Examples of Sensors
with IEEE 1451 Protocol
(Dot 2 and Dot 4)

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Goal: Demonstrate reference implementation of smart sensors and actuators with IEEE 1451 protocol

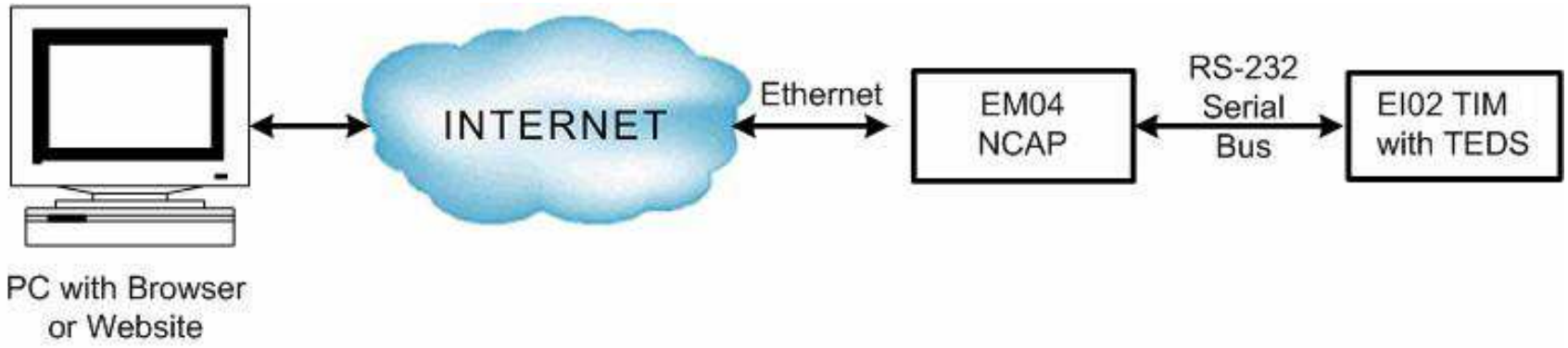
Dot 0 TEDS Compiler Features

- Dot 0 TEDS (and protocol) is comprehensive (282 pages) and thus complex
- A TEDS compiler is a practical necessity for widespread deployment
- Draft version of TEDS reader/writer is available (UB grad student)
- Includes simplified Channel & Calibration TEDS preparation for linear sensors
- Automatic UUID calculation, insertion of default values into required (but often obscure) fields and other features
- Internet-based TIM (and some NCAP) IEEE 1451 conformance test procedures available

Dot 0 TEDS Compiler Screen

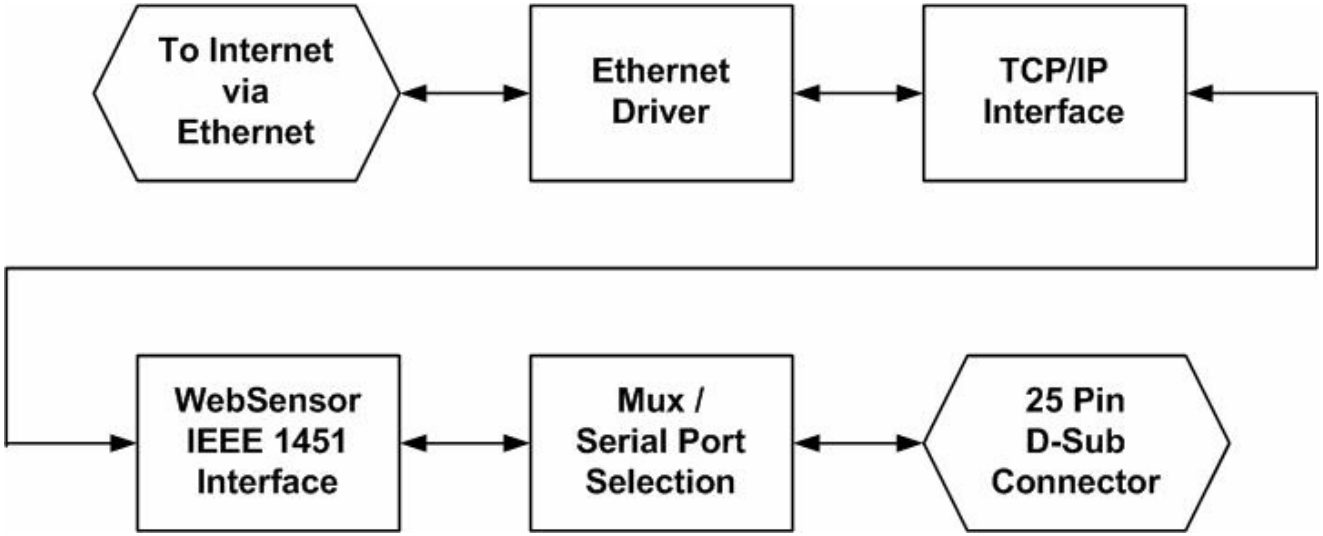
IEEE p1451.2 (Dot 2)
NCAP and TIM

- Uses RS232 (and other serial buses)
- Point-to-point (one TIM per NCAP)
- Proposed revision of Dot 2 (original was TII or augmented SPI)
- TEDS and protocol being revised to conform to Dot 0
- Internet via Ethernet on Network side



