба да ги познавате стандардните постапки за спречување несреќни случаи. Искористете го бројот на изјавата што се наоѓа на крајот на секое предупредување за да го најдете неговиот период во преведените безбедносни предупредувања што се испорачани со уредот.</p> <p>ЧУВАЈТЕ ГИ ОБИЕ НАПАТСТВИЈА</p>
Ostrzeżenie	<p>WAŻNE INSTRUKCJE DOTYCZĄCE BEZPIECZEŃSTWA</p> <p>Ten symbol ostrzeżenia oznacza niebezpieczeństwo. Zachodzi sytuacja, która może powodować obrażenia ciała. Przed przystąpieniem do prac przy urządzeniach należy zapoznać się z zagrożeniami związanymi z układami elektrycznymi oraz ze standardowymi środkami zapobiegania wypadkom. Na końcu każdego ostrzeżenia podano numer, na podstawie którego można odszukać tłumaczenie tego ostrzeżenia w dołączonym do urządzenia dokumencie z tłumaczeniami ostrzeżeń.</p> <p>NINIEJSZE INSTRUKCJE NALEŻY ZACHOWAĆ</p>
Upozornenie	<p>DŮLEŽITÉ BEZPEČNOSTNÉ POKYNY</p> <p>Tento varovný symbol označuje nebezpečenstvo. Nachádzate sa v situácii s nebezpečenstvom úrazu. Pred prácou na akomkoľvek vybavení si uvedomte nebezpečenstvo súvisiace s elektrickými obvodmi a oboznámte sa so štandardnými opatreniami na predchádzanie úrazom. Podľa čísla na konci každého upozornenia vyhľadajte jeho preklad v preložených bezpečnostných upozorneniach, ktoré sú priložené k zariadeniu.</p> <p>USCHOVAJTE SI TENTO NÁVOD</p>
Opozorilo	<p>Ta naprava mora biti bito ozemljena. Nikoli ne odklapljajte ozemljitve oz. upravljajte naprave, ki primerno ozemljena. V primeru, da niste sigurni, ali imate primerno ozemljitev, nemudoma pokličite pooblaščen električni servis ali električarja.</p>

警告	<p>重要安全性指示 此警告符號代表危險，表示可能造成人身傷害。使用任何設備前，請留心電路相關危險，並熟悉避的標準作法。您可以使用每項警告後的聲明編號，查詢本裝置隨附之安全性警告譯文中的翻譯。請妥善保留此指示</p>
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WARNING: When installing the product, please use the provided or designated connection cables/power cables/AC adapters. Using any other cables/adapters could cause a malfunction or a fire. Electrical Appliance and Material Safety Law prohibits the use of UL-certified cables (that have the “UL” shown on the code) for any other electrical devices than products designated by CISCO. The use of cables that are certified by Electrical Appliance and Material Safety Law (that have “PSE” shown on the code) is not limited to CISCO-designated products. Statement 371

WARNING: Read the wall-mounting instructions carefully before beginning installation. Failure to use the correct hardware or to follow the correct procedures could result in a hazardous situation to people and damage to the system. Statement 378

WARNING: To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports both use RJ-45 connectors. Use caution when connecting cables. Statement 1021

WARNING: This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

WARNING: If the symbol of suitability with an overlaid cross appears above a port, you must not connect the port to a public network that follows the European Union standards. Connecting the port to this type of public network can cause severe personal injury or can damage the unit. Statement 1031

WARNING: Connect the unit only to DC power source that complies with the safety extra-low voltage (SELV) requirements in IEC 60950 based safety standards. Statement 1033

Requirements in IEC 60950 based safety standards. Statement 1033

WARNING: When installing or replacing the unit, the ground connection must always be made first and disconnected last. Statement 1046

WARNING: Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, because they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 1052

WARNING: No user-serviceable parts inside. Do not open. Statement 1073

WARNING: Installation of the equipment must comply with local and national electrical codes. Statement 1074

WARNING: Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

WARNING: Read the installation instructions before connecting the system to the power source. Statement 1004

WARNING: Ultimate disposal of this product should be handled according to all national laws and regulations. Statement 1040

WARNING: The covers are an integral part of the safety design of the product. Do not operate the unit without the covers installed. Statement 1077

WARNING: Hot surface. Statement 1079

Related Documentation

- <https://www.cisco.com/c/en/us/support/ios-nx-os-software/ios-15-5m-t/tsd-products-support-series-home.html>
- [Cisco 800 Series Industrial Integrated Services Routers](#)
- [Cisco IR800 Integrated Services Router Software Configuration Guide](#).

Searching Cisco Documents

To search an HTML document using a web browser, press **Ctrl-F** (Windows) or **Cmd-F** (Apple). In most browsers, the option to search whole words only, invoke case sensitivity, or search forward and backward is also available.

To search a PDF document in Adobe Reader, use the basic Find toolbar (**Ctrl-F**) or the Full Reader Search window (**Shift-Ctrl-F**). Use the Find toolbar to find words or phrases within a specific document. Use the Full Reader Search window to search multiple PDF files simultaneously and to change case sensitivity and other options. Adobe Reader's online help has more information about how to search PDF documents.



CHAPTER 2

Product Overview

This chapter provides an overview of the features available for the Cisco IR829 Integrated Services Routers (ISRs) and contains the following sections:

- [Product Overview, on page 9](#)

Product Overview

This chapter provides an overview of the features available for the Cisco IR829 Integrated Services Routers (ISRs) and contains the following sections:

NOTE: For compliance and safety information, see [Regulatory Compliance and Safety Information for Cisco 800 Series Routers](#).

General Description

The Cisco IR829 Integrated Services Router, part of the Cisco Integrated Services Routers Generation 2 (ISR G2) Family, is designed as a next generation ruggedized fixed form factor router. It is a small-form factor cellular router targeting mobile/vehicle applications and includes WiFi to provide connectivity in non-carpeted IT spaces, Industrials, Utilities, Transportation, Infrastructure, Industrial M2M application, and asset monitoring.

The IR829 comes in two models, single LTE modem and dual LTE modems.

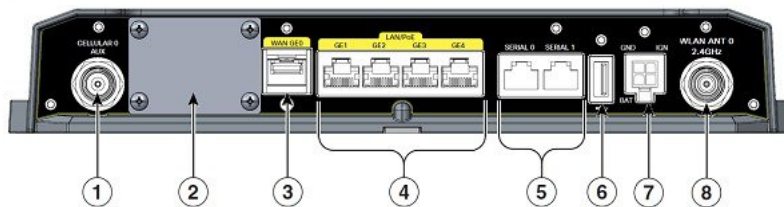
[Figure 1: Cisco IR829 Integrated Services Router, on page 10](#) shows the IR829.

Figure 1: Cisco IR829 Integrated Services Router



Figure 2: Cisco IR829 Front Panel Single Modem, on page 10 shows the front panel details of the Cisco IR829 Single Modem.

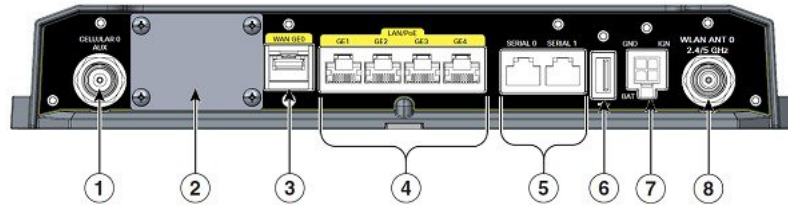
Figure 2: Cisco IR829 Front Panel Single Modem



1	CELLULAR 0 AUX	5	Serial Ports
2	mSATA SSD Slot	6	USB 2.0 type-A Port
3	Gigabit WAN (SFP)	7	Power Input, Battery, and Ignition connector. Refer to the DC Power section for pin-outs.
4	Gigabit Ethernet LAN/PoE (RJ45)	8	WLAN ANT 0 2.4GHz

Figure 3: Cisco IR829 Front Panel Dual Modem, on page 11 shows the front panel details of the Cisco IR829 Dual Modem.

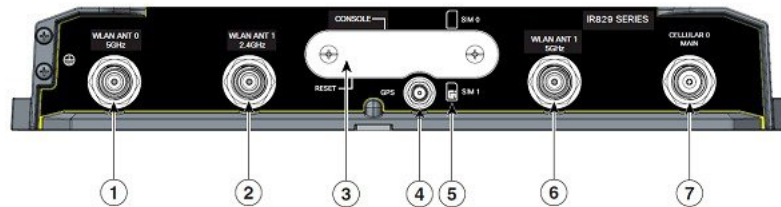
Figure 3: Cisco IR829 Front Panel Dual Modem



1	CELLULAR 0 AUX	5	Serial Ports
2	Limited Modularity Slot	6	USB 2.0 type-A Port
3	Gigabit WAN (SFP)	7	Power Input, Battery, and Ignition connector. Refer to the DC Power section for pin-outs.
4	Gigabit Ethernet LAN/PoE (RJ45)	8	WLAN ANT 0 2.4/5GHz

Figure 4: Cisco IR829 Back Panel Single Modem, on page 11 shows the back panels details of the Cisco IR829 Single Modem.

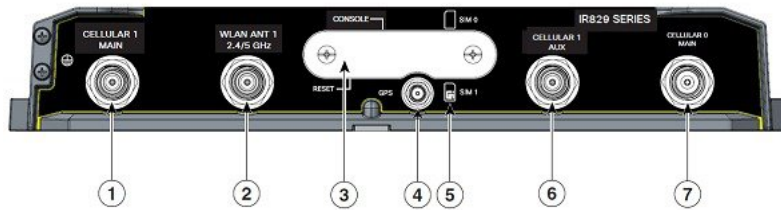
Figure 4: Cisco IR829 Back Panel Single Modem



1	WLAN ANT 0 5GHz	5	Denotes SIM card order, SIM0 on top and SIM1 on bottom.
2	WLAN ANT 1 2.4GHz	6	WLAN ANT 1 5GHz
3	Cover over SIM cards, reset button and console port cover, see Figure 6: Behind the SIM Door , on page 12	7	CELLULAR 0 MAIN
4	GPS SMA		

Figure 5: Cisco IR829 Back Panel Dual Modem, on page 12 shows the back panels details of the Cisco IR829 Dual Modem.

Figure 5: Cisco IR829 Back Panel Dual Modem



1	Cellular 1 Main	5	Denotes SIM card order, SIM0 on top and SIM1 on bottom.
2	WLAN ANT 1 2.4/5GHz	6	Cellular 1 AUX
3	Cover over SIM cards, reset button and console port cover, see Figure 6: Behind the SIM Door, on page 12	7	CELLULAR 0 MAIN
4	GPS SMA		

NOTE: Behind the SIM Door Assembly, there is a reset switch(1), Mini USB console port(2), and Dual SIM slots(3). See [Figure 6: Behind the SIM Door, on page 12](#) for details

Figure 6: Behind the SIM Door

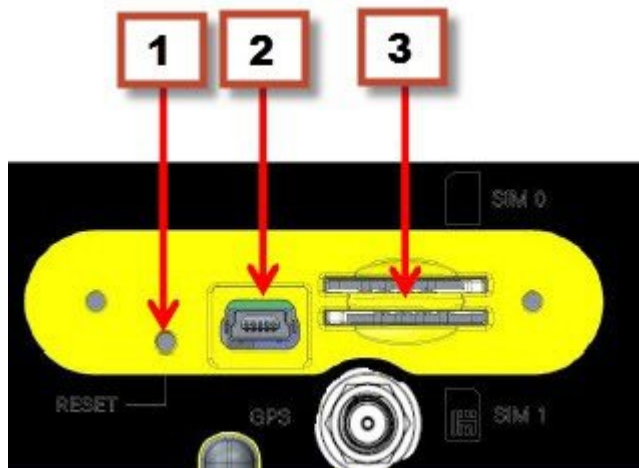


Figure 7: Cisco IR829 Top Cover (single modem version), on page 13 shows the top of the Cisco IR829.

Figure 7: Cisco IR829 Top Cover (single modem version)



Figure 8: Cisco IR829 LED Detail, on page 13 shows the LED detail from the Dual Modem SKU. Single Modem SKUs will only have Cellular 0 LEDs.

Figure 8: Cisco IR829 LED Detail



The following section shows a detailed description of the LEDs.

LEDs

The following table describes the LEDs for the Cisco IR829.

Table 1: LED Descriptions

LED	Activity	Description
PWR	Power Status	<p>In normal operating mode, after system boots. (typically about 2 minutes)</p> <p>Off — No power</p> <p>Green Steady on — Router is reachable, and all interfaces are up and functioning properly</p> <p>Green Flashing — Router is reachable, and no interface is in a failed state</p> <p>Amber Steady on — Router is unreachable (An external interface of the router, that prevents the router from being remotely managed, is in a critical failed state)</p> <p>Amber Flashing — Router is reachable, but at least one of the interfaces is in a non-critical failed state (functionality of that interface is affected)</p> <p>In bootup mode (during the first 60 seconds after powerup)</p> <p>Green Steady on — Router is booting</p> <p>Amber Steady on — Router has a system hardware failure</p> <p>In ROMMON mode:</p> <p>Amber Steady on — Router is in bootup phase or in ROM Monitor mode.</p>
POE	POE Power Supply Status	<p>Off — No -54V PoE power supply detected or no PoE board installed</p> <p>Green Steady on — 54V POE power supply good and all powered port operating normally</p> <p>Amber Steady on — 54V POE power supply good, but one or more POE ports has a fault.</p>
VPN	VPN	<p>Off — No VPN tunnel</p> <p>Steady on — At least one VPN tunnel is up</p>

LED	Activity	Description
GE0 WAN	Link Status	Off — No link Steady on — Link is up Flashing — Transmitting and Receiving data
GPS	GPS Status	Off — GPS not configured On — GPS configured Slow Flash — GPS Acquiring in Standalone GPS Fast Flash — GPS Acquiring in Assisted GPS Slow Flash is defined as the LED will be on for 0.25 seconds and off for 0.75 seconds. Fast Flash is defined as the LED will be on for 0.25 seconds and off for 0.25 seconds.
MOD	LED 0 LED 1 (not used)	LED 0 is used for the SKUs that support mSATA Off - Power off or no mSATA detected Green Steady on — mSATA detected
Ethernet LAN Switch Ports GE1-GE4] Single LED per Port	Link Status/POE Status	Off — No link Green Steady on — Link is up Green Flash — Transmitting and Receiving data Amber — POE Fault, implies no link
WLAN	2.4GHz 5GHz	Flashing Green — Radio is down, Bootloader, IOS Ethernet Initialization, IOS Start Up after system initialization. Green to Red to Amber — Discovery/Join process. Rapid Flashing Green — Joined to a controller Steady Green — One wireless client is associated. Flashing or Steady Red — The embedded AP803 inside the IR829 has reported a hardware or software problem.

