MANUFACTURED BY **LAWNSWOOD TECHNOLOGY LIMITED**

User Manual

USB HART Modem

HM1-UD

Contents

CHAPTER 1

Introduction

The **HM1-UD** is a single-channel USB HART modem. It connects a PC or laptop to HART field instruments so that standard asset-management software can configure, calibrate, maintain and diagnose them.

The modem communicates with the PC over a USB connection. A driver supplied for the product creates a **virtual serial (COM) port** that behaves exactly like a conventional serial port, so any HART-capable device-management package can use it. Because the connection is USB, the HM1-UD suits portable engineering tools — laptops and tablets that no longer provide a built-in serial interface.

The HM1-UD is a "dumb" device: it converts between the serial data on the COM port and the HART signalling on the instrument loop, at the electrical level. Implementing the HART protocol itself is the job of the software on the PC. Any DTM- or DD-based tool — for example **PACTware**, **FieldCare**, **FieldMate** or **SIMATIC PDM** — can therefore work through the modem.

What this manual covers

This manual describes how to install the modem and its driver, connect it to a HART loop, use it with your device-management software, and resolve common problems. If you only need the essentials to get running, start with the **Quick Start Guide** (Chapter 2 summarises the same steps).

About HART

HART (Highway Addressable Remote Transducer) is a digital communication protocol that shares the same wiring as a conventional 4–20 mA analogue current loop. A small digital signal is superimposed on the analogue current, allowing a host to read and write configuration, diagnostics and additional process variables without disturbing the primary measurement. The HM1-UD provides the physical connection between your PC and that digital signal.

CHAPTER 2

Getting Started

This chapter is a linear walkthrough from unboxing to reading your first HART device. Later chapters expand on each step.

1. Install the driver

Install the USB driver before connecting the modem for the first time. On a Windows PC with internet access the driver normally installs automatically the first time the modem is plugged in. If it does not, you can download it from the support site — see Software Installation.

The driver creates a **virtual serial (COM) port** on the PC. Your HART software talks to that COM port; the modem does the rest.

2. Connect the modem to your PC

Plug the HM1-UD into a free USB port on the PC, either directly or through a USB extension cable. No separate power supply is needed — the modem is powered from the USB port.

3. Find the COM port

Once the driver is installed and the modem connected, the operating system reports an additional serial port. On Windows, open **Device Manager** and expand **Ports (COM & LPT)** to see the COM number assigned to the modem (for example `COM4`). You will select this port in your device-management software.

4. Connect to the HART loop

Attach the two flying leads, using their grabber clips, across the HART loop. You can connect either **across the loop sense resistor** or **directly across the instrument** — both are shown in Hardware Installation. The connection is polarity-independent, so it does not matter which lead goes where, and the loop interface is fully isolated from your PC.

A HART signal needs a loop load of roughly **250 Ω**. On a live 4–20 mA loop this is usually already present; on the bench you will need to add a suitable resistor.

5. Open your device-management software

Start your HART tool — PACTware, FieldCare, FieldMate, SIMATIC PDM or another DTM/DD-based package — and set its HART communication driver to use the modem's COM port. HART uses standard serial settings of **1200 baud, 8 data bits, odd parity, 1 stop bit** (8-O-1); most tools apply these automatically.

6. Scan for devices

Start a HART scan or connect in your software. Use polling address **0** for a single point-to-point device, or scan addresses **1–15** for a multi-dropped loop. When the device is found you can read and write its configuration as normal.

If anything does not respond, see Troubleshooting.

CHAPTER 3

Specifications

All figures are taken from the HM1-UD product datasheet.

HART interface

Channels	1
Master type	Primary or secondary master
Multi-drop	Supported (point-to-point and multi-dropped loops)
Loop connection	Two flying leads with grabber clips
Polarity	Independent (either lead to either terminal)

Host interface

USB	1 × USB 2.0
USB connector	Type B
PC interface	Virtual serial (COM) port via supplied driver
Interface protocol	Raw modem

Power

Supply	+5 V from the USB port (bus-powered)
Consumption	< 0.25 W

Isolation and safety

Loop interface	Fully isolated
Dielectric isolation	2500 V (1 minute duration)

Environment

Operating temperature	0 to +50 °C ambient
Storage temperature	−20 to +70 °C
Humidity	0 to 70 % non-condensing

Compliance

Region	Mark
Europe	CE, in accordance with EN ISO 17050-1:2004
USA	FCC Part 15, Class A
Canada	ICES-003

Software compatibility

Works with PACTware, FieldCare, FieldMate, SIMATIC PDM and other DTM/DD-based device-management tools that can use a serial (COM) HART communication driver.

