HART COMMUNICATION FOUNDATION

TECH NOTE

*Wireless*HART Adaptor

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Synopsys:

This document will answer these questions:

1. Why would I use a WirelessHART adaptor?
2. What information/data will the adaptor provide?
3. How does the adaptor work?
4. How would you connect an adaptor?
5. What do you have to do to commission an adaptor?

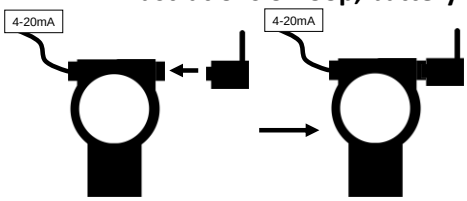
Introduction

Over 24 million HART 4-20mA instruments have been installed over the past two decades; however, very little use has been made of the stored digital information in these instruments. Approximately 90% of the instruments are connected to analog only IO and DCS that have no HART communication capability. The digital information in HART instruments connected to analog systems is "trapped" and cannot easily be used by monitoring, alarming, diagnostic and asset management applications.

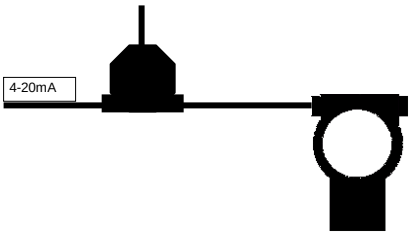
Perhaps the reason for this underuse of valuable digital information is that there is a reluctance to modify an installation by placing a HART multiplexer in the 4-20mA control loop. On the other hand, a WirelessHART adaptor provides an alternative simple, low cost and low risk method to access the potentially valuable information in existing intelligent HART instruments.

A WirelessHART adaptor is wireless communications equipment used to retrofit and upgrade intelligent HART instruments in the installed base with the capability of WirelessHART communication. The adaptor provides host applications such as asset management, diagnostic and alarm monitoring with continuous access over the WirelessHART network to these valuable digital information formerly trapped in HART instruments connected to analog only IO.

Illustrations of loop, battery and field powered WirelessHART adaptor configurations



4-20mA instrument with loop or battery powered plug-in adaptor



4-20mA instrument with loop or battery powered adaptor installed in-line along the loop

Battery or field powered wireless adaptor that also powers HART instrument and eliminates need for 4-20mA loop

Why would I use a WirelessHART adaptor?

The digital HART signal has rarely been used outside of commissioning and calibration, resulting in potentially valuable information not being available in the control room or maintenance area. There are of course several methods to gain remote access to HART data

1. Use Input/output (I/O) cards which provide HART pass-through
2. Install a HART multiplexer
3. Add a WirelessHART network with wireless adaptors

The first two options, listed above, require a certain amount of re-work of existing wiring and may also require loops to be shut down. The use of a WirelessHART adaptor (option 3) requires no change to

marshalling rack wiring. The methods of connecting WirelessHART adaptors to HART are similar to the method of connecting a HART hand held configurator

The WirelessHART adaptor plugs into an existing instrument, perhaps via an unused instrument connection port, or at a junction box, or other convenient location anywhere on the loop just like a hand held configurator. The result is that the instrument can now become part of a WirelessHART network with full, remote, access to instrument information such as:

Process Variables

- Each instrument could provide up to 4 process values (mass flow – analyzers – calculated values etc)
- Could be used to read valve position feedback

Configuration

- Allow you to maintain a central instrument configuration database

Maintenance/diagnostic messages

- Valve operation
- Instrument status

In summary, the WirelessHART adaptor provides remote access to instrument information by connection methods that are similar to the methods of connecting a HART hand held configurator.

What information/data will the adaptor provide?

The WirelessHART adaptor will provide exactly the same information as available via a HART handheld or multiplexer. The adaptor may also report other wireless information such as status of the adaptor itself, battery condition, and communication statistics.

Process information

The wireless adaptor will provide remote access to the 8 (4 in HART 5/6) available process variables within the instrument it is connected to. The exact process variable type will depend upon the instrument and the vendor however here is a list of what may be available:

Pressure Instrument

- Pressure (in engineering units)
- Static Pressure
- Process Temperature (multivariable pressure instrument)
- Mass/Volumetric flow (multivariable pressure instrument)
- Instrument output (4-20mA) and percentage range

Temperature Instrument

- Temperature 1 (in engineering units)
- Temperature 2 (in engineering units)
- Average – difference T1,T2
- Sensor input
- Redundancy

Flow Instrument (depends upon type)

- Flow
- Total flow
- Process Temperature
- Density

Positioner

- Setpoint
- Position
- Deviation
- Instrument temperature
- Supply pressure

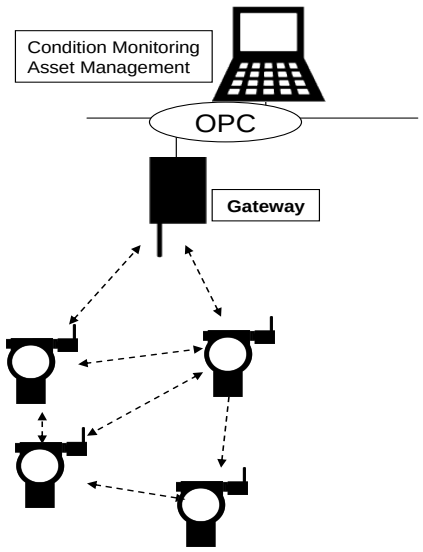
Diagnostic/Maintenance information

The wireless adaptor is able to provide instrument diagnostic information to asset management applications. The diagnostic information depends upon the instrument connected bus may include the following

