Product Overview

This section describes the Cisco IE 2000U Industrial Ethernet *Switch (IE 2000U)*, hereafter referred to as *the switch*. The *switch* provides a Gigabit Ethernet aggregation and small form factor switch for the substation automation family of Connected Grid switches. It is suitable for Connected Energy applications such as grid automation, distributed generation, integrated renewable energy, trackside substations, and water applications.

You can connect these switches to devices such as servers, routers, and other switches. In connected grid environments, you can connect any Ethernet-enabled industrial communication devices, including field area routers (FARs), connected grid routers (CGRs), programmable logic controllers (PLCs), human-machine interfaces (HMIs), drives, sensors, video devices, traffic signal controllers, and intelligent electronic devices (IEDs).

You can mount the switch on a DIN rail in an industrial enclosure. Its components are designed to withstand extremes in temperature, vibration, and shock that are common in an industrial environment.

The Cisco IE 2000U Industrial Ethernet *switch* has six models, which are grouped according to five different port configurations. The IE 2000U-16TC-G-X model is the only model available with a conformal coating (Humiseal AR/UR UV40).

Note: The switch does not have cooling fans.

■ Switch Models, page 9

■ Front Panel, page 11

■ Rear Panel, page 26

■ Management Options, page 27

■ Network Configurations, page 28

Switch Models

Table 1 on page 9 describes the switch models.

Table 1   Switch Descriptions

Model	Description	Software Image
IE 2000U-4S-G	4 100 Mb/s SFP module slots and 2 100/1000 Mb/s SFP module slots	LAN Base
IE 2000U-4T-G	4 10/100BASE-T ports and 2 10/100/1000BASE-T ports	LAN Base
IE 2000U-4TS-G	4 10/100BASE-T ports and 2 100/1000 Mb/s SFP module slots	LAN Base

Table 1   Switch Descriptions

Model	Description	Software Image
IE 2000U-8TC-G	8 10/100BASE-T ports, 2 Gigabit Ethernet (GE) dual-purpose ports (2 10/100/1000BASE-T ports and 2 SFP module slots) Supports the IEEE-1588 standard.	LAN Base with 1588
IE 2000U-16TC-G	16 10/100BASE-T ports, 2 GE dual-purpose ports (2 10/100/1000BASE-T ports and 2 SFP module slots) and 2 Fast Ethernet (FE) dual-purpose ports (2 10/100BASE-T ports and 2 SFP module slots) Supports the IEEE-1588 standard.	LAN Base with 1588
IE 2000U-16TC-G-X	16 10/100BASE-T ports, 2 GE dual-purpose ports (2 10/100/1000BASE-T ports and 2 SFP module slots), and 2 FE dual-purpose ports (2 10/100BASE-T ports and 2 SFP module slots) Supports the IEEE-1588 standard.	LAN Base with 1588 and conformal coat
IE 2000U-16TC-GP	16 10/100BASE-T ports, 4 Power over Ethernet (PoE) ports, and 2 GE dual-purpose ports (2 10/100/1000BASE-T ports and 2 SFP module slots) Supports the IEEE-1588 standard. **Note:** The four PoE ports can operate as PoE, or as PoE+ ports with certain constraints.	LAN Base with 1588

# Front Panel

This section describes the front panel components:

- 4, 8, or 16 10/100BASE-T Ethernet ports.

- Two 10/100/1000 ports (available on some models). See Table 1 on page 9.

- Two or four dual-purpose ports (available on some models). See Table 1 on page 9.

- Two or four SFP module slots (available on some models). See Table 1 on page 9.

- Four PoE ports (available on some models). See Table 1 on page 9.

Note: You can also configure the four PoE ports as PoE+ ports. The PoE ports require that a separate DC power source be connected to the switch (optional). The switch has a terminal block on its front panel to connect to a power supply module or to a site source.

- RJ-45 console port

- USB mini-Type B (console) port

- LEDs

- Power connectors

- Alarm connector

- Flash memory card slot

All of the switches have similar components. See Figure 1 on page 12, Figure 2 on page 13, Figure 3 on page 14, Figure 4 on page 15, Figure 5 on page 16 and Figure 6 on page 17 for examples.

