



HART Connection Systems

Flexible Solutions

**COOPER** Crouse-Hinds

HART Connection Systems



MTL Instruments, the world leader in intrinsic safety, has built an outstanding reputation over 40 years for supplying quality products into the harshest environments.

Where explosive gases are present, MTL's 'intrinsic safety' technique prevents ignition by restricting the energy available in high-risk areas. MTL's solution is simply the most cost effective and reliable method of preventing explosions.

When it comes to HART Connections MTL offers the most cost effective, reliable and flexible solutions for every application and industry. From Siberian oil fields to Mexican power plants MTL HART Connections provide the optimum solution.

The world's leading companies rely on MTL to protect their business and their personnel because MTL's quality and reliability are beyond question.



Whatever the client's needs, MTL's holistic, flexible approach delivers a safe, reliable, total solution that integrates easily with existing components and systems.

The simplicity, quality and robustness of MTL's components and processes contribute to significant cost savings when MTL solutions are compared with less well-engineered or incomplete approaches.



HART is a registered trademark of HART Communication Foundation

better management of plant assets



What is HART?

HART is an open protocol that enables two way digital communication with Smart field devices. It has become the de facto standard for communicating with SMART devices in the process industry as it allows the user to realise the full potential of Smart field devices whilst preserving the traditional 4-20mA signal.



The HART protocol allows additional information to be carried on the same pair of wires with the 4-20mA analogue signal. Simultaneously and Transparently

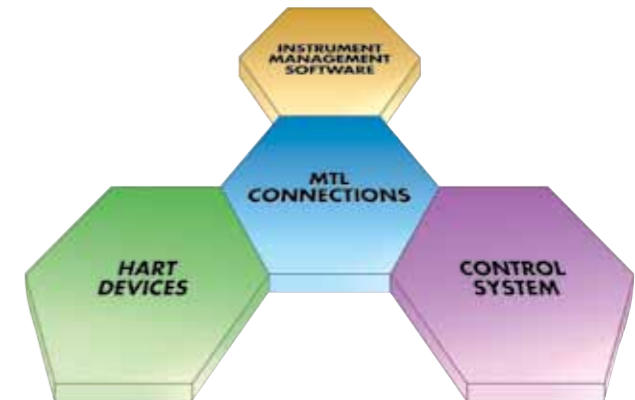
What does HART give you

There are millions of HART devices installed in process plants worldwide and each contains valuable data which can enable better management of plant assets, helping to reduce commissioning, maintenance and documentation costs.

To communicate with HART devices and extract this data a wide range of powerful Instrument Management Software has been developed by a number of different manufacturers e.g. AMS, Cornerstone, FieldCare etc. These software packages offer online continuous communication with your HART devices simplifying configuration, calibration, diagnostics, predictive maintenance and automating documentation etc.

HART Connections

MTL provide the HART CONNECTION between your field devices, your control system and instrument management software packages. Our HART CONNECTIONS strip the HART digital signal from the 4-20mA signal (which passes to the control system unscathed) and sends it directly to your maintenance PC. Thus giving you access to the benefits offered by the latest powerful configuration and predictive maintenance software.



letting you take control



To access this information and maximise the benefits of online HART communication you need HART CONNECTIONS.

HART is a registered trademark of HART Communication Foundation



For process control systems using traditional I/O installations the MTL4850 HART Connection System is the ideal HART solution for new installation or upgrades, Intrinsically Safe or general purpose applications.



communicating with SMART devices

HART Connections

for traditional point to point installations

A typical MTL4850 HART Connection will consist of the following three components

1. A **HART Communication Board** to provide a physical connection - HART Connection Unit for safe area applications or intrinsically safe backplane for hazardous area applications.
2. **HART Multiplexer** to route the communication between the maintenance PC and the HART devices.
3. **HART Backplane** HMP-HM64 to mount the HART multiplexer modules.

The HART Communication Board is the link between the HART field devices and the HART backplane. Normally a 16 channel board, it accepts either analogue input or output signals maintaining channel to channel isolation between each.

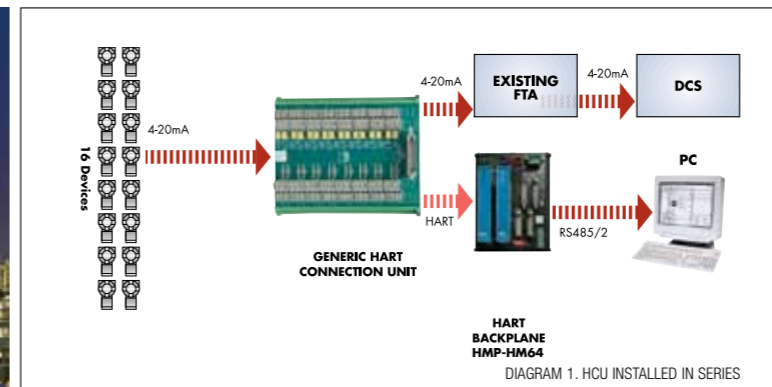
The HART backplane is the backbone of the system. This small but vitally important board holds the MTL4850 HART Modules which handle the HART multiplexing. Each board can communicate with up to 64 HART devices.

