HM-APL-PCB User Manual

Introduction

The HM-APL-PCB converts existing HART transmitters to the new Ethernet Advanced Physical Layer (APL) interface. The PCB offers an easy migration path for existing HART Transmitters. The PCB can be modified to incorporate custom features or size requirements (see HART-APL-DEV).

System Diagram

The complete HART to APL system consists of a HART transmitter, the HM-APL-PCB, a 12Vdc power supply, an APL switch, an Ethernet switch, and a host device running a HART-IP compliant App.
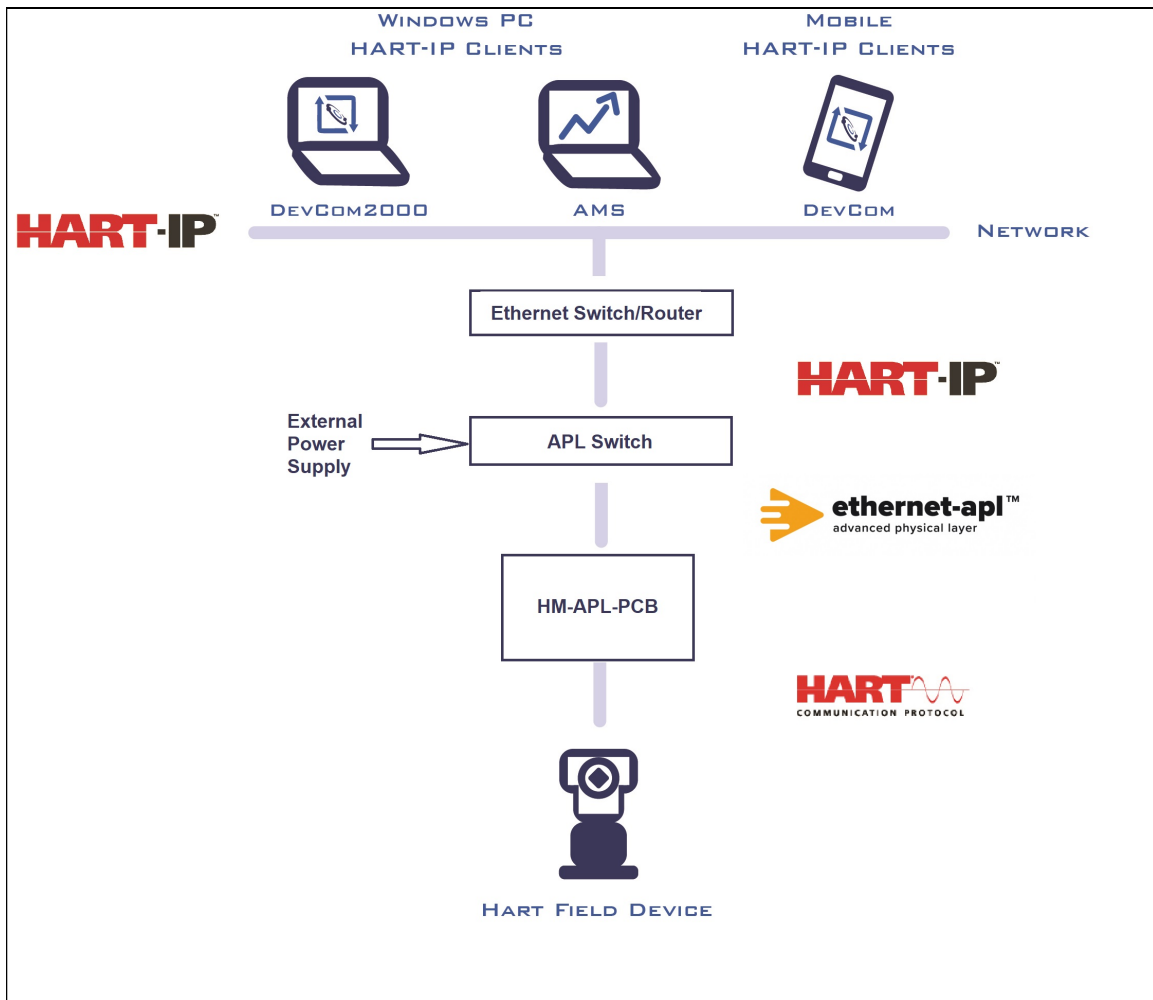

