SIEMENS	INSTALLATION GUIDE

IGWiPS200-1
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May 2007

WiPS-200 Series

Wireless Process Solution

Frequency Hopping Spread Spectrum Radio

Two-Way (Multipoint-to-Point) for Monitoring and Control

With Expandable I/O Options

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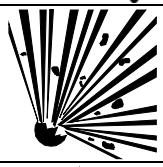
PREFACE

CONVENTIONS AND SYMBOLS

The following symbols may be used in this manual and may appear on the equipment. The reader should become familiar with the symbols and their meaning. Symbols are provided to quickly alert the reader to safety related text.

Symbol	Meaning
 DANGER	Indicates an immediate hazardous situation which, if not avoided, *will* result in death or serious injury.
 WARNING	Indicates a potentially hazardous situation which, if not avoided, *could* result in death or serious injury.
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, *may* result in minor or moderate injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in property damage.
NOTICE	Indicates a potential situation which, if not avoided, may result in an undesirable result or state.
IMPORTANT	Identifies an action that should be taken to avoid an undesirable result or state.
Note	Identifies supplemental information that should be read before proceeding.
	**Electrical shock hazard –** Either symbol indicates the presence of an electrical shock hazard. The associated text states the nature of the hazard.
	**Explosion hazard –** Symbol indicates that the danger of an explosion hazard exists. The associated text states the nature of the hazard.
	**Electrostatic discharge –** The presence of this symbol indicates that electrostatic discharge can damage the electronic assembly.
	**Pinch hazard –** Symbol indicates that a pinch hazard exists if correct procedures are not followed.

QUALIFIED PERSONS

The described equipment should be installed, configured, operated, and serviced only by qualified persons thoroughly familiar with this manual. A copy of this manual is supplied with the equipment. The current version of the manual, in Portable Document Format (PDF), can be downloaded from the Siemens Internet site; see Product Support in this manual.

For the purpose of this manual and product labels, a qualified person is one who is familiar with the installation, assembly, commissioning, and operation of the product, and who has the appropriate qualifications for said activities such as:

- Training, instruction, or authorization to operate and maintain devices/systems according to the safety standards for electrical circuits, high pressures, and corrosive, as well as, critical media.

- For devices with explosion protection: training, instruction or authorization to work on electrical circuits for systems that could cause explosions.
- Training or instruction according to the safety standards in the care and use of suitable safety equipment.

SCOPE

This manual does not purport to cover all details or variations in equipment or to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to a support group listed in the Product Support section of this manual.

The contents of this manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements continued herein do not create new warranties or modify the existing warranty.

General Warnings and Cautions

WARNING

An explosion-proof device may be opened only after power is removed from the device.

An intrinsically safe device loses its license as soon as it is operated in a circuit that does not meet the requirements of the examination certificate valid in your country.

The device may be operated with high pressure and corrosive media. Therefore, serious injury and/or considerable material damage cannot be ruled out in the event of handling of the device.

The perfect and safe operation of the equipment is conditional upon proper transport, storage, installation and assembly, as well as, on careful operation and commissioning.

The equipment may be used only for the purposes specified in this manual.

CAUTION

Electrostatic discharge can damage or cause the failure of semiconductor devices such as integrated circuits and transistors. The symbol at right appears on a circuit board or other electronic assembly to indicate that special handling precautions are needed.

- A properly grounded conductive wrist or heel strap must be worn whenever an electronics module or circuit board is handled or touched. Static control kits are available from most electrical or electronic supply companies.
- Electronic assemblies must be stored in static protective bags when not installed in equipment.

Changes for Revision 3, May 2007

Figure 1 updated.
Product Support section updated.
Analog output wiring for a loop power external device added. See Figures 9 and 10.
RF Link contact rating added to Specifications.

■

INTRODUCTION

This publication describes installation of the Siemens Wireless Process Solution (WiPS) 200 Series Two-Way Multipoint-To-Point Radios and I/O Expansion Modules. Radios (i.e. transceivers)[1] and I/O modules are used to construct a WiPS wireless network for the gathering and distribution of process related analog, digital, and pulse/frequency data. Table 1, on the next page, identifies each WiPS 200 Series model. The table also provides a description of each item and an order/part number. Shown at right are a transceiver, the right-most module, and five I/O modules mounted on a section of DIN rail.

A WiPS wireless network is built using a selection of transceivers, I/O Expansion modules, and accessories, such as antennas, antenna cables, and power supplies. Transceivers perform two-way wireless communications. They also have I/O capability with one analog input channel, one analog output channel, two digital input channels, and two digital output channels. I/O Expansion modules perform the bulk of the process data gathering and distribution. A selection of modules is available to accommodate analog, digital, and pulse/frequency data. Antenna selections include a wide range of omnidirectional and Yagi directional models. These antennas can be paired with low loss antenna cable to further improve transmitted signal strength allowing communication over longer distances. Siemens Logo power supplies are available to power transceivers and I/O Expansion modules. Other accessories include surge voltage protection adapters and cable connector adapters.

Transceiver with 1/4-Wave Antenna

Typical I/O Expansion Module

Siemens Logo Power Supplies

Two types of transceivers are provided: Master and Remote (i.e. Slave[2]). The master transceiver is installed at a central data collection and processing location, such as a control room. Remote transceivers are installed near field devices, such as transmitters, counters, motors, fans, conveyer belts, stirrers, and annunciators. Each wireless network must have one master transceiver and at least one remote transceiver. Up to eight remote transceivers can be installed on a network allowing access to widely distributed field devices.

Table 1 lists the seven types of WiPS I/O Expansion modules and their model and order numbers. I/O Expansion modules are added to the wireless network's Master and Remote transceivers in *complementary* pairs. Up to eight I/O Expansion modules of any combination can be connected to a Master transceiver. Eight complementary I/O Expansion modules can then be connected to up to eight remote transceivers. Thus a total of sixteen modules can be connected to your WiPS wireless network. As mentioned above, I/O Expansion modules are added to the network in complementary pairs:

- An input module at the Master transceiver must be complemented by an output module of the same type at a remote transceiver.
- An output module at the Master transceiver must be complemented by an input module of the same type at a remote transceiver.

The network can accommodate a maximum of 32 analog signals or 64 digital signals or 16 pulse signals or a combination of analog, digital, and pulse signals (total of inputs *or* outputs, not the sum of input *and* outputs).

[1] The terms radio and transceiver are used interchangeably in this guide.
[2] The terms remote and slave are used interchangeably in this guide.

Each transceiver and each I/O Expansion module has bus connectors on both sides of its cover: a male connector on one side, a female connector on the other. A transceiver and several I/O Expansion modules can be physically interconnected by way of their bus connectors and then snapped onto a section of DIN rail as a single unit. These bus connectors carry signal, power, and ground connections between the interconnected devices.

An easy to use wireless network Configurator is available at the Siemens Internet site to help you select remote transceivers and I/O expansion modules. A master transceiver and one remote transceiver are the configuration starting point. When adding an I/O module to a remote transducer, the complementary module is automatically added to the master transceiver. For example, adding an 8-Channel Digital Input Module to a remote transceiver will cause an 8-Channel Digital Output Module to be automatically added to the master transceiver. The online Configurator totals the number of I/O Expansion modules and displays a warning if the maximum quantity is exceeded.