The HART multiplexer is the brains of the system. It provides the HART data interface between smart devices in the field and HART instrument management software run on a PC. The modules connect to the field devices via either HART connection units or IS backplanes depending on the application.

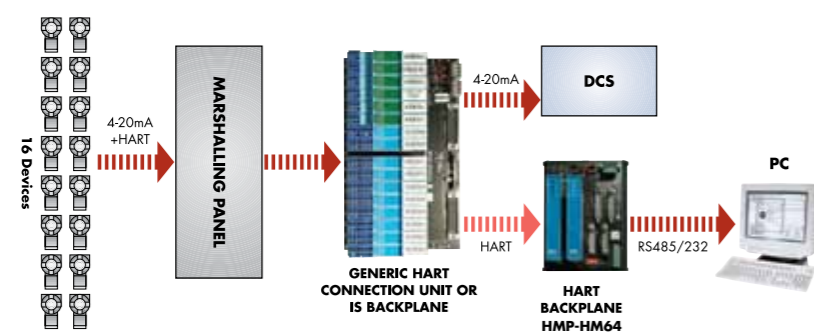
The flexibility of the MTL4850 and its ability to communicate with any of the instrument management software packages on the market today allows MTL the ability to offer the optimum solution for any application. Whether for general purpose or IS applications, retrofit or new installations, the versatile MTL4850 system with its wide range of standard or customised backplanes and HART Connection Units offers the best connection solution.

Safe area applications

For safe area applications HART field devices are connected to the HART multiplexer via a range of HART Connection Units, the choice of HCU being dependent on the type and number of the HART field devices. The generic HART Communication Boards are generally mounted in series to the existing Field Termination Panel, see diagram 1, but in certain retrofit applications they can be mounted in parallel, see diagram 2 - Discuss with your MTL representative which is the most appropriate installation for your application.

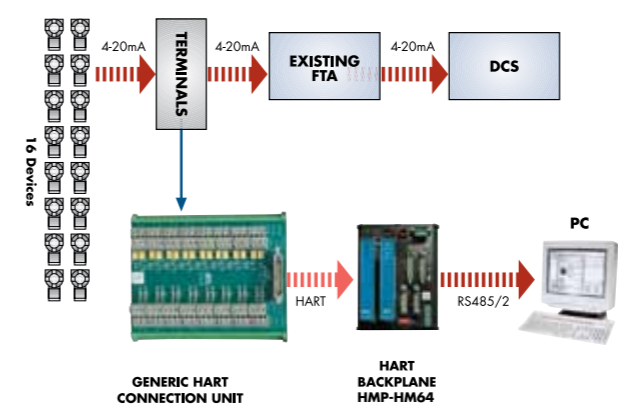


A simple system layout for a 16 channel system is illustrated below



The MTL4850 system is however completely modular and scalable allowing you to grow the system to the size you require. Each multiplexer can communicate with up to 32 different HART devices, additionally up to 63 MTL4850 HART modules can be connected on one network, giving access to more than two thousand devices. The host PC or Control System may have connection to more than one of these HART networks to monitor an entire plant. (See illustration on page 10)

DIAGRAM 2. HCU INSTALLED IN PARALLEL



Alternatively customised HCUs can be utilised to replace the existing Field Termination Panel thereby reducing the number of connections and simplifying the installation (see Integrated Solutions - page 10)



Intrinsically Safe applications

When HART field devices are mounted in the hazardous area the HART signal will have to pass through the IS Interface that is protecting the loop.

MTL offer a range of HART compatible zener barriers and galvanic isolators including:

MTL4500 - Galvanic Isolators - backplane mounting

MTL5500 - Galvanic Isolators for DIN rail mounting

MTL700 & MTL7700 - Zener barriers

The MTL4850 is designed specifically for use with the MTL4500 range of Backplane mounted galvanic isolators; connections and integration with this system is as simple as safe area applications.

General purpose and custom backplanes for analogue I/O signals are fitted with the HART connector to give simple connection to the HART backplane.

MTL4500 Series backplanes provide both mechanical and electrical connections through the backplane. The advantages they offer include:



Integrated Solutions incorporate	Benefits seen
Power distribution / Dual Supply connection / Power fail relay	Saves on wiring and installation time, Less chance of wiring error, Higher reliability, Peace of mind
Optional system connector	Saves money, no marshalling panel needed Easy integration gives less chance of wiring errors
Removable connectors	Easier maintenance
16mm module width to give high packing density	Saves money and panel space (Dual channel options)
Mechanical and electrical connection	Saves installation time, Less wiring, Less chance of wiring errors



All of the analogue input and analogue output interface modules in the MTL4500 and MTL4600 backplane mounted series, and the corresponding modules in the DIN rail mounted MTL5500 Series, pass HART communications. For example, any modules in the MTL454x range can be used to provide an Intrinsic Safety interface for signals to be connected to the HART multiplexers. Single and dual channel modules provide comprehensive options to match the particular application requirements.



