Network communication guide
RMC, XSeries^{G5}, XIO

ABB

Contents

— Additional information

Additional free publications are available for download at www.abb.com/upstream.

Table 0-1: Related documentation

Documents	Document number
XIO User Manual	2106424
Wi-Fi Antenna Kit	2106123
XIO Interface Application Guide	2107011
Ethernet-to-Serial Passthrough Application Guide	2107010
RMC User Manual	2105552

Cyber security

This guide provides information to configure and enable Ethernet and wireless networking on ABB Totalflow devices. ABB Totalflow devices with Ethernet networking capabilities are designed to be connected, and communicate information and data, via a network interface, which should be connected to a secure network. It is the customer's sole responsibility to provide and continuously ensure a secure connection between the product and the customer network or any other network (as the case may be). The customer shall establish and maintain appropriate measures (such as, but not limited to, the installation of firewalls, application of authentication measures, encryption of data, or installation of antivirus programs) to protect this product, the network, its system and interfaces against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB Inc. and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Although ABB provides functionality testing on the products and updates that it releases, the customer should institute its own testing program for any product updates or other major system updates (to include, but not limited to, code changes, configuration file changes, third party software updates or patches, hardware change out) to ensure that the security measures that the customer has implemented have not been compromised and that the system functions in the customer's environment as expected.

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1 Networking

This document describes networking options and scenarios for ABB Totalflow devices. Network connection support is required for remote or local access for device management (host-to-device communication) or device-to-device field data communication.

This document also provides detailed parameter and function description for the Networking tab available from PCCU (version 7.68 or later). The networking tab provides configuration options for both Ethernet and Wi-Fi® for all products:

— Ethernet networking is supported by all ABB Totalflow devices with Ethernet interfaces: RMC-100, XSeries^{G5}, µFLO^{G5}, XIO, etc.
— Wi-Fi networking is supported by devices with wireless interfaces. These devices must have antennas installed: XSeries^{G5}, XIO.

IMPORTANT NOTE: This document indicates when content is applicable only to certain product(s) and configurations in the ABB Totalflow product family.

1.1 Networking capability implementation differences

It is important to understand the difference in networking capability when planning field connections and configuring interfaces. ABB Totalflow products support single or multiple Ethernet ports. In installations with multiple devices, there may be a combination of single and multi-port devices. Single-port devices support a single network connection. Multi-port devices support daisy-chain connections and switching capabilities which provide multiple network connection options.

1.1.1 Multiple network connection types

"Network connection" in documentation for older ABB Totalflow software versions traditionally referred to the connection of single-port ABB Totalflow devices with the wide area customer management network through a single Ethernet interface. This connection is typically through a field network switch with an uplink connection to the customer network. With the introduction of devices with multiple Ethernet ports and switching capabilities, as well as wireless interfaces, the "network connection" may now refer to other network connection types, not only to the connection to the customer wide area network.

1.1.1.1 Network connections on Ethernet (LAN)

Multi-port devices can support additional logical networks associated with each of their ports. These networks are local and offer the option to separate or isolate traffic in the field, if required. They support local connection of additional ABB Totalflow devices or peripherals. Configuring additional devices for their network connection means each device must be connected to the correct port on the core device, or device up the chain, and have IP addressing compatible with the network associated with the port. Remote access to these devices from the customer wide area network requires a router. If you plan to have separate networks in the field, plan for additional network equipment if remote management is required.

IMPORTANT NOTE: Connections on Ethernet support remote or local access to ABB Totalflow devices depending on topology.

1.1.1.2 Network connections on Wi-Fi

Devices with wireless interfaces can support connections to the Wi-Fi wireless network. The network connection in this case is not physical, but over the airwaves. Wi-Fi clients join the Wi-Fi network advertised by the ABB Totalflow device and can then connect to the device over that network.

IMPORTANT NOTE: Connections to Wi-Fi support only local access to the ABB Totalflow device.

1.1.2 Ethernet Networks on the PCCU Networking tab

Distinctions between the Ethernet implementation and wireless support on ABB Totalflow devices are reflected in the Networking tab screen (see additional details in section 2, Configuration options: Networking tab (PCCU) overview).

1.1.2.1 Single-port devices

The Ethernet configuration section for single-port devices is labeled "Wired Network." The Ethernet interface in these devices is simply a network adapter. Devices connect as passive network nodes. In devices with wireless interfaces, the term "wired" differentiates Ethernet networking, which requires a physical connection, from wireless networking on Wi-Fi.

1.1.2.2 Multi-port devices

The Ethernet configuration sections for multi-port devices provide several options based on the Ethernet mode. For example, for the XIO, the Ethernet networking section shows as "Ethernet" when in switch mode, then it changes to "Enterprise" when not in switch mode. An additional section, the Industrial Network, also displays to distinguish between the A and B Ethernet ports. The separate sections allow for the configuration of each interface as separate logical networks require.

1.2 Auto Discovery on the network

Network connections support the Auto Discovery feature which devices use to advertise and detect services. Services are applications or processes that run on devices and that listen for connection requests from applications running on other devices.

Examples of these services are those advertised by the XIO: Ethernet-to-Serial Passthrough or XIO Read or Write servers. The XIO Interface or communication applications on an RMC act as client applications and can request connections to those services.

When the network configuration is correct and Auto Discovery is enabled on all devices, unique connection parameters associated with the discovered services are also automatically detected. This capability reduces configuration time and errors in the field. The Auto Discovery feature is enabled from the factory. It is available from the Communications Services tab in PCCU.

> **i** **IMPORTANT NOTE:** The ABB Auto Discovery implementation is based on Avahi's Multicast DNS/DNS-SD service discovery and RFC 3927 (Dynamic Configuration of IPv4 Link-Local Addresses).

2 Configuration options: Networking tab (PCCU) overview

The Networking tab screen displays configuration and monitoring parameters for the Ethernet and Wi-Fi® (wireless) interfaces. Configuration options displayed depend on the modes of operation selected for these interfaces.
— See 2.1 Ethernet networks overview in this section or details in 6.1 Ethernet parameters.
— See 2.2 Wi-Fi network overview in this section or details in 6.2 Wi-Fi parameters.

> **i** **IMPORTANT NOTE:** Click **Help** on the **Networking** tab screen to display help topics available from PCCU. Like the section 6 Reference information section in this document, the help topics provide screen parameters, function overview, and detailed descriptions.

2.1 Ethernet networks overview

Configuration options for Ethernet networking depend on the number of Ethernet ports the device has and the Ethernet mode selected:

— Single-port devices support a single Ethernet network connection. For these devices, the configuration parameters are for a single interface (mode: 1 Network). The Ethernet interface is merely the device adapter for the network. The Ethernet configuration section for single-port devices is named Wired Network, to contrast with the wireless network section also available on the same screen for devices with Wi-Fi support.

— Multi-port devices support multiple modes for Ethernet interface configuration. They support independent per-port network connections or switched-port configurations. These modes support single (switched) LAN or multi-LAN configurations that help combine traffic on all interfaces on a single network or isolate or separate traffic on separate networks. For these devices, a unique configuration may be required for each of its ports. Each Ethernet interface is configured to connect to a separate network.

Figure 2-1: Multi-port device support for several Ethernet interfaces (XIO)
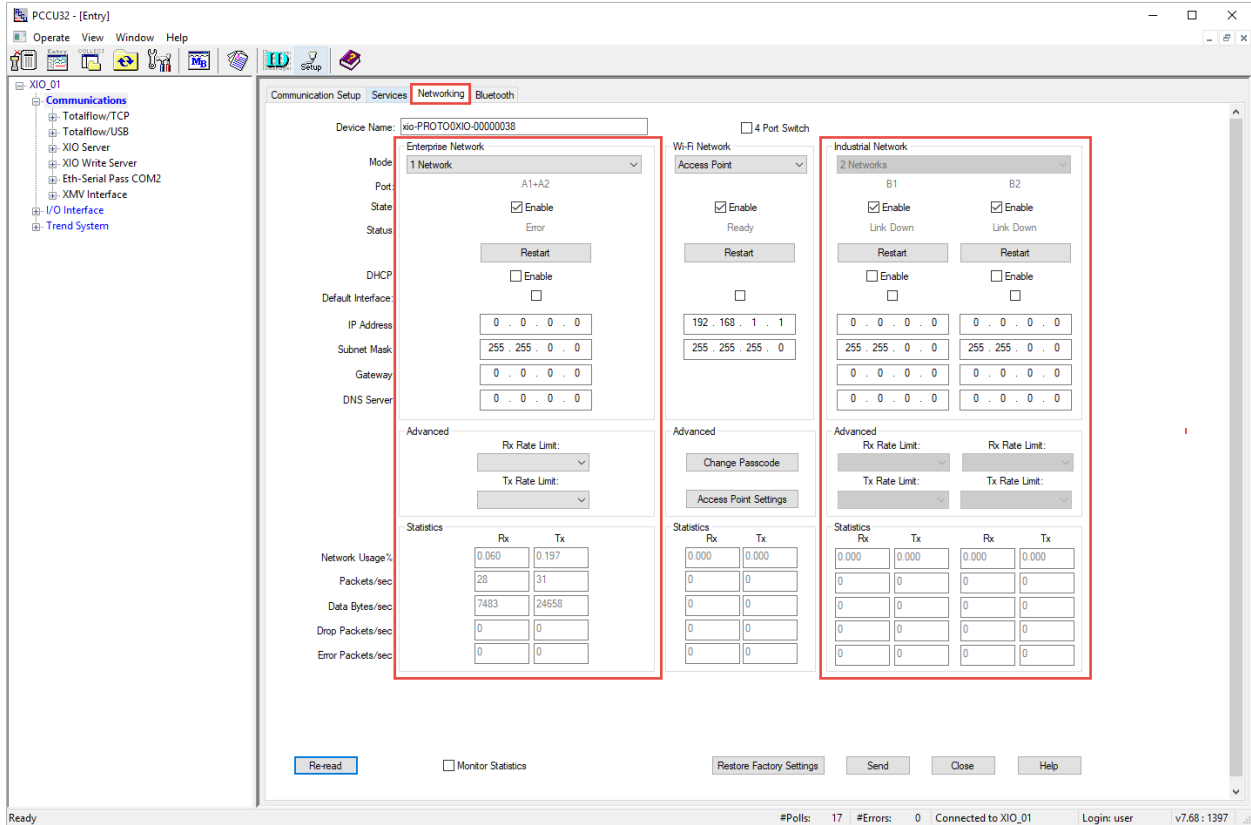
2.1.1   Default Ethernet modes (multi-port devices)

Multi-port devices have their ports configured in switched mode from the factory:

— RMC-100: The two Ethernet interfaces are configured in 2-port switch mode (E1+E2) or single network (Figure 2-2). Only a single set of configuration parameters is required for both ports.

IMPORTANT NOTE: The RMC does not have a specific 2-port switch option on the screen (like the XIO does). Configure the 2-port switch behavior by selecting the mode: 1 Network. If planning to connect XIOs to an RMC, review options for connections in either mode. When in switch mode, the RMC can be used by XIOs to connect to the corporate network, eliminating the need for additional network equipment in the field.

Figure 2-2: Default Ethernet mode for the RMC-100 (2-port switch)
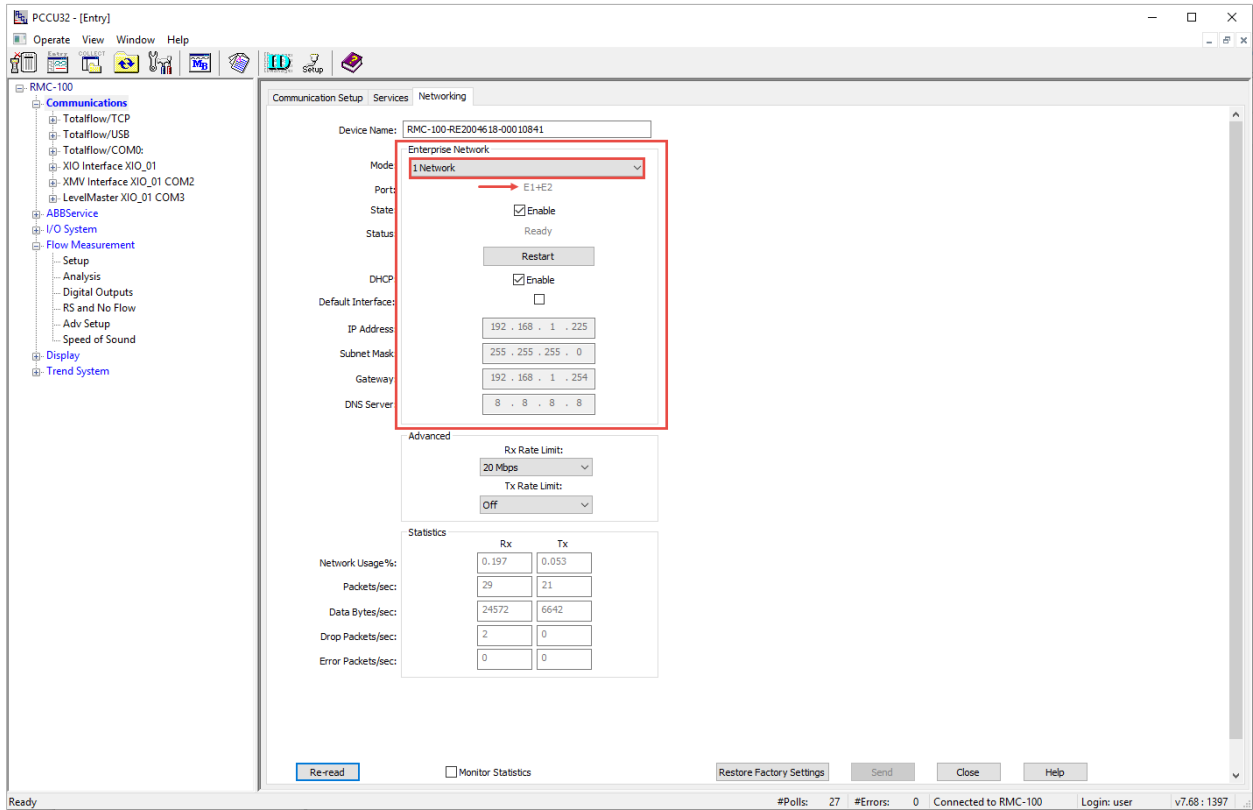
— XIO: The 4 Ethernet interfaces are configured in 4-port switch mode (Figure 2-3), single network (A1+A2+B1+B2). Only a single set of configuration parameters is required for all 4 ports.

> **IMPORTANT NOTE:** There is a specific option to configure 4-port switch behavior on screen. Choose this mode by selecting the **4 Port Switch** checkbox. The option is not available from the Mode drop-down list. The mode field only displays 4 Port Switch when the checkbox is selected.

Figure 2-3: Default Ethernet mode for the XIO (4-port switch)
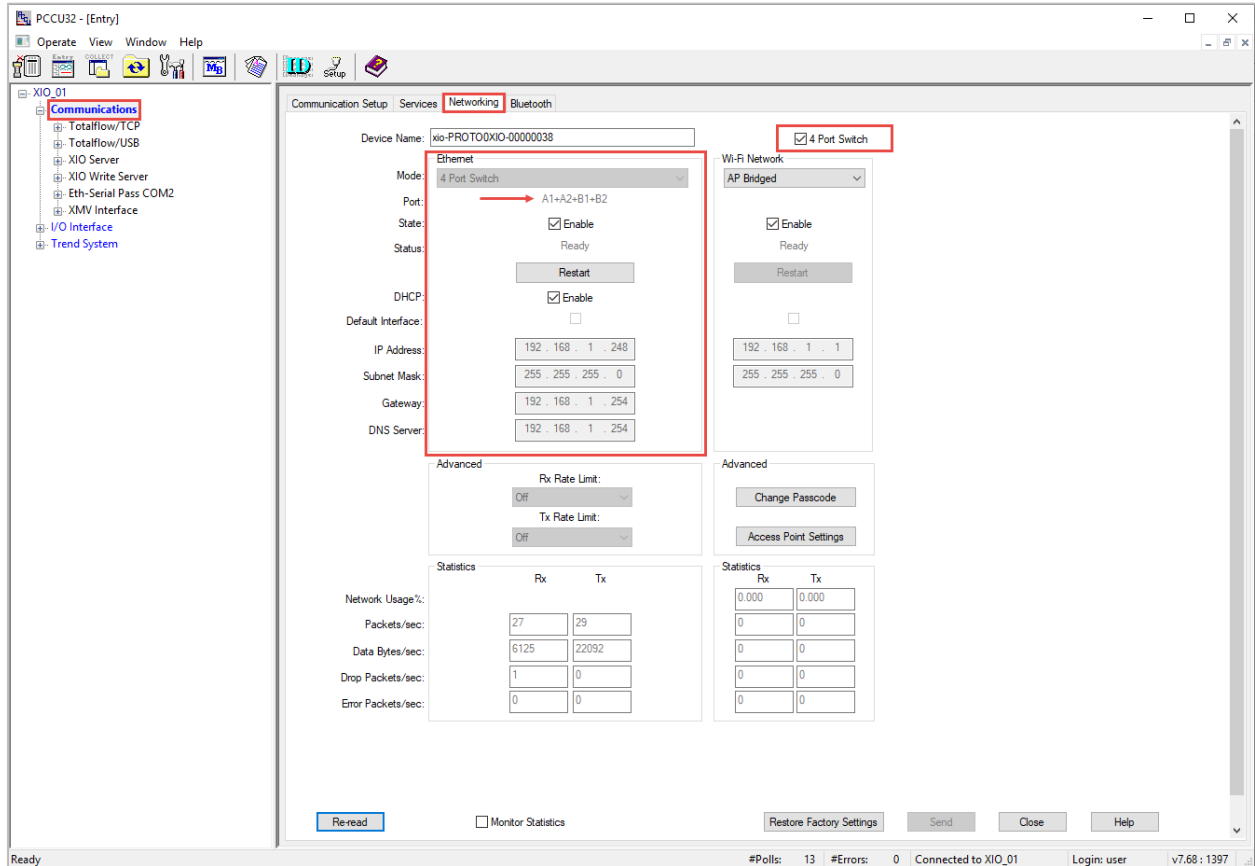
2.1.2   Enterprise network (XIO, RMC only)

The names of the enterprise network interfaces differ depending on device type:

— On the RMC Networking tab, the interfaces are named E1 and E2. The physical Ethernet ports are labeled as 1 and 2 on the device enclosure.
— On the XIO Networking tab, the interfaces are named A1 and A2. The physical Ethernet port set corresponding to these interfaces are identified as A-Network on the device enclosure.

The Enterprise network configuration section is available as follows:

— On the RMC: It is the default configuration section displayed whether in switched mode (1 Network) or separate networks per port (2 Networks).
— On the XIO: It becomes available when the XIO is not in 4-port switch mode. The parameter configuration fields display depending on whether ports A1 and A2 are in switched mode (1 Network) or separate (2 Networks). When A1 and A2 are separate, traffic on A1 is isolated from A2. Enterprise port traffic is isolated from the industrial ports.

2.1.3   Industrial network (XIO only)

On the XIO Networking tab, the Industrial interfaces are named B1 and B2. The physical Ethernet port set corresponding to these interfaces is identified as B-Network on the device enclosure.

The Industrial Network parameter configuration section becomes available when the XIO is not in 4-port switch mode. It supports XIO Ethernet ports B1 and B2. Industrial ports are configured as separate interfaces with a different network associated with each port. Enable and configure each port separately. Industrial port traffic is isolated from Enterprise ports.

2.1.4   Ethernet parameter categories

Configuration options depend on the Ethernet mode selected. The mode determines the number of interfaces that need configuration. For each interface available, the following parameter categories are available:

— **Main Ethernet parameters**: Select Ethernet mode for multi-port devices, enable interfaces, configure IP addressing options. See details in section 6.2.2 Main Wi-Fi parameters.

— **Advanced parameters**: Control network traffic flow or bandwidth per enabled interface. See details in section 6.1.4 Advanced Ethernet parameters.
— **Statistics**: Observe key network and Ethernet parameters to help troubleshoot and monitor performance issues. See details in section 6.1.6 Advanced parameters for µFLOG5, XSeriesG5 (XRCG5, XFCG5).

2.2 Wi-Fi network overview

Options for wireless networking are available only for devices with wireless interfaces (XSeries^{G5}, XIOs). Devices must have an antenna installed.

Configuration options depend on the Wi-Fi role the device is configured for. Supported Wi-Fi roles depend on the product type:

— XSeries^{G5} (XFC^{G5} and XRC^{G5}) devices support the Access Point role only.
— XIO devices support Access Point, Client, and Access Point-Bridged modes.

2.2.1 Wi-Fi parameter categories

Configuration options depend on the Wi-Fi role selected:

— **Main Wi-Fi parameters**: Select Wi-Fi role, enable wireless interface, configure IP addressing options. See details in section 6.2.2 Main Wi-Fi parameters.
— **Advanced parameters**: Configure additional parameters as applicable to the selected Wi-Fi role. See details in sections 6.2.3 Advanced Wi-Fi Client mode parameters and 6.2.4 Advanced Wi-Fi Access Point mode parameters.
— **Statistics**: Observe key wireless network parameters to help troubleshoot and monitor performance issues. See details in section 6.2.5 Statistics (Expert view only).

Figure 2-4: Wi-Fi Network configuration section
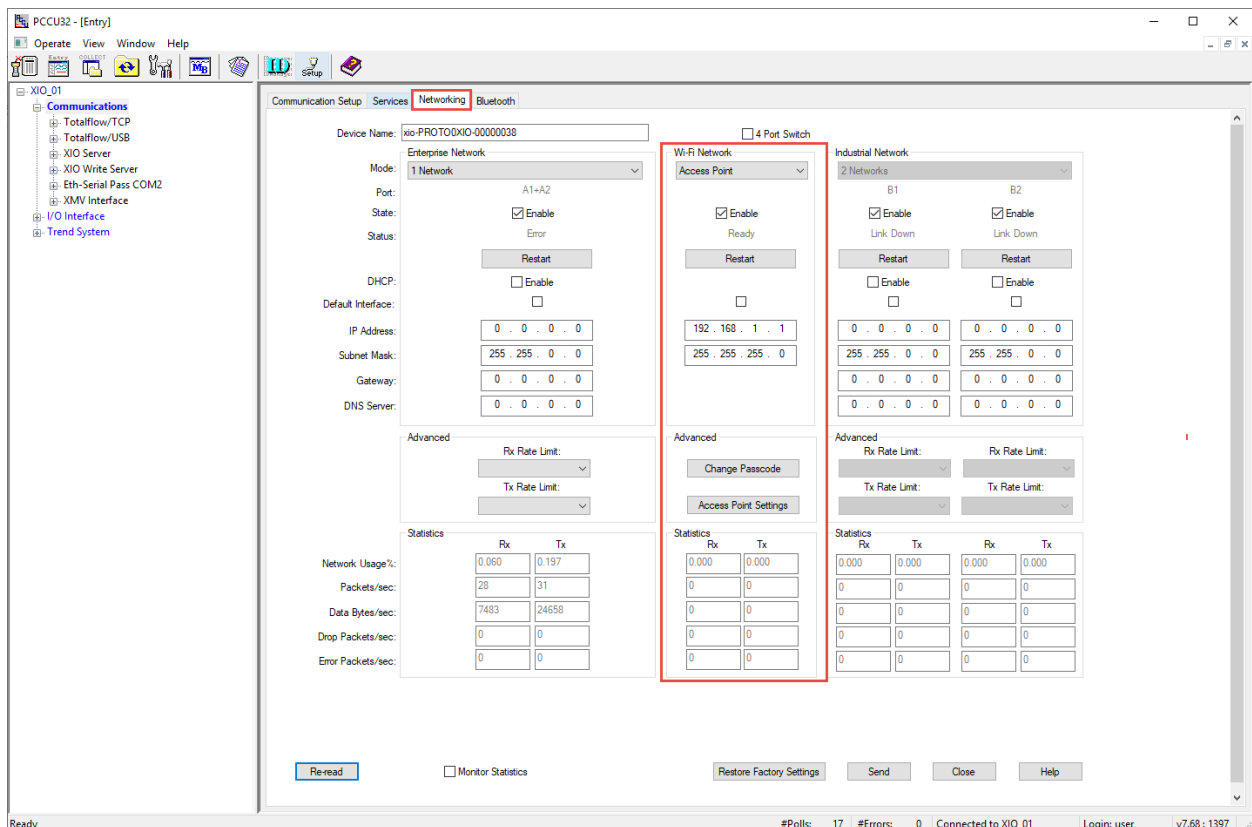
3 Ethernet connectivity scenarios

ABB Totalflow devices support standard-compliant Ethernet interfaces. Ethernet ports support connections between devices and the following:

— Host systems (PC or laptop): for access by user interfaces and other host software for local or remote communication to configure, monitor, or collect data

— Network equipment (Ethernet hubs/switches): to support network communications locally (onsite) or remotely (over the wide area customer network)
— Other ABB Totalflow devices: remote controllers, flow computers or analyzers to support field data transmission
— Other ABB or third-party control or peripheral equipment with Ethernet ports

There are a multitude of scenarios for Ethernet connections and configuration. These scenarios depend on the type and number of devices at a site, available network equipment, security requirements/constraints, and applications. The following sections provide common scenarios. For more complex requirements, call ABB technical support for assistance.

> **i** **IMPORTANT NOTE:** Plan Ethernet connections carefully to protect your device and peripherals from unauthorized or malicious access. The device should only connect to a firewall-protected private customer network, never directly to the Internet. Follow your company policies and guidelines for cybersecurity. For additional details on device security, refer to the user manuals (see Additional information).

Connection options are determined by the number of Ethernet interfaces on the devices. Review sections 3.1 Single port devices and 3.2 Multi-port devices to plan your connections.

> **i** **IMPORTANT NOTE:** Logical network diagrams included in some of the sections depict logical networks as a cloud for wide area networks, or as blue ovals for logical local networks associated with Ethernet interfaces. Logical connections between hosts and devices are depicted as blue dotted lines. Solid lines represent physical connections. Lines with arrows in a different color represent communication or data flows.

3.1 Single port devices

Single-port devices have a single Ethernet interface and they support a single physical Ethernet connection. These devices require a local network switch to support local or remote access, or device-to-device communication simultaneously. Direct physical Ethernet connection from a host is supported for initial access for configuration and commissioning. Once the device is configured with a permanent network connection, local access should be through the local switch. At sites with multiple core ABB Totalflow devices, the single-port devices can connect to multi-port devices in daisy-chain fashion if the local network switch does not have enough ports to support independent connections for each device. See section 3.2 Multi-port devices below.

3.2 Multi-port devices

Multi-port devices offer more connection options. These devices have switching capabilities. They can support multiple simultaneous physical connections and can forward traffic between those connections. These devices support daisy-chain connections to other devices or direct connection to field network switches (star topology). When daisy-chaining on switched-mode interfaces, the devices expand Ethernet port availability when the local network switch port number is limited.

3.3 Ethernet mode supported on single-port devices

ABB Totalflow devices with a single Ethernet port support only one mode of operation: 1 Network. These devices behave as network nodes with a single adapter attached to a network (Table 3-1).

Table 3-1: Ethernet mode for single-port devices

Mode	Ethernet interface configuration	Ports	Number of required IP addresses	Supported connections
1 Network	(Factory default) Single port can connect to a single network only.	ETH	1 address	Single physical connection to a field network switch or to another multi-port ABB Totalflow device. If the device is not managed over a network, and there is not a local network switch available, it can support direct physical Ethernet connection to analyzers for analysis data transmission over TCP. Support for additional equipment would require the installation of a network switch.

3.4   Ethernet modes supported on multi-port devices

ABB Totalflow devices with multiple Ethernet ports offer several configuration options depending on the Ethernet mode. Table 3-2 shows the options for both the RMC-100 and the XIO. The RMC has 2 Ethernet ports and the XIO has 4 Ethernet ports.

