Panel Air Conditioner

REMOTE CONTROL AND COMMUNICATION

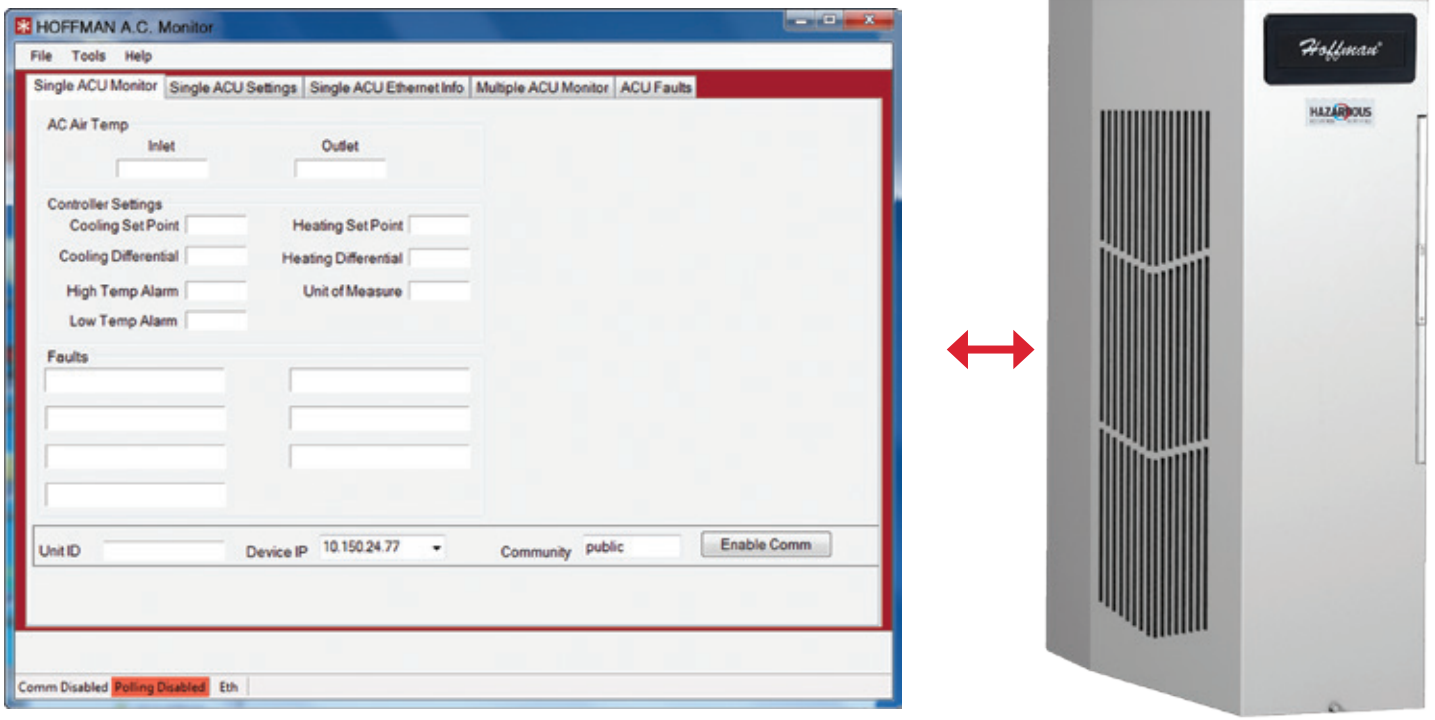

Figure 1: Illustrates the configurations of ACU

HISTORY

The way end-users interface with air conditioners has changed over time based on the availability of varying technology.

- Early air conditioners were all mechanically controlled and treated as an isolated device on the system. Operators have had to pay more attention to the status of the air conditioner.
- The next stage of air conditioners was controlled with electronic controllers. This gave the ability to precisely adjust the set-points and review temperatures, but it was still treated as an isolated device on the system.
- The later stage added serial communication to the electronic controllers. The drawback for this technique is that the air conditioner is still being treated as an isolated device on the system.