HART is a registered trademark of HART Communication Foundation



Generic HART connection boards

I/O Card Type	GP Applications	IS Applications
16ch Analogue inputs	HCU16	CPH-SC16 - fitted with screw connectors
16ch Analogue outputs	HCU16AO	As above
Mix of analogue inputs/outputs	HCU16AO	As above
8ch Analogue outputs	HCU08	As above
32ch Analogue inputs/outputs	HTP-SC32	CPH-SC32

Special applications

Some applications only require the use of a few HART field devices in a single location e.g. pipe line monitoring for RTV's. For these applications MTL can mount the HART multiplexer directly onto the HCU or IS Backplane.



For General Purpose applications of up to 32 analogue in or analogue out loops.



For IS applications, the interface modules can be mounted directly on the backplane alongside the IS isolators.

SIL rated multiplexers

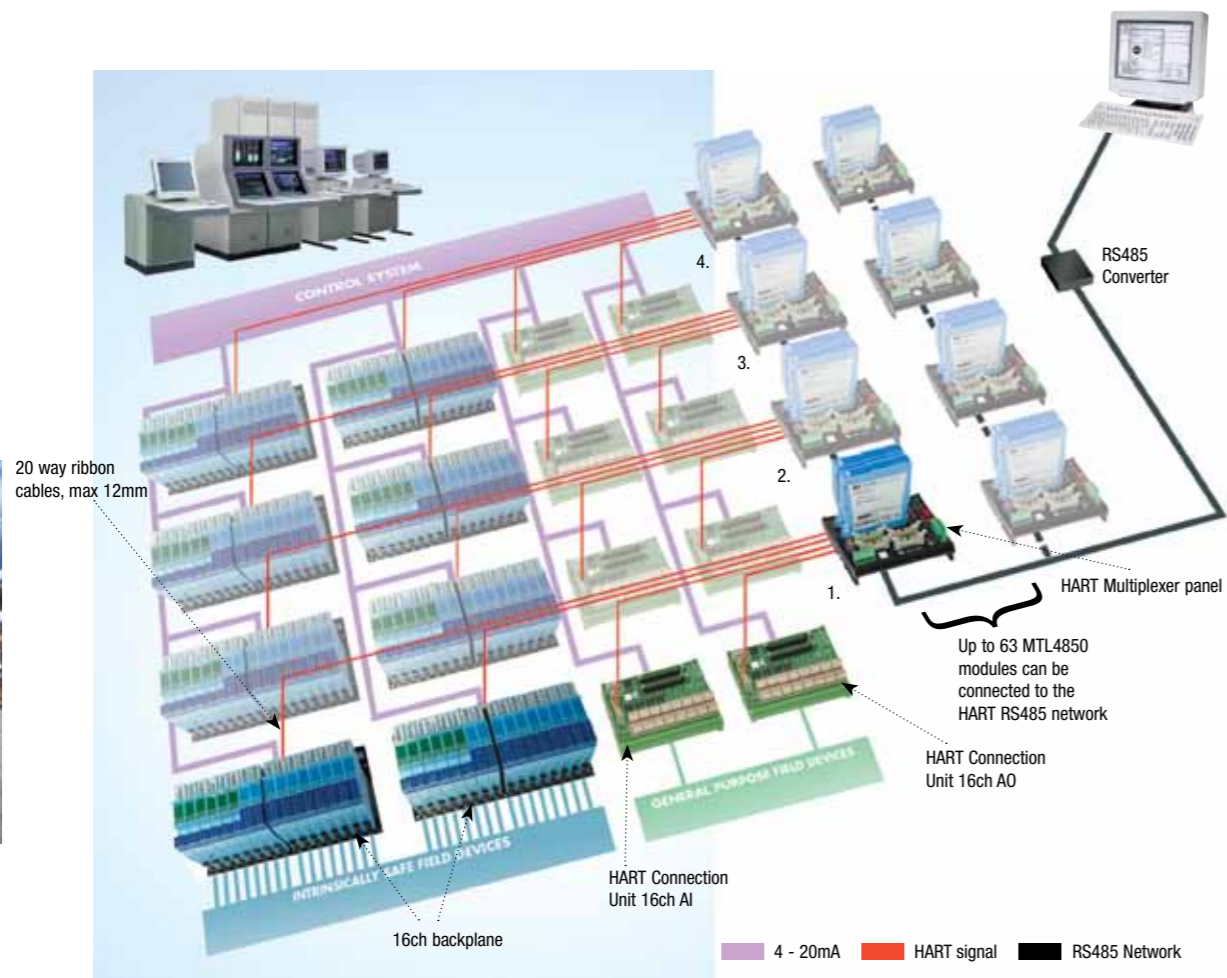
Approved for applications to IEC61508, the MTL HART multiplexers are ideal for use as a safety related sub system in SIL 3 loops.