Table 3-2: Ethernet modes supported on multi-port devices

Mode	Ethernet interface configuration	Ports	Number of required IP addresses	Supported connections
RMC-100				
Enterprise ports: 1 Network (2-port switch)	(Factory default) Single interface, all ports assigned to a single network	E1+E2	1 address	The RMC provides a single network. It behaves as a switch allowing traffic forwarding from one interface to the other. Devices connecting to the RMC's Ethernet ports, when in switch mode, are nodes on a common network. All share the same subnet.
Enterprise ports: 2 Networks	Two interfaces: One for each Enterprise port	E1, E2	2 addresses (1 address for each interface)	The RMC provides separate networks on each of its interfaces. Traffic on each interface is isolated from the other interface. Each interface must have its own subnet.
XIO				
4-port switch	(Factory default) Single interface, all ports assigned to a single network	A1+A2+B1+B2	1 address	The XIO provides a single network. It behaves as a switch allowing traffic forwarding from one interface to the other. Devices connecting to the XIO when in switch mode are nodes on a common network. All share the same subnet.
Enterprise ports: 1 Network Industrial ports: 2 Networks	Three interfaces: 1: One for both Enterprise ports 2: One for each Industrial port	A1+A2 B1, B2	3 addresses (1 address for each interface used)	The XIO behaves like a 2-port switch on its Enterprise ports (labeled as A Network on the enclosure). It provides a single network for connections on those ports. The XIO provides separate networks for connections on its industrial ports (labeled as B Network on the enclosure).
Enterprise ports: 2 Networks Industrial ports: 2 Networks	Four Interfaces: 2: One for each Enterprise port 2: One for each Industrial port	A1, A2 B1, B2	4 addresses (1 address for each interface used)	The XIO provides separate networks on each of its interfaces. Traffic on each interface is isolated from the other interface. Each interface must have its own subnet.

3.5   First-time local communication (host-to-device)

The startup configuration of ABB Totalflow devices requires first-time local communication. Establish a connection between a PC or laptop and the device after installation and power-on sequence is complete.

The Ethernet factory default configuration of all devices supports initial connection with pre-configured IP parameters. Table 3-3 provides default IP addresses for devices in their default mode. Connect to any of the ports and use the default IP address to establish connection. Connect either directly to any of the Ethernet ports or to the local network switch if one is used.

The default IP configuration on an ABB Totalflow device is available to support initial local access by an operator during installation and first-time configuration. If the device is configured for network communication, a valid IP configuration for the field network must replace the factory default.

Local access to devices on a network is still supported after the default configuration is replaced, but the operator laptop must have an IP configuration compatible with the non-default addresses assigned to the devices. If physical connection to Ethernet ports is not possible without disconnecting devices, local access is also available using Wi-Fi® as described in section 4 Wi-Fi® connectivity scenarios.

Table 3-3: Factory default IP addresses for first-time local communication

Device	Default mode	Default IP address	Port for initial connection
Single-port devices	1 Network	169.254.0.11	ETH
RMC-100	1 Network (2-port switch)	169.254.0.11 (All ports)	Any of the two ports: E1 or E2
XIO	4-port switch	169.254.0.13 (All ports)	Any of the four ports: A1, A2, B1, or B2
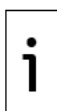
> **IMPORTANT NOTE:** Multi-port devices also have a unique factory default address for each interface when not in switch mode. Change default addresses only if the interface will be used. An unused interface should be left with its default value. Direct physical connection to an available port for local operator access can use this default address to establish communication. See section 6.1.1 IP addressing for the default values for all interfaces.

3.6   General recommendations for configuration

Ethernet interface configuration requires some planning for multi-port devices. Multi-port devices, such as the RMC and XIO, can reduce the need for additional network equipment and IP addresses when their switching capabilities are enabled in the field. Enabling and configuring Ethernet interfaces correctly provides additional network topology options. Consult with your IT administrator about what is appropriate for your field networks. The following are general guidelines to consider:

1. Keep unused interfaces disabled. Enable only when needed. Enabled interfaces do have an impact on power consumption and device resource usage.
2. Keep unused interfaces with their factory default IP configuration. Default IP configuration allows plug and play local access for operators (no need for laptop configuration to be able to connect to the device). Local operator access may be required at any time. Having a port available for connection is helpful.
3. If Ethernet port sets are in 1-Network mode, that is, they are configured as a single Ethernet interface, they required only one IP address for the interface.
4. All Ethernet interfaces used to connect to a field LAN must have a unique IP address for successful connectivity over that LAN. IP addresses should be valid public or private IP addresses.
5. It is recommended that IP addresses are statically configured (inserted manually). Automatic IP assignment using DHCP may cause connection loss if the DHCP server fails and the interface loses its IP address configuration. Loss of IP addresses must be avoided, especially if the Ethernet interface handles connections containing real-time measurement traffic.
6. For scenarios with port forwarding enabled (supported by the XIO):
   a. If an interface is used as the uplink, then it should have a valid IP address for the corporate (WAN) network. This may be a public IP address from the range assigned to the customer. Obtain valid IP addresses from your IT administrator.
   b. If the interface is used as the connection for the local or field network (field LAN), it should have an IP address from any of the reserved private IP addressing ranges. All devices daisy-chained through this connection must have a unique address in this range. Private IP address ranges are defined by Internet authorities. There are several ranges available. Follow the convention set by your IT administrator. Totalflow devices have factory-default private addresses for initial local connection, but the addresses must be changed on those interfaces that will be used to connect to the field LAN.
7. If ports are in 2-Network mode, they need to be treated as completely separate networks and must be configured with unique addresses in different subnets.
8. For communication between different logical networks:
   a. The embedded switch on the RMC and XIO does not support routing. If different subnets are implemented in the field, an additional external layer 3 router may be required.
   b. The XIO supports port forwarding. This function can be used to provide communication between devices in different logical subnets. The communication is not automatic once the function is enabled. Specific forwarding rules must be manually defined in the XIO for communication to be possible. See section 3.12 XIO: Port forwarding for details.

9. Ethernet interface configuration may require mode and IP parameter configuration changes. See sections 6.1.1 IP addressing and 6.1.2 IP addressing after mode and configuration changes for additional recommendations in configuration.

IMPORTANT NOTE: Additional information is available in the online PCCU help files. Click **Help** on the configuration screens for details on parameter descriptions, procedures, and other configuration guidelines. The Networking tab, Port Forwarding tab and Network Diagnostic tools tab have several associated topics available in PCCU. The help file information is always the most up-to-date information.

3.7 RMC: 1 Network mode (2-port switch)

The RMC supports switching capability and can behave as a 2-port switch. This mode of operation is the factory default and is displayed as: 1 Network, in the Mode field on the Networking tab screen.

IMPORTANT NOTE: When the RMC is in 1 Network mode (2-port switch), never connect the Ethernet ports to an external Ethernet switch at the same time (Figure 3-1). Connecting to the same switch in this mode causes loss of connections to the device. Connect only one port to the switch.

Figure 3-1: Incorrect connection of RMC in 2-port switch mode to a network switch

DO NOT SET UP THIS CONNECTION

Ethernet 1
Ethernet 2

10/100 BaseT
Ethernet switch or hub

Do not connect Ethernet 1 and Ethernet 2 ports to the same Ethernet switch or hub
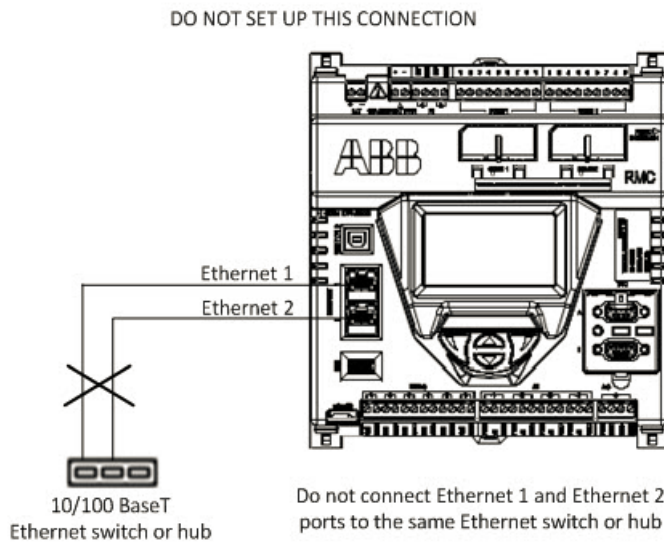
3.7.1 First-time local communication connections

Figure 3-2 shows first-time local communication through direct connection to either port or through a local field switch. The RMC can connect to a network switch using either port. The example shows the RMC's default IP address (168.254.0.11). The laptop shows an example of a compatible IP address. The laptop can obtain this address automatically (default and preferred) or you can configure it manually.

Figure 3-2: Local access by host to an RMC-100 in 2-port switch mode
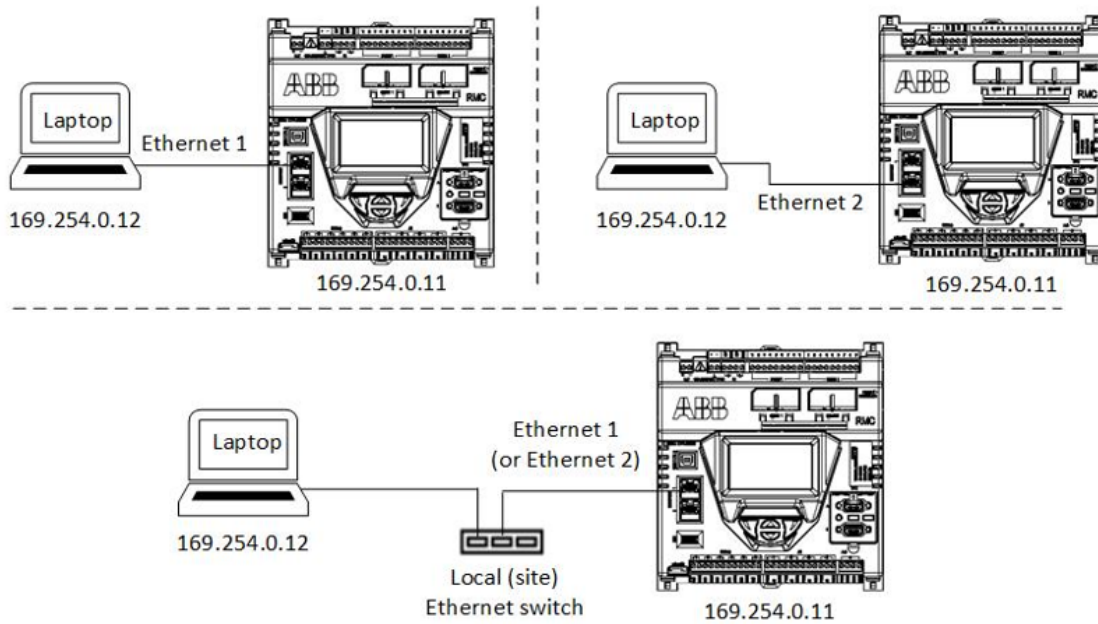
3.7.2 Remote access to RMC by host

Figure 3-3 shows remote access through the customer wide area network. Use either Ethernet port to connect the RMC to the field network switch. The RMC's IP address is a non-default generic number as an example. The subnet address the RMC is configured for is represented by "ZZZ". The address remains the same whether the RMC is connecting using Ethernet port 1 or 2.

Figure 3-3: Remote access by host to an RMC-100 in 2-port switch mode
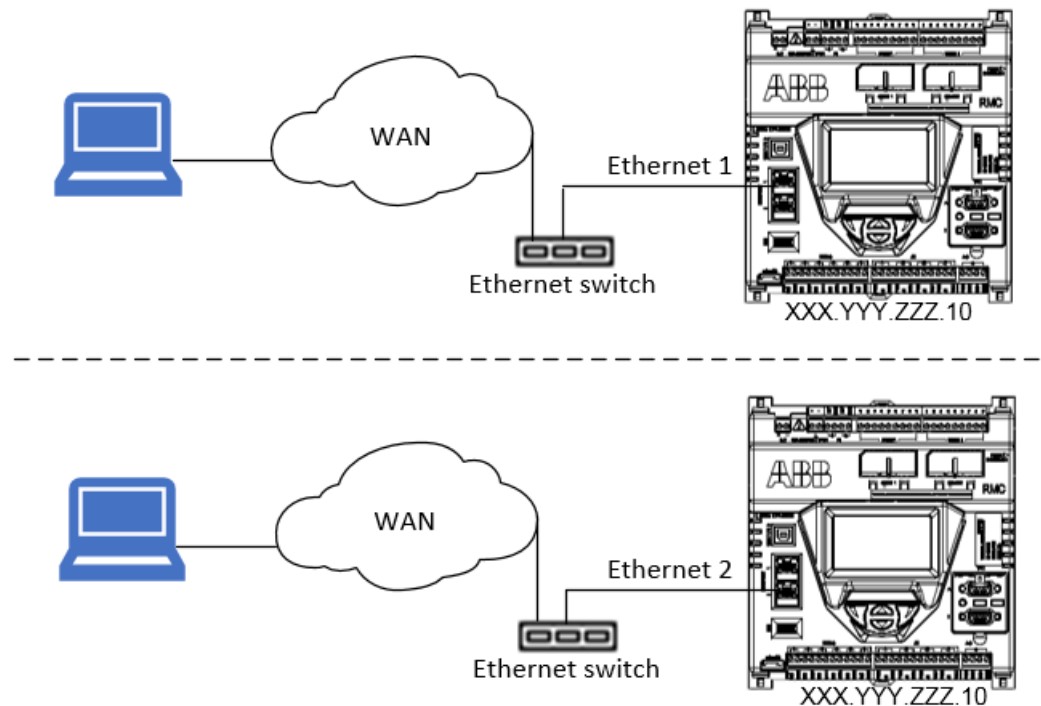
3.7.3 Local access to RMC by host

Figure 3-4 shows local access with an RMC that has been configured for connection to the customer wide area network. Local access to the RMC using Ethernet does not require disconnecting the RMC from the network. You can connect to the unused Ethernet port while leaving the connection to the network intact.

> **IMPORTANT NOTE:** When the RMC is configured for network connection, the default IP address is no longer available. The laptop must have an IP address compatible with the new non-default address assigned to the RMC.

Figure 3-4: Local access by host
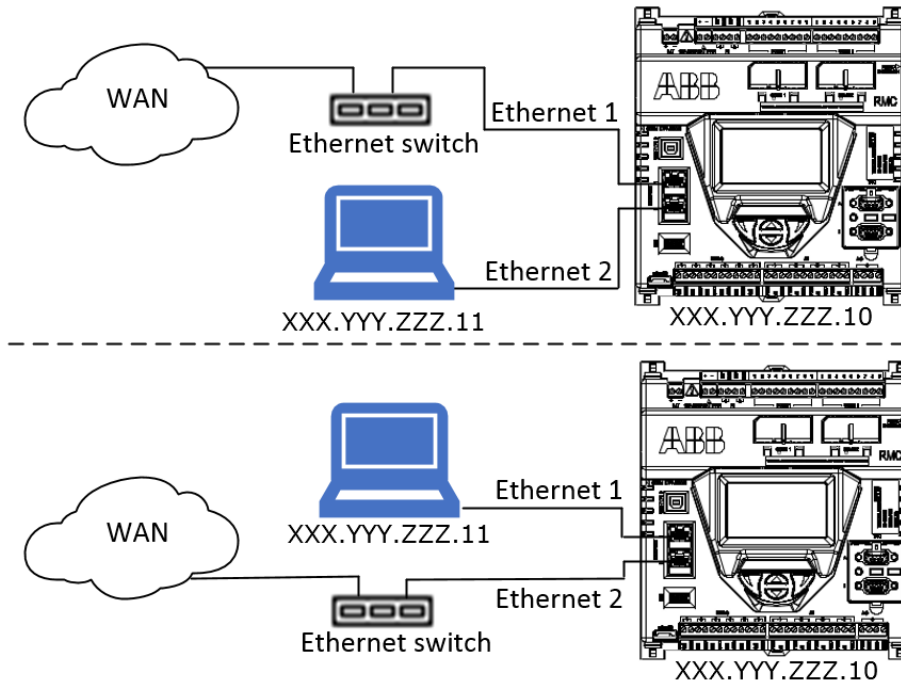
3.7.4 Daisy-chain connection support for other devices

The RMC in 1 Network (2-port switch) mode supports daisy-chain connections with other devices. Additional devices in the field can connect to a local network switch (star topology) or to the RMC for the uplink to the wide area customer network (daisy-chain topology). Figure 3-5 shows an example of a daisy-chain of multiple XIOs and an RMC. Because the XIOs have multiple ports, they can support additional devices. To simplify device management and configuration, daisy-chained XIOs are also in switched mode. Ethernet interfaces connected through the chain are combined into a single network; their assigned IP addresses have the same common subnet. In the example, the generic subnet is represented by "ZZZ" and each device has a unique IP address on that subnet.

An RMC in 1 Network mode forwards traffic between the network and daisy-chained devices transparently. Figure 3-5 shows an example of daisy-chain connection support with two XIOs. The local network switch is not shown. The local switch may have a limited number of ports and support only the RMC and the uplink connection. RMC port E1 connects to the customer network and port E2 daisy-chains to the XIOs (in 4-port switch mode).

Figure 3-5: RMC daisy-chain connection support (1 Network mode)
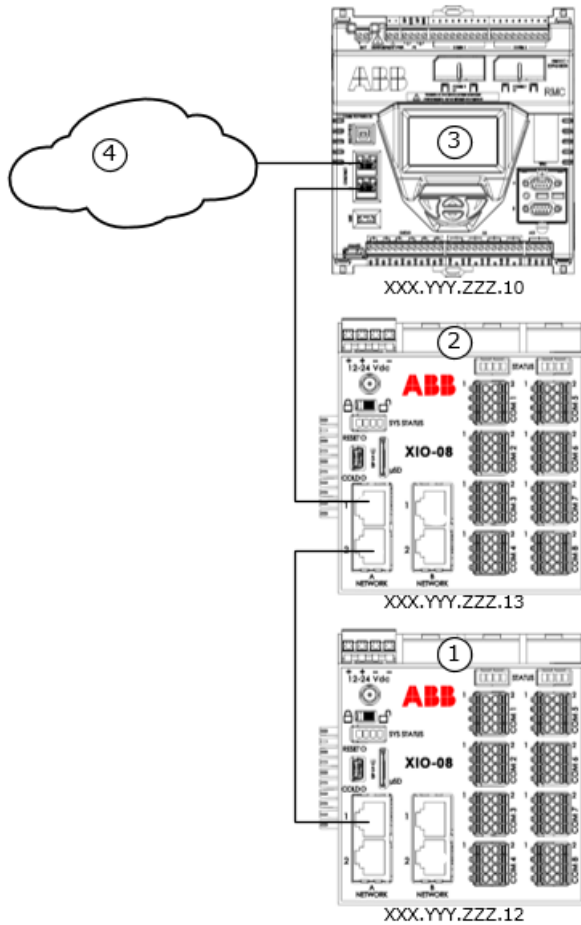
Legend: RMC daisy-chain connection support (1 Network mode)

1	XIO (4-port switch mode)	3	RMC: 1 Network Mode (2-port switch)
2	XIO (4-port switch mode)	4	Customer wide area network (WAN)

Remote access to the daisy-chained devices is through the single network associated with the 2 RMC ports. Access to those devices is transparently done through the RMC.

Local access to the RMC and XIOs is possible by connecting to any available port in the chain (B1 or B2 on the first XIO, or A2, B2, or B1 on the second XIO). Local access is also possible through a switch if one is used and it has available ports. Note that neither RMC port is available for local connection without disconnecting the RMC from other devices (E1 and E2 are permanent local connections).

For details on remote or local access to daisy-chained XIOs in 4-port switch mode, see examples described in sections 3.9.2 Remote access to XIO by host and 3.9.3 Local access to XIO by host.

If not in proximity to the last available port, then wireless access to the devices, including the RMC, is possible through an XIO configured as an access point with bridging. See section 4 Wi-Fi® connectivity scenarios for details.

> **ⓘ** **IMPORTANT NOTE:** The RMC supports connection with single-port devices, but the daisy-chain is limited to two devices as the single-port device does not have additional ports to connect other devices. With multi-port devices such as other RMCs or XIOs, the daisy-chain can include more than 2 devices.

3.8   RMC: 2 Network mode

The RMC in 2 Network mode separates the two Ethernet interfaces into two networks. Figure 3-6 shows an RMC supporting daisy-chain connection to a couple of XIOs. While physical connections are the same as for 1 Network mode, the logical networks resulting from this mode are not the same. Port E1 and E2 are each associated with a different network [E1 LAN (5) and E2 LAN (6) in the figure]. The XIOs connected on RMC port E2 are no longer part of the network associated with RMC port E1. Each of the RMC Ethernet interfaces

requires an IP address on a different subnet. The figure shows generic IP addresses for each of the RMC Ethernet interfaces in two different subnets ("ZZZ" for E1 and "AAA" for E2). The XIOs daisy-chained to RMC-E2 (6) are in 4-port switch mode and therefore each require a single IP address on the same subnet ("AAA").

Figure 3-6: RMC daisy-chain connection support (2 Network mode)
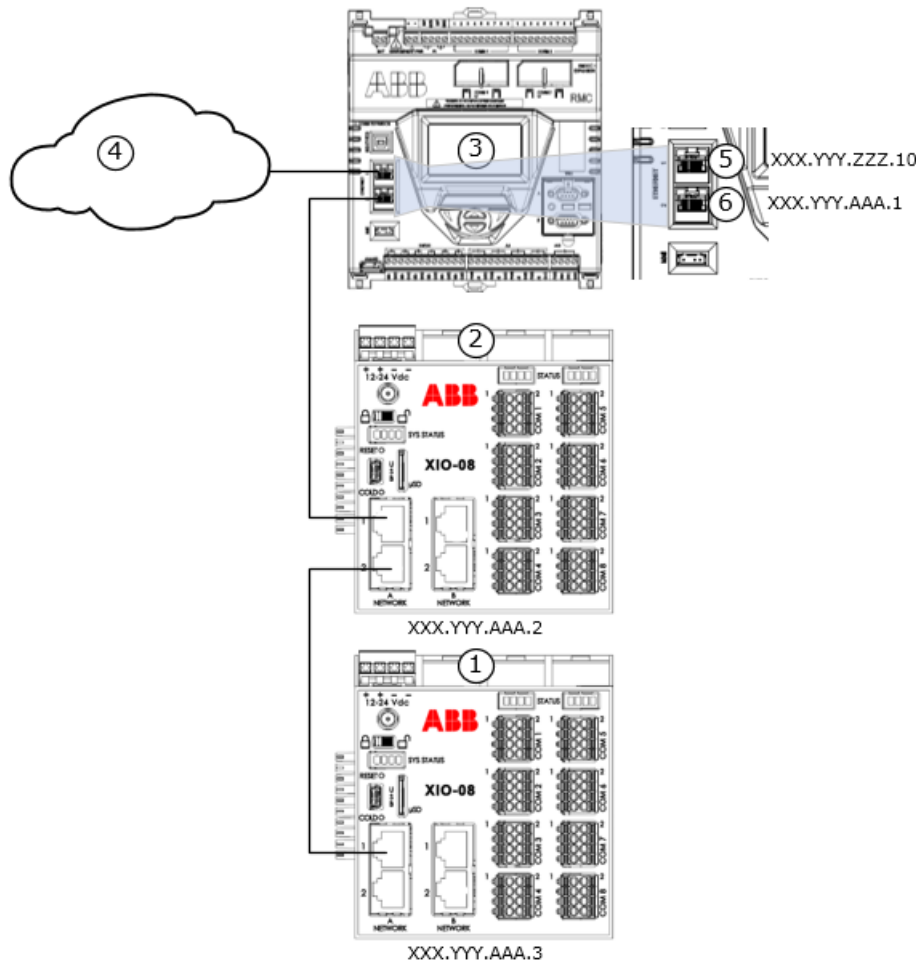
Legend: RMC daisy-chain connection support (2 Network mode)

1	XIO (4-port switch mode)	**4**	Customer Wide Area Network (WAN)
2	XIO (4-port switch mode)	**5**	RMC-E1 (LAN E1)
3	RMC (2 Networks Mode)	**6**	RMC-E2 (LAN E2)

Traffic on one RMC port is isolated from the other port.

Remote access to the RMC should use the IP address assigned to the port with uplink connection to the network (in the example, E1 IP address XXX.YYY.ZZZ.10).

Local access to the RMC should use the IP address assigned to the other port (in the example, E2 IP address XXX.YYY.AAA.1) if the operator connects a laptop to an available port on any of the XIOs.

3.8.1   Daisy-chain connection support for other devices

As shown in figure above, the RMC in 2 Network mode supports daisy-chain connections with other devices (in this example, XIOs). In this mode, however, the RMC isolates daisy-chained XIOs in the field, as traffic received on the RMC's network uplink port will not be automatically switched (forwarded) to the port with the daisy-chained XIOs.

Remote and local access to the daisy-chained devices are impacted with the RMC in 2 Network mode. Plan connections carefully to ensure that access to devices is available as required.

3.8.1.1   Local access to daisy-chained devices

Figure 3-7 is a logical representation of the 2 Network configuration of the RMC and its support for daisy-chained devices, as depicted in Figure 3-6 above. It shows local access on one of the networks (3)

associated with one of the RMC Ethernet ports (in this example, E2). The laptop and devices must have the same subnet in their IP addresses. Operators can establish connections to all devices over this network (blue dashed lines show logical connections).

Figure 3-7: RMC on 2 Network mode supports local access only
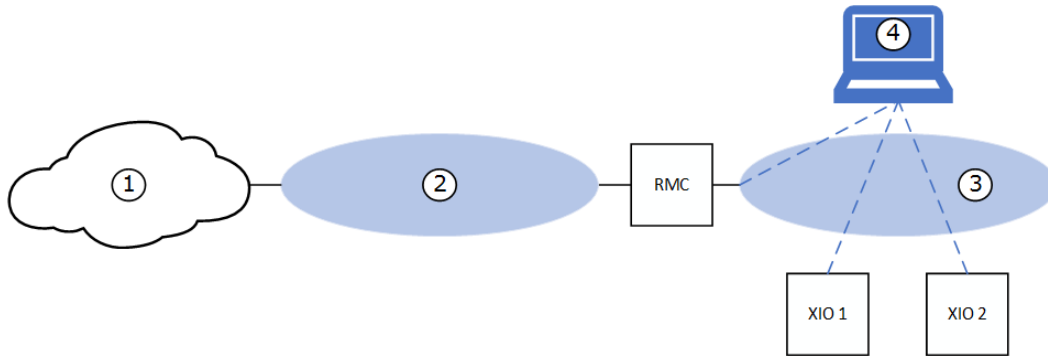
Legend: RMC on 2 Network mode supports local access only

1	Customer Wide Area Network (WAN)
2	RMC (2 Network mode): E1-LAN
3	RMC (2 Network mode): E2-LAN
4	Operator laptop

3.8.1.2   Remote access to daisy-chained devices (routing required)

Figure 3-8 below shows that remote access is only available to the RMC (blue dashed line shows logical connection from PC or laptop to the RMC). Access to the XIOs is not possible in this scenario as the RMC does not route between E1 [LAN (3)] and E2 [LAN (4)]. Traffic from the customer wide area network (2) is not forwarded to the XIOs [on LAN (4)].

For remote access to the XIOs, a router is required.

Figure 3-8: RMC on 2 Network mode isolates local field network
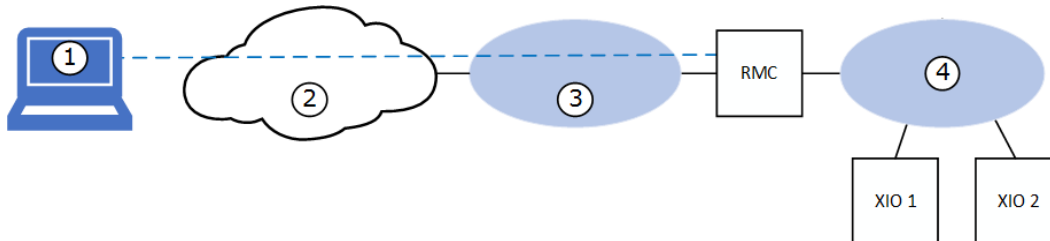
Legend: RMC on 2 Network mode isolates local field network

1	Host system with PCCU
2	Customer Wide Area Network (WAN)
3	RMC (2 Network mode): E1-LAN
4	RMC (2 Network mode): E2-LAN

3.9   XIO: 4-port switch mode

The XIO controller must be configured for network communication since its core functionality depends on TCP/IP-based connections with remote controllers.

Successful network communication depends on correct configuration of valid IP parameters for all devices on a field network. Configuration depends on desired network topologies. The XIO supports several scenarios with its different modes of operation as described in section 3.4 Ethernet modes supported on multi-port devices.

The XIO supports switching capability and can behave as a 4-port switch. This mode of operation is the factory default (the 4-port switch checkbox on the default Networking tab screen shows selected).