Figure 1   IE 2000U-4S-G Front Panel View
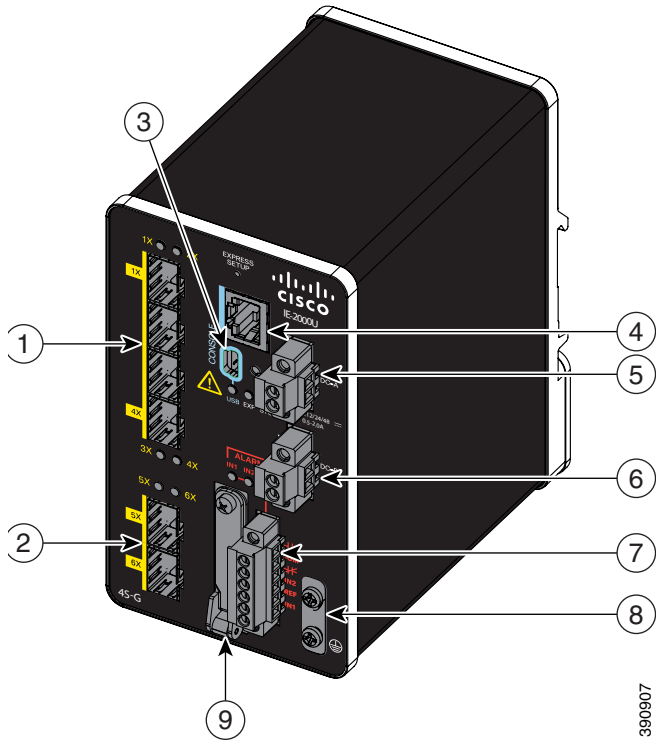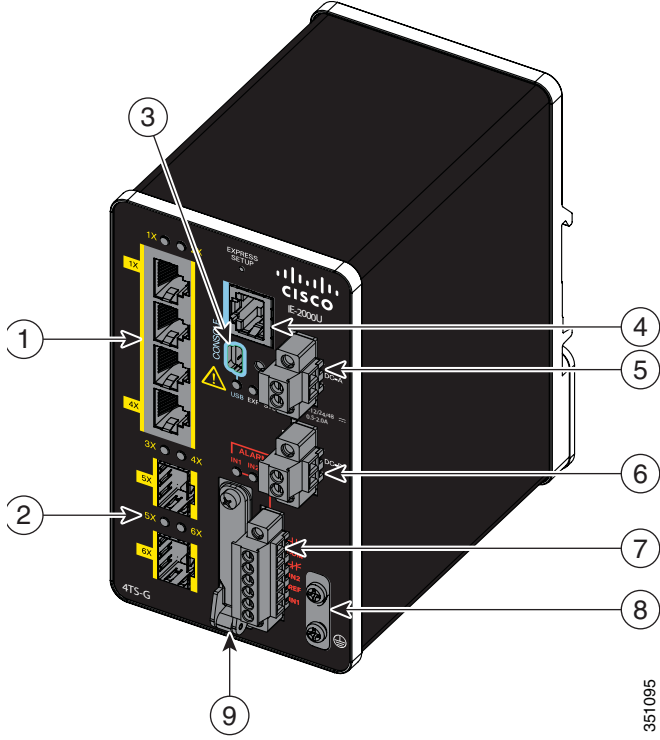

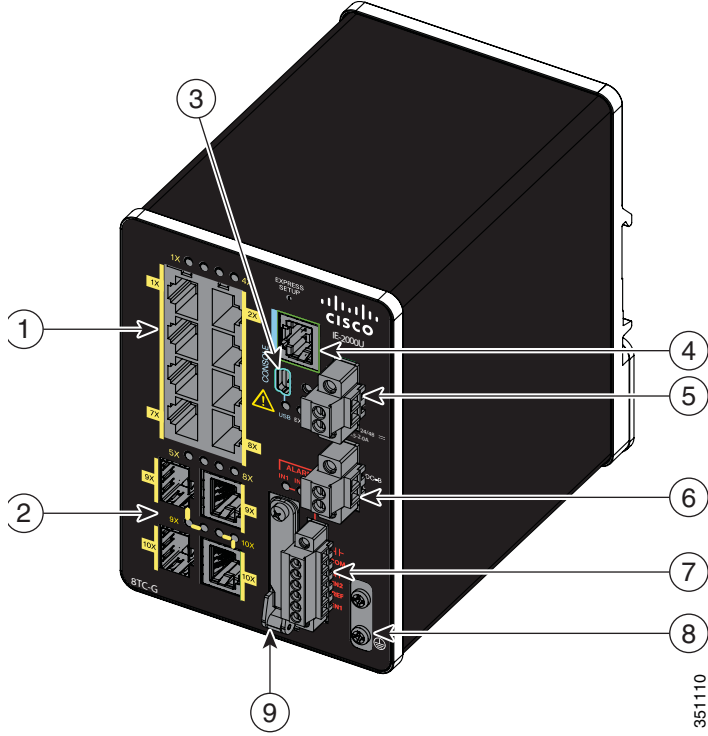| 1 | 100 Mb/s SFP module slots | 6 | Power connector DC-B |
2	100/1000 Mb/s SFP module slots	7	Alarm connector
3	USB mini-Type B (console) port	8	Protective ground connection
4	RJ-45 console port	9	Flash memory card slot
5	Power connector DC-A		

Figure 2   IE 2000U-4TS-G Front Panel View

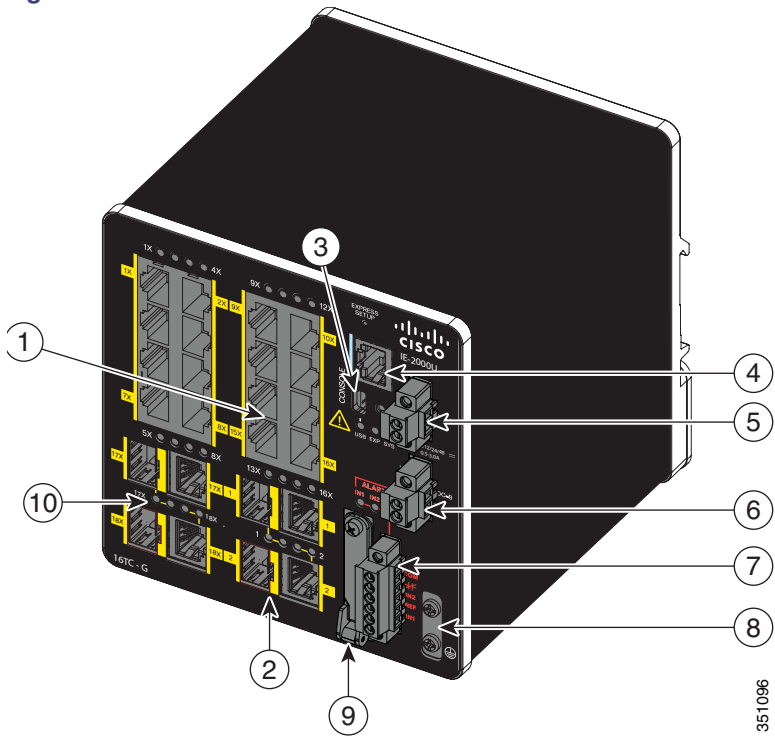|			
1	10/100 Ethernet ports	6	Power connector DC-B
2	SFP module slots	7	Alarm connector
3	USB mini-Type B (console) port	8	Protective ground connection
4	RJ-45 console port	9	Flash memory card slot
5	Power connector DC-A		

