

# MICROLINK M+

101-0097

*HART Protocol Modem*

*HART to Modbus Accumulator*

*USB, RS-485 or RS-232 Communications Port*

*DIN Rail Mount*

## **Installation**

## **Operation**

## **Specifications**



**HART**   
COMMUNICATION PROTOCOL

 **Modbus**

## Table of Contents

---

Safety Considerations.....	1
Overview .....	2
Configuration .....	2
Block Diagram .....	3
Mounting .....	4
Power Supply .....	4
Connecting to a HART Loop .....	4
Serial Port.....	5
USB Port .....	5
USB Drivers .....	5
Modbus Registers.....	6
Specifications .....	7
Warranty .....	9

## Safety Considerations

---



- Read and understand this manual before starting the configuration and installation.
- Installation and wiring should be performed by a professional to meet all facility, local, and state requirements and regulations.



**FC** Conformity in accordance with Part 2, and Part 15, Subparts A and B of the Federal Communications Rules and Regulations, and ICES-003 of the Industry Canada standards.

- !** This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Changes or modifications not expressly approved by Microflex could void the user's authority to operate this equipment.

**CE** Emissions EN55022: 1998  
Electrostatic Discharge EN61000-4-2: 1995, A1: 1998, A2: 2001  
Radiated Immunity EN 61000-4-3: 2002  
Safety Compliance EN 60950-1: 2002

- !** This device is not intended for connection to the phone line through the appropriate converters and shall not be connected to telecommunication lines because it has no protection against over-voltages which may exist in these lines.
- !** The user shall ensure the protection of the operator from access to areas with hazardous voltages or hazardous energy in their equipment.
- !** The user shall ensure that the connection port of the field device and the modem is separated at least by basic insulation from any primary circuit existing in the field device.

## **Overview**

---

MicroLink-HM+ is a HART® protocol modem to USB/RS-485/RS-232 serial interface. In addition to functioning as a HART protocol modem, it can also be configured to continuously poll HART devices, filling modbus registers with device values without any additional HART software. Modbus registers can then be read using modbus-RTU command 3 from the USB and/or RS-485/RS-232 serial ports.

As a HART protocol modem the serial port is typically set to 1200 baud, odd parity. Most HART software will require these settings. It is possible to set the serial port to other baud rates and parity settings. In this case MicroLink-HM will receive the HART command at the higher baud rate then transmit the HART data at 1200 baud, odd parity onto the HART loop. The 1200 baud, odd parity HART reply packet is received by the MicroLink-HM modem and then transmitted back at the higher baud rate.

MicroLink-HM+ ships configured to operate as a HART protocol modem compatible with most HART configuration and test software. Included on the CD is the PACTware FDT frame, HART Protocol DTM, and Microflex Generic DTM software. For information on installing PACTware and the DTM, please reference the PACTware Quick Start Guide. Serial communications to the HART modem can be USB, RS-485, or RS-232. The serial port is set for RS-485 protocol, 1200 baud, odd parity by default. Use the HM Configurator app, included on the CD, to change the port settings.

If Fill Modbus Registers mode is enabled, MicroLink-HM will function as a HART master (primary or secondary) continuously polling devices and storing variable values into registers. No additional HART software is needed. The HART loop may contain a single device or up to 16 devices. When more than one device is in the loop each HART device must have a unique HART polling address. The address for each device is set separately before wiring the device into the multi-drop loop. The HART Device Addresser software application, installed with the HM Configurator app, can be used to assign addresses to HART devices.

Modbus-RTU command 3 is used to read the registers from the MicroLink-HM modbus slave. Variable data can be read as 16 bit integers or 32 bit floating point. Up to 4 variables plus loop current for each polled HART device is available.

If configured to Fill Modbus Registers and a HART packet is received on the USB or RS-485/RS-232 port MicroLink-HM will temporarily switch to HART modem mode and pause polling devices. A packet type is identified by monitoring the first byte received in a new packet. HART protocol packets always begin with a hex FF preamble character and modbus packets begin with the slave address. If no HART commands are received over the serial port for 60 seconds, or if a modbus slave address is received, MicroLink-HM will exit HART modem mode and resume polling and filling modbus registers.

Modbus port type, slave address, baud rate, parity, and other settings are set using the HM Configurator app software.