> **ℹ** **IMPORTANT NOTE:** When the XIO is in 4-port switch mode, never connect the Ethernet ports to an external Ethernet switch at the same time (Figure 3-9). Connect only one port to the switch. Connecting to the same switch in this mode causes loss of connections to the device.

Figure 3-9: Incorrect Ethernet connections (XIO in 4-port switch mode)
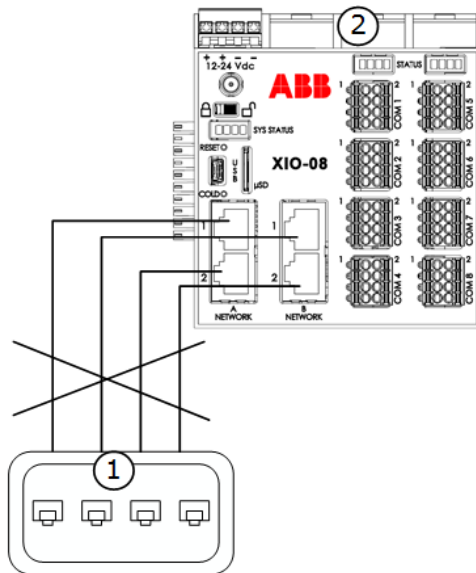
Legend: Incorrect Ethernet connections (XIO in 4-port switch mode)

1	Third party field Ethernet switch or hub
2	XIO

3.9.1   First-time local communication connections

Figure 3-10 shows first-time local communication through direct connection to an A or B XIO Ethernet port. An XIO on 4-port switch mode supports first-time connection on any of the ports. If a switch is used, first time local connection is also possible through the switch.

Figure 3-10: Local connection to XIO on 4-port switch mode
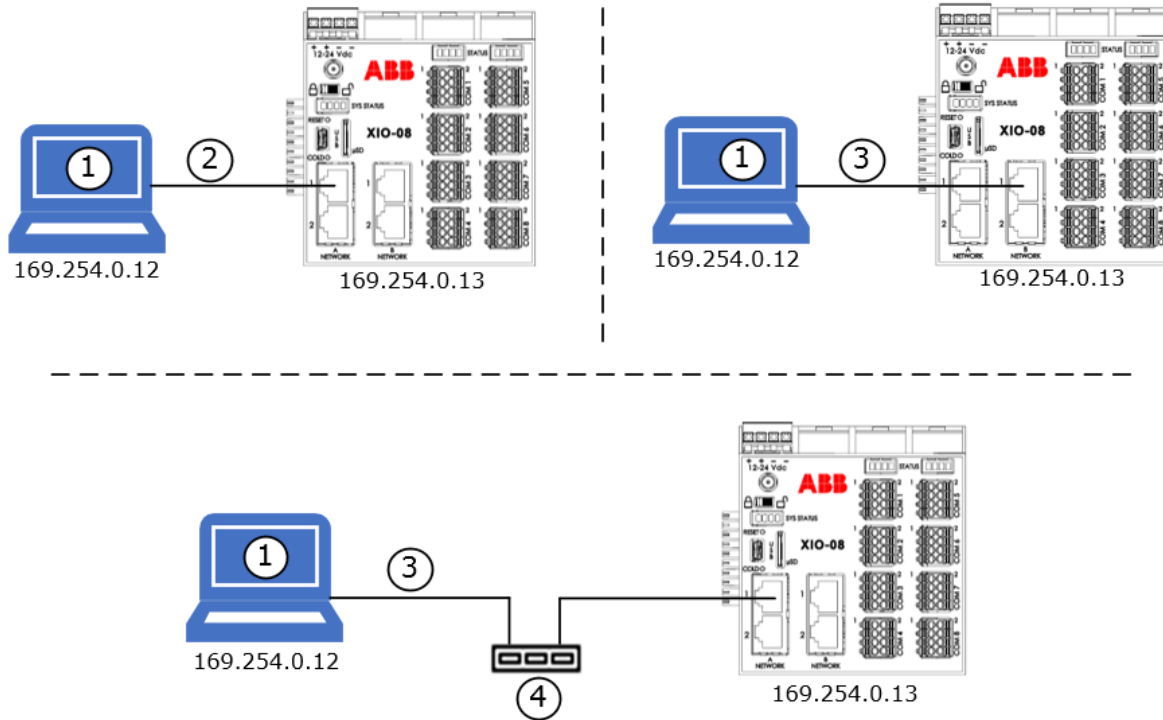
Legend: Local connection to XIO on 4-port switch mode

1	Operator laptop for local connection
2	Connection to network A port (either port is usable)
3	Connection to network B port (either port is usable)
4	Field network switch

3.9.2   Remote access to XIO by host

Network communication is necessary for remote management of the device over a TCP/IP network (customer private wide area network). Hosts can have remote access to the XIO when both the host and the XIO are configured with valid IP parameters to connect to the customer network.

In 4-port switch mode, the XIO requires only a single valid IP address which the host can use to establish connection over the network.

3.9.2.1   Host connects to XIO on field network switch (star topology)

Manage XIO(s) with independent connections to a field network switch. Figure 3-11 shows the network connection for an XIO on a field switch (3) in a star topology implementation. This connection requires that a network switch is available in the field and that there are enough ports available for additional equipment or XIOs. In the figure, the RMC and XIO have generic IP addresses on the same subnet (represented by "ZZZ"). Each device has a unique IP address. Traffic between devices on the same subnet is switched by the field Ethernet switch (no routing required).

> **IMPORTANT NOTE:** When the XIO is in 4-port switch mode, you can use any of the Ethernet ports (A1, A2, B1 or B2) to connect to the network switch. You can move the connection to any of the ports without the need to reconfigure the IP address of the XIO. Keep consistency in selecting the ports for network connection when installing multiple XIOs; for example, use A1 port.

Figure 3-11: Remote access by host supported physical connections (star topology)
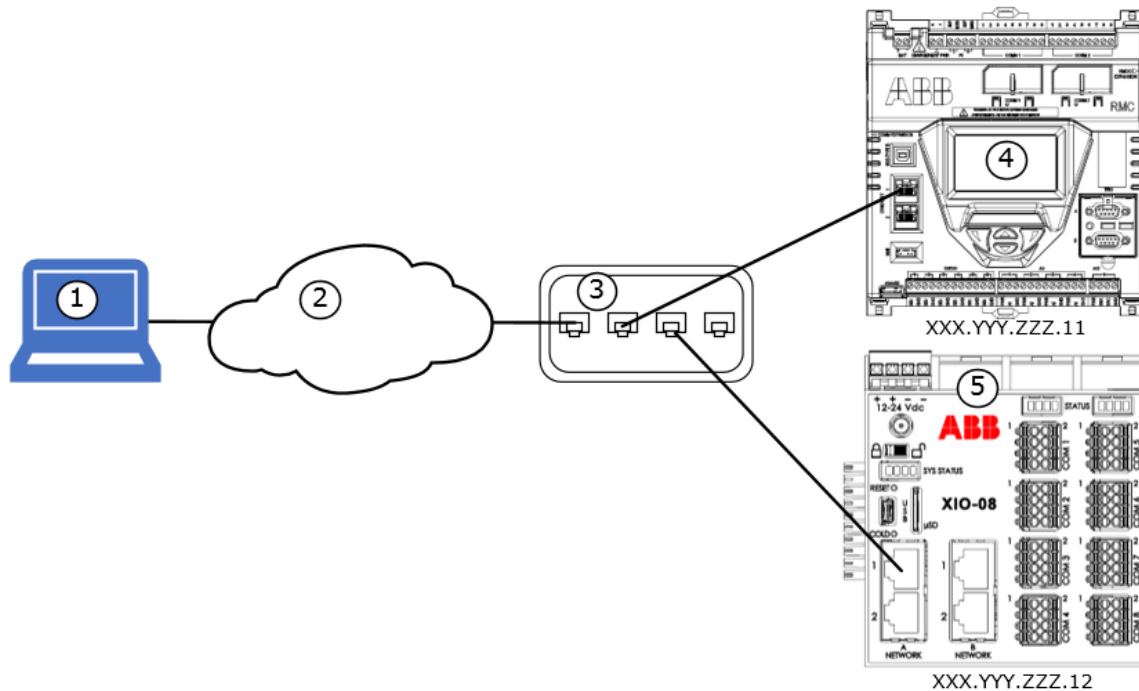
Legend: Remote access by host supported physical connections (star topology)

1	Host system with PCCU	**4**	RMC-100 (1 Network mode)
2	Customer Wide Area Network (WAN)	**5**	XIO (4-port switch mode)
3	Field network switch		

3.9.2.2   Host connects to XIO daisy-chained to RMC

Figure 3-12 shows the network connection for the XIO through an RMC-100 in a daisy-chain topology. This connection requires that the RMC-100 Ethernet interfaces are configured in 1 Network mode as described in section 3.7.4 Daisy-chain connection support for other devices. This mode allows the RMC-100 to behave as a 2-port switch to switch traffic between the network and the XIO. This scenario may be necessary when there are no additional ports available on a field network switch. The figure shows generic IP addresses for the RMC and XIO as examples. Both addresses are on the same subnet (represented by "ZZZ").

> **IMPORTANT NOTE:** When the XIO is in 4-port switch mode, any of the Ethernet ports (A1, A2, B1 or B2) are usable to connect to the RMC-100. Move the connection to any of the ports without reconfiguration of the IP address of the XIO. Additional XIOs can connect to the chain. For example, a second XIO can connect to port A2 on the first XIO. A third XIO can connect to port A2 on the second XIO, etc. Each XIO must have a unique and valid IP address. All devices, including the RMC, must have IP addresses on the same subnet.

Figure 3-12: Remote access by host – physical connections (daisy-chain topology)

XXX.YYY.ZZZ.11

XXX.YYY.ZZZ.12
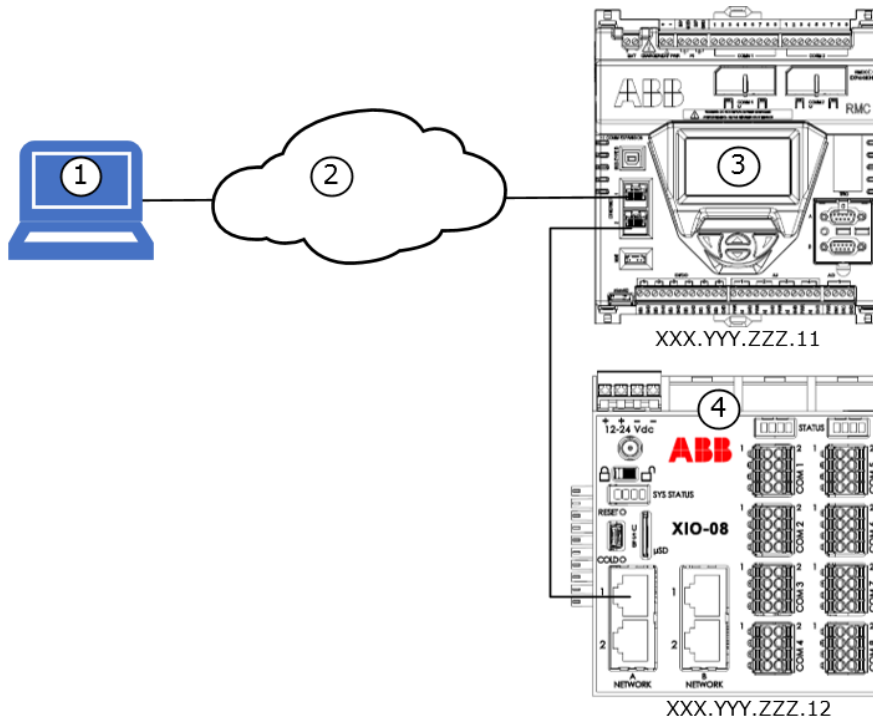
Legend: Remote access by host – physical connections (daisy-chain topology)

1	Host system with PCCU	**3**	RMC-100 (1 Network mode)
2	Customer Wide Area Network (WAN)	**4**	XIO (4-port switch mode)

3.9.3   Local access to XIO by host

Figure 3-13 shows the connections for local access by a host for devices daisy-chained in the field. In this example, the RMC (3) is configured as a 2-port switch (Ethernet interfaces E1 and E2 are set to 1 Network Mode). The XIOs (1, 2) are configured as 4-port switches (Ethernet interfaces A1, A2, B1, and B2 set to 4-port switch mode). The first XIO (2) connects to the RMC with A1, and to the second XIO (1) with A2.

To establish communication with the devices, the operator can connect the host system (5) to any of the available ports without permanent connections. The figure shows two connections from the host as examples, but only one physical connection is needed. When the host connects to either interface, it is connecting to the common network that the switched-mode interfaces provide. See the logical equivalent of this configuration in Figure 3-14: Local access by host – logical connections to all daisy-chained devices.

Figure 3-13 shows generic IP addresses for each connected device all in the same subnet (represented by "ZZZ"). In 4-port switch mode, each XIO requires only one IP address regardless of the port used for direct connection.

Figure 3-13: Local access by host – supported physical connections (daisy-chain topology)

XXX.YYY.ZZZ.11

XXX.YYY.ZZZ.13

XXX.YYY.ZZZ.20

XXX.YYY.ZZZ.12
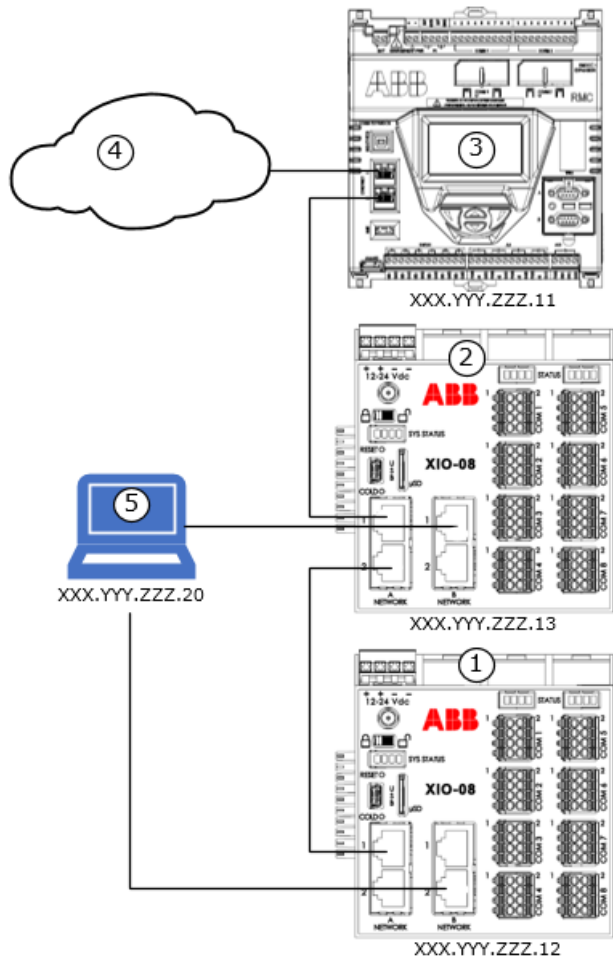
Legend: Local access by host – supported physical connections (daisy-chain topology)

1	XIO (4-port switch mode)
2	XIO (4-port switch mode)
3	RMC-100 (1 Network mode)
4	Customer Wide Area Network (WAN)
5	Operator laptop with PCCU: local access through XIO-1 (B1) or XIO-2 (B2)

Figure 3-14 below shows the logical network equivalent to the connections shown in Figure 3-13 above. A local system with PCCU (1) can establish connections to each daisy-chained device on the same network (3). Each device must have an IP address with the same subnet assigned to the network. The host must also have that same subnet in its IP address. Note that connections lines on diagrams are independent logical TCP/IP based connections to each device (from a PCCU instance for each). The host connects to any available Ethernet port on any of the XIOs (physical connection not shown).

Figure 3-14: Local access by host – logical connections to all daisy-chained devices
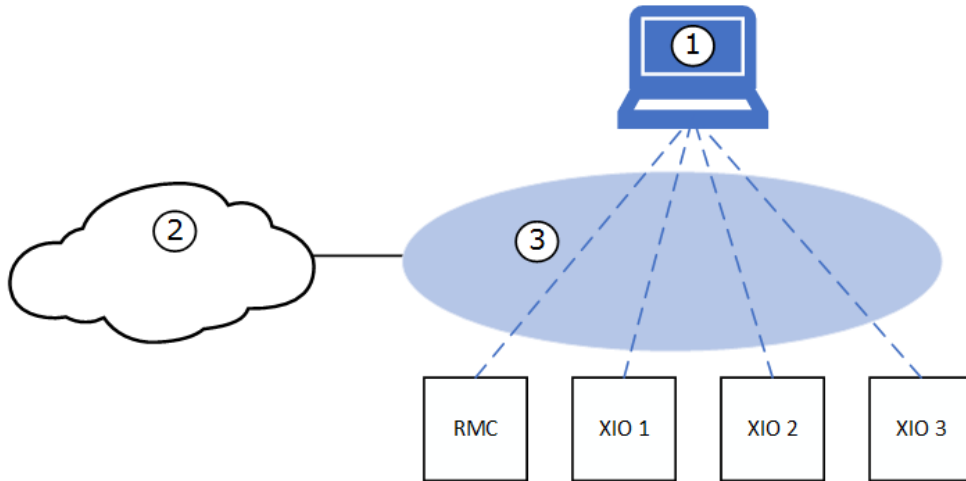
Legend: Local access by host – logical connections to all daisy-chained devices

1	Operator laptop with PCCU for local access	**3**	Field network (all devices, same subnet)
2	Customer Wide Area Network (WAN)		

If not in proximity to the last available port, then wireless access to the devices, including the RMC, is possible through an XIO configured as an access point with bridging. See section 3.12 XIO: Port forwarding for details.

3.9.4 Device-to-device communication

Device-to-device communication includes the communication flow between ABB Totalflow applications running on the different devices installed in the field and connected through a network.

Using client-server-based communication, client applications on one device can request and establish a TCP/IP connection to a server application on another device.

In the case of the XIO, its core functionality depends on secure and stable TCP/IP based connections with a remote controller. These connections must have their end points correctly configured to successfully establish communication.

Table 3-4 shows the connections required for successful implementation of XIOs. These connections require that the end points (responsible for establishing and maintaining the connection), be on devices connected to the same network. Each application end point must be configured with a unique IP address valid for that network.

When configuring IP parameters, consider the following:

— When both the RMC and XIOs are in switched mode, the RMC and the XIOs need unique IP addresses with the same subnet as the single network segment resulting from this mode.
— When the RMC is not in 2-port switch mode, the RMC requires two IP addresses for each of its Ethernet Interfaces. One address is for the connection upstream to the local network switch or to the corporate network. The other address is for the connection to the XIOs. In this case, the RMC IP address must have the same subnet as the network it connects to for communication with the XIO.
— When XIOs are not in 4-port switch mode, the XIO IP address configuration depends on how the interfaces are configured and what network segment is used to connect both the RMC and the XIO.

Unless routers are installed in the field network, traffic between different subnets is not possible. Plan your field network topology carefully.

Table 3-4: Required connections for XIO – RMC communication

Client app (RMC)	Server app (XIO)	Connection end points	Network config
XIO Interface	XIO [Read] Server	RMC IP to XIO IP/Read TCP port	Both end points MUST be on same network.
XIO Interface	XIO Write Server	RMC IP to XIO IP/Write TCP port	Both end points MUST be on same network.
Communication Application Instance	Ethernet-Serial Passthrough instance	RMC IP to XIO IP/E-S Instance TCP port	Both end points MUST be on same network.

3.10   XIO: Enterprise and Industrial (3 Network) support

The 4 Ethernet interfaces on the XIO can support separate networks in two sets: The Enterprise A-Network ports (port A1 and port A2) and Industrial B-Network ports (port B1 and port B2). Each of these sets can be configured independently of the other to provide additional connection and topology options in the field.
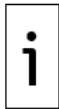
> **i** **IMPORTANT NOTE:** Separate configuration options for these ports become available only when the XIO 4-port switch mode is disabled. Configuring an XIO for 3 Network support requires 3 separate subnets. The IP address for each supported interface must have the correct subnet.

The Enterprise port set (A-Networks) supports both 1 Network and 2 Network modes. The Industrial port set (B-Networks) supports only 2 Network mode. For this scenario, the Enterprise Network set is left on 1 Network mode.

Table 3-5 summarizes the configuration options for this scenario. The Enterprise Network ports can be used for device management connections (connections supporting remote or local host access, contained in the associated subnet). The industrial ports can be used for application and measurement data traffic (supporting device-to-device communication flows, contained in a separate subnet from the one associated for management traffic). This scenario supports complex applications with several XIOs and where there is need to isolate XIOs in separate subnets or domains within in the field. Consult with ABB Technical Support for more details.

Table 3-5: Enterprise (A) and Industrial (B) networks configuration

Ethernet Mode	Ethernet interface configuration	Interface	Number of networks	Number of required IP addresses
Enterprise A-Network ports: 1 Network	1: One for both Enterprise ports	A1+A2	1	One per interface (A1+A2)
Industrial B-Network ports: 2 Networks	2: One for each Industrial port	B1, B2	2	One per port: (B1 IP, B2 IP)

3.10.1   Configuration

To configure for 3 Network support:

1. Connect to the XIO on PCCU entry mode.
2. On the navigation tree, select **Communications**. The Communication Setup screen displays.
3. Select the **Networking** tab.
4. Clear the **4-Port switch** mode checkbox to display options.
5. Click **Send**. The Enterprise (A-Network) and Industrial (B-Network) interfaces activate for individual configuration (Figure 3-15). In new systems, default or factory IP addresses may display for each of the interfaces.

Figure 3-15: XIO 3 network support (1 Enterprise and 2 Industrial networks)
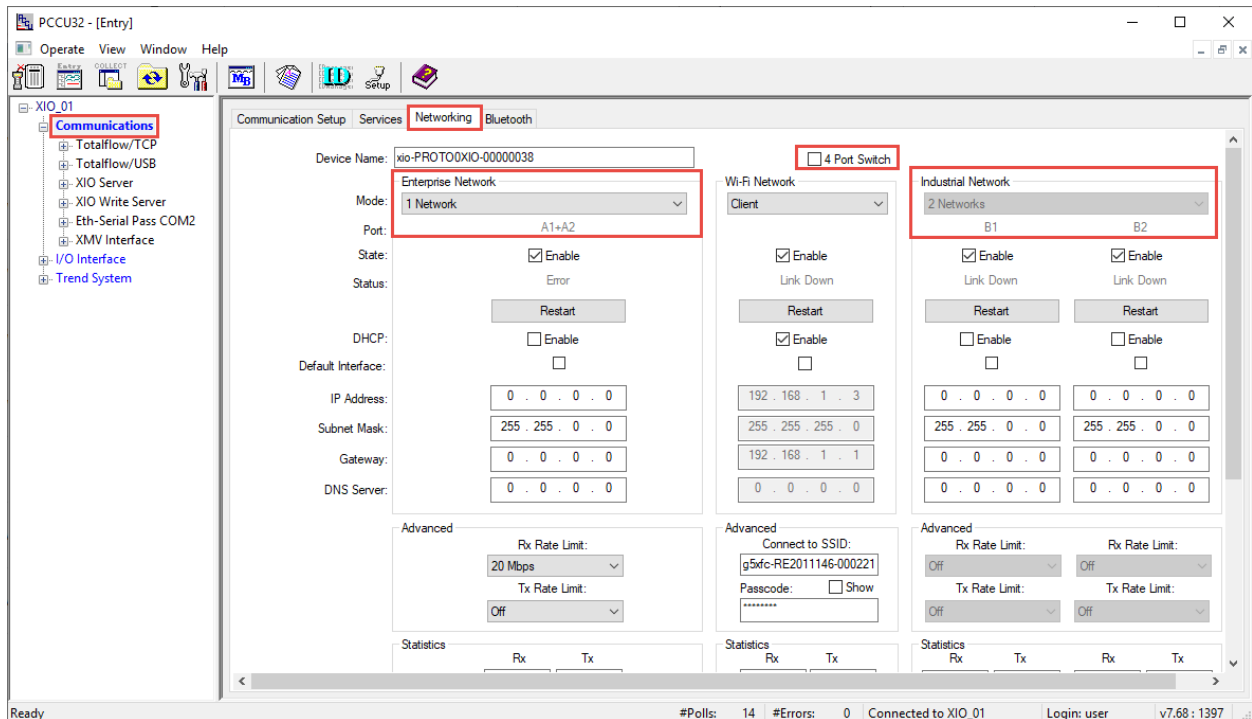
6. On the Enterprise Network section, in the **Mode** drop-down list, leave the default: 1 Network.
7. Select **Enable** for the State of the A1+A2 interface. The IP parameter fields activate for configuration.
8. Change the default IP parameters to the required IP parameters for LAN connection.
9. Click **Send**.
10. Click **Restart**.
11. Verify that the link status for the interface shows: Ready.

> **IMPORTANT NOTE:** After completing the configuration of the Enterprise interface, a single (A1+A2) interface should display as an option in the Enterprise Interface drop-down list in the XIO's Port Forwarding tab. If the XIO will be used in port forwarding mode, see section 3.12.6 Define port forwarding rules.

12. On the Industrial Network section, select **Enable** for the State of the preferred port (B1 or B2). The IP parameter fields activate for update. If you are enabling both interfaces, enable the state for each and configure each interface.
13. Configure IP parameters as required.
14. Click **Send**.
15. Click **Restart**.
16. Verify that the link status for the configured interface shows: Ready.

> **IMPORTANT NOTE:** After completing the configuration of the Industrial interfaces, the enabled interface (B1 or B2) should display as an option in the Enterprise Interface drop-down list in the Port Forwarding tab. If both interfaces have been configured, each will display in that list. If the XIO will be used in port forwarding mode, define port forwarding rules. See section 3.12.6 Define port forwarding rules.

3.11 XIO: Enterprise and industrial (4 Network) support

The 4 Ethernet interfaces on the XIO can support 4 separate networks: 2 networks by the Enterprise Network ports (port A1 and port A2) and 2 networks by the Industrial Network ports (port B1 and port B2). Each of these ports can be configured independently of the other to provide additional connection and topology options in the field.

IMPORTANT NOTE: Separate configuration options for these ports become available only when the XIO 4-port switch mode is disabled. Configuring an XIO for 4 Network support requires 4 separate subnets. The IP address for each supported interface must have the correct subnet.

Table 3-6 summarizes the configuration options for this scenario. In this scenario, all 4 interfaces support separate networks. Traffic in each network is isolated to that network. The XIO does not route traffic between interfaces. This scenario supports complex applications with several XIOs and where there is need to isolate XIOs in separate subnets or domains within in the field. Consult with ABB Technical Support for more details.

Table 3-6: Separate 4-network support

Ethernet Mode	Ethernet interface configuration	Interface	Number of networks	Number of required IP addresses
Enterprise ports: 2 networks	Two interfaces: one for each Enterprise port	A1, A2	2	One per port: (A1 IP, and A2 IP)
Industrial ports: 2 networks	Two interfaces: one for each Industrial port	B1, B2	2	One per port: (B1 IP, B2 IP)

3.11.1   Configuration

To configure for 4 network support:

1. Connect to the XIO in PCCU entry mode.
2. On the navigation tree, select **Communications**. The Communication Setup screen displays.
3. Select the **Networking** tab.
4. Clear the **4-Port switch** mode checkbox.
5. Click **Send**. The Enterprise (A-Network) and Industrial (B-Network) interfaces activate for individual configuration. In new systems, default or factory IP addresses display for each of the interfaces.
6. On the Enterprise Network section, in the **Mode** drop-down list, select: 2 Networks (Figure 3-16).