Figure 3   IE 2000U-8TC-G Front Panel View

1	10/100 Ethernet ports	6	Power connector DC-B
2	Dual-purpose ports	7	Alarm connector
3	USB mini-Type B (console) port	8	Protective ground connection
4	RJ-45 console port	9	Flash memory card slot
5	Power connector DC-A		

Figure 4   IE 2000U-16TC-G Front Panel View

1	10/100 Ethernet ports	6	Power connector DC-B
2	Dual-purpose ports (Gigabit Ethernet)	7	Alarm connector
3	USB mini-Type B (console) port	8	Protective ground connection
4	RJ-45 console port	9	Flash memory card slot
5	Power connector DC-A	10	Dual-purpose ports (Fast Ethernet)

Figure 5   IE 2000U-16TC-GP Front Panel View

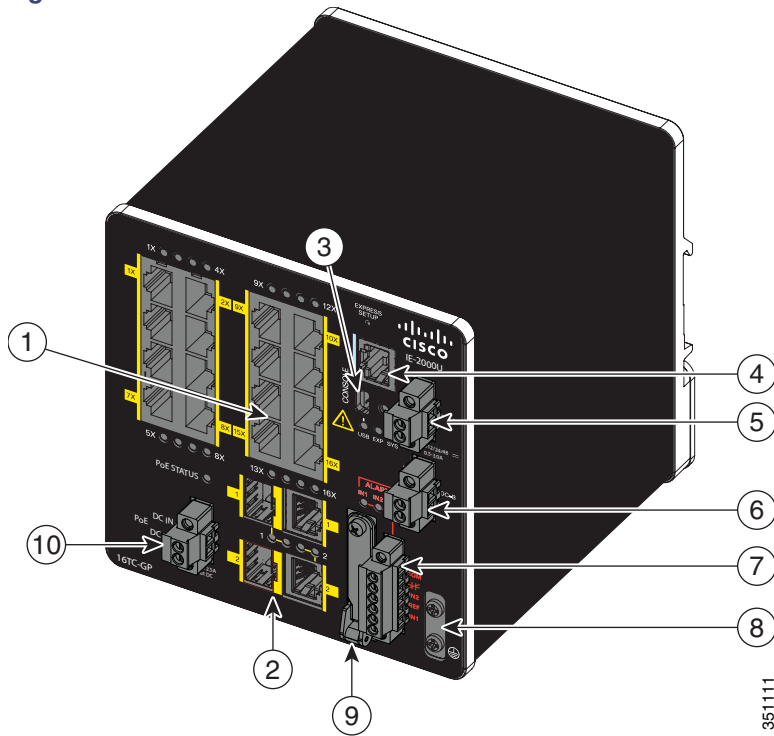|			
1	10/100 Ethernet ports	6	Power connector DC-B
2	Dual-purpose ports	7	Alarm connector
3	USB mini-Type B (console) port	8	Protective ground connection
4	RJ-45 console port	9	Flash memory card slot
5	Power connector DC-A	10	PoE power connector