## **MicroLink-HM Configuration**

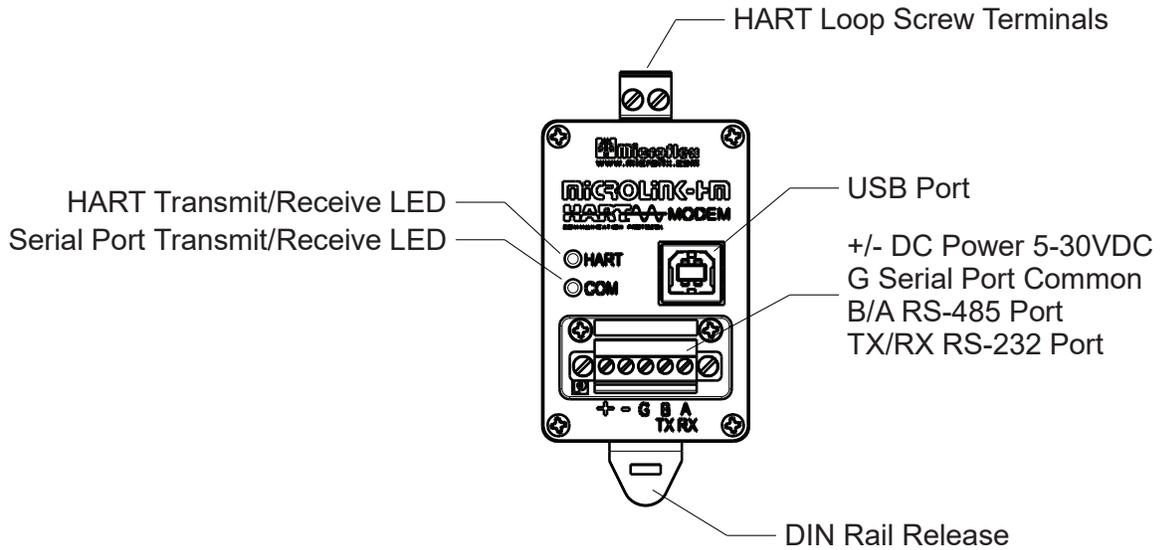
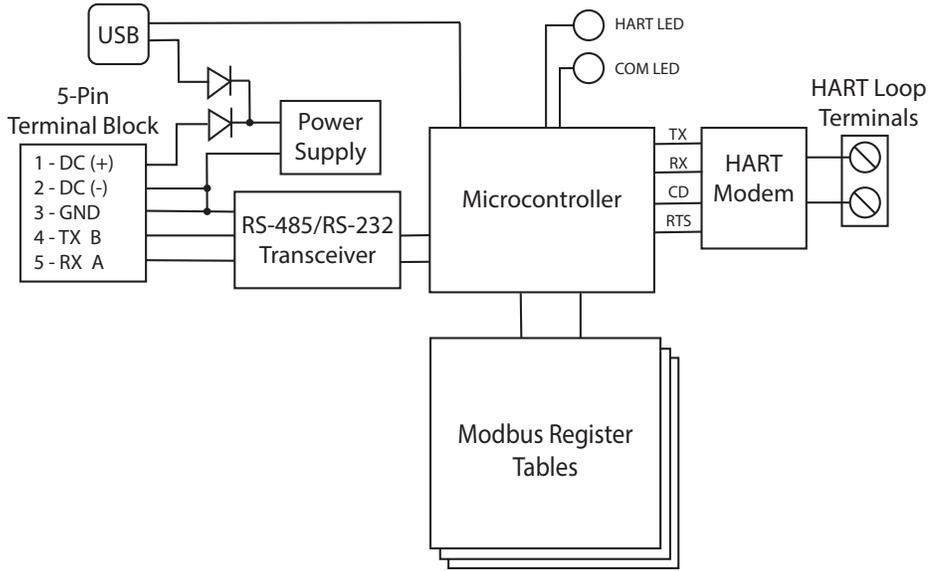
---

Configuration changes are done using the included HM Configurator app. The app can be connected to the MicroLink-HM+ USB port or to the RS-485/RS-232 serial port. The serial port was set at the factory to RS-485 mode. To change the serial port to RS-232 mode you must connect using the USB port first.