Figure 3-16: XIO 4 Network support (2 Enterprise and 2 Industrial Networks)
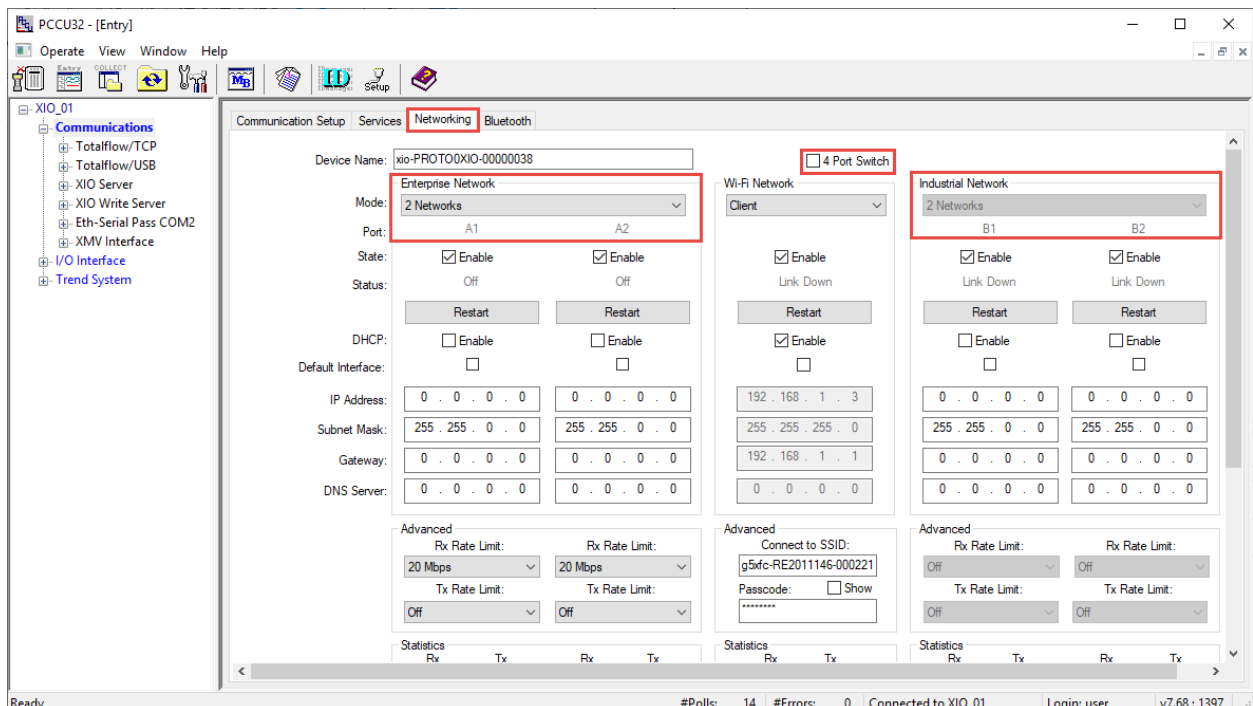
7. Click **Send**. Two separate interfaces display: A1 and A2, each may have its own factory default address (new systems).
8. Click **Restart**.

9. Select **Enable** for the State of each interface. The IP parameter fields activate for configuration.
10. Configure or update all IP parameters for each interface as required.
11. Click **Send**.
12. Click **Restart** for each interface.
13. Verify that the link status for each interface shows: Ready

> **i** **IMPORTANT NOTE:** After completing the configuration of each Enterprise interface, both A1 and A2 should display as options in the Enterprise Interface drop-down list in the XIO's Port Forwarding tab. If the XIO will be used in port forwarding mode, define port forwarding rules. See section 3.12.6 Define port forwarding rules.

14. On the Industrial Network section, select **Enable** for each preferred interface (B1 and B2). The IP parameter fields activate for update.
15. Configure IP parameters as required.
16. Click **Send**.
17. Click **Restart** for each interface.
18. Verify the link status shows for the configured interface shows: Ready.

> **i** **IMPORTANT NOTE:** After completing the configuration of the Industrial interfaces, the enabled interfaces (B1 and B2) should display as options in the Enterprise Interface drop-down list in the Port Forwarding tab. If the XIO will be used in port forwarding mode, define port forwarding rules. See section 3.12.6 Define port forwarding rules.

3.12   XIO: Port forwarding

The XIO 3- or 4-network support provides options to separate connected Totalflow devices into different logical networks. In addition to this capability, the XIO also supports port forwarding. When an XIO is in port forwarding mode, it can be used as a gateway with specific rules to control access to other field devices. For example, the XIO can be connected to the corporate network on one of its Ethernet interfaces and connected to other field devices on any of the other available Ethernet interfaces. Figure 3-17 shows an example of this scenario.

Figure 3-17: Use of a port forwarding XIO to securely isolate field LAN from WAN
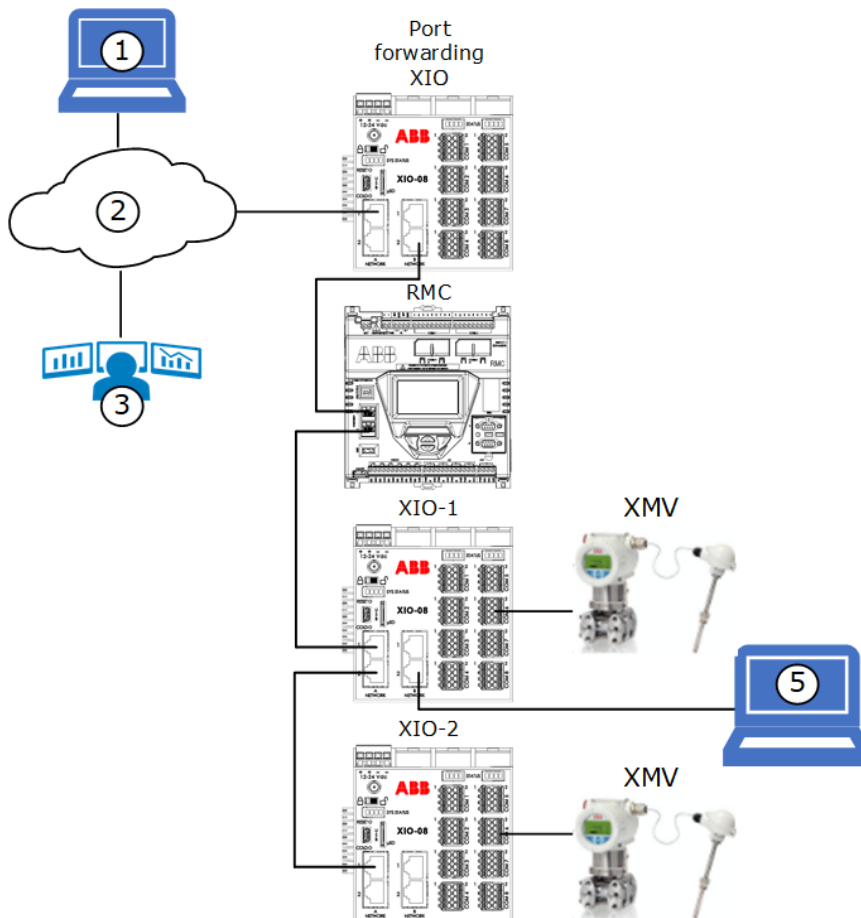
The XIO connection to the corporate network (2) is considered the uplink connection (also referred to as the enterprise connection in PCCU). The connections to field devices (on XIO port B2) are local connections. In the example in Figure 3-17, devices (RMC, XIO-1, XIO-2) are daisy-chained. For security, the port forwarding XIO can be configured to keep the uplink connection to the corporate network isolated from the connections to the field while still allowing access to specific devices and their enabled services. That is, the Enterprise (A-Network) is separated from the Industrial (B-Networks).
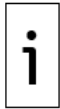
**i** **IMPORTANT NOTE:** The term **"**uplink" in port forwarding refers to the interface used for the connection to the wide area network. The **Port Forwarding** tab uses the term "enterprise" for the interface for this connection. Note that any of the Ethernet interfaces that are active and enabled can be selected as the enterprise interface from the **Enterprise Interface** drop-down menu on the Port Forwarding tab. Therefore, any A-Network or B-Network interface can be selected, not just A interfaces (which are the ones referred to as Enterprise interfaces on the Networking tab). The choice depends on the customer requirements for field connections.

Port forwarding requires careful selection and configuration of the Ethernet interfaces used for WAN and LAN connections. Review sections 3.12.1 Ethernet interface IP addressing guidelines and 3.12.2 Determine field connections to determine configuration requirements for your field conditions.

Sections 3.12.5 Enable port forwarding and 3.12.6 Define port forwarding rules describe how to enable port forwarding and configure forwarding rules on the XIO. These procedures assume that the devices for which the XIO executes port forwarding are correctly configured and that their Ethernet interfaces are correctly configured and enabled. The procedures also assume the port forwarding XIO interfaces are configured correctly, enabled, and ready.
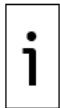
i **IMPORTANT NOTE:** The port forwarding function can be enabled and configured on the **Port Forwarding** tab in PCCU. On this tab, click **Help** for additional configuration details.

3.12.1   Ethernet interface IP addressing guidelines

Port forwarding protocols provide the ability to use private addressing to reduce the number of unique valid public IP addresses required. With port forwarding enabled on an XIO in the field, devices attached to the XIO may be configured with addresses from any of the reserved private address ranges defined by the Internet authorities.

There are several private addressing ranges. Customers must configure their IP parameters based on their IT requirements. The port forwarding procedures in this document show addressing from one of the private address ranges as an example. Consult with your IT administrator for the recommended parameters and conventions used in your company.

The factory default addresses for Totalflow Ethernet interfaces are from the 169.254.0.1 to 169.254.255.254 range. These addresses are typically used for local point-to-point connection with the device. It is expected that those default addresses will be changed to unique IP addresses on interfaces used to connect to the field LAN. You may use addresses from the other ranges available. For more information, see the **IP addressing/G5/RMC/XIO** topic in the PCCU Help files

3.12.2   Determine field connections

The XIO has 4 Ethernet ports available for network connections. There are several ways to use these ports based on the Ethernet modes available. The default configuration is 4-port switch mode. Clear this mode before configuring XIO port forwarding. Table 3-7 shows the available XIO Ethernet interfaces when not in 4-port switch mode. Any interface can be selected as the enterprise or uplink connection. The choice depends on the desired topology. Note that the B-Network ports are always independent (they cannot be combined into a single network). The A-Network ports can be either combined (1 Network mode, 2-port switch behavior) or independent (2-Network mode).

Table 3-7: Supported mode by Ethernet ports

Ethernet Ports	Mode	Configurable uplink interface options
A-ports, B-ports	4-port switch	None
A-ports	1 Network	A1+A2*
B-ports	2 Network **	B1, B2
A-ports	2 Network	A1, A2
B-ports	2 Network **	B1, B2

* Use either port A1 or A2 for actual physical connection
** B-Network ports support only 2-Network mode. B ports are always two independent interfaces.

Sections [3.12.3 Example: Use A-Network ports for field LAN connections](#) and [3.12.4 Example: Use A-Network ports for WAN (uplink) connection](#) provide examples for selecting interfaces for field connections.
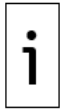
> **ℹ️ IMPORTANT NOTE:** Consider leaving ports available for local access when planning connections. It is assumed that local access to any device once it is in-service should be done without disconnecting the device from the field LAN.

3.12.3   Example: Use A-Network ports for field LAN connections

The interface selected as the uplink (enterprise interface) depends on customer preference and access requirements in the field. [Figure 3-18](#) shows the A-Network used for field connections. In this scenario, if A-Network ports are set to 1 Network mode (A1+A2), then they can be used for field network connections. Connections on A1 and A2 are part of the same logical network. One port (A2 for example) can be used to connect other field devices in daisy-chained configuration.

The other port (A1) can be left available for local connection by an operator or field technician (see connection for laptop 4 in the figure). Connection to A1 gives access to all the devices, provided that the operator laptop is configured with a compatible IP address.

With this configuration, if the other devices are not collocated with the XIO, operators do not have to move to the location of the other devices to access them. Access is available from the A1 port. In this scenario, either interface B1 or B2 can be selected as the enterprise or uplink interface to the corporate WAN (2). Local access to all devices associated with the A1+A2 Network is also available on any unused port on those devices (See laptop 4 connecting to A1 on the port forwarding XIO and laptop 5 connecting to port B2 on the XIO-1).

**Figure 3-18: Use A-Network ports for field LAN connections**
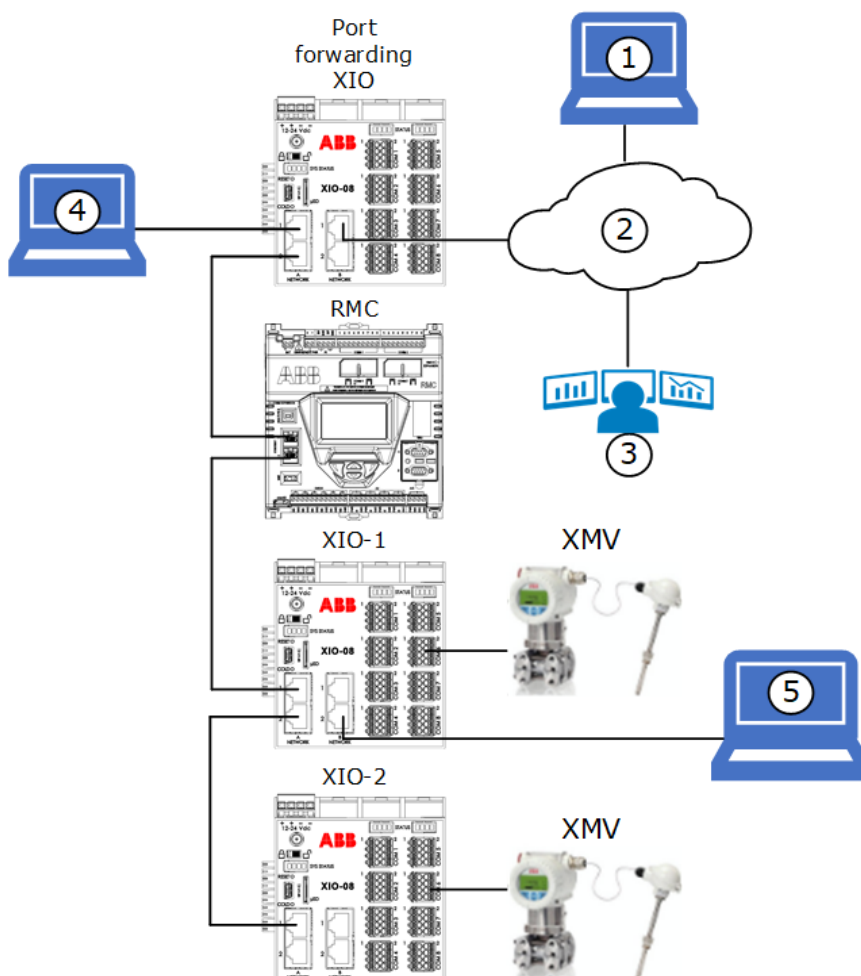
[Figure 3-19](#) The figure below shows a logical diagram of the networks associated with the B1 interface (network 3) and the A1+A2 interface (network 5). The operator can connect to the port forwarding XIO on port A1 (see laptop 4) and be able access all field devices on that logical network (5). The RMC, XIO-1, and

XIO-2 are configured in 2- and 4-port switch modes. All their Ethernet interfaces are associated with network 5.

Figure 3-19: Logical network diagram when A-Network ports are used for field LAN
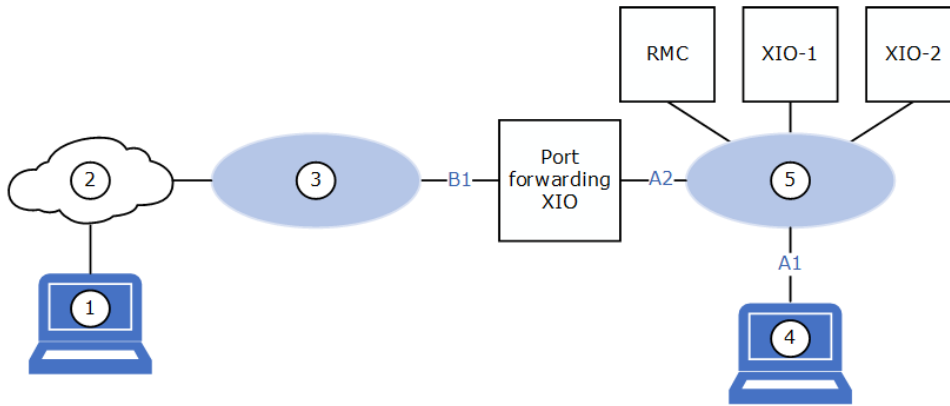
3.12.4   Example: Use A-Network ports for WAN (uplink) connection

A-Network interfaces can also be used as the enterprise interface whether in 1-Network or 2-Network mode. Either of the B-Network ports can be used to connect to other devices in daisy-chain configuration. The example in the figure below shows port A1 on the port forwarding XIO connected to the corporate WAN (2). The field devices connect to port B2. In this scenario, local access to the field devices attached to the port forwarding XIO will need a connection to an available port on any of these devices (see connection of laptop 5). Connecting to the port forwarding XIO directly (see connection of laptop 4) provides access only to that XIO, since the A-Network ports and B-Network ports are in separate logical networks.

Figure 3-20: Use A-Network ports for WAN (uplink) connection

shows a logical diagram of the networks associated with the A1+A2 interface (network 3) and the B2 interface (network 6). The operator (see laptop 4) can connect to the port forwarding XIO on port A1 and access only that XIO. To access the other devices, the operator (see laptop 5) connects to an available

port on one of the other XIOs (for example, XIO-1 port B2). The RMC, XIO-1, and XIO-2 are configured in 2- and 4- port switch modes. All of their Ethernet interfaces are associated with a single logical network (6).
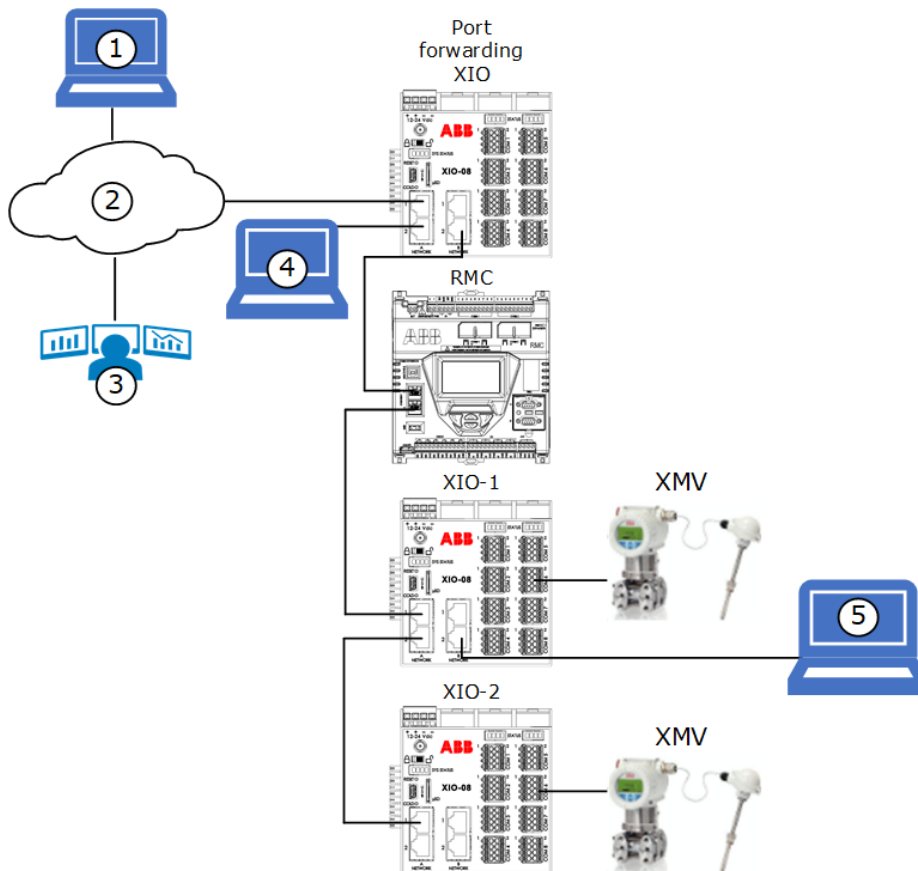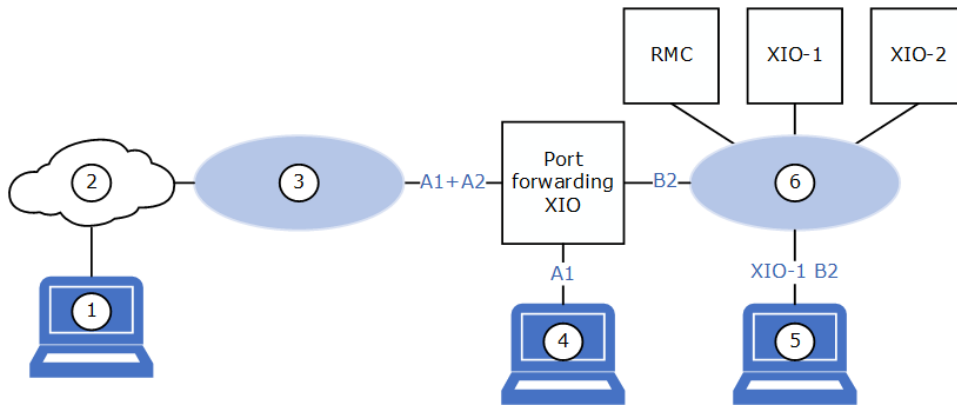
Figure 3-21: Logical network diagram when A-Network ports are used for WAN connection

3.12.5   Enable port forwarding

This procedure assumes that the required XIO Ethernet interfaces are correctly configured and enabled on the Network tab. Port forwarding is available only when the default 4-port switch mode is disabled. See section 3.10 XIO: Enterprise and Industrial (3 Network) support or 3.11 XIO: Enterprise and industrial (4 Network) support for instructions to disable the XIO 4-port switch mode and configure the Ethernet interfaces.

To enable Port Forwarding:

1.   Select **Communications** on the PCCU navigation tree.
2.   Select the **Port Forwarding** tab.
3.   Select the **Enable Port Forwarding** check box.
4.   Click **Send**.
5.   Verify that the Port Forwarding Status displays: Ready.
6.   Click the **Enterprise Interface** drop-down list. Verify that the desired interface for the uplink connection displays.

> **IMPORTANT NOTE:** Only enabled Ethernet interfaces display in the **Enterprise Interface** list. If the interface you plan to use as uplink does not display, go to the Networking tab, verify configuration, and set to enable.
>
> Any of the XIO Ethernet interfaces, A1+A2 (if combined), A1, A2, B1 or B2, can be used as the "Enterprise" interface for connection to the customer network on the WAN. The selection depends on the customer configuration and field requirements.

7.   Proceed to 3.12.6 Define port forwarding rules next.

3.12.6   Define port forwarding rules

In the Port Forwarding tab's **Port Forwarding Rules** table, define rules for each device that the XIO will forward traffic for. There could be several rules or table entries for a single destination device. For example, if forwarding traffic to access several services on a single device, each service will need its own entry on the table. Add as many rules as needed to ensure access to those devices. Table 3-8 shows TCP ports assigned to PCCU, Device Loader and SSH/SFTP in each Totalflow device. PCCU and device loader access is normally required. SSH/SFTP access is normally reserved for advanced users and should not be enabled if not needed.

This procedure provides configuration steps for the example described in section 3.12.4 Example: Use A-Network ports for WAN (uplink) connection. Adapt steps to your specific configuration requirements. Click **Help** on the Port Forwarding screen for additional details.

Table 3-8: Reserved TCP ports on Totalflow devices

Service	Access type	TCP port
PCCU	Ability to connect with destination device using the Totalflow user interface, PCCU, for device management or data collection	9999
Device Loader	Ability to connect with destination device using device loader (for software updates, configuration backup, etc.)	65535
SSH/SFTP	Secure access to device using Secure Shell (SSH) or Secure File	9696

Service	Access type	TCP port
PCCU	Ability to connect with destination device using the Totalflow user interface, PCCU, for device management or data collection	9999
service	Transfer Protocol (SFTP).	

For each device, and for each service, under the Add New Port Forward Rule section in the Port Forwarding tab:

1. Select the **Enterprise Interface** drop-down list and choose the interface associated with the uplink port (that is, the port connecting the XIO to the corporate network). In the example in section 3.12.4, XIO ports A1 and A2 are configured in 1 Network mode (both ports are assigned a single interface: A1+A2). Port A1 is connected to the corporate network. Port A2 is left unused.
2. In the **Enterprise Port** field, type the XIO's TCP port assigned to handle traffic for the destination device or service. Be sure to use a unique port number for each entry (TCP port number range: 0-65532, except those already in use). The port should not be in use by other services or applications on the XIO.
3. In the **Forward to IP** field, type the IP address of the destination device the XIO will forward traffic to.
4. In the **Forward to Port** field, type the TCP port assigned to the service available on the destination device.
5. Click **Add**. This adds the rule values into the Port Forwarding Rules table.
6. Verify that the rule displays correctly in the table.
7. Click **Send**. The rule is permanently saved in the table.
8. Repeat steps for each rule as needed.
9. Verify that all required rules display on the table. Rules can be added as needed if additional devices are connected to the field network. Figure 3-22 shows an example of forwarding rules for several devices for access using PCCU (on port 9999), device loader (on port 65535), or SSH/SFTP (on port 9696). Note that there are several rule entries for each device to provide access to these 3 services.

**Figure 3-22: Port Forwarding Rules table example**

	Enterprise Interface	Enterprise Port	Forward to IP	Forward to Port	Protocol
1	A1+A2	30001	192.168.2.11	9999	TCP
2	A1+A2	30002	192.168.2.12	9999	TCP
3	A1+A2	30003	192.168.2.11	65535	TCP
4	A1+A2	30004	192.168.2.12	65535	TCP
5	A1+A2	30005	192.168.2.11	9696	TCP
6	A1+A2	30006	192.168.2.12	9696	TCP

3.12.7 Verify access to field devices with PCCU

Verify access to each of the field devices that rules were defined for. This procedure uses PCCU to test access to those devices. If the forwarding rules are configured correctly, you should be able to establish PCCU connections with each of the devices attached to the port forwarding XIO. Test as follows:

— Locally: If using A1+A2 as the uplink interface, you can connect your laptop to the available port (A1 or A2) and attempt PCCU connection to the devices from there. In the example in Figure 3-23, the laptop is directly connected to XIO port A2. (The uplink connection to port A1 is not shown). Two instances of PCCU are used to verify connections: The PCCU connection with the RMC (1) is handled at port XIO TCP port 30001. The PCCU connection with the XIO-1 (2) is handled at XIO TCP port 30002.

Figure 3-23: Verify local access
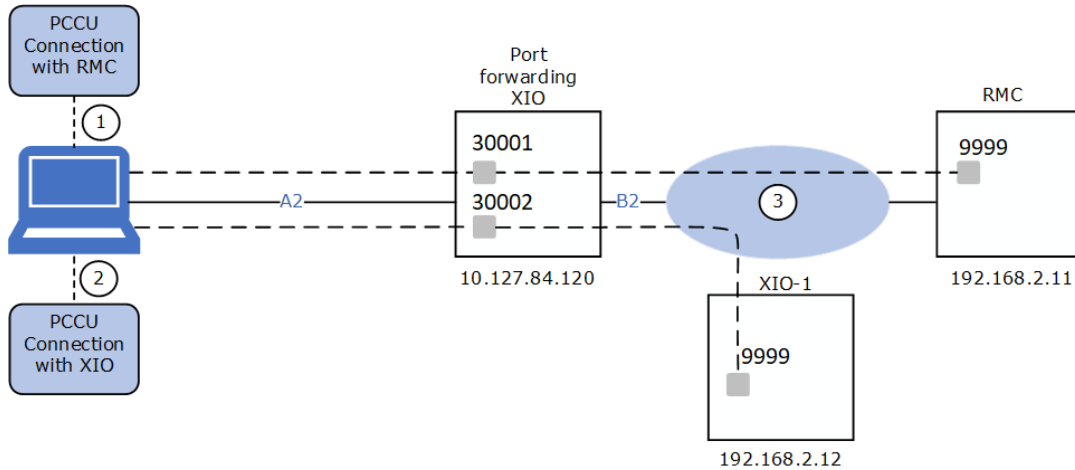
— Remotely: Verify connection from a remote host on the corporate network. In the example below, the laptop with PCCU is connected to the corporate network (3) and establishes connection over that network (WAN). Two instances of PCCU are used to verify connections. The PCCU connection with the RMC (1) is handled at port XIO TCP port 30001. The PCCU connection with the XIO-1 (2) is handled at XIO TCP port 30002.

