



Air-Farm User Manual

CO2 / Temperature / Humidity Transmitter

Features

- It can measure CO₂, Temperature and Humidity.
- It is having three high sensitivity sensors.
- RS485(MODBUS) Communication
- Analog Voltage and 4-20mA Current Output
- Alarm function for Air Status Warnings.
- It has a compact waterproof box of size 120mm x 80mm x 55mm.



Model : MC-S100

Application

Air-Farm (Model: MC-S100) can measure the Air Status such as: CO₂, Temperature and Humidity values. This model has three sensitive sensors, which makes it an optimum choice for installation in Factories or Greenhouses.

This interface supports RS485 communication and two analog output types (i.e, Voltage and Current). So, this model can be connected to other systems. Maximum 100 devices are possible to be connected on RS485 bus, Each of these device can have 0-5V, 4-20mA Output.

This model has Active Low Output (NPN driven Output) for the systems such as Relays, LEDs, etc, for CO₂ quality warning.

Table 1. General Specifications

| Parameter | Min | Typ | Max | Unit | Notes |
|-----------------------|------|------|------|------|---------------------------------------|
| Power Supply | 8 | 12 | 36 | V | |
| Current Consumption | 0.04 | 0.05 | 0.15 | A | Test with Vin = 12V Supply Voltage |
| Operating Temperature | -10 | - | 50 | °C | |

Table 2. Sensors Specifications

| Parameter | Min | Typ | Max | Unit | Notes |
|-----------------------------|------|-----|-------|------|----------------------------------|
| CO2 Measuring Range | 0 | - | 10000 | ppm | |
| Accuracy (CO2) | -30 | - | +30 | ppm | Typically +/-5% (Above, 0 °C) |
| | -50 | - | +50 | ppm | Typically +/-7% (Below, 0 °C) |
| Temperature Measuring Range | -10 | - | 50 | °C | |
| Accuracy (Temperature) | -0.4 | - | +0.4 | °C | |
| Humidity Measuring Range | 0 | - | 80 | % | |
| Accuracy (Humidity) | -4 | - | 4 | % | |

Table 3. Interface Specifications

| Parameter | Min | Typ | Max | Unit | Notes |
|--|-----|------|-------|------|--|
| RS485 Recommended Request Time | 500 | 1000 | - | ms | |
| Analog Output Range | 0 | - | 5 | V | |
| 4-20mA Current Output Range | 4 | - | 20 | mA | |
| Response Time (for Analog and Current Output) | 1.7 | 2 | - | ms | |
| Alarm 'On' State | - | 2000 | 10000 | ppm | Alarm will be triggered 'On' on these ppm levels. |

RS485 Interface

The MC-S100 communicates with other devices over RS485 bus. MODBUS follows RS485 communication standard. See, Table 1, for configuration of RS485 communication.

Table 4. Communication Configuration

| | |
|---------------------|----------|
| Baudrate | 9600 bps |
| Stop Bits | 1 bit |
| Parity Check | None |
| Data Length | 8 bits |

The details about request and response protocols are given in, Table 5. And this protocol is followed by RTU (Remote Terminal Unit). Description of MODBUS Protocol is given in, Table 6.

Table 5. MODBUS Protocol

| | | | | | |
|---------------------|----------|---------------|------------------|------------------|-----|
| No. of Bytes | 1 | 1 | 2 | 2 | 2 |
| Tx | Slave ID | Function Code | Starting Address | Request Quantity | CRC |

| | | | | | |
|---------------------|----------|---------------|-------------|---------|-----|
| No. of Bytes | 1 | 1 | 1 | n | 2 |
| Rx | Slave ID | Function Code | Data Length | Data[n] | CRC |

Table 6. MODBUS Protocol Byte Description

| Name | Bytes | Description |
|------------------|-------|--|
| Slave ID | 1 | Set Device ID, through a rotary switch. |
| Function Code | 1 | Reading and Writing Request Code. |
| Starting Address | 2 | Starting address of data bytes. |
| Request Quantity | 2 | Number of sensors to be loaded with data. |
| Data Length | 1 | Number of data bytes. |
| Data[n] | n | Number of data bytes (n), sent by sensor. (Each device sends 2 data bytes) |
| CRC | 2 | Error checking according to CRC16 standard. |

See Picture1, This rotary switch is for configuration of RS485 Slaves' Device ID. The left switch is for tens digit and right switch is for ones digit of decimal Device ID. So, User can easily configure Slaves' Device ID (a decimal number).

