InLink-HM™
101-0014

Transformer Coupled HART® Protocol Modem & Modbus Accumulator Module for OEM Applications

General Description

InLink-HM is a complete modem for Highway Addressable Remote Transducer (HART) communications. It allows designers to easily implement a HART compliant modem - without knowledge of the HART physical layer requirements. InLink-HM is intended to be used as a HART primary or secondary master. Communications direction control is handled internally so there is no need to handle tricky carrier detect (CD) and request-to-send (RTS) handshake timing, greatly simplifying software development.

InLink-HM can also be used as a HART to modbus Accumulator. It can be configured to poll up to 16 HART devices and save the HART device data into modbus registers. Modbus RTU commands can then be used to read the HART device data. Configuration can be done using the Microflex HM Configuration software or by writing to modbus registers using modbus RTU commands. InLink-HM requires only two controller I/O pins; transmit data (TXD) and receive data (RXD). Serial port baud rates can be set from 1200 to 57,600 and parity can be odd, even, or none. HART protocol communications between the InLink-HM and HART devices is always 1200 baud, odd parity. Inlink-HM includes transformer galvonic isolation, eliminating grounding and polarity issues.

HART or modbus command packets are shifted into the (TXD) input pin. Received HART or reply modbus packets are shifted out on the (RXD) output pin at the configured baud rate and parity. The Driver Enable (DE) output pin can be used for RS-485 transceiver direction control. A logic high on (DE) indicates HART or Modbus reply packets are being shifted out on (RXD). (DE) will remain high until all bytes are shifted out.

In modbus fill mode, the selected HART devices are continuously polled and internal modbus registers filled with variable data. Modbus RTU command 3 is used to read the registers.

HART® Protocol

The HART protocol is supported by the HART Field Comm Group, 9430 Research Blvd., Austin Texas 78759, USA. HART protocol specifications are available from the FieldComm Group.
Visit www.fieldcommgroup.org for details.

Features

- Complies with HART Protocol Physical Layer
- Transformer Isolation Eliminate Grounding Effects and Polarity Issues
- Modem Module - Reduces Time-To-Market
- Small Footprint - Simplifies Design Integration
- Rugged Encapsulated Package with Gold Plated Pins for Increased Reliability
- Through-hole or Socket mounting
- Supply Range (2.7V to 3.6V)
- Industrial Temperature Range, -40°C to +85°C
- Transmit Signal Wave-Shaping Sinusoidal Output with Lowest Harmonic Distortion
- Receive Band-Pass Filter
- CMOS Compatible (3.3V)
- Low Power
- Evaluation Boards Available
- RS-485 Transceiver Direction Control - DE

Applications

- Conversion between other communications protocols and the HART physical layer
- Remote Data Logging
- SCADA Units with HART capabilities
- Flow Computers
- Fieldbus - HART Interfaces
- Wireless HART Interfaces
- HART Multiplexor
- HART to RS-485 Converter
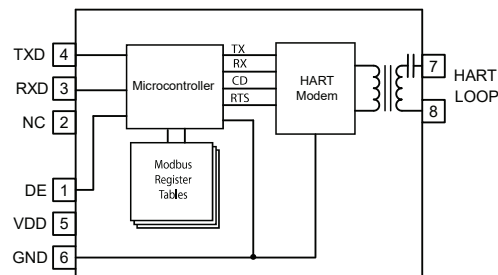- HART to Modbus Accumulator

Block Diagram

Figure 1. InLink-HM Block Diagram

Microflex

Typical Application

The InLink-HM application shown in Figure 2 is for an RS-485 HART protocol interface master with modbus accumulator. Pins A, B, and Ground of the RS-485 transceiver can be connected to an RS-485 network bus and used with most HART configuration software. A similar circuit was used on the InLink-HM evaluation board (Microflex part number 101-0093). The evaluation board uses a Texas Instruments SN65HVD12D RS-485 transceiver and can be used to evaluate the InLink-HM module. Contact Microflex for additional information on the InLink-HM evaluation board and software.
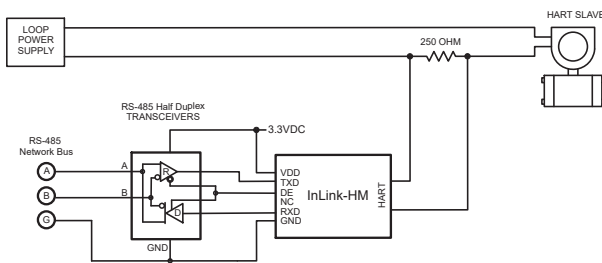

Figure 2. Typical Application RS-485 to HART Interface

Configuration

The InLink-HM configuration is done using the TXD and RXD serial port. Modules are shipped with the port set to 1200 baud odd parity, modbus slave address 1. Settings are saved in modbus registers. For information on configuration registers refer to the InLink-HM Setup Software, Installation & Operation manual 620-0021.

