

# 5904 HART Interface Module

Installation, Operation and Maintenance  
Setup Manual

5/19/2011



The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed. Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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## Safety Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

### **DANGER**

**DANGER** indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

### **WARNING**

**WARNING** indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

### **CAUTION**

**CAUTION** indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate.

### **CAUTION**

**CAUTION** used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** equipment damage..

**PLEASE NOTE**

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and the installation, and has received safety training to recognize and avoid the hazards involved.

**BEFORE YOU BEGIN**

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

 **CAUTION****EQUIPMENT OPERATION HAZARD**

Verify that all installation and set up procedures have been completed.

Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.

Remove tools, meters, and debris from equipment.

**Failure to follow these instructions can result in injury or equipment damage.**

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

**Software testing must be done in both simulated and real environments.**

Verify that the completed system is free from all short circuits and grounds, except those grounds installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove ground from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

**OPERATION AND ADJUSTMENTS**

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

## About The Book

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### At a Glance

#### Document Scope

This manual describes the operation and maintenance of the 5904 HART Interface module.

#### Validity Notes

This document is valid for all versions of the 5904 HART Interface module.

#### Product Related Information

### **WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise should be allowed to program, install, alter and apply this product.

Follow all local and national safety codes and standards.

Failure to follow these instructions can result in death, serious injury or equipment damage.

#### User Comments

We welcome your comments about this document. You can reach us by e-mail at [technicalsupport@controlmicrosystems.com](mailto:technicalsupport@controlmicrosystems.com).



## Overview

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The 5904 HART Interface Module provides communication between SCADAPack or Micro16 controllers and intelligent field instruments using the industry standard HART (Highway Addressable Remote Transducer) communications protocol. The 5904 HART Interface Module is a 5000 module and may be fully integrated into a DIN rail mounted controller system. Operating power is received from the I/O Bus and the 5904 HART Interface module requires no external power source.

A document titled *A Technical Overview* is available from the HART Communication Foundation. It provides an overview of the technical details of the HART protocol.

## Installation

The installation of the 5904 HART Interface Module requires mounting the module on the 7.5mm by 35mm DIN rail and connecting the module to the system I/O Bus. Refer to the **System Configuration Guide**, at the beginning of this manual, for complete information on system layout, I/O Bus cable routing and power supply requirements.

## Field Wiring

The 5904 HART Interface Module has one connector for field wiring. Refer to **Table 1: P3 Connections** for details.

**Table 1: P3 Connections**

| Pin                        | Description   |
|----------------------------|---|
| Pin 1<br>Chassis Ground    | The terminal provides a convenient point to terminate the shield when using shielded wiring.  |
| Pin 2<br>250 ohms          | A load resistor is required in the current loop. This 250 ohm resistor can be used by connecting pin 2 to pin 3.                    |
| Pin 3<br>Signal (+)        | Signal I/O (+). The current flow in the connection loop requires that this signal be kept more positive than pin 4.                 |
| Pin 4<br>Signal Common (-) | Signal I/O (-). Typically connected to the – side of the DC Power Supply. Internally connected to one side of the 250 ohm resistor. |

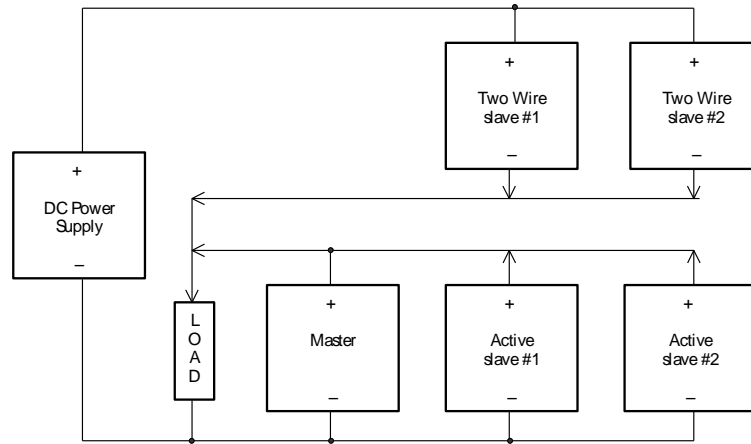
## The Connection Loop

A conventional instrument loop consists of three components, a power supply, a two-wire transmitter and a load resistor, connected in series. When using an active transmitter the power supply is not necessary and the transmitter drives the load resistor directly. In both cases the transmitter current (4 to 20mA) generates a voltage across the load resistor.

The HART Protocol allows multiple transmitters called slaves. These slave transmitters can be either two wire or active. The slaves are addressable and are accessed by a master. The master connects across the load resistor. **Figure 1: Typical HART Wiring Diagram** shows an example multidrop HART application with two, two wire transmitters and two active transmitters. Each transmitter will have a unique address and an output current of 4mA for a total load current of 16mA.