Figure 1. HART-APL System Diagram

PCB Block Diagram

The HM-APL-PCB consists of the APL interface and the HART interface. Firmware runs on a ST microelectronics microcontroller. Peripheral interfaces are available for example, adding memory and analog measurement circuits.
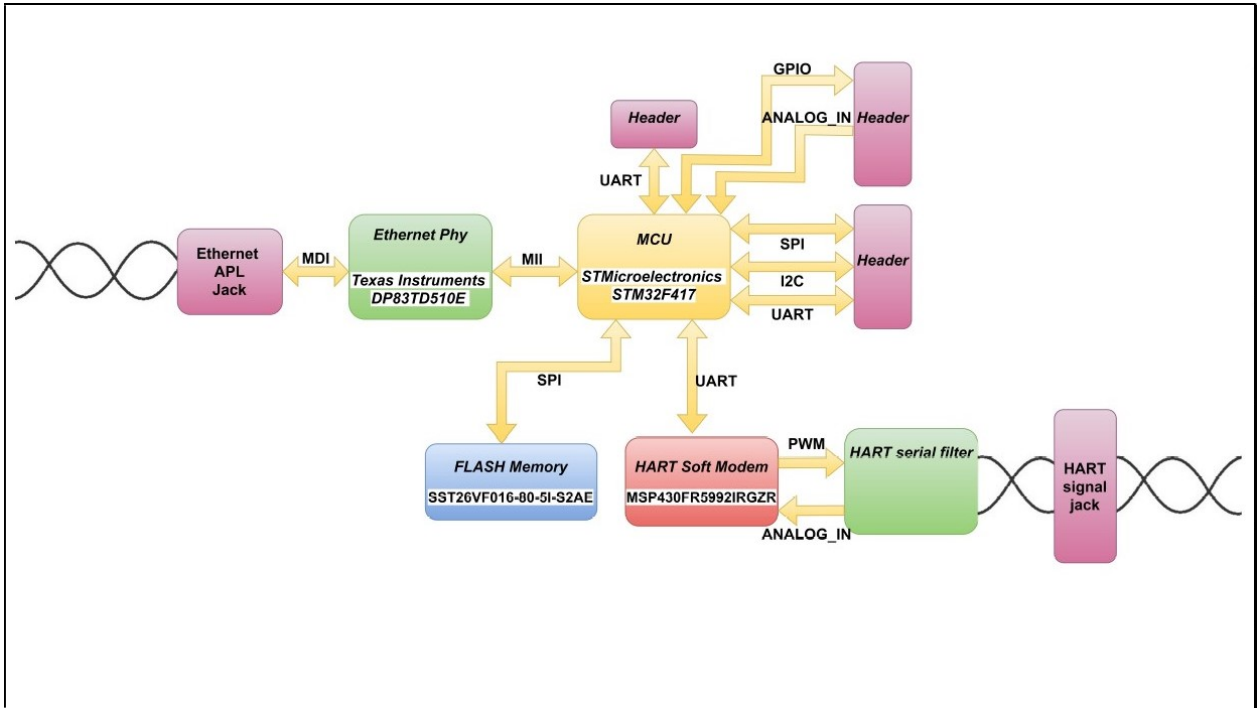
Figure 2. HM-APL-PCB Block Diagram

HART Connections

A two terminal wire connector is used to make the connection to the existing HART transmitter. A HART power supply is NOT needed. A loop resistor is also not needed. The PCB supplies loop power to the HART transmitter. Note that polarity it important. The HART + connects to the Loop + terminal of the HART device and the HART - connects to the Loop - terminal.
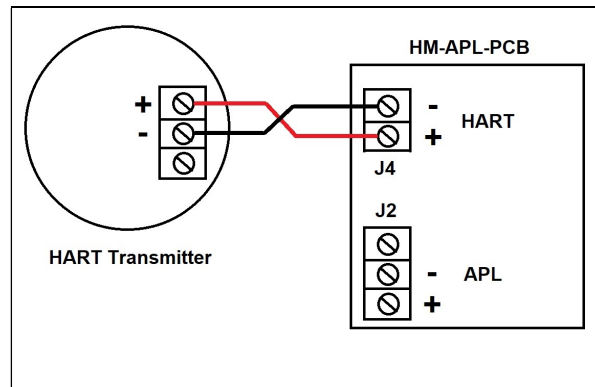
Figure 3. HART Connections

HART Polling Address
Using a HART Communicator, set the HART transmitter to Polling Address 1. This puts the transmitter in a fixed current modem (4mA). This only needs to occur 1 time. Also, the APL PCB uses Polling Address 1 to communicate HART as the default setting.