The USB port can supply power to the MicroLink-HM. This allows you to make configuration changes without connecting an external power supply.

Refer to the HM Configurator App manual for details on installing and using the configuration software.

**MicroLink-HM+ Block Diagram**



## Mounting

The DIN rail mounting clip is compatible with widely used 35mm EN 50022 rails. It can be snap mounted and removed from the mounting rail without tools for quick installation and servicing.

## Power Supply

MicroLink-HM+ requires an external 5 to 30 volt DC power supply.

Positive side to Pin 1, and negative side to Pin 2 on the 5-pin screw terminal block.

Maximum supply current ranges from 5mA at 30 volts to 25mA at 5 volts.

In most cases the transmitter loop power supply can be used to power MicroLink-HM, eliminating the need for a dedicated MicroLink-HM supply.

Power can also be supplied by an active enumerated USB port, making configuration possible with only a USB connection. MicroLink-HM+ can function as a USB to HART protocol modem without the need for an external power supply.

## Connecting to a HART Loop

Connect the two screw terminals to the HART device or HART loop. MicroLink provides electrical isolation between the HART loop and the serial port so it is safe to ignore grounding and polarity issues when making the HART connections. Figure 1 shows one device and multi-drop HART loop connections.

**⚠ The HART protocol requires a loop resistance of 230 to 600 ohms, typically 250 ohms.**

Refer to your equipment installation instructions for details on connecting a HART master or configuration device to the loop.

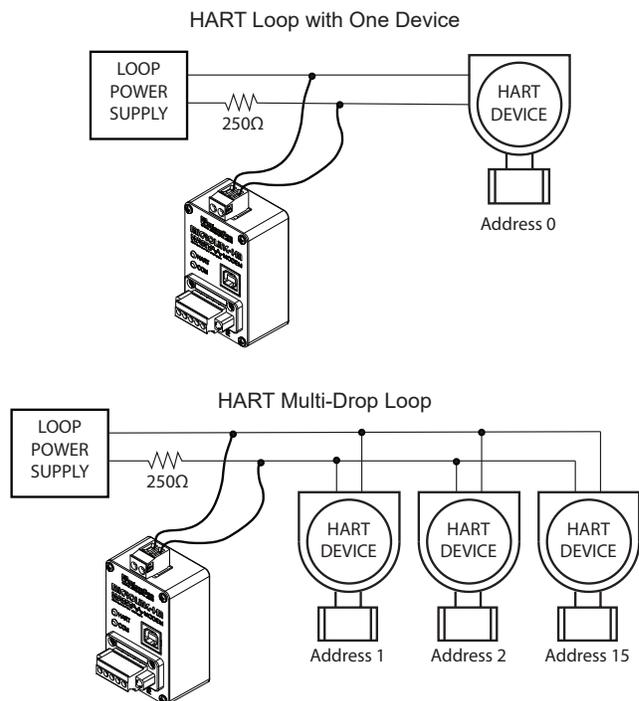


Figure 1. Connecting HART modem to device loop.

## Serial Port

---

The serial port can be configured for RS-485 or RS-232 protocol using the HM Configurator app software or by writing to modbus register 775. The factory default is RS-485 mode, 1200 baud odd parity.

### RS-485 Serial Protocol

An RS-485 bus can consist of multiple RS-485 devices connected in parallel to a bus cable. To eliminate line reflections, each cable end should be terminated with a termination resistor whose value matches the characteristic impedance of the cable. This method, known as parallel termination, allows for higher data rates over a longer cable length. MicroLink-HM+ does not include internal RS-485 termination internally.

- Connect terminal G to the RS-485 bus shield or ground wire. Internally connected to Supply (-) or ground
- Connect terminal B to the RS-485 bus B or (+)
- Connect terminal A to the RS-485 bus A or (-)



MicroLink-HM does not provide isolation between the RS-485 port and power supply ground. The G terminal is internally connected to the power supply (-) terminal.

### RS-232 Serial Protocol

By default the serial port is set to RS-485 protocol. Connect HM Configurator app software to the MicroLink-HM USB port to change the serial port to RS-232 mode using the **Setup -> Modbus** dialog.

Figure 2 shows typical wiring connections to connect to a 9-Pin RS-232 connector. Only transmit, receive, and ground are used.