Dot 2 NCAP Example

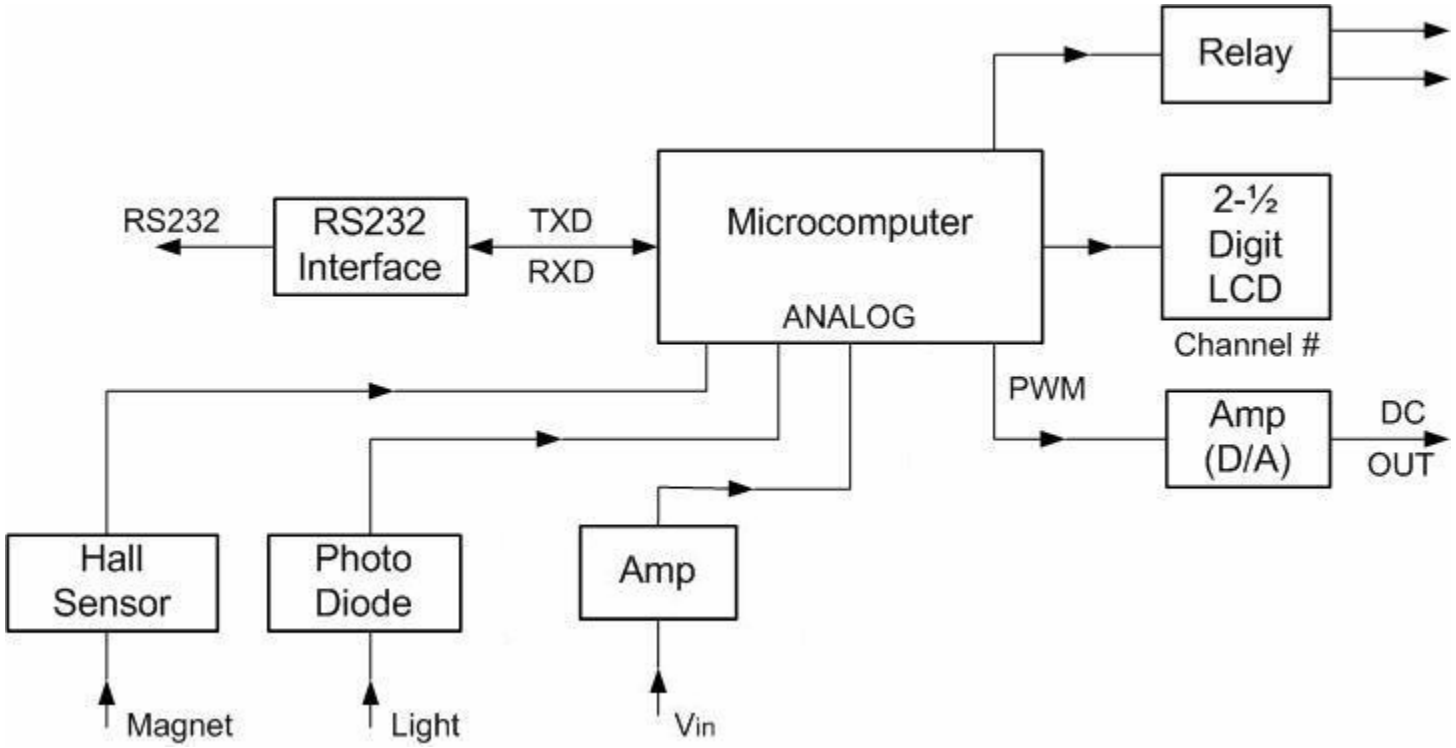
- Uses RS232 (and other serial buses)