LED	Activity	Description
CELLULAR0/CELLULAR1	RSSI	The RSSI LEDs are a 3 LED bar graph to indicate signal strength. Their functionality is described in the RSSI LED figure below.
CELLULAR0/CELLULAR1	ACT	Off — Module not powered on On — Module is powered on and connected but not transmitting or receiving Slow Flash — Module is powered on and searching for connection Fast Flash — Module is transmitting or receiving.
SIM0/SIM1	Sim cards	Off — No USIM Green — USIM installed and active

Table 2: RSSI LED

RSSI	RSSI (2)	RSSI (1)	RSSI (0)
	Green	Green	Green/Amber
< -110dBm	Off	Off	Off
-110 to -90dBm	Off	Off	On - Amber
-90 to -75dBm	Off	Off	On - Green
-75 to -60dBm	Off	On - Green	On - Green
> -60dBm	On - Green	On - Green	On - Green

Memory

The Cisco IR829 uses flash memory and main memory. The flash memory contains the Cisco IOS software image and the boot flash contains the ROMMON boot code. All memory components are factory default and not upgradeable by the end user.

Table 3: Cisco IR829 Memory, on page 16 shows the memory allocation.

Table 3: Cisco IR829 Memory

Memory	Capacity
DDR	2GB

Memory	Capacity
Boot ROM	16MB
System Flash	4GB

SKU Information

Table 4: Supported SKUs for Cisco IR829s, on page 17 lists the different SKUs available for the Cisco ISRs. All SKUs support external antenna.

Table 4: Supported SKUs for Cisco IR829s

SKU	LTE	Dual LTE	PoE	mSATA SSD	Availability
IR829GW-LTE-VZ-AK9	Yes	No	Optional	No	US - Verizon
IR829GW-LTE-NA-AK9	Yes	No	Optional	No	US (AT&T) and Canada
IR829GW-LTE-GA-*K9	Yes	No	Optional	No	Europe
IR829GW-LTE-LA-*K9	Yes	No	Optional	No	LATAM and APJC
IR829B-LTE-EA-*K9	Yes	No	No	No	North America and Europe
IR829M-LTE-EA-*K9	Yes	No	Yes	Yes	North America and Europe
IR829M-2LTE-EA-*K9	Yes	Yes	Yes	Yes	North America and Europe
IR829M-LTE-LA-ZK9	Yes	No	Yes	Yes	Australia, New Zealand and Brazil
IR829-2LTE-EA-*K9	Yes	Yes	Optional	No	North America and Europe

For detailed product information, see the [Cisco 829 Industrial Integrated Services Routers Data Sheet](#).

Hardware Features

This section provides an overview of the following hardware features for the Cisco IR829.

Platform Features for Cisco IR829

The following lists the hardware platform features for the Cisco IR829.

- Intel Atom Dual-Core Rangeley CPU, 1250 MHz

- 2GB DDR3 memory capacity
- 16MB SPI BIOS NOR flash
- 8GB (4GB usable) “eMMC” bulk storage flash
- 4-port GE LAN switch, optional PoE 802.3at (30W max) for Cisco devices only.

NOTE: The software does not support PoE negotiation over LLDP, only CDP. Therefore, PoE will only power up Cisco devices,

- WAN 1 GE SFP
- WWAN /WLAN
 - 2 internal mini PCIe slots for 3G/4G/LTE modems, dual SIM — 2 external SIM card slots
 - Single 802.11 a/b/g/n WiFi radio with MIMO support.
- Optional Limited Modularity (BYOI) slot
- One RJ45 RS232 DTE serial port
- One RJ45 RS232 DCE/RS485 serial port
- One USB 2.0 Type A external port
- One mini USB type B connector for console
- Lithium Ion battery backed-up RTC
- External Reset/Recovery Push Button
- External Power
 - Direct-wire 12/24VDC vehicle charging system input (9 — 32VDC)
 - 4-pin locking power connector
- External GPS SMA Connector
- Six External TNC/RP-TNC connectors (depends on the configuration) for connection to WWAN /WLAN internal modules
- Class A EMC compliance
- RoHS6 compliance
- Mechanical
 - Fanless operation
 - Form-factor with no cable cover = 11.00” x 7.70” x 1.73” (WDH)
 - Horizontal, Vertical, wall, floor, cabinet-mount and shelf-mount

Wi-Fi

Table 5: Wi-Fi domains, on page 18 shows the different Wi-Fi domains associated with the SKUs.

Table 5: Wi-Fi domains

SKU	Country	Wi-Fi Domain	Cellular Carrier
IR829GWR-LTE-LA-QK9	Japan	Q	NTT, DoCoMo, Softbank, KDDI
IR829GW-LTE-LA-DK9	India	D	N/A
IR829GW-LTE-LA-ZK9	Australia, New Zealand	Z	Telstra, Spark
IR829GW-LTE-LA-KK9	Korea	K	N/A

SKU	Country	Wi-Fi Domain	Cellular Carrier
IR829GW-LTE-LA-HK9	China	H	N/A
IR829GW-LTE-LA-LK9	Malaysia	L	N/A
IR829GW-LTE-LA-SK9	Hong Kong	S	N/A
IR829GW-LTE-LA-NK9	Panama	N	N/A
IR829GW-LTE-NA-AK9	North America	A	AT&T
IR829GW-LTE-VZ-AK9	North America	A	Verizon
IR829GW-LTE-GA-EK9	Global	E	Global
IR829GW-LTE-GA-ZK9	Australia	A	Australia

Reset Button

The Reset button resets the router configuration to the default configuration set by the factory. To restore the router configuration to the default configuration set by the factory, use a standard size #1 paper clip with wire gauge 0.033 inch or smaller and simultaneously press the reset button while applying power to the router.

NOTE: The rear cover must be removed to expose the reset switch.

NOTE: Before performing a write erase and reboot on the IR829, review the details in the [Cisco IR800 Integrated Services Router Software Configuration Guide](#). The IR829 differs from traditional IOS routers.

Antennas

The IR829 has RP-TNC connectors for Wi-Fi and TNC connectors for cellular. The IR829 also has an SMA connector for a GPS antenna.

Standard antennas are:

- Two multiband swivel-mount dipole antennae (ANT-4G-DP-IN-TNC) and one extender (4G-AE010-R).
- WLAN: Three Cisco Multiband Swivel-Mount Dipole Antennae. (AIR-ANTM2050D-R) for WLAN functionality.

For detailed information about Cisco Antennas, please refer to the following guides:

Cisco Industrial Routers Antenna Guide:

<http://www.cisco.com/c/en/us/td/docs/routers/connectedgrid/antennas/installing-combined/industrial-routers-antenna-guide.html>

Cisco Aironet Antennas and Accessories Reference Guide

http://www.cisco.com/c/en/us/products/collateral/wireless/aironet-antennas-accessories/product_data_sheet09186a008008883b.html

Antennas and Installation Scenarios

NOTE: Before choosing your antenna type and installation scenario, read through the following information.

Coexistence of radio standards:

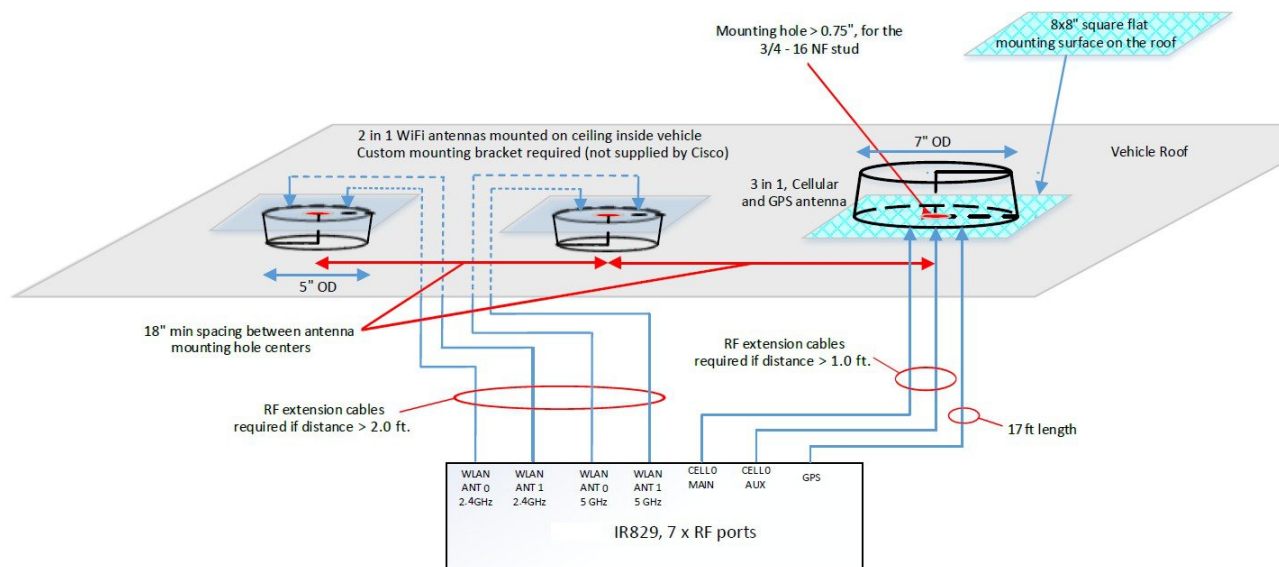
When operating and planning installation of products with WiFi, 4G LTE, and GPS wireless standards coexisting on the IR829 platform, the user needs to provision greater than 15dB isolation between the WiFi and LTE antennas at all frequencies of 4G LTE and WiFi operation for minimum impact to performance.

Ideally, isolation should be 20-25dB or more. Specifically, users should not install 4G LTE dipoles and WiFi dipoles on the chassis at the same time, since doing so would generally result in less than 15dB isolation and may have a strong impact on performance depending on frequency bands in question.

Vehicular 5-in-1 and 2-in-1 installation and deployment notes

In the section that follows, the 5-in-1 antenna refers to ANT-5-4G2WL2G1-O, and 2-in-1 antenna refers to ANT-2-WLAN-D-O.

IR829, 7 Port Vehicular Antennas Installation Diagram



Installation

Users need to provision a 8 x 8" flat mounting surface with a mounting hole on the roof of the vehicle for the 5-in-1 antenna, and a 6 x 6" flat mounting surface with a mounting hole for the 2-in-1 WiFi antenna. Without a flat mounting surface, the antenna will not meet IP67 standards and may have reduced service life.

Ground plane

Cisco recommends having a 1 foot ground plane under both the 5-in-1 and 2-in-1 antennas. In case of a metal vehicle roof, the roof itself shall be the ground plane. While Cisco has investigated the effects of ground plane and no ground plane, wireless performance was certified with the 1 foot ground plane.

Isolation between 5-in-1 and 2-in-1 antennas

Cisco recommends 18" inch spacing between the 5-in-1 and the 2-in-1 antenna centers for optimal isolation.

Cisco recommends routing the 2.4GHz WLAN ports of the IR829 to the 2-in-1 antenna, and the 5GHz ports to the 5-in-1 antenna to optimize isolation between WiFi 2.4 GHz and cellular 4G LTE. The 5-in-1 antenna has been fully optimized for WiFi and cellular LTE coexistence and isolation. Connecting the 2.4GHz WiFi signals to a separate antenna simply allows to user to optimize the antenna isolation further. Both the 5-in-1 and 2-in-1 are dual band WiFi capable and fully support both 2.4 GHz or 5GHz WLAN signals.

MIMO ports on 5-in-1 and 2-in-1

Cellular and WLAN ports on the 5-in-1 and 2-in-1 antennas support MIMO technology. MIMO brings significant improvements in throughput and robustness of the wireless link in fading channels. Users choosing to connect only one wireless port on MIMO capable products are giving up significant wireless performance in both throughput and robustness of the link.

- The individual 4G antenna cables on the 5-in-1 antenna can be connected to either cellular port of IR829. There is no one-to-one assignment requirement.
- The individual WLAN antenna cables on the 5-in-1 antenna and the 2-in-1 antenna can be connected to any WLAN port of IR829. There is no one to one assignment requirement.

The following section shows some examples of different installation scenarios.

Modem Support

The Cisco IR800 series Industrial routers use the MC73XX and MC74XX series modems. The software download page can be found here:

<https://software.cisco.com/download/navigator.html?mdfid=286288566&flowid=76082>

NOTE: Be sure to select the correct firmware download for your carrier.

The Cisco Firmware Upgrade Guide for Cellular Modems can be found here:

http://www.cisco.com/c/en/us/td/docs/routers/access/interfaces/firmware/Firmware_Upgrade.html

Previous versions of this guide contained additional configuration information which has now been relocated to the [Cisco IR800 Integrated Services Router Software Configuration Guide](#).

Supported Cisco Antennas and Cables

4G/LTE Radio Cables/Antennas

4G/LTE Radio Cables/Antennas Use Case 1

Item	Description
Antenna Arrangement	Front Panel Swivel Mount 4G-LTE dipoles

Item	Description
Indoor Cable	Chose one of 3 scenarios: <ul style="list-style-type: none"> • None • Quantity of 2 <ul style="list-style-type: none"> • PID: 4G-AE010-R • 10ft extension base for TNC dipole antennas • Quantity of 2 <ul style="list-style-type: none"> • PID: 4G-AE015-R • 15ft extension base for TNC dipole antennas
Adapter and/or Lightning Arrestor	None
External Cable	None
Antenna	Quantity of 2 4G Indoor Swivel Mount Dipole, 0 dBi, TNC(m), white <ul style="list-style-type: none"> • ANT-4G-DP-IN-TNC

4G/LTE Radio Cables/Antennas Use Case 2

Item	Description
Antenna Arrangement	1' 2', 5', 10', 15' or 20' cable to mast mounted antenna, Stick Omni or Directional Flat Panel antenna
Indoor Cable	None, router located in outdoor protective enclosure
Adapter and/or Lightning Arrestor	None
External Cable	RA-TNC(m) to N(m), LMR-400-DB, 20', qty 2 <ul style="list-style-type: none"> • "CAB-L400-20-TNC-N
Antenna	2x 4G Omni Stick, Standard Perf, 10" 2dBi, 1x N(f) each <ul style="list-style-type: none"> • ANT-4G-OMNI-OUT-N 1x 4G Panel Antenna, 2x N(f) each <ul style="list-style-type: none"> • ANT-4G-PNL-OUT-N

4G/LTE Radio Cables/Antennas Use Case 3

Item	Description
Antenna Arrangement	1' 2', 5', 10', 15' or 20' cable to mast mounted antenna, Stick Omni or Directional Flat Panel antenna

Item	Description
Indoor Cable	R/A-TNC(m) to N(m), LMR-240-FR/CMR, 2', qty 2 R/A-TNC(m) to N(m), LMR-240-FR/CMR, 1', qty 2 R/A-TNC(m) to N(m), LMR-240-FR/CMR, 5', qty 2 R/A-TNC(m) to N(m), LMR-240-FR/CMR, 10', qty 2 R/A-TNC(m) to N(m), LMR-240-FR/CMR, 15', qty 2 R/A-TNC(m) to N(m), LMR-240-FR/CMR, 20', qty 2 Note: These cables not available from Cisco
Adapter and/or Lightning Arrestor	None
External Cable	None
Antenna	1x 4G Panel Antenna, 2x N(f) each <ul style="list-style-type: none"> • ANT-4G-PNL-OUT-N