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Figure 2: Illustrates the access point

TODAY

The emerging future is to interface with air conditioners from anywhere, at any time, securely, and look at devices on a system as all interconnected. This innovation allows air conditioners to be an integral part of the system as opposed to isolated units.

Today, panel air conditioners can be monitored, trended, and controlled from anywhere, at any time. This enhances the reliability and reduces the failure of the system by allowing easier maintenance and service. nVent's SpectraCool and Slim Fit air conditioners with Remote Access Control utilize this established technology, making nVent one of the first to integrate this into the design of an air conditioner.

Panel air conditioners with Remote Access Control can provide the ability to interface with the air conditioner via an Ethernet port from a remote location, via USB port on a local computer, or through a display keypad on the unit. Figure 2 shows the access points for both an Ethernet and USB ports.

The option of using Ethernet, USB or a display keypad provides the ability to install the air conditioner on various systems with various technologies. If the system does not require any form of communication, the air conditioner can be configured through the display keypad and can be monitored through its alarm output.

If the system engineer desires some form of communication but does not have an Ethernet network, the USB port can be used to configure the unit and periodically monitor and control the unit. The technology for interfacing with the air conditioner via USB communication is the Modbus RTU protocol. The USB is presented as a virtual communication port for ease of use.

If the system engineer wants to integrate the air conditioner into a system that is connected to an Ethernet network, the Ethernet port can be used. The Ethernet communication supports Profinet, EtherNet/IP, Modbus TCP, and SNMP protocols. This provides the ability to implement a SpectraCool and a Slim Fit Air Conditioner with Remote Access Control to any of these Ethernet network systems without purchasing additional components.

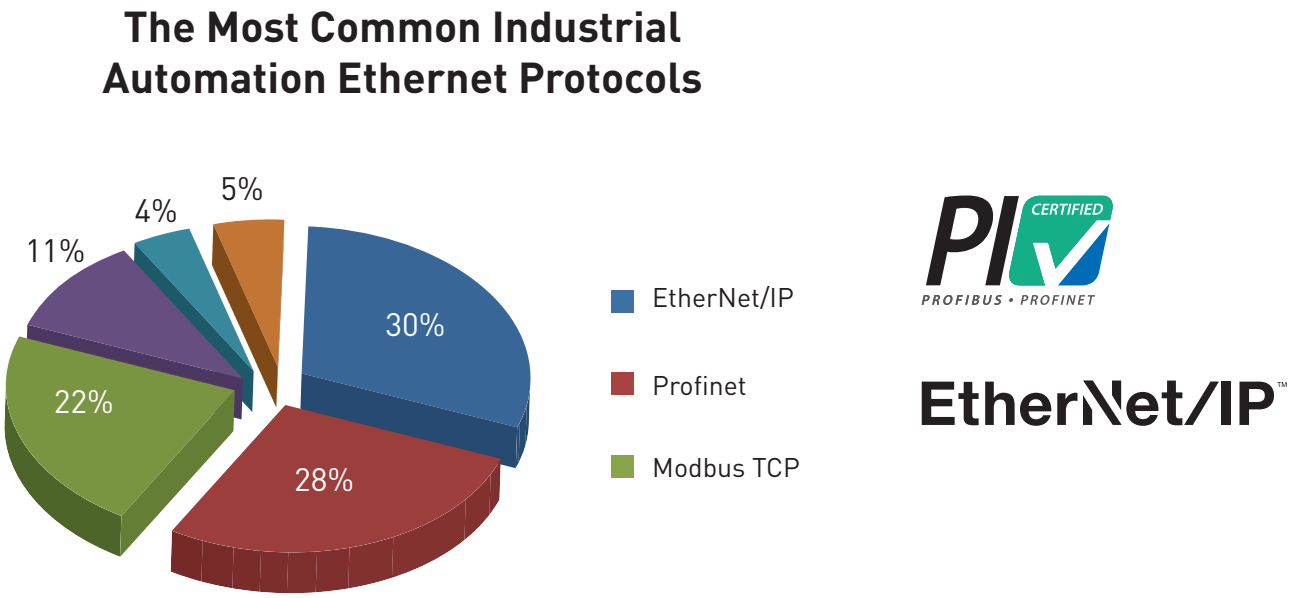

Figure 3: Forecasted protocol market share for 2015

SUPPORTED PROTOCOLS

The protocols that are supported by SpectraCool and Slim Fit air conditioners with Remote Access Control are:

- **EtherNet/IP** – SpectraCool and Slim Fit air conditioners with Remote Access Control are ODVA Conformance tested. EtherNet/IP is widely used today, especially in North America, and is projected to be a dominant protocol in industrial networking in the region. The air conditioner will be directly interfaced with Rockwell PLC. EtherNet/IP is an industrial application layer protocol similar to SNMP that treats the devices on the network as a series of "objects." It is an implementation of the common industrial protocol and uses all transport and control protocols used in a traditional Ethernet network. Structuring EtherNet/IP on standard PC technologies, allows EtherNet/IP to work transparently with all standard off-the-shelf PCs and their derivatives. Most importantly EtherNet/IP will be moving forward as base technologies evolve in the future. EtherNet/IP market share is expected to grow more in 2015.
- **Profinet** – SpectraCool and Slim Fit air conditioners with Remote Access Control are PROFI Interface Center Profinet Conformance tested. Profinet is widely used today, especially throughout Europe and Asia, and is projected to be a dominant protocol in industrial networking in the region. The air conditioner will be directly interfaced with Siemens PLC. Profinet market share is expected to grow more in 2015.
- **Modbus TCP** – This protocol is supported because it is commonly used in industrial networking today. Though its future is not as bright as EtherNet/IP and Profinet, it is a simpler Ethernet network system protocol. The main objectives for the use of Modbus in the industrial environment are developed with industrial in mind, openly published and royalty-free, easy to deploy and maintain, and moving raw bits or words without placing many restrictions on vendors. Modbus TCP market share is expecting to slightly decline in the future.
- **SNMP** – This protocol is supported because it's an established protocol in Ethernet networking that is commonly used in IT management.

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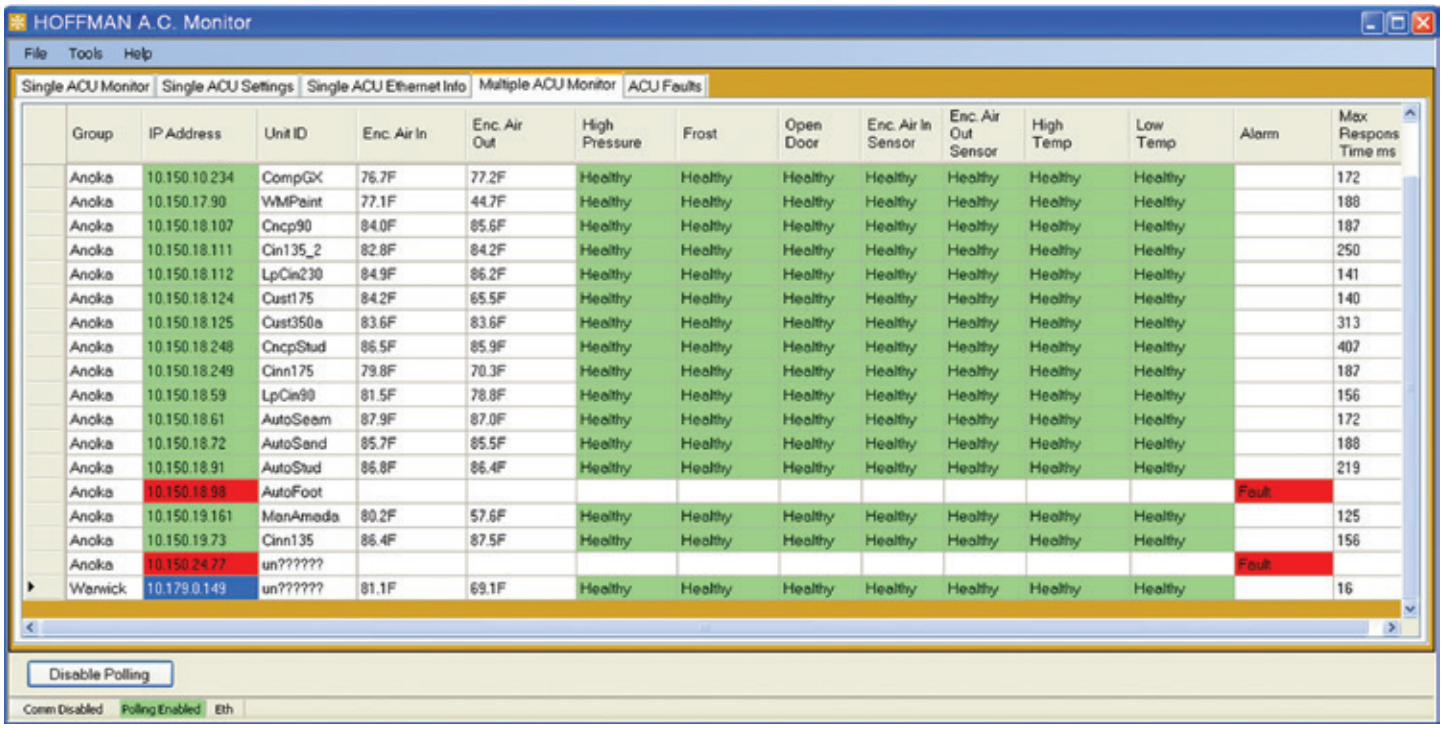