Application Considerations

Power Considerations

The InLink-HM power supply, VDD, should be heavily filtered to prevent noise from interfering with the received HART data and receiver filter. VDD should have less than ±50mV P-P noise. Wait at least 25 milliseconds after power on before starting any communications transactions.

Connecting to the HART Loop

The HART protocol requires that a HART modem be coupled to the field device loop in a way that does not interfere with the current loop. InLink-HM includes the necessary components to simplify this. There is no need to consider polarity or ground issues between the HART network and the InLink ground. InLink provides the necessary isolation between the modem interface and the HART loop. In most cases the two HART pins can be connected directly to the HART loop in the same way that any other HART modem can be connected. The HART protocol requires a loop resistance of 230 to 600 ohms, typically 250 ohms.

Pin Descriptions

1 - DE Driver Enable is a digital output. A logic high indicates that a HART or modbus reply packet is being shifted out serially on RXD. DE can be used for RS-485 transceiver direction control.

2 - NC No Connection

3 - RXD RXD output pin uses 3.3 volt CMOS logic levels. If InLink-HM is in HART modem mode the RXD pin will shift out HART reply packets at the configured baud rate and parity settings. In modbus command mode RXD will shift out the modbus reply packets at the configured baud rate and parity settings.

4 - TXD TXD input pin uses 3.3 volt CMOS logic levels. TXD accepts either HART or modbus formatted serial data at the configured baud rate and parity.

5 - VDD This is the InLink-HM power input. To ensure a valid power on reset VDD should rise from 0V to 3V in less than 1ms. VDD should be between 2.7V and 3.6V and have less than 50mv P-P noise. Wait at least 25ms after power on before starting a HART transaction

6 - GND InLink-HM ground.

HART These two pins are the HART protocol interface to the InLink-HM modem. The interface is transformer isolated and AC coupled. Follow the same loop connection requirements outlined for all HART masters when connecting InLink-HM to a HART loop.

Additional Documentation

Additional application information, including the modbus register maps, Microflex HM configuration software and application notes are available for download at www.microflx.com.

The Microflex HM software CD includes the HM program, documentation in PDF format, and the HART device addressing tool program. The CD does not ship with each InLink-HM but is available at no charge. The files are also available for download at www.microflx.com.

Absolute Maximum Ratings

Supply Voltage   3.6V

DC Input, Output   -0.3 Min, V_{DD} + 0.3 Max

Storage Temp. Range -55°C to 150°C

Operating Ratings
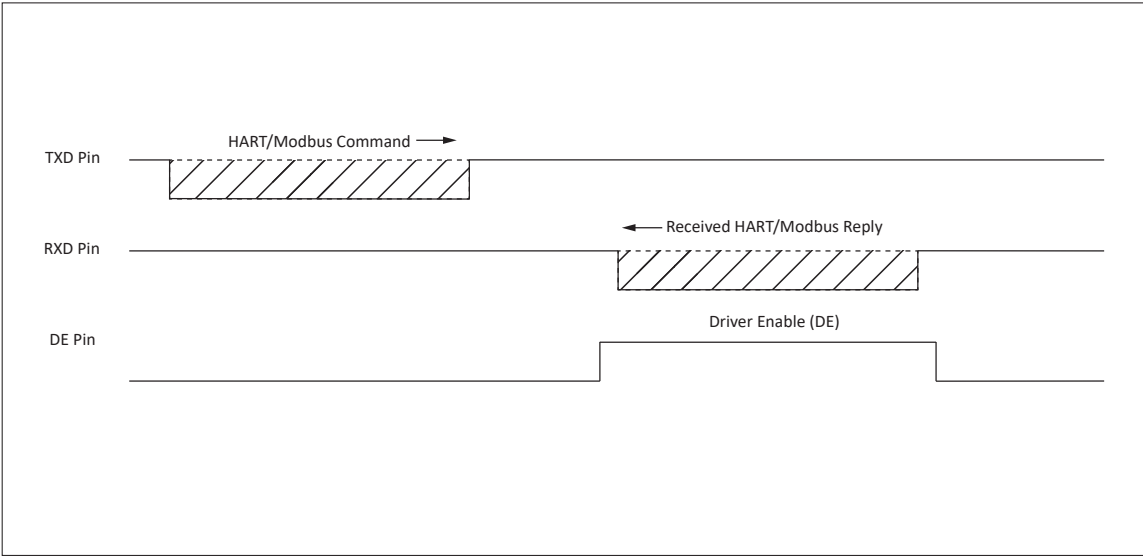
Supply Voltage   2.7V to 3.6V