NCAP

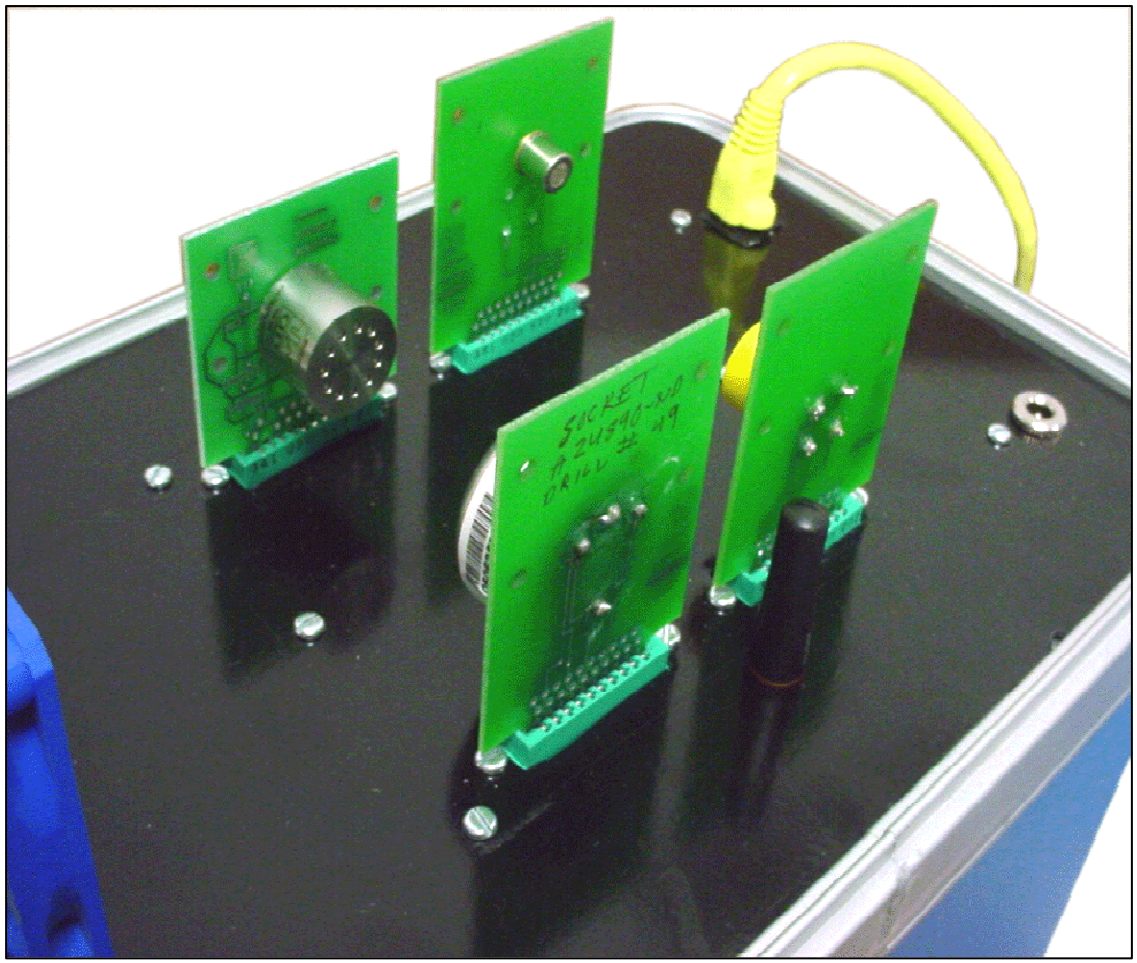
TIM

Dot 2 TIM Example
(3 sensors, 2 actuators)