Group	IP Address	Unit ID	Enc. Air In	Enc. Air Out	High Pressure	Frost	Open Door	Enc. Air In Sensor	Enc. Air Out Sensor	High Temp	Low Temp	Alarm	Max Respons Time ms
Anoka	10.150.10.234	CompGX	76.7F	77.2F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		172
Anoka	10.150.17.90	VMPaint	77.1F	44.7F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		188
Anoka	10.150.18.107	Cncp90	84.0F	85.6F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		187
Anoka	10.150.18.111	Cin135_2	82.8F	84.2F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		250
Anoka	10.150.18.112	LpCin230	84.9F	86.2F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		141
Anoka	10.150.18.124	Cust175	84.2F	65.5F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		140
Anoka	10.150.18.125	Cust350a	83.6F	83.6F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		313
Anoka	10.150.18.248	CncpStud	86.5F	85.9F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		407
Anoka	10.150.18.249	Cinn175	79.8F	70.3F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		187
Anoka	10.150.18.59	LpCin90	81.5F	78.8F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		156
Anoka	10.150.18.61	AutoSeam	87.9F	87.0F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		172
Anoka	10.150.18.72	AutoSand	85.7F	85.5F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		188
Anoka	10.150.18.91	AutoStud	86.8F	86.4F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		219
Anoka	10.150.18.98	AutoFoot										Fault	
Anoka	10.150.19.161	ManAmada	80.2F	57.6F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		125
Anoka	10.150.19.73	Cinn135	86.4F	87.5F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		156
Anoka	10.150.24.77	un??????										Fault	
Warwick	10.179.0.149	un??????	81.1F	69.1F	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy		16

Figure 4: Illustrates the status of multiple air conditioners.

INTERFACING WITH THE AIR CONDITIONER

There are multiple ways a customer can interface with a SpectraCool and Slim Fit air conditioner with Remote Access Control; an off-the-shelf application, generating their own application, or just using the computer application that is provided by nVent.

- When using an off-the-shelf application, the system engineer has the option of using an application that supports Profinet, EtherNet/IP, Modbus TCP or SNMP protocol.
- Generating Custom Application–customers can develop their own applications, or add a SpectraCool and Slim Fit Air Conditioner with Remote Access Control to their existing application, using the protocol of their choice.
- Using nVent's Remote Access Application–customers can use the nVent Remote Access Application to configure and monitor nVent HOFFMAN SpectraCool and Slim Fit Air conditioners with Remote Access Control. Figure 4 above shows the status of multiple units that can be viewed simultaneously.