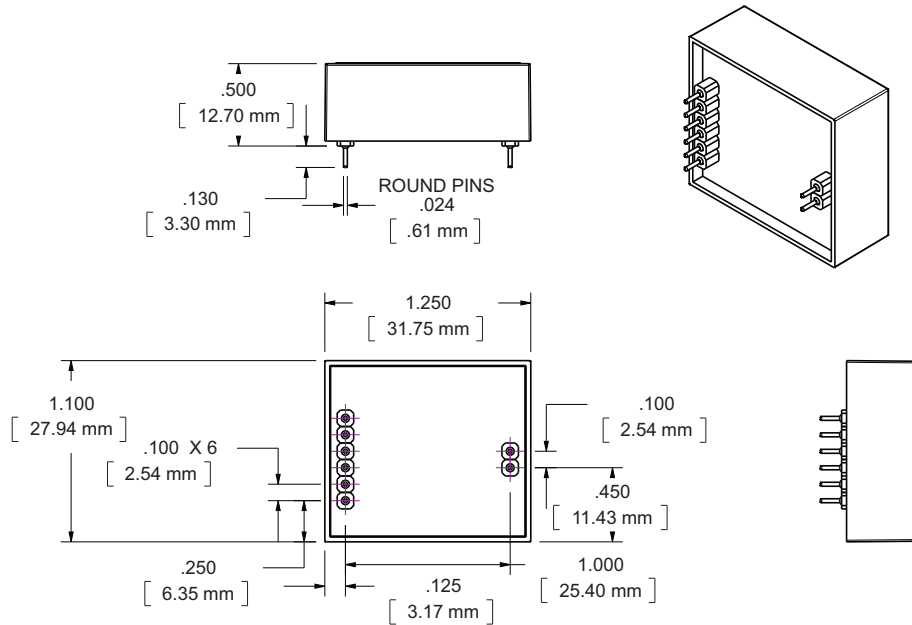Temperature Range   -40°C to 85°C

Cautions:

1. CMOS devices are damaged by high-energy electrostatic discharge. Modules must be stored in conductive foam or static bags.
2. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability and cause permanent damage to the module.
3. Remove power before insertion or removal of this module.

Symbol	Parameter	V_{DD}	Min.	Typ.	Max.	Units
V_{IL}	Input Voltage - Low	3.3			0.15 x VDD	V
V_{IH}	Input Voltage - High	3.3	0.25 x VDD + 0.8			V
V_{OL}	Output Voltage - Low (IOL=6mA)	3.3			0.6	V
V_{OH}	Output Voltage - High (IOH=3mA)	3.3	VDD - 0.7			V
C_{IN}	Input Capacitance			2.9		pF
$I_{IL/IH}$	Input Leakage Current				±500	nA
I_{OLL}	Output Leakage Current				±10	µA
I_{DTX}	Supply Current HART Transmit (250 Ω Load)	3.3		4.8	5.2	mA
I_{DI}	Supply Current Idle	3.3		1.3		mA
J_{D}	Demodulator Jitter			12		% of 1 bit
R_{PO}	Power On Reset			0.5	2	mS
P_{OD}	Power On Delay		25			mS

DE- Driver Enable

Physical Dimensions

.500
[12.70 mm]

ROUND PINS
.024
[.61 mm]

.130
[3.30 mm]

1.250
[31.75 mm]

1.100
[27.94 mm]

.100 X 6
[2.54 mm]

.100
[2.54 mm]

.450
[11.43 mm]

.250
[6.35 mm]

.125
[3.17 mm]

1.000
[25.40 mm]

PCB PATTERN RECOMMENDATION

Ø.035 HOLES
[Ø.89 mm]

Ø.060 PAD
[Ø1.52 mm]

TOP VIEW

6 - GND
5 - VDD
4 - TXD
3 - RXD
2 - NC
1 - DE

HART
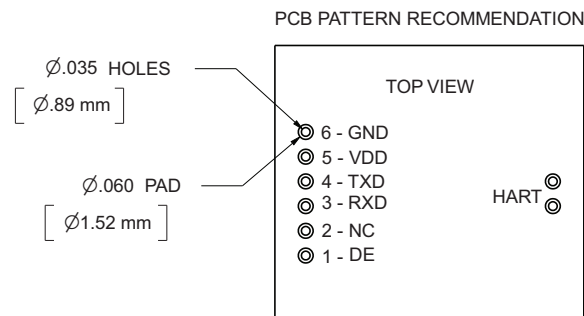
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