CHAPTER 4

Hardware Installation

Installing the HM1-UD is a two-part job: connect it to the PC, and connect it to the HART loop.

Connecting to the PC

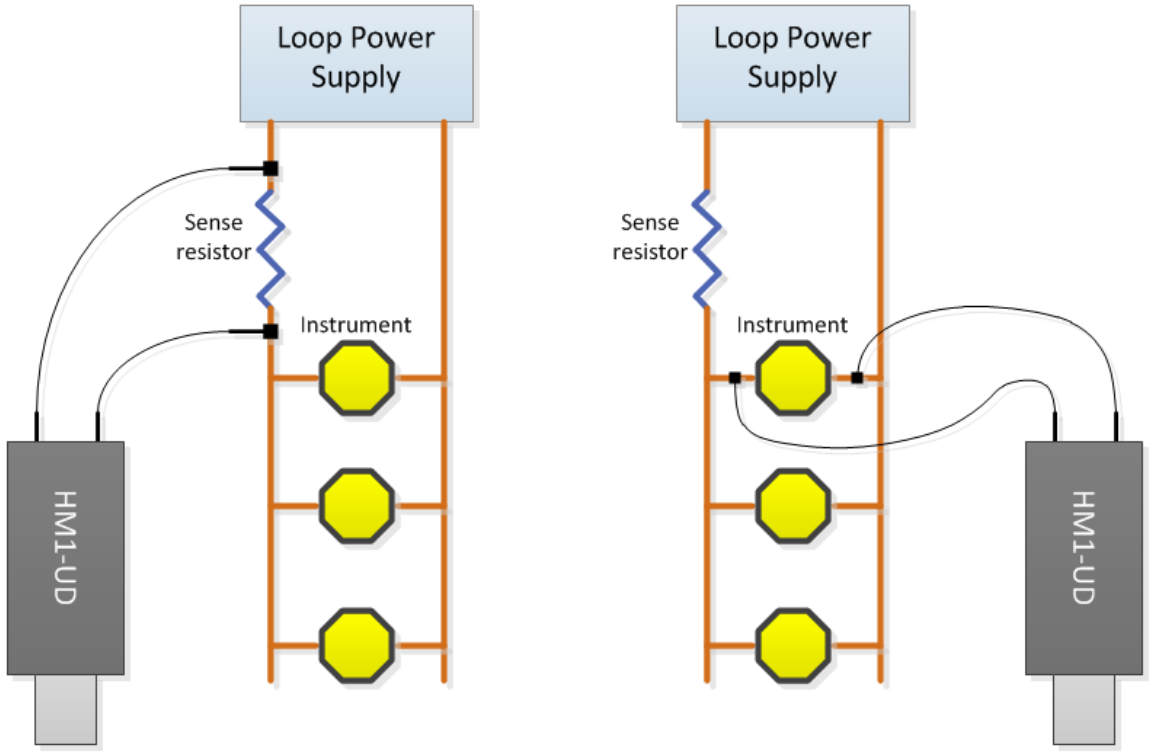
Plug the modem into a free USB port on the host computer. If the modem cannot reach the port comfortably, a standard USB extension cable can be used to extend its reach without affecting operation. The modem draws its power from the USB port, so no external supply is required.

Connecting to the HART loop

Connect the two flying leads to the HART loop using their grabber clips. There are two equivalent ways to do this:

- **Across the loop sense resistor** — clip the leads across the resistor that provides the loop load.
- **Directly across the instrument** — clip the leads across the instrument's own terminals.

Both options are shown in the figure.



Two ways to connect the HM1-UD to the loop: across the loop sense resistor (left) or directly across the instrument (right).