For example, If left switch is set at "3" and right switch is set at "1", then, RS485 Slave ID will be "31", which is equivalent to 0x1F (in hexadecimal notation).

Picture 1. Rotary Switch



List of functions is given in, Table 7 and address of each sensor is given in Table 8.

Table 7. Function Code Table

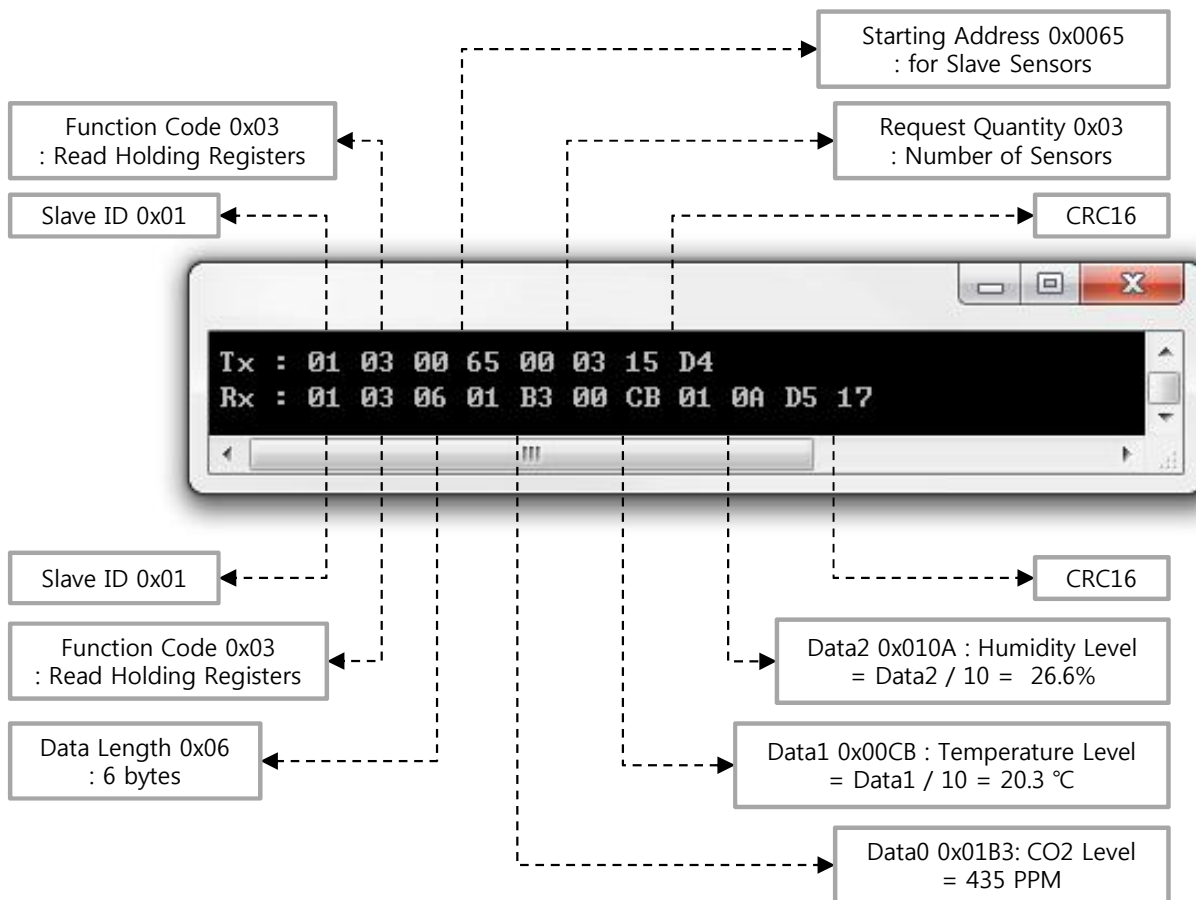
| Function Description | Function Code |
|------------------------|---------------|
| Read Holding Registers | 0x03 |