Table 1 WiPS Series 200 Multipoint-To-Point Transceivers and I/O Expansion Modules

WiPS Model Number	Transceiver and I/O Expansion Modules (see Notes below)	Order Number
WiPS-20	Unconfigured Transceiver	TGX:16347-320
WiPS-22	8-Channel Digital Input Module	TGX:16347-322
WiPS-23	8-Channel Digital Output Module	TGX:16347-323
WiPS-24	4-Channel Analog Input Module	TGX:16347-324
WiPS-25	4-Channel Analog Output Module	TGX:16347-325
WiPS-26	Combination Input/Output Module with: 1 analog input channel 1 analog output channel 2 digital input channels 2 digital output channels	TGX:16347-326
WiPS-27	2-Channel Pulse Input Module	TGX:16347-327
WiPS-28	2-Channel Pulse Output Module	TGX:16347-328
Notes: Order antennas, antenna cable, power supplies, and other accessories separately. Siemens Logo power supply is part number 6EP13311SH02. All 200 Series transceivers and I/O Expansion module have bus connectors for distribution of power and data.		

A WiPS Series 200 transceiver is a frequency hopping spread spectrum radio designed for professional installation and integration with other products. When installed with an approved antenna and cable, the system integrator needs to make sure that the unit's FCC label is clearly visible on the outside of the integrated product. WiPS is approved within the 902 to 928 MHz ISM band under 47CFR15.247 of the FCC Rules and Regulations.

Frequency hopping spread spectrum technology was originally developed by the U.S. military to prevent interference or interception of radio transmissions on the battlefield. Frequency hopping devices concentrate their full power into a very narrow signal and randomly hop from one frequency to another within a designated frequency band. If they encounter interference on a particular frequency, the devices error-check the affected data, hop to another point on the spectrum, and resume communications on subsequent hops. Since there are always spaces without interference somewhere in the allotted radio spectrum, a frequency hopping device will use those spaces to complete a transmission.

IMPORTANT

Save this Installation Guide and have it available when installing the above products.

PRODUCT SUPPORT

When contacting Siemens for support:

- Please have complete product information at hand:
    - For hardware, this information is provided on the product nameplate (part number or model number, serial number, and/or version).
    - For most software, this information is given in the Help > About screen.
- If there is a problem with product operation:
    - Is the problem intermittent or repeatable? What symptoms have been observed?
    - What steps, configuration changes, loop modifications, etc. were performed before the problem occurred?
    - What status messages, error messages, or LED indications are displayed?
    - What troubleshooting steps have been performed?
    - Is the installation environment (e.g. temperature, humidity) within the product's specified operating parameters? For software, does the PC meet or exceed the minimum requirements (e.g. processor, memory, operating system)?
- A copy of the product Service Instruction, User's Manual or other technical publication should be at hand. The Siemens public Internet site (see the table below) has current revisions of technical publications, in Portable Document Format, for downloading.
- To send an instrument to Siemens for repair, contact Siemens and request a Return Material Authorization (RMA).

IMPORTANT

An instrument must be thoroughly cleaned (decontaminated) to remove any process materials, hazardous materials, or blood born pathogens prior to return for repair. Read and complete the Siemens RMA form(s).

Contact Information

United States of America	Telephone	+1 800 333 7421
	Public Internet Site	http://www2.sea.siemens.com/Products/Process-Instrumentation
	Repair Service	+1 215 646 7400 extension 3187

For customer/product support, visit the Siemens Process Instrumentation product support page at http://www2.sea.siemens.com/Products/Process-Instrumentation/Support/Customer-Support.htm. Select the desired type of support (e.g. Sales, Technical).

The current revision of this publication and other Siemens WiPS technical publications can be found at http://www2.sea.siemens.com/Products/Process-Instrumentation/Wireless-Solutions/Wireless+Solutions.htm. Click on the WiPS series interest (i.e. 100, 200, or 300). The publications are in Portable Document Format (PDF).

INSTALLATION

This section provides installation procedures for a WiPS 200 Series wireless network. A wireless network contains a master transceiver and up to eight remote (i.e. slave) transceivers. I/O Expansion modules provide the network with additional analog, digital, and pulse I/O capacity. Transceivers and I/O modules are mounted on user-supplied DIN rail by the installer. Accessories include antennas (omnidirectional and directional as needed), low-loss antenna cables, connector adapters, voltage transient suppression adapters, and power supplies.

A sample installation is shown in Figure 1. It shows a DIN-rail mounted transceiver and two I/O modules located in a NEMA 4X rated enclosure. Note the use of a single-point ground system to prevent undesired ground loop currents. Installation of user-supplied DIN rail and transceiver and I/O modules is discussed later in this section.

The highly directional Yagi antenna, shown below, is used when data transmission over longer distances is necessary. An omnidirectional whip antenna is used for shorter distances and when a circular radiation pattern is desired, often due to the wide physical distribution of remote transceivers. Regardless of antenna type, a surge arrestor is highly recommended, particularly in out-of-doors installations, to protect the connected transceiver from very large voltages induced by lightning strikes and other electromagnetic events.

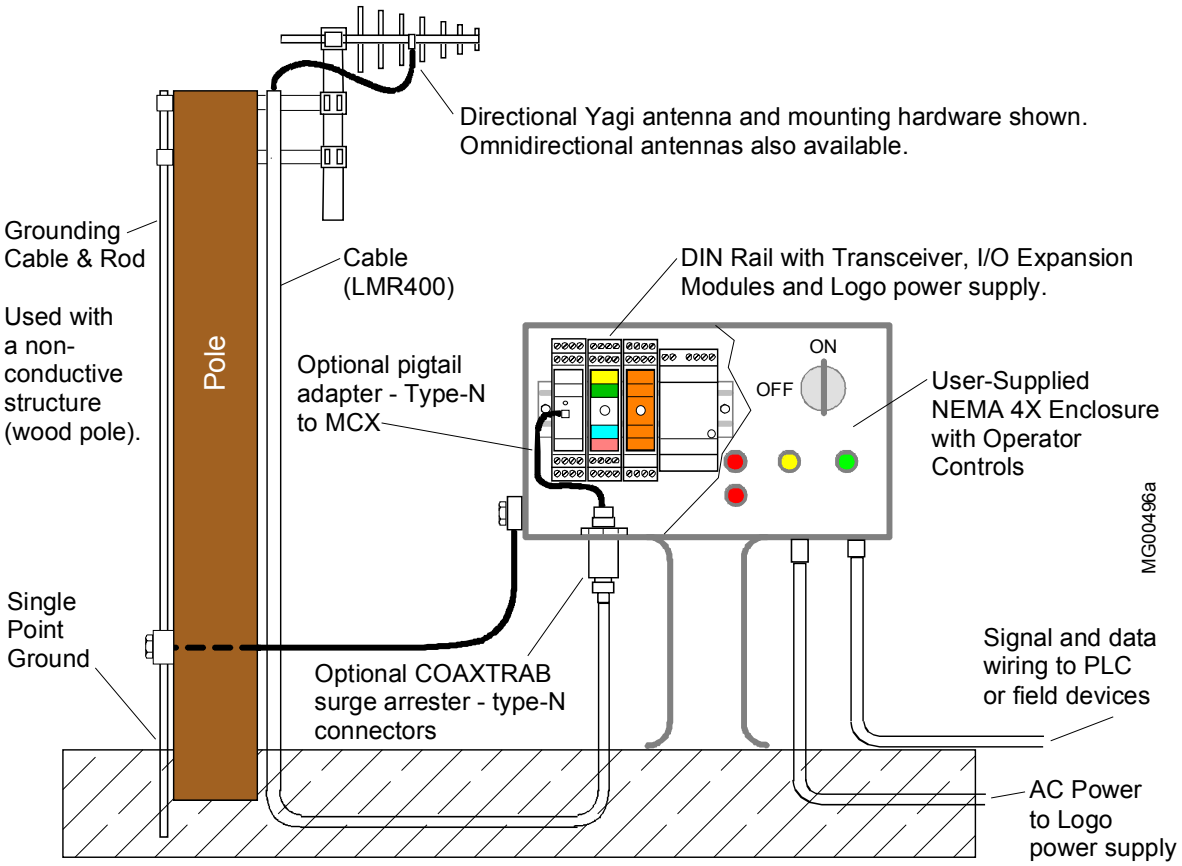


Figure 1 Sample Installation

DANGER

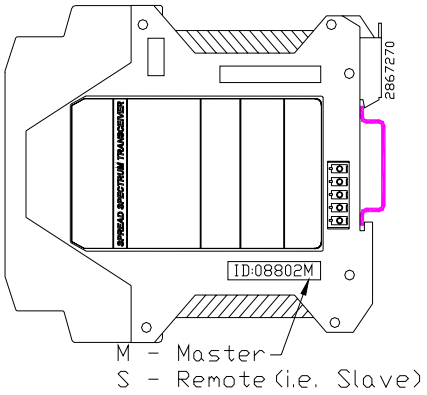
Electrical shock hazard
Explosion hazard

Will cause death or injury.