4G/LTE Radio Cables/Antennas Use Case 4

Item	Description
Antenna Arrangement	Front Panel Swivel Mount 4G-LTE dipoles
Indoor Cable	Chose one of 3 scenarios: <ul style="list-style-type: none"> • None • Quantity of 2 <ul style="list-style-type: none"> • PID: 4G-AE010-R • 10ft extension base for TNC dipole antennas • Quantity of 2 <ul style="list-style-type: none"> • PID: 4G-AE015-R • 15ft extension base for TNC dipole antennas
Adapter and/or Lightning Arrestor	None
External Cable	None
Antenna	Quantity of 2 4G Indoor Swivel Mount Dipole, 0 dBi, TNC(m), white <ul style="list-style-type: none"> • ANT-4G-DP-IN-TNC

4G/LTE Radio Cables/Antennas Use Case 4

Item	Description
Antenna Arrangement	Front Panel Swivel Mount 4G-LTE dipoles
Indoor Cable	Chose one of 3 scenarios: <ul style="list-style-type: none"> • None • Quantity of 2 <ul style="list-style-type: none"> • PID: 4G-AE010-R • 10ft extension base for TNC dipole antennas • Quantity of 2 <ul style="list-style-type: none"> • PID: 4G-AE015-R • 15ft extension base for TNC dipole antennas
Adapter and/or Lightning Arrestor	None
External Cable	None
Antenna	Quantity of 2 4G Indoor Swivel Mount Dipole, 0 dBi, TNC(m), black <ul style="list-style-type: none"> • 4G-LTE-ANTM-D

4G/LTE Radio Cables/Antennas Use Case 5

Item	Description
Antenna Arrangement	2x ceiling mount 4G-LTE antennas
Indoor Cable	None
Adapter and/or Lightning Arrestor	None
External Cable	None
Antenna	Quantity of 2 4G Indoor omni-directional Ceiling Mount 2 dBi, <ul style="list-style-type: none"> • 4G-ANTM-OM-CM Quantity of 2 4G Dipole Ceiling Mount 2 dBi <ul style="list-style-type: none"> • ANT-4G-DP-IP-TNC

4G/LTE Radio Cables/Antennas GPS Use Case 1

Item	Description
Antenna Arrangement	GPS Antenna with Integrated 15' coax cable, Mounted to top of Utility Cabinet Roof SMA(f), qty 1
Indoor Cable	None
Adapter and/or Lightning Arrestor	None
External Cable	None
Antenna	GPS Antenna Need one with integrated coax cable and SMA(m) connector, 17ft, outdoor, IP67 Quantity of 1 <ul style="list-style-type: none"> • GPS-ACT-ANTM-SMA=

Single Band Cisco WiFi Antenna**Supported Single Band Cisco WiFi Antenna Use Case 1**

Item	Description
Antenna Arrangement	Single Band, Front Panel Mounted Antennas
Radio Module	Dual Band Simultaneous 802.11n 2x2 MIMO WiFi Connectors: 4x RP-TNC (jack)
Adapter and/or Lightning Arrestor	N/A
Indoor Cable	N/A
External Cable	N/A
Antenna	2x Single Band, Swivel Mount Omni, RP-TNC(plug), 2.2dBi @ 2.4 GHz <ul style="list-style-type: none"> • AIR-ANT4941 2x Single Band, Swivel Mount Omni, RP-TNC(plug), 3.5dBi @ 5 GHz <ul style="list-style-type: none"> • AIR-ANT5135

Supported Single Band Cisco WiFi Antenna Use Case 2

Item	Description
Antenna Arrangement	Single Band, Single Element, Ceiling Mounted Antennas

Item	Description
Radio Module	Dual Band Simultaneous 802.11n 2x2 MIMO WiFi Connectors: 4x RP-TNC (jack)
Adapter and/or Lightning Arrestor	N/A
Indoor Cable	Choose one of 2: <ul style="list-style-type: none"> • None • RP-TNC (jack) to RP-TNC (plug), Outdoor rated, Plenum rated, 0.195" O.D. cable, 5' long • AIR-CAB005PL-R
External Cable	N/A
Antenna	2x Single Band, Ceiling Mount Omni, 36" LONG RG-58 cable with RP-TNC (plug), 5.2dBi @ 2.4 GHz <ul style="list-style-type: none"> • AIR-ANT1728 2x Single Band, Ceiling Mount Omni, 36" LONG RG-58 cable with RP-TNC (plug), 5.2dBi @ 5 GHz <ul style="list-style-type: none"> • AIR-ANT5160V-R

Supported Single Band Cisco WiFi Antenna Use Case 3

Item	Description
Antenna Arrangement	2.4 GHz, Dual Element, 5 GHz Single Element, Ceiling Mounted Antennas
Radio Module	Dual Band Simultaneous 802.11n 2x2 MIMO WiFi Connectors: 4x RP-TNC (jack)
Adapter and/or Lightning Arrestor	N/A
Indoor Cable	Choose one of 2: <ul style="list-style-type: none"> • None • RP-TNC(jack) to RP-TNC(plug), Outdoor rated, Plenum rated, 0.195" O.D. cable, 5' long • AIR-CAB005PL-R
External Cable	N/A

Item	Description
Antenna	<p>1x Single Band, Ceiling Mount Omni, Dual Element, 36" LONG RG-58 cable with RP-TNC, 2.0dBi @ 2.4 GHz</p> <ul style="list-style-type: none"> • AIR-ANT24020V-R <p>2x Single Band, Ceiling Mount Omni, 36" LONG RG-58 cable with RP-TNC (plug), 5.2dBi @ 5 GHz</p> <ul style="list-style-type: none"> • AIR-ANT5160V-R

Supported Single Band Cisco WiFi Antenna Use Case 4

Item	Description
Antenna Arrangement	Single Band, Dual Element, Wall Mounted Antennas
Radio Module	Dual Band Simultaneous 802.11n 2x2 MIMO WiFi Connectors: 4x RP-TNC (jack)
Adapter and/or Lightning Arrestor	None, or: RP-TNC lightning arrestor, qty 4 <ul style="list-style-type: none"> • AIR-ACC245LA-R
Indoor Cable	None
External Cable	Choose one of 4: <ul style="list-style-type: none"> • None • RP-TNC(plug) to RP-TNC(jack) LMR-400-DB, 5' qty 4 <ul style="list-style-type: none"> • AIR-CAB005LL-R • RP-TNC(plug) to RP-TNC(jack) LMR-400-DB, 20' qty 4 <ul style="list-style-type: none"> • AIR-CAB020LL-R • RP-TNC(plug) to RP-TNC(jack) LMR-400-DB, 50' qty 4 <ul style="list-style-type: none"> • AIR-CAB050LL-R • RP-TNC(plug) to RP-TNC(jack) LMR-600-DB, 100' qty 4 <ul style="list-style-type: none"> • AIR-CAB100ULL-R

Supported Single Band Cisco WiFi Antenna Use Case 5

Item	Description
Antenna	<p>1x Single Band, Dual Element, Wall Mount Patch, 18" LONG RG-58 cable with RP-TNC, 6.5dBi @ 2.4 GHz</p> <ul style="list-style-type: none"> • AIR-ANT2465P-R <p>1x Single Band, Dual Element, Wall Mount Omni, 18" LONG RG-58 cables with RP-TNC, 4.5dBi @ 5 GHz (INDOOR ONLY)</p> <ul style="list-style-type: none"> • AIR-ANT5145V-R <p>— OR</p> <p>1x Single Band, Dual Element, Wall Mount Patch, 18" LONG RG-58 cables with RP-TNC, 7.0dBi @ 5 GHz (INDOOR/OUTDOOR)</p> <ul style="list-style-type: none"> • AIR-ANT5170P-R

Supported Single Band Cisco WiFi Antenna Use Case 5

Item	Description
Antenna Arrangement	Single Band, Dual Element, Wall Mounted Patch, Indoor/ Outdoor Antennas
Radio Module	Dual Band Simultaneous 802.11n 2x2 MIMO WiFi Connectors: 4x RP-TNC (jack)
Adapter and/or Lightning Arrestor	N(f) to N(f), RF-adapter, qty 4 • AIR-ACC370-NF-NF
Indoor Cable	None
External Cable	RP-TNC(plug) to N(m)-R/A, LMR-240-DB, 5', qty 4 • AIR-CAB005LL-R-N
Antenna	<p>1x Single Band, Dual Element, Wall Mount Patch, 18" LONG RG-58 cable with N(m), 13dBi @ 2.4 GHz</p> <ul style="list-style-type: none"> • AIR-ANT2413P2M-N <p>1x Single Band, Dual Element, Wall Mount Patch, 18" LONG RG-58 cable with N(m), 14dBi @ 5 GHz</p> <ul style="list-style-type: none"> • AIR-ANT5114P2M-N

Dual Band Cisco WiFi Antenna

Supported Dual Band Cisco WiFi Antenna Use Case 1

Item	Description
Antenna Arrangement	Dual Band Front Panel Mounted Antennas

Item	Description
Radio Module	Dual Band Simultaneous 802.11n 2x2 MIMO WiFi Connectors: 4x RP-TNC (jack)
Adapter and/or Lightning Arrestor	N/A
Indoor Cable	N/A
External Cable	N/A
Antenna	2x Dual Band, Swivel Mount Omni, RP-TNC(plug), 2dBi @ 2.4 GHz, 4dBi @ 5 GHz <ul style="list-style-type: none"> • AIR-ANT2524DB-R

Supported Dual Band Cisco WiFi Antenna Use Case 2

Item	Description
Antenna Arrangement	Dual Band Front Panel Mounted Antennas
Radio Module	Dual Band Simultaneous 802.11n 2x2 MIMO WiFi Connectors: 2x RP-TNC (jack)
Adapter and/or Lightning Arrestor	N/A
Indoor Cable	N/A
External Cable	N/A
Antenna	1x Dual Band, Dual Element per Band, Omni, 18" LONG RG-58 cables with RP-TNC (plug), 2.0dBi @ 2.4 GHz (2 ports), 3.0dBi @ 5 GHz (2 ports) <ul style="list-style-type: none"> • AIR-ANT2451V-R

Supported Dual Band Cisco WiFi Antenna Use Case 3

Item	Description
Antenna Arrangement	Dual Band Front Panel Mounted Antennas
Radio Module	Dual Band Simultaneous 802.11n 2x2 MIMO WiFi Connectors: 2x RP-TNC (jack)
Adapter and/or Lightning Arrestor	N(f) to N(f), RF-adapter, qty 2 <ul style="list-style-type: none"> • AIR-ACC370-NF-NF
Indoor Cable	N/A

Item	Description
External Cable	RP-TNC(plug) to N(m)-R/A, LMR-240-DB, 5', qty 2 <ul style="list-style-type: none"> • AIR-CAB005LL-R-N
Antenna	2x Dual Band, Swivel Mount Omni, RP-TNC(plug), 2dBi @ 2.4 GHz, 4dBi @ 5 GHz <ul style="list-style-type: none"> • AIR-ANT2524DB-R

7 in 1 Antenna Configuration for Transportation

Transportation Use Case 1

Antenna Arrangement

7 x RF ports, with the IR829 deployed in a transportation application.

(Default Configuration)

Quinta 5-in-1 antenna AND a WiFi 2-in-1 antenna to utilize all 7 ports.

The 5-in1 Quinta antenna and the 2-in1 WiFi antennas need to be separated 18" between mounting hole centers of the two antennas.

Extension Cable

No extension cables are required if the IR829 is located within ~1.0ft of 5-in-1 antenna, and ~2.0ft of WiFi 2-in-1 antenna.

If these conditions are not met, this deployment requires the following extension cables:

Cellular extension cables (2 ports)

Qty 2X LMR-400-DB TNC(m)-R/A - TNC(f), 5ft

- 4G-CAB-LMR400-5

— **OR**

Qty 2X LMR-400-DB TNC(m)-R/A - TNC(f), 10ft

- G-CAB-LMR400-10

— **OR**

Qty 2X LMR-400-LLPL plenum / indoor only TNC(m)-R/A - TNC(f), 20ft

- 4G-CAB-ULL-20

WiFi 2.4 GHz / 5GHz extension cables (4 ports, can mix and match lengths per installation requirements if needed) Qty 4x LMR-400-DB RPTNC(plug) - STR RPTNC(jack) - STR, 5ft

- AIR-CAB005LL-R

— **OR**

Qty 4x LMR-400-DB RPTNC(plug)-R/A RPTNC(jack)-STR, 10ft

- CAB-L400-10-R

— **OR**

Qty 4x LMR-400-DB RPTNC(plug)-STR RPTNC(jack)-STR, 20ft

- AIR-CAB020LL-R

— **AND**

GPS port

No extension cable required, 5-in-1 antenna comes with integrated active GPS antenna with 17ft cable.

Antenna

Quinta 5 element 5-in-1 transportation antenna, black radome color, 2x 4G cellular, 2x dual band WiFi, 1xGPS

- ANT-5-4G2WL2G1-O
- 07-100261-01

Has the following integrated cables:

qty 2 x cellular, LMR-195, 2ft long, TNC(m)

qty 2 x WiFi, 2ft long, LMR-195 RPTNC (plug)

qty 1 x GPS, RG-174, 17ft long, SMA(m)

— **AND**

WiFi 2-in-1 2 element 2 in 1 transportation antenna, black radome color, 2x dual band WiFi

- ANT-2-WLAN-D-O

Has the following integrated cables:

qty 2 x WiFi, 3ft long, LMR-240 RPTNC (plug)

Transportation Use Case 2

Antenna Arrangement

7 x RF ports, with the IR829 deployed in a transportation application.

(Alternate Configuration, can be used in case the application calls for the WiFi antennas to be separate from the LTE antenna for example. a ceiling mount WLAN).

This case describes a Tercia 3-in-1 transportation antenna (which covers MIMO cellular and GPS) together with qty 2 x 2-in-1 WiFi antennas.

NOTE: A custom ceiling mount bracket is required for the 2-in-1 antenna if installed in a ceiling mount configuration (NOT SUPPLIED BY CISCO)

Extension Cable

No extension cables are required if the IR829 is located within ~1.0ft of 5-in-1 antenna, and ~2.0ft of WiFi 2-in-1 antenna.

If these conditions are not met, this deployment requires the following extension cables:

Cellular extension cables (2 ports)

Qty 2X LMR-400-DB TNC(m)-R/A - TNC(f), 5ft

- 4G-CAB-LMR400-5

— **OR**

Qty 2X LMR-400-DB TNC(m)-R/A - TNC(f), 10ft

- G-CAB-LMR400-10

— **OR**

Qty 2X LMR-400-LLPL plenum / indoor only TNC(m)-R/A - TNC(f), 20ft

- 4G-CAB-ULL-20

WiFi 2.4 GHz / 5GHz extension cables (4 ports, can mix and match lengths per installation requirements if needed) Qty 4x LMR-400-DB RPTNC(plug) - STR RPTNC(jack) - STR, 5ft

- AIR-CAB005LL-R

— **OR**

Qty 4x LMR-400-DB RPTNC(plug)-R/A RPTNC(jack)-STR, 10ft

- CAB-L400-10-R

— **AND**

GPS port - No extension cable required, 3-in-1 antenna comes with integrated active GPS antenna with 17ft cable.