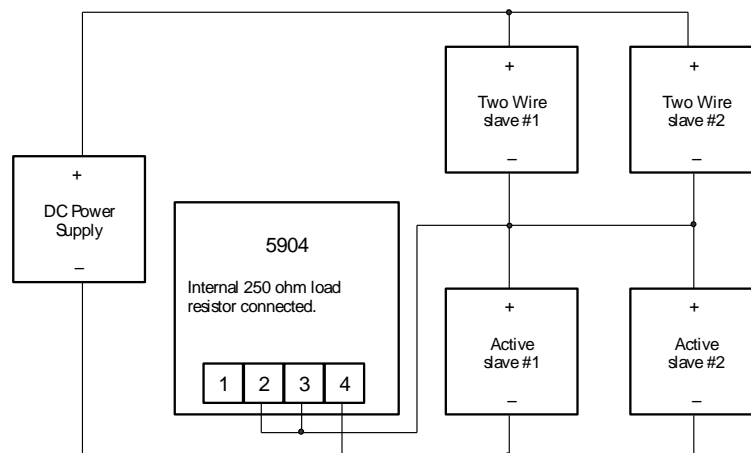
The maximum of 15 HART transmitters may be connected to each 5904 HART module. Refer to the document titled *A Technical Overview*, available from the

HART Communication Foundation. It provides an overview of the technical details of the HART protocol.



**Figure 1: Typical HART Wiring Diagram**

**Figure 2: Model 5904 Wiring Diagram** shows how to wire a Model 5904 as a master in the same application as shown in **Figure 2: Model 5904 Wiring Diagram**. The Model 5904 includes a 250-ohm load resistor across pins 2 and 4. In this example the 250 ohm resistor is wired as the load resistor by connecting pins 2 to 3. Refer to section **Specifications** for the current handling limits of this resistor.



**Figure 2: Model 5904 Wiring Diagram**

## Wiring Considerations

### Power Supply

24V DC power supplies are used to energize the HART connection loop. The power supply is specified as follows.

| Voltage                                   | 24 VDC typical |
|---|----------------|
| Maximum ripple (47 to 125 Hz.)            | 0.2 Vp-p       |
| Maximum noise (500 to 10 kHz.)            | 1.2 mV         |
| Maximum series impedance (500 to 10 kHz.) | 10 ohms        |

The 24V power supplies (DC PWR +/-) in the Micro16 and SCADAPack controllers may be used for the HART connection loop.

Vloop power from the SCADAPack is not recommended for HART devices. If the maximum noise and ripple specification is exceeded, the HART transmitters and 5904 HART module may not communicate correctly.

The Vloop power supply built into SCADAPack controllers may be used with some HART devices; however compatibility depends on the specific device, the number of HART devices on the system, cable length, and the total loading of the SCADAPack power supply.

Optimum performance can be achieved by using an external low noise supply for the HART devices, particularly when multiple devices are connected to the 5904.

### Load Resistor

The HART specification allows load resistors to range from 230 ohms to 1100 ohms. Larger values have the advantage of increasing the transmitter signal at the master. Larger values have the disadvantage of reducing the voltage available to power the two wire transmitters. Each transmitter will contribute 4mA of current to the loop. 4 Volts will appear across the 250-ohm load resistor (4mA X 4 X 250 ohms) in the example shown in **Figure 2: Model 5904 Wiring Diagram**. The 250-ohm resistor included in the Model 5904 should work well. The resistor is used by connecting pins 2 and 3 of the Model 5904 connector P3. The resistor can be replaced by connecting a load resistor between pins 3 and 4 of the Model 5904 connector P3. Pin 2 remains unconnected.

### Cabling

A twisted pair with a shield should be used. This minimizes interference from other communicating signals. The shield is grounded at one end only, preferably at the Model 5904. P3 Pin 1 is a chassis connection for that purpose.

### Grounding

The Model 5904 is transformer isolated. The 5904 can be used anywhere in the connection loop. It can be used with transmitters that have wiring or grounding restrictions.

**Hand Held Programmer**

Two pins labeled "Programmer P4" are available for a secondary master hand held programmer. This allows a convenient connection to the HART loop without disturbing the field wiring. Observe the + and – polarity indications when connecting the hand held programmer to these pins.