- Remove power from all wires and terminals before working on equipment.
- In a potentially hazardous atmosphere, remove power from equipment before connecting or disconnecting power, signal, or other circuit.
- Observe all pertinent regulation regarding installation in hazardous area.

Matched Transceivers

When WiPS transceivers (see Table 1) are ordered, a master transceiver and up to eight *matched* remote (i.e. slave) transceivers are supplied. These transceivers will communicate only with each other.[3] Matched transceivers have ID labels with the same five digit number. A master transceiver ID will have an "M" suffix; a remote transceiver will have an "S" suffix. See the adjacent figure.

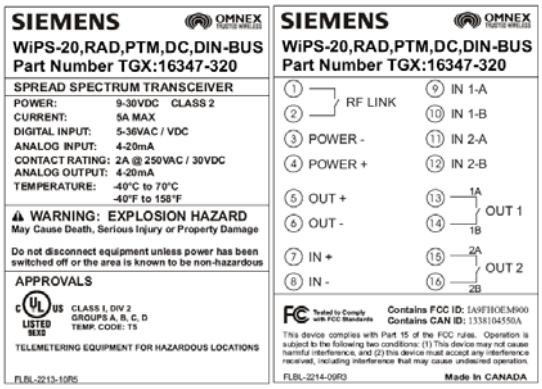


Note

When installing several wireless networks, keep track of the matched transceivers to insure that the proper data is delivered to the intended controller, PLC, recorder, or field device.

Nameplate and Wiring Labels

Each transceiver and I/O module has a nameplate label and a wiring label. The nameplate label carries the module's part number, agency approvals, and other data. The wiring label identifies the connection terminals. Sample labels are shown here.



To assist module identification, color coded faceplate labels are provided.

Transceiver – White
4-Channel Analog Input – Green
4-Channel Analog Output – Yellow
8-Channel Digital Input – Blue
8-Channel Digital Output – Pink
Combination Module – Multicolored, by signal type
Pulse Input and Pulse Output – Orange

FCC RULES AND COMPLIANCE

This device complies with 47CFR15.247 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

[3] Each transceiver has an internal Hop Key. All transceivers on a WiPS wireless network must have factory programmed Hop Keys with identical programming allowing them to communicate and exchange data. Hop Keys contain the electronic identifier and the unique frequency hopping pattern for the transceivers on that WiPS wireless network. For additional details, see Adding an Extra or Spare Transceiver to Your System later in this Guide.

Changes or modifications not expressly approved by Siemens will void the user's authority to operate the equipment.

This product is intended for fixed installation applications. In order to comply with FCC/ISC adopted RF exposure requirements, installation of this transmitter system's antenna must be performed in a manner that will provide at least a six foot (2m) clearance from the front radiating aperture to any user or member of the public.

FCC	47CFR15.247
ISC	RSS 210
UL	Class I, Div. 2 (Groups A,B,C,D)

CSA HAZARDOUS LOCATION PRECAUTIONS

This section provides CSA hazardous location precautions that should be observed by the user when installing or servicing the equipment described in this Instruction. These statements supplement those given in the preceding section.

Precautions - English

For Class I, Division 2 hazardous locations:

- Use only factory-authorized replacement parts. Substitution of components can impair the suitability of this equipment for hazardous locations.

For Division 2 hazardous locations:

- When the equipment described in this publication in installed without safety barriers, the following precautions should be observed. Switch off electrical power at its source (in non-hazardous location) before connecting or disconnecting power, signal, or other wiring.

Précautions - Français

Emplacements dangereux de classe I, division 2:

- Les pièces de rechange doivent être autorisées par l'usine. Les substitutions peuvent rendre cet appareil impropre à l'utilisation dans les emplacements dangereux.

Emplacement dangereux de division 2:

- Lorsque l'appareil décrit dans la notice ci-jointe est installé sans barrières de sécurité, on doit couper l'alimentation électrique a la source (hors de l'emplacement dangereux) avant d'effectuer les opérations suivantes branchment ou débranchement d'un circuit de puissance, de signalisation ou autre.

ENVIRONMENTAL CONSIDERATIONS

Operate each device within its environmental specifications to help ensure reliable, trouble-free operation with minimum down time. Refer to the Specifications section for operating temperatures limits, operating humidity, and maximum moisture content.

CAUTION

Exceeding the specified operating temperature limits can adversely affect performance and may cause damage to the instrument.

ANTENNA CONNECTORS AND SURGE VOLTAGE PROTECTION

Each transceiver has an MCX female antenna connector. The base 3-1/2", 1/4-wave whip antenna has an MCX male connector. Optional higher gain antennas and low-loss coaxial cables have type-N connectors. MCX to type-N adapters and other connector adapters are available. Optional antennas may be accompanied by additional installation instructions.

If an antenna will be installed out-of-doors or otherwise exposed to surge voltages or strong electromagnetic fields, such as from a nearby lightning strike, a COAXTRAB Surge Voltage Protection Adapter should be included in the installation; see Figure 1 for a typical installation. The adapter features a user replaceable gas arrestor tube that shunts induced high voltage to ground to help protect the transceiver.

Type-N connectors are provided on the adapter; the genders of the two adapter connectors are specified by the adapter part number. Mount the surge adapter through a bulkhead, through the wall of an enclosure (as shown in Figure 1), in-line with the antenna cable, on the supplied straight bracket, or on a user-fabricated bracket. Installation instructions are supplied with the adapter.

CURRENT (AMPERAGE) BUDGET CALCULATION

A common current bus interconnects a transceiver and its connected I/O modules; see Figure 2. The current on this bus may not exceed 5A. This section shows how to calculate the current flowing on the common current bus. Note that the calculations in this section are also useful when determining power supply requirements at each transceiver location.

Figure 2 shows a two-node (remote site and control room) wireless network. The remote site has a remote transceiver, two input modules, and a power supply. The master transceiver is installed at a control room with two complementary output modules and a power supply.

The bus current at each transceiver location is calculated by summing the current requirements for the transceiver and all connected I/O modules. Table 2 lists the current requirements of each module type.