Figure 3-24: Verify remote access
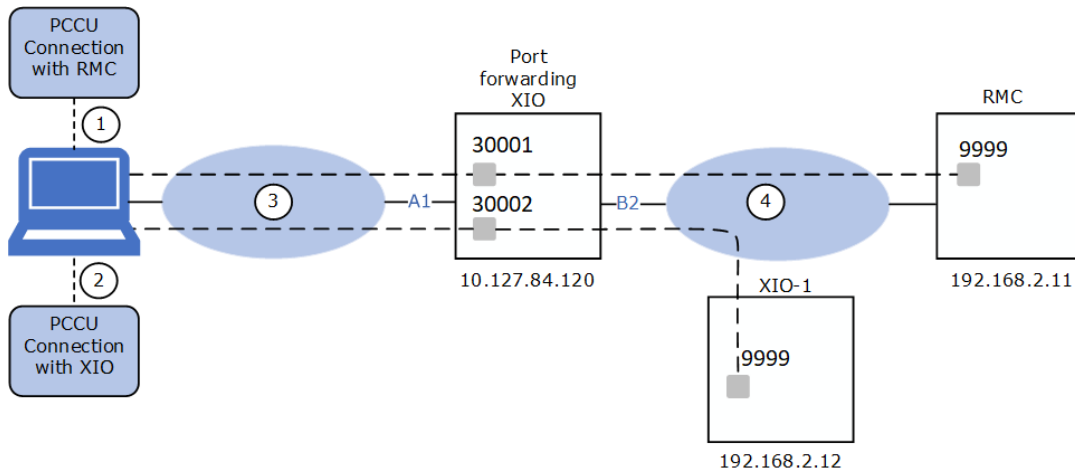
i **IMPORTANT NOTE:** Obtain a screen capture of the forwarding rule table before testing for quick reference.

To verify access to the device using PCCU:

1. Start PCCU.
2. Click **Setup** on the top PCCU menu. The **Setup** tab displays.
3. Select the **TCP/IP** radio button under the Communications section (Figure 3-25).
4. In the Network ID or IP field, type the IP address of the port forwarding XIO and the XIO TCP port configured for the traffic to the destination device service. Use the following format: <XIO IP address>/<XIO TCP port number>. Refer to the forwarding rule table to configure the correct TCP port number. The image below shows an example of the PCCU connection setup when going through an XIO with IP address 10.27.84.120 and TCP port 30001. The XIO uses TCP port 30001 to handle PCCU connection traffic for the device with IP address 192.168.2.11.

Figure 3-25: Connection Setup for destination device connected to port forwarding XIO
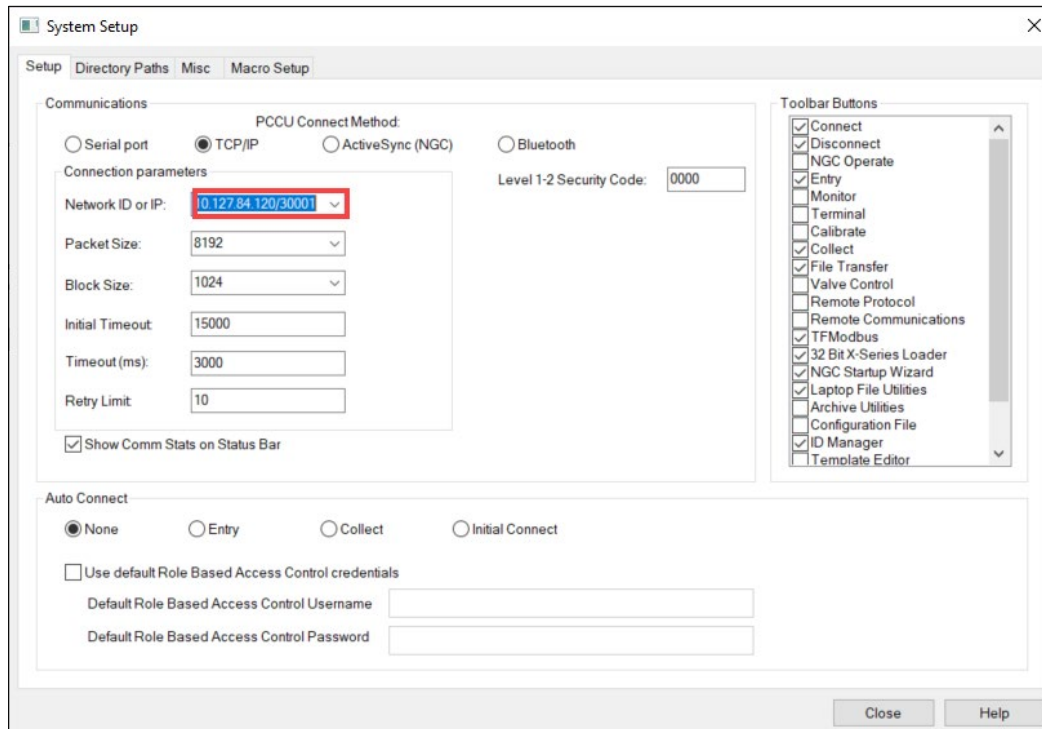
5.   Click **Close** to exit System Setup and return to the main PCCU screen.
6.   Click the Entry icon on the top PCCU menu.
7.   Verify that connection with the destination device is successfully established.

> **IMPORTANT NOTE:** For details on other connection setups, see PCCU online help topics. For connection using the Device Loader, see the **Loader connection setup** topic. For connection using SSH or SFTP clients, see the **SSH and SFTP service** topic.

4   Wi-Fi® connectivity scenarios

This section depicts several connectivity scenarios supported by devices with Wi-Fi functionality. Supported wireless access depends on the device type and Wi-Fi modes supported.

> **IMPORTANT NOTE:** A wireless network made available by enabling Wi-Fi on an ABB Totalflow device is for the purpose of local access by hosts only. The wireless network does not support device-to-device connections carrying critical real-time measurement data.

> **IMPORTANT NOTE:** The term "network" in this section refers to a wireless network. In older ABB Totalflow documentation, the term "network" has been used to describe an Ethernet network. With Wi-Fi support introduced in newer devices, the term applies to either an Ethernet or a Wi-Fi network. The type of network will be clearly indicated in the text and diagrams.
>
> The term "connection" in this section refers to the wireless link established between a wireless client and an advertised wireless network. The term is not used to refer to a physical connection as with Ethernet. Nodes on a wireless network can establish logical TCP connections with each other on the same wireless network. Diagrams depict wireless networks or links with dotted lines. Solid lines represent physical connections. Lines with arrows in different color represent communication or data flows.

IMPORTANT NOTE: Wi-Fi support requires installation of the Wi-Fi antenna. Refer to the Antenna Installation Kit Guide for instructions (see the Additional information section). Install the antenna prior to wireless configuration and verification. Always change default passcodes to private passcodes and configure the highest security protocols to prevent unauthorized local wireless access to the devices.

4.1   Wi-Fi Modes

Table 4-1 shows ABB Totalflow devices' Wi-Fi modes and the connections. The XSeries^{G5} products support only one mode: Access Point. The XIO supports multiple modes.

For the XIO, the preferred configuration depends on the number of XIOs, their location in the field, and the access requirements. Wi-Fi is a convenient way to access XIOs without having to be in proximity with the device. When there are several XIOs, the optimal configuration is to configure one as an access point and the rest as clients. The XIO can also support wireless access to devices connected to its Ethernet interfaces (Access Point-Bridged mode).

Table 4-1: Wi-Fi modes

Wi-Fi Mode	Supported connections	Description
XSeries^{G5} (XRC, XFC)		
Access Point	[Host Wi-Fi client]-to-XSeries^{G5} device	Point-to-point connection from a wireless client to a G5 device. Wireless client joins the network advertised by the G5 device and then establishes TCP connections over that network. To access multiple G5 devices, each device must be enabled as an access point. The Wi-Fi client must join each of the advertised networks, one at a time, to establish connection with each G5 device.
XIO		
Access Point	[Host Wi-Fi client]-to-XIO	Point-to-point connection from a wireless client to XIO. Wireless client joins the network advertised by the XIO. Use when there is only one XIO and there are no other ABB Totalflow devices that can support Wi-Fi Access Point functionality.
	[XIO Client]-to-XIO	An XIO in client mode joins the network advertised by an XIO in AP mode. Wi-Fi clients can join the same network and connect to the XIO-client and XIO-AP over the same network.
Client	XIO-to-[XIO Wi-Fi Access Point]	XIO and other Wi-Fi clients join wireless network advertised by another XIO configured as an Access Point. Wi-Fi clients can connect to the XIO over that network.
	XIO-to-[Totalflow Wi-Fi Access point]	XIO and other Wi-Fi clients join wireless network advertised by an ABB Totalflow device configured as an Access Point. Wi-Fi clients can connect to the XIO over that network.
	XIO-to-[Third-party Wi-Fi Access Point]	XIO joins wireless network advertised by a third-party access point. Wi-Fi clients can connect to the XIO over that network.
Access Point (AP)-Bridged (Available only when XIO is in 4-port switch mode).	[Host Wi-Fi client]-to-XIO	Wireless client joins the network advertised by the XIO. Wi-Fi clients can connect to the XIO over that network.
	[Host Wi-Fi client]-to-device connected to XIO on the Ethernet interface	Wireless client joins the network advertised by the XIO. Wi-Fi client can establish connection with a device connected to the XIO on Ethernet. XIO bridges traffic between the wireless interface and the Ethernet interface.
	[XIO Client]-to-XIO	An XIO in client mode joins the network advertised by an XIO in AP Bridged mode. Wi-Fi clients can connect to both XIOs over that network.

4.2   IP parameter configuration

Connections over Wi-Fi networks are TCP/IP based. Each device joining a wireless network must have a unique and valid IP address. IP configuration depends on the Wi-Fi mode. Table 4-2 describes the IP configuration requirements.

When the XIO is configured as a Wi-Fi Access Point, it can automatically provide IP addresses for Wi-Fi clients with its DHCP server. Automatic addressing is the preferred option for host-based Wi-Fi clients.

When the XIO is configured as a Wi-Fi client, it can obtain its IP address from the Wi-Fi Access Point available or be configured manually (static addressing).

IMPORTANT NOTE: Plan IP parameter configuration carefully when enabling both Ethernet and Wi-Fi interfaces on the same device. If the device connects to both wireless and wired networks, it is recommended to use a static address from different private addressing ranges for each network. For example, use an address in the 192.x.x.x range on the LAN and an address on the 10.x.x.x or 172.x.x.x ranges on the Wi-Fi or vice versa. Configure static addresses and make sure appropriate subnet masks are assigned to isolate the networks and facilitate management. Consult your IT or network engineer for additional or specific requirements for your implementation.

Table 4-2: IP parameter configuration

Wi-Fi Mode	Configuration	Description
Access Point (AP)	Default: 192.168.1.1 DHCP Server available to clients	Wi-Fi clients (up to 10) can obtain their IP addresses from the XIO if DHCP server is enabled. Default IP address is user-configurable. Wi-Fi clients can use default or user-configured XIO address to connect to the XIO.
Client	Default: none Obtains IP address from Access Point DHCP Server.	XIO performs the Wi-Fi client role. Manually configure Access Point SSID and passcode For IP address: – If the XIO is a client of an XIO in AP mode, ensure DHCP server in Access Point is supported and enabled for automatic IP configuration. – If the XIO is a client to an XIO in AP Bridged mode, then the IP address must be configured manually.
Access Point (AP) Bridged	No IP address assigned to wireless interface. No DHCP server available.	Available only in 4-port switch mode – IP address only configurable for the Ethernet interface, not the wireless interface. Wi-Fi clients must be manually configured with static IP addresses compatible with the IP address of the Ethernet interface. – A DHCP server is not supported on XIO when in AP Bridged mode. For optimal performance, it is recommended to limit the number of Wi-Fi clients to 10. **Note**: Wi-Fi Clients must use the IP address assigned to the XIO Ethernet interface to establish connection with the XIO.

4.3   Local point-to-point wireless access to XIO (AP) by host

The XIO supports local wireless access by Wi-Fi clients. Wi-Fi clients can establish connections to the XIO in all Wi-Fi modes.

IMPORTANT NOTE: For simplicity, the two scenarios below do not show the Ethernet connections between the XIOs or connections to an RMC which will typically be integrated with XIOs. The scenarios depict wireless access only. The XIOs depicted do not use the wireless network for measurement data. All connections for measurement data traffic are on the Ethernet interfaces.

The XIOs shown are in 4-port switch mode. Although not shown, XIOs in 1 Network or 2 network mode also support wireless access.

- When there is only a single XIO with no other ABB Totalflow Wi-Fi access point available, the XIO needs to be configured as an access point for Wi-fi clients to connect (Figure 4-1). The Wi-Fi client detects and joins the network advertised by the XIO. The connection is basically a logical wireless point-to-point connection since no other devices act as clients to the XIO AP.
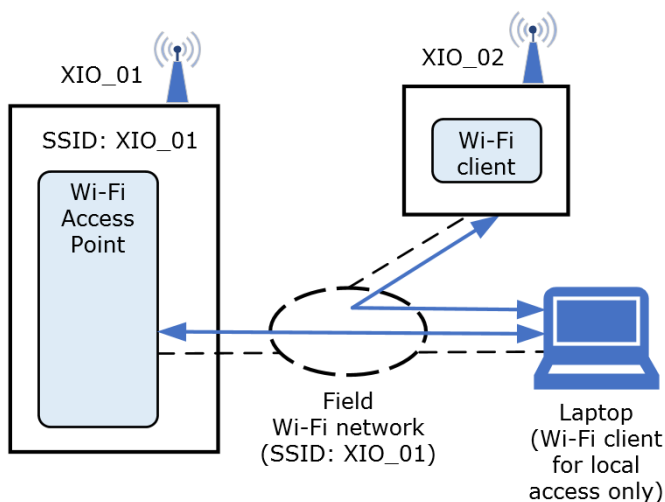
Figure 4-1: XIO Access Point: local access by operator
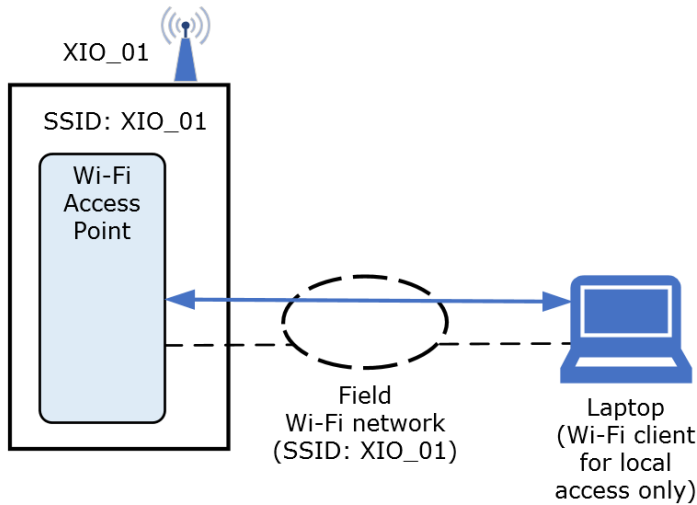
Table 4-3: Configuration summary (access to XIO:AP)

Device	Interface/type	Mode	IP addressing
XIO_01	Ethernet	4-port switch (A1+A2+B1+B2)	User-defined static address compatible with field LAN. Ethernet connections not shown above.
XIO_01	Wi-Fi	Access Point (AP)	Default or user-defined
Laptop (Wi-Fi client)	Wi-Fi	N/A	Setup for automatic addressing if the DHCP server in XIO_01 is enabled. The IP address automatically assigned will be compatible with the address of the XIO.

- When there are several XIOs, one may be configured as an access point and the others as clients (Figure 4-2). In this scenario, the Wi-Fi client only joins a single wireless network, but can establish wireless connections to all XIOs on that network. Depicted by the blue lines, each connection is an independent logical connection to each device.

Figure 4-2: Local wireless access by operator to multiple XIOs

**Table 4-4: Configuration Summary (access to XIO: AP, and XIO: client)**

Device	Interface/type	Mode	IP addressing
XIO_01	Ethernet	4-port switch (A1+A2+B1+B2)	User-defined static address compatible with field LAN. Ethernet connections not shown above.
	Wi-Fi	Access Point (AP)	Default or user-defined
XIO_02	Ethernet	4-port switch	User-defined static address compatible with field LAN. Ethernet connections not shown above.
	W-Fi	Client	– User-defined or – Automatically configured if DHCP server enabled in XIO_01 (Access point)
Laptop	Wi-Fi	N/A	– User-defined or – Automatically configured if DHCP server enabled in XIO_01 (Access point)

4.3.1 Configure the XIO as an Access Point (AP)

The XIO supports the Access Point mode for all Ethernet modes (4-port switch and other modes). Access point mode is the factory default. If the default configuration has been changed, return the XIO to Access Point mode as follows:

1. Connect to the XIO on PCCU entry mode.
2. On the navigation tree, select **Communications**. The Communication Setup screen displays.
3. Select the **Networking** tab.

Figure 4-3: Wi-Fi Network section in the Networking tab
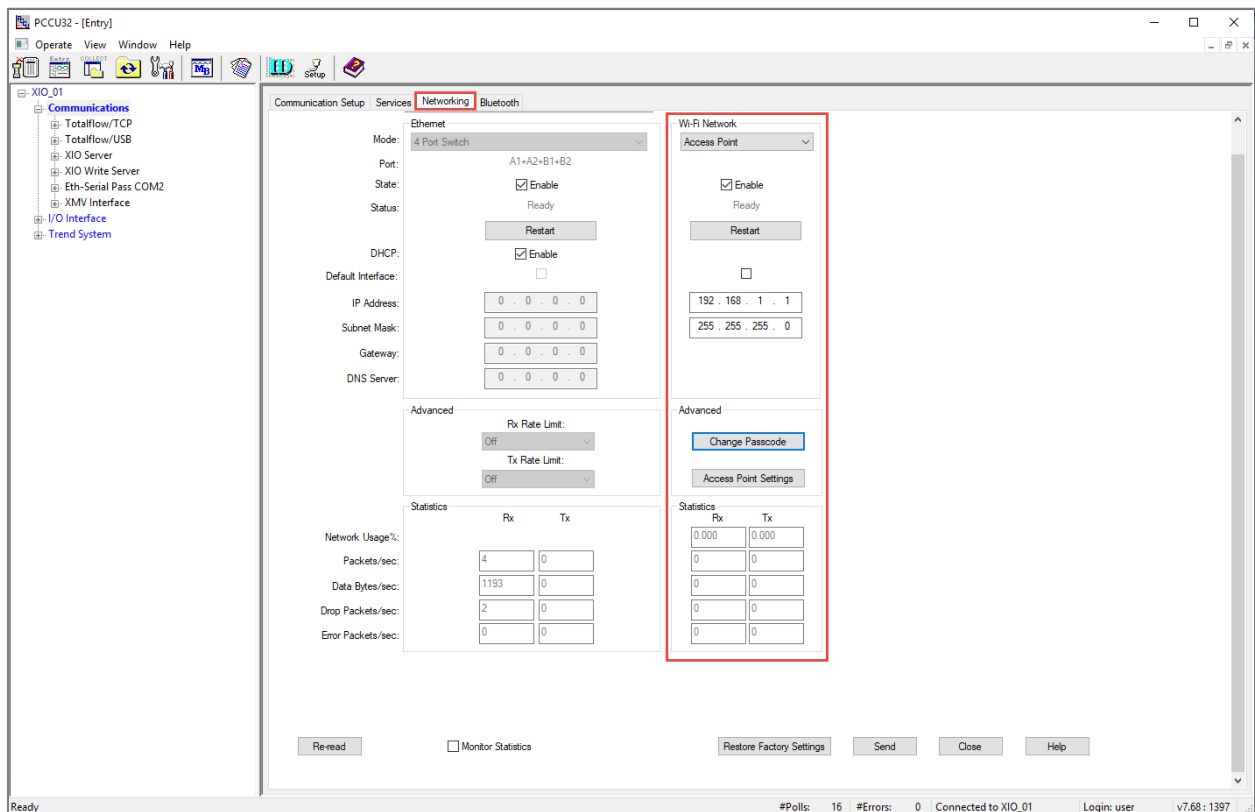
4. In the Wi-Fi Network section, select **Access Point** from the **Mode** drop-down list.
5. Ensure the State **Enabled** checkbox is selected.
6. Configure IP parameters if needed. Recommended: leave factory default values. Note that the screen allows update of the IP parameters only when the State **Enabled** box is selected.
7. In the Advanced section, select **Change Passcode**. The Change Security Passcode dialog displays.

Figure 4-4: Change Security Passcode
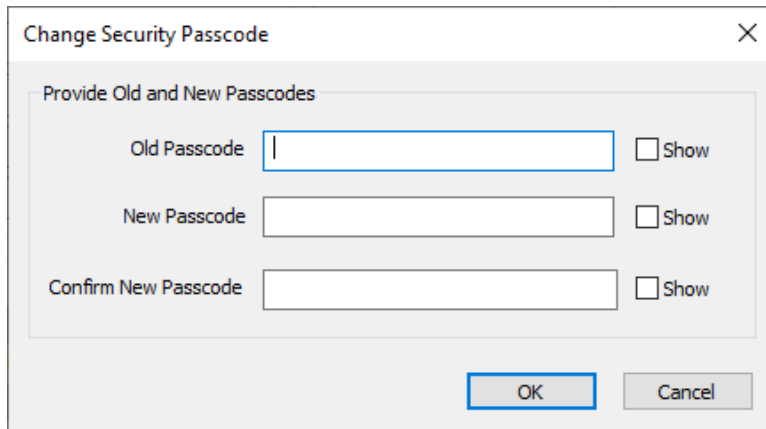
a. Select the **Show** boxes to display values as typed in the next step.

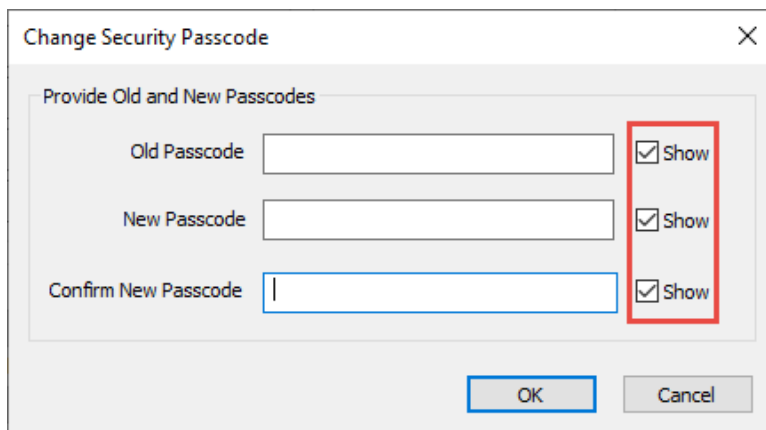**Figure 4-5: Select to show typed passcodes**

b. Type the factory default passcode (**totalflow**) if it has not been changed. If the XIO has a different passcode, then type the current passcode. The correct current passcode is required for the update.
c. Type and confirm new passcode.
d. Click **OK**.
8. In the Advanced section, select **Access Point Settings**.
    a. Ensure Security Mode is: WPA2. This is the highest security mode. Always use this mode when the device is in Access Point mode to prevent malicious or unauthorized access.
    b. Ensure the **Broadcast SSID** checkbox is selected. This helps Wi-Fi clients automatically identify the network advertised by the XIO.
    c. Ensure the **Enable DHCP Server** checkbox is selected.
9. Click **Send** to save parameters. The screen displays the successful passcode update. If unable to change the passcode, the old passcode provided does not match the existing passcode saved in the device. Obtain the correct passcode and retry.

Figure 4-6: Successful passcode change
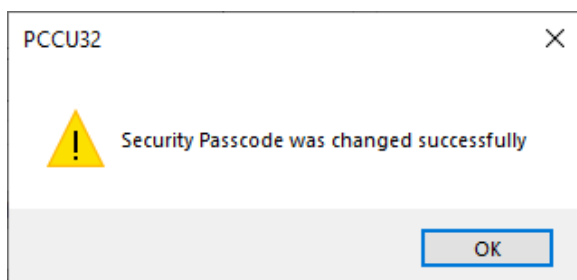
10. Click **OK**.
11. Click **Restart** to re-initialize the Wi-Fi interface.

Figure 4-7: Restart the Wi-Fi interface
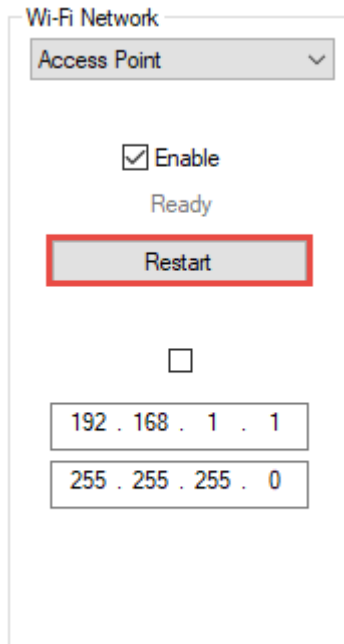
12. Click **Yes** to confirm.

Figure 4-8: Confirm Wi-Fi interface restart
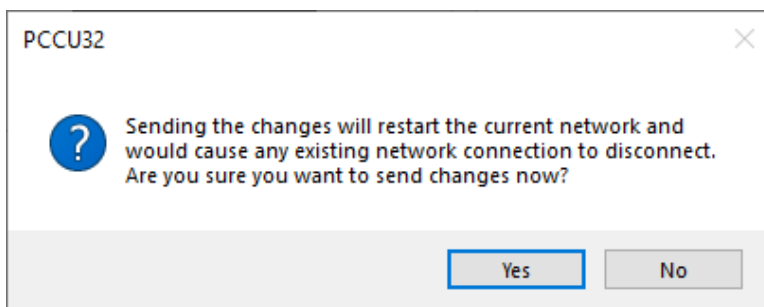
13. Verify configuration.
14. Verify that the host Wi-Fi client can detect the network advertised by the XIO. The network advertises the device name configured in the Networking tab. If the default is kept, this is the product module and its serial number.

Figure 4-9: Detected XIO device name (as advertised Wi-Fi network) in Windows 10
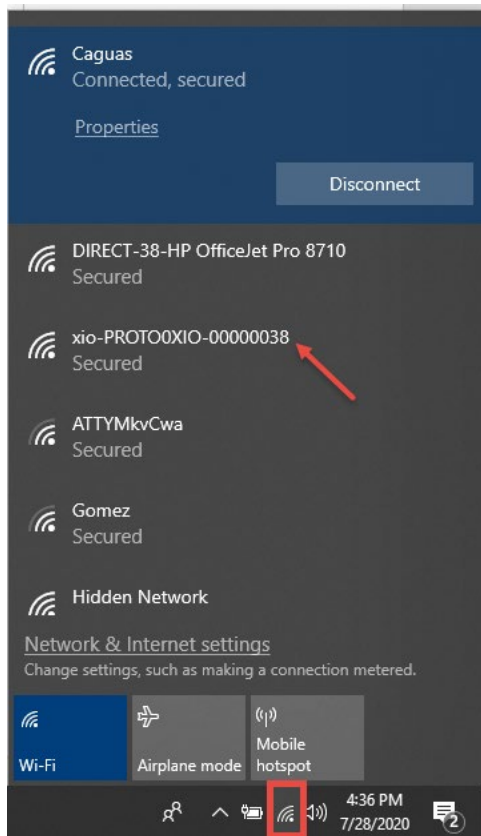
4.3.2 Connect with an XIO in AP Mode

Wi-Fi clients can join the advertised XIO Wi-Fi network and connect to the XIO to obtain their IP address automatically. Once the Wi-Fi client has its IP address, configure PCCU for connection to the XIO. Use the default XIO IP address as your target address (192.168.1.1) for connection.

If you are connected to another wireless network, connecting to the XIO causes loss of existing connections on the other network.

To connect to the XIO:

1. Select the XIO device name from the list of detected networks.
2. Select **Connect**.

Figure 4-10: Join the network the XIO in AP mode advertises
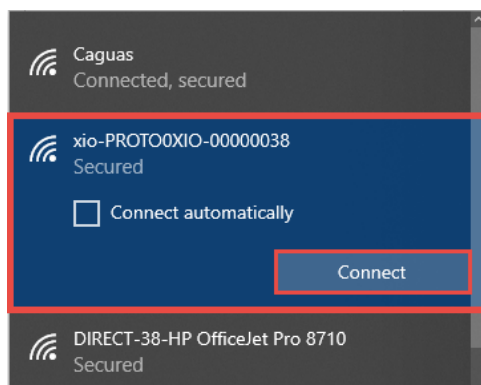
3. Wait for the host to verify access. The first time you attempt to connect, the system prompts for the passcode after checking for network requirements. Depending on the operating system of the Wi-Fi client, the passcode may also be referred to as the "network security key".
4. Type correct passcode when prompted.
5. Verify that connection is successful. The network should display: Connected, secured.
6. Start PCCU.