MTL is a Functional Safety Management company and the safety system designer is able to apply the MTL HART multiplexer equipment without concern as to suitability.



HART System overview

The MTL4850 HART connection system provides the link between HART field instruments, the control system and the instrument management software package.



The MTL systems strip the HART digital signal from the 4-20mA signal (which passes to the control room unscathed) and sends it directly to a maintenance PC, thus giving access to the benefits offered by the latest powerful configuration and predictive maintenance software.

The illustration above shows the architecture of the system and how it can be built to monitor either a few devices or many devices on one network.

The connection boards detailed are our generic solution, however we offer a wide variety of connection units to allow full integration of the system wherever DCS, ESD or PLC is used on site.

CONNECTION OPTIONS

HMP-HM64

Designed to be connected to remote connection units via ribbon cables the HMP-HM64 HART interface provides the user with a building block easily configurable and expandable to meet the system requirements. Each HMP-HM64 accommodates two MTL4850 HART multiplexers and any of the MTL connection modules can be linked to this board.

HTP-SC32

This self-contained item is a 32 channel connection unit with screw terminals for the field devices and the instrument system, plus an integrated MTL4850 multiplexer. Apart from an RS485 to USB or Ethernet protocol converter, no other external hardware is required.

HCU16AO

16 channel analogue output interface with HART filters for use in systems where the analogue output signal interferes with the HART data or may become unstable with the presence of the HART data signal. Each filter presents a low impedance at d.c. thus maintaining good current drive capability. Removable screw terminal strips are provided for field and system connections in groups of 4 channels. Connection to the HMP-HM64 is made via a 20 way ribbon cable. Channel to channel isolation is provided.



HCU16

16ch analogue input or output with options to add series or parallel conditioning to provide the correct impedance characteristics to enable the HART signals to function. Three screw terminals per channel are provided to allow through connection for the Tx+, Input and return signals. Connection to the HMP-HM64 is made via a 20 way ribbon cable. Channel to channel isolation is provided.

Standard and custom backplanes

MTL has a range of standard and customised backplanes that accept MTL4500 or MTL4600 Series isolators. The standard backplanes such as the CPH-SC16 will carry sixteen input/output modules with an MTL4850 HART multiplexer module, providing a convenient integrated assembly. Custom backplanes are available for various types of DCS and PLC instrumentation with system connectors that suit the particular equipment type. These backplanes are fitted with a ribbon cable connector to enable the backplane to be connected to an HMP-HM64 multiplexer panel.



HART is a registered trademark of HART Communication Foundation

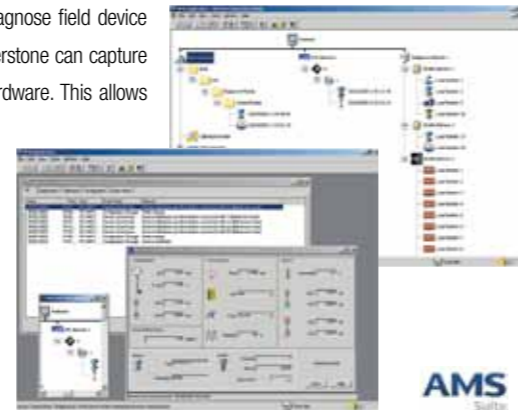


Instrument management software

Powerful instrument management software is being widely adopted by the process industry to provide detailed process and maintenance information for a broad range of HART field devices.

The online access to the information contained within HART devices allows users to diagnose field device troubles before they lead to costly problems. Software such as AMS, Fieldcare and Cornerstone can capture and use diagnostic data from HART field instruments via the MTL HART connection hardware. This allows users to realise the full potential of their field devices to optimise plant assets, which results in significant operations improvement and direct maintenance savings.

IMS products provide essential configuration, calibration, monitoring and maintenance history functions for conventional analogue (4-20 mA) and HART® protocol compatible smart process instruments and field devices. They deliver powerful tools to meet the need for standardised instrument maintenance procedures and record keeping mandated by some quality standards and regulatory bodies.



One of the simplest and most cost effective methods of integrating HART CONNECTIONS into a traditional point to point Process I/O solution is to install a customised HART connection board in place of the normal DCS Field Termination Panel.

MTL manufacture a wide range of customised backplanes and HART connection units to replace the standard DCS termination boards and provide direct pickup of the HART signal. The MTL HART connection units have all the features of the standard DCS termination board with the addition of the HART multiway connector which links the board to the HART backplane. Additional features can be added as required.