Antenna

Quinta 5 element 5-in-1 transportation antenna, black radome color, 2x 4G cellular, 2x dual band WiFi, 1xGPS

- ANT-5-4G2WL2G1-O

Has the following integrated cables:

- qty 2 x cellular, LMR-195, 2ft long, TNC(m)
- qty 2 x WiFi, 2ft long, LMR-195 RPTNC (plug)
- qty 1 x GPS, RG-174, 17ft long, SMA(m)

— **AND**

WiFi 2-in-1 2 element 2 in 1 transportation antenna, black radome color, 2x dual band WiFi

- ANT-2-WLAN-D-O

Has the following integrated cables:

- qty 2 x WiFi, 3ft long, LMR-240 RPTNC (plug)

Power Supply

The Cisco IR829 comes with an external power connector.

- Direct-wire 12/24VDC vehicle charging system input (9 — 32VDC).
- 4-pin locking Molex power connector, Cisco part number 29-2562-01.

There is an external AC to DC power adapter for the IR829. It meets ITE standards and operating temperature range of -20C to 60C, but is not suited for industrial environment. Part Number is IR829-PWR125W-AC.

There is a 12.5 feet power cable available to order. Part Number is IR829-DC-PWRCORD.

IR829-PWR125W-AC



IR829-DC-PWRCORD



SFP Modules

The router Ethernet SFP modules provide connections to other devices. These field-replaceable transceiver modules provide the uplink interfaces. Local connectors (LCs) provide the fiber-optic connection. RJ-45 connectors allow copper connections. You can use any combination of the supported SFP modules listed in the table that follows.

Type of SFP Module	Model
Rugged and Industrial SFPs—40 to 185°F (-40 to 85°C)	GLC-SX-MM-RGD with digital optical monitoring (DOM) support GLC-LX-SM-RGD with digital optical monitoring (DOM) support GLC-ZX-SM-RGD with digital optical monitoring (DOM) support
Commercial SFPs 32° to 158°F (0° to 70°C)	GLC-SX-MM GLC-LH-SM GLC-BX-U, with Digital Optical Monitoring (DOM) support GLC-BX-D, with Digital Optical Monitoring (DOM) support CWDM-SFP, with Digital Optical Monitoring (DOM) support DWDM-SFP, with Digital Optical Monitoring (DOM) support
Extended Temperature SFP 23° to 185°F (-5° to 85°C)	SFP-GE-S, with Digital Optical Monitoring (DOM) support SFP-GE-L, with Digital Optical Monitoring (DOM) support SFP-GE-Z, with Digital Optical Monitoring (DOM) support GLC-SX-SMD GLC-LH-SMD GLC-EX-SMD GLC-TE GLC-FE-100LX-RGD GLC-FE-100FX-RGD

Type of SFP Module	Model
Copper SFP	GLC- T (0 to 70°C)
Supported on IOS 15.6(3)M but GE only	SFP-GE-T (-5 to 85°C)

NOTE: The WAN port GE0 can accept either fiber SFP or Copper SFP modules. The speed is fixed at 100Mbps or 1Gbps depending on the SFP installed. Since there is no I-temp copper SFP available in the market, there is no Copper SFP supported. In order to use a Copper SFP, you must enter service internal mode, and enter “unsupported transceivers”. Then unplug and insert the Copper SFP again.

NOTE: Speed and duplex commands are not available on the GE0 WAN interface.

The following two Copper SFPs (non I-temp) will be officially supported at 1Gbps:

- Copper SFP - GLC- T
 - Copper 1Gbps, (0 to 70°C), CPN is 30-1410-04
- Copper SFP - SFP-GE-T
 - Copper 1Gbps, (-5 to 85°C), CPN is 30-1421-02

Additional SFPs with added support are:

- GLC-FE-100LX-RGD
 - Fiber (fixed speed of 100Mbps)
- GLC-FE-100FX-RGD
 - Fiber (fixed speed of 100Mbps)
- GLC-TE
 - Copper (fixed speed of 1Gbps)
- GLC-FE-T=
 - Copper 100Mbps

NOTE: Auto negotiation is not supported on these SFPs.

For minimum software requirements, refer to the Release Notes for your platform.

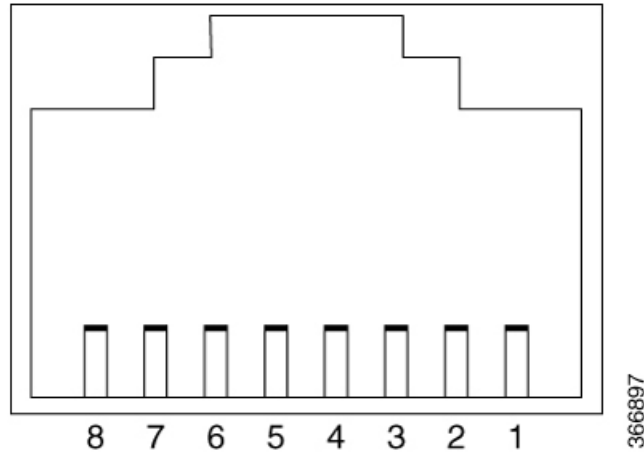
For the most up-to-date list of supported SFP models for Cisco Industrial Ethernet switches, see http://www.cisco.com/en/US/docs/interfaces_modules/transceiver_modules/compatibility/matrix/OL_6981.html#wp138176

Serial RJ45 Ports

Two RJ45 serial ports are provided to control and monitor RS232 or RS485 equipment. Serial port 0 can be configured for either RS232 DCE or RS485 half or full duplex. Serial port 1 can be configured for RS232 DTE only.

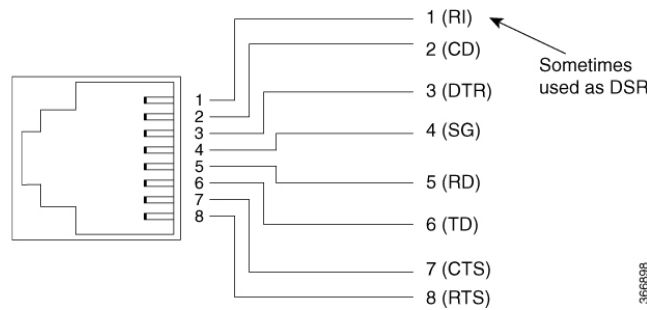
The RJ45 connector orientation as it appears on the router is shown in [Figure 9: RJ45 connector, on page 35](#).

Figure 9: RJ45 connector



The RJ45 pinouts are shown in [Figure 10: RJ45 Pinouts](#), on page 35

Figure 10: RJ45 Pinouts



Serial Port Characteristics

Figure [#unique_56 unique_56_Connect_42_tab_1193452](#) shows the characteristics of the S0 and S1 ports.

Table 6: S0 and S1 Characteristics

RS232					RS485 Full Duplex		RS485 Half Duplex	
Pin #	Signal Description	Abbr.	S0 (DCE)	S1 (DTE)	Signal	DIR	Signal	DIR
1	DCE Ready, used as DSR in IOS	DSR/RI	output	input	TX+	output	TX+	<->
2	Received Line Signal Detector	DCD	output	input	TX-	output	TX-	<->
3	DTE Ready	DTR	input	output	RX-	input		
4	Signal Ground	COM			COM		COM	
5	Received Data	RxD	output	input				
6	Transmitted Data	TxD	input	output	RX+	input		

RS232					RS485 Full Duplex		RS485 Half Duplex	
7	Clear To Send	CTS	output	input				
8	Request To Send	RTS	input	output				

Cisco refers to the signal on pin 1 as DSR. Use the **show interface async 0 (or 1)** from the IOS command line will give you the state of the modem control signals on the last line:

DCD=up DSR=up DTR=down RTS=down CTS=up

Note: The Serial 0 and Serial 1 pin out is different from the Console/Auxiliary port, do **NOT** use the RJ-45 to DB-9 Blue colored Console Cable (72-3383-01).

DTE to DCE

While the equipment shown in [Figure 11: Traditional DTE to DCE concept, on page 36](#) is less common today, the concept of DTE (Data Terminal Equipment) and DCE (Data Communication Equipment) comes from the use of dial-up modems that were used on the telephone network until the late 1990's.

Figure 11: Traditional DTE to DCE concept

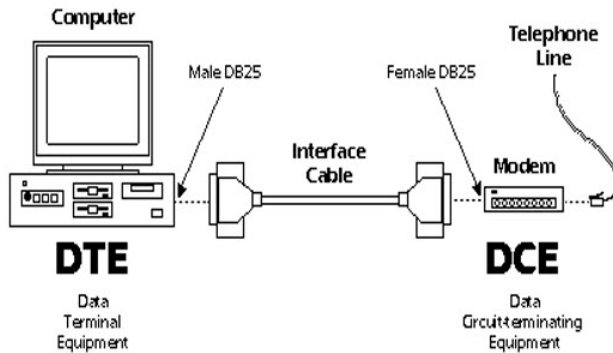


Table 7: RS-232 logic and voltage levels

Data Circuits	Control Circuits	Voltage
0 (space)	Asserted	+3 to +15 V
1 (mark)	Deasserted	-15 to -3 V

Note: Circuits must tolerate voltages of +/- 15 V with respect to a ground reference and be able to withstand indefinite short circuit to ground. Minimum outputs for the IR809 and IR829 are +/- 5 V.

RS232 Port

The RS232 signal names in [#unique_56 unique_56_Connect_42_tab_1193452](#) apply to both Serial 0 and Serial 1 ports on the IR809 and IR829. It is the direction of the data and flow control signals that differs. The RS232-DCE port, Serial 0, is designed to be connected to a far-end DTE port, or to another DCE port via a crossover (null-modem) cable. The RS232-DTE port, Serial 1 is designed to be connected to a far-end DCE port, or to another DTE port via a crossover (null-modem) cable.

CAUTION: please read the following three caution statements.

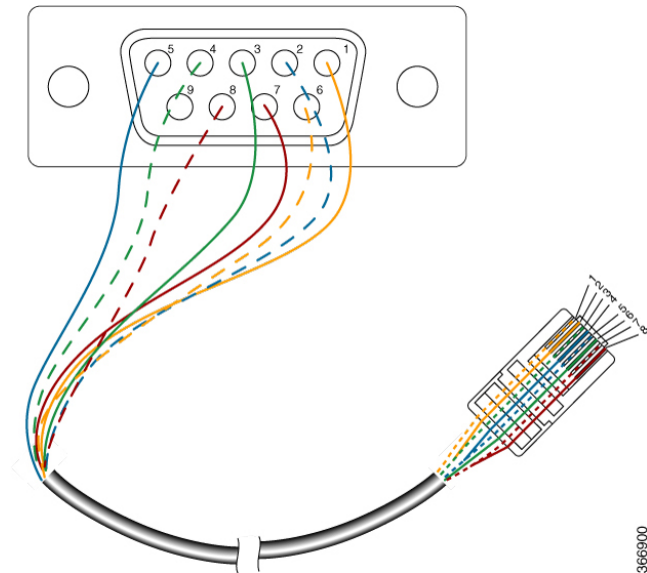
- This port is not shared with the Console port as is seen on some routers and switches in the Cisco Enterprise Portfolio where a console is provided that can be accessed both via USB and RS232 delivered on an RJ-45 style physical port.
- The pinout is also different from the connector pinout that was used for a Cisco RS232 console delivered on an RJ-45 style physical port.
- Serial 0 and Serial 1 use EIA-561 standard for RS-232 signals on an RJ-45 style physical port. This means the “baby blue” colored Cisco Serial Console Cable (72-3383-01) **WILL NOT WORK**.

RS232 is Point to Point – DTE to DCE

EIA/TIA-561 Pin Layout with a DB9 Connector

The pinouts are shown in [Figure 12: DB9 pinout, on page 37](#)

Figure 12: DB9 pinout



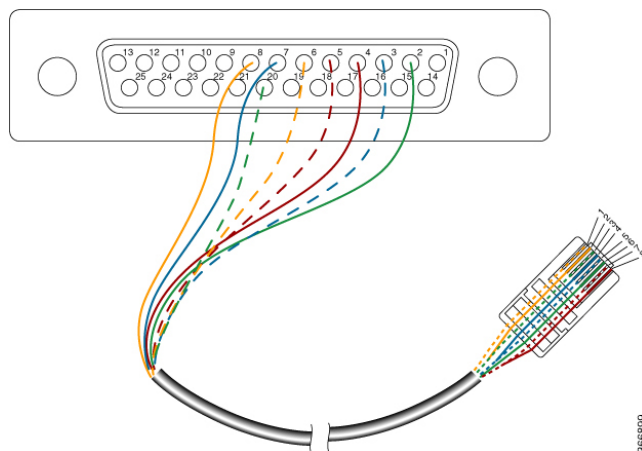
DB9 Female connector viewed from the front. Plugs into the PC.

8P8C plug, commonly referred to as RJ45. Plugs into controlled equipment.

EIA/TIA-561 Pin Layout with a DB25 Connector

The pinouts are shown in [Figure 13: DB25 pinout, on page 38](#)

Figure 13: DB25 pinout



DB25 Female connector viewed from the front. Plugs into the PC.

8P8C plug, commonly referred to as RJ45. Plugs into controlled equipment.

EIA/TIA-561 Pin Layout and RS-232 pin assignments

Note: The cable pinouts shown in [EIA/TIA-561 Pin Layout with a DB25 Connector, on page 37](#) and [EIA/TIA-561 Pin Layout with a DB9 Connector, on page 37](#) illustrate pin 1 on the RJ45 connector connecting to pin 6 on the DB9/DB25 connector.

[Table 8: RJ45 Pin Layout and RS-232 pin assignments, on page 38](#) shows the pin layout and signal assignment for both the DB9 and RS-232 plugs.

Table 8: RJ45 Pin Layout and RS-232 pin assignments

8P8C (RJ45)	DB9	DB25	Signal	Description
1	6 or 9	6 or 22	RI Ready (Used as DSR in IOS)	Ring Indicator, (used as DSR in IOS) Optional use.
2	1	8	DCD	Data Carrier Detect
3	4	20	DTR	Data Terminal Ready
4	5	7	SG (COM)	Signal Ground (Common)
5	2	3	RXD	Received Data
6	3	2	TXD	Transmitted Data
7	8	5	CTS	Clear To Send
8	7	4	RTS	Request To Send

Serial 0 configured as an RS485 Port

The RS232 pin out follows the EIA-561 standard, however, there is no standard for an RJ-45 connector used for RS485. In the IR809 and IR829, the pin-pairs 1,2 and 3,6 were chosen for RS485 so that an Ethernet CAT-5 with the standard twisted-pair pin assignments can be used.

Note: RS485 usually requires 120 Ohm terminators at each end of the bus but there may be variations that depend upon the cable type.

