

# INDUSTRIAL INTERNET OF THINGS



**Figure 1:** The first step in creating an IIoT application is to make sure that your devices – both legacy and new – can communicate with each other, so that you are getting the most out of all of your data.

## Speaking a common language: Getting your devices ready for IIoT

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### Introduction

If you have any connection to the world of industrial automation, then you know you can't walk down to the break room for a cup of coffee without seeing an ad, flyer, tradeshow announcement, or magazine that's touting Industrie 4.0 or IIoT (Industrial Internet of Things, in case you've been living under a rock) as the future of automation. And, chances are that as you're sipping that coffee and perusing white papers, you're still wondering just what the IIoT is.

You're not alone.

Regardless of the specific industry, everyone has similar goals—to do more with what you already have. In much the same way that your personal smart devices may receive new features thanks to a firmware upgrade, industrial facilities are driven to find ways to get more out of the equipment that they already own. Monitoring equipment health can improve overall equipment effectiveness (OEE) and can be part of a predictive maintenance strategy that reduces operating costs. Finding ways to do remote calibration and configuration saves time in the field. Less time in the field means more efficiency and safer personnel. All of this adds up to less downtime and a better bottom line.

The lynchpin in this grand scheme is to have a way for all the equipment to connect—to “speak” a common language: Ethernet. However, the drive to

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ubiquitous Ethernet connectivity is not without challenges: No one wants to disturb a functioning system or make further investment by replacing functioning devices, nor will anyone shut down for a total changeover. Further, the needed devices may not be available with an Ethernet connection.

So what's the point? The IIoT is like an elephant. You need to eat it one bite at a time. The first step is to assess the operation and equipment. What's currently stranded in a dark corner of your facility? If it were easy to access, would you gain anything?

## Getting the most out of your HART data

Take HART as an example. According to market surveys, there are over 40 million HART devices installed globally, and yet less than 10% are used to their potential. For the uninitiated, HART is an industrial fieldbus protocol used heavily in process automation. Most transmitters that measure pressure, level, temperature, or flow use the HART protocol in conjunction with the industry standard 4-20 mA signal. HART enables you to remotely configure and calibrate the transmitters, and also provides a way to access vast amounts of diagnostic information on a device by device basis. Imagine a world where your valves can tell you they're stuck open, and your flow meters can also report pressure and temperature.

That checks all the boxes we mentioned earlier, right?

Unfortunately, most PLC or DCS systems were installed sans HART capability, and reworking that is undesirable, to say the least. The need for a way to transfer HART data onto an Ethernet network without disturbing the existing control system becomes quite obvious.

## HART to Ethernet

An Ethernet HART multiplexer solution provides a simple way to parameterize and monitor HART devices via HART-IP, Profinet, Modbus TCP, and FDT/DTM for easy integration into nearly any host system. It is a modern alternative for traditional RS-485 HART multiplexers. (Figure 2)

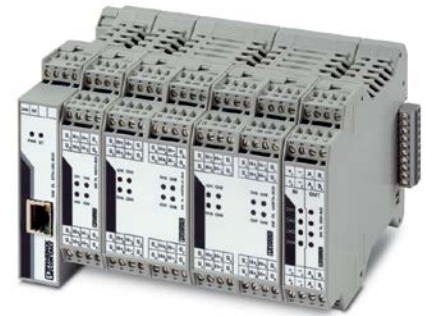
A multiplexer consisting of a head station and a variety of HART expansion modules can suit any application need. Modular design provides a scalable solution for modern distributed control systems and phased rollout.

Another valuable feature is a 1x1 HART master, which means one HART master per channel. This approach allows the user

to speed up their maintenance routines, specifically when it relates to multiple instruments at one maintenance interval.

A head station with an embedded web server makes it easy to configure the device. Additionally,

a CommDTM can be used with an FDT Frame application, such as PACTware or any of the wide range of plant asset management applications offered by the major process automation system suppliers.



