

Smart I/O Technical Note

Introduction

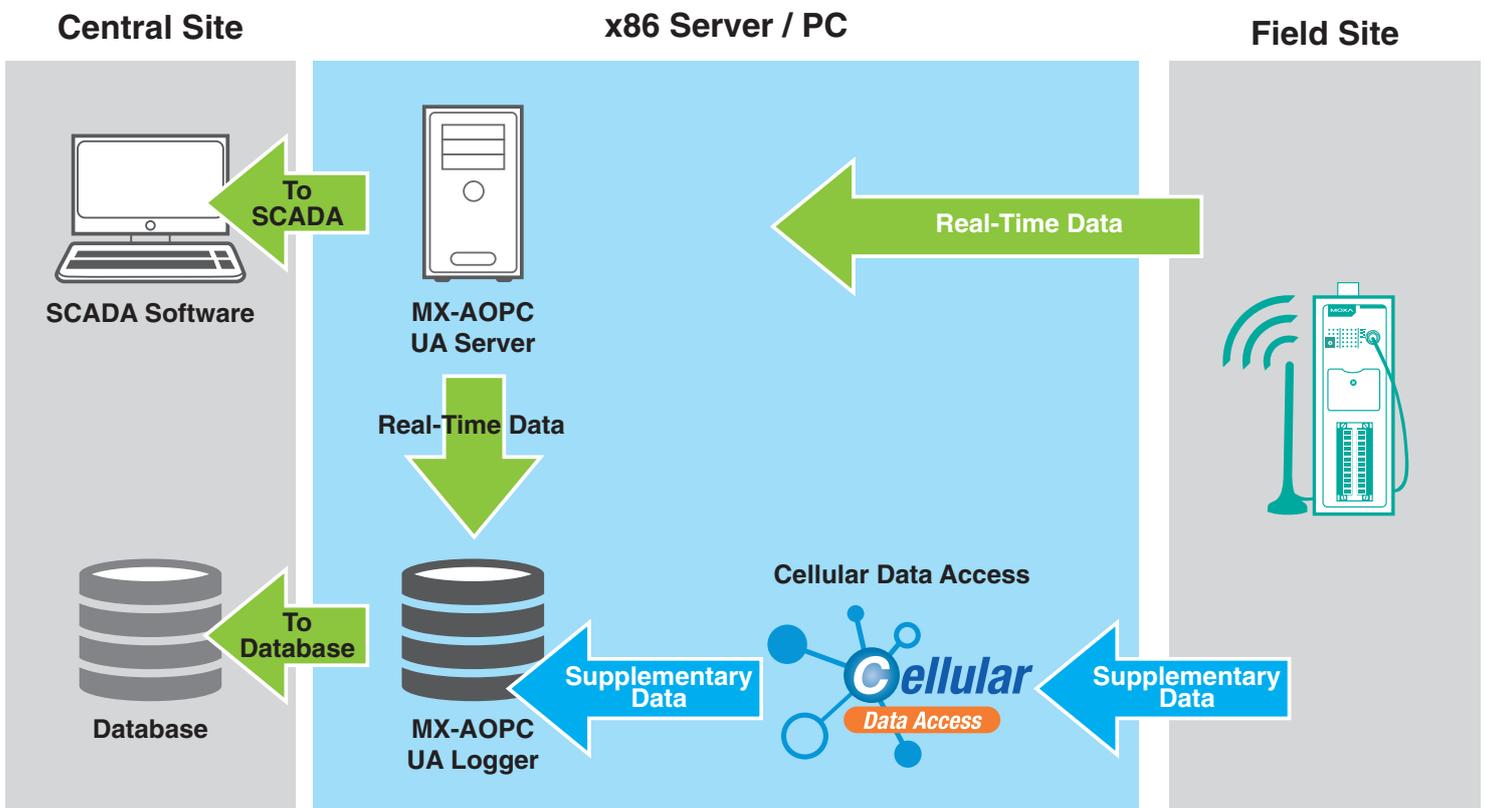
The purpose of Cyber-Physical Systems (CPSs), or smart systems, is to send signals from the physical world to the digital world. A CPS combines communications, control, and data acquisition technology to develop a complete system for IIoT applications. In the past, communications, control, and data acquisition were separated, posing numerous challenges to users collecting field data, with data loss the most notable challenge. Moxa has identified why data loss often occurs when collecting data via cellular networks in IIoT environments and has developed three features to allow users to successfully overcome the problem of data loss when operating in IIoT environments.