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## Operation

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### LED Indicators

The 5904 HART Interface module has two status LEDs. The SCADAPack controller powers these LEDs through the I/O Bus. These LEDs can be disabled to conserve power.

| LED | Color | Function   |
|-----|-------|--|
| TX  | Red   | The TX LED is on when the 5904 is transmitting data to the connection loop.  |
| RX  | Red   | The RX LED is on when the module is receiving data from the connection loop. |

### Address Selection

The 5000 I/O bus will support a maximum of twenty I/O (input/output) modules. 5000 I/O module types may be combined in any manner to the maximum supported by the controller used. The types of input and output modules available are:

- Digital Input modules
- Digital Output modules
- Analog Input modules
- Analog Output modules
- Counter Input modules
- HART Interface modules

Each type of I/O module, connected to the I/O bus, has a unique I/O module address. Different types of I/O modules may have the same module address.

The address range supported by the SCADAPack controller module may restrict the I/O module address range. Refer to the controller manual for the maximum address supported.

A maximum of four 5904 HART modules may be connected to a controller. Refer to the CNFG 5904 HART Interface Module register assignment for further information.

The two address switches labeled 1 and 2 set the module address. To set the address:

Open the three switches by pressing down the left side of the switch.

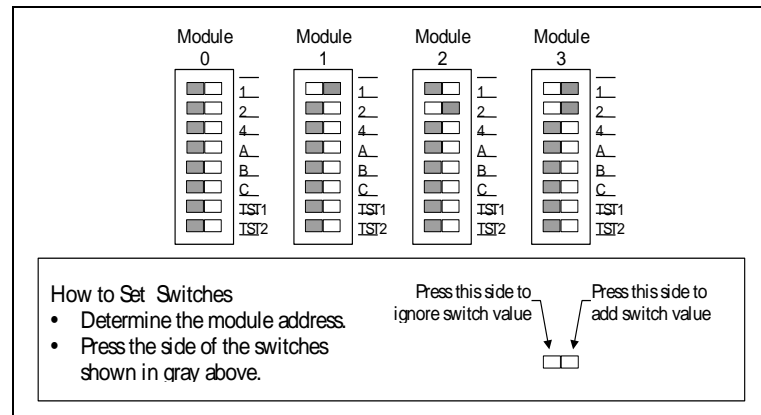
Close the switches that total to the desired address.

**Figure 3: 5904 Module Address Switches** shows the switch setting for each of the 4 module addresses.

A 5904 HART module set to address 1 is not supported for the following controllers:

- SCADAPack 32 and SCADAPack 32P controllers.
- SCADAPack controllers with 5604 I/O module.

These controllers support only HART module addresses 0, 2 and 3.



**Figure 3: 5904 Module Address Switches**

## Maintenance

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This module requires no routine maintenance. If the module is not functioning correctly, contact Control Microsystems Technical Support for more information and instructions for returning the module for repair.



## Specifications

**Disclaimer:** Control Microsystems reserves the right to change product specifications. For more information visit [www.controlmicrosystems.com](http://www.controlmicrosystems.com).

|                            |   |
|----------------------------|---|
| <b>Modulation</b>          | Bell 202 Frequency Shift Keying (FSK)<br>Mark = 1200 Hz.<br>Space = 2200 Hz.  |
| <b>Data Rate</b>           | 1200 baud   |
| <b>Transmit Level</b>      | 500mVp-p into 250 ohms  |
| <b>Receive Sensitivity</b> | 120mVp-p on<br>80mVp-p off  |
| <b>Output Impedance</b>    | 300 ohms<br>transformer isolated  |
| <b>Input Impedance</b>     | 4000 ohms<br>transformer isolated   |
| <b>Load Resistor</b>       | 250 ohms, 1 Watt maximum.   |
| <b>Visual Indicators</b>   | TX: Transmitted data LED<br>RX: Received data LED                             |
| <b>Power Requirements</b>  | 5V at 20mA  |
| <b>Field Termination</b>   | 4 pole, removable terminal block<br>12 to 22 AWG<br>15 amp contacts           |
| <b>Dimensions</b>          | 4.25 inch (108 mm) wide<br>4.625 inch (118 mm) high<br>1.75 inch (44 mm) deep |
| <b>Mounting</b>            | 7.5 x 35 DIN rail   |
| <b>Packaging</b>           | Corrosion resistant zinc plated steel with black enamel paint                 |
| <b>Environment</b>         | 5% RH to 95% RH, non-condensing<br>-40°C to 70°C<br>-40°F to 158°F            |

## Approvals and Certifications

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**Safety** Non-Incendive Electrical Equipment for Use in Class I, Division 2 Groups A, B, C and D Hazardous Locations.

UL Listed to the following standards:

- CSA Std. C22.2 No. 213-M1987 - Hazardous Locations.
- CSA Std. C22.2 No. 142-M1987 - Process Control Equipment.
- UL Std. No. 1604 - Hazardous (Classified) Locations.
- UL Std. No. 508 - Industrial Control Equipment.