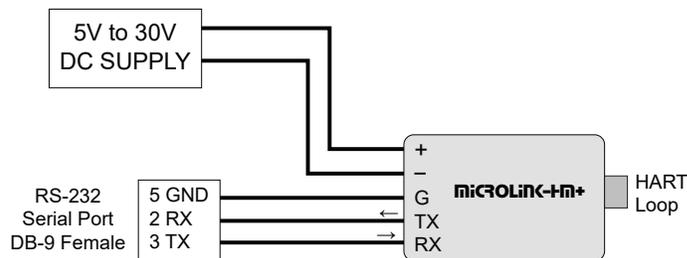


Figure 2. Connecting to DB-9 RS-232 9-Pin serial port.

## USB Port

---

The USB port can be used for device configuration, monitoring, or as a USB to HART protocol modem. MicroLink-HM can distinguish between HART and modbus packets. When a HART protocol packet is received on USB it will be routed directly to the HART modem and transmitted onto the HART loop. If MicroLink-HM is polling devices the polling process will be disabled while the HART command is being processed. Polling will be re-enabled after 60 seconds of no HART packet activity on the USB port or if a modbus packet is received on the USB port.

### USB Drivers

USB drivers create a virtual serial COM port that appears as a serial port to your application software. If your PC is connected to the Internet the drivers will be automatically downloaded and installed when the HM modem is first connected to a USB port. The drivers can also be installed before connecting to the USB port by running file **CDM21228\_Setup.exe** from the included CD. To download drivers go to [www.microflx.com/pages/drivers](http://www.microflx.com/pages/drivers).

The USB virtual serial port operates at 1200 baud and odd parity, slave ID 250, and uses standard modbus commands to read and write registers.

Use the Windows Device Manager to determine the assigned Com port number. It will be listed under Ports (COM & LPT) while the cable is attached to the MicroLink-HM+ USB port.

## **Modbus Registers**

---

Register locations and details can be found in the HM Configurator software manual. The manual is included on the CD and can be downloaded from [www.microflx.com](http://www.microflx.com).

### **Write Locking**

Writing to registers can be locked or write-protected after setting the configuration to prevent unwanted changes to the configuration. Refer to the HM Configurator software manual for details on write locking and unlocking registers.

### **Polled HART Devices Long Address Table, 700 - 747**

Device ID information is read from each polled device using the devices polling address and HART command 0. The reply to command 0 for each polled device is used to populate the long address table. When MicroLink-HM needs to poll for the device variables, using HART command 3, this table holds the information needed to build the 5-byte long address. Table values can be read using modbus-RTU command 3. Only the polled devices you have configured will contain valid information. The table is updated when the device address is unknown or a bad HART reply was received.

### **HART Device Polling Address Table, 748 - 755**

The polling address for each polled device is stored in this table. Two polling addresses in each 16 bit register. If address 0 is used then only one device can be polled and Device 1 should be set to 0. Address 0 is not valid in multi-drop systems. For HART devices with HART revision 3 through 5 you should use polling addresses 1 - 15. Addresses 16-63 require HART revision 6 or higher.

### **Number of Decimal Places Table, 756 - 771**

When storing the HART variable data in 16-bit modbus registers the maximum range is -32768 to 32767. To increase the possible resolution, the variable value read from the HART device is decimal position adjusted before being saved in the 16-bit register. When the register is read, the value must be corrected by the number of decimal places to produce the correct value. The number of decimal places for each variable occupies 4-bits in the register with one register for each polled device.

### **Setup Registers, 772 - 777**

The MicroLink-HM configuration can be changed using the HM Configurator App or by writing to modbus registers using modbus-RTU commands 6 or 16. Command 6 writes to a single register and command 16 writes to a range of modbus registers. The configuration register values are saved in nonvolatile memory and are not lost when MicroLink-HM power is removed.