APL Connections
APL is a two wire Ethernet physical layer. APL also provides power to the APL Transmitters. Each APL transmitter is connected via a twisted pair cable to a APL switch or gateway. The switch/gateway supplies power to the individual APL transmitters.

APL Switch/Gateway
When deployed in the field, an APL Switch/Gateway is used. This device must be intrinsically safe and rugged for industrial use. These devices are starting to become available. However, for APL development and testing, a gateway EVM board made by TI can be used. It is not for use in the field.

Low Cost Development Gateway Option
The TI EVM recommended is the DP83TD510E-EVM available from DigiKey, Mouser, etc. The TI EVM setup requires an external 12Vdc supply. The diagram below shows typical setup of the jumpers and headers and power supply connections.
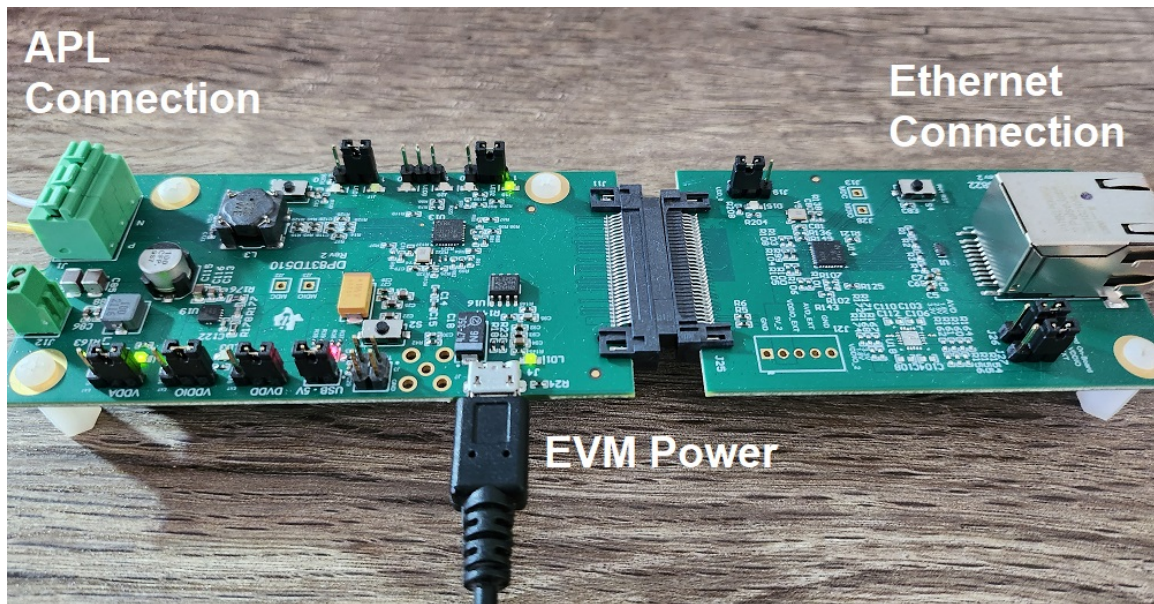

Figure 4. TI EVM Board Configuration

Power Cable for Low Cost Gateway
A special power supply cable must be assembled when using the TI EVM Board. Below is the wiring diagram.
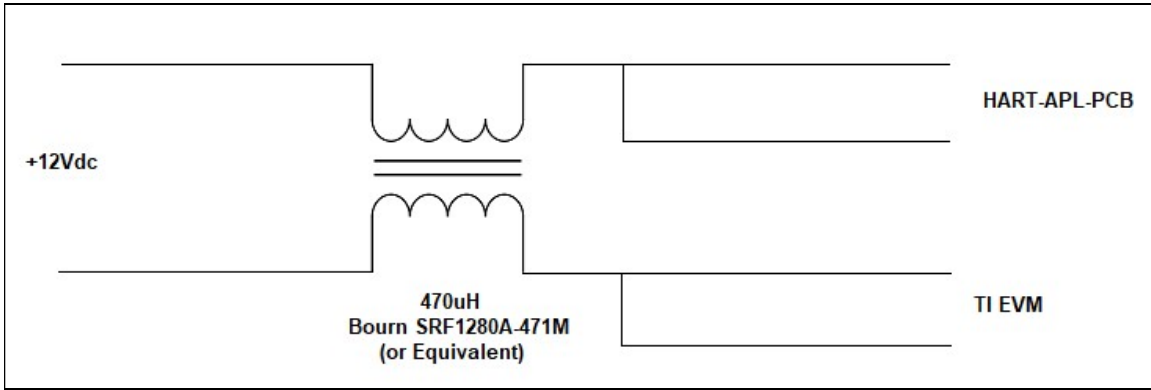
Figure 5. TI EVM Power Cable Wiring Diagram