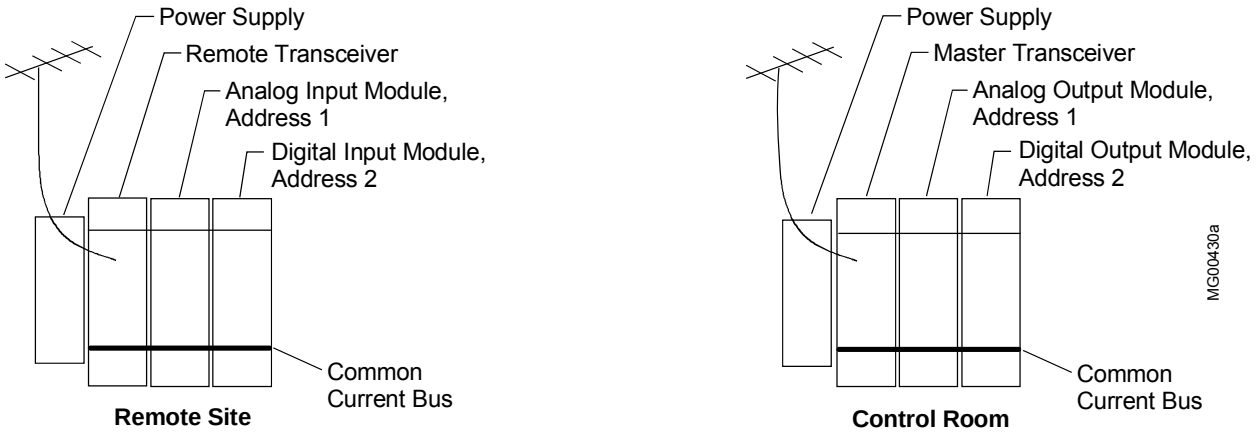


Figure 2 Current (Amperage) Budget Example

Remote Site

As shown in Figure 2, the remote site has one remote transceiver, one analog input module, and one digital input module. Table 2 shows that the transceiver draws 75 mA, the digital input module 26 mA, and the analog input module 32 mA plus 20 mA per active channel. The total current (I_t) requirement is:

$$I_t = 75 \text{ mA} + 26 \text{ mA} + 32 \text{ mA} + (4 \times 20 \text{ mA}) = 213 \text{ mA}$$

Control Room

At the control room, there is one master transceiver and complementing I/O: one analog output module, and one digital output module. The total current requirement is 287 mA [75 mA +100 mA + 32 mA + (4 x 20 mA)].

Table 2 WiPS Module Bus Current Requirements

Module	Bus Current Requirement (in mA @ 24 Vdc)
Transceiver	75 mA average; 200 mA peak* + 20 mA per active analog channel
8-Channel Digital Input Expansion Module	26 mA
8-Channel Digital Output Expansion Module	100 mA
4-Channel Analog Input Expansion Module Module only* Internal Loop Power**	 32 mA + 20 mA per active analog channel
4-Channel Analog Output Expansion Module Module only* Internal Loop Power**	 32 mA + 20 mA per active analog channel
Combination Module Module only* Internal Loop Power**	 80 mA + 20 mA per active analog channel
Pulse Input Expansion Module	50 mA
Pulse Output Expansion Module	120 mA

* Base current for module.

** Add 20 mA for each analog channel using internal loop power. Externally powered analog loops are not added to the calculation.

USER SUPPLIED MATERIALS

A partial list of the materials the user must furnish is provided below. Additional materials may be needed, depending upon peripheral and accessory equipment and the particular installation.

1. DIN rail(s), mounting hardware, and enclosure(s) appropriate to the environment and hazardous area certification
2. Signal and power wiring and appropriate tools for wire preparation (e.g. wire cutters and strippers)
3. Conduit tubing, adapters, and outlet boxes and appropriate tools for cutting and routing conduit
4. Circuit protection devices (e.g. fuses, circuit breakers, on-off switches)

Electrostatic Discharge

Semiconductor devices must be protected from electrostatic discharge. A properly grounded conductive anti-static wrist strap must be worn whenever a circuit board assembly is handled or touched. A service kit with a wrist strap and static dissipative mat is available from most electronic parts supply companies.

I/O MODULE CONFIGURATION SWITCH SELECTIONS

Configure the following modules before mounting on the DIN rail.[4] Field settable switches are provided module configuration. Default settings are provided.

- 4-Channel Analog Output Module (See Figure 13 on page 23 and paragraph A below.)
- 8-Channel Digital Output Module (See Figure 15 on page 24 and paragraph A below.)
- Combination Input/Output Module (See Figure 16 on page 25 and paragraph A below.)
- 2-Channel Pulse Input Module (See Figure 17 on page 26 and paragraph B below.)
- 2-Channel Pulse Output Module (See Figure 18 on page 26 and paragraph B below.)

[4] A module may be configured after installation. However, access to switches may be impeded by adjacent modules.

A. Analog Output and Digital Output Fault Response Selections

Three I/O modules (4-Channel Analog Output Module, 8-Channel Digital Output Module, and Combination Input/Output Module) contain DIP switches that may be set by the user to determine the module's response to the connected transceiver's loss of an RF Link or to the loss of an input signal. There is a DIP switch for each signal channel allowing individual programming of each channel. See Figures 13, 15, and 16 on pages 23, 24, and 25 respectively.

When a loss of RF Link or signal occurs:

- If the DIP switch is set to ON, the default setting, the output from that channel will MAINTAIN LAST STATE.
- If the DIP switch is set to OFF, the output from an analog channel will be 2 mA; the output from a digital channel will be OFF.

Refer to paragraph C to set the DIP switches.

B. Pulse Input and Pulse Output Mode of Operation Selections

The 2-Channel Pulse Input Module has five sliding-shunt switches, the complementary 2-Channel Pulse Output Module has four DIP switches. Several switches are used to select mode of operation: counter or frequency. Others allow selection of coupling, impedance, speed, and sensor input. Setting for Pulse Input and Pulse Output Modules are detailed below. Refer to paragraph C to set the switches.

Pulse Input Module (See Figure 17 on page 26)

Switch 1 Coupling – AC or DC; Default setting is AC
Set the jumper to AC Coupling if the pulse voltage will never drop below 3.6V with respect to the transceivers power supply negative. This would apply where there is a DC bias voltage added to the pulse input voltage, where the DC bias exceeds 3.6V such as in a ground loop condition. All other applications, including an AC sine wave input, should be set to DC Coupling.

Switch 2 Input Impedance – Low or High; Default setting is High
The Low impedance setting has an input impedance of 1K Ohm and the High setting has an impedance of 90K Ohm. Use the High impedance setting for magnetic transducers to prevent the current draw from dropping the voltage below the 100 mVAC peak-to-peak minimum. Use the Low impedance setting for digital and relay interfaces because the additional current draw will prevent electrical noise from causing false pulse counts.

Switch 3 Operation – Counter or Frequency; Default setting is Counter
Pulse input values are stored in the PLC register in either of two formats: an absolute count of the number of pulses, which will require that the register be reset periodically to prevent overflow, or a frequency value. The frequency setting will take the average number of pulses every second.

Switch 4 Speed – Low or High; Default setting is High
The Low speed pulse setting is for a maximum input frequency of 2 Hz with a minimum pulse width of 70 ms. The High speed setting is designed for pulse frequencies up to 32 kHz and requires a minimum pulse width of 10 microseconds. Use the Low speed setting for mechanical pulse generating devices such as relays and the high speed setting for all other applications. The Low speed setting prevents contact bounce from being recorded as pulses.

Switch 5 Sensor Input – Single Ended (Common Mode) or Differential Mode; Default setting is Single Ended
If the pulse signal is expected to be of negative polarity, with respect to ground, set the module to Differential mode, whereas if the signal will remain positive at all times, set it to Single Ended (Common Mode).

Pulse Output Module (See Figure 18 on page 26)

There are two DIP switches for each channel: switches 1 and 2 for channel 1, switches 3 and 4 for channel 2.

Switches 1 (CH1) and 3 (CH2) – Counter or Frequency Mode; Default setting is Counter
When Counter mode is selected, the module will output a specific number of pulses as determined by the PLC value written to it by the Pulse Input Module. If Frequency mode is selected, the pulse output module will generate pulses in accordance with the desired frequency, with a 50% duty cycle. In Frequency mode, the low or high speed switch setting below is ignored.