Figure 6   IE 2000U Switches Front Panel View
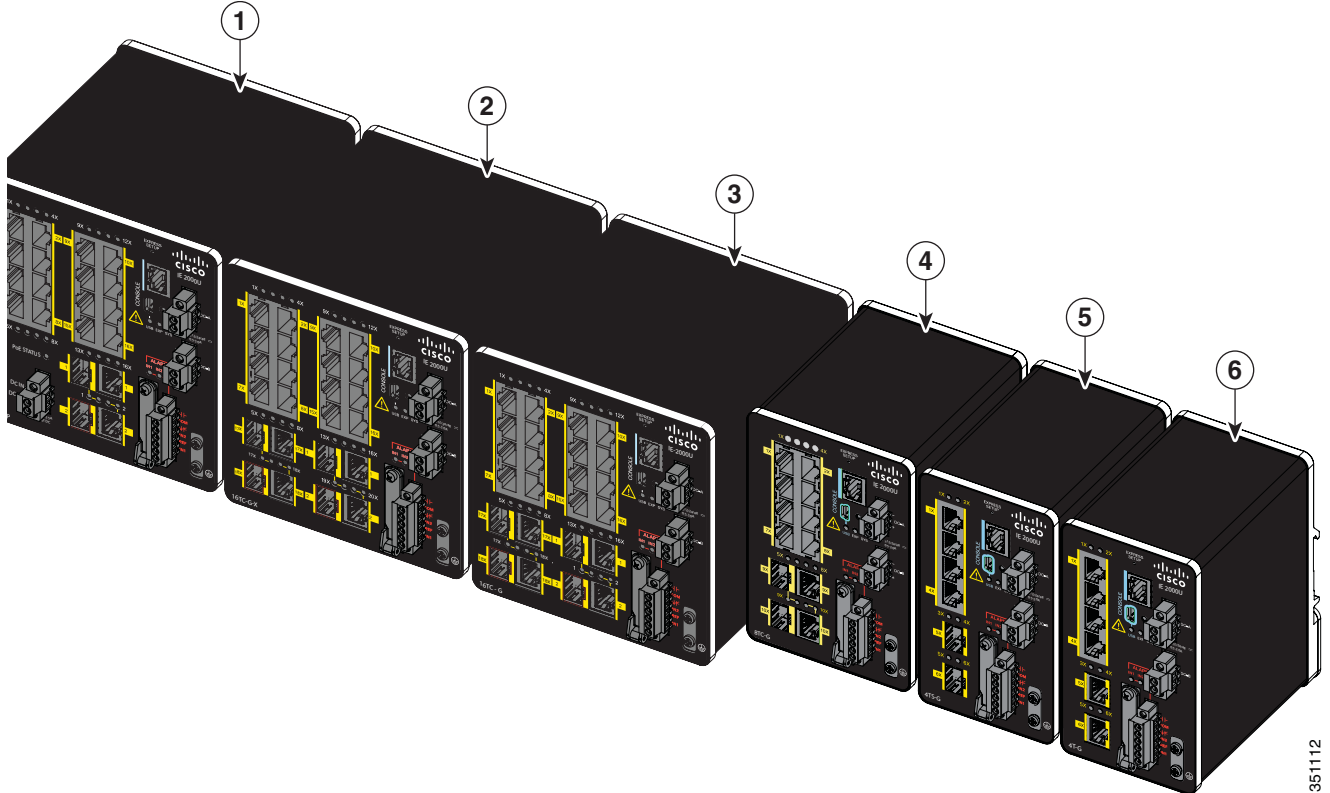
1	IE 2000U-16TC-GP	4	IE 2000U-8TC-G
2	IE 2000U-16TC-G-X[1]	5	IE 2000U-4TS-G
3	IE 2000U-16TC-G	6	IE 2000U-4T-G

1. The IE-2000U-16TC-G-X model has a conformal coating (Humiseal AR/UR UV40).

10/100BASE-T Ports

You can set the 10/100BASE-T ports to operate at 10 or 100 Mb/s in full-duplex or half-duplex mode. You can also set these ports for speed and duplex autonegotiation in compliance with IEEE 802.3ab. (The default setting is autonegotiate.) When set for autonegotiation, the port senses the speed and duplex settings of the attached device and advertises its own capabilities. If the connected device also supports autonegotiation, the switch port negotiates the best connection (that is, the fastest line speed that both devices support, and full-duplex transmission if the attached device supports it) and configures itself accordingly. In all cases, the attached device must be within 328 feet (100 meters). 100BASE-TX traffic requires CAT5 cables or better. 10BASE-T traffic can use Category 3 cables or better.

When connecting the switch to workstations, servers, routers, and Cisco IP Phones, make sure that the cable is a straight-through cable.

You can use the **mdix auto** interface configuration command in the command-line interface (CLI) to enable the automatic medium-dependent interface crossover (auto-MDIX) feature. When the auto-MDIX feature is enabled, the switch detects the required cable type for copper Ethernet connections and configures the interfaces accordingly.

Power over Ethernet Ports

On the IE 2000U-16TC-GP model of the IE 2000U switch, four of the 10/100BASE-T ports are available as PoE ports. The four ports can operate either as PoE (IEEE 802.3af) ports or can be configured to operate as PoE+ (IEEE 802.at) ports. In order to operate 10/100 ports as PoE ports, a separate DC power source is required. For more information, see Connecting Power to the Switch PoE DC-Input (Optional), page 53.

Cable lengths of up to 328 feet (100 m) are supported.

10/100/1000BASE-T Ports

The IEEE 802.3u 10/100/1000BASE-T ports provide full-duplex 10, 100 or 1000 Mb/s connectivity over CAT5 unshielded twisted pair (UTP) copper cabling. The default setting is autonegotiate.

Cable lengths of up to 328 feet (100 m) are supported.

100 Mb/s SFP Module Slots

The IEEE 802.3u 100 Mb/s SFP module slots provide full-duplex 100 Mb/s connectivity over multi-mode (MM) fiber cables or single-mode (SM) fiber cables. These ports use a SFP fiber-optic transceiver module that accepts a dual local connector (LC). Check the SFP specifications for the cable type and length.

100/1000 Mb/s SFP Module Slots

The IEEE 802.3u 100/1000 Mb/s SFP module slots provide full-duplex 100 or 1000 Mb/s connectivity over multi-mode (MM) fiber cables or single-mode (SM) fiber cables. These ports use a SFP fiber-optic transceiver module that accepts a dual LC connector. Check the SFP specifications for the cable type and length.

Dual-Purpose Fast Ethernet Ports

You can configure the dual-purpose Fast Ethernet ports on the switch as either 10/100BASE-T ports or as 100 Mb/s SFP-module ports. You can set the 10/100BASE-T ports to autonegotiate, or you can configure them as fixed 10 or 100 Mb/s (Fast) Ethernet ports.