Table 8. Sensor Address Table

| Sub Device | Starting Address |
|-------------|------------------|
| CO2 | 0x0065 |
| Temperature | 0x0066 |
| Humidity | 0x0067 |

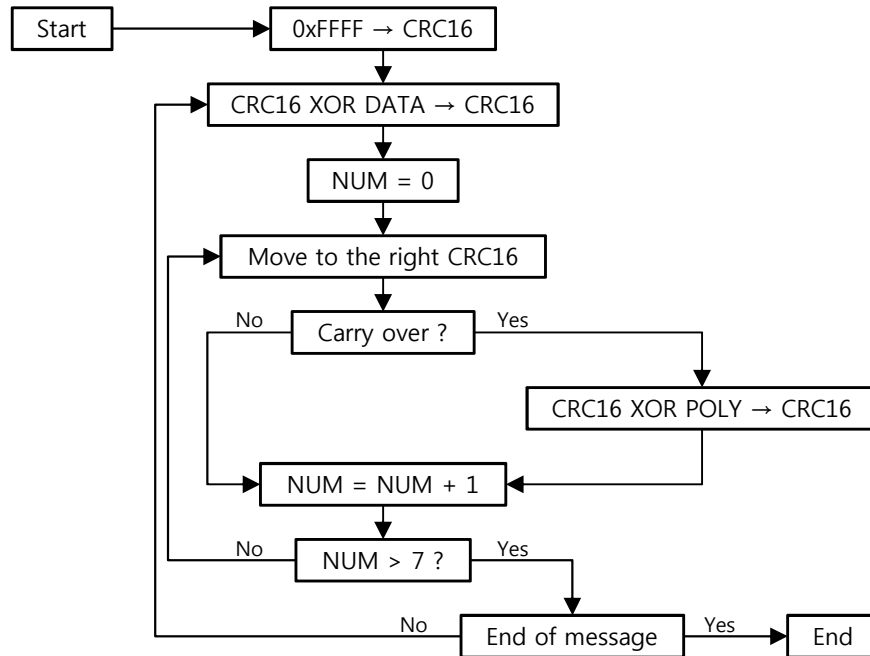
This is an example of serial communication protocol.
There is an example of CRC calculation for serial communication, on the next page.

Example 1. Serial Communication



That is how the calculation of CRC (Cyclic Redundancy Check) is done. CRC16 is used in MODBUS RTU Mode. See figure 1, This figure is flow chart of CRC16 calculation and an example in C language for it.