## Specifications

---

### Power

Supply Range.....	5 to 30 Volts DC
Max Operating Current .....	25mA @ 5V, 5mA @30V
Typical Operating Current .....	8.8mA @ 12V, 5.2mA @ 24V

### Field Connections

Termination .....	Pluggable Screw Terminal, 26-16 AWG
+ Power Supply (+) .....	Pin 1
- Power Supply (-) .....	Pin 2
G Serial Port Ground <i>Internally connected to Supply (-)</i> .....	Pin 3
TX B RS-485 (+), RS-232 Transmit .....	Pin 4
RX A RS-485 (-), RS-232 Receive .....	Pin 5

### HART Modem

Termination .....	Pluggable Screw Terminals, 26-12 AWG
Connection Method .....	Transformer Isolated, Capacitor Coupled
Loop Isolation.....	3000Vrms 1 min Pri-Sec Dielectric Strength
DC Loop Voltage.....	50Vdc Max
Demodulation Jitter .....	12% of 1 bit Typical
Carrier Detect Threshold.....	100mV Typical
Leakage to Process Loop .....	±10µA Max

### Serial Port

Baud Rates .....	1200, 2400, 4800, 9600, 14400, 19200, 39400, 57600
Parity .....	None, Odd, Even
Protocol.....	HART or Modbus-RTU, Commands 3,6,16
Floating point byte order .....	AD-CD or CD-AB (swapped)
Number of polled HART devices .....	1 to 16
Variables per polled HART device .....	(4) PV, SV, TV, FV
Supported Modbus-RTU Commands .....	3, 6, 16
Surge Protection.....	600W Silicone Avalanche Diodes
±15kV (HBM) ESD Protected Bus (RS-232 or RS-485)	

### RS-485 Mode

Driver Output Voltage .....	2V Min Unloaded, 1.5V Min RL = 50Ω
Δ Input Threshold Receive Voltage .....	+/- 0.2V
Receiver Input Hysteresis.....	35 mV Typ
Receiver Input Current.....	+/- 1mA Max
Does not include RS-485 termination resistor	
• Auto transmit control	
• Power Up/Down glitch-free permits live insertion or removal	
• Common mode range permits +/-7V ground difference	

### RS-232 Mode

Receiver Input Voltage Range .....	+/-25V
Receiver Input Threshold .....	VIL 1.1V, VIH 1.6V
Receiver Input Hysteresis.....	35mV
Transmitter Output .....	+/-5V Typ

### USB

Connector .....	USB-B
Type & Settings .....	FTDI Virtual Com Port, 1200 Baud, 8, O, 1
Protocol.....	HART or Modbus-RTU, Slave address 250, Commands 3,6,16

### HART LED

Green .....	HART Modem is transmitting
Red .....	HART modem is receiving

### COM LED

Green .....	Serial Port is Transmitting
Red .....	Serial Port is Receiving

**Default Settings**

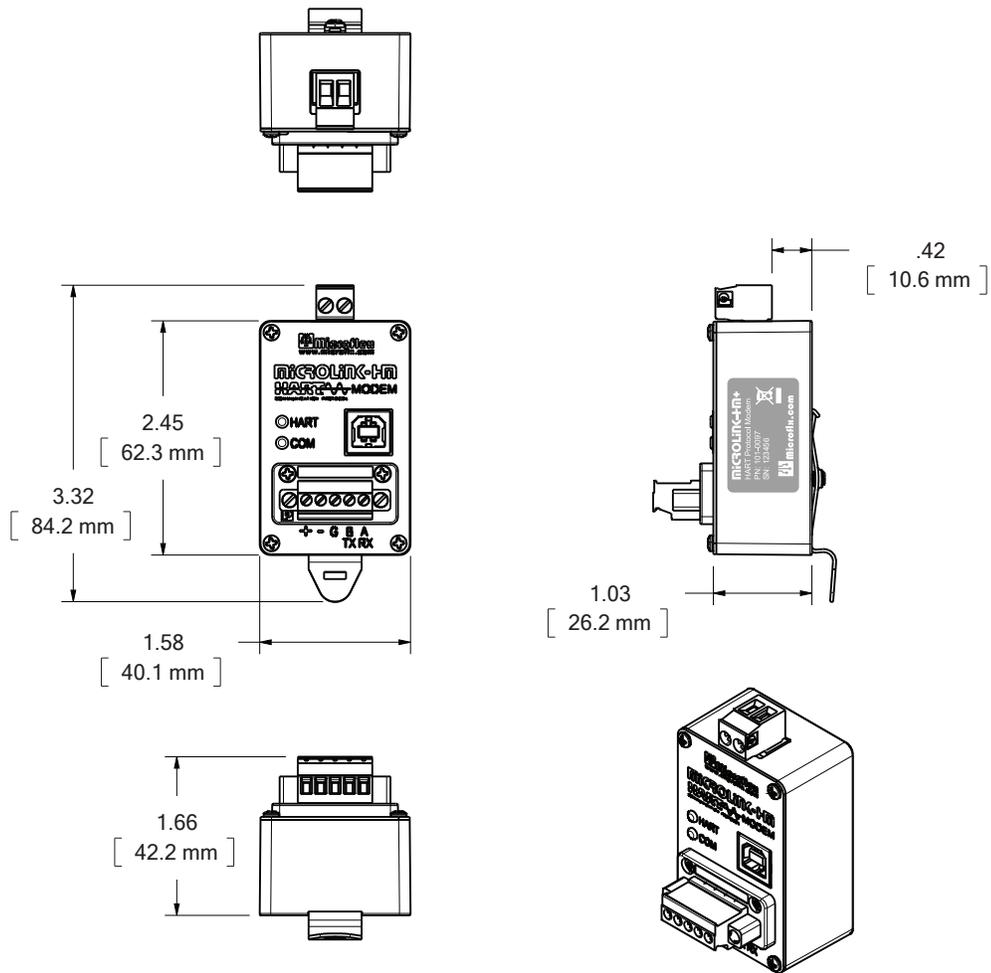
Serial Port.....RS-485 Mode, 1200 Baud, Odd Parity, 1 Stop  
 Modbus Address ..... 1  
 Fill Modbus Registers .....Disabled (HART Protocol Modem Mode)  
 Poll Interval ..... 2 Seconds

