

# HART over IP for industrial automation networks

*Using a combination of both wired HART and wireless Hart technology provides a cost-effective, low-risk communication solution.*

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In today's competitive landscape, all companies aim to reduce operation costs, deliver products rapidly, and improve product quality. The highway addressable remote transducer (HART) protocol directly contributes to these business goals by providing cost savings in:

- Commissioning and installation
- Plant operations and improved quality
- Maintenance

The HART Protocol was developed in the mid-1980s by Rosemount Inc, The protocol was soon published for free use by anyone, and in 1990 the HART User Group was formed. In 1993, the registered trademark and all rights in the protocol were transferred to the HART Communication Foundation (HCF).

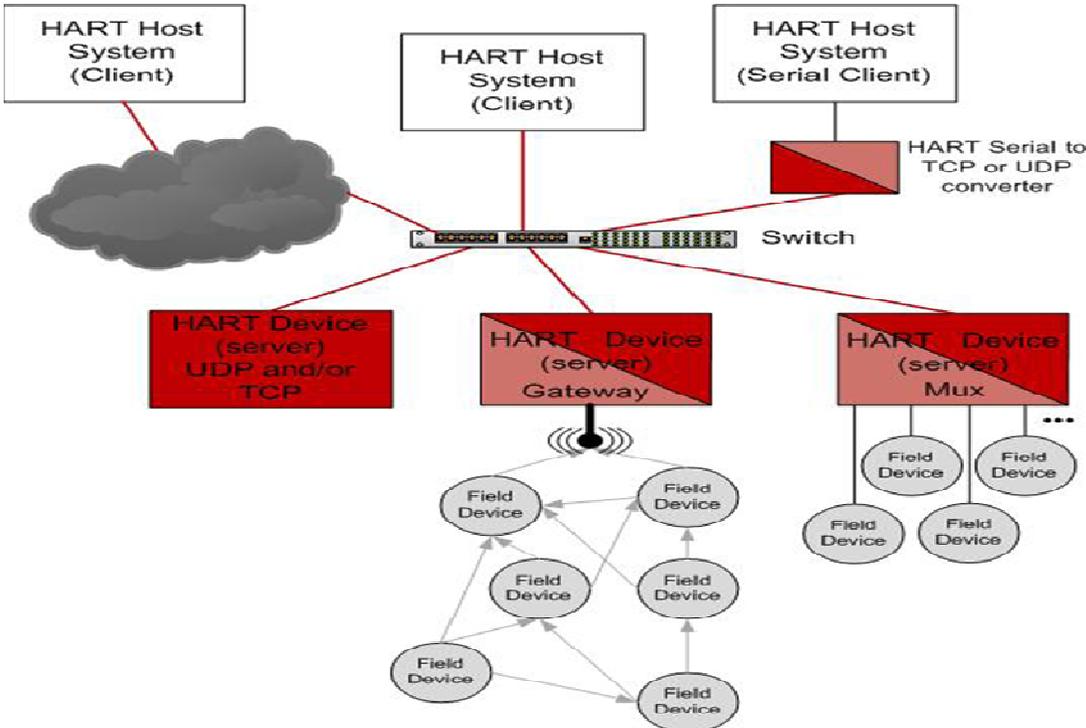


Figure 1: Typical HART Over IP network

### What is HART over IP?

The HART Protocol is the global standard for sending and receiving digital information across analogue wires between smart devices and control or monitoring systems.

The principle objective of the HART Protocol is to establish standards that allow host applications and field devices from differing companies to work with each other as a system. Even if a system component is replaced with a similar device from another company, the system should still function properly.

Accordingly, HART promotes interoperability in many ways:

- Compatibility with the 4-20mA loop allows a HART device to work with existing plant systems.
- Providing a well defined Physical Layers for devices to communicate over.
- Specifying Data Link Layer framing, error detection and bus arbitration requirements to ensure the integrity of communications.
- Requiring all devices to support all Universal Commands.