Data Buffering and Data Completeness

IIoT applications are developed to collect data, and when the data is collected and sent to a control center via a cellular network for analysis, the biggest challenge is ensuring that the network is reliable enough so that data isn't lost. Moxa's iLogik provides a data buffering feature to store data when the network is down. Once the network is functioning normally, the iLogik will transmit all of the data that had been buffered back to the database automatically. With Moxa's unique Cellular Data Access Server and UA logger, businesses don't have to worry about losing valuable data when the network is down.

Data completeness can be enabled in two simple steps:

1. Install two pieces of Moxa software: Moxa MX-AOPC UA Suite (MX-AOPC UA server + MX-AOPC UA Logger) and Cellular Data Access Server on an x86 server under a public IP address.



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- Use the IOxpress utility to configure the MX-AOPC UA server IP address and Cellular Data Access IP address in the ioLogik 2500.

The screenshot shows the configuration interface for the ioLogik 2500. The left sidebar lists various settings, with 'Active OPC' selected. The main panel is titled 'Server Connection' and includes the following fields:

- Enable Connection to Active OPC Server, with Heartbeat sec.
- Redundant mode:
 - Single server mode: 1st AOPC Server ; 2nd AOPC Server ; Port
 - Synchronicity mode
 - Fail-over mode
- Retry Times:
- Retry Interval: sec.

The screenshot shows the configuration interface for the ioLogik 2500, specifically the 'Cellular Data Access' settings. The left sidebar lists various settings, with 'Cellular' selected. The main panel is titled 'Cellular Data Access' and includes the following fields:

- Enable Cellular Data Access
- IP Address:
- Port:
- Unique ID:
- Heartbeat (sec.):

The process works as follows: Your SCADA system acquires real-time IO data through the OPC UA protocol and transfers the IO data to your database through the MX-AOPC UA Logger at the same time. If the cellular link is down, the ioLogik 2500 will buffer the IO data, and then once the network has recovered, the data will be transferred to your database automatically.

Once these two steps have been completed, data buffering and data completeness will work automatically, allowing users to overcome the serious problem of losing data when the network is down, often experienced in cellular-based IIoT applications.

Click&Go Plus Event Handling for IIoT Data Collection

When collecting data in IIoT environments, devices have to perform many actions to respond to many events in the real world. Ladder logic, which is often the first choice for data collection, was originally designed for sequence control applications. For event handling, ladder logic is not ideal and is very difficult to maintain. Click&Go Plus is a coding-free control logic based on a simple IF-THEN-ELSE concept. This control logic is ideal for event handling and data logging, which are most common in IIoT applications.

Since all the conditions and actions are configured manually, you will find Click&Go Plus easy to use in IIoT environments where there are often a very large number of events that need to be handled.