7. From the top menu, select **Setup**. The System Setup displays.
8. Configure PCCU to connect to the default XIO AP address, if the default is kept (Figure 4-11).

Figure 4-11: PCCU Setup for connection to XIO in AP role (factory default address)
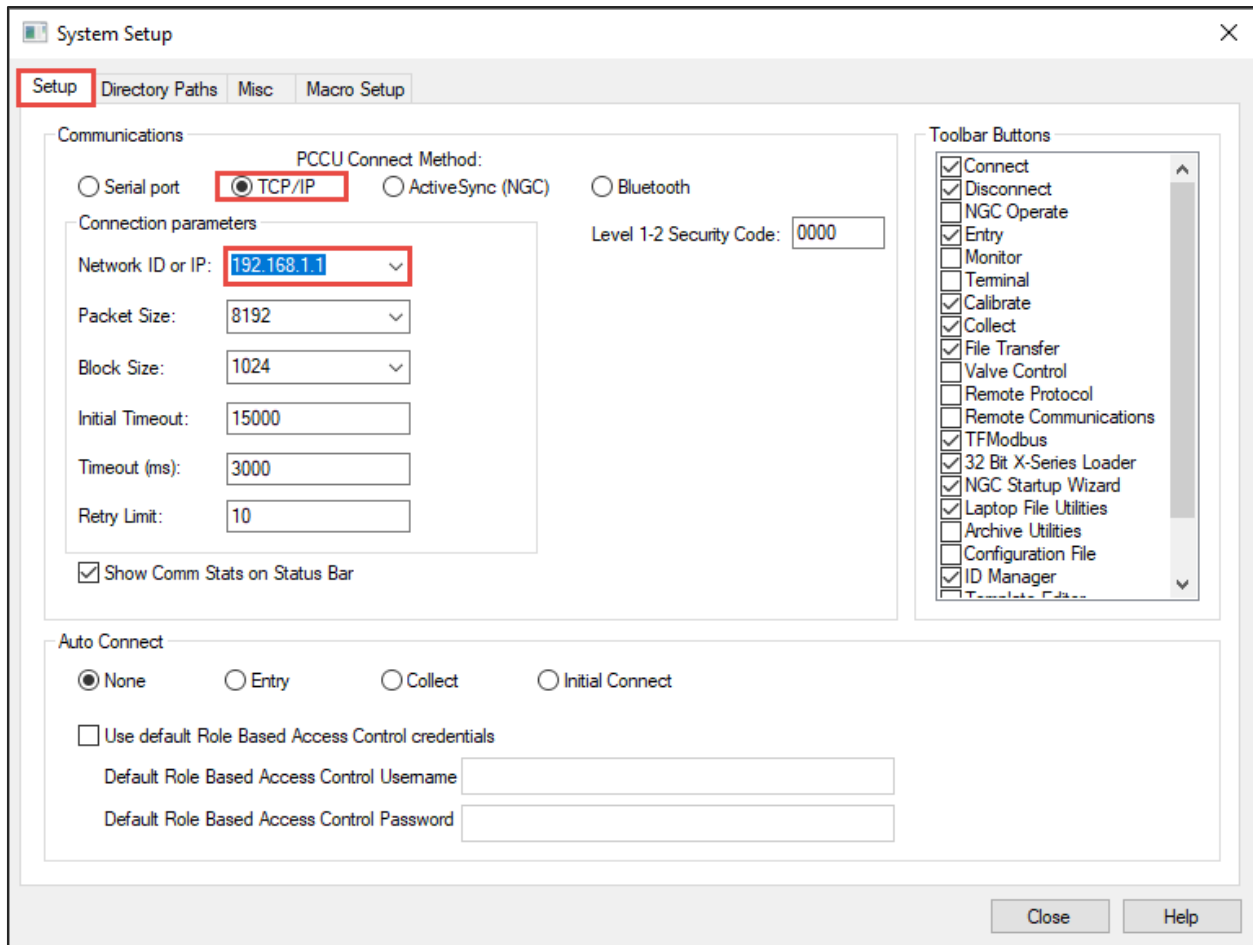
9. Click **Close** to exit PCCU setup.
10. Click the Entry icon on the top menu bar to connect with the XIO.
11. Verify that the main entry mode screen displays.

4.4 Local wireless access to RMC by host through XIO

The XIO AP Bridged mode supports bridging of network traffic from a local wireless client to a wired device. Figure 4-12 depicts this scenario. The host with PCCU has Wi-Fi client capabilities and can establish a wireless link to the local wireless network advertised by the XIO. The XIO is configured in AP Bridged mode. It connects to the wired network (using A1 port). When it receives traffic directed to the RMC IP address, on its wireless link, it bridges that traffic to the A1 port. The RMC receives traffic on its Ethernet port (E2). This network traffic flow is depicted by the blue line.
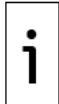
> **ℹ** **IMPORTANT NOTES:** The XIO supports the Wi-Fi AP Bridged mode only when in 4-port switch mode. AP Bridged mode does not provide DHCP services to Wi-Fi clients. Wi-Fi clients IP parameters must be manually configured (assign static IP address).

Figure 4-12: Local wireless access to an RMC (through an XIO)
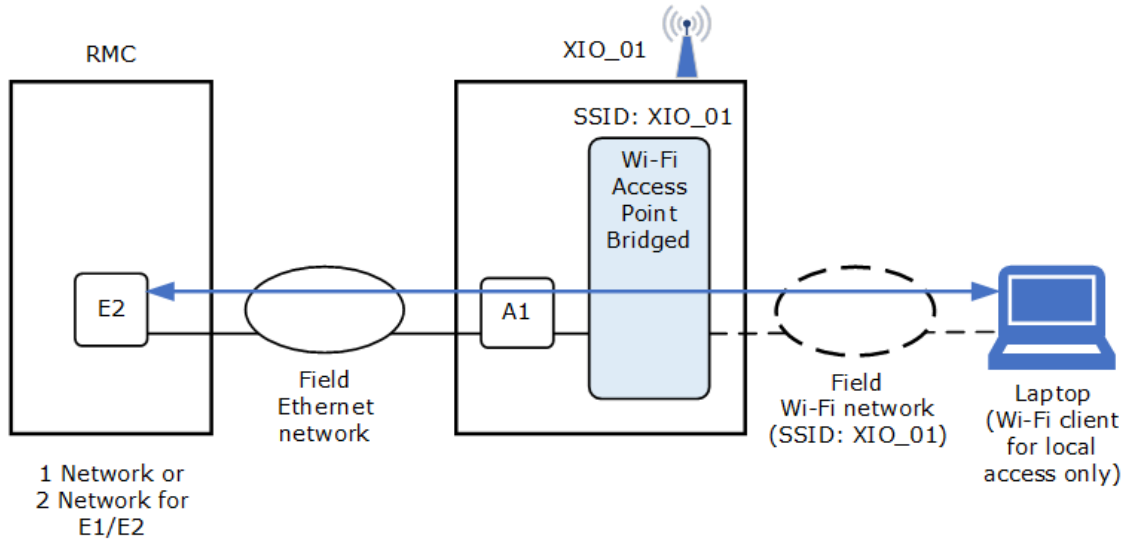
Table 4-5 provides a configuration overview for wireless access to the RMC or other device connected to the XIO Ethernet interface.

Table 4-5: Configuration summary (access to RMC: 1 Network, and XIO: AP Bridged)

Device	Interface/type	Mode	IP address
RMC	Ethernet - Enterprise	1 Network (2-port switch)	User-defined static address compatible with field LAN. Must be on the same subnet as the XIO_01 IP address.
XIO_01	Ethernet	4-port switch (A1+A2+B1+B2)	User-defined static address compatible with field LAN. Must be on the same subnet as the RMC IP address. See section 4.4.2.1 Configure the XIO IP parameters for Ethernet (wired network).
XIO_01	Wi-Fi	Access Point Bridged	Not used. Wi-Fi clients must use the IP address assigned to the XIO Ethernet interface to connect to the XIO and the attached devices on Ethernet.
Laptop	Wi-Fi	N/A	User-defined static address compatible with the IP addresses of the RMC and XIO IP addresses on Ethernet.

4.4.1   Configure the XIO as an Access Point (AP) Bridged

The XIO in AP Bridged mode bridges traffic between the wireless interface and the Ethernet interface. The XIO bridges between the wired and wireless LANs. The need for the bridged mode is to allow access to devices that connect to the XIO but that have no wireless support.

To configure the XIO in AP Bridged mode:

1. Connect to the XIO on PCCU entry mode.
2. On the navigation tree, select **Communications**. The Communication Setup screen displays.
3. Select the **Networking** tab.
4. Ensure that the **4 Port switch** checkbox is selected.
5. In the Wi-Fi Network section, select **AP Bridged** from the **Mode** drop-down list.

Figure 4-13: Select Mode: AP Bridged (4-port switch only)
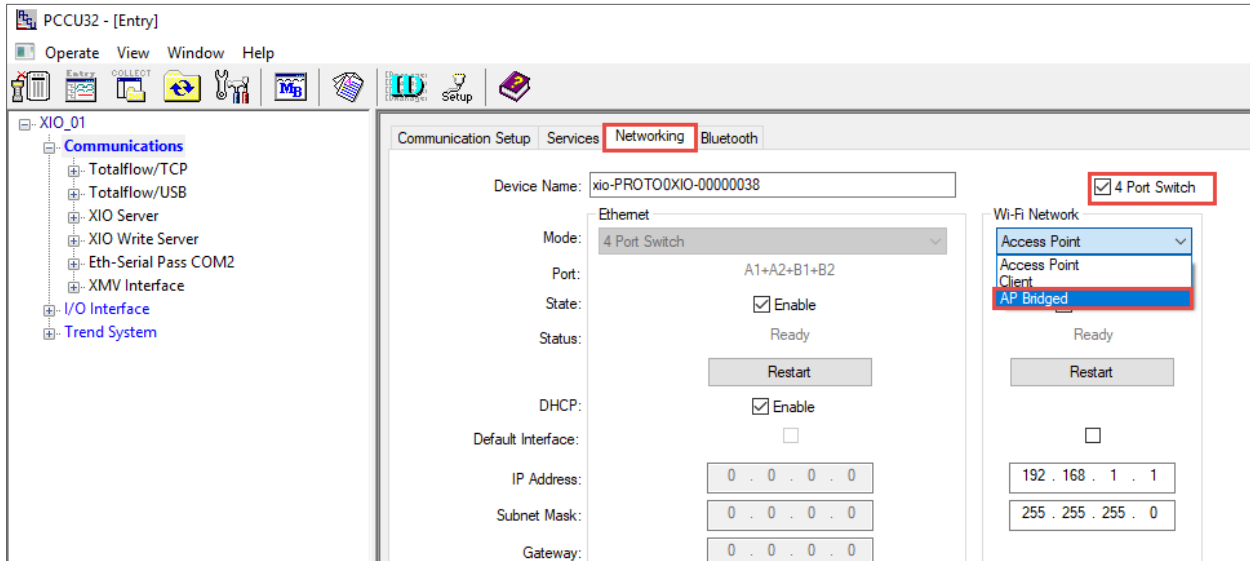
6. Ensure the State **Enabled** checkbox is selected.
7. In the Advanced section, select **Change Passcode**. The Change Security Passcode dialog displays.
   a. Select the **Show** boxes to display values as typed in the next step.
   b. Type the factory default passcode (**totalflow**). This step assumes the factory default has not been changed. If the XIO has a different passcode, then type the current passcode. The correct current passcode is required for the update.
   c. Type and confirm new passcode.
8. In the Advanced section, select **Access Point Settings**.
   a. Ensure Security Mode is: WPA2. This is the highest security mode. Always use this mode when the device is in any of the Access Point modes to prevent malicious or unauthorized access.
   b. Ensure the **Broadcast SSID** checkbox is selected. This helps Wi-Fi clients automatically identify the network advertised by the XIO.
9. Click **Send** to save parameters. The screen displays the successful passcode update. If unable to change the passcode, then the old passcode provided does not match the existing passcode saved in the device. Obtain the correct passcode and retry.
10. Click **OK**.
11. Click **Restart** to reinitialize the Wi-Fi interface.
12. Click **Yes** to confirm.
13. Verify that the Wi-Fi Status displays: Ready. Note that the Port in the Ethernet section displays: A1+A2+B1+B2+Wifi, to indicate the XIO is set to bridge wireless traffic to the Ethernet interface.
14. To connect to the devices (XIO or the devices connected to the XIO through Ethernet), configure the IP parameters as described in the following sections.

4.4.2 Configure IP parameters

This section shows how to configure IP parameters to support Wi-Fi client host connection to an XIO in AP Bridged mode and an attached RMC on the XIO's Ethernet's interface.

For illustration purposes, the procedures use IP addresses from the 192.x.x.x range. In this example, the XIO address for Ethernet will be in the 192.168.10.0 subnet (255.255.255.0 mask).

> **ⅈ** **IMPORTANT NOTES:** For simplicity, the examples in these sections do not show a gateway IP address. If there is a local network switch/router onsite used as a gateway to the customer's WAN, the gateway IP address can be configured. The IP configuration depends on the XIO mode and connection topology. Plan your IP configuration based on your field requirements.

4.4.2.1 Configure the XIO IP parameters for Ethernet (wired network)

To configure XIO IP parameters on Ethernet:

1. Establish PCCU connection with the XIO using the USB port.
2. On the navigation tree, select **Communications**, then select the **Networking** tab.
3. Under the Ethernet section:
   a. Type the IP address. In this example: 192.168.10.14.

b. Type the subnet mask. In this example: 255.255.255.0.

Figure 4-14: XIO IP parameter configuration
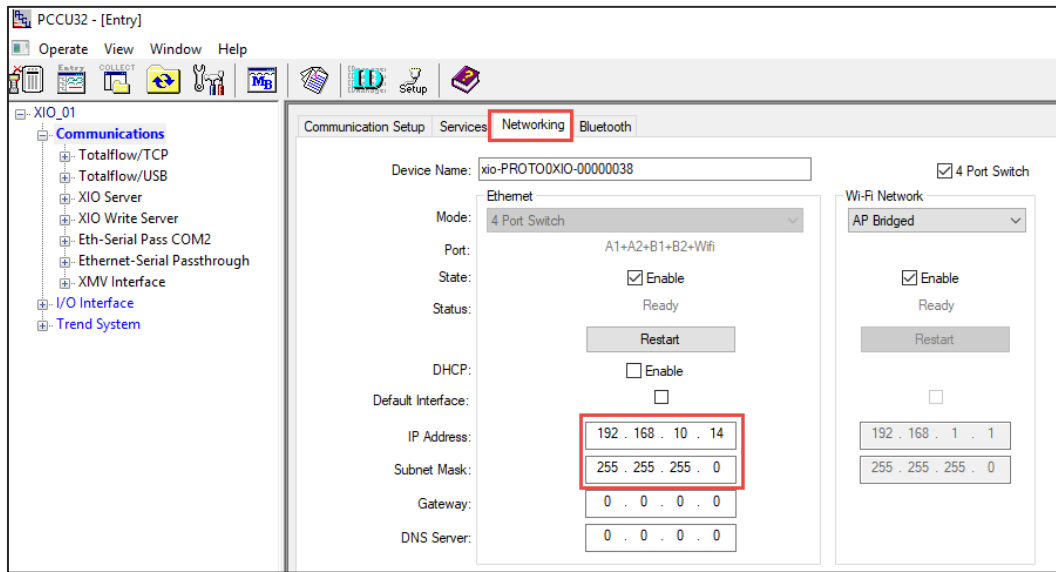
4. Click **Send**.
5. Click **Restart**.
6. Verify that the Ethernet interface Status displays: Ready.

4.4.2.2   Configure the RMC IP parameters for Ethernet

The RMC IP parameters on the Ethernet interface used to connect to the XIO must be compatible with the parameters configured in the XIO in procedure above.

To configure RMC IP parameters:

1. Establish PCCU connection with the RMC using the USB port.
2. On the navigation tree, select **Communications**, then select the **Networking** tab.
3. Under the Ethernet section:
   a. Type the IP address. In this example: 192.168.10.20. The IP address is on the same subnet as the XIO IP address (192.168.10.0).
   b. Type the subnet mask. In this example: 255.255.255.0.

Figure 4-15: RMC IP parameter configuration

4. Click **Send**.
5. Click **Restart**.
6. Verify that the Ethernet interface Status displays: Ready.

4.4.2.3   Configure Wi-Fi host client IP parameters

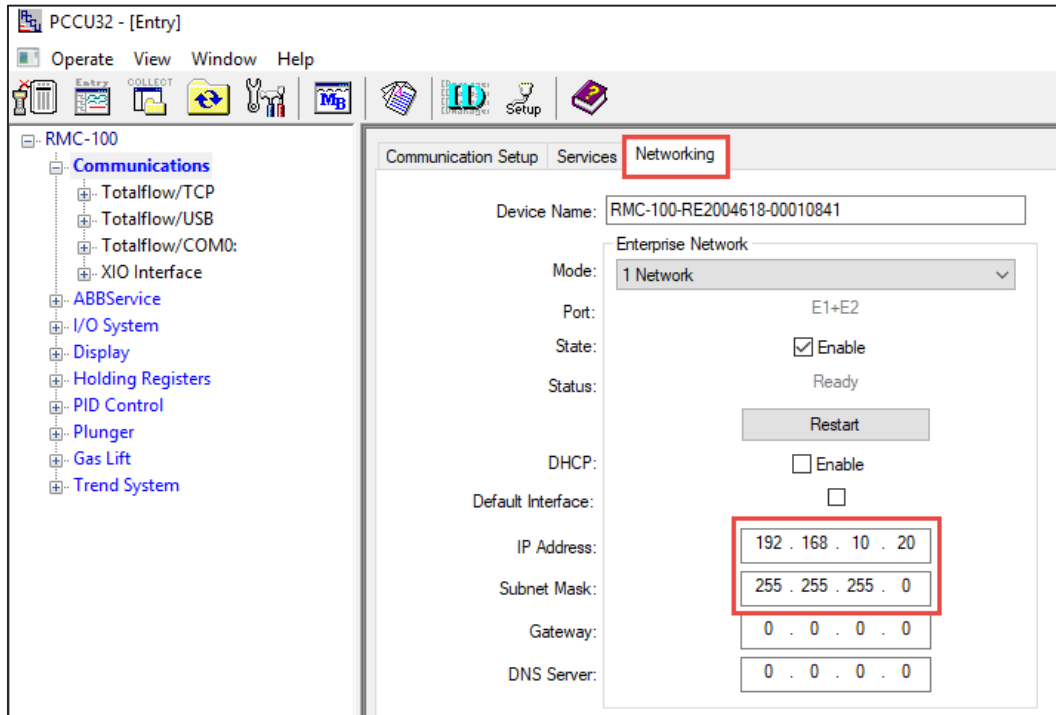The XIO in AP Bridged mode does not support DHCP services. Wi-Fi clients cannot obtain their IP addresses automatically from the XIO and require manual configuration of the IP parameters. This procedure describes how to configure the Wi-Fi client laptop with a static IP address compatible with the IP address assigned to the XIO Ethernet interface.

The IP configuration of the Wi-Fi client should allow connection to the XIO and to the device attached to the XIO's Ethernet interface. The Wi-Fi client should be on the same subnet as the XIO and the attached device.

These steps show Windows 10 screens. Use equivalent steps for other Windows Operating systems.

To configure Wi-Fi client host:

1. Select the wireless icon at the bottom right corner of Windows 10 application menu bar.
2. On the detected wireless network list, select **Network & Internet settings**.

Figure 4-16: Network & Internet settings option
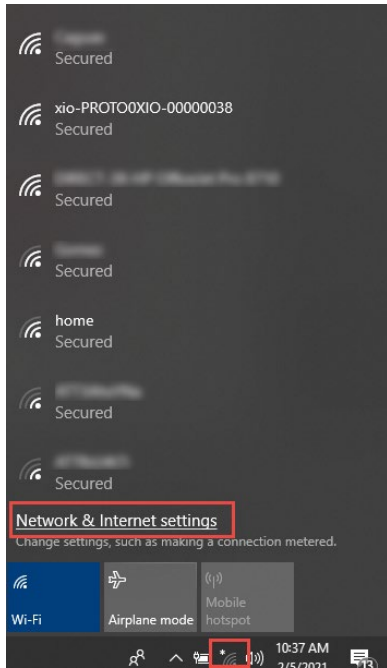
3. On the Settings navigation tree, select **Wi-Fi**.

Figure 4-17: Network & Internet settings
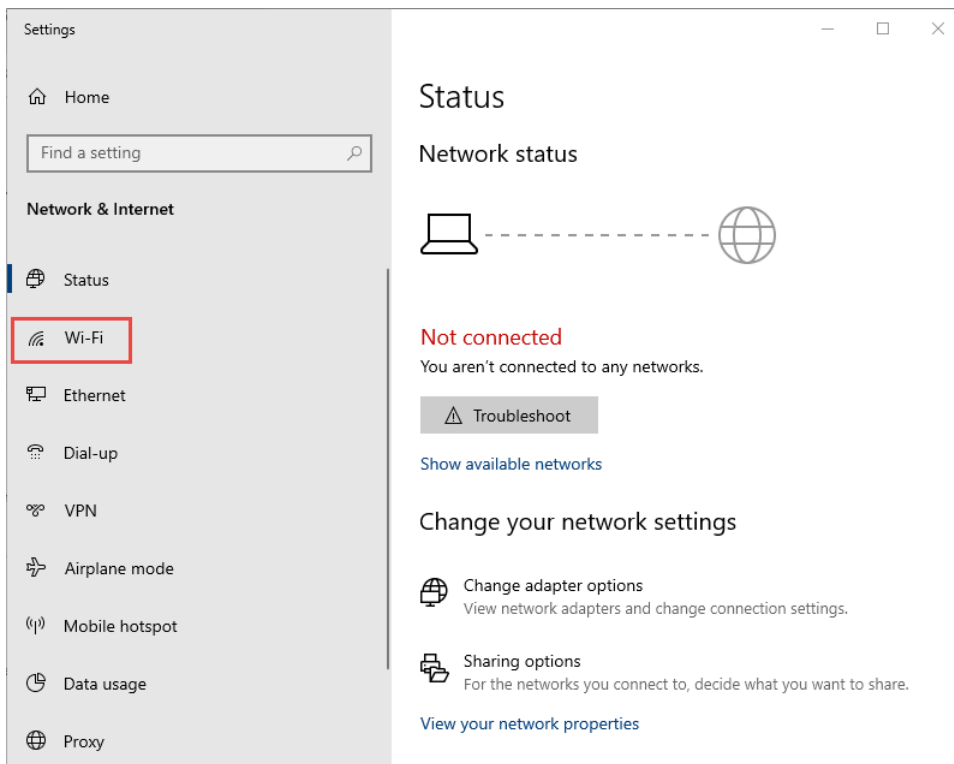
4. Scroll down the Wi-Fi configuration, locate the Related settings section, and select **Change adapter options**.

Figure 4-18: Wi-Fi configuration options
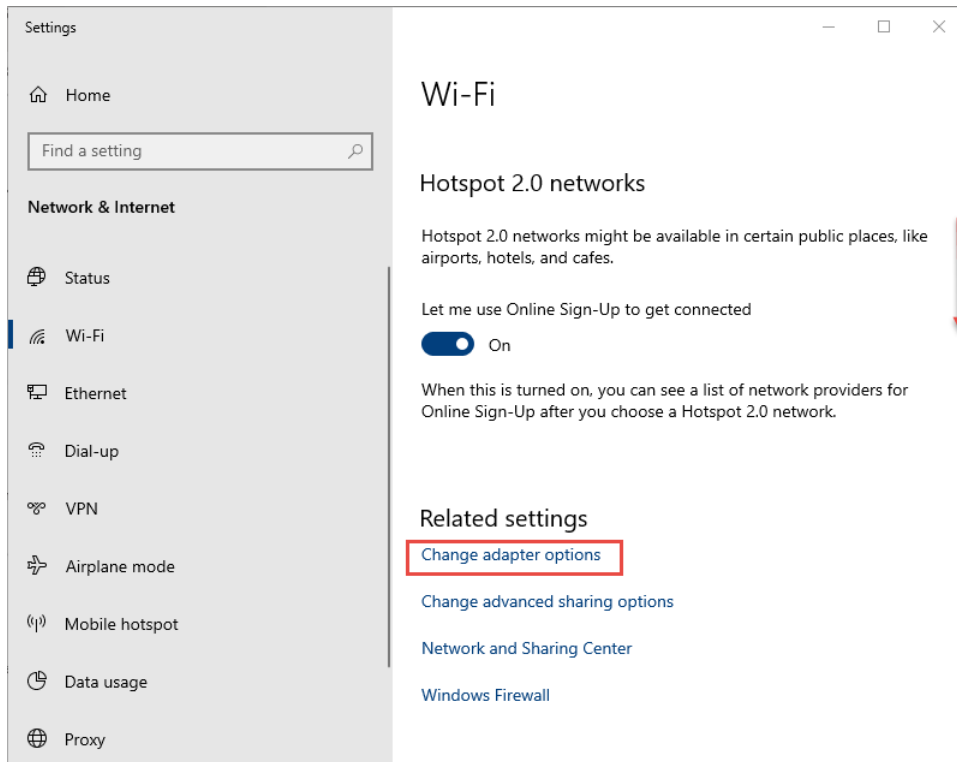
5. On the Network Connections screen, locate and right click the **Wireless Network Connection**.
6. Select **Properties** from the drop-down menu.

Figure 4-19: Wireless Network Connection (Wi-Fi interface on client)
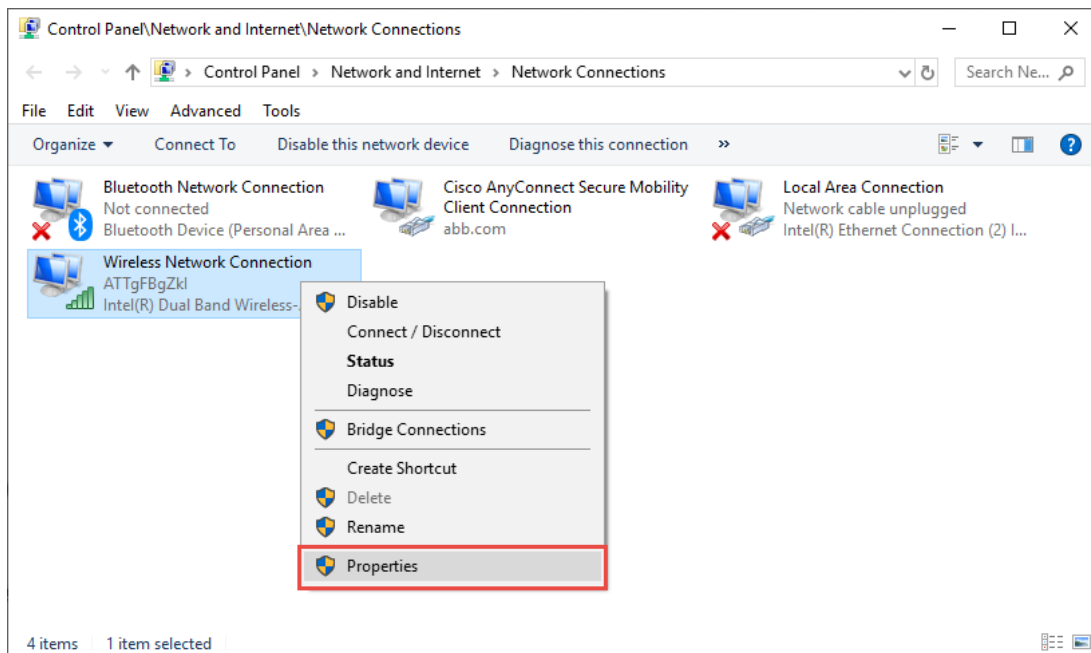
7. On the Wireless Network Connection Properties window, locate and select **Internet Protocol Version 4 (TCP/IPv4)**.
8. Click **Properties**.