HART is a bi-directional communication protocol that provides data access between intelligent field instruments and host systems. A host can be any software application from technician's hand-held device or laptop to a plant's process control. The HART TCP/IP Communication Interface is a Transport Layer specification.

### HART host system: Client

The HART client allows a user application to implement information exchange with a remote device. The client builds a HART request with information sent by the user application to the client interface. The request is then sent to the UDP or TCP port of the server.

### HART TCP device: Server

A HART Device (server) listens for a HART request on particular port. The request is processed and a response is returned to the client that made the request.

### How HART technology works

HART broadly operates in two modes that are described below.

*Master slave mode:* HART technology is a master/slave protocol, which means that a smart field (slave) device only speaks when spoken to by a master.

*Burst mode:* In Burst mode, the master instructs the slave device to continuously broadcast a standard HART reply message. The master receives the message at the higher rate until it instructs the slave to stop bursting.

*Message format:* The basic message format includes a header to describe the content of the UDP or TCP payload and a standard, wired Token-Passing Data-Link Layer frame format message. This allows a HART Host/client application to address the HART device directly or have the server forward the message based on the long address to the appropriate HART sub-device.

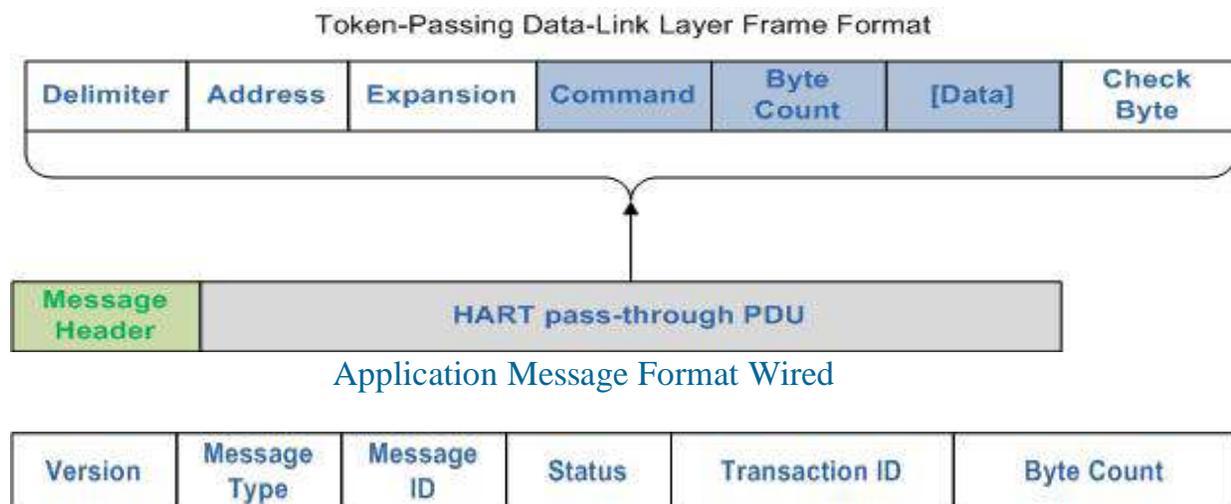


Figure 2: HART message header format for use over UDP or TCP.

## Benefits of using HART

The HART network has many benefits when used as a network infrastructure. A few of them are listed below:

- Increase Plant Availability & Access
- Integrate devices and systems for detection of previously undetectable problems.
- Detect device and/or process connection problems real time.
- Minimise the impact of deviations by gaining new, early warnings.
- Avoid the high cost of unscheduled shutdowns or process disruptions.
- Reduce Maintenance Costs
- Quickly verify and validate control loop and device configuration.
- Use remote diagnostics to reduce unnecessary field checks.
- Capture performance trend data for predictive maintenance diagnostics.
- Reduce spares inventory and device management costs.

## Deployment

The HART Enhancement with Wireless as WirelessHART had different deployment scenarios among which HART being a Wired Networked and WirelessHART is a wireless Network. This has also enabled connectivity to wireless networks for wired HART devices.