- Channel to channel isolation
- Customised field and system connectors
- HART signal conditioning
- HART filters for use in systems where the analogue output signal either interferes with HART data or may become unstable with the presence of the HART signal
- Variable number of channels
- Channel labelling

Whatever the application, MTL have or can design, an integrated solution to allow simple, flexible and space effective connection to your control system. Installations worldwide show that users everywhere recognise the quality and reliability of MTL Integrated Solutions



The benefits of utilising these powerful software packages online include:

- Reduced commissioning time and costs
- Reduced maintenance costs
- Reduced documentation
- Reduced process downtime

The MTL HART Connection System offers connectivity to a comprehensive range of both...

- general instrument management software packages and
- dedicated software packages for optimising Valve positioner performance and maintenance including...

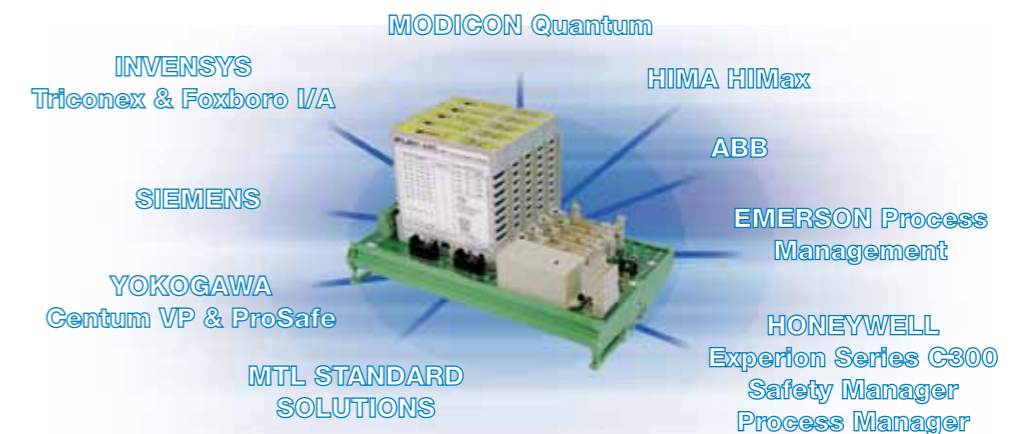


	AMS Device Manager	Emerson Process Management
	Cornerstone	Applied System Technologies
	FDM	Honeywell
	FieldCare	Endress & Hauser/Metso Automation
	HART OPC Server	HART Communication Foundation
	PACTware	PACTware Consortium
	PDM	Siemens
	Fieldmate	Yokogawa
	SmartVision	ABB
	SoftTools	Flowserve
	ValveLink	Emerson Process Management
	Valvue	Masonellan



For software packages that are based on a FDT frame i.e FieldCare, PACTware etc communication with the MTL HART multiplexer system requires the MTL Generic Communications DTM. This can be downloaded Free of Charge from the MTL website.

The range of integrated options is too extensive to list. Please contact your local MTL representative for full details.



Connecting HART

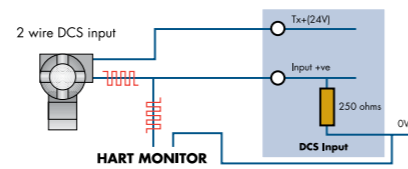
When connecting any HART device, be it an instrument, hand held configurator or HART connection system there are a few rules to follow concerning the impedance of the loop. Customised backplanes and HCUs are designed with these rules in mind making HART connections simple and reliable.

ANALOGUE INPUTS

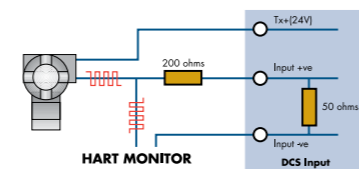
As HART devices monitor the HART signal in a voltage form, the impedance at the monitoring point must be >240 ohms or the amplitude of the signal will be insufficient for the input circuits in the monitoring device to detect the data. Where the HART signal is monitored within the loop is not important, as long as there is sufficient impedance. This can be at the transmitter or across the DCS input if it has a 250ohm input resistor.

Where HART is to be detected on inputs of <240 ohms, either in IS or safe area applications, a series resistor must be added to the loop to raise the impedance to >240 ohms. Various versions of the HCU16 are available to add the necessary resistance to the loop. Custom backplanes for IS applications are already fitted with components to raise the impedance where necessary.

Impedance in the loop >240 ohms



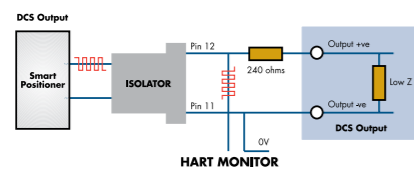
If the DCS inputs are less than 240 ohms



ANALOGUE OUTPUTS

With analogue outputs there is more to consider. As with inputs, the impedance in the loop for HART to operate must be $>240\Omega$. Very few DCS analogue outputs present a high impedance to the loop. Most analogue outputs monitor the current in the loop and control a voltage source to obtain the correct current. Voltage sources are generally low impedance so connecting a HART signal will limit the amplitude of that signal to a point where it can no longer work.