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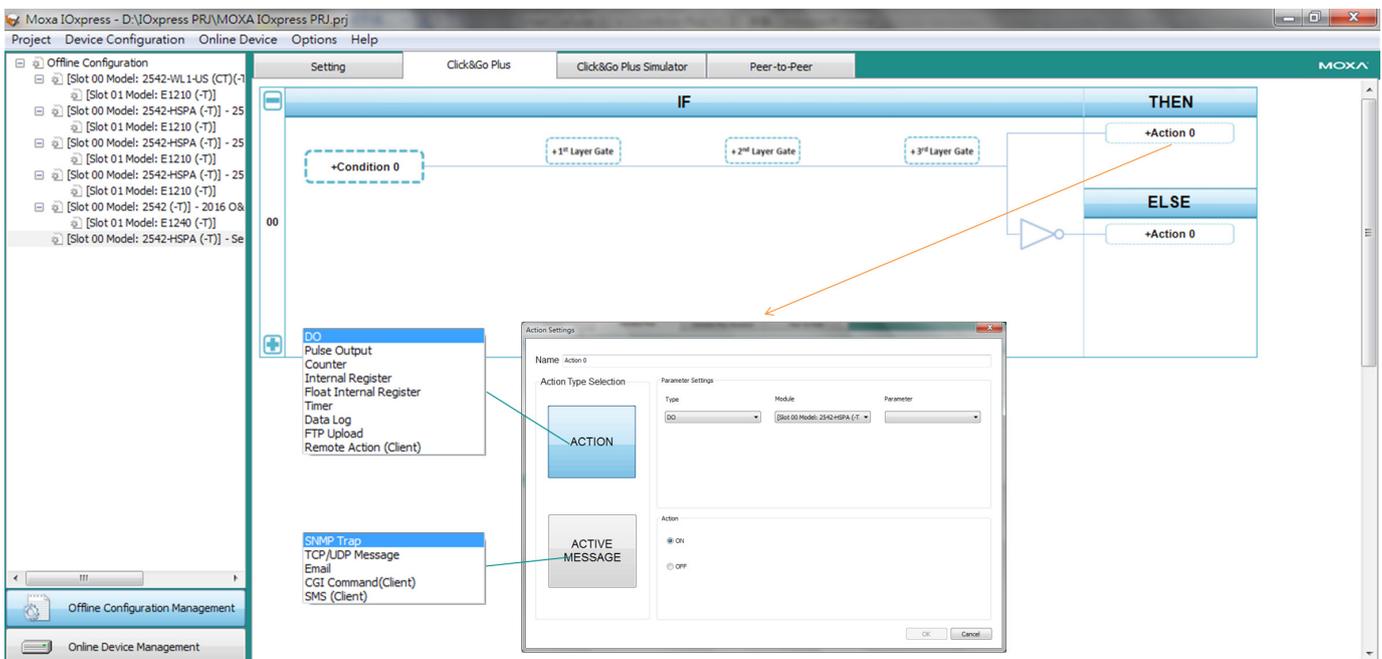
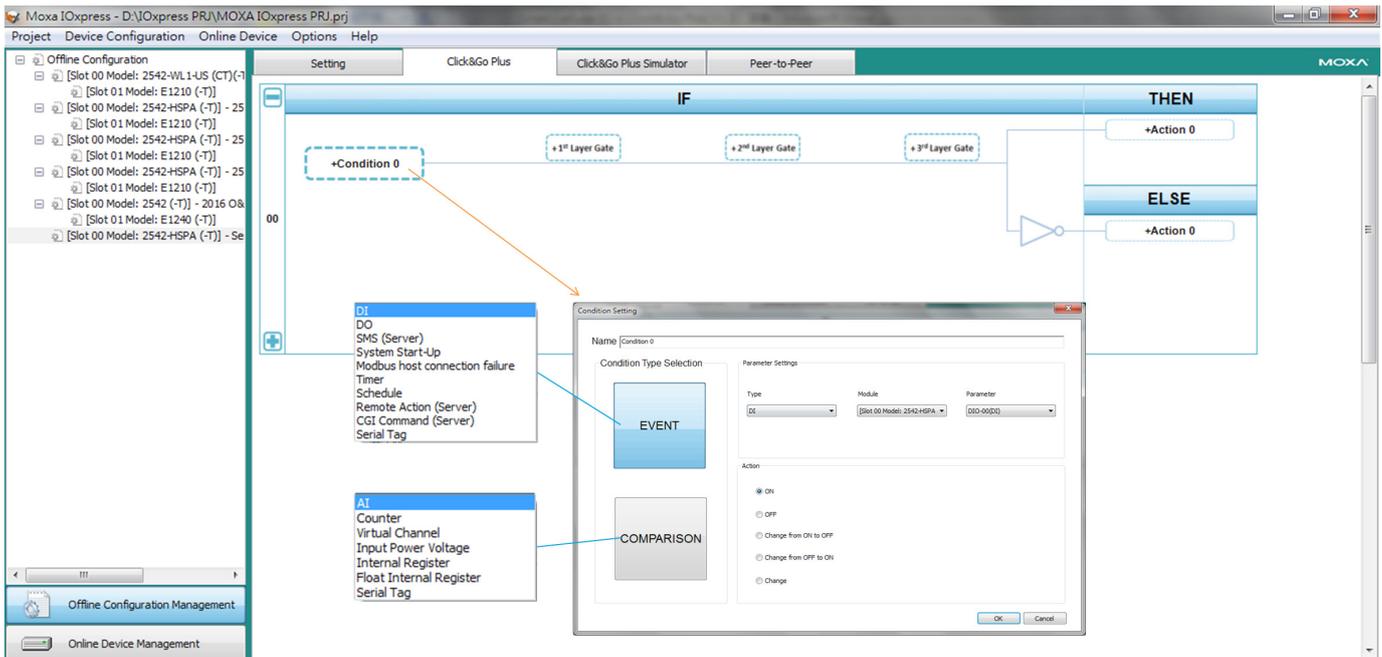
The IF-THEN-ELSE logic settings can be easily completed by the IOxpress utility in two steps:

1. Set conditions

When you click *condition*, you can configure the event received by the ioLogik 2500.

2. Select actions to respond to the conditions

The actions are not limited to only the traditional DO/AO/Pulse options. The ioLogik 2500 also provides IT technologies such as FTP/email/SMS, can be set instead of programmed.



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In the example shown here, a rule is set to handle the event of a cabinet door opening unexpectedly. The required actions are sending an SMS alert to an engineer based near the cabinet as well as triggering the alarm inside of the cabinet. The SMS contents and receivers can be configured easily, saving the user time and effort.



As Server | As Client

No.	Name
1	SMS
2	SMS_DIO_Status_Response

Name: SMS

Phone Book

SMS Information

Recipient Count: 03

Recipient 1: User1 | Recipient 2: User2 | Recipient 3: User3

Enable Synchronicity mode | Enable Escalation mode

Retry Count: 0 | Acknowledgement Timeout: 0 Hour 15 Min 0 Sec

Interval: 0 Sec. | Retry loop Count: 0

Content Settings

Send as GSM 7-bit alphabet | Send as UNICODE | Send as HEX (separated by ',')

Content: 76 (character limit=120)

SMS Alarm from MOXA ioLogik 2542-HSPA!

Phone Book

No.	Name	Phone Number
1	User 1	+886963176123
2	User 2	+886963176124
3	User 3	+886963176125
4	User 4	+886963176126
5	User 5	+886963176127