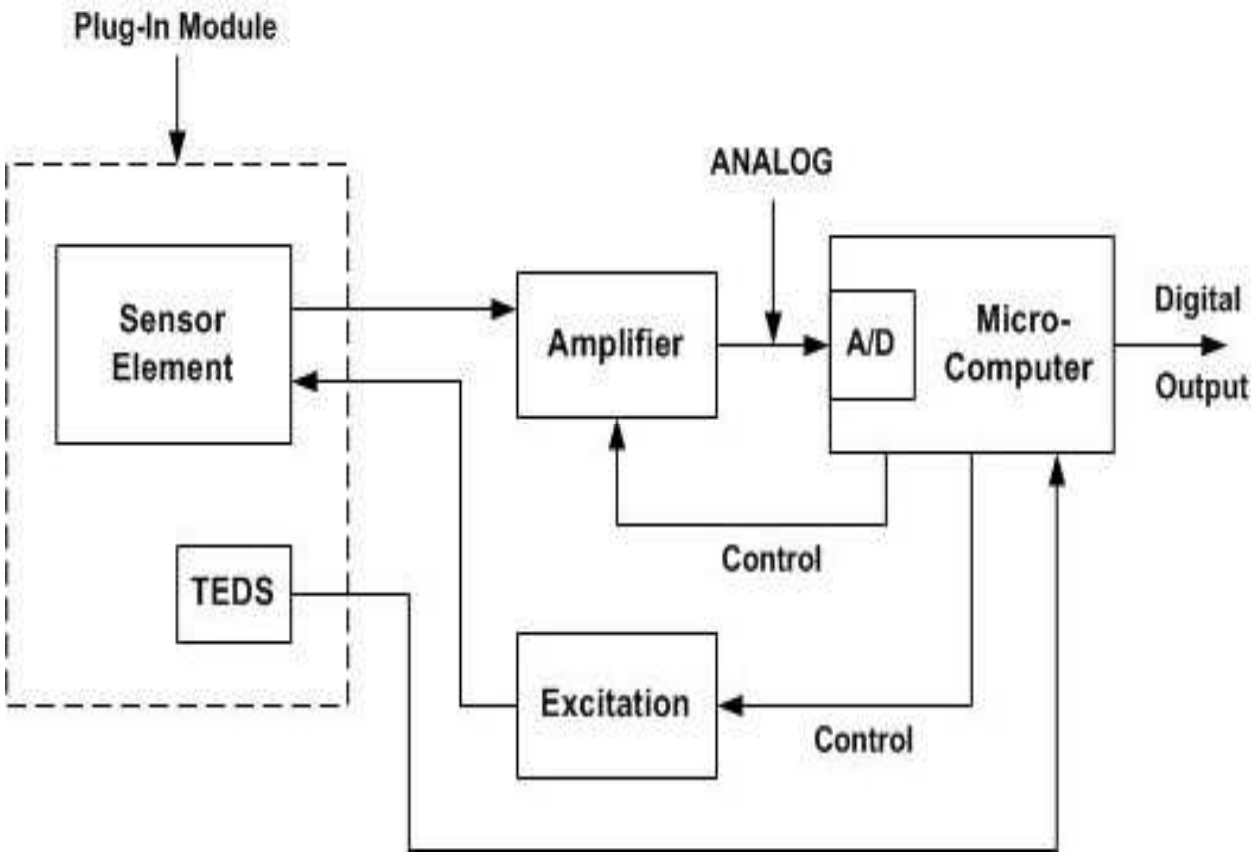
Environmental Monitor

-- a Dot 4 TEDS example with plug-in gas sensors--

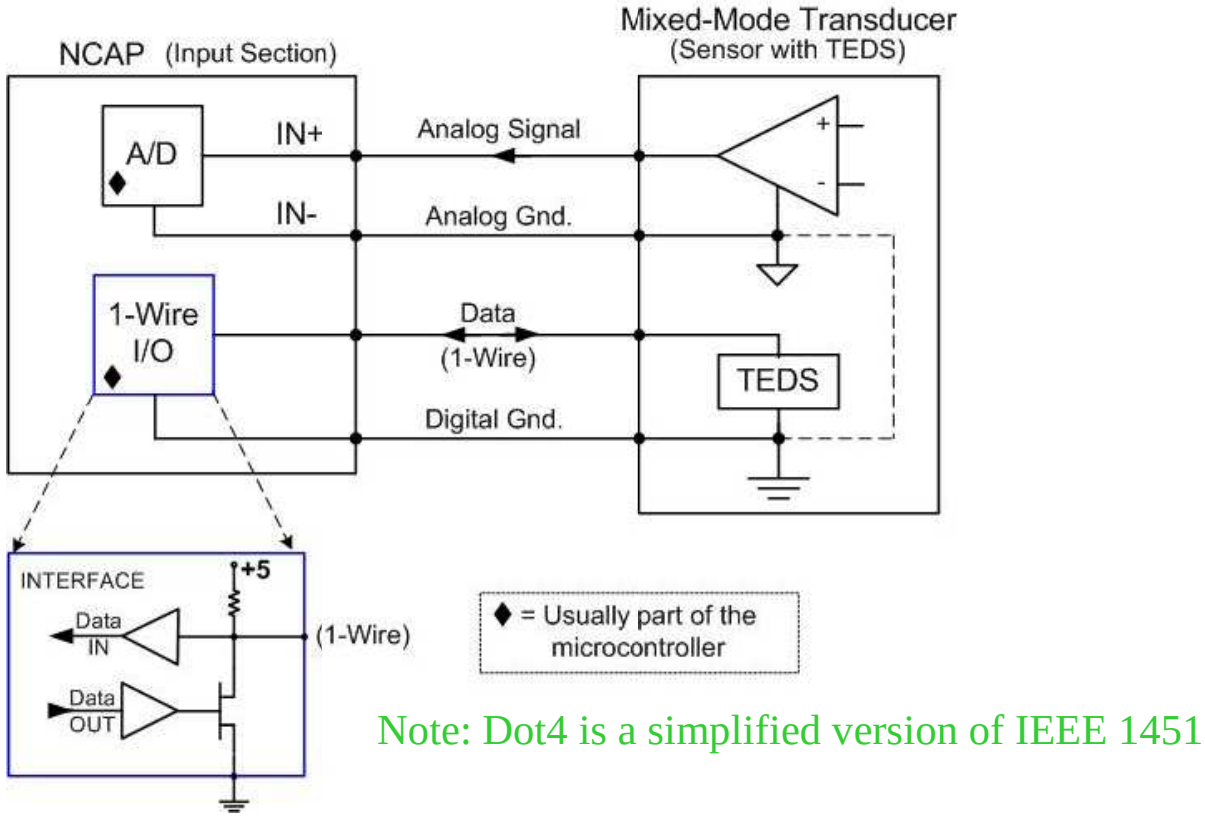


Start of Dot 4 slide section

Block Diagram of Plug-in Sensor Module (Dot 4 style TEDS)



IEEE 1451.4 Interface
(featuring the Dot 4 style TEDS)



Note: Dot4 is a simplified version of IEEE 1451

Transducer Electronic Data Sheet (Dot 4 TEDS)