IS ANALOGUE OUTPUTS

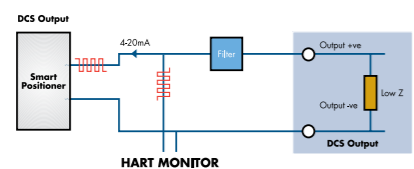


In IS applications fitting a simple resistor between the output +ve and the input to the isolator will raise the impedance up to the required level. In some cases it may be necessary to add additional filtering between the output and the isolator if:

1. the HART signal affects the stability of the current signal or;
2. the noise generated by the analogue output interferes with the HART data.

Talk to MTL for full installation details and advice.

NON-IS ANALOGUE OUTPUTS



In safe area applications it's important not to significantly increase the resistance to the loop. A simple resistive filter will reduce the available voltage to the loop by up to 5V. This in many applications will cause the loop to 'run out of volts' towards 20mA. The filter circuit used on the HCU16AO presents a very low series resistance to dc but a high impedance to the HART signal. This filter circuit should be used in these applications and will maintain the full output drive specification of the control system.

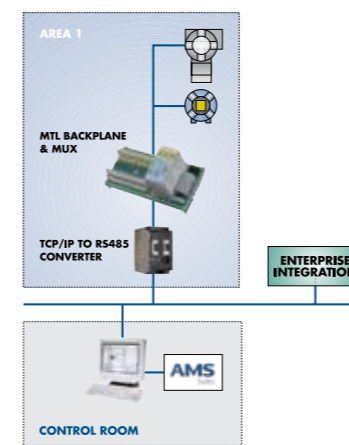
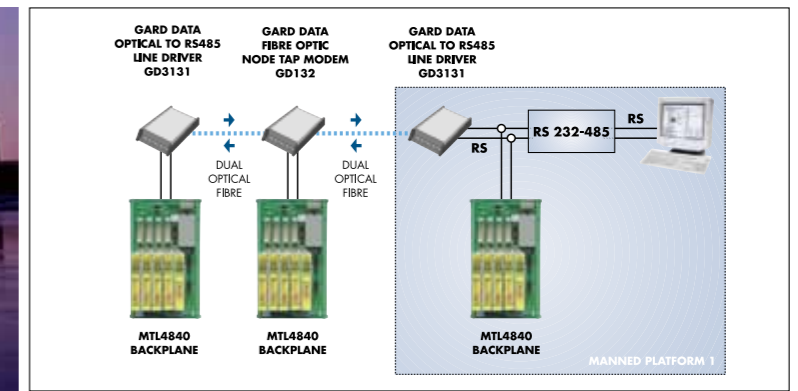
HART APPLICATIONS

MTL HART maintenance systems are utilised in a wide variety of applications around the world. The system is extremely flexible allowing communication between the host and HART device to be carried by copper, optical fibre, wireless or ethernet.

One application in the North Sea required HART devices situated on a number of unmanned platforms to be connected to the Instrument Management Software system running on a nearby manned platform.

An underground fibre optic network had been installed to connect the various platforms and this was utilised to carry the HART signals. On each of the unmanned platforms the HART devices were connected to a standard MTL HART Maintenance System. The RS485 connection from each of the HART backplanes was then connected to a Gard Data Fibre Optic Node Tap Modem.

HART devices on the manned platform were connected via the HART backplanes to the copper RS485 network. All HART devices on manned and unmanned platforms were now connected to the serial port on one PC running Cornerstone software. This enabled all devices to be monitored and configured without the need for an engineer to visit the unmanned platform.



Similarly on large plants where HART devices may be scattered over a very large area the use of a copper RS485 network is impractical. At a recent installation in Kazakhstan there was a requirement to connect up to 20,000 HART devices to a Predictive Maintenance software package.

The site had been designed to include a full Ethernet network, the brief from the contractor was to offer a HART maintenance system which would run over the Ethernet LAN.

AMS Device Manager from Emerson has the ability to run on an Ethernet network allowing secure access from a number of Client Stations.