Name: _____ Add Modify Delete

Phone No.: _____ OK Cancel

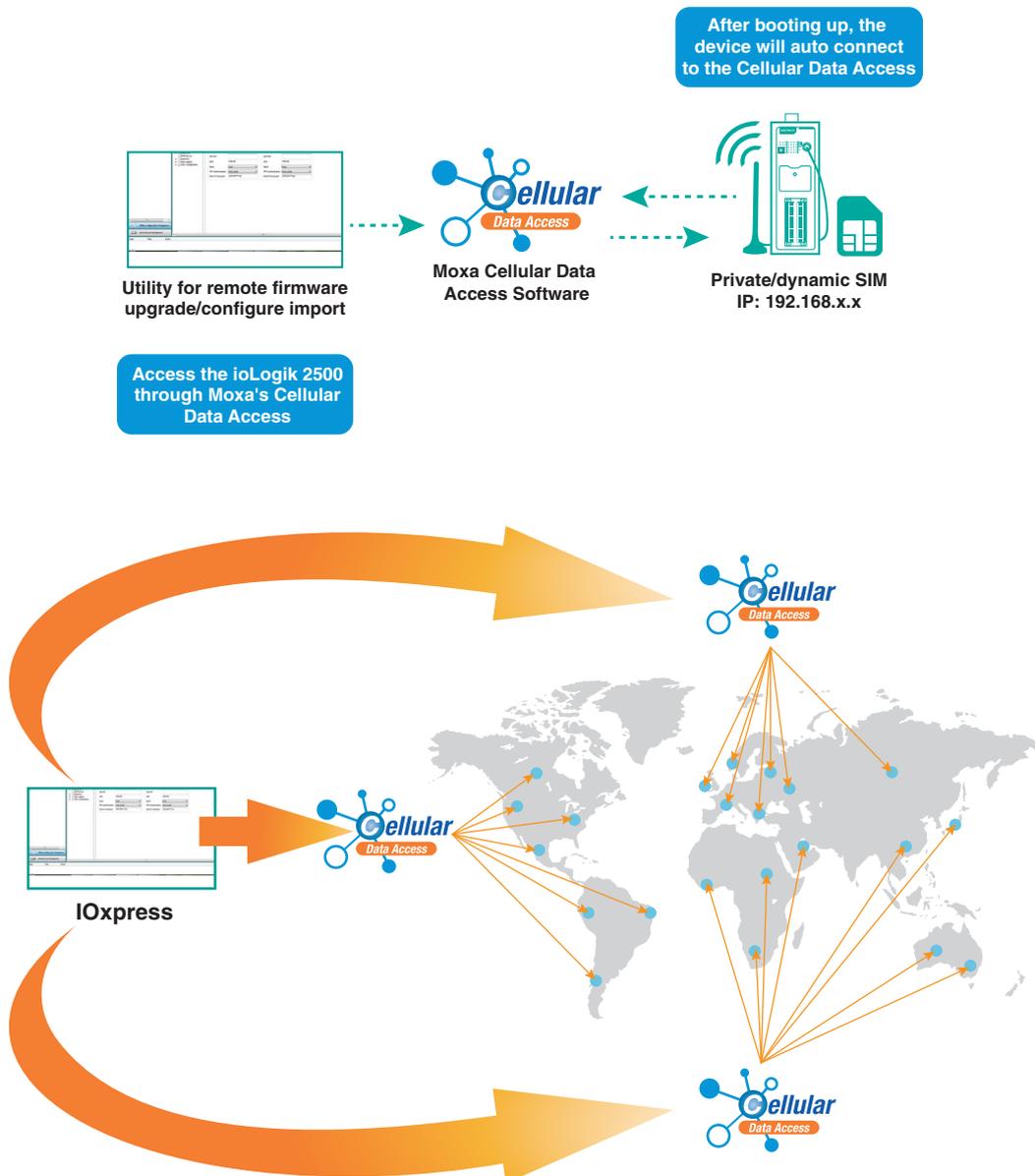
- <Server_Day>
- <Server_Time>
- <Server_IP>
- <Server_Name>
- <Server_Location>
- <Server_MAC>
- Slot-00 Channel Tag ▶
- Slot-00 Channel Alias Name ▶
- Slot-01 Channel Tags ▶
- Slot-01 Channel Alias Name ▶

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Device Management and Configuration

Once an IIoT device is installed, maintenance, which could include bug fixes and software updates, is still required. In addition, some devices may fail and need to be repaired or replaced. This is standard throughout all IIoT environments.

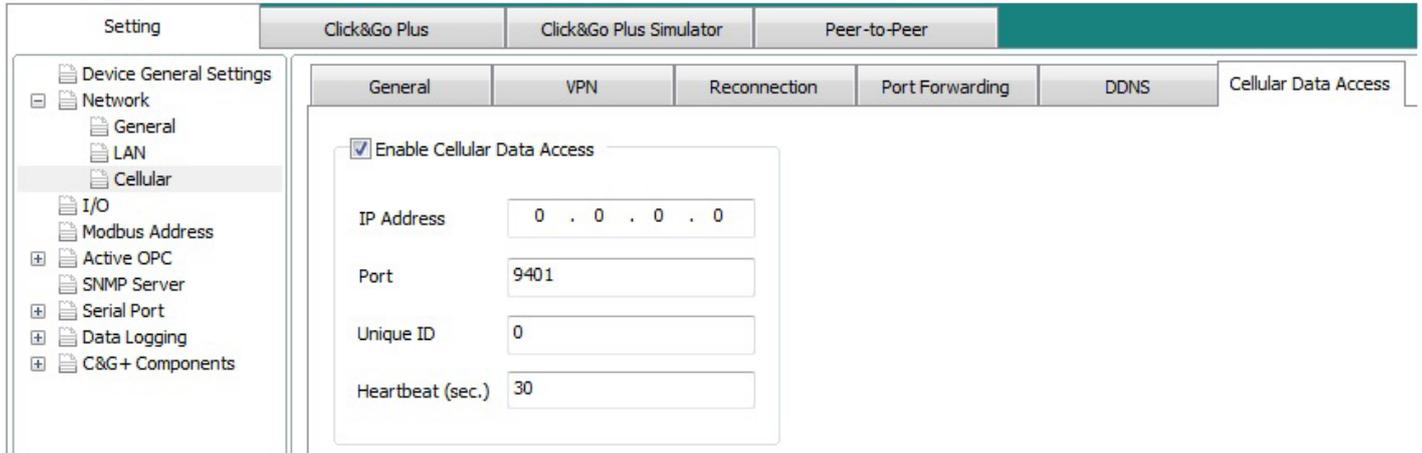
Cellular device management becomes even more challenging on remote devices because the devices usually have dynamic private IP addresses, which hinders the utility's ability to locate devices. Moreover, when multiple devices are connected to a cellular network, it is even harder to find and configure a particular device. In order to solve this problem, Moxa has developed a Cellular Data Access (CDA) software utility. The utility functions as a server that allows the ioLogik 2500 to automatically update its IP address to the CDA server. The IOxpress utility can acquire the list of devices from the CDA and access the ioLogik 2500 devices listed in the CDA server. By functioning this way, firmware upgrades and configurations can be performed easily.