The following are some of the common RS485 characteristics:

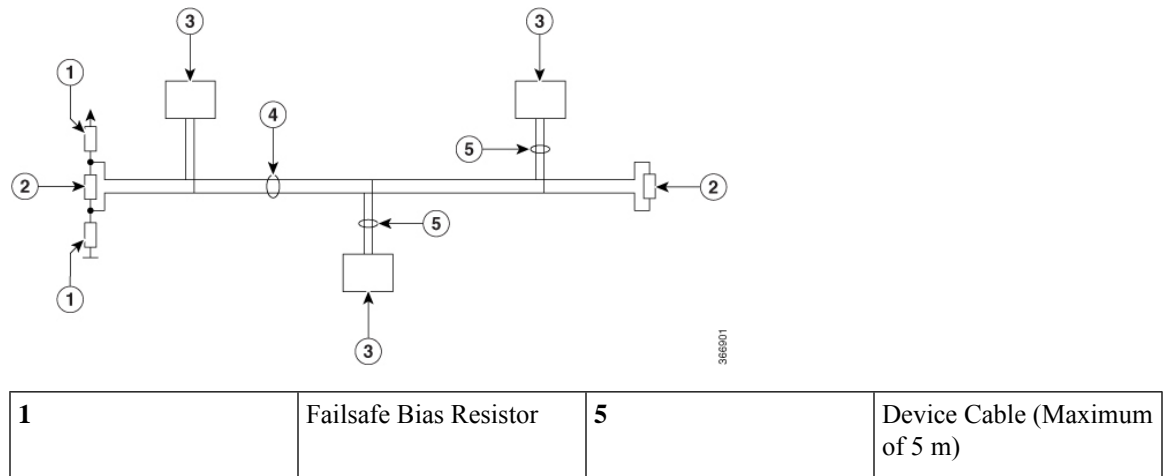
- Electrical
 - Same signal levels as RS-422 except the topology is implemented as a bus rather than point-to-point
 - A – B (differential signal) < -0.3V = MARK = OFF = logical 1
 - A – B (differential signal) > +0.3V = SPACE = ON = logical 0
- Implications
 - When RS485 is implemented as a bus, effectively, this is a form of a LAN and requires a higher level protocol. As a bus technology, you must have a protocol that controls access to the media vs. point-to-point where you can simply stream individual asynchronous characteristics.
 - Since higher level protocol are used and the technology is primarily a LAN, no MODEM control signals are implemented in RS485.

2 Wire RS485 (Half Duplex)

Characteristics of a 2 wire, or Half Duplex RS485 connection include:

- Bus cable with a max. length of 1200 m (4000 ft) depending upon cable quality and speed of the data
- Stub cable with a max. of 5 meters
- Multi-master capability similar to coaxial cable based Ethernet
- Inverted line is generally indicated by the index "A" or "-" (TX/RX-)
- Non-inverted line designated as "B" or "+" (TX/RX+)
- Except for trivially short point to point connections, terminating resistors are generally required.
- A ground wire is also normally used in addition to what is shown in [Figure 14: 2 Wire RS485 \(Half Duplex\)](#), on page 39

Figure 14: 2 Wire RS485 (Half Duplex)



4 Wire RS485 (Full Duplex)

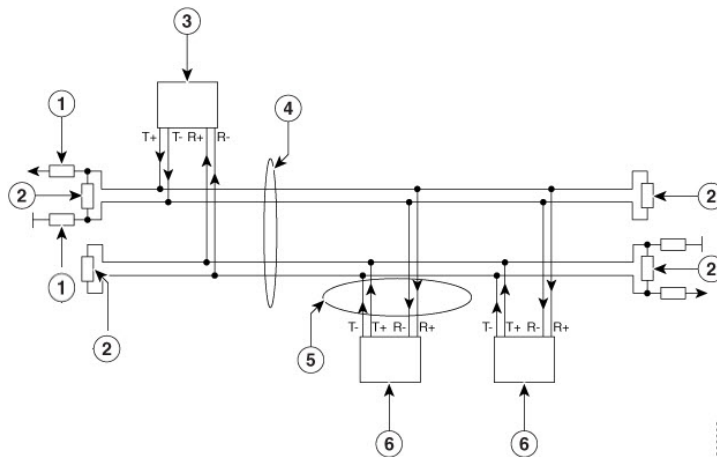
2	Terminating Resistor	6	
3	RS485 Device	7	
4	Bus Cable 1200m (4000 ft.)		

4 Wire RS485 (Full Duplex)

Characteristics of a 4 wire, or Full Duplex RS485 connection include:

- Bus cable with a max. length of 1200 m (4000 ft) depending upon cable quality and speed of the data
- Stub cable of max. 5 meters
- Master/slave applications
- Inverted line is generally indicated by the index "A" or "-"
- Non-inverted line designated as "B" or "+"
- Except for trivially short point to point connections, terminating resistors are generally required.
- A ground wire is also normally used in addition to what is shown in [Figure 15: 4 Wire RS485 \(Full Duplex\)](#), on page 40

Figure 15: 4 Wire RS485 (Full Duplex)



1	Failsafe Bias Resistor	5	Device Cable (Maximum of 5 m)
2	Terminating Resistor	6	RS485 Slave
3	RS485 Master	7	
4	Bus Cable 1200m (4000 ft.)		

Wiring Recommendations for RS-485 Networks:

- Typically Category 5 Ethernet cable is suitable for RS-485.
- Shielded cable is desirable and the shield should be grounded at on end if it is used.

- Half Duplex - one pair shall be used for TX/RX+ and TX/RX- signals (orange and white/orange) and one wire for GND (blue).
- Full Duplex - one pair shall be used for RX+ and RX- signals (green and white/green), one pair shall be used for TX+ and TX- signals (orange and white/orange), and one wire for GND (blue).
- Unused wires should be terminated with 100 ohm resistors to ground at both ends of the cable using your chosen wire termination method, e.g. screw terminals, punch down blocks, etc. This will help to avoid undesirable inductive pickup in the unused conductors.

RS485 Termination Resistors

The following are some best practices when using terminating resistors:

- When the bit time is not substantially longer than the loop time of the cable, termination is crucial for minimizing reflections. (Speed for the signal to go the length of the cable and reflect back)
- If the bit time is substantially longer than the loop time of the cable, you can usually get by without terminating resistors as can be observed with short point to point cables at lower baud rates.
- For standard termination, you would match the termination resistor value with the differential-mode characteristic impedance of the cabling on both ends of the network. Typically 120 Ohm.
- No 120 Ohm terminations are used on the other multi-drop ports in the middle of the network, only at the two far ends of the network.

RS485 Failsafe Resistors

The following are some best practices when using failsafe resistors:

- When inputs are between -200mV and +200mV, receiver output is "undefined". There are four common fault conditions that result in the undefined receiver output that can cause erroneous data:
 - All transmitters in a system are in shutdown.
 - The receiver is not connected to the cable.
 - The cable has an open.
 - The cable has a short.
- Fail-safe biasing is used to keep the receiver's output in a defined state when one of these conditions occurs.
- The fail-safe biasing consists of a pull-up resistor on the non-inverting line and a pull-down resistor on the inverting line.
- With proper biasing, the receiver will output a valid high when any one of the fault conditions occurs.
- Fail-safe bias resistors should be placed at the receiver end of the transmission line.

Serial Port Control

The entire layer 1 configuration of the IR809 / IR829 serial ports is done in IOS under the following constructs. The following example shows values other than the defaults to show most of the IOS keywords.

```
interface Async0 (or Async 1)
no ip address
encapsulation relay-line
line 1 (or line 2)
transport preferred none
transport input all
transport output all
databits 7
parity odd
```

```
stopbits 1
speed 1200
```

Note: To allow an IOx application to control the serial port parameters (set baud rate, data bits, parity, stop bits), you must use the “propagation” keyword as shown in the following example:

```
IR800#conf t

Enter configuration commands, one per line. End with CNTL/Z.
IR800(config)#relay line 1 1/5 ?

propagation Allow virtual serial port to control the parameters
<cr>

IR800(config)#relay line 1 1/5 propagation
```

Virtual Serial Ports

Line 1/5 and 1/6 are the Linux serial ports viewed from IOS

```
line 1/5 1/6
transport preferred none
transport input all
transport output all
```

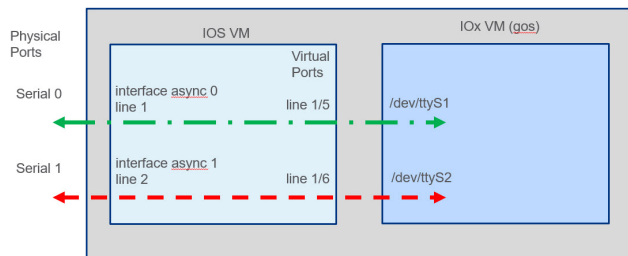
The physical and virtual ports are then linked by the following constructs:

```
relay line 1 1/5
relay line 2 1/6
```

- The serial devices, line 1/5 and 1/6, in IOS are instantiated in IOx as /dev/ttyS1 and /dev/ttyS2.
- The IOx serial device on the Linux host can then be exposed to an application container.

The port mapping from the physical port through IOS to the IOx would appear as in [Figure 16: Port Mappings, on page 42](#):

Figure 16: Port Mappings



To switch Serial 0 from RS232 to RS485, the configuration is set in interface Async0. The RS485 half or full duplex is set there as well. For example:

RS485 HALF DUPLEX - Serial 0 Only:

```
interface Async0 no ip address
encapsulation relay-line half-duplex
media-type rs485
```

RS485 FULL DUPLEX - Serial 0 Only:

```
interface Async0 no ip address
encapsulation relay-line full-duplex (
<- default- will not print for a "show run" command
)
media-type rs485
```

Additional Resources

How Far and How Fast Can You Go with RS-485:

<https://www.maximintegrated.com/en/app-notes/index.mvp/id/3884>

Interface Circuits for TIA/EIA-232-F – Design Notes:

<http://www.ti.com/lit/an/slla037a/slla037a.pdf>

RS232 Quick Guide

<http://cds.linear.com/docs/en/product-selector-card/RS232%20Quick%20Guide.pdf>



CHAPTER 3

Installing the Router

This chapter describes the equipment and the procedures for successfully installing the Cisco IR829 and contains the following sections:

- [Installing the Router, on page 45](#)
- [Equipment, Tools, and Connections, on page 46](#)
- [Installing the Router, on page 46](#)

Installing the Router

This chapter describes the equipment and the procedures for successfully installing the Cisco IR829 and contains the following sections:

CAUTION: Do not place anything on top of the router that weighs more than 10 pounds (4.5 kilograms), and do not stack routers on a desktop. Excessive weight on top of the router could damage the chassis.

CAUTION: Do not install the router or power supplies next to a heat source of any kind, including heating vents.

WARNING: Read the installation instructions before connecting the system to the power source. Statement 1004

WARNING: Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

WARNING: No user-serviceable parts inside. Do not open. Statement 1073

WARNING: Ultimate disposal of this product should be handled according to all national laws and regulations. Statement 1040

WARNING: Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, because they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes (for example, U.S.:NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54). Statement 1052

WARNING: This product is not intended to be directly connected to the Cable Distribution System. Additional regulatory compliance and legal requirements may apply for direct connection to the Cable Distribution System. This product may connect to the Cable Distribution System ONLY through a device that is approved for direct connection. Statement 1078

Equipment, Tools, and Connections

This section describes the equipment, tools, and connections necessary for installing your Cisco IR829. It contains the following topics:

Items Shipped with your Router

Unpack the box and verify that all items listed on the invoice were shipped with the Cisco IR829.

The following items are shipped with your router:

- Getting Started Guide Part Number 78-100611
- Power Cable components
- Grounding Lug
- Ethernet Cable Part Number 75-1501-01

Additional Items

The following items are not shipped with the router but are required for installation:

- ESD-preventive cord and wrist strap.
- Screws for mounting the router on a wall.
- Two number-8 wood screws (round- or pan-head) with number-8 washers or two number-8 washer-head screws, for mounting on a wall stud. The screws must be long enough to penetrate at least 3/4 inch (20 mm) into the supporting wood or metal wall stud.
- Two number-8 wall anchors with washers, for mounting the router on a hollow wall.
- Wire crimper for chassis grounding.
- Wire for connecting the chassis to an earth ground.
- Ethernet cables for connecting to the Fast Ethernet (FE) WAN and LAN ports.
- Ratcheting torque flathead screwdriver that exerts up to 15 in-lb (1.69 N-m) of pressure.
- A number-2 Phillips screwdriver.

Ethernet Devices

Identify the Ethernet devices that you will connect to the router: hub, servers, and workstations or PCs. Ensure that each device has a network interface card (NIC) for connecting to Ethernet ports.

If you plan to configure the software using Cisco IOS commands through the console port, provide an ASCII terminal or a PC that is running terminal emulation software to connect to the console port.

Installing the Router

This section describes how to install the Cisco IR829. This router can be installed on a table top or other flat horizontal surface mounted on a wall or DIN rail.

The recommended clearance when horizontally mounted is 1.5 inches on both sides for floor mount bracket clearance and 2 inches on top. Top clearance is not required but stacking heat-dissipating objects on top of

the router is not allowed. I/O side clearance is needed as it is required to access the cable connections. Clearance is not required on the backside (opposite side from I/O face) unless DIN rail mounting is required. Clearance is required to attach and mount the DIN rail bracket. The same clearances apply when mounted vertically.

This section also describes how to attach external antennas to the routers and contains the following topics:

Warnings

WARNING: This equipment needs to be grounded. Use a green and yellow 6 AWG ground wire to connect the host to earth ground during normal use. Statement 242

Accessing the SIM Cards

The SIM cards are high reliability, and cellular multihoming support for dual SIM card socket.

The IR800 series of routers use the Mini-SIM (2FF). Specifications are:

- ISO/IEC 7810:2003, ID-000
- Length - 25mm, Width - 15mm, Thickness - 0.76mm
- To ensure a reliable contact to the SIM socket, gold plated SIM cards must be used

This section describes how to install and/or replace a SIM card. Ensure that the router is not mounted to a wall, floor, or DIN rail.



Caution Do not touch any part of the exposed PCB circuit area when the SIM cover is removed.



Warning The covers are an integral part of the safety design of the product. Do not operate the unit without the covers installed. **Statement 1077**



Warning Hot surface. **Statement 1079**



Note High Temperature SIMs are required for 4G operations if the Ambient temperature is above 95F (35C)

To access the SIM card in the Cisco IR829, follow these steps:

1. Place the router on its bottom and ensure that any installed antennas are carefully oriented.
2. Remove the SIM access panel using two Phillips head screws. (See [Figure 17: Accessing the SIM Cards, on page 48.](#))
3. Locate the SIM card you wish to install/replace. Details are shown in [Figure 18: Sim Card Detail, on page 48.](#)
4. Remove the SIM card (if present) and install the new card(s).

- To install a card, slide it into the slot, and press it in until it clicks in place. The card is keyed so that you cannot insert it the wrong way.
- To remove the card, push it in until it releases for it to pop out. Place it in an antistatic bag to protect it from static discharge.