By default, the switch selects the medium for each dual-purpose port (10/100BASE-T or SFP). When a link is achieved on one media type, the switch disables the other media type until the active link goes down. If links are active on both media, the SFP-module port has priority, but you can use the **media-type** interface configuration command to manually designate the port as an RJ-45 port or an SFP port.

You can configure the speed and duplex settings consistent with the selected media type. For information on configuring interfaces, see the *Cisco Connected Grid Switches Interfaces Software Configuration Guide*.

Dual-Purpose Gigabit Ethernet Ports

You can configure the dual-purpose Gigabit Ethernet ports on the switch as either 10/1001000BASE-T ports or as 100/1000 Mb/s SFP-module ports. You can set the 10/100/1000BASE-T ports to autonegotiate, or you can configure them as fixed 10, 100, or 1000 Mb/s (Gigabit) Ethernet ports.

By default, the switch selects the medium for each dual-purpose port (10/100/1000BASE-T or SFP). When a link is achieved on one media type, the switch disables the other media type until the active link goes down. If links are active on both media, the SFP-module port has priority, but you can use the **media-type** interface configuration command to manually designate the port as an RJ-45 port or an SFP port.

You can configure the speed and duplex settings consistent with the selected media type. For information on configuring interfaces, see the *Cisco Connected Grid Switches Interfaces Software Configuration Guide*.

SFP Modules

The switch Ethernet SFP modules provide connections to other devices. These field-replaceable transceiver modules provide the uplink interfaces. The modules have LC connectors for fiber-optic connections or RJ-45 connectors for copper connections. You can use any combination of the supported SFP modules listed in Table 2 on page 19.

Table 2   Supported SFP Models

Type of SFP Module	Model
Rugged and Industrial SFPs –40 to 185°F (–40 to 85°C)	■ GLC-SX-MM-RGD ■ GLC-LX-SM-RGD ■ GLC-ZX-SM-RGD ■ GLC-FE-100FX-RGD ■ GLC-FE-100LX-RGD ■ GLC-FE-T-I
Commercial SFPs 32 to 131°F (0 to 55°C)	■ GLC-BX-U with digital optical monitoring with DOM support ■ GLC-BX-D with DOM support ■ GLC-FE-100FX ■ GLC-FE-100LX ■ GLC-FE-100EX ■ GLC-FE-100ZX ■ GLC-FE-100BX-U ■ GLC-FE-100BX-D ■ GLC-T ■ CWDM-SFP with DOM support
Extended temperature SFPs 23 to 185°F (–5 to 85°C)	■ SFP-GE-S with DOM support ■ SFP-GE-L with DOM support ■ SFP-GE-Z with DOM support ■ SFP-GE-T ■ GLC-EX-SMD with DOM support ■ GLC-TE

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#wp1
38176

For information about SFP modules, see your SFP module documentation and the Installing SFP Modules into SFP Module
Slots, page 65. For cable specifications, see SFP Module Cables, page 86.

Power Connectors

You connect the DC power to the switch through the front panel connectors. The switch has a dual-feed DC power
supply; two connectors provide primary and secondary DC power (DC-A and DC-B). The DC power connectors are near
the top right of the front panel. See Figure 1 on page 12. Each power connector has an LED status indicator.

The switch power connectors are attached to the switch chassis. Each power connector has screw terminals for
terminating the DC power (see Figure 7 on page 20). All connectors are attached to the switch front panel with the
provided captive screws.

The power connector labeling is on the panel. The positive DC power connection is labeled "+", and the return
connection is labeled "−".

Figure 7   Power Connector
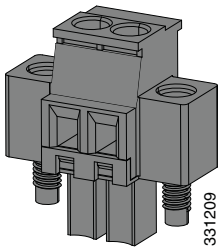
The switch can operate with a single power source or with dual power sources. When both power sources are
operational, the switch draws power from the DC source with the higher voltage. If one of the two power sources fails,
the other continues to power the switch.

In systems configured with the redundant power option, connect each of the two power supplies to separate
independent power sources. If you fail to do this, your system might be susceptible to total power failure due to a fault
in the external wiring or a tripped circuit breaker.

The switch can be powered from a site source or a 50 Watt AC-input power supply module (part number
PWR-IE50W-AC=). For more information on wiring the DC power source, see Wiring the DC Power Source, page 45. For
information on power consumption, see Table 16 on page 79 in the Technical Specifications, page 79 chapter.

PoE Power Connector

The IE 2000U switch model with PoE capability (IE 2000U-16TC-GP) is equipped with an additional DC input terminal
block. This DC terminal block allows the connection of a power supply, either the PWR-IE65W-PC-AC= or PWR-IE170W-
PC-AC= AC Input power supply or the PWR-IE65W-PC-DC= or PWR-IE170W- PC-DC= DC Input power supply, or an
input from site source DC that is used to provide dedicated external power to operate the PoE or PoE+ ports. The PoE
terminal block accepts 48 VDC or 54 VDC at 2.5 A.

Alarm Connector

You connect the alarm signals to the switch through the alarm connector. The switch supports two alarm inputs and one
alarm output relay. The alarm connector is on the bottom right of the front panel. See Figure 1 on page 12.

The alarm connector provides six alarm wire connections. The connector is attached to the switch front panel with the provided captive screws.