Switches 2 (CH1) and 4 (CH2) – Low or High Speed Operation; Default setting is High
Set this switch when the channel is set to Counter mode; see preceding paragraph. If High speed is selected the pulses will be sent at a frequency of 10 kHz with a 50% duty cycle. If Low speed is selected the pulses will be sent at a frequency of 10 Hz also with a 50% duty cycle.

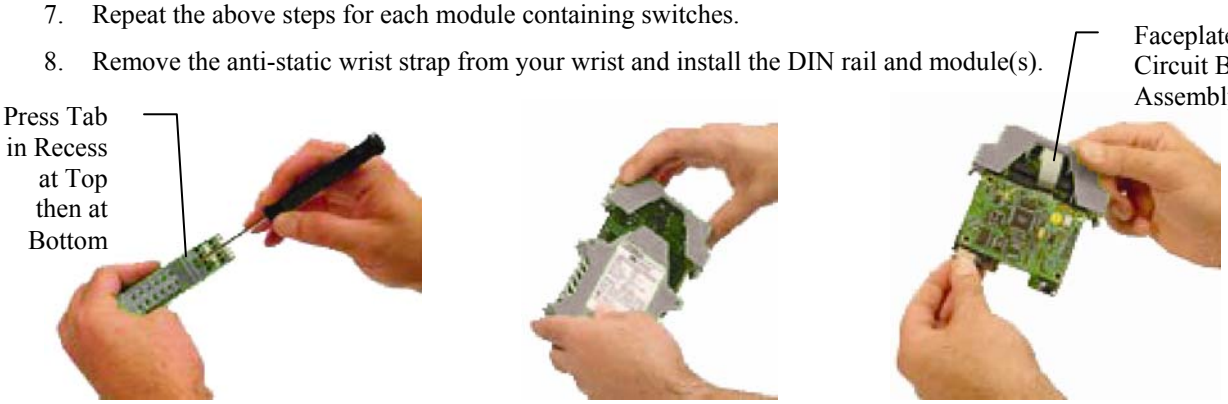
C. Setting Module Switches

Perform the following steps to change switches from default settings.

1. Place an anti-static wrist strap on your wrist and connect the strap's ground lead to a good ground. If the module to be configured is installed on DIN rail, go to step 2; if it has not been installed, go the step 3.
2. Remove power and signal from the transceiver and all I/O modules, if the module is installed and wired.

   At the module to be configured, remove the wired connector block(s) from the module; see Figure 5 on page 17 for photographs (alternatively, label each wire to facilitate reconnection and then disconnect the wires).

   Physically separate interconnected modules to disconnect the common current bus connectors. Use a small straight slot screwdriver to lever the spring-loaded module mounting lip away from the DIN rail allowing that module to slide on the rail. Remove the module from the DIN rail.
3. Remove the faceplate/circuit board assembly by locating a rectangular recess near the numbered terminals on the top of the module cover; see the photographs below and Figure 4 on page 15. With a small flat blade screwdriver, press the tab in the recess inward and pull that corner of the faceplate outward slightly. Repeat this process at the bottom of the module. Carefully pull the faceplate/circuit board assembly from the cover.
4. Locate the module at hand in Figures 12 through 18 on pages 23 through 26. Set the switches as described in the appropriate preceding paragraph and figure.
5. Press the faceplate ribbon cable into the module and carefully insert the circuit board into its cover until it snaps into place. When inserting the circuit board into its cover, be sure the circuit board engages the card guides in the cover and that the circuit board card edge connector mates with the connector in the cover.
6. If the module was removed from DIN rail in step 2, install the module on the rail. Fully insert the connector blocks (or connect removed wires).
7. Repeat the above steps for each module containing switches.
8. Remove the anti-static wrist strap from your wrist and install the DIN rail and module(s).



MOUNTING THE DIN RAIL

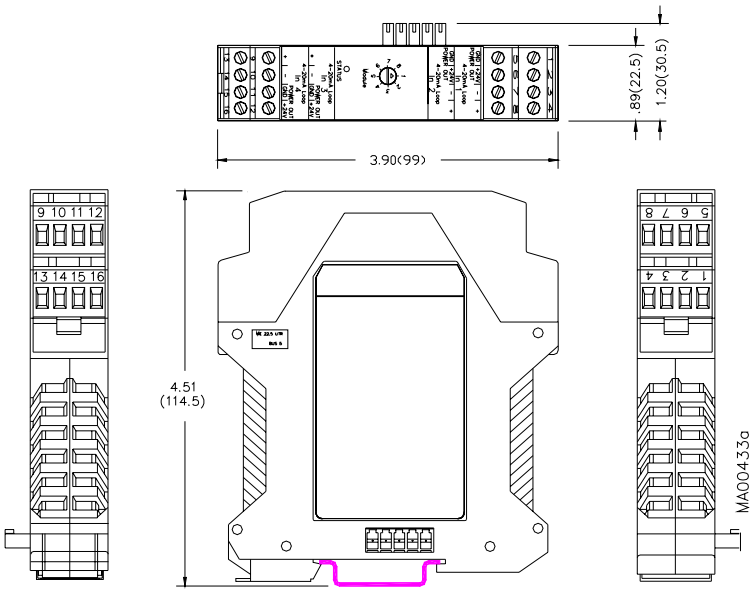
At each installation site, mount the DIN rail and DIN rail mount modules (e.g. transceiver, I/O modules, power supply) in a NEMA enclosure appropriate for the environment and hazardous area classification. Refer to Figure 3 for transceiver and I/O module dimensions. Allow room for:

- Physically mounting and wiring the modules and for antenna, power, ground and signal wire runs
- Accessories (e.g. low loss cable and MCX to N-type connector adapter, surge voltage protection adapter)
- Conduit adapters
- Operator controls
- Circuit protection/safety devices (e.g. switches, circuit breakers, or fuses)
- Other items as determined by the installer/user.

Fasten the DIN rail to a rigid panel within the enclosure using user-supplied hardware. An enclosure is required in a hazardous area installation. In a non-hazardous area, a secure enclosure can provide safety for area personnel and it restricts access to the equipment.

IMPORTANT

The DIN rail must be grounded. When mounting the DIN rail in a non-conductive enclosure, install a ground wire between the rail and the single point ground.



DIN Rail Mount Transceiver or I/O Expansion Module

Figure 3 Physical Dimensions

MOUNTING A TRANSCEIVER OR I/O MODULE

I/O Expansion Modules may be mounted on a section of DIN rail in any sequence. Mount the Transceiver at either end of the row of up to 8 I/O modules, to ensure sufficient heat dissipation.

IMPORTANT

If a module contains configuration switches that have not been set, refer to I/O Module Configuration Switch Selections on page 11 before installing the module on DIN rail. A list of modules with configuration switches is provided in the referenced section.

At each installation site, the transceiver and I/O modules are interconnected by built-in bus connectors; see Figure 4 below. Each module has male bus connectors on one side and female bus connectors on the other. When mounting modules on a DIN rail, be sure to correctly orient modules so they interconnect and the module faceplates are oriented for easy reading. Refer to the following procedures to install modules.

Each module has a moveable, spring-loaded mounting lip to assist in mounting a module, sliding a module along the DIN rail, and removing a module from the DIN rail. This lip has a slotted tab so the blade of a small screwdriver can be inserted and the lip levered away from the rail.