Figure 17: Accessing the SIM Cards

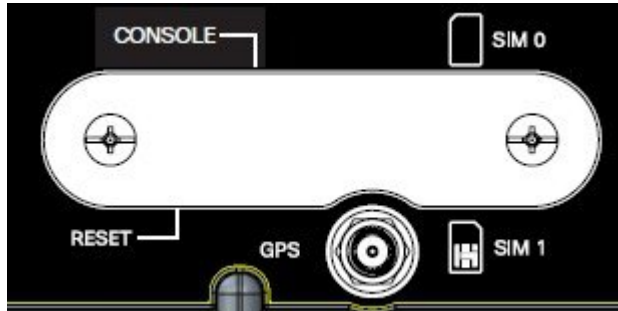
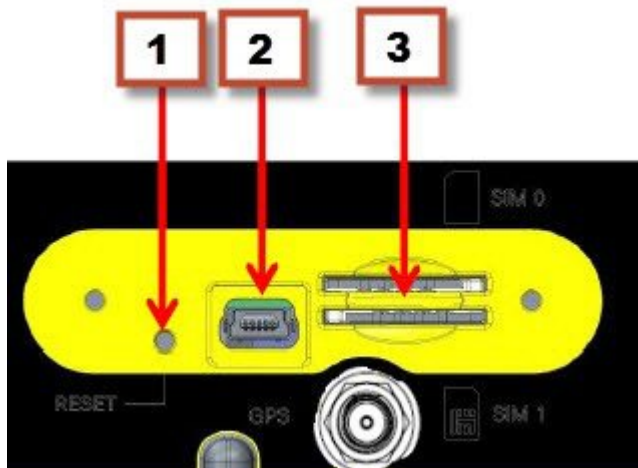


Figure 18: Sim Card Detail



1	Reset Button
2	Mini USB Port
3	Dual Sim Slots

Replace the panel and the screws.

Installing Antennas

NOTE: Before you install the Cisco IR829 Integrated Services Router on a table, wall, or DIN rail, install the antennas on the front panel. It is difficult to install the antennas after the router is installed.

There are two TNC connectors on the front side of the chassis. There are four TNC and one SMA connectors on the back side of the chassis. Two TNC connectors are used to connect to the 4G modem. The four TNC

connectors at the back will be connected to the two 4G modems. The front two TNC connectors will be used for WiFi.

Orient the antennas. For optimum wireless performance, the antennas should be perpendicular with respect to the floor.

If the router is being mounted on a desk, orient the antennas straight up.

To attach the radio antennas to your wireless router, follow these steps:

1. Manually screw the antenna tight to the TNC connectors on the back of the router.
2. Orient the antennas. For optimum wireless performance, antennas should be generally perpendicular to each other.

Mounting on a Wall, Table, or Other Flat Surface

The Cisco IR829 has mounting holes on the bottom of the chassis for mounting the unit on a wall or other vertical surface. The attachment hardware is provided.



Note When choosing a location for wall-mounting the router, consider cable limitations and wall structure.

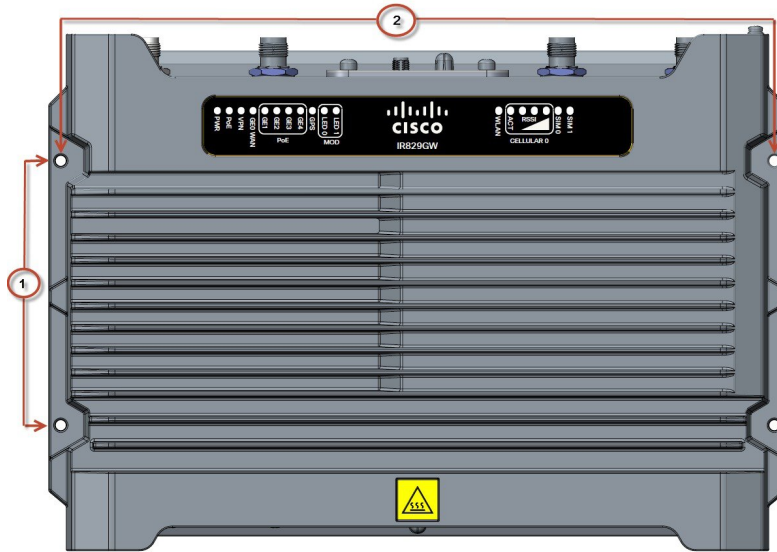


Warning Read the wall-mounting instructions carefully before beginning installation. Failure to use the correct hardware or to follow the correct procedures could result in a hazardous situation to people and damage to the system. **Statement 378**

To mount the router on a wall, follow these steps:

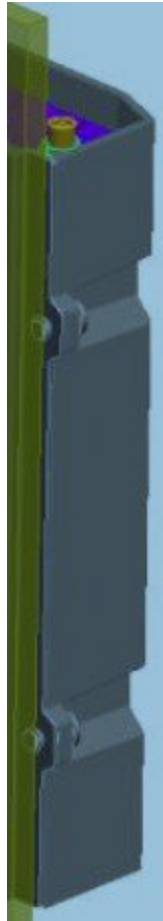
1. Locate the mounting holes on the router. There are 4 holes are shown in [Figure 19: Cisco IR829 Mounting Holes, on page 50](#). The mounting distance between the holes shown as #1 is 3.94 inches (10.0 cm), and the mounting distance between the holes shown as #2 is 10.64 inches (27.0 cm).

Figure 19: Cisco IR829 Mounting Holes



2. Install the router to a wall stud using two number-8 wood screws, round- or pan-head, with number-8 washers or two number-8 washer-head screws. The screws must be long enough to penetrate at least 1.0 inch (25.4 mm) into the supporting wood or metal wall stud. (See [Figure 20: Mounted to wall, on page 51.](#))

Figure 20: Mounted to wall



NOTE: For hollow-wall mounting, each bracket requires two wall anchors with washers. Wall anchors and washers must be size number 8.

3. Route the cables so that they do not put a strain on the connectors or mounting hardware. Cables should be routed down relative to the router to prevent water from traveling on the cables.

Installing a DIN Rail

The DIN Rail can be installed in four different orientations. Connectors facing UP is not recommended because of water and dust ingress.

To attach the Cisco IR829 to a DIN rail, follow these steps:

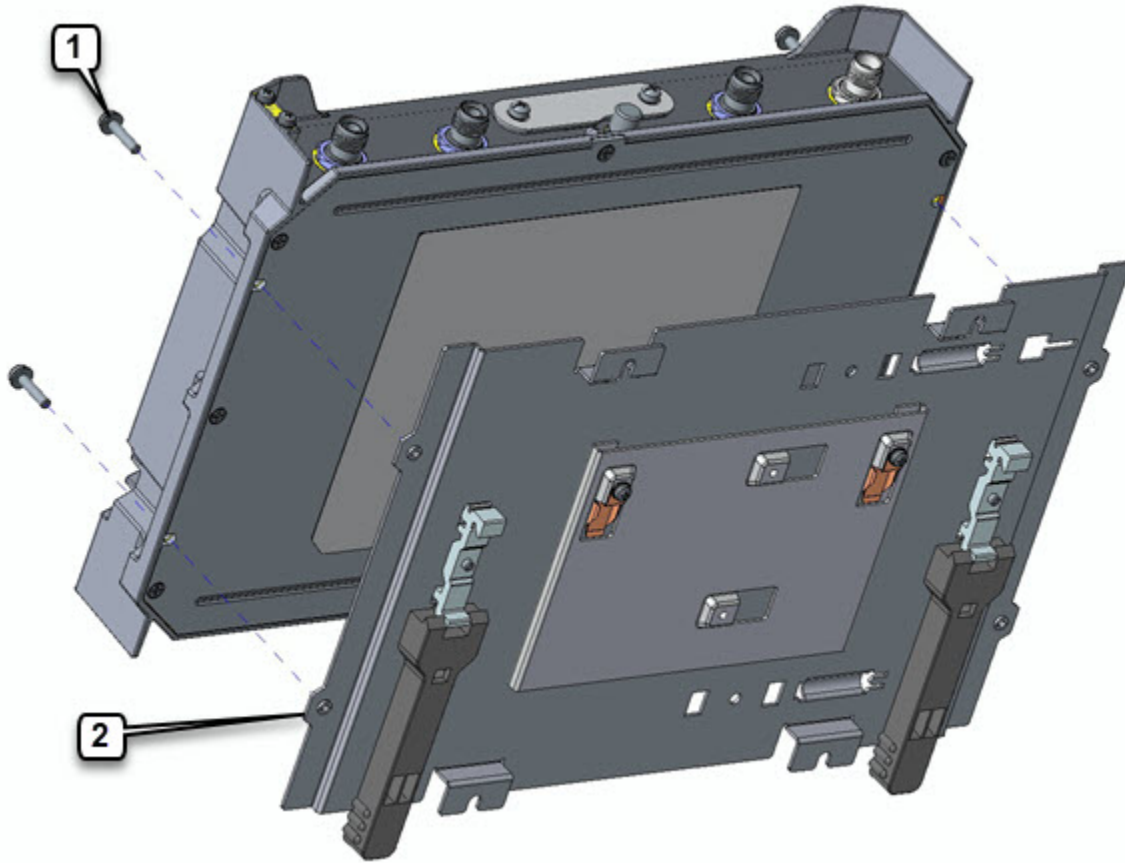
Before you begin

The DIN Rail kit is ordered separately. The PID is IR829-DINRAIL.

Step 1

Attach the DIN rail bracket to the back of the router. Align the DIN rail bracket on the back of the router and secure it to the 4 mounting points using the 4 screws provided. See the following figure.

Figure 21: Mounting the DIN Rail Bracket on the Router

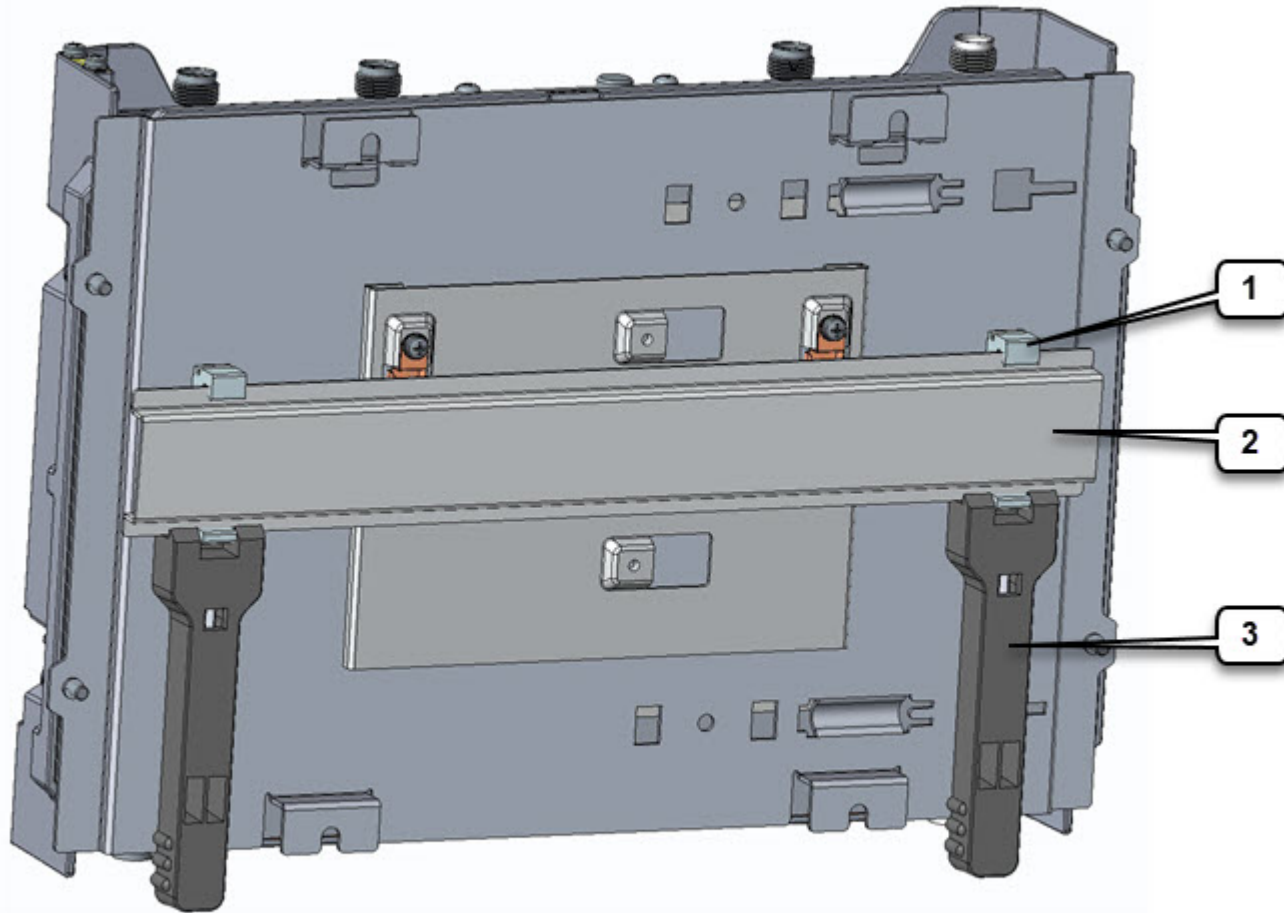


Item	Description
1	Mounting screws
2	Mounting holes in DIN bracket

Step 2 Torque the 4 screws to 22-30 in-lbs.

Step 3 Once the bracket is attached to the router, it can be mounted onto the DIN Rail. See the following figure.

Figure 22: Attaching the Device to the DIN Rail



Item	Description
1	DIN Rail Clips
2	DIN Rail
3	Spring-Loaded Handles

Step 4 Position the router so that the hook on the DIN rail bracket hooks onto the top edge of the DIN rail. The weight of the product can rest on the hook temporarily while the DIN rail bracket latches are secured.

Step 5 Pull down the spring loaded handles at the same time and slide the DIN Rail bracket up and over the latches.

- Step 6** Push the DIN rail bracket latch up after the router is over the DIN rail to secure it. The router is now installed in the DIN rail.
- Step 7** To remove the router from the DIN Rail, simply reverse the procedure.

Installing the Router Ground Connection

The router must be connected to a reliable earth ground. Install the ground wire in accordance with local electrical safety standards.

WARNING: This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

WARNING: This equipment needs to be grounded. Use a green and yellow 6 AWG ground wire to connect the host to earth ground during normal use. Statement 242

To install the ground connection, follow these steps:

1. Locate the grounding lug attached to the back of the Cisco IR829. It will be attached underneath two screws. Remove the screws holding it to the router and set it aside for reuse.
2. Strip one end of the ground wire to the length required for the terminal.
3. Crimp the ground wire to the grounding lug using the wire crimper.
4. Attach the grounding lug to the chassis using the screws set aside in step 1. Tighten the screw to a torque of 8 to 10 inch-pound (0.9 to 1.1 newton meter). (See [Figure 23: Chassis Ground Connection Points](#), on page 54.)

Figure 23: Chassis Ground Connection Points



5. Connect the other end of the ground wire to a known reliable earth ground point at your site.
6. If you are using this router in a vehicle, attach the ring terminal to the chassis using one of the screws provided and the green or green and yellow striped wire. Connect the other end of the wire to the vehicle ground.