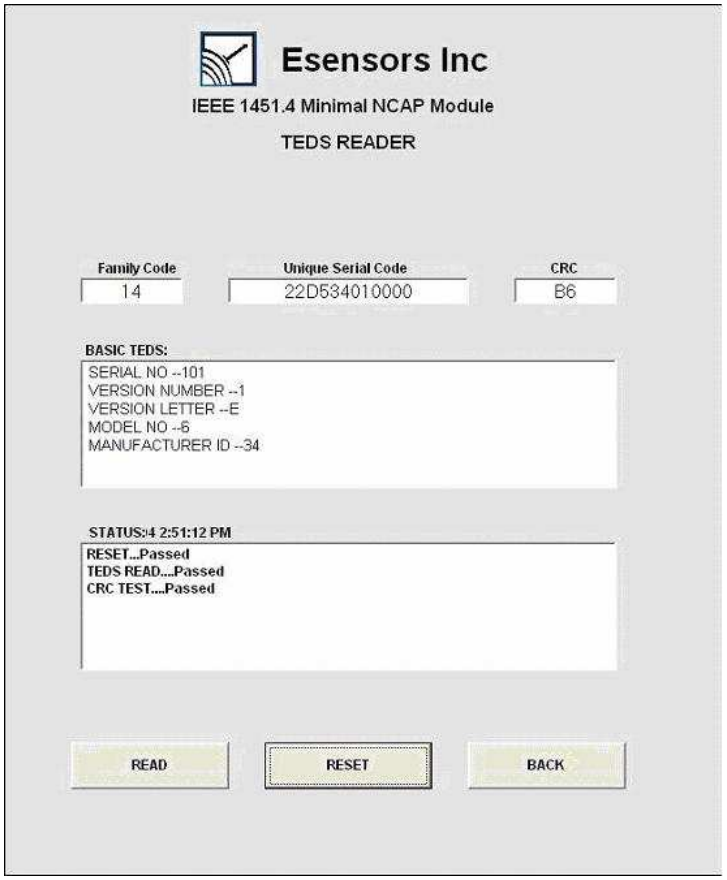
- UUID (Universal **Unique** Identifier)

  Supplied by EEPROM (DS2433) manufacturer (6 bytes)
- Basic TEDS (8 bytes)
  - Model Number (15 bits)
  - Version Letter (5 bits, A-Z)
  - Version Number (6 bits)
  - Manufacturer ID (14 bits)
  - Serial Number (6 bits)
- Manufacturer's TEDS

  Sensor type and calibration parameters (16 bytes)

  [used instead of standard IEEE sensor template]

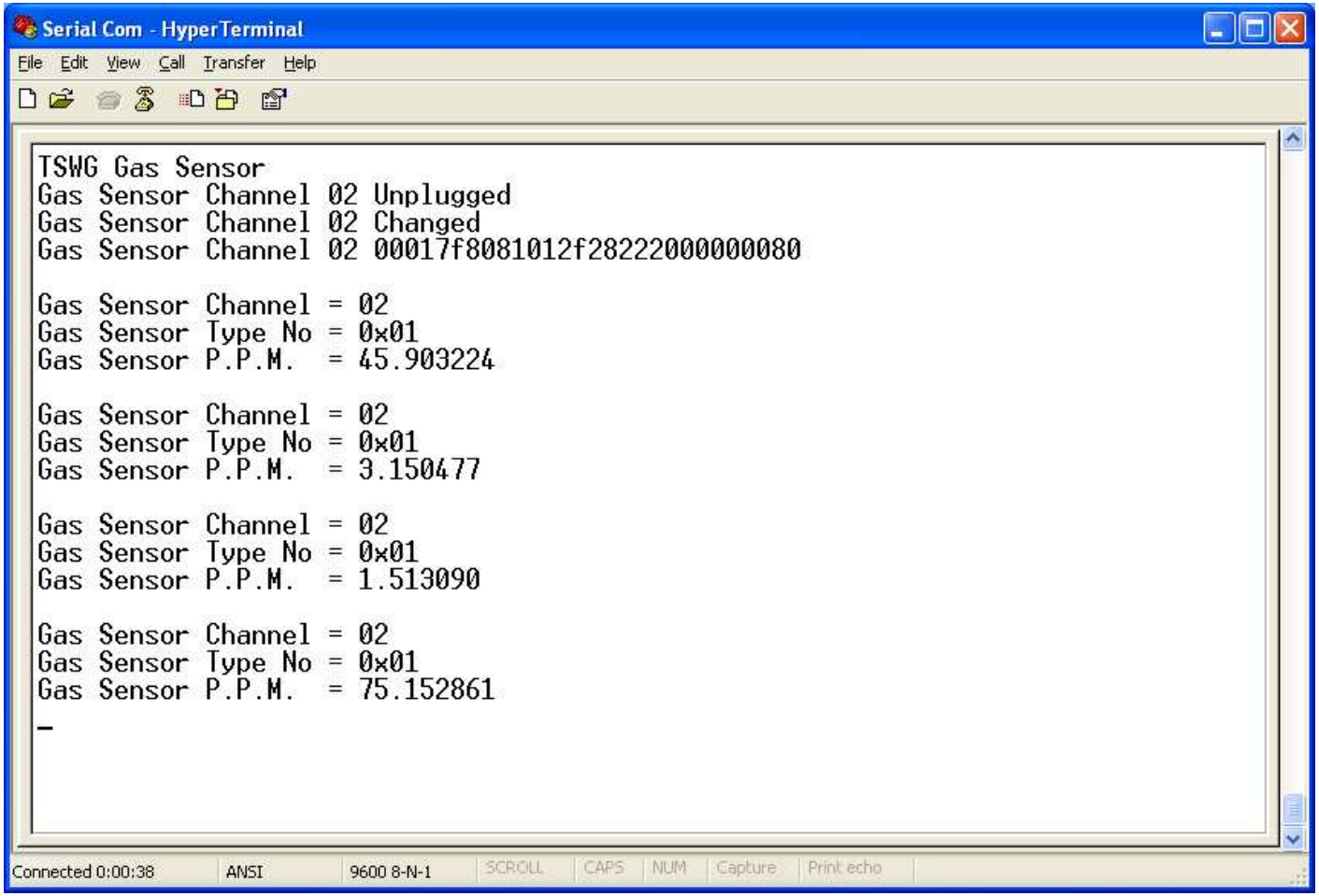
Dot 4 TEDS Reader/Writer
(PC Screen Display)