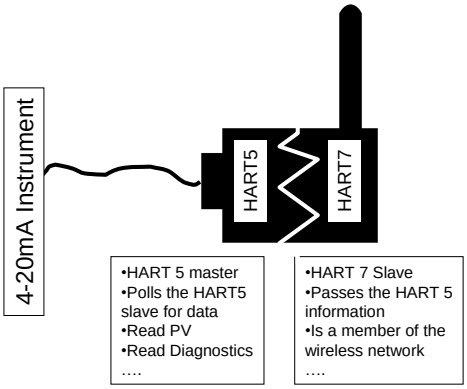
- Indication of a sticky valve
- Predict maintenance based upon valve stroke counter
- Positioner outside of working range
- Pressure transmitter over pressure – over temperature
- Broken Temperature sensor
- Faulty instrument

Instrument configuration

The wireless adaptor provides full access to the connected instrument digital information; this includes the parameters normally used to configure it (Range – transducer type (rtd, tcpl) – engineering units). Once a wireless adaptor is installed in the loop then is possible to read the instrument configuration and store it remotely, which will allow you to maintain a database of instrument configuration.



How does the adaptor work?
The WirelessHART adaptor passes information bi-directionally to and from the installed field Instrument up to the WirelessHART network. The adaptor acts as a wired HART master to the instrument and WirelessHART slave to the WirelessHART Gateway. When configured as a secondary master, the adaptor should defer to another temporarily connected secondary master such as a hand held.



WirelessHART Adaptor to HART5 Instrument

New HART commands have been added to the HART7 specification to allow the adaptor to simplify installation, these commands allow the adaptor to identify connected slave(s) and act on their behalf as part of the WirelessHART network.

The adaptor can be powered in three ways:

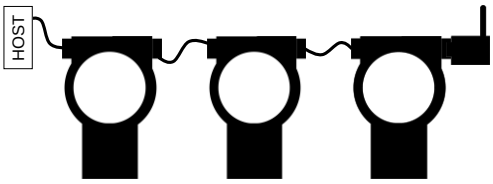
- The adaptor is powered by the connected instrument, e.g. a device with external power supply (4-wire device).
- The adaptor takes power from the 4-20 mA loops.
- Or it will be self powered using batteries or solar panels.

The adaptor acts as a wired HART master to the connected field instrument and as a wireless slave to the WirelessHART network.

How do you connect an adaptor?
The WirelessHART adaptor can be connected to field instruments in two ways, these are:

- Single instrument connection
- Multidrop connection

Perhaps the most common application will be as a single instrument connection; in this case the adaptor is connected at an unused instrument connection port, fitted at an instrument junction box, or other convenient location anywhere on the loop.



WirelessHART Adaptor in Multidrop topology

In the multidrop configuration the adaptor is connected to several instruments at the same time (note that not all adaptors will be able to support more than 1 salve). This would be the normal HART multidrop topology where the current loop is fixed at 4mA. It would be a good solution for reading relatively slow process variables in an economic way.

The WirelessHART adaptor is simple to install at a spare instrument connection port, at a junction box or other convenient location on the loop. It can support either point to point (single instrument) or multidrop (several instruments) topologies.

What do you have to do to commission an adaptor?

WirelessHART has been designed to carry on the simple engineering workflow available in traditional wired HART instruments; the wireless adaptor is no exception. There are only a few additional parameters to set when compared to the normal WirelessHART commissioning workflow. In the case that the application falls under the category process monitoring these additional parameters include the process variables of the connected instrument and its update rate.

When commissioning a WirelessHART adaptor this is a typical workflow:

Connect the adaptor

- Connection option 1: screw the adaptor into an available instrument connection port
- Connection option 2: insert the adapter anywhere in the loop using a junction box type fitting
- Connect the adaptor cables to the instrument or if using a junction box type fitting connect the cables inside the junction box
- If the adaptor is self powered enable the power supply

Set the adaptor parameters

- Connect a HART hand held configurator or PC configuration program via a HART PC modem to the adaptor.
- Add the WirelessHART Join Key.
- Add the WirelessHART Network identification.
- Select the process variables of one of the installed instruments to send.
- Select update rate.

In case that the adaptor is used to gain diagnosis information the work flow is very similar but instead of the process variables the status of the instrument is send.

There are only a few additional parameters to set when using a WirelessHART adaptor and a single connected instrument. All parameters are set using existing HART hand held configurator or PC HART configuration program with updated DD's installed.

Conclusion

The WirelessHART adaptor provides a low cost and low risk alternative to installing multiplexers or hart pass-through I/O as no re-work of wiring is required. The adaptor provides access to all the variables and parameters within an installed, wired, HART instrument. The adaptor is simple to install and commission and will become a full member of a WirelessHART network.

The main benefits provided by the adaptor are:

- Remote access to process information (Calculated variables, positioner feedback, flow totals….) otherwise not available
- Read diagnostic/maintenance information (valve operation, valve stroke counter, over pressure warning…)
- Upload device configuration to help maintain a central database