After you install and properly ground the router, you can connect the power wiring, the LAN cables, and the cables for administrative access as required for your installation.



CHAPTER 4

mSATA Module Installation

This chapter provides an overview of the mSATA SSD available for the Cisco IR829M and IR829B Integrated Services Routers (ISRs). The mSATA SSD provides additional flash memory storage and occupies the mSATA SSD slot in the IR829M/IR829B platform.

- [mSATA SSD Module Installation, on page 55](#)

mSATA SSD Module Installation

Mini-SATA, or mSATA, is a low-profile interface connector that enables more effective Serial ATA (SATA) integration in small form-factor drives roughly the size of a business card, such as solid state disks (SSDs).

This chapter provides an overview of the mSATA SSD available for the Cisco IR829M and IR829B Integrated Services Routers (ISRs). The mSATA SSD provides additional flash memory storage and occupies the mSATA SSD slot in the IR829M/IR829B platform.

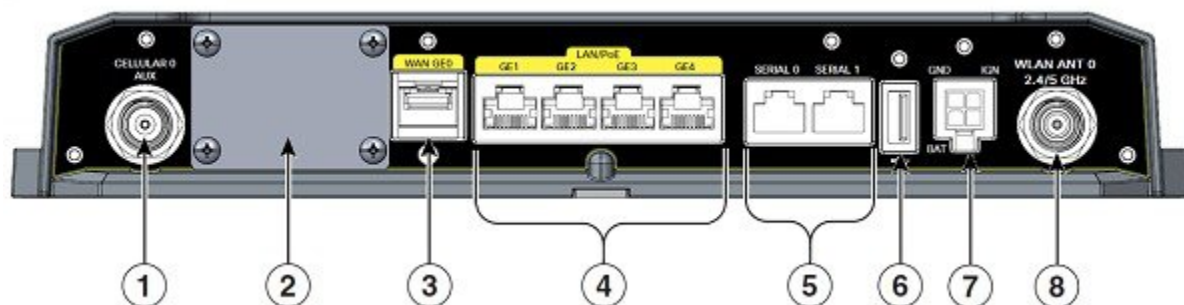
Installation Instructions

Note: Ensure that you are using proper static discharge techniques such as a wrist strap and static mat.

Caution: Ensure the device is powered down before performing any removal or installation of a module.

The mSATA SSD module plugs into the slot shown as item number 2 in [Figure 24: Cisco IR829 Front Panel Dual Modem, on page 55](#)

Figure 24: Cisco IR829 Front Panel Dual Modem



1	CELLULAR 0 AUX	5	Serial Ports
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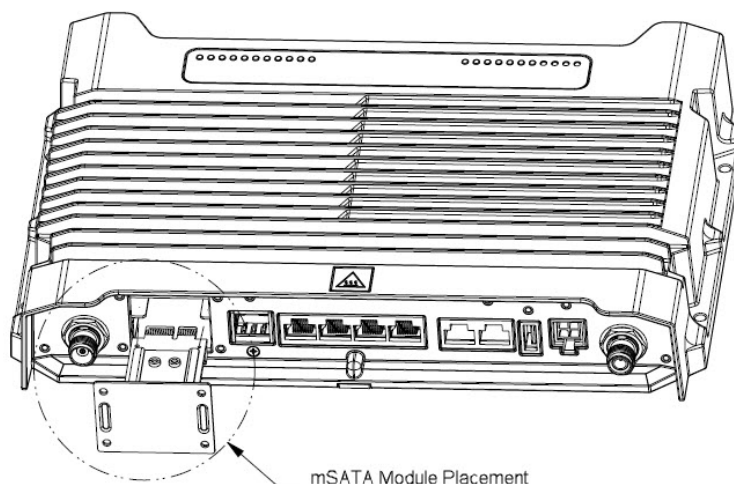
2	mSATA SSD Slot	6	USB 2.0 type-A Port
3	Gigabit WAN (SFP)	7	Power Input, Battery, and Ignition connector. Refer to the DC Power section for pin-outs.
4	Gigabit Ethernet LAN/PoE (RJ45)	8	WLAN ANT 0 2.4/5.0GHz

Perform the following steps in order to install the module.

1. Remove the 4 screws holding the cover over the Limited Modularity Slot. If you are replacing an existing module, set them aside for later use to attach the new module. If this is the first time you are installing a module, use the screws provided with the module.
2. Insert the mSATA SSD module into the slot on the IR829. The module slides in with the IR829 metal guide rail in between the mSATA SSD bottom plate and the mSATA SSD PCB.

Refer to [Figure 25: Module Placement](#), on page 56 for the placement of the module.

Figure 25: Module Placement



3. Ensure that the placement of the mSATA SSD module is correct. An incorrect installation can damage the module or the IR829. Refer to the three detailed figures [Figure 26: Module Placement \(Detail 1\)](#), on page 57, [Figure 27: Module Placement \(Detail 2\)](#), on page 57, and [Figure 28: Module Placement \(Detail 3\)](#), on page 58 to assist in proper positioning.

Figure 26: Module Placement (Detail 1)

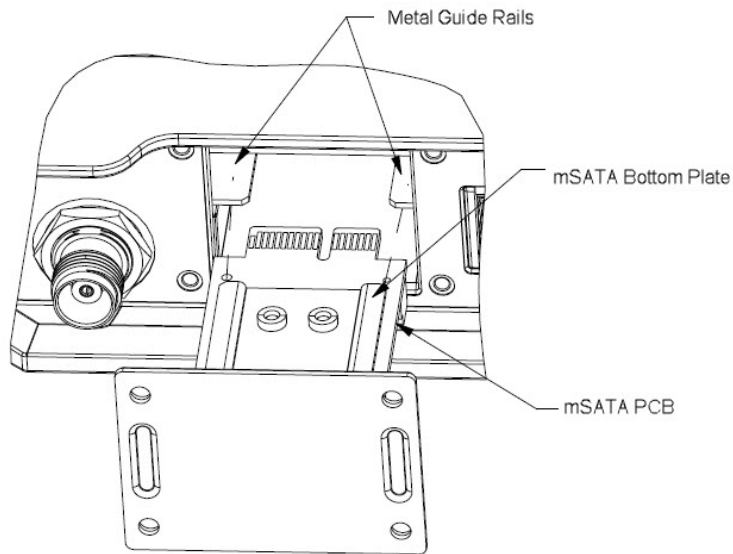


Figure 27: Module Placement (Detail 2)

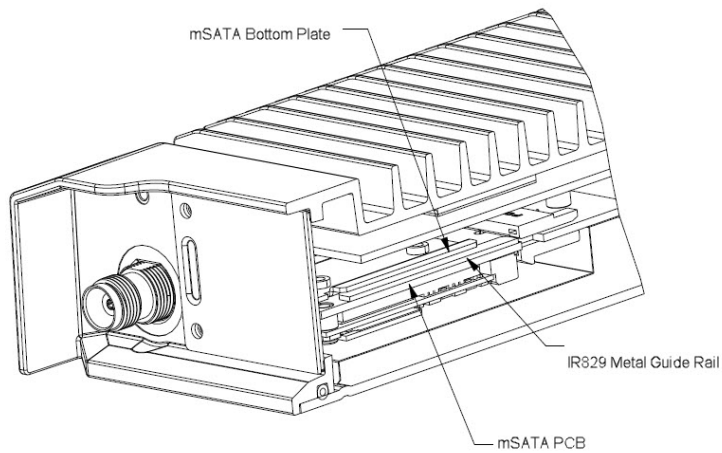
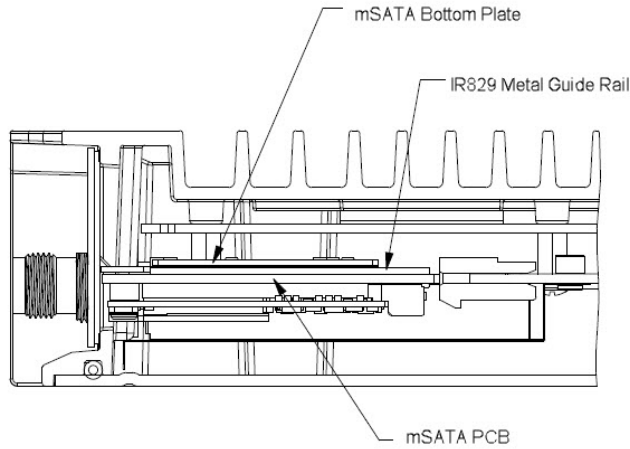
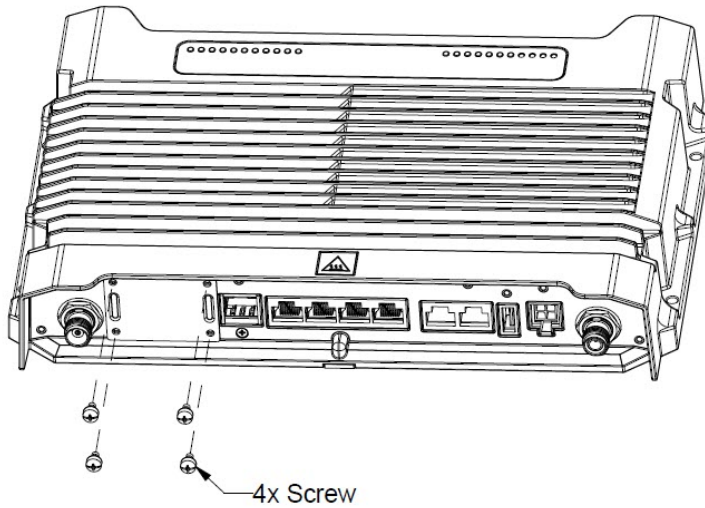


Figure 28: Module Placement (Detail 3)



4. After the module is properly inserted, use the 4 screws set aside earlier to tighten the module plate to the IR829. The screws should be torqued to 5-6 in-lb (0.6 N-m). Refer to [Figure 29: Securing the New mSATA SSD Module, on page 58](#).

Figure 29: Securing the New mSATA SSD Module



5. The installation is now complete. The finished installation is shown in [Figure 30: Finished Installation, on page 58](#).

Figure 30: Finished Installation





CHAPTER 5

Connecting the Router

This chapter describes how to connect Cisco IR829 Integrated Services Router (ISRs) to Ethernet devices and a network. The chapter contains the following sections:

- [Connecting the Router, on page 59](#)

Connecting the Router

This chapter describes how to connect Cisco IR829 Integrated Services Router (ISRs) to Ethernet devices and a network. The chapter contains the following sections:

Preparing to Connect the Router

Before you connect the router to the devices, install the router according to the instructions in [Chapter 1, “Installing the Router”](#).

Preventing Damage to the Router

To prevent damage to your router, follow these guidelines when connecting devices to your router:

- Turn off power to the devices and to the router until all connections are completed.

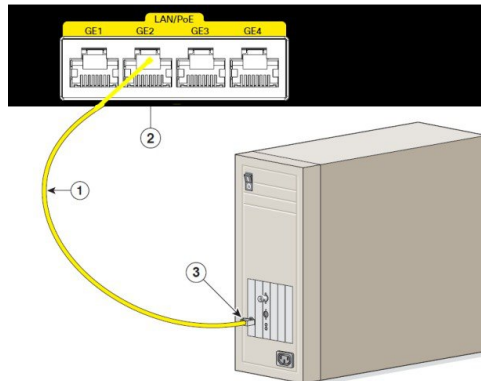
CAUTION: Do not turn on the devices until after you have completed all connections to the router.

Connecting a PC, Server, or Workstation

To connect a PC (or other Ethernet devices) to an Ethernet switch port, follow these steps:

1. Connect one end of the Ethernet cable to an Ethernet switch port on the router. In this example a PC is being connected to GE LAN Port 2. See [Figure 31: Connecting a Server, PC, or Workstation, on page 60](#).

Figure 31: Connecting a Server, PC, or Workstation



1	Ethernet cable	3	RJ-45 port on the PC, Server, or Workstation
2	Ethernet switch port on the router		

1. Connect the other end of the cable to the RJ-45 port on the network interface card (NIC) that is installed in the PC, server, or workstation.
2. (Optional) Connect additional servers, PCs, or workstations to the other Ethernet switch ports.

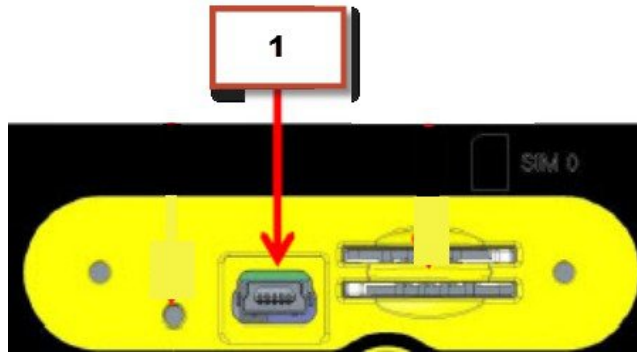
Connecting a Terminal or PC to the Console Port

Connect a terminal or PC to the Console port either to configure the software by using the CLI or to troubleshoot problems with the router.

To connect a terminal or PC to the console port on the router and access the CLI, follow these steps:

1. Connect the mini-USB side of a cable to the USB Console port on the router. Figure 2 shows the mini-USB location (1) for the Console port on the router.
2. Connect the opposite end of the mini-USB cable to the USB port on your laptop or PC.
3. To communicate with the router, wait for your laptop or PC to discover the new device.
4. If your laptop or PC warns you that you do not have the proper drivers to communicate with the router, you can obtain them from your computer's manufacturer, or go here: <https://www.silabs.com/developers/usb-to-uart-bridge-vcp-drivers>
5. Run a Terminal Emulation Application (such as Tera Term) from the PC. Select the "standard" serial Com Port (from the standard or enhanced options), and configure it for 9600 Baud rate with no flow control.

Figure 32: Connecting a Terminal or PC to the Console Port



Connecting to DC Power

WARNING: This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that the protective device is rated not greater than 36 VDC, 6A Statement 1005

WARNING: This product requires short-circuit (overcurrent) protection, to be provided as part of the building installation. Install only in accordance with national and local wiring regulations. Statement 1045

Plugs and Pin-Outs

The IR829 ships with a DC power accessory kit that contains a 4-pin locking connector and pins to use for the power connections. Four contacts are supplied, but only three are used. One is a spare. The Molex power connector is Cisco part number 29-2562-01.

The power entry receptacle is on the IR829. The pin-outs are shown in [Figure 33: Power Connector Pin-outs, on page 61](#).