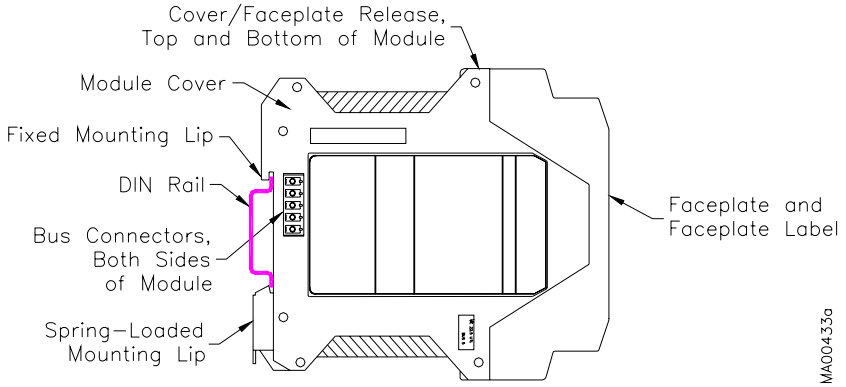


Figure 4 Module Features

To mount a row of up to 8 modules on a DIN rail:

1. Interconnect the modules by mating the bus connectors.
2. Hook the fixed mounting lips, see Figure 4, on the DIN rail.
3. Press the assembly onto the DIN rail. The spring-loaded mounting lips will snap onto the rail. Do not use excessive force.
4. A transceiver is supplied with a bus connector cover, shown at right. Place the cover over the exposed male bus connectors at one end of a group of modules.

To add a module to a row:

1. Note the gender of the installed module's bus connector.
2. Orient the module and hook the module's fixed mounting lip on the DIN rail.
3. Press the module against the DIN rail until the spring-loaded mounting lip snaps onto the rail.
4. Slide the module to one side until the bus connector mates with the adjacent module. A module will easily slide on the DIN rail if the spring-loaded lip is levered away from the rail.
5. As required, place a bus connector cover (supplied with a transceiver) over the exposed male bus connectors at one end of a group of modules.

To remove a module from the DIN rail:

1. Separate the module to be removed from adjacent modules. To move a module, use a small straight-slot screwdriver to lever the spring loaded mounting lip slightly away from the rail and slide the module along the DIN rail until the bus connectors separate. Be sure the bus connectors *on both sides* of the module to be removed are fully disengaged from adjacent modules.
2. On the module to be removed, lever the moveable, spring-loaded mounting lip away from the DIN rail. Then pull the module from the DIN rail.

MOUNTING THE 1/4-WAVE WHIP ANTENNA

Mount the 3-1/6" (80.4 mm) high, omnidirectional whip antenna[5], shown at right, within 5' (1.5m) of the transceiver to allow the supplied 6' (2m) cable to easily reach between the antenna and transceiver. A mounting bracket and three screws are supplied. Antenna spacing (transmitter to receiver) should not exceed 600' to 1000' (183m to 305m). Line of sight is not a requirement.

Incorrect antenna placement and positioning can have a significant impact on the performance of the system. Keep the omnidirectional antenna vertical and mounted as high as possible.

1. Fasten the supplied right-angle bracket to a rigid, vibration-free surface such that the antenna is oriented vertically.
2. Unscrew the black disk from the antenna cable end. Insert the antenna cable stud into the large center hole in the bracket and thread the disk onto the stud. The shallow shoulder on the disk should be toward the bracket surface. Refer to the cover of this publication.
3. Center the disk in the hole using the shallow shoulder on the disk to assist centering and then tighten the disk. The supplied hex wrench can be inserted in a hole in the disk perimeter to help tighten the disk. Do not over tighten. *The threaded stud must not be in contact with the grounded bracket.*
4. Thread the antenna onto the stud and tighten.
5. Once the transceiver is installed, plug the MCX male connector on the end of the antenna cable into the MCX female connector on the transceiver faceplate.

WIRING

This section provides wiring guidelines for the transceiver and I/O Expansion modules.

A wireless network contains a master transceiver and up to eight *matched* remote transceivers. These transceivers will communicate only with each other. Refer to Installation, Matched Transceivers for additional information. Before wiring transceivers, confirm that the ID numbers match and that the installed locations are correct. This is particularly important when installing several wireless networks.

These devices must be wired in accordance with Class 1, Div. 2 wiring methods as described in the National Electrical Code, Article 501-4(b) or the authority having jurisdiction.

DANGER

Electrical shock hazard
Explosion hazard

Will cause death or injury.

- Remove power from all wires and terminals before working on equipment.
- In a potentially hazardous atmosphere, remove power from equipment before connecting or disconnecting power, signal, or other circuit.
- Observe all pertinent regulations regarding installation in a hazardous area.

[5] For other antenna models, refer to the appropriate antenna Data Sheet for specifications and mounting dimensions. Additional installation information may be provided with the antenna.

Electrical Connections – Power and I/O connections are completed through screw actuated compression terminals.

Connector blocks can be removed from a module for wiring, as shown in the two figures below. Insert a small straight-slot screwdriver between a connector block and the faceplate and use a gentle prying motion to separate the connector block from the module. Each connector in a module is uniquely keyed. When installing a connector block, be sure to fully insert the block in the module.

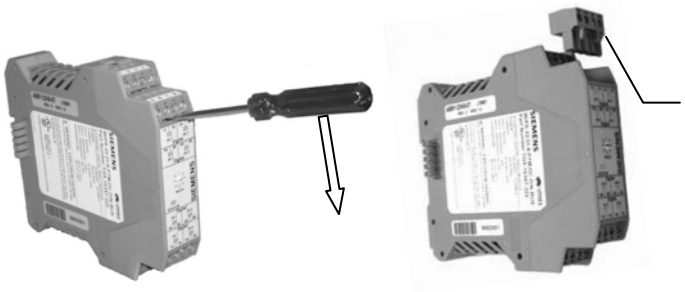


Figure 5 Removing a Connector Block

A snap-in MCX female connector is provided for the transceiver antenna connection.

Wire Stripping Recommendations:
Screw terminal wiring - 1/4" (6 mm) to 5/16" (8 mm)
Be careful not to nick the conductor or cut away strands.

Wire Selection - Stranded wire is recommended for most connections. Carefully select wire size, conductor material, and insulation. Some selection considerations are:

- current and voltage to be carried
- total length of each wire run
- whether wire will be bundled or run singly
- indoor or outdoor installation
- temperature extremes (Use supply wires suitable for 5°C (10°F) above ambient temperature.)
- exposure to sunlight
- vibration
- types of contaminates

Wire Routing and Conduit - DC wiring should be separated from AC wiring and away from AC powered pushbuttons, alarms, annunciators, motors, solenoids, and similar devices. Conduit and raceways are commonly used for routing wiring. Wiring not installed in conduit or raceway should be clamped or supported approximately every 12 inches (300 mm).

Power Input Circuit Protection

A circuit protection device must be installed in the power input circuit between the power source and the WiPS transceiver or I/O module. Locate the protective device in a non-hazardous area unless suitable for use in a hazardous area. Circuit protection can be provided by a circuit breaker, fuse or on-off switch accessible to the operator, except where otherwise stated in this guide or by a certifying agency.

- AC to DC (converter) power supply – Typically, this power supply includes a fuse or circuit breaker in its output circuit and often includes current limiting. An additional protective device at the module enclosure is recommended. Check power supply specifications carefully.
- Battery power supply – This power system, because of the large amount of energy stored in a battery, must include circuit protection.

Transceiver Wiring Examples

Five transceiver wiring examples are provided below. Figures 6, 7, and 8 show typical transceiver wiring for 2-wire, 3-wire, and 4-wire current loops. Figures 9 and 10 show two variations on the wiring for a loop powered external analog device. Also shown in Figures 9 and 10 is the wiring for an RF Link annunciator, which can be an input to a PLC or controller or a separate light or siren. A digital output wiring example is provided in Figure 9.