The polarity of the connection to the loop is **not** important — either lead may go to either point. The loop interface is fully isolated from the PC, protecting the computer from the loop.

Loop load resistance

HART communication relies on a resistance in the loop across which the digital signal develops — typically about **250 Ω**. On a working 4–20 mA loop this load is normally already present (for example the input resistance of the controller or a dedicated sense resistor). When bench-testing an instrument on its own, add a suitable resistor in the loop so that the HART signal has something to develop across.

CHAPTER 5

Software Installation

The HM1-UD needs a driver that creates a virtual serial (COM) port on the PC. Your device-management software then communicates through that port.

Automatic installation

On a Windows PC with an internet connection, the required driver is normally downloaded and installed automatically the first time the modem is plugged in. Wait for the operating system to finish installing the device before continuing.

Manual installation

If the PC has no internet connection, or the driver does not install automatically for any other reason, you can obtain the driver from the support download section at **support.lawnswoodtechnology.com**. Follow the instructions supplied with the driver to install it, then connect the modem.

Drivers have been produced for Windows, macOS and Linux. If you need the driver for an operating system other than Windows, raise a support ticket and we will point you to the correct download.

Confirming the COM port

Once the driver is installed and the modem is connected, the operating system reports an additional serial port. On Windows this appears in **Device Manager** under **Ports (COM & LPT)** — note the COM number (for example `COM4`), as you will need to select it in your HART software. On macOS and Linux the port appears as a device entry that your software can select in the same way.

If no new port appears, see Troubleshooting.

CHAPTER 6

Using the Modem with Device Software

The HM1-UD presents itself to the PC as a standard serial (COM) port. Any HART tool that can drive a serial HART modem can therefore use it — for example PACTware, FieldCare, FieldMate or SIMATIC PDM.

Selecting the COM port

In your device-management software, add or open a **HART communication driver** (the exact name varies between tools — it may be called a communication DTM, a comms driver, or a modem/interface setting). Set it to use the COM port that the modem was assigned (see Software Installation).

Serial settings

HART uses a fixed set of serial parameters:

Setting	Value
Baud rate	1200
Data bits	8
Parity	Odd
Stop bits	1

This is usually written as **8-O-1**. Most tools apply these settings automatically when you choose a HART driver; if your software asks for them manually, enter the values above.

Point-to-point and multi-drop loops

- **Point-to-point** — a single instrument on the loop, operating at polling address **0**. This is the most common arrangement and the default for most 4–20 mA loops.
- **Multi-drop** — several instruments sharing one pair of wires, each at a distinct polling address in the range **1–15**. In multi-drop the 4–20 mA current is usually fixed and only the digital HART values are used.

When you start a scan, point-to-point devices are found at address 0; for a multi-dropped loop, have your software scan the address range so it can discover every device.

Reading and writing

Once the device is found, your software handles all HART communication — reading configuration and diagnostics, and writing changes back. The modem simply passes the signalling through in both directions; it does not itself interpret or store any device data.

CHAPTER 7

Theory of Operation

The HM1-UD appears as a standard serial communications port on the host computer. It is a "dumb" device: it acts purely as a protocol converter at the electrical signal level. Implementation of the HART protocol itself — framing, addressing, retries and so on — is the responsibility of the software on the PC.

Transmit and receive

Communication is half-duplex and controlled by the serial port's **RTS** (Request To Send) signal:

- **Transmit** — with RTS asserted, data written to the serial port's TX line is encoded into a HART-compatible FSK signal and placed onto the instrument loop.
- **Receive** — with RTS de-asserted, a HART signal detected on the loop is decoded and made available to be read from the serial port's RX line.

Carrier-detect signalling

When a HART carrier is present on the loop, the modem asserts the serial handshaking lines **CTS**, **DSR**, **DCD** and **RI**. HART software uses these to tell when the loop is busy and when a reply is arriving. The table below summarises the serial signals.

Serial signal	Meaning
TX	Data sent to the HART loop
RX	Data received from the loop
RTS	Enables transmission (asserted = transmit)
CTS, DSR, DCD, RI	Indicate that the loop is busy / a carrier is present

Because the modem only moves the signalling back and forth, all timing and protocol behaviour is determined by the host software. This is why the HM1-UD works with such a wide range of DTM- and DD-based tools: each supplies its own HART protocol stack and simply uses the modem as its physical interface.