Figure 33: Power Connector Pin-outs

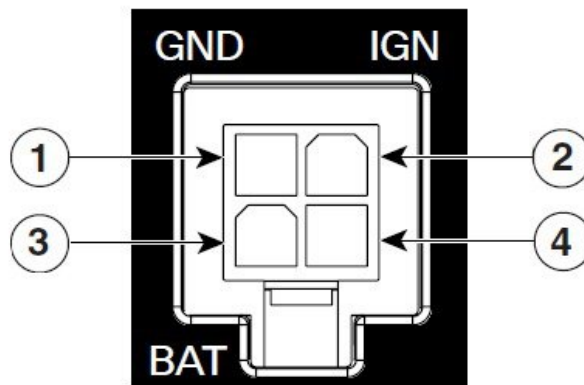


Table 9: Power connector Descriptions

Pin Number	Name	Description	Color
1	DC In -	DC Power Return (GND-)	Black
2	Ignition	Ignition Input (IGN)	Blue
3	DC In +	DC Power In (BAT+)	Red
4	N/A	N/A	N/A

Constructing a Power cable

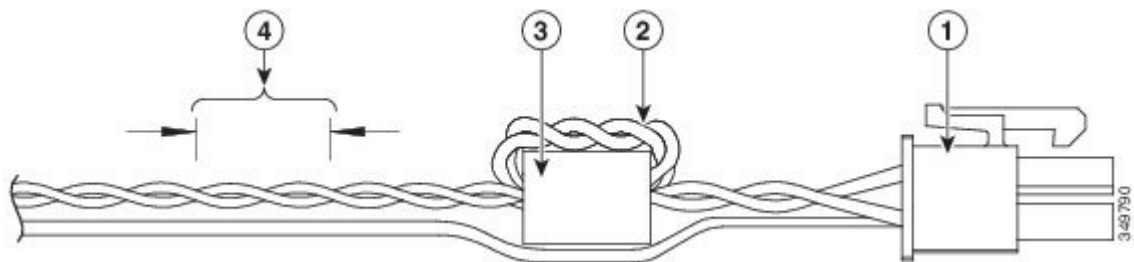
Cisco provides a power cable that can be ordered under part number IR829-DC-PWRCORD. If you choose to construct your own power cable, use special care when making the connections for DC power. It is easy to make a mistake when crimping connections, and there is a very good tutorial available at Molex: <http://www.molex.com/tnotes/crimp.html>

The specifications for the wiring are as follows:

- 16 AWG (1.02-to-1.29mm)
- UL1015 Rated
- Wires will be wound at 1 twist per inch

The example in [Figure 34: Power cable, on page 62](#) shows a cable constructed with a ferrite for a different certification. You can build your cable without the ferrite eliminating items 2 and 3 in the diagram.

Figure 34: Power cable


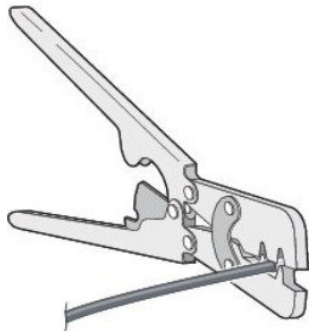


Details listed in the power cable example are:

1	4-pin locking connector	
2	2 loops of DC power and power return wires only. Other wires that may be used should run outside the Ferrite.	Note: Ferrite bead and the loops of wire are not needed at this time.
3	Ferrite Bead	Note: Ferrite bead and the loops of wire are not needed at this time.
4	Wires wound at 1 twist per inch	

Wiring the DC Power

To connect the DC power on your Cisco IR829, follow these steps:

1.	Identify the DC power source and measure 4 strands of copper wire 16 AWG (1.29mm) long enough to connect to the DC power source. NOTE: The maximum length of the cable before twisting is 15 feet (4.6 meters).	
2.	Using an 16-gauge wire-stripping tool, strip each of the wires coming from each DC-input power source to 0.25 inch (6.3 mm) \pm 0.02 inch (0.5 mm). Do not strip more than 0.27 inch (6.8 mm) of insulation from the wire. Stripping more than the recommended amount of wire can leave exposed wire from the power connector after installation.	
3.	Using the pins included in the kit, crimp each pin onto a wire.	
4.	Insert the pins into the power connector, referring to previous figures for guidance.	
5.	Plug the connector into the power entry receptacle.	
6.	When connecting the IR829 to a DC power source, a suitable disconnect device shall be provided at the point of connection to the DC power source.	

Vehicle Connections

When connecting to automotive power, it is expected that the ignition output will be +12 VDC, or +24 VDC (following the battery voltage). Connect the Ignition Input (IGN) of the router to the ignition output of the

automobile. The DC In + and DC In - leads can be directly connected to the battery, but it is recommended that they be connected after a fuse.



Important For vehicle installations, it is required to connect the Ignition Input (IGN), and use the Ignition Power Management feature of the router. This will eliminate unnecessary power cycling of the router whenever the vehicle is turned off and then turned back on.



Note For details about the Ignition Power Management Software and setting it up, see the [Cisco IR800 Integrated Services Router Software Configuration Guide](#).

Connecting to AC Power

The IR829 can be connected to AC power through an AC to DC power adapter. The Cisco part number is IR829-PWR125W-AC, and it meets ITE standards and operating temperature range of -20C to 60C but not suited for industrial environment.

To disconnect the device from power when using the adapter, simply unplug the adapter from the AC power source.

Verifying Connections

To verify that all devices are properly connected to the router, first turn on all the connected devices, then check the LEDs. To verify router operation, refer to [Table 10: Verifying the Router Operation](#), on page 64.

For full LED description, see [Chapter 1, “LEDs”](#)

Table 10: Verifying the Router Operation

Power and Link	LEDs to Check	Normal Patterns
PWR	Green steady On	Normal operation
	Green (flashing)	Initializing interface ports
	Amber	Solid after powerup - HW failure state Solid after 60 seconds - In ROM Monitor mode Solid after 60 seconds - Router is unreachable
GE0 WAN	Steady On	Link is up
	Flashing	Transmitting and Receiving data
	Off	No network activity.
Ethernet LAN Switch Ports	Single LED per port	Off — No link Green Steady on — Link is up Green Flash — Transmitting and Receiving data Amber — POE Fault, implies no link

Power and Link	LEDs to Check	Normal Patterns
Sim cards	SIM0/SIM1	Off — No USIM Green — USIM installed and active
Cellular Modems	CELLULAR0/CELLULAR1	Off — Module not powered on On — Module is powered on and connected but not transmitting or receiving Slow Flash — Module is powered on and searching for connection Fast Flash — Module is transmitting or receiving.

NOTE: There are single LTE and dual LTE SKUs available with the IR829. See [Figure 8 on page -17](#) for details.



CHAPTER 6

IP54 Kit Installation

This chapter describes how to install the IP54 kit on the Cisco IR829 Integrated Services Router (ISR).

- [IP54 Kit Installation, on page 67](#)

IP54 Kit Installation

This chapter describes how to install the IP54 kit on the Cisco IR829 Integrated Services Router (ISR).

The following are the features of this enclosure:

- Provides dust and water protection.
- Discourages tampering

The chapter contains the following sections:

Product Kit Contents

The IP54 kit contains the following items:

- Top Cover
- Bottom Cover
- 4 Short Screws
- 2 Long screws
- 2 Foam Plugs

Tools You Need

- #2 Phillips head screwdriver

Note: For compliance and safety information, see [Regulatory Compliance and Safety Information for Cisco 800 Series Routers](#).

What to do before installing the IP54 Kit

Before you begin, make sure that you have followed all of the standard installation steps that are previously explained.

Caution: The IP54 kit installed with the IR829 chassis is not intended to meet the hazardous locations IP54 requirement per IEC 60079-15:2005, clause 23. For hazardous locations installation instructions, see the [Getting Started and Product Document of Compliance for IR829 Integrated Services Router](#).

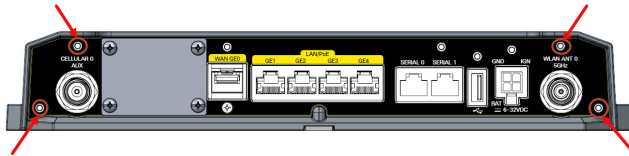
Caution: All cabling that extends from the IR829 and terminates elsewhere (i.e. Power, Ethernet, Antenna, etc.) must have a minimum ingress protection rating of IP54 per EN60529 when used in conjunction with the IP54 shroud. It is the responsibility of the customer to ensure all cabling and terminations outside of the IR829 meet the required ingress protection requirement. In addition, the IR829 is NOT designed for and should not be placed outdoors. The intent of the IP54 shroud is to provide supplementary protection to the IR829 against dust and occasional splashing water. Cisco cannot guarantee prolonged reliable operation of the IR829 product if these guidelines are violated.

Caution: Before beginning the installation of the IP54 kit, consider carefully whether the installation site is strong enough to support the combined weight of the IP54 enclosure and the Cisco IR829 that it encloses.

Assembling the IP54 Enclosure

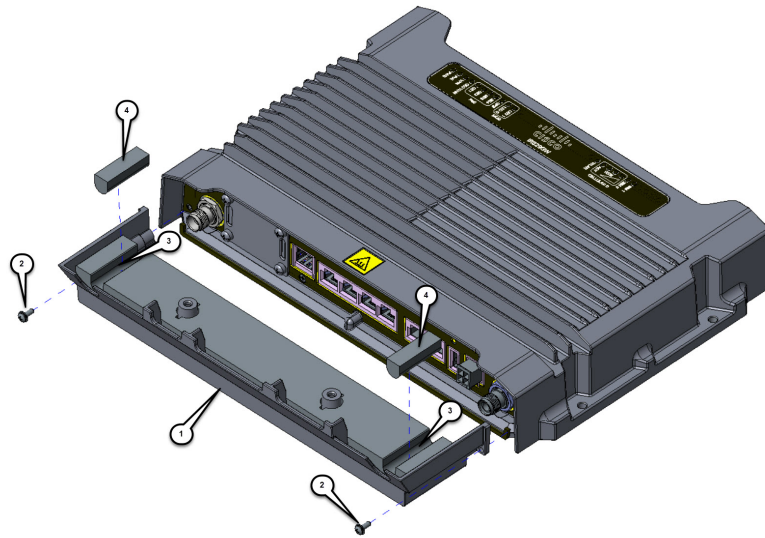
1. Locate the mounting holes on the Cisco IR829. [Figure 35: Mounting Holes, on page 68](#) shows the available mounting holes noted in red.

Figure 35: Mounting Holes



2. Refer to [Figure 36: Bottom Cover Assembly, on page 69](#) and [Figure 37: Top Cover Assembly, on page 69](#) as a reference to the assembly instructions.

1	Bottom Cover	5	Top Cover
2	Short Screws	6	Long Screws
3	Cable Guide Holes	7	Short Screws
4	Foam Plugs	8	Guide Holes

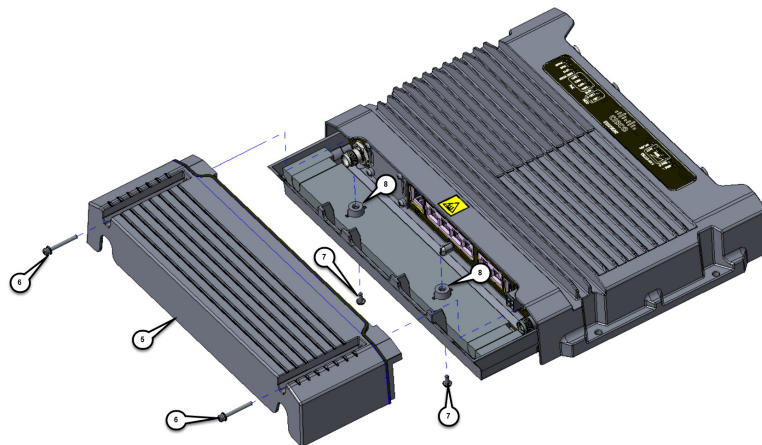
Figure 36: Bottom Cover Assembly

3. If you have not already done so, attach all cables to their proper connection points on the Cisco IR829 and route them away from the device. Antenna connections are routed through the guide holes (3).

Note: All cables should be properly routed and lying flat across the entire width of the bottom cover. Avoid grouping cables together in bundles.

4. Attach the bottom cover (1) to the Cisco IR829 using two short screws (2). Tighten screws until snug.

5. If your device does not have antennas attached, insert the foam plugs into the cable guide holes.

Figure 37: Top Cover Assembly

6. Attach the top cover (5) to the Cisco IR829 using two long screws (6). Tighten screws until snug.

7. Connect the top cover and bottom cover to each other using 2 short screws (7). The screws are routed up through the guide holes (8) in the lower cover (1) and screwed into the top cover (6). Tighten screws until snug.

8. Ensure that all of the screws are tightened properly and that the top and bottom covers are properly joined.



CHAPTER 7

Technical Specifications

This appendix provides router, port, cabling specifications, and power adapters for the Cisco IR829 Integrated Services Router (ISRs).

- [Technical Specifications, on page 71](#)

Technical Specifications

This appendix provides router, port, cabling specifications, and power adapters for the Cisco IR829 Integrated Services Router (ISRs).

NOTE: For compliance and safety information, see the [Regulatory Compliance and Safety Information for Cisco IR800 Series Routers](#)

Router Specifications

The following tables list the operational limits of the Cisco IR829. Operating the router outside of the limits specified is not supported.

Table 11: Certifications

Description	Design Specification
Standard Safety Certifications	UL 60950-1, 2nd edition; CAN/CSA C22.2 No. 60950-1, 2nd edition, EN 60950-1, 2nd edition; CB to IEC 60950-1, 2nd edition with all group differences and national deviations

Table 12: Physical Characteristics

Description	Design Specification
Dimensions (H x W x D)	(height x width x depth) are 7.70 x 11 x 1.73 in. (19.6 x 27.9 x 4.39 cm).
Weight	5 lb (2.26 kg)
Maximum Power Consumption	70 Watts with PoE

Table 13: Environmental Tests

Description	Design Specification
Ingress Protection Rating	IP 40 per IEC 60529 for Vertical Falling Water, Pollution Degree 3
Humidity	Non-condensing Relative Humidity: 5% to 95%
Military Standard	MIL-STD-810G Method 514.6: Procedure 1 Category 4, Secured Cargo - Common MIL-STD-810G Method 514.6: Procedure 1 Category 20, Ground Vehicles MIL-STD-810G Method 516.6. Procedure 1, Functional Shock MIL-STD-810G Method 516.6. Procedure 5, Crash Hazard MIL-STD-810G Method 516.6. Procedure 6, Bench Handling
Vibration and Shock (Railway Vehicles)	EN61373 Functional Random Vibe - Category 1, Class B EN61373 Simulated Non-op Long-life Vibe - Category 1, Class B EN61373 Non-op Shock, Class B
Heavy-Duty Vehicle Applications	SAE J1455 Operating Random Vibe, Cab Mounted Truck SAE J1455 Operating Sinusoidal Vibe, Category 3 SAE J1455 Non-operating Sinusoidal Vibe, Category 3 SAE J1455 Handling Drop Test

Table 14: Environmental Operating Ranges

Description	Design Specification
Operating Temperature and Altitude	-40° to 140°F (-40° to 60°C) in a sealed NEMA cabinet with no airflow -40° to 158°F (-40° to 70°C) in a vented cabinet with 40 lfm of air -29° to 167°F (-34° to 75°C) in a forced air enclosure with 200 lfm of air (type tested at +85C for 16 hours) -500 to 5,000 feet. Derate max operating temperature 1.5°C per 1000 feet. 10,000 ft maximum
Humidity	10% — 95% non-condensing