

Design Summary:

The specified Honeywell ammonia sensor (EC-FX-NH3)^[1] is a three-wire 4/20 mA transmitter/sensor operates at 24VDC, 0.5A. The sensor sends 0.5 mA signal in fault condition. The 4/20 output uses 18/3 Shielded cable less than 1500 feet (~450m).

**[1] – Used manual provided by Honeywell ([Link](#))

Conclusions:

As the sensor to control room distance 100m which is less than 1500 feet, no additional signal repeaters are required to maintain the signal quality. The sensor provided constant 0.5mA signal for fault detection.

My design aims to build 3 modules namely:

- 1) AC to DC power converter module (220-240 VAC to 24VDC)
- 2) 4/20 mA receiver module
 - i. To convert the received signal in current to voltage for microcontroller usage.
 - ii. Input: 4/20 mA signal from sensor.
 - iii. Output: Sensor signal in 0-5VDC to microcontroller, fault detection signal in VDC.
 - iv. Power Input: 24VDC
- 3) Microcontroller module
 - i. Power Input: 24VDC
 - ii. I2C 16x4 Segment Display
 - iii. Buzzer

The sensor's current signal is converted into voltage level signal, also a fault detection signal is generated for the microcontroller, using 4/20mA receiver module.

The receiver module and microcontroller unit (MCU) are separated designed in such a fashion that a MCU can interface with multiple receiver module. This is done to reduce the cost by encapsulating common functionalities and, the modular approach helps in easy maintenance and service in case of failure. As failed modules can be replaced or serviced without interfering other working devices, which is essential in an industrial setup.

Assumptions:

- The output of the sensor is between 4mA to 20mA and does not exceed more than 25mA.
- The cables used in the design does not affect the signal quality within 100m.
- The receiver modules are in EM noise free environment.