The transceiver is DC-powered, typically by a DIN rail mount power supply, as shown below. The power supply for the transceiver also powers the connected I/O modules. Power is supplied through the transceiver and across the common current bus as shown in Figure 2 on page 10.

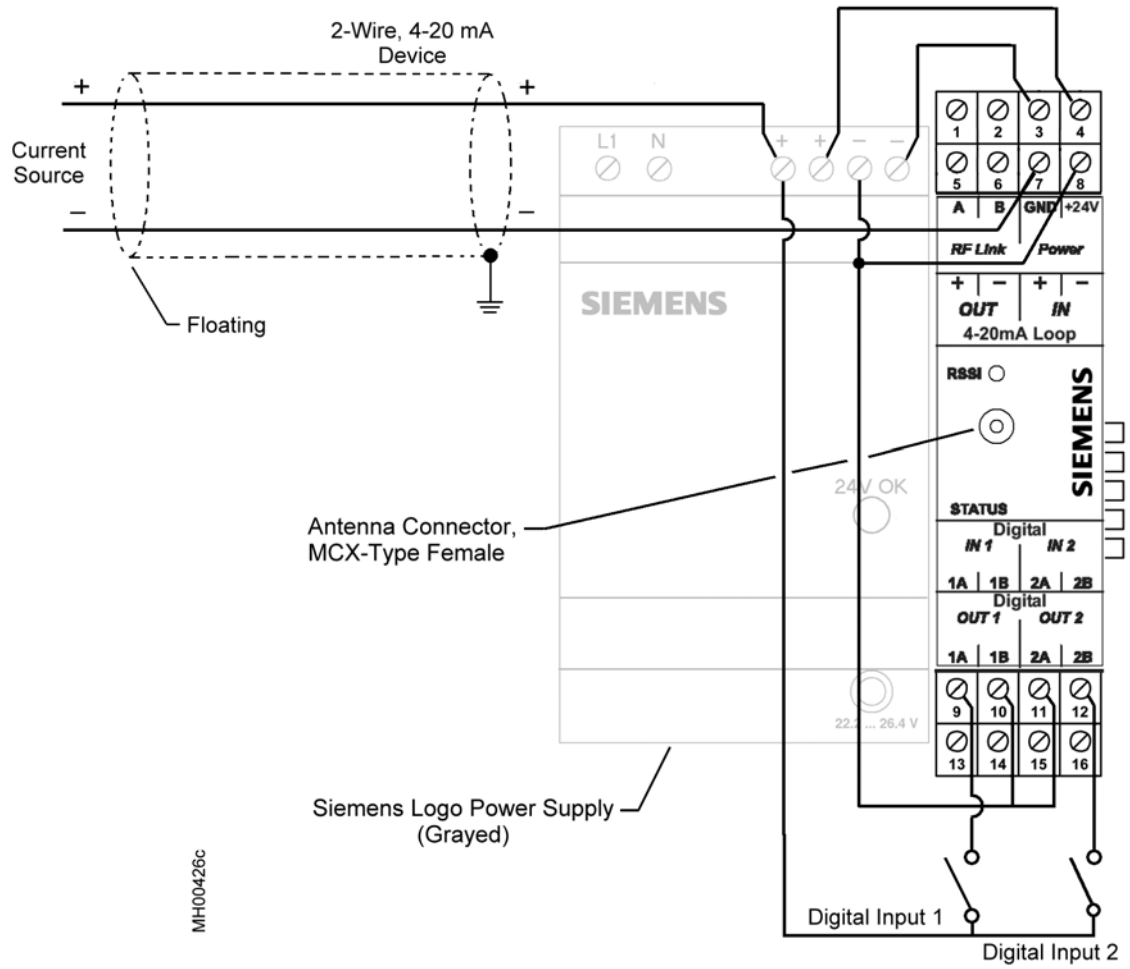


Figure 6 Transceiver Wiring, 4-20 mA Current Loop with 2-Wire Device