Figure 8   Alarm Connector
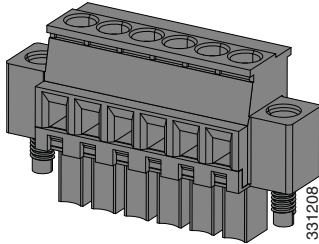
Both alarm input circuits can sense if the alarm input is open or closed. The alarm inputs can be activated for environmental, power supply, and port status alarm conditions. From the CLI, you can configure each alarm input as an open or closed contact.

The alarm output circuit is a relay with a normally open and a normally closed contact. The switch is configured to detect faults that are used to energize the relay coil and change the state on both of the relay contacts: normally open contacts close, and normally closed contacts open. The alarm output relay can be used to control an external alarm device, such as a bell or a light.

See the *Cisco Connected Grid Switches System Management Software Configuration Guide* for instructions on configuring the alarm relays.

For more information about the alarm connector, see Cable and Connectors, page 83

Management Ports

You can connect the switch to a PC running Microsoft Windows or to a terminal server through either the RJ-45 console port or the USB mini-Type B console port, also referred to as the USB-mini console port. These ports use the following connectors:

- RJ-45 console port uses an RJ-45-to-DB-9 female cable.

- USB-mini console port (5-pin connector) uses a USB Type A-to-5-pin mini-Type B cable.

The USB-mini console interface speeds are the same as the RJ-45 console interface speeds.

To use the USB-mini console port, you must install the Cisco Windows USB device driver on the device that is connected to the USB-mini console port and that is running Microsoft Windows.

Note: For information about downloading the Cisco USB device driver, see the Installing the Cisco Microsoft Windows USB Device Driver, page 97.

With the Cisco Windows USB device driver, connecting and disconnecting the USB cable from the console port does not affect Windows HyperTerminal operations. Mac OS X or Linux requires no special drivers.

Note: The 5-pin mini-Type B connectors resemble the 4-pin mini-Type B connectors, but they are not compatible. Use only the 5-pin mini-Type B. See Figure 9 on page 22.

Figure 9   USB Mini-Type B Port
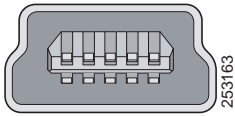
The configurable inactivity timeout reactivates the RJ-45 console port if the USB-mini console port is activated, but no input activity occurs for a specified time period. When the USB-mini console port deactivates due to a timeout, you can restore its operation by disconnecting and reconnecting the USB cable. For information on using the CLI to configure the USB-mini console interface, see the *Cisco Connected Grid Switches Interfaces Software Configuration Guide*.

LEDs

You can use the LEDs to monitor the switch status, activity, and performance. Figure 10 on page 22 and Figure 11 on page 25 show the front panel LEDs.

Figure 10   LEDs on the IE 2000U Switch
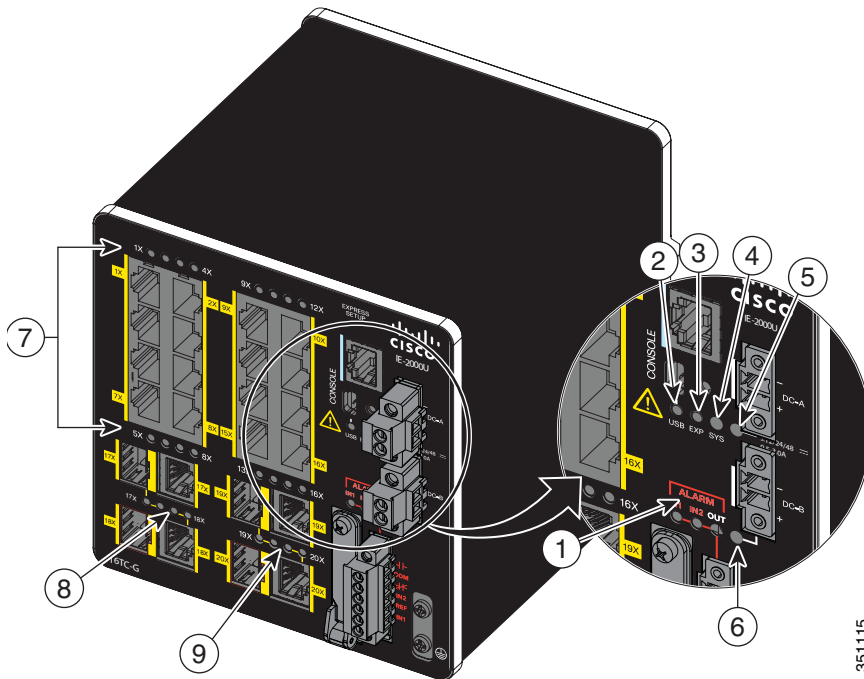
1	Alarm LEDs	6	Power connector DC-B LED
2	USB mini-Type B (console) port LED	7	10/100BASE-T port LEDs
3	Express Setup LED (not currently supported by software)	8	Dual-purpose (Gigabit Ethernet) port LEDs
4	System LED	9	Dual-purpose (Fast Ethernet) port LEDs
5	Power connector DC-A LED		

System LED

The System LED shows whether the system is receiving power and is functioning properly.

Table 3 on page 23 lists the system LED colors and their meanings.

Table 3   System LED

Color	System Status
Off	System is not powered on.
Blinking green	Boot fast is in progress.
Green	System is operating normally.
Red	Switch is not functioning properly.