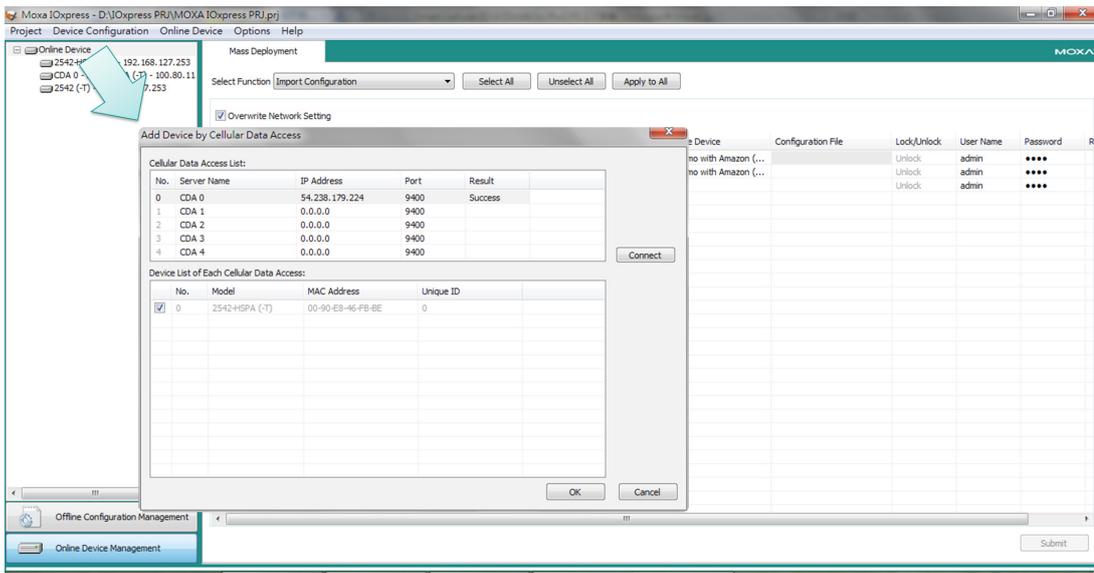
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Only three simple steps are required to configure device management:

1. Install the CDA on an x86 server under a public IP address.
2. Configure the ioLogik 2500 to connect to the CDA.



3. Use IExpress to add devices from the Cellular Data Access server.



Summary

As an innovative solution provider of industrial automation applications, Moxa provides a wide range of IO products for industrial automation. In 2006, Moxa was the first company to introduce the Smart IO methodology in the industrial automation market. Now, Moxa is applying its innovative technical expertise to transform remote IO into something even better. The Smart IO concept has three major features: a push function with retransmit capabilities, coding is not required, and an all-in-one design. A Smart IO solution merges IT and IA technologies to create more possibilities for the automation world. With over 25 years of experience in industrial automation, Moxa's solutions are now widely used in factory automation, security, telecom, ITS, oil and gas, and renewable energy.