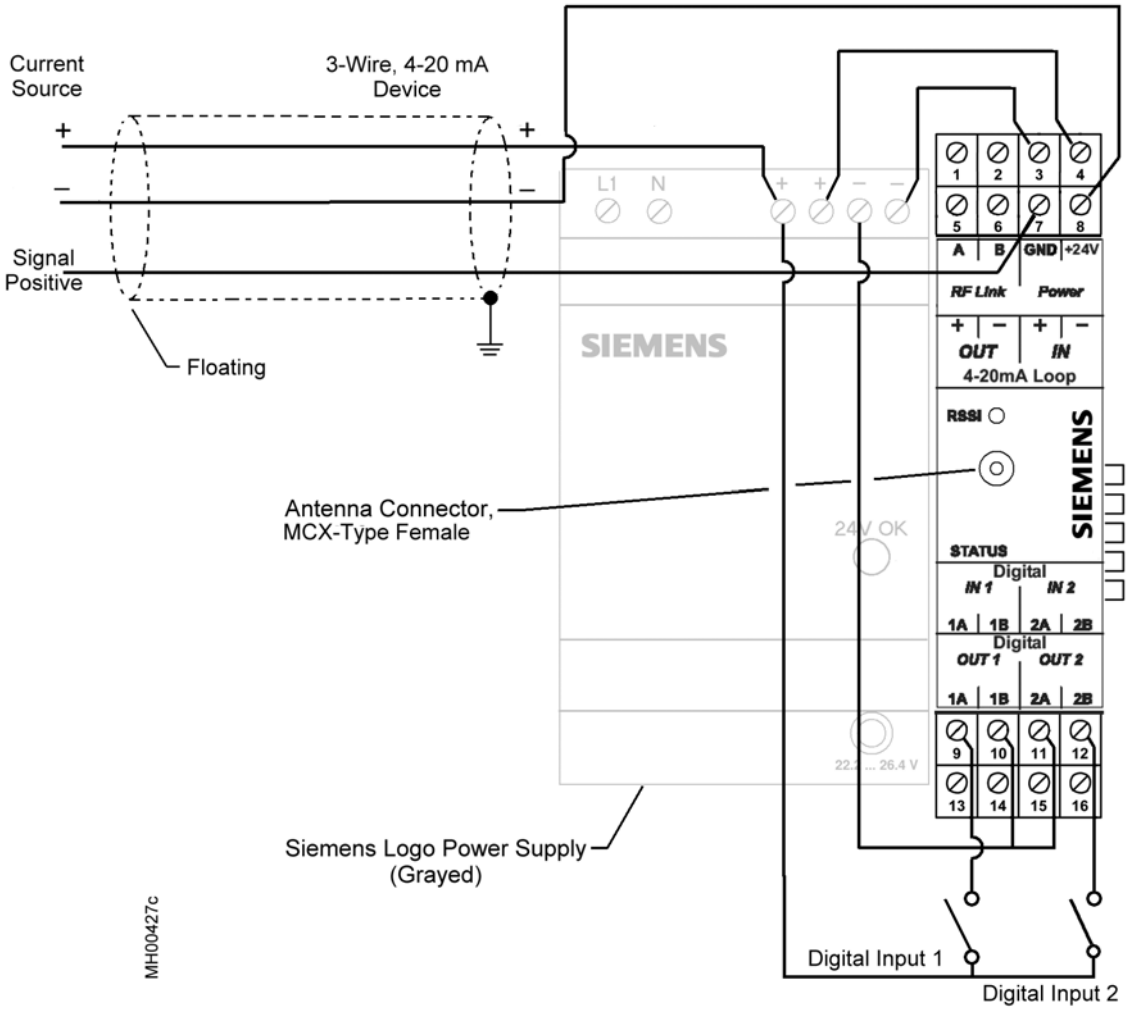


Figure 7 Transceiver Wiring, 4-20 mA Current Loop with 3-Wire Device

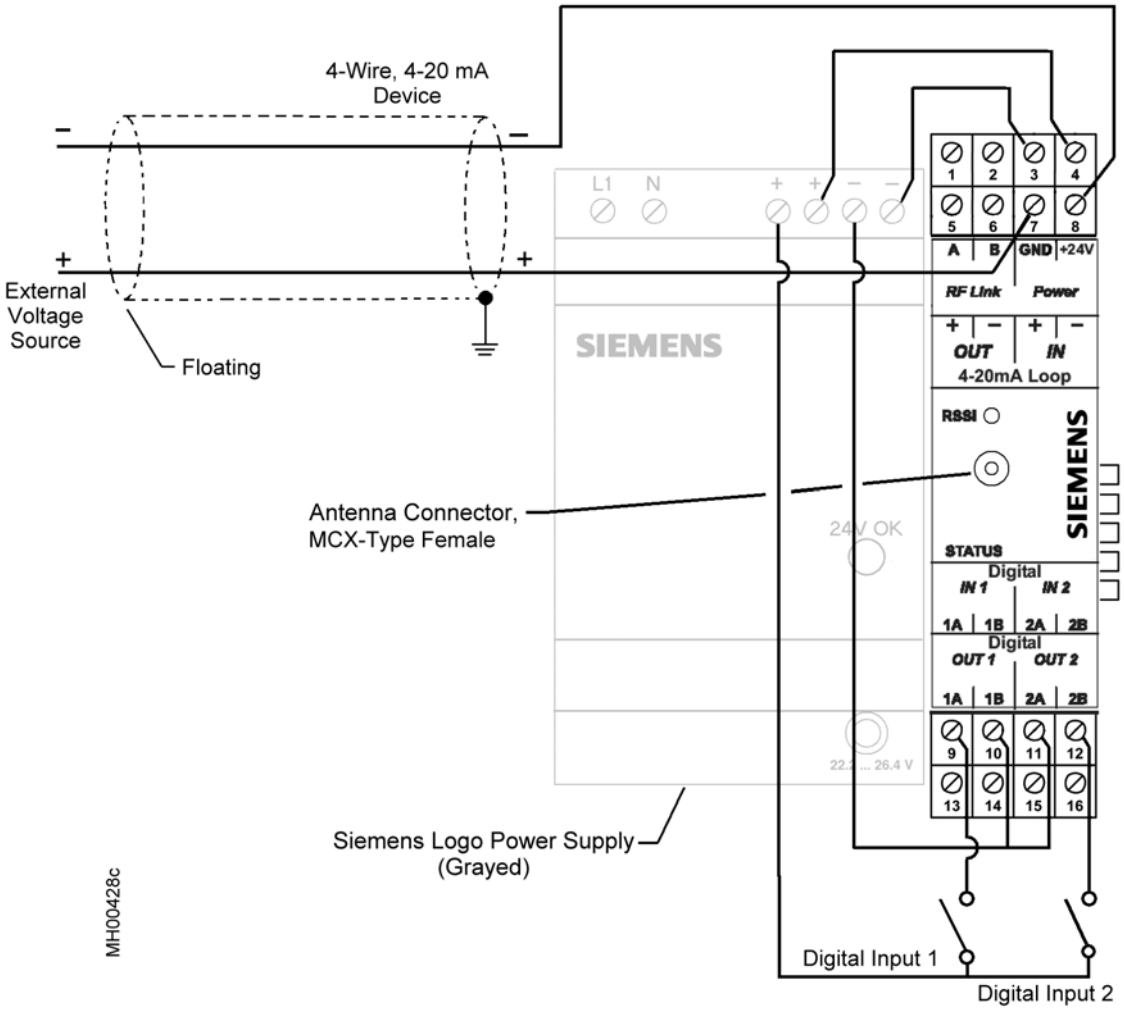


Figure 8 Transceiver Wiring, 4-20 mA Current Loop with 4-Wire Device

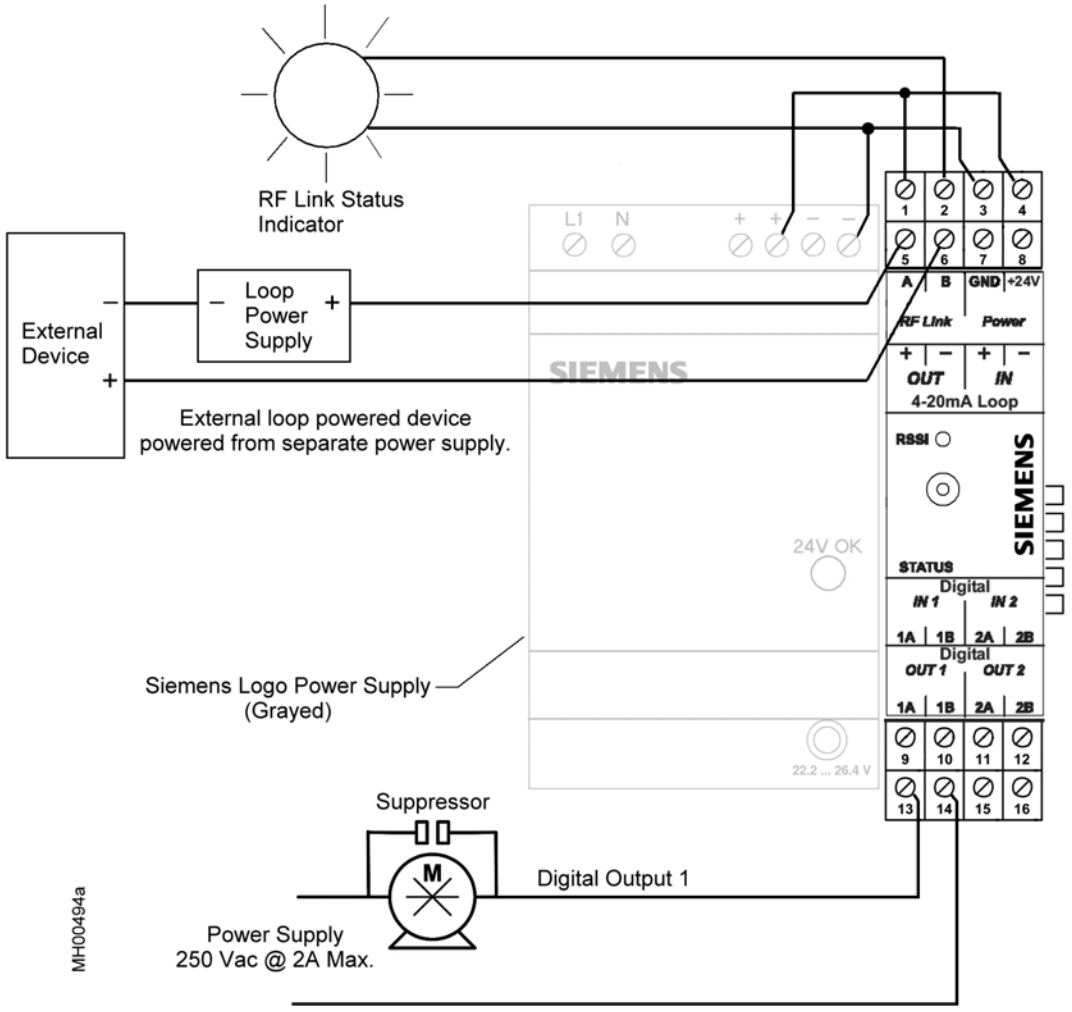


Figure 9 Transceiver Wiring, Analog and Digital Outputs