USB-Mini Console LED

The USB-mini console LED shows which console port is in use. See Figure 10 on page 22 for the LED location.

If you connect a cable to a console port, the switch automatically uses that port for console communication. If you connect two console cables, the USB-mini console port has priority. Table 4 on page 23 describes the system LED colors and their meanings.

Table 4   USB-Mini Console Port LED

Color	Description
Green	USB-mini console port is active. RJ-45 console port LED is not active.
Off	Port is not active. RJ-45 console port is active.

Alarm LEDs

Table 5 on page 23 and Table 6 on page 23 list the alarm LED colors and their meanings.

Table 5   Alarm OUT Status LED

Color	System Status
Off	Alarm OUT is not configured, or the switch is off.
Green	Alarm OUT is configured, no alarm detected.
Blinking red	Switch has detected a major alarm.
Red	Switch has detected a minor alarm.

Table 6   Alarm IN1 and IN2 Status LEDs

Color	System Status
Off	Alarm IN1 or IN2 not configured.
Green	Alarm IN1 or IN2 configured, no alarm detected.
Blinking red	Major alarm detected.
Red	Minor alarm detected.

Power Status LEDs

The switch can operate with one or two DC power sources. Each DC input has an associated LED that shows the status of the corresponding DC input. If power is present on the circuit, the LED is green. If power is not present, the LED color depends on the alarm configuration. If alarms are configured, the LED is red when power is not present; otherwise, the LED is off.

If the switch has dual power sources, the switch draws power from the power source with the higher voltage. If one of the DC sources fails, the alternate DC source powers the switch, and the corresponding power status LED is green. The power status for the failed DC source is either off or red, depending on the alarm configuration.

lists the power status LED colors and meanings.

Table 7   Power Status LEDs

Color	System Status
Green	Power is present on the associated circuit, system is operating normally.
Off	Power is not present on the circuit, or the system is not powered up.
Red	Power is not present on the associated circuit, and the power supply alarm is configured.

Note: The Power A and Power B LEDs show that power is not present on the switch if the power input drops below the low valid level. The power status LEDs only show that power is present if the voltage at the switch input exceeds the valid level.

For information about the power LED colors during the boot fast sequence, see the .

Port Status LEDs

Each 10/100BASE-T port, 10/100/1000BASE-T port, dual-purpose port, and SFP module slot has a port status LED, also called a port LED, as shown in and . displays LED information about the switch and the individual ports.

Table 8   Port Status LEDs

| Color	System Status
Off	No link.
Solid green	Link present.
Blinking green	Activity. Port is sending or receiving data.
Alternating green–amber	Link fault. Error frames can affect connectivity, and errors such as excessive collisions, CRC errors, and alignment and jabber errors are monitored for a link-fault indication.
Solid amber	Port is not forwarding. Port was disabled by management, an address violation, or STP. **Note:** After a port is reconfigured, the port LED can remain amber for up to 30 seconds while STP checks the switch for possible loops.

Dual-Purpose Port LEDs

shows the LEDs on a dual-purpose port. You can configure each port as either a 10/100/1000BASE-T port through the RJ-45 connector or as an SFP module, but not both at the same time.

There is one LED for each port and each media type (Ethernet or SFP module). Each port LED acts independently for the particular port and media. The LED colors have the same meanings as described in .

Figure 11   Dual-Purpose Port LEDs
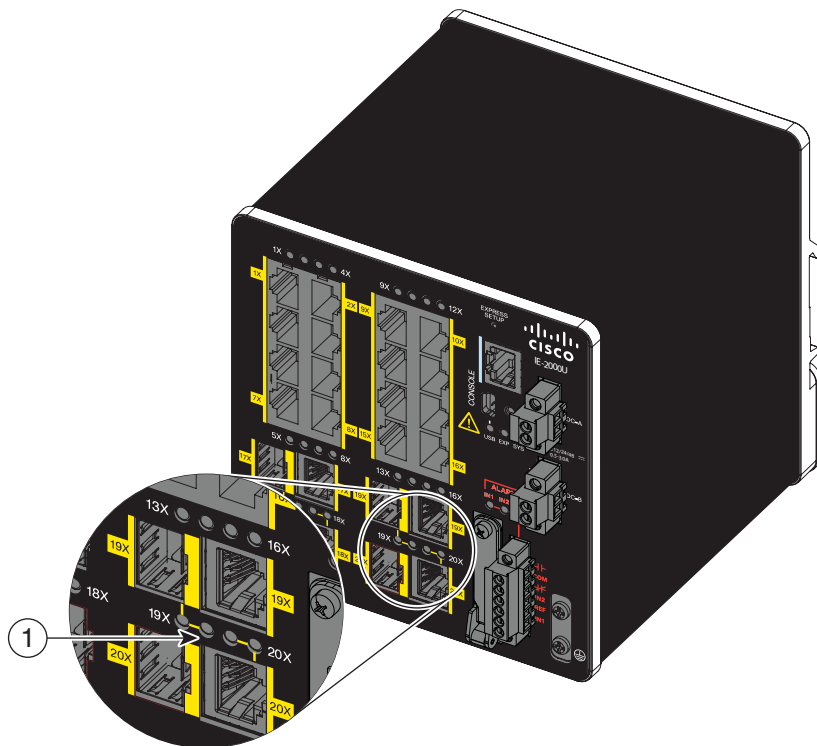
1	Dual-purpose port LEDs

PoE Status LED

The PoE STATUS LED is located on the front panel of the IE 2000U switch models that are equipped with PoE ports (IE 2000U-TC-GP).The LED displays the functionality and status of the PoE ports. The LED colors and meanings are listed in Table 9 on page 25

Table 9   PoE Status LED

| Color	PoE Status
Off	PoE is not enabled.
Green	PoE function is enabled and all of the PoE-enabled ports are functioning correctly.
Flashing Amber	PoE function is enabled, but one of the PoE port's power is disconnected or has failed.
Amber	PoE function is enabled, but all of the PoE ports have failed.