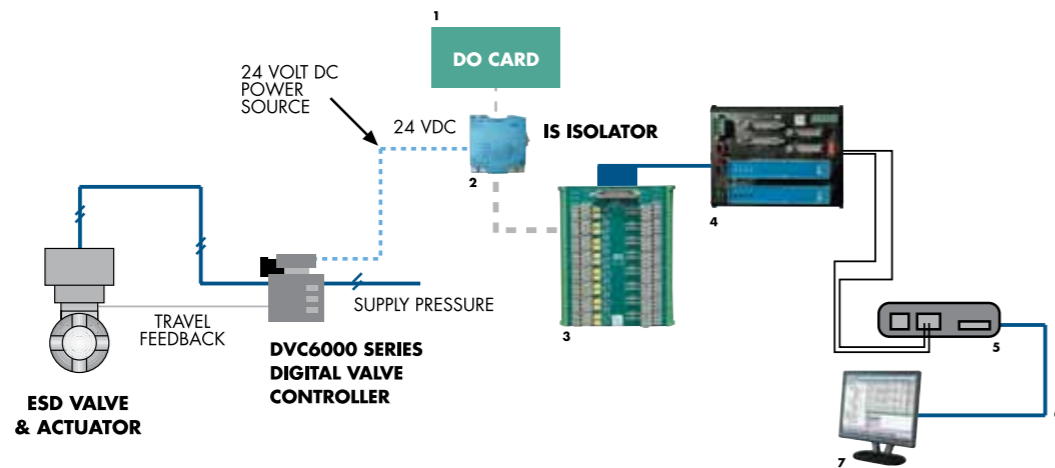
The site will eventually have 20 operating areas and cover approx 400 square kilometers. The MTL HART Maintenance System will link all the HART devices from each of these areas into a single database running on the AMS server, giving the ability to check a device status, configure, re-range and perform diagnostics from the PC without going into the field.



HART applications

An increasingly popular application for HART is for the partial stroke testing of Emergency Shut Down (ESD) valves. Unlike normal process valves which are continuously moving, ESD valves can stay in one position for a long time. Therefore they can become stuck and may not operate when needed.

Connecting a SMART positioner such as the DVC6000 to the MTL HART Maintenance System allows the software to perform a Partial Stroke test on the ESD valve without the need for a disruptive process shutdown.



NOMENCLATURE:

- ITEM 1 - Safety system DO card
- ITEM 2 - Repeater power supply barrier - MTL5541
- ITEM 3 - HCU16-P250 HART Connection Unit (with 250 ohm parallel resistor)
- ITEM 4 - HMP-HM64 HART backplane with MTL4850 HART multiplexer
- ITEM 5 - RS485 converter
- ITEM 6 - Communications cable
- ITEM 7 - Instrument Management Software workstation

The system can be used for intrinsically safe, Exd or safe area applications. The diagram above shows an IS application with a MTL5541 IS isolator connected between the Safety System DO card, the SMART positioner and the HART Maintenance system. For Exd or safe area applications the Isolator can be removed from the circuit.

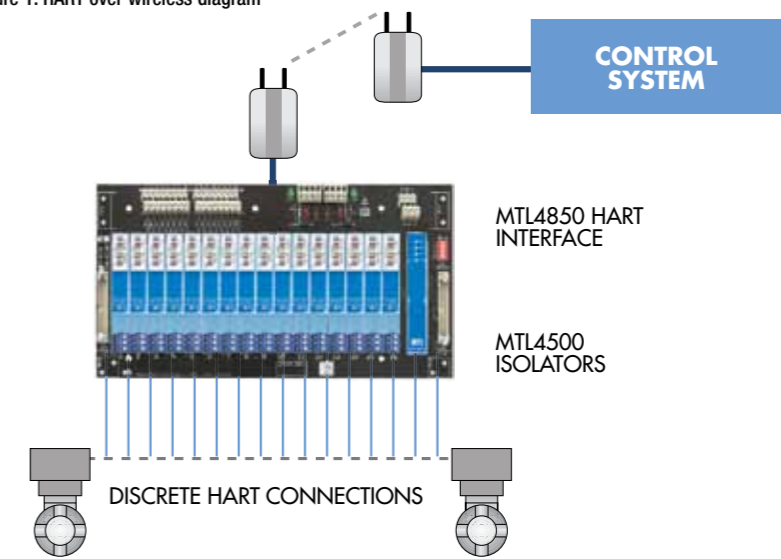


HART wireless solution

The new MTL4850 HART multiplexer can be readily connected via the MTL wireless range, making several different network architectures possible.

The MTL 'HART over wireless' approach increases the possibilities to get HART data from the instrument to the control room, carrying with it a unique set of benefits and features.

Figure 1: HART over wireless diagram



Typical wireless-enabled remote HART™ device monitoring station

FEATURES:

- MTL radio network provides access to site for diagnostic and configuration purposes, reducing maintenance costs.
- Easy expansion for additional sites being added to the network, better support for gradual network expansion and test sites.
- Reduced variability in install costs as physical location of equipment has reduced dependence on cable.
- Automatic conversion between interface standards (RS232, RS485, Ethernet).
- Reduced installation costs, particularly over long distance (e.g. >1km).
- Greater number of options available for the location of devices.

HART is a registered trademark of HART Communication Foundation

Scope of supply



Cooper Crouse-Hinds integrates a comprehensive line of electrical and instrumentation products with expert support, industry insights and local availability to improve safety and productivity in the most demanding industrial and commercial environments worldwide.