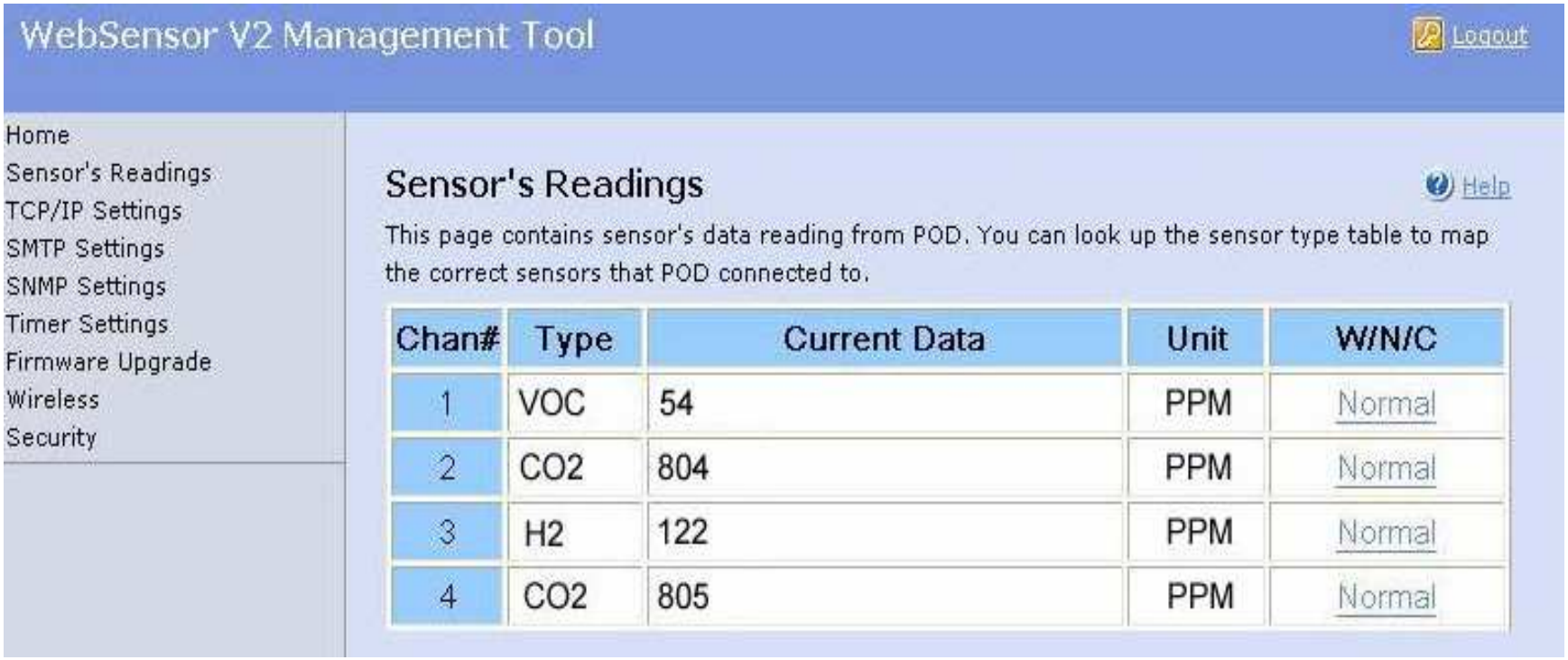
Writer

Reader

Gas Sensor Plug and Play Testing
(Screen Capture)