CHAPTER 8

Troubleshooting

Most problems fall into one of two categories: the PC cannot see the modem, or the software cannot see the field device. Work through the relevant section below.

The modem is not recognised

No new COM port appears in Device Manager.

- Confirm the driver installed. On an internet-connected Windows PC it usually installs automatically the first time the modem is connected; wait for that to finish. Otherwise install it manually (see Software Installation).
- Try a different USB port, and a different USB cable if you are using an extension lead.
- Reconnect the modem after the driver is installed, and re-check **Device Manager → Ports (COM & LPT)**.

The software cannot find the device

A COM port exists, but a scan finds nothing.

- Check that your software is set to the **correct COM port** — the one assigned to the modem.
- Confirm the serial settings are **1200 baud, 8-O-1**. Most tools set these automatically, but a manually configured driver may be wrong.
- Check the **flying-lead connection** to the loop, and that the clips are making good contact.
- Confirm there is a **loop load of about 250 Ω** in the circuit. Without it the HART signal has nothing to develop across. On the bench, add a resistor.

Communication is intermittent or unreliable

- Ensure an adequate loop load resistance is present and that connections are secure.
- Keep the flying leads away from sources of electrical noise, such as motors, contactors and variable-speed drives.
- On a busy loop, allow your software's normal retry behaviour to run — the modem passes retries through transparently.

A multi-drop device is missing

- Devices on a multi-dropped loop are **not** at address 0. Have your software scan polling addresses **1–15** so it can discover every device.
- Confirm each device on the loop has a unique polling address.

Still stuck?

Raise a support ticket at **support.lawnswoodtechnology.com**. Quote the model **HM1-UD**, the operating system and the device-management software you are using, and describe what you have tried.

CHAPTER 9

Glossary

Short definitions of the terms used in this manual.

- **8-O-1** — the serial line settings HART uses: 8 data bits, odd parity, 1 stop bit, at 1200 baud.
- **COM port** — a serial communications port on a PC. The modem's driver creates a virtual COM port that behaves like a physical one.
- **DD** — Device Description. A vendor-supplied file describing a device's HART parameters, used by DD-based host tools.
- **DTM** — Device Type Manager. A vendor-supplied software module that knows how to configure a particular instrument, loaded into a frame application such as PACTware or FieldCare.
- **FSK** — Frequency-Shift Keying. The modulation HART uses to carry the digital signal on top of the 4–20 mA loop.
- **HART** — Highway Addressable Remote Transducer. A digital protocol that rides on top of the 4–20 mA analogue signal.
- **Loop sense resistor** — a resistor in the current loop across which the HART signal develops; typically about 250 Ω.
- **Multi-drop** — several instruments sharing one pair of wires, each at a distinct polling address (1–15), communicating digitally.
- **Point-to-point** — a single instrument on the loop at polling address 0, usually with a live 4–20 mA output.
- **Polling address** — the HART address used to reach a device: 0 for a point-to-point device, 1–15 for devices on a multi-dropped loop.
- **RTS / CTS / DSR / DCD / RI** — serial handshaking signals. The modem uses RTS to switch between transmit and receive, and asserts CTS/DSR/DCD/RI to indicate loop activity.
- **Virtual serial port** — a COM port created in software by the modem's driver; applications use it exactly as they would a hardware serial port.

CHAPTER 10

Support

Getting help

For assistance with the HM1-UD, raise a support ticket at **support.lawnswoodtechnology.com**. To help us resolve your query quickly, please include:

- the model — **HM1-UD**;
- the operating system on your PC;
- the device-management software you are using (for example PACTware or FieldCare); and
- a description of the problem and what you have already tried.

The support site is also where you can download the modem driver and the latest copy of this manual and the product datasheet.

Warranty

The HM1-UD is covered by the standard product warranty. Refer to your purchase documentation for the applicable term and conditions, or contact support if you are unsure.

Manufacturer

The HM1-UD is a **RAP SYSTEMS** product, manufactured by **Lawnswood Technology Limited**.