Figure 4-20: Wireless Network Connection properties
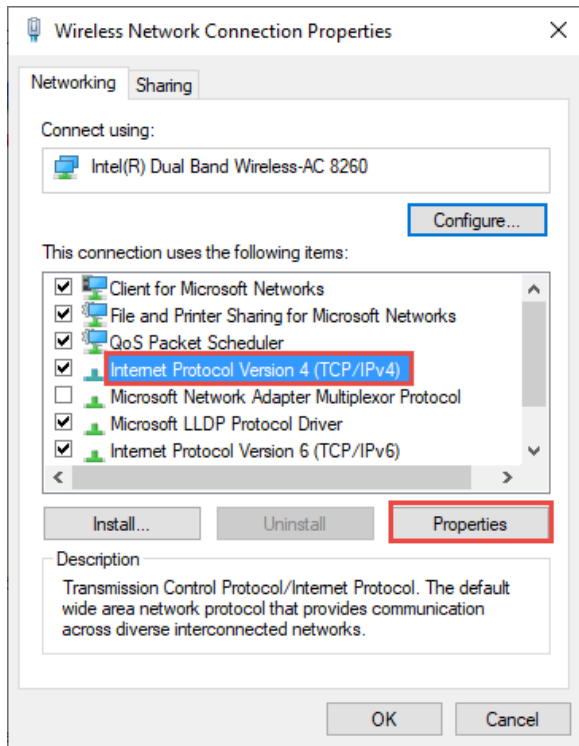
9. In the Internet Protocol Version 4 Properties window, select **Use the following IP address** and type the IP address and subnet mask. The IP address of the client should be on the address range or subnet used for the XIO's Ethernet interface. In this example, then number used is 192.168.10.15 and the subnet mask 255.255.255.0.

Figure 4-21: Internet Protocol Version 4 (TCP/IPv4) Properties
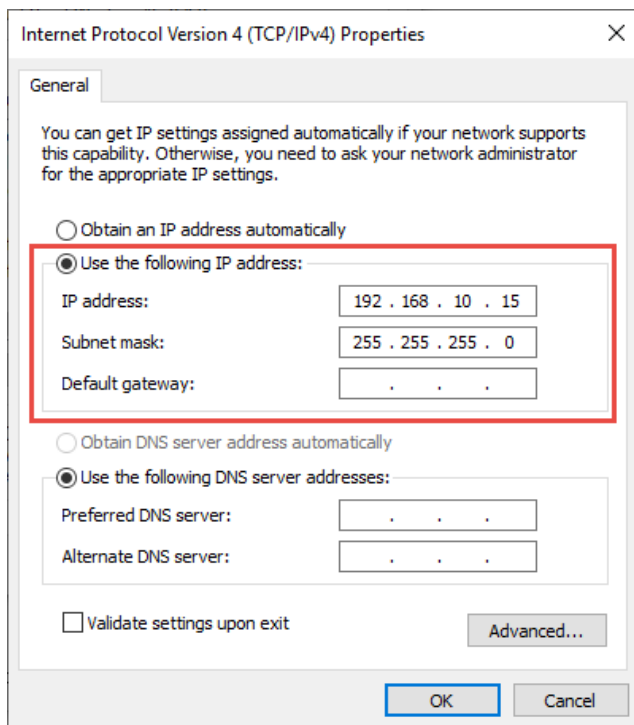
10. Click **OK** to exit the IP v4 Properties window.
11. Click **Close** to exit the Wireless Network Connection Properties window.

4.4.3   Join the network advertised by the XIO

On the Wi-Fi client host:

1. Select the wireless icon at the bottom right corner of Windows 10 application menu bar.
2. Locate the network advertised by the XIO in AP Bridged mode.

Figure 4-22: Detected XIO-advertised network
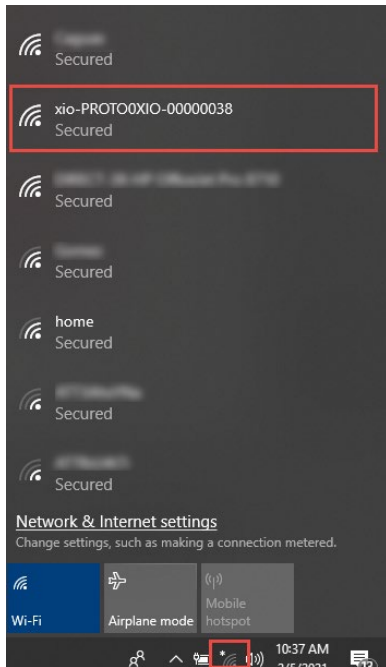
3. Select the network and then click **Connect**. Wait for connection to establish.

Figure 4-23: Join the detected XIO network
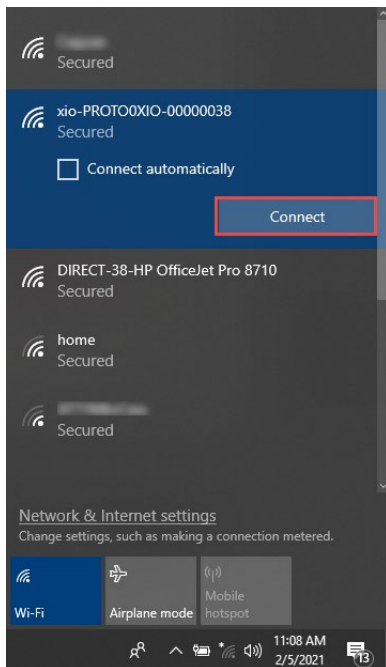
4. Verify connection with the XIO in the next procedure.

4.4.4   Connect with the XIO in AP Bridged mode

To connect with the XIO configured in the previous section:

1. Start PCCU32 on the Wi-Fi Client host.
2. Click **Setup** on the top menu.

3. On the System setup window, under Communications, select **TCP/IP**.
4. Under Connection parameters, type the IP address assigned to the Ethernet interface of the XIO. In this example, 192.168.10.14.
5. Click **Close** to exit System setup.
6. Click the Entry icon on the top PCCU32 menu.
7. Verify that the connection with the XIO succeeds.
8. Verify that you can connect to the RMC in the next procedure.

4.4.5 Connect with an RMC through an XIO in AP Bridged mode

This procedure shows how to connect to an RMC from a Wi-Fi client host (operator laptop). The RMC does not provide native Wi-Fi support, but when connected to the Ethernet port of an XIO in AP Bridged mode, it can become accessible to Wi-Fi clients. This access is required in daisy-chained scenarios when the RMC ports cannot be disconnected from other devices for local access. Wireless access makes connections available without the need to be next to the devices.

For access to an RMC with Wi-Fi client host:

1. Start PCCU32.
2. On the top menu bar, click **Setup**.
3. Set up PCCU using the RMC IP address used for the connection with the XIO Ethernet port. In this example: 192.168.10.20.
4. Click **Close** to exit setup.
5. Click the Entry icon on the top PCCU32 menu.
6. Verify that the connection with the RMC is established.

4.5 Local wireless access to XIO (Wi-Fi client) by host

The Wi-Fi procedures in previous sections describe access to a single Access Point-XIO or attached RMC. An XIO in any of the access point modes also supports access to other XIOs on the same wireless network. This section describes wireless access to an XIO in client mode for scenarios with multiple XIOs installed. One of the XIOs is in access point mode.

> **i** **IMPORTANT NOTE:** The client XIO can join a wireless network advertised by any Wi-Fi access point. The access point can be another XIO in any of the AP modes, an ABB Totalflow device supporting the AP role (for example, an XFC^{G5}), or a third-party AP in the field. The configuration of client XIO requires correct IP parameters, the SSID or device name of the access point, and the passcode. If the access point is another ABB Totalflow device, the default SSID is the same as the device name. The default device name is the product and unique serial number assigned from the factory. If using a non-default device name, obtain the user-defined name from the Networking tab, and ensure the correct name is configured on the XIO client. If the access point is a third-party device, obtain the IP parameters, SSID and passcode from the administrator.

Figure 4-24 shows a client XIO (XIO_02) on a wireless network advertised by XIO_01 in AP mode. XIO_02 joins the wireless network as a client. The Wi-Fi host client (laptop) can access both devices on the same network. The blue flow lines from the laptop to XIO_01 and XIO_02 indicate individual connections to the XIOs.

Figure 4-24: Local wireless access to Client XIO by host (access point XIO in AP mode)
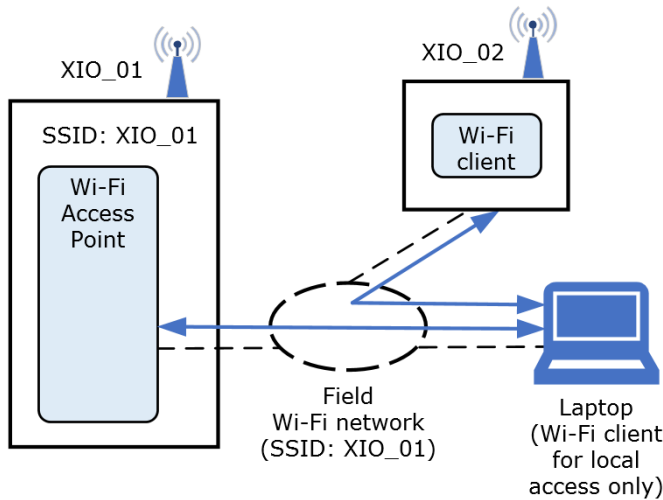
Table 4-6 provides a configuration overview for access to a client XIO (XIO_02).

Table 4-6: Configuration summary (XIO_02: client of XIO_01: AP)

Device	Interface/type	Mode	IP addressing
XIO_01	Ethernet	4-port switch (A1+A2+B1+B2)	User-defined static address compatible with field LAN. Ethernet connections not shown above.
	Wi-Fi	Access Point (AP)	Default or user-defined
XIO_02	Ethernet	4-port switch (A1+A2+B1+B2)	User-defined static address compatible with field LAN. Ethernet connections not shown above.
	Wi-Fi	Client	— User-defined or — Automatically configured if DHCP server enabled in XIO_01 (Access point)
Laptop	Wi-Fi	N/A	— User-defined or — Automatically configured if DHCP server enabled in XIO_01 (Access point)

4.5.1   Configure XIO as a Wi-Fi client of an XIO AP

This procedure describes how to configure the client XIO for the network advertised by the XIO in Access Point mode.

Determine the SSID or device name of the access point and its passcode prior to configuration. The client requires these parameters to successfully join the Wi-Fi network and be accessible for connection.

To configure the XIO in Client mode:

1. Connect to the XIO on PCCU entry mode.
2. On the navigation tree, select **Communications**. The Communication Setup screen displays.
3. Select the **Networking** tab.
4. In the Wi-Fi Network section, select **Client** from the **Mode** drop-down list (Figure 4-25).

Figure 4-25: Select Wi-Fi Mode: Client
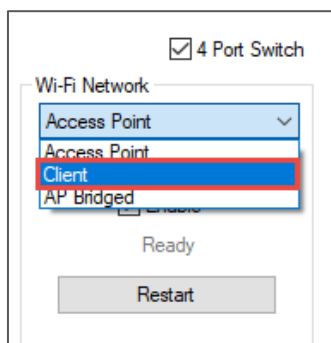
5. Ensure that the State **Enable** checkbox is selected.
6. Configure IP addressing parameters:
   a. If the access point XIO has its DHCP server enabled (recommended), select the DHCP **Enable** checkbox. The XIO in client mode can then obtain its IP address from the access point automatically. The IP parameter fields are grayed out (Figure 4-26).

Figure 4-26: Client XIO configuration to obtain IP parameters from the XIO AP DHCP server
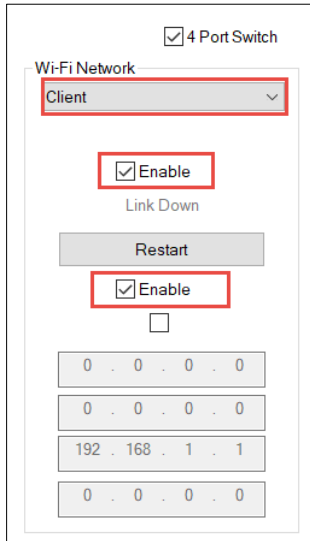
   b. If the access point XIO does not have its DHCP server enabled, clear the DHCP **Enable** check box, and configure the IP address, subnet mask and gateway manually. The IP address and subnet mask must be compatible with the IP address of the XIO access point on its Ethernet interface. The gateway must be the IP address of the access point XIO.
7. In the Advanced section (Figure 4-27):
   a. Type Access Point SSID. In this example, the access point is another XIO with its default factory device name.
   b. Type the Access Point passcode. Select **Show** to view the typed passcode and verify it is correct.
   c. Click **Send**.

Figure 4-27: Configure access point parameters
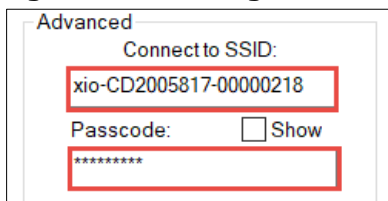
8. Click **Restart** to reinitialize the Wi-Fi interface.
9. Observe the Wi-Fi Status messages (Figure 4-28). The connection of the XIO with the Access point is successful when the status displays: Ready. If DHCP was enabled for the client XIO, the IP parameter fields populate automatically with the configuration obtained from the Access Point DHCP server. Take note of the IP address. This address is the target address for connections from PCCU. In this example, the access point XIO has its default IP address (192.168.1.1) and therefore the client XIO IP address was automatically configured for that address range/subnet (192.168.1.2).

Figure 4-28: Client XIO Wi-Fi Status: Ready (IP parameters obtained from AP DHCP)
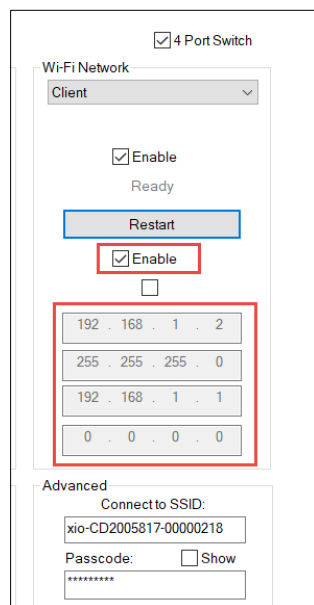
4.5.2   Join network advertised by the access point XIO

To connect to the XIO in client mode, join the Wi-Fi network advertised by the access point XIO:

1. Manually configure the Wi-Fi client host IP address as described in section 4.4.2.3 Configure Wi-Fi host client IP parameters. The IP address should be compatible with the Access Point XIO Ethernet IP address (Same subnet as that of the wired network).
2. Verify that the Wi-Fi client host detects the access point network.
3. Select the access point device name from the list of detected networks.
4. Select **Connect**.
5. Wait for the host to verify access. The first time you attempt to connect, the system prompts for the passcode after checking for network requirements. Depending on the operating system of the Wi-Fi client, the passcode may also be referred to as the "network security key."
6. Type the correct passcode when prompted.
7. Verify that the connection is established. The network should display: Connected, secured.

4.5.3   Connect with the client XIO

Access to XIOs that are clients of another XIO is a convenient way to connect without having an Ethernet connection on the laptop. When the laptop joins the network advertised by the XIO access point, it joins the network the XIO clients are connected to. The laptop (with PCCU) can establish connections with the access point XIO and all its XIO clients on the same wireless network.

Once the Wi-Fi client host joins the wireless network, connect to the client XIO:

1. Start PCCU.
2. From the top PCCU menu, select **Setup**. The System Setup displays.
3. Configure PCCU to connect to the client XIO address.
4. Click **Close** to exit PCCU setup.
5. Click the Entry icon on the top menu bar.
6. Verify that the connection with the client XIO is established.

5   Network diagnostic tools

Network communications diagnostic tools are available on the Network Diagnostic tools tab. This tab provides the ability to run the well-known PING and Traceroute network utilities. These two utilities are used to determine packet delay and routes between a Totalflow device and a host or another device.

> **i** **IMPORTANT NOTE:** Running PING and Traceroute require that Ethernet Interfaces are enabled, active, and configured with correct IP parameters. Be sure to configure the appropriate interfaces on the Networking tab before running these commands.

To run diagnostics:

1. Click **Communications** on the PCCU navigation tree.
2. Click the **Network Diagnostic Tools** tab.
3. Select the utility from the **Tools Type** drop-down list.
4. Configure required parameters.
5. Click the **Start** button to run the utility.
6. Review results.
7. Click **Help** for additional parameter details and for interpreting results.

6 Reference information

This section includes information for the (Communications) Networking tab screen which provides configuration and monitoring options for Ethernet and Wi-Fi. Configuration options displayed depend on the product and generation.

> **IMPORTANT NOTE:** The content in this section is also available in the PCCU help topics. Click **Help** on the **Networking** tab screen and follow the links to display the topics of interest. The online help topics typically contain the most up-to-date content.

6.1 Ethernet parameters

The Ethernet section(s) in the Networking tab display configuration and monitoring parameters for the Ethernet interfaces. The sections display interfaces and parameters that are applicable to the different configuration options available.

Configuration and monitoring include main, advanced, and statistical parameters. The main and advanced parameters are visible from the Advanced view. The statistical parameters area available in Expert view.

> **IMPORTANT NOTE:** Change to Expert view to see all parameters and to update configuration. Configuration changes are supported in Expert view only.

> For multi-port devices, depending on the mode, the first Ethernet parameter section (on the left of the Networking screen) may display with the name: Enterprise Network. The Enterprise Network is associated with RMC's Ethernet ports 1 and 2 or XIO Ethernet ports A1 and A2. For the XIO, when not in 4-port switch mode, an additional section displays as Industrial Network (for ports B1 and B2). When the Enterprise and Industrial ports are configured separately, make sure to connect ports correctly. The labels for these ports on the XIO enclosure show as A Network and B Network, not Enterprise or Industrial Networks.

6.1.1 IP addressing

IP addressing consists of assigning the IP address(es) that an ABB Totalflow device requires for successful network communication. A valid IP address must replace the factory default address when the interface is used for network communication. Valid IP addresses must be unique. Additional IP parameters such as the subnet mask and gateway are also required.

Configure as follows:

— Assign a single IP address on single Ethernet port devices such as the μFLO, XFC, XRC. Table 6-1 shows the only mode supported by single-port devices. The Ethernet port is the single interface used to connect to a network.

Table 6-1: IP addressing for single-port devices (μFLO, XFC, XRC)

Mode	Ethernet interface configuration	Ports	Number of required IP addresses	Default IP addresses (port assigned)
1 Network	Single interface	ETH	1 address	169.254.0.11

— Assign IP address(es) on multi-Ethernet-port devices based on interface configuration. Multi-port devices support several Ethernet configuration modes including switched modes where ports are combined into single network domains. The mode determines the number of addresses required and the options for connections in the field.
— Table 6-2 and Table 6-3 below provide details on each mode supported for the RMC and the XIO. These devices support 2 and 4 Ethernet ports respectively.

IMPORTANT NOTE: Assign new IP addresses only on those interfaces you plan to use. The factory default address on an unused port can still be used for direct connection for local operator access.

Table 6-2 shows that the RMC-100 in 1 Network mode requires only one valid IP address to replace the default address. When in 2 Network mode, the RMC-100 requires 2 valid IP addresses to replace the defaults.

Table 6-2: IP addressing per mode for 2-port device (RMC-100)

Mode	Ethernet interface configuration	Ports	Number of required IP addresses	Default IP addresses (Port assigned)
1 Network	Single interface: both ports assigned to a single network	E1+E2	1 address	169.254.0.11 (All ports)
2 Networks	Two interfaces: One for each port	E1, E2	1 address for each interface used	169.254.0.11 (E1) 169.254.0.12 (E2)

Table 6-3 shows that the XIO in 4-port switch mode requires only one valid IP address to replace the default address. When not in 4-port switch mode, the number of addresses vary depending on the mode selection for the Enterprise ports. The Industrial ports support only 2 Network modes; these ports always require separate IP addresses.

Table 6-3: IP addressing per mode for 4-port switch device (XIO)

Mode	Ethernet interface configuration	Ports	Number of required IP addresses	Default IP addresses (Port assigned)
4-port switch	Single interface: all ports assigned to a single network	A1+A2+B1+B2	1 address	169.254.0.13 (All ports)
Enterprise ports: 1 Network Industrial ports: 2 Networks	Three interfaces: 1: One for both Enterprise ports 2: One for each Industrial port	A1+A2 B1, B2	1 address for each interface used	169.254.0.13 (A1+A2) 169.254.0.15 (B1) 169.254.0.16 (B2)
Enterprise ports: 2 Networks Industrial ports: 2 Networks	Four Interfaces: 2: One for each Enterprise port 2: One for each Industrial port	A1, A2 B1, B2	1 address for each interface used	169.254.0.13 (A1) 169.254.0.14 (A2) 169.254.0.15 (B1) 169.254.0.16 (B2)

6.1.2   IP addressing after mode and configuration changes

Changing mode on an Ethernet interface may cause IP configuration loss on that interface. The following guidelines can be helpful when configuring Ethernet for the first time or when updating an existing configuration on the **Networking** tab:

1. Always take note of the IP configuration assigned to any interface before changing the mode on that interface. Mode change may set interfaces back to factory defaults. Re-configuration may be needed.
2. Be sure to restart an Ethernet interface every time you change its configuration. For example:
   a. When changing the mode on an Ethernet interface, be sure to click **Send** and then **Restart** for the mode change to take effect. If an existing IP address is lost or is set to factory default values, re-configure the required address, click **Send**, and then **Restart** to save the new address.
   b. When changing both the mode and the IP address on an Ethernet interface, change the mode first and then the IP address:
      i. Change the mode, click **Send** and then, **Restart** to commit the mode change.

      ii. Change the IP address, click **Send** and then, **Restart** to commit the address change.

6.1.3   Main Ethernet parameters

Table 6-4 below describes parameters for several configuration options applicable to the Ethernet Interfaces. It contains:

— General configuration options applicable to all ABB Totalflow G5 devices, RMC-100 and XIO models
— Specific configuration options for devices with:

- A single Ethernet interface (single port): µFLO^{G5}, XSeries^{G5} (XRC^{G5}, XFC^{G5})
- Multiple Ethernet interfaces (multiple ports) such as the RMC-100 (2 ports) and XIO (4 ports)

When options are applicable only to certain devices, it is indicated in the parameter description.

Table 6-4: Main Ethernet parameters

Parameter/ Function	Description	Values/setting
Device Name	Name (hostname) assigned to the device for its unique identification on a wired local area network (Ethernet LAN). The device name applies to both the Ethernet interfaces and the wireless interfaces. The same name is used to identify the device as a host on an Ethernet LAN or as an access point on a Wireless LAN.	(User-configurable) – <Device model>-<unique serial number> (default): Recommended to keep the factory default name as it guarantees uniqueness and makes it easy to identify the device when enabled as Wi-Fi access point for example. – User-defined name: Type a new name using another preferred naming convention but ensure that the name is unique (any naming convention must conform to those recommended by RFC 952).
4-Port Switch	(Applicable only to the XIO) One of the modes of operation of the XIO embedded Ethernet switch: All 4 Ethernet interfaces or ports are logically combined into a single broadcast domain or network. Unicast traffic between each port is switched (only the devices connected to those ports see the traffic); broadcast traffic is seen by all ports (all devices connected to all ports see the traffic). This mode of operation allows the interconnection of multiple XIOs in daisy-chain fashion with IP addresses on the same subnet.	Select or clear the checkbox for preferred operation: – Enabled (Default): XIO behaves as a 4-port switch. All ports are part of a single network. This mode requires the configuration of a single IP address. Devices connecting to any of the ports must have an IP address on the same subnet. When enabled, the Mode field displays: 4 Port Switch. – Disabled: XIO provides other connection options to logically separate Ethernet interfaces into separate networks.
Mode	(Applicable to the RMC-100 and XIO) Mode is the configuration of the XIO embedded Ethernet switch which determines how Ethernet interfaces or ports are managed. Ports are switched and are part of a network or are isolated into individual networks.	For the µFLO^{G5} and XSeries^{G5} (XRC^{G5}, XFC^{G5}), this field is read-only and displays "1 Network" as default (mode is not selectable). These devices have only one Ethernet port. For the RMC and the XIO, the mode is selectable: – On the RMC, mode options are always available for selection for the available Enterprise interfaces: E1 and E2. – On the XIO, the mode options become available only when the 4-port switch option is not enabled. Mode options are available for both Network-A interfaces (A1 and A2) and Network-B interfaces (B1 or B2). Note that on PCCU, Network-A interfaces are named Enterprise interfaces and Network-B interfaces are named Industrial interfaces. Select from the Mode drop-down list: – 1 Network (Enterprise ports only): Ethernet interfaces are configured as switched ports (part of the same network or broadcast domain). Traffic on one port is seen by the other. This mode requires the configuration of a single IP address. Devices connecting to these ports must have an IP address on the same subnet. – 2 Networks (Enterprise and Industrial ports): Ethernet interfaces are isolated into individual

Parameter/ Function	Description	Values/setting
		ports, each assigned to its own network. Traffic on one port is not seen by the other. This mode requires that each port is assigned an IP address, each on different subnets. Devices attached to each port must have an IP address on the same subnet as the one assigned to the port.
Port	Physical Ethernet port configuration	(Read-only) For µFLO^{G5}, XSeries^{G5} (XRC^{G5}, XFC^{G5}): – ETH: Single port (1 Network mode) For multi-port devices: – Port configuration is automatically displayed based on the selected mode. For the RMC-100 Enterprise ports: – E1+E2: Both ports assigned to a single network (1 Network mode) – E1, E2: Each port assigned to its own network (2 Networks mode) For the XIO Enterprise ports: – A1+A2: Both ports assigned to a single network (1 Network mode) – A1, A2: Each port assigned to its own network (2 Networks mode) For the XIO Industrial ports: – B1, B2: Each port assigned to its own network (2 Networks mode)
State	Function to enable or disable the Ethernet interface for communication	Checkbox: – Select to Enable the Ethernet interface: Ports transmit and receive traffic. – Clear to disable the Ethernet interface: Ports do not transmit or receive traffic. **Note:** Disabling the Ethernet interface(s) does not remove the associated IP configuration.
Status	Indicates the current state of the Ethernet interface	(Read-only) The following messages display indicating status: – Off: The Ethernet interface is disabled (State checkbox is cleared). – Wait: The Ethernet interface is initializing and getting ready to communicate. – Ready: The Ethernet interface has initialized correctly and is ready for communication. – Error: The Ethernet interface failed to initialize, or it lacks a valid IP configuration. – Link Down: The Ethernet physical link is broken or absent (cable unplugged or damaged).
Restart	Re-initializes the Ethernet interface(s)	Click **Restart**: – After configuration changes (make sure to click **Send** before restart) – As necessary when troubleshooting
DHCP	DHCP client function used to enable the ABB Totalflow devices for automatic IP configuration. The DHCP client requests and receives valid IP parameters from a DHCP server on	Checkbox: – Select to Enable dynamic IP configuration. It requires a DHCP server on the network or field network router

Parameter/ Function	Description	Values/setting
	the local router or customer network, and automatically configures these parameters for the Ethernet interfaces. The use of the DHCP function requires that the network is active at all times and that a DCHP server is enabled on the local field network router or corporate network.	– Clear to disable dynamic IP configuration (Default). If a DHCP server is not available on the local router or corporate network, add the IP configuration manually (static IP addressing). **Note:** For XIOs and XSeries^{G5} (XRC^{G5}, XFC^{G5}), the DHCP client function for Ethernet is not the same as the DHCP server function available for Wi-Fi. The DHCP client function requests IP configuration from a DHCP Server. The DHCP server function provides IP configuration to Wi-Fi clients. Ethernet and Wi-Fi are separate interfaces on the XIO, and these functions are enabled or disabled independently.
Default Interface	Interface selected to be default when more than one interface is connected to the same network	Checkbox: – Select to Enable: The Ethernet interface is the default interface. – Clear to Disable: The interface is not the default interface.
IP Address	Internet Protocol (IP) address assigned to the Ethernet Interface(s)	User-defined (static addressing) or automatically configured (if using DHCP) ABB Totalflow devices have factory default IP configurations. Keep these configurations intact for initial local communication and configuration. For permanent Ethernet connections, such as connection to network equipment or other devices, ensure that the devices have valid public IP addresses. Each field device must have a unique IP address. See section 6.1.1 IP addressing in this document for details.
Subnet Mask	Address mask determining the subnet an IP address belongs to	User-defined or automatically configured (if using DHCP) 255.255.0.0 (Default)
Gateway	IP address of the field network node or router providing access to the corporate network or the Internet	User-defined or automatically configured (if using DHCP) 0.0.0.0 (Default)
DNS Server	IP address of the Domain Name Server (DNS) which contains a database of public IP addresses and their associated hostnames	User-defined or automatically configured (if using DHCP) 0.0.0.0 (Default)
Restore factory settings	Returns current configuration values for the interfaces to their factory defaults	Click **Restore Factory Settings** to return existing configuration values to factory defaults.
Monitor Statistics	Function that activates real-time tracking of the values for the statistical traffic parameters. Statistical parameters are available only on Expert view.	Checkbox: – Select to enable real time monitoring – Clear to disable real-time monitoring **Note:** Right-click next to the checkbox to select the refresh frequency (options: 1-60 seconds).