Display of Gas Concentration in Engineering Units

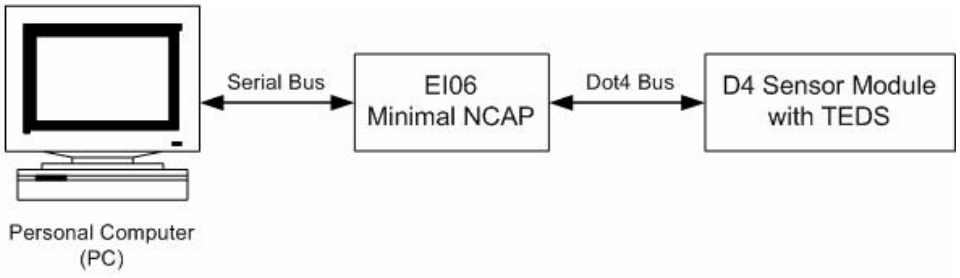


Dot 4 to Dot 0 Format Conversion

for environmental monitor

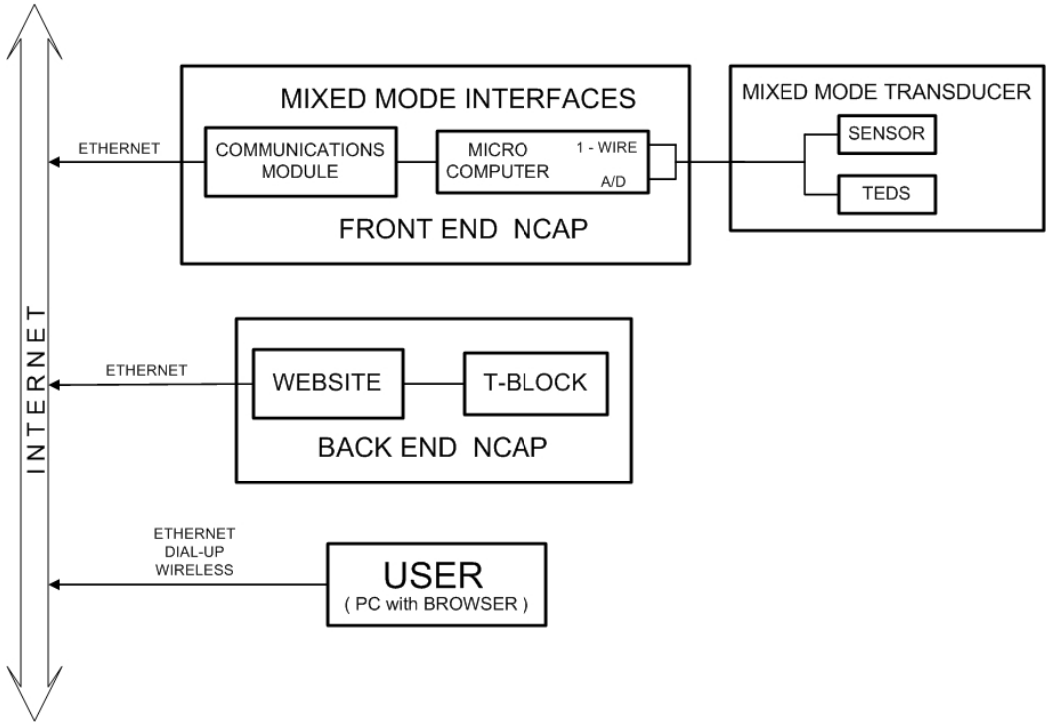
- Monitor is TIM, except that units with gateway function are NCAPs
- No standard method of Dot 0 to Dot 4 conversion
- For the UUID (10 bytes), the least significant bits are Dot4 UUID (6 bytes, chan 1)
- Dot 0 channel # is (gas) sensor number
- No calibration TEDS (this model) since linearization and calibration done in TIM and not NCAP
- Dot 4 basic TEDS transferred to Dot 0 Channel-ID TEDS