Flash Memory Card

The switch supports a flash memory card that makes it possible to replace a failed switch without reconfiguring the new switch. The slot for the flash memory card is on the front of the switch. See Figure 12 on page 26.

The flash card is hot swappable and can be accessed on the front panel. A cover protects the flash card and holds the card firmly in place. The cover is hinged and closed with a captive screw. This prevents the card from coming loose and protects against shock and vibration.

Note: For more information on inserting and removing the flash memory card, see the Installing or Removing the Flash Memory Card, page 33.

Figure 12   Flash Memory Card Slot
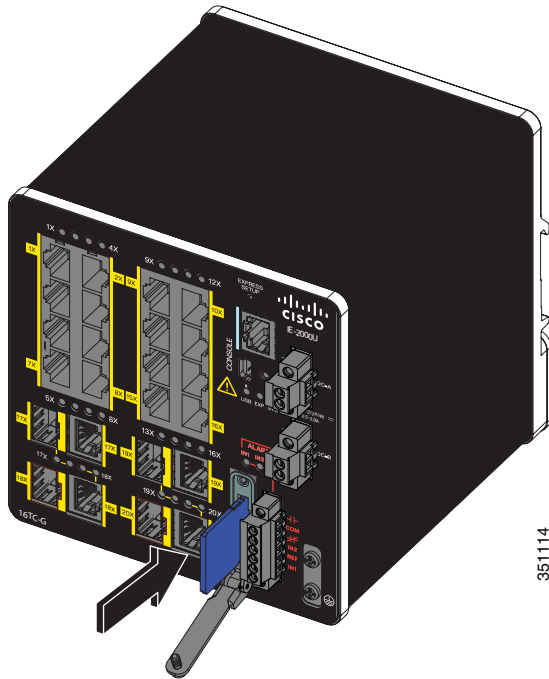
Note: You can obtain replacement flash memory cards (SD-IE-1GB=) by calling Cisco Technical Assistance Center (TAC).

Rear Panel

The rear panel of the switch has a latch for installation on a DIN rail. See . The latch is spring-loaded to move down to position the switch over a DIN rail and return to the original position to secure the switch to a DIN rail.

Figure 13   IE 2000U Switch Rear Panel
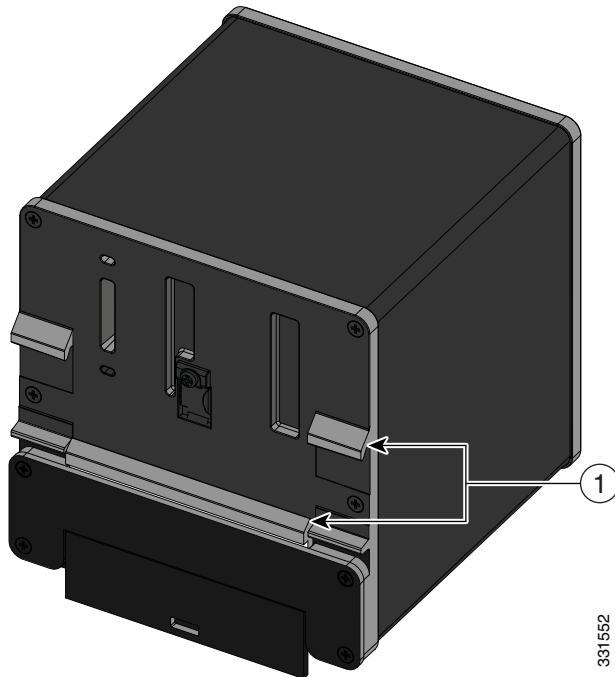
| 1 | Latch |

Management Options

The switch supports these management options:

■   Cisco Configuration Professional

Cisco Configuration Professional is a PC-based application that provides device management for switches and routers. It simplifies configuration of features through easy-to-use wizards.

■   Cisco IOS CLI

The switch CLI is based on Cisco IOS software and is enhanced to support desktop-switching features. You can fully configure and monitor the switch. You can access the CLI either by connecting your management station directly to the switch management port or a console port, or by using Telnet from a remote management station. See the *Cisco IOS Basics and File Management for Connected Grid Switches* on Cisco.com for more information.

■   SNMP network management

You can manage switches from an SNMP-compatible management station that is running platforms such as HP OpenView or SunNet Manager. The switch supports a comprehensive set of Management Information Base (MIB) extensions and four Remote Monitoring (RMON) groups. See the *Cisco Connected Grid Switches System Management Software Configuration Guide* on Cisco.com and the documentation that came with your SNMP application for more information.

Network Configurations

See the guides on Cisco.com for network configuration concepts and examples of using the switch to create dedicated network segments and interconnecting the segments through Gigabit Ethernet connections. For more information, go to: www.cisco.com/go/ie2000u-docs