**Environmental**

Operating Temperature.....-30°C to 60°C (-22°F to 140°F)  
 Storage Temperature .....-40°C to 85°C (-40°F to 185°F)  
 Humidity ..... 0 to 95% (non-condensing)

**Enclosure**

Polycarbonate plastic with Stainless Steel Cover  
 Weight.....2.3 ounces  
 Mounting ..... 35mm DIN Rail Clip



### ***Limited Warranty***

---

Microflex, LLC warrants this unit against defects in materials and workmanship for a period of one year from the date of shipment. Microflex, LLC will, at its option, repair or replace equipment that proves to be defective during the warranty period. This warranty includes parts and labor.

A Return Materials Authorization (RMA) number must be obtained from the factory and clearly marked on the outside of the package before equipment will be accepted for warranty work.

Microflex, LLC believes that the information in this manual is accurate. In the event that a typographical or technical error exist, Microflex, LLC reserves the right to make changes without prior notice to holders of this edition. The reader should consult Microflex, LLC if any errors are suspected. In no event should Microflex, LLC be liable for any damages arising out of or related to this document or the information contained in it.

EXCEPT AS SPECIFIED HEREIN, MICROFLEX, LLC MAKES NO WARRANTIES OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. CUSTOMER'S RIGHT TO RECOVER DAMAGES CAUSED BY FAULT OR NEGLIGENCE ON THE PART OF MICROFLEX SHALL BE LIMITED TO THE AMOUNT THEREFORE PAID BY THE CUSTOMER. MICROFLEX, LLC WILL NOT BE LIABLE FOR DAMAGES RESULTING FROM LOSS OF DATA, PROFITS, USE OF PRODUCTS, OR INCIDENTAL OR CONSEQUENTIAL DAMAGES, EVEN IF ADVISED OF THE POSSIBILITIES THEREOF. This limitation of the liability of Microflex, LLC will apply regardless of the form of action, whether in contract or tort, including negligence. Any action against Microflex, LLC must be brought within one year after the cause of action accrues. The warranty provided herein does not cover damages, defects, malfunctions, or service failures caused by owners failure to follow Microflex, LLC's installation, operation, or maintenance instructions; owners modification of the product; owner's abuse, misuse, or negligent acts; and power failure or surges, fire, flood, accident, actions of third parties, or other events outside reasonable control.

*Microflex, LLC  
35900 Royal Road  
Pattison, Texas 77423  
USA*

*Phone 281-855-9639  
Fax 832-422-4391  
[www.microflx.com](http://www.microflx.com)*