Figure 1. Flow Chart



Example 2. CRC16 Calculation

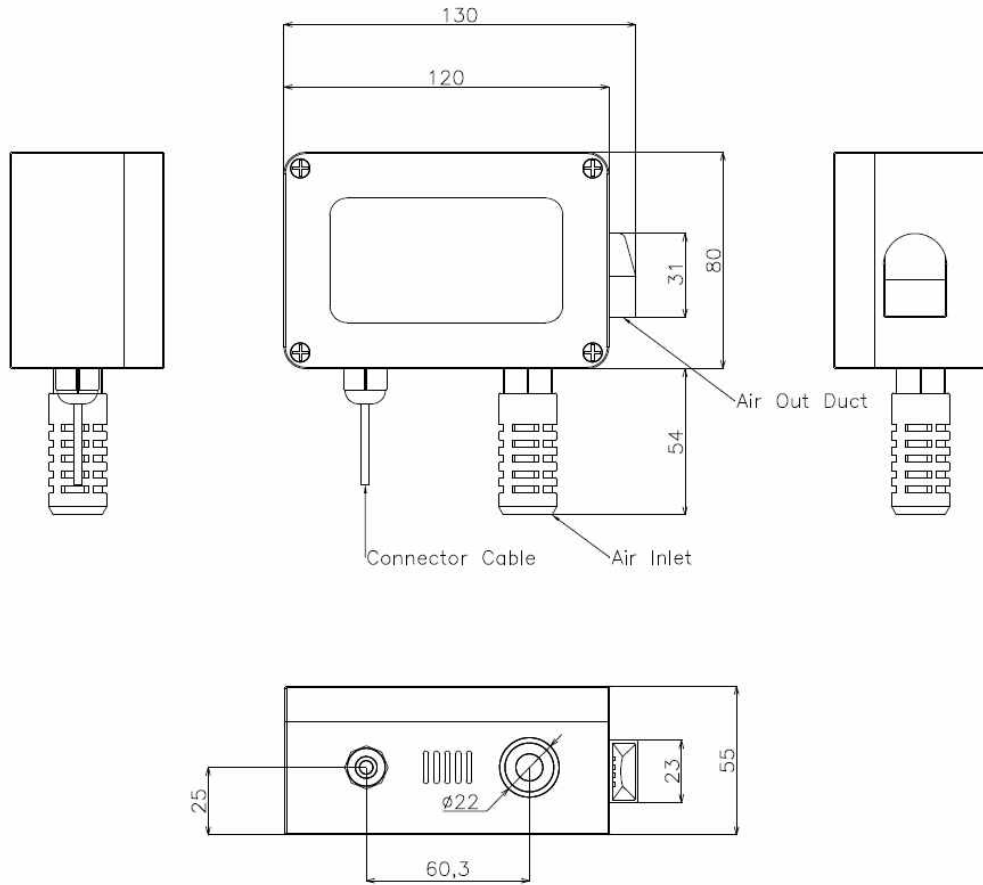
```

#define POLYNORMALIAL 0xA001
unsigned short CRC16(unsigned char *puchmsg, int dataLength){
    int i;
    unsigned short crc, flag;
    crc = 0xFFFF;

    while(usDataLen--){
        crc ^= *puchmsg++;
        for (i=0; i<8; i++){
            flag = crc & 0x0001;
            crc >>= 1;
            if(flag){ crc ^= POLYNORMALIAL; }
        }
    }
    return crc;
}

void main(void){
    unsigned char data[8] = {0x01, 0x01, 0x00, 0x00, 0x00, 0x03, 0, 0};
    unsigned short crc16;
    crc16 = CRC16(data, 6);
    data[6] = (unsigned char)((crc16>>8) & 0x00FF);
    data[7] = (unsigned char)(crc16 & 0x00FF);
}
  
```

Dimension



Connector Pin Description

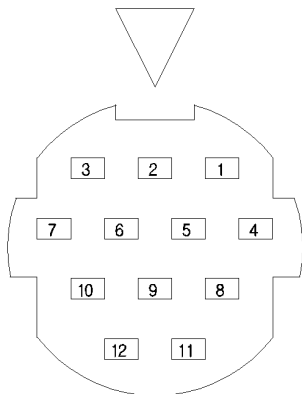


Table 9. Pin Description

| Pin No. | Pin Assigned | Pin No. | Pin Assigned |
|---------|-----------------------|---------|--------------|
| 1 | Analog Output | 7 | SEN_ID2 |
| 2 | SEN_ID1 | 8 | NC |
| 3 | RS485+ | 9 | GND |
| 4 | RS485- | 10 | VIN |
| 5 | 4-20mA Current OutPut | 11 | Alarm |
| 6 | GND | 12 | NC |

Figure 1. HR30-8P-12PC(71), Hirose

“SEN_ID1” and “SEN_ID2” are for detecting open circuit.

Cautions on Usage

- Do not use this device for medical or safety purpose.
This product is designed only for industrial and ordinary use.
- This product must abide by the operating and storage Temperature and humidity conditions. Do not leave or use the device for longtime in a highly damped place, in which humidity is over 95%RH.
- The standard test condition in which the product was tested is $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$, $50 \pm 30\% \text{RH}$. Signal may vary slightly with environmental condition.
- Be careful while installation and using it, as it may cause serious damage to the sensor in case of, vibration or shock or falling on the hard surface.
- We do not guarantee the performance of this device in case of user installation, disassembling, assembling it at anybody's discretion. If installation and inspection is required, then, Please, contact our technicians.
- NDIR type CO₂ sensor is influenced by air pressure. It can be used without correction within 300m range, above sea level. However, the output value may vary by $\pm 1.0\%$ / 100m height, above, 300m from sea level.
- Use when it is fixed, not, while it is in motion.

Warranty Information

During this 1 year period, our liability hereunder is limited to the replacement of the products.

The warranty will become void, if the product is been damaged due to an accident, unreasonable use, negligence, tampering or other causes not arising from defects in material or workmanship and extends to the original consumer of the product only.



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