## Wired HART network

When HART devices are deployed as network infrastructure by connecting the devices with wired HART devices the Process Variable (PV) is read at the control system via the 4-20mA loop interfaced with a HART modem.

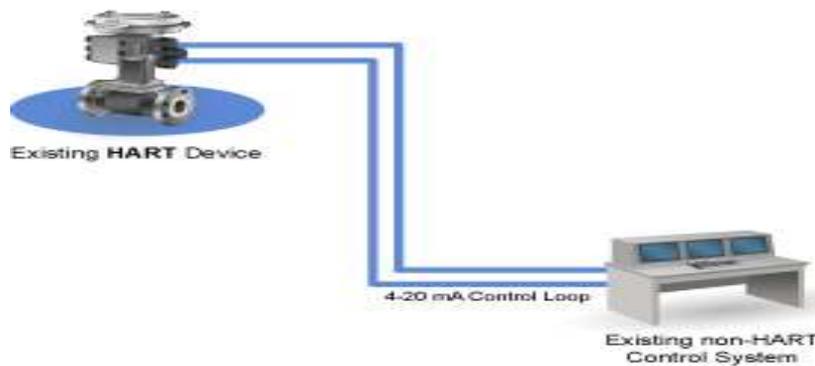


Figure 3: Wired HART network.

## Wired and wirelessHART adaptor

Retrofitting a wired connection to retrieve HART data may not be feasible. By connecting a Wireless Hart Adapter to an existing installed device, the stranded information can be easily accessed. The HART Data is transmitted to a Wireless Hart Gateway and interfaced to a control or asset management system.

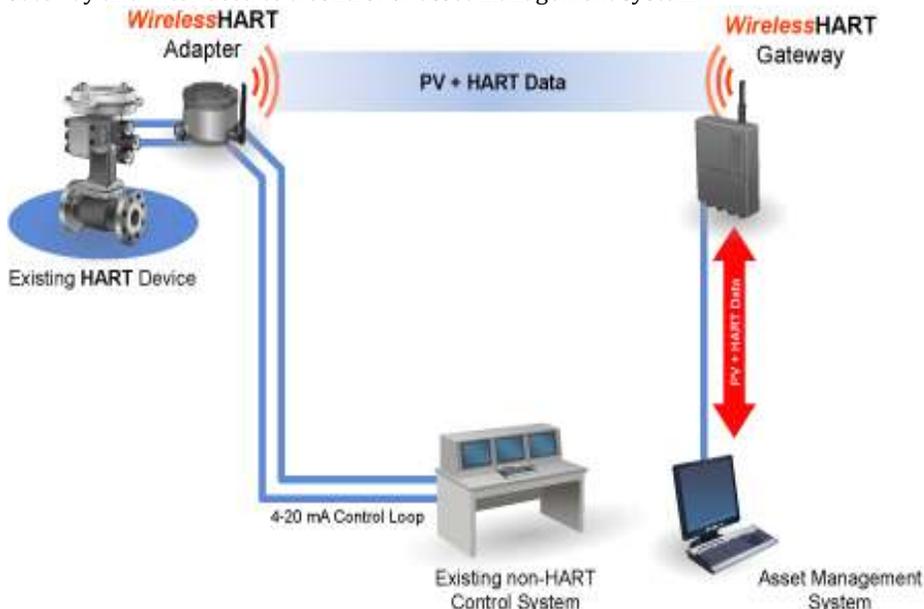


Figure 4: Wired & wirelessHART adaptor.

A WirelessHART device is a free-standing device that eliminates the analogue connection to the control system. The device can be installed anywhere in the plant without the cost of wires. The PV and HART data is connected to a control or asset management system via a Wireless Hart Gateway.

### **Conclusion**

In the real world, using a combination of both wired HART + Wireless Hart technology provides a cost-effective, low-risk communication solution. Working together, investments in installed HART devices is protected and additional HART devices can be added quickly and economically. ■

### **About the authors**



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