Minimal Dot 4 NCAP and Sensors



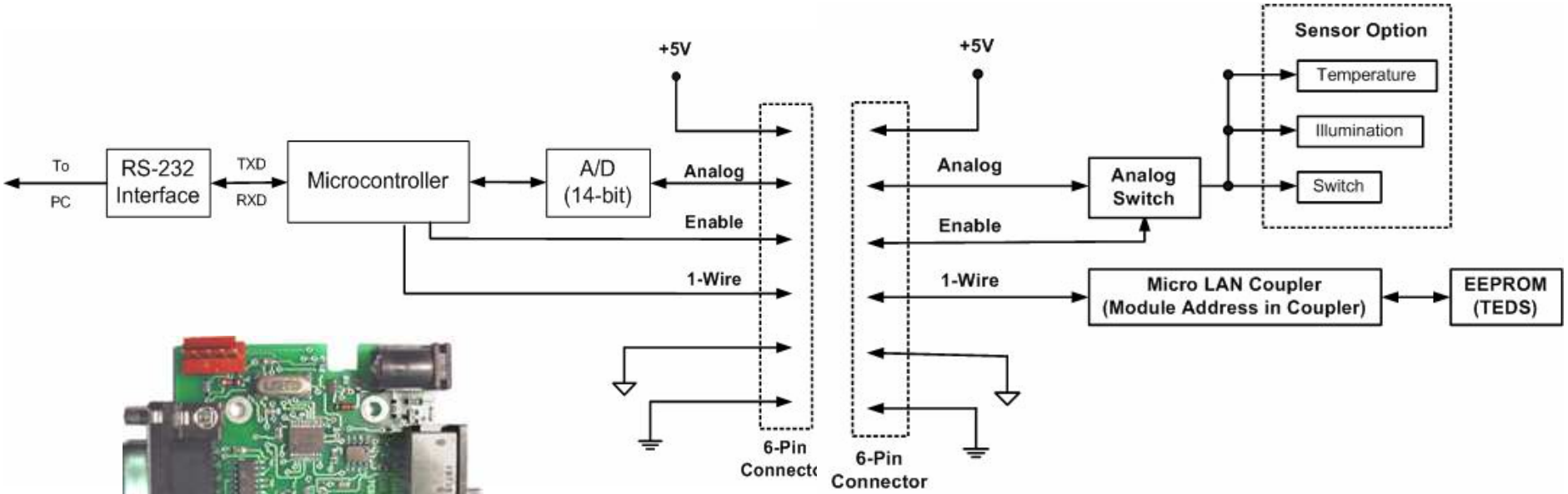
← PC Version

Internet Version →



Block Diagram of Minimal NCAP

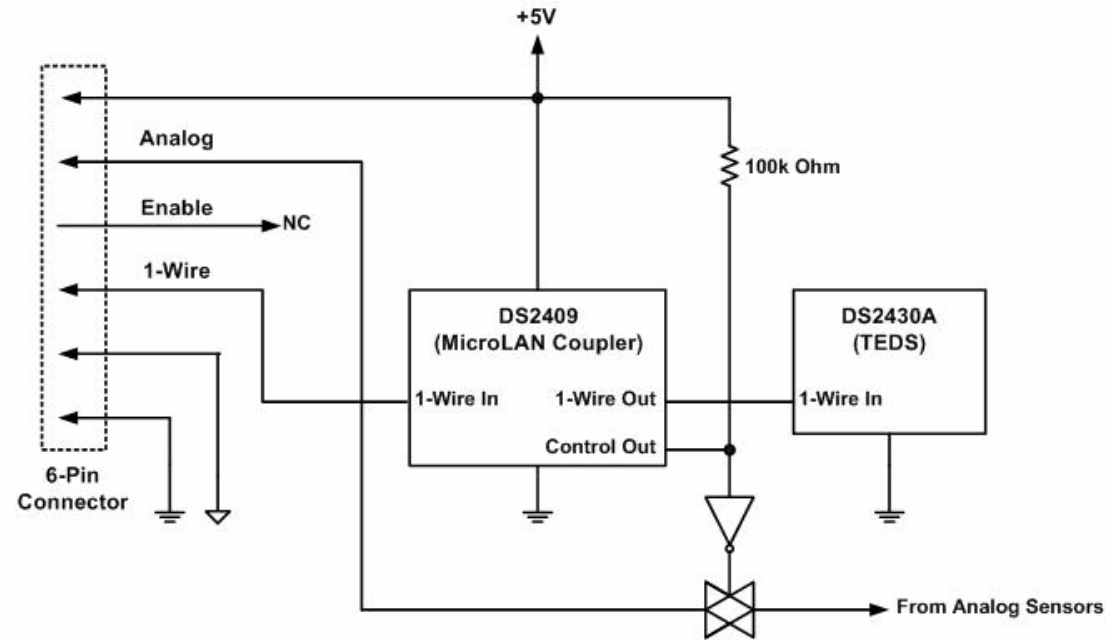
with Dot4 Bus and Sensors

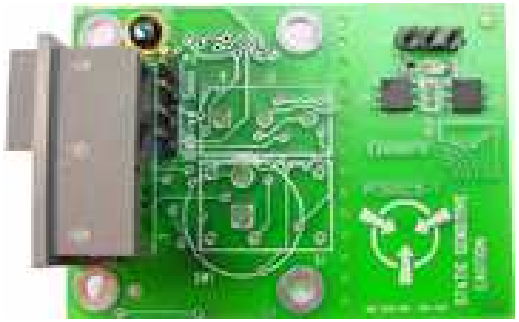


Dot4 Bus

Minimal Dot4 NCAP

Circuit Diagram of Multi-drop Sensor Module

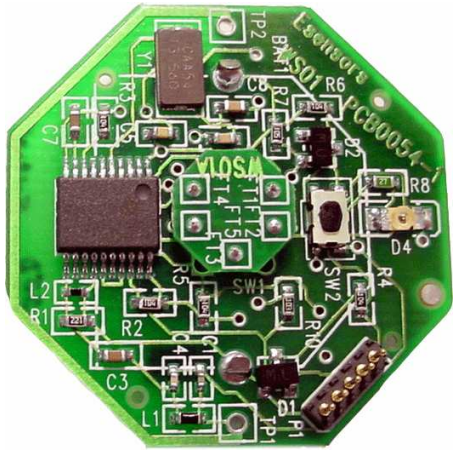




Dot4 Bus

Low-cost, Transmit-only Wireless Sensors

- Format: Preamble, Sync(1), Header(3), Address/channel(3), Data or TEDS (2+), CRC(2)
- Manchester encoded, 9600 Baud, SNAP protocol
- TEDS is Dot 4 type
- Transmission is short (few bytes)
- Converted to Dot 5 or Dot 0 (more bytes) by transceiver or NCAP

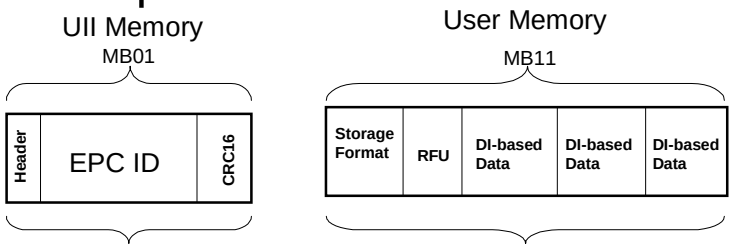


End of Dot 4 slide section

RFID with IEEE 1451 (suggested Dot 4 type format)

- Augmented RFID tag memory has additional user memory (flag set)
- User memory has Dot4 TEDS section
- Optional data pointer to “Virtual TEDS” (external file)
- User memory has section for block of sensor data

Proposed Data Structure



EPC
- Data construction according to EPC proposal

ISO/IEC 15961/15962
- Data construction according to ISO/IEC 15961/15962 standards

NEEDED: Within MB01, use bit 15 to indicate that MB11 is, or is not, used.

- End D. Wobschall section