APL-SW-3, Development APL Switch Option
An easier to use alternative to the low cost gateway option is the ProComSol APL-SW-3, Ethernet-APL Switch, 3 Channels. This switch greatly simplifies APL connections to Ethernet. It requires one standard 24Vdc power supply input. It provides APL connections to 3 APL devices. It has an Ethernet port to connect to the Ethernet network.
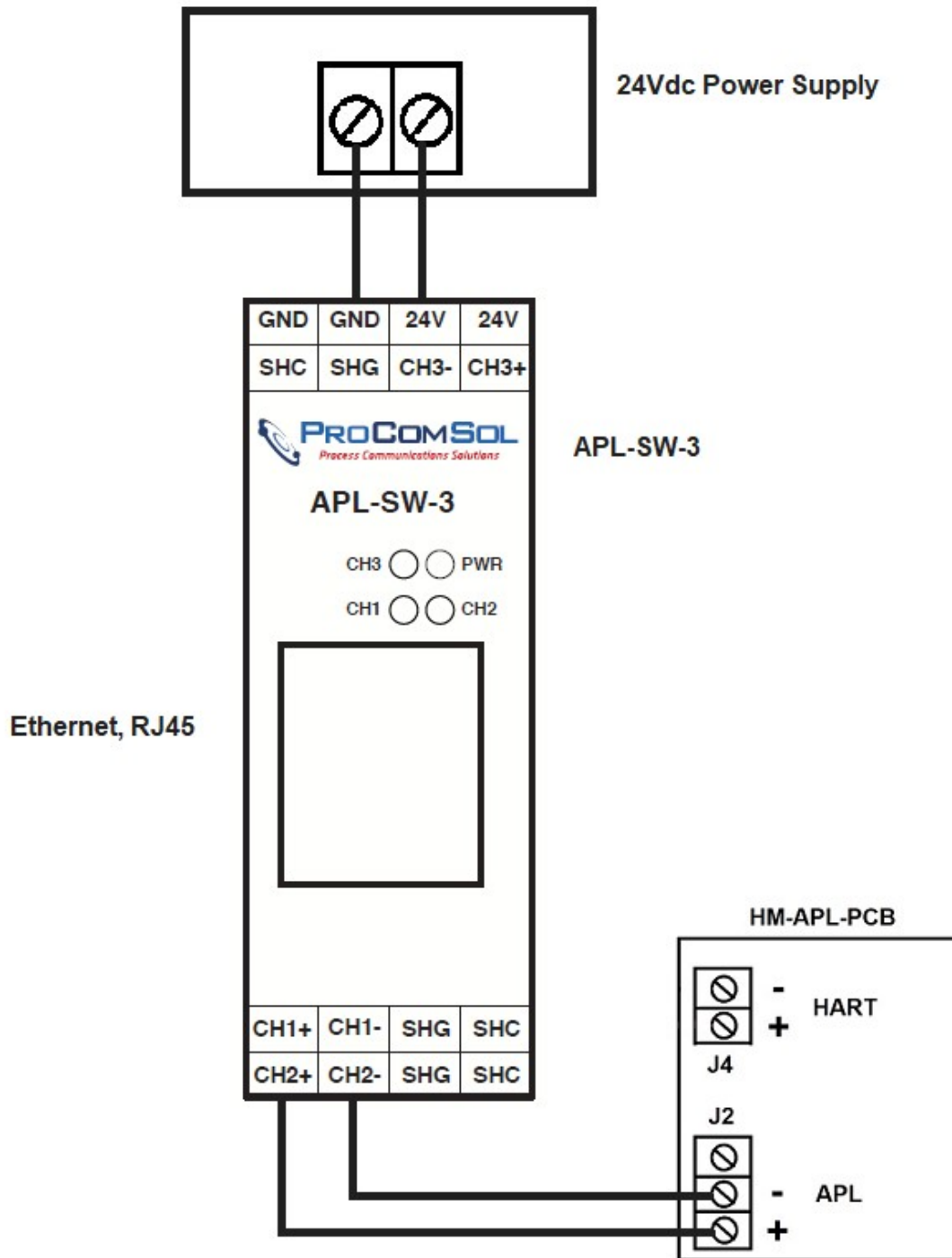
Figure 6. APL-SW-3 Connections

Switches

The PCB has two switches. SW1 is located near the board edge. It is used for board development testing. It is no longer used. SW2 is located near the Bournes transformer. It is used to reset the PCB.