Customers will now be able to benefit from a single supplier for all of their hazardous area needs, whether this is for instrumentation products, fieldbus components, electrical switchgear or enclosure and wiring solutions.

MTL Instruments is recognised as a world leader in the development and supply of Intrinsic Safety, Process Control and Surge Protection products. Many of the world's safety-critical processes are monitored, controlled or protected by MTL Instruments products and the company is distinguished by its global network of sales and support centres and by its acknowledged position as a thought leader in this high technology marketplace.

More information on our product range is available in separate, comprehensive catalogues or datasheets available from your local MTL Instruments office, Hitech Instruments office or via our website.

'Many of the world's safety-critical processes are monitored, controlled or protected by **MTL Instruments** products'



FIELDBUS NETWORKS



NETWORK SECURITY



INTRINSICALLY SAFE ETHERNET



WIRELESS CONNECTIVITY



INTRINSIC SAFETY SOLUTIONS



PROCESS ALARM EQUIPMENT



VISUALISATION & INDICATORS



REMOTE I/O



HART



SURGE PROTECTION



GAS ANALYSER SYSTEMS



INDUSTRIAL ETHERNET

www.mtl-inst.com



GLOBAL LOCATIONS

AUSTRALIA

MTL Instruments Pty Ltd, 9 /12 Billabong Street,
Stafford, Queensland 4053
Australia

Tel: + 61 1300 308 374 Fax: + 61 1300 308 463
E-mail: enquiries@mtlaus.com.au

CHINA

Cooper Electric (Shanghai) Co. Ltd. Room 2001, China Life Tower,
16 Chao Yang Men Wai Street,
Chao Yang District, Beijing, China 100020

Tel: + 86 10 5980 0288 Fax: + 86 10 8562 5725
E-mail: bjsales@mtl-inst.cn

FRANCE

MTL Instruments sarl, Les Carrés du Parc
10 rue des Rosiéristes, 69410 Champagne au Mont d'Or
France

Tel: + 33 (0)4 78 64 98 32 Fax: + 33 (0)4 78 35 79 41
E-mail: info@mtl-inst.fr

GERMANY

MTL Instruments GmbH, An der Gumpgesbrücke 17
D-41564 Kaarst, Germany

Tel: + 49 (0)2131 718930 Fax: + 49 (0)2131 7189333
E-mail: info@mtl.de

INDIA

MTL India, No.36, Nehru Street
Off Old Mahabalipuram Road
Sholinganallur, Chennai - 600 119, India

Tel: + 91 (0) 44 24501660 /24501857 Fax: + 91 (0) 44 24501463
E-mail: sales@mtlindia.com

ITALY

MTL Italia srl, Via Cantù 11
I - 20092 Cinisello Balsamo MI, Italy

Tel: + 39 (0)2 61802011 Fax: + 39 (0)2 61294560
E-mail: info@mtl-inst.it

JAPAN

Cooper Crouse-Hinds Japan KK,
MT Building 3F
2-7-5 Shiba Daimon, Minato-ku,
Tokyo, Japan 105-0012

Tel: + 81 (0)3 6430 3128 Fax: + 81 (0)3 6430 3129
E-mail: sales@mtlkk.co.jp

KOREA

Cooper Crouse-Hinds Korea
12F, Vision Tower
707-2 Yeoksam-Dong Gangnam-Gu,
Seoul 135-080, South Korea.

Tel: + 82 2 3484 6795 Fax: + 82 2 3484 6778
E-mail: enquiry@mtl-inst.com

NETHERLANDS

MTL Instruments BV
Terheijdenseweg 465, 4825 BK Breda
The Netherlands

Tel: +31 (0) 76 7505360 Fax: +31 (0) 76 7505370
E-mail: info@mtlbenelux.com

SINGAPORE

Cooper Crouse-Hinds Pte Ltd
No 2 Serangoon North Avenue 5, #06-01 Fu Yu Building
Singapore 554911

Tel: + 65 6 487 7887 Fax: + 65 6 487 7997
E-mail: sales@mtlsing.com.sg

UNITED ARAB EMIRATES

MTL Instruments, Villa No. 4, Sector 2-17
Street 6, PO Box 53234
Abu Dhabi, UAE

Tel: + 971 2 446 6840 Fax: + 971 2 446 6841
E-mail: mtlgulf@mtl-inst.com

UNITED KINGDOM

Measurement Technology Limited,
Great Marlings, Butterfield, Luton
Beds LU2 8DL

Tel: + 44 (0)1582 723633 Fax: + 44 (0)1582 422283
E-mail: enquiry@mtl-inst.com

AMERICAS

Cooper Crouse-Hinds MTL Inc.
3413 N. Sam Houston Parkway W.
Suite 210, Houston TX 77086, USA

Tel: + 1 281-571-8065 Fax: + 1 281-571-8069
E-mail: csinfo@mtl-inst.com