**Figure 2:** An Ethernet HART multiplexer is a modern alternative for traditional RS-485 HART multiplexers.

## Serial data – with security

Now, let's look at those old serial devices. There are still a lot of devices out there with simple RS-232 or RS-485 ports that just spit out an ASCII string of characters—think bar code scanners, weigh scales, RFID readers, and the like. There's a good possibility that a serial badge reader let you into the building this morning. Connecting these “dumb” devices to Ethernet can give them a new lease on life. When was the last time you saw a serial port on a new PLC or PC?

This conversion is not really any stretch of the imagination; serial device servers (or terminal servers) have been available for years. They've also been the subject of some industrial espionage, as they've been hacked in some high profile situations. There's also the potential that those old serial devices may be sending some sensitive data that was never meant for a “public” LAN, so you should definitely consider some type of data encryption and user authentication plan.

## Serial device servers

Serial device servers provide a simple way to migrate legacy serial devices to modern Ethernet networks. A variety of devices, ranging from universal RS-232/485, one-, two-, and four-port serial versions, with one or two Ethernet ports, are available to fit any application. (Figure 3)

Device servers may be used as a “virtual COM Port” and as a native TCP or UDP Ethernet device. COM Port Redirector software, as well as a Windows driver, is available for



**Figure 3:** While serial device servers have been available for years, encryption and authentication can prevent them from being hacked.

integration with a PC application.

An embedded web server can make startup and configuration simple. To keep communication secure, look for a device with 256-bit AES encryption and the ability to install your own authentication

certificates. Devices with a wide operating temperature range (-40 to 70 C) and hazardous area approvals are suitable for use in any industry.

Taking it a step further, integrating those old serial devices into an industrial control network takes it up a notch. If your old serial barcode scanner could be converted into a Modbus TCP or EtherNet/IP barcode scanner, this opens up a host of new possibilities. A barcode can be scanned and used to direct an AGV inside an automotive plant, or to push an item onto the correct conveyor belt in a warehouse. Talk about doing more with what you already have!

## ASCII to industrial Ethernet protocol converter

ASCII converter modules are used to convert RAW or ASCII serial strings from devices such as barcode scanners, weigh scales, or RFID tags into industrial protocols such as Modbus TCP or EtherNet/IP. One-, two-, and four-port serial versions, with one or two Ethernet ports, are available to fit any need. (Figure 4)



**Figure 4:** An ASCII converter module can make old data from a barcode usable in a modern Ethernet network.

Lastly, let's not forget about those old controllers and RTUs that are still clicking away in the far reaches of your domain. They still work fine, but require a visit in person to maintain them, not to mention they're out of reach of each other. They probably support an old communication protocol like

Modbus RTU, but that's not compatible with the shiny new Ethernet network that's running the recent facility expansion. Adapting those legacy devices for use with the new system can keep everything humming along for years to come, and they'll even be humming the same tune.

## Modbus RTU to Modbus TCP

MODBUS TCP/RTU gateways convert serial-based Modbus RTU (or ASCII) to Modbus TCP. These modules are extremely powerful and can be configured to almost any combination of Modbus client and server, including a shared memory configuration, allowing two Modbus masters (servers) to communicate with each



**Figure 5:** Converting Modbus RTU data to Modbus TCP will make sure your facility expansion runs more smoothly.

other. Device ID aliasing is also supported to create a "virtual" Modbus ID for Modbus devices that do not have configurable Modbus addresses. One-, two-, and four-port serial versions, with one or two Ethernet ports, are available. (Figure 5).

## Conclusion

With minimal investment and effort, you can take the first step into the realm of the IIoT. Your equipment has a lot to tell you if you have a way to listen, and your aging equipment can have a long, meaningful life with a little assistance. So, finish up that coffee and get to work. Your bottom line will thank you.

## ABOUT PHOENIX CONTACT

Phoenix Contact develops and manufactures industrial electrical and electronic technology products that power, protect, connect, and automate systems and equipment for a wide range of industries. Phoenix Contact GmbH & Co. KG, Blomberg, Germany, operates 50 international subsidiaries, including Phoenix Contact USA in Middletown, Pa.

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