LED Indications

There are three LEDs. D4 is located near SW2. When Green, it means power is applied to the board. D5 is located near J4. When blinking Orange, it means there is APL network activity. When it is solid Green, no APL link is detected.

Headers and Jumpers

The board ships preconfigured for HART to APL adapter. All headers are blank.

J3 APL connector

Pin 1	Shield ground
Pin 2	Loop-
Pin 3	Loop+

J5 I/O Header

Pin 1	Digital I/O	Pin 6	GND
Pin 2	Digital I/O	Pin 7	Analog In
Pin 3	Digital I/O	Pin 8	GND
Pin 4	Digital I/O	Pin 9	Analog In
Pin 5	GND	Pin 10	GND

J4 HART Connector

Pin 1	HART+
Pin 2	HART-

J1 I/O header

Pin 6	I2CSDA	Pin 6	SPI SCK
Pin 7	I2CSCL	Pin 7	SPI MISO
Pin 8	UART TX	Pin 8	SPI MOSI
Pin 9	UARTRX	Pin 9	SPICS
Pin 10	GND	Pin 10	GND

Step by Step Connection Procedure Using Low Cost Gateway

1. Power up the HART transmitter and verify loop current is less than 9mA.
2. Remove connections from Step 1 and connect the Loop + to the HART + terminal on the PCB. Also connect Loop - to the HART - terminal on the PCB.
3. Connect the APL terminals to the APL terminals on the TI demo board.
4. Connect a 12Vdc power supply to the APL interface using the wiring diagram of Figure 5.
5. Connect the USB port to a USB PC port and turn on the 12Vdc supply.
6. Verify D4 LED is green.
7. Verify D6 LED is blinking Orange.

8. Using a Ethernet IP address sniffer, find the IP address for the TI Demo board.

9. Launch DevCom on a device connected to the same Ethernet as the TI Demo board.

10. Configure DevCom to use TCP/IP (HART-IP).

11. Enter the IP address from Step 7.

12. Poll the network.

13. You should see the TI Demo board with the HART transmitter listed as a sub device.

14. Click the HART transmitter.

15. You can now view the HART device using the APL connection. You can edit parameters, run methods, etc. just like if you were connected to the HART device with a HART modem. Except now you are using APL and HART-IP.

Step by Step Connection Procedure Using APL-SW-3

1. Power up the HART transmitter and verify loop current is less than 9mA.

2. Remove connections from Step 1 and connect the Loop + to the HART + terminal on the PCB. Also connect Loop - to the HART - terminal on the PCB.

3. Connect the APL terminals to the APL terminals on the APL-SW-3. There are 3 different channels.

4. Connect a 24Vdc power supply to the APL-SW-3

6. Verify D4 LED is green on the PCB.

7. Verify D6 LED is blinking Orange on the PCB.

8. The APL-SW-3 has default setting of a DHCP server enabled. It will appear on the network as 192.168.2.1. This setting can be changed using the Web UI discussed later in this manual. If you connect the APL-SW-3 directly to your PC's Ethernet port, it should get an IP assigned at 192.168.2.26. As APL devices are added, they appear as 192.168.2.27 (Channel 1), 192.168.2.28 (Channel 2), and 192.168.2.29 (Channel 3).

9. Launch DevCom or some other HART-IP enabled host on a device connected to the same Ethernet network as the APL Switch.

10. Configure DevCom to use TCP/IP (HART-IP).

11. Enter the IP address of the APL channel you wish to communicate on.

12. Poll the network.

13. You should see the APL switch with the APL transmitter listed as a sub device.

14. Tap the APL device.

15. You can now view the APL device using the APL connection. You can edit parameters, run methods, etc.

Warranty

The HM-APL-PCB is warranted for 1 year for materials and workmanship. Contact Support at ProComSol, Ltd if having any problems. An RMA (Return Material Authorization) number obtained from ProComSol, Ltd is required on all returned items.

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