6.1.4   Advanced Ethernet parameters

The Advanced parameter section in the Networking tab allows data rate limiting on Ethernet interfaces. Data rate limiting allows the user to set rate limits on incoming and outgoing Ethernet traffic processed by the CPU on a per port basis without changing the bandwidth of the Ethernet interface.

— For Rx Rate Limit, packets are dropped at the port when the incoming data rate exceeds the specified rate limit.
— For Tx Rate Limit, the throughput of the Ethernet is limited by the specified rate limit.

6.1.5   Advanced parameters for the RMC and XIO

Table 6-5 describes the rate limiting parameters available for the Ethernet ports on the RMC and XIO.

Table 6-5: Advanced Ethernet parameters (RMC-100, XIO)

Parameter/Function	Description	Values/setting
Rx Rate Limit	(Applicable to RMC-100, XIO) The incoming rate limit in bits per second	Select from drop-down list: 64 Kbps 128 Kbps 192 Kbps 256 Kbps 1 Mbps 10 Mbps (Default) 20 Mbps 30 Mbps 40 Mbps 50 Mbps Off - No limit set
Tx Rate Limit	(Applicable to RMC-100, XIO) The outgoing rate limit in bits per second	Select from drop-down list: 64 Kbps 128 Kbps 192 Kbps 256 Kbps 1 Mbps 10 Mbps (Default) 20 Mbps 30 Mbps 40 Mbps 50 Mbps Off – No limit set

6.1.6   Advanced parameters for µFLO[G5], XSeries[G5] (XRC[G5], XFC[G5])

Table 6-6 describes the link speed and mode parameters available for the Ethernet ports on the µFLO[G5] and XSeries[G5] (XRC[G5], XFC[G5]). Ethernet bandwidth and the duplex mode configuration depends on the other devices connecting to the field network (network switches/routers or other ABB Totalflow devices, etc.).

Auto negotiation is always enabled on Ethernet ports. For example, if the Ethernet speed is set to 100 Mbps, and the device is connected to a 10 Mbps switch on the other end, the operating speed will be negotiated to 10 Mbps.

Table 6-6: Advanced Ethernet parameters (µFLO[G5], XSeries[G5] (XRC[G5], XFC[G5])

Parameter/ Function	Description	Values/setting
Link Speed	Function to select the desired speed of the Ethernet interface	Select from drop-down list: – 10 Mbps (Default): The interface communicates at 10 Mbps. – 100 Mbps: The interface communicates at 100 Mbps.
Current Link Speed	Displays the operating speed of the Ethernet interface after negotiation with the connected device	(Read-only) Negotiated speed to one of the following values: – 10: The interface and the connected device agreed to communicate at 10 Mbps. – 100: The interface and the connected device agreed to communicate at 100 Mbps.
Duplex Mode	Function to select desired duplex mode	Select from drop-down list: – Half-duplex: The interface either transmits or receives traffic, but not both. – Full-duplex (default): The interface transmits and receives traffic at the same time
Current Duplex	Displays the operating duplex mode after negotiation with connected device	(Read-only) Negotiated duplex mode to one of the following values:

– Half-duplex: The interface and the connected device agreed to communicate in half-duplex mode.
– Full-duplex: The interface and the connected device agreed to communicate in full-duplex mode.

6.1.7 Statistics (Expert view only)

Ethernet usage statistics allow for monitoring the traffic on the Ethernet interfaces for bandwidth used, dropped packets or error packets. Users can trend these parameters to get a historical view of the Ethernet activity for both received and transmitted traffic. Table 6-7 provides details on statistical parameters available for monitoring.
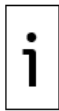
> **IMPORTANT NOTE:** Statistics parameter values are displayed in real-time. They provide a snapshot of the performance during the monitoring period. Statistical values are not accumulated over time (no averaged or accumulated values are calculated or saved in the device). Statistical values display a zero when there is no traffic on the Ethernet interfaces.

Table 6-7: Ethernet interface Statistics

Parameter/ Function	Description	Values/setting
Rx	**Statistics on the traffic received by the Ethernet interface**	
Network Usage %	Percentage utilization of the Rx bandwidth	(Read-only) Range: 0-100%
Packets/sec	Number of packets received per second	(Read-only) Range: 0 to MAX MAX = (UINT32) or $[0-(2^{32}/2)]$
Data Bytes/sec	Rate of incoming data in bytes per second. It should always be less than or equal to Rx Rate Limit.	0 to Rx bandwidth
Drop Packets/sec	Number of incoming packets dropped per second because Rx Rate exceeds Rx Rate Limit	(Read-only) Range: 0 to MAX MAX = (UINT32) or $[0-(2^{32}/2)]$
Error Packets/sec	Number of error packets received per second	(Read-only) Range: 0 to MAX MAX = (UINT32) or $[0-(2^{32}/2)]$
Tx	**Statistics on traffic transmitted from the Ethernet interface**	
Network Usage %	Percentage utilization of the Tx bandwidth	(Read-only) Valid range 0-100%
Packets/sec	Number of packets sent per second	(Read-only) Range: 0 to MAX MAX = (UINT32) or $[0-(2^{32}/2)]$
Data Bytes/sec	Rate of outgoing data in bytes per second. It should always be less than or equal to Tx Rate Limit.	(Read-only) Range: 0 to Tx bandwidth
Drop Packets/sec	Number of outgoing packets dropped per second because Tx Rate exceeds Tx Rate Limit	(Read-only) Range: 0 to MAX MAX = (UINT32) or $[0-(2^{32}/2)]$
Error Packets/sec	Number of packets per second which could not be transmitted due to errors	(Read-only) Range: 0 to MAX MAX = (UINT32) or $[0-(2^{32}/2)]$

6.2 Wi-Fi parameters

The Wi-Fi section in the Networking tab displays configuration and monitoring parameters for the Wi-Fi interface. The section displays parameters based on selected Wi-Fi modes. It displays only for devices whose hardware supports Wi-Fi, such as the XSeries[G5] and XIO products.

> **IMPORTANT NOTE:** Install required hardware: XSeries[G5] and XIO devices require an antenna to support Wi-Fi and onboard Bluetooth communication. Install the antenna before enabling and configuring the wireless parameters. See the Wi-Fi Antenna Kit Installation Guide at www.abb.com/upstream.

Secure device access: For security reasons, enable Wi-Fi access only when necessary. Replace the default security passcode with a strong password that is available only to authorized personnel.

6.2.1   Parameter categories

Configuration and monitoring include main, advanced and statistical parameters. The main and advanced parameters are visible from the Advanced view. The statistical parameters are available on Expert view.

ⓘ **IMPORTANT NOTE:** Change to Expert view to see all parameters and to update configuration. Configuration changes are supported in Expert view only.

6.2.2   Main Wi-Fi parameters

The Wi-Fi Network main parameters display based on the selected Wi-Fi mode (the role the Totalflow device performs on a Wi-Fi network). Table 6-8 describes the main Wi-Fi network parameters and indicates when parameters apply only to certain modes and device models or product families.

For additional mode-specific parameters, see sections 6.2.3 Advanced Wi-Fi Client mode parameters and 6.2.4 Advanced Wi-Fi Access Point mode parameters. Advanced parameters are available for the client and access point modes.

ⓘ **IMPORTANT NOTE:** Wi-Fi functionality is disabled in the factory for security reasons. Default values are set for the highest level of security. All ABB Totalflow devices with Wi-Fi capabilities have the same security passcode. To prevent unauthorized access, ABB highly recommends that you change the password immediately when installing the unit in the field.

The Wi-Fi parameters are never overwritten when you use a configuration from another device.

Table 6-8: Main Wi-Fi parameters

Parameter /function	Description	Values/setting
Device Name	The name is also referred to as Network ID (see Services tab). This is the name that the ABB Totalflow device advertises from its wireless interfaces when configured as an access point. This is also referred to as the Service Set Identifier or SSID. Wireless clients scan for available networks and detect this name to establish connection. **Note**: The device name applies to both the Ethernet interfaces and the wireless interfaces. The same name is used to identify the device as a host on an Ethernet LAN or as an access point on a Wireless LAN.	Keep factory default name or type new name: <Device model-<unique serial number> (Default recommended. The factory default name guarantees uniqueness.) User-defined name: Type new name using another preferred naming convention but ensure that the name is unique. (Any naming convention must conform to those recommended by RFC 952).
Mode	Configuration options for the desired Wi-Fi role of the ABB Totalflow device. Mode configuration depends on the devices available in the field network and the type or topology of their connections. For example, in installations with multiple ABB Totalflow devices with Wi-Fi capabilities, one device may be configured as an access point, while others as clients.	Select from the drop-down list: – Access Point (default): Enables the ABB Totalflow device as a Wi-Fi access point. The device with this configuration advertises its network ID which Wi-Fi clients detect for connection. – Client (XIO only): Enables the ABB Totalflow device as Wi-Fi client. The device with this configuration connects to a network served by a Wi-Fi access point. The access point can either be another ABB Totalflow device in an

Parameter /function	Description	Values/setting
	Mode configuration affects local wireless operator access to the devices. Plan configuration to simplify access. Consider the following: Local access to several devices, all on access point mode, requires that the operator connects to each advertised network separately to be able to connect to each device. Local access to several devices, one on access point mode and the rest as clients, requires that the operator connects only to one network to be able to connect to each device.	access point role or a third-party access point installed in the field. – AP Bridged (XIO only): Available only when the XIO is in 4-port switch mode. Enables the ABB Totalflow device as a Wi-Fi access point with bridging capability to the Ethernet interface. This capability makes it possible to have wireless local access to devices connected to the XIO Ethernet ports. The XIO forwards traffic between the Ethernet network and the Wi-Fi network. **Note:** If you plan to enable the device as an access point, verify that security is also enabled. The device is vulnerable to access by unauthorized Wi-Fi clients in the vicinity unless security is enabled. Make sure to change the default security passcode to a private passcode to prevent unauthorized access.
State	Function to enable or disable the wireless interface for communication	Checkbox: – Select to Enable Wi-Fi. The wireless interface transmits and receives based on the selected Wi-Fi mode. – Clear to disable the Wi-Fi. The wireless interface does not transmit or receive. It is unavailable as a wireless node. **Note:** For security and power-saving reasons, enable Wi-Fi functionality only when necessary. Disabling the Wi-Fi interface does not remove the associated IP configuration.
Status	Indicates the current state of the wireless interface	(Read-only) The following messages display indicating status: – Off (Default): Wi-Fi interface is disabled (State checkbox is cleared). – Ready: The Wi-Fi interface is enabled and working correctly. The device is ready to operate as configured in its Wi-Fi mode. – Wait: The Wi-Fi interface is in the process of being enabled or disabled. – Error: The Wi-Fi interface is enabled but cannot start successfully. The device is not able to operate in its configured Wi-Fi role. – Link Down: The Wi-Fi interface on client mode does not establish a connection to an access point.
Restart	Re-initializes the wireless interface	Click **Restart** after configuration changes. Make sure to click **Send** before restart as necessary when troubleshooting. **Note:** Any existing connections are lost when you restart the wireless interface.
Default Interface	(Client mode only) Interface selected to be default when more than one interface is connected to the same network	Checkbox: – Select to Enable: The wireless interface is the default interface. – Clear to Disable: The interface is not the default interface.
DHCP	(Client mode only) Function that enables the DHCP client capability on a device configured as	Checkbox: – Select to enable DHCP (recommended) to automatically obtain the IP configuration from

Parameter /function	Description	Values/setting
	Wi-Fi client. DHCP allows the device to obtain IP parameters from an access point and automatically configure those parameters for the wireless interface.	the access point. The access point must have its DHCP server enabled. – Clear to disable DHCP. Manually configure IP parameters compatible with the access point. Ensure that the IP address is unique. **Note:** The DHCP function in a Wi-Fi client is not the same as the DHCP function in the access point. In a Wi-Fi client, DHCP requests IP configuration from an access point. In an access point, DHCP provides IP configuration to the Wi-Fi clients.
IP Address	Internet Protocol (IP) address assigned to the Wi-Fi wireless interface	IP address configuration depends on the mode: – For Access Point mode: While this can be user-defined (manually configured), it is recommended to keep the factory default: 192.168.1.1. **Note:** This IP address is associated with the Wi-Fi interface, not any of the Ethernet interfaces. It only applies to local wireless communication with the Wi-Fi clients. It is not an IP address for remote access. – For client mode: User-defined or automatically configured (if using DHCP). Default: 0.0.0.0. When configuring manually, make sure the address is compatible with the address of the access point the client expects to connect to. – For AP Bridged mode: The IP address is not user-editable (The IP address field shows grayed out in this mode). When manually configuring the IP addresses (for Access Point and Client modes), make sure the State **Enable** check box is selected. If the checkbox is not selected, the configuration fields are greyed out. **Note:** This IP address is associated with the Wi-Fi interface, not any of the Ethernet interfaces. It only applies to local wireless communication. It is not an IP address for remote access.
Subnet Mask	This is an address mask that determines what subnet an IP address belongs to.	Subnet mask configuration depends on the mode: – For access point modes: User-defined (manually configured). It is recommended to keep the factory default: 255.255.255.0. – For client mode: User-defined or automatically configured (if using DHCP). Default: 0.0.0.0. When configuring manually, make sure the mask matches the mask on the access point the client expects to connect to. – For AP Bridged mode: The Subnet Mask is not user-editable (The Subnet Mask field shows grayed out in this mode). When manually configuring the subnet mask addresses (for Access Point and Client modes), make sure the State **Enable** check box is selected. If the checkbox is not selected, the configuration fields are greyed out.
Gateway	(Client mode only) IP address of the field network node or router providing access to the corporate network or the Internet	(Client-mode only) User-defined or automatically configured (if using DHCP). Default: 0.0.0.0 When manually configuring the subnet mask,

Parameter /function	Description	Values/setting
		make sure the State **Enable** check box is selected. If the checkbox is not selected, the configuration fields are greyed out.
DNS Server	IP address of the Domain Name Server (DNS) which contains a database of public IP addresses and their associated host names	User-defined or automatically configured (if using DHCP) 0.0.0.0 (Default)
Restore factory settings	Returns current configuration values for the interfaces to their factory defaults.	Click **Restore Factory Settings** to return existing configuration values to factory defaults.
Monitor Statistics	Function that activates real-time tracking of the values for the statistical traffic parameters. (Statistical parameters are available only on Expert view).	Checkbox: – Select to enable real time monitoring – Clear to disable real-time monitoring **Note:** Right-click next to the checkbox to select the re-refresh frequency (options: 1-60 seconds).

6.2.3   Advanced Wi-Fi Client mode parameters

Advanced client mode parameters (Table 6-9) are applicable when the device is configured as a Wi-Fi client. When in client mode, the device requests connection to a local wireless network served by a Wi-Fi access point (another ABB Totalflow device or a third-party device).

The device must be connected to a wireless network to be available for wireless local operator access (connecting using PCCU). The access point is required by the ABB Totalflow client. Ensure that the access point is enabled and ready to grant connections.

Make sure that the device has the correct IP configuration. The client mode supports static IP values (manually configured) or dynamic values (obtained by enabling its DHCP function).

Table 6-9: Wi-Fi client mode parameter description

Parameter/ function	Description	Values/setting
Connect to SSID	Name of wireless (Wi-Fi) network that the device can attempt to connect to when in Wi-Fi client mode. If the access point to the wireless network is another ABB Totalflow device, the SSID is the same as the access point's Network ID.	Manually configured. Type desired value: – Third-party access point. Obtain and type the SSID configured in the access point – ABB Totalflow device access point. Obtain and type the Network ID of that device. The Network ID displays in the device's Communication Services tab.
Passcode	Credential the device in client mode must provide to access the (Wi-Fi) wireless network. The passcode is configured and stored in the access point advertising the wireless network.	Manually configured. Type desired value: – Third-party access point. Obtain and type the passcode configured in the access point – ABB Totalflow device access point. Obtain and type the passcode of that device.

6.2.4   Advanced Wi-Fi Access Point mode parameters

Advanced access point parameters are applicable when the device is configured as a Wi-Fi access point. Configuration options are available when the Wi-Fi interface is enabled, and the selected mode is either Access point or Access Point Bridged (if supported).

6.2.4.1   Access Point passcodes

The passcode restricts access to the devices configured as access points. Table 6-10 below shows the parameters required to configure a passcode on a device. Any previously configured passcode or the factory default must be provided to allow passcode change.

Table 6-10: Access Point passcodes

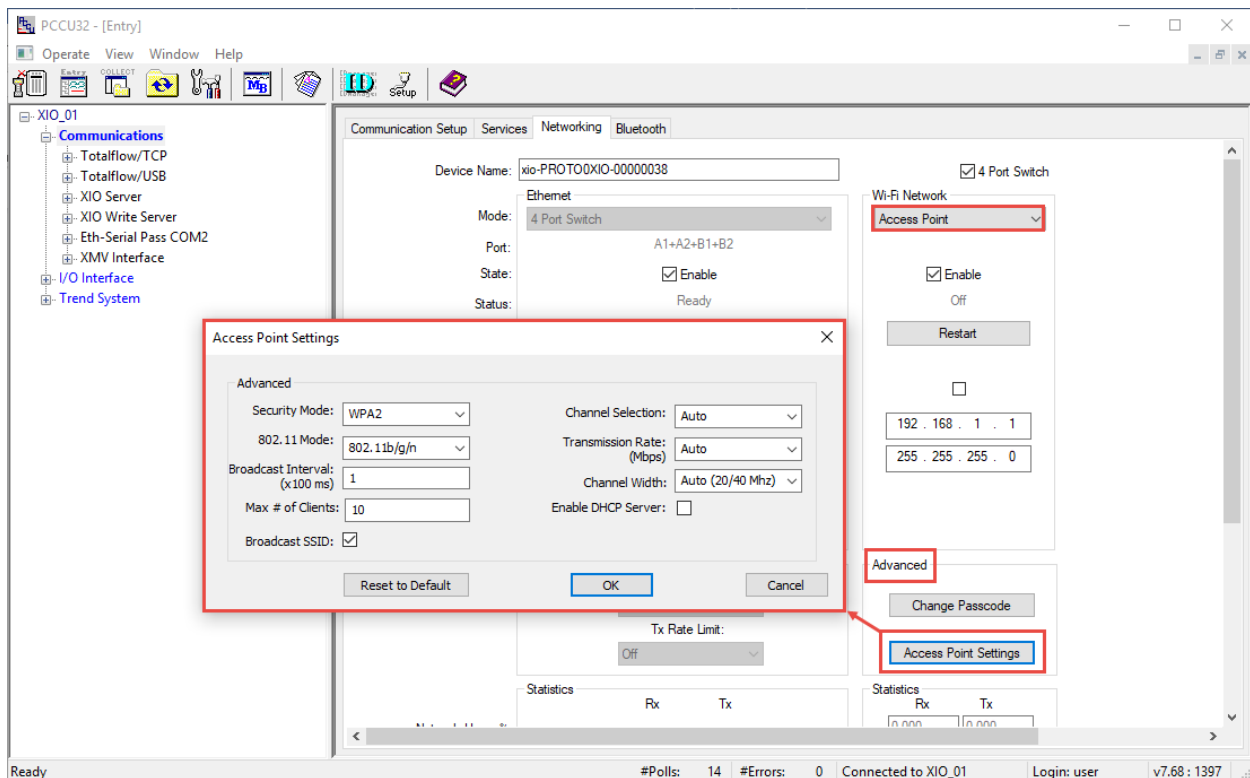| Parameter/ function	Description	Values/setting
Old Passcode	Current access code required by the ABB Totalflow device to grant connection requests to Wi-Fi clients	User-defined Factory value (Default) Current user-defined value Select **Show** to display passcode as you type.
New Passcode	Desired access code or credential	User-defined Type new value to change existing one Select **Show** to display passcode as you type.
Confirm New Passcode	Desired access code or credential	User-defined Type the new value again Select **Show** to display passcode as you type.

6.2.4.2   Access Point settings

Access point settings (Figure 6-1) are advanced parameters applicable to devices configured as access points. These settings display for the Wi-Fi Network under the Advanced parameter section. The Wi-Fi interface state must be enabled to activate access to these parameters.

To access these settings:

1. Select **Access point** or **Access Point Bridged** from the **Mode** drop-down list.
2. Select the State **Enable** check box. The Advanced buttons activate.
3. Click **Access Point Settings**. The Access Point Settings configuration window displays with factory default values.

Figure 6-1: Access Point Settings

4. Refer to Table 6-11 for details on configuration options if changes are necessary.

Table 6-11: Access Point Settings description

Parameter/ function	Description	Values/setting
Security Mode	Configuration options to enforce secure access to the ABB Totalflow device, and the encryption method	Select from the drop-down list:

Parameter/ function	Description	Values/setting
	to protect the data transmitted on a Wi-Fi connection.	– None. Select when you do not require authentication or encryption to grant connection requests from Wi-Fi clients. ABB does not recommend this mode if the device is enabled for Wi-Fi. This option leaves the device vulnerable to unauthorized access. – WPA. Wi-Fi Protected Access – WPA2 (default, recommended). Wi-Fi Protected Access version 2 is the highest level of security supported.
802.11 Mode	The IEEE 802.11 operational mode determines the network's transmission rate and channel width.	Select from the drop-down list: – 802.11b: Select only if all prospective wireless clients are 802.11b. – 802.11b/g: Select if the prospective wireless clients are a mix of 802.11b and 802.11g. – 802.11b/g/n (default): Select if the prospective wireless clients are a mix of 802.11b, 802.11g, and 802.11n.
Broadcast Interval (x100 ms)	Specifies the time interval in milliseconds for the ABB Totalflow device to broadcast beacon signals to synchronize the Wi-Fi network	User-defined. Type from value range: 1 (default) to 60 **Notes:** The actual time interval is the value typed multiplied by 100. Time intervals larger than 40 (4000 ms) can prevent Wi-Fi clients from connecting to or joining the network.
Max # of clients	Maximum number of simultaneous Wi-Fi clients the ABB Totalflow device supports when configured as an access point	User-defined. Type value from number of clients: 1 to 10 (Default). Checkbox: – Select (recommended) to make the SSID visible to clients during a survey. – Clear to disable the SSID broadcast. **Note:** If the SSID is not advertised, the Wi-Fi client must know the SSID through other means. ABB Totalflow devices configured as Wi-Fi clients provide options to configure the SSID manually.
Broadcast SSID	Function to configure the ABB Totalflow device to advertise or hide the SSID to or from the Wi-Fi clients in the neighborhood	Checkbox: – Select (recommended) to make the SSID visible to clients during a survey. – Clear to disable the SSID broadcast. **Note:** If the SSID is not advertised, the Wi-Fi client must know the SSID through other means. ABB Totalflow devices configured as Wi-Fi clients provide options to configure the SSID manually.
Channel Selection	The channel(s) available at the 2.4 Ghz band the access point operates on.	Select from the drop-down list: – Auto (default, recommended). The ABB Totalflow device automatically selects the channel with the least amount of interference. – Manually select one of channels from the following range: 1 to 11.
Transmission rate (MBits/s)	Data transmission rate or throughput in Mbits/s (Mbps)	Select from the drop-down list: – Auto (default, recommended): The ABB Totalflow device automatically selects the transmission rate. – Manually select one of the following rates: 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, 54 **Notes:** If you select the transmission rate

Parameter/ function	Description	Values/setting
		manually, select the rates that the IEEE 802.11 Mode supports:
		– 802.11b allows only 1, 2, 5.5, and 11 Mbps.
		– 802.11g allows all 802.11b rates plus 6, 9, 12, 18, 24, 36, 48, and 54 Mbps.
		– 802.11n allows all 802.11g/b rates.
		The 802.11 supports a maximum 54 Mbps for a system operating at the 2.4 GHz band.
Channel Width	Communication bandwidth. Determines how broad the signal for transferring data is.	Select from the drop-down list:
		– Auto (20/40 MHz). Default, recommended. The ABB Totalflow device automatically selects the channel width based on the selected 802.11 mode.
		– 20 MHz. Manually set to 20 MHz to. See the Wi-Fi overview topic in the PCCU help files for additional details.
		Note: 802.11b and 802.11g support only 20 MHz channel width.
Enable DHCP Server	Access Point Mode only [The AP Bridged mode does not support the DHCP server function] Function to enable the ABB Totalflow device to automatically provide IP addresses to Wi-Fi clients. When the DHCP server is enabled, clients automatically obtain the IP address required for establishing the connection to the device without manually assigning them.	Checkbox:
		– Select to Enable the DHCP server (Default). The ABB Totalflow device activates its DHCP server function (role). The device stores up to 10 IP addresses and provides them to the requesting Wi-Fi clients. Wi-Fi clients can be hosts seeking local connection or other XIOs configured in Wi-Fi Client mode and DHCP addressing.
		– Clear to disable the DHCP server. Configure Wi-Fi clients manually with IP addresses and the subnet mask that is compatible with the default IP address and mask on the ABB Totalflow device.
		XIOs in Wi-Fi client mode can be configured for DHCP addressing when the XIO AP has its **Enable DHCP Server** selected. They can obtain their IP addresses automatically. Host Wi-Fi clients must be configured to automatically obtain an IP address. Wi-Fi clients only use these IP addresses for local connection.
Reset to Default	Function to discard the current access point settings and restore factory values. **Note:** This function restores only the access points settings. If you wish to restore default settings for all Networking parameters, select **Restore Factory Settings** at the bottom of the Networking screen.	Click **Reset to Default** to return access point settings to their factory default values.

6.2.5   Statistics (Expert view only)

Wi-Fi usage statistics allow for monitoring the traffic on the wireless interface for bandwidth used, dropped packets or error packets. Users can trend these parameters to get a historical view of the wireless activity for both received and transmitted traffic. Table 6-12 provides details on statistical parameters available for monitoring.

IMPORTANT NOTE: Statistics parameter values are displayed in real-time. They provide a snapshot of the performance during the monitoring period. Statistical values are not accumulated over time (no averaged or accumulated values are calculated or saved in the device). Statistical values display a zero when there is no traffic on the Ethernet interfaces.

Table 6-12: Wi-Fi interface Statistics

Parameter/Function	Description	Values/setting
Rx	**Statistics on the traffic received by the Ethernet interface**	
Network Usage %	Percentage utilization of the Rx bandwidth	(Read-only) Range: 0-100%
Packets/sec	Number of packets received per second	(Read-only) Range: 0 to MAX MAX = (UINT32) or $[0-(2^{32}/2)]$
Data Bytes/sec	Rate of incoming data in bytes per second. It should always be less than or equal to Rx Rate Limit.	0 to Rx Bandwidth
Drop Packets/sec	Number of incoming packets dropped per second because Rx Rate exceeds Rx Rate Limit	(Read-only) Range: 0 to MAX MAX = (UINT32) or $[0-(2^{32}/2)]$
Error Packets/sec	Number of error packets received per second	(Ready-only) Range: 0 to MAX MAX = (UINT32) or $[0-(2^{32}/2)]$
Tx	**Statistics on traffic transmitted from the Ethernet interface**	
Network Usage %	Percentage utilization of the Tx bandwidth	(Read-only) Valid range 0-100%
Packets/sec	Number of packets sent per second	(Read-only) Range: 0 to MAX MAX = (UINT32) or $[0-(2^{32}/2)]$
Data Bytes/sec	Rate of outgoing data in bytes per second. It should always be less than or equal to Tx Rate Limit.	(Read-only) Range: 0 to Tx Bandwidth
Drop Packets/sec	Number of outgoing packets dropped per second because Tx Rate exceeds Tx Rate Limit	(Read-only) Range: 0 to MAX MAX = (UINT32) or $[0-(2^{32}/2)]$
Error Packets/sec	Number of packets per second which could not be transmitted due to errors	(Read-only) Range: 0 to MAX MAX = (UINT32) or $[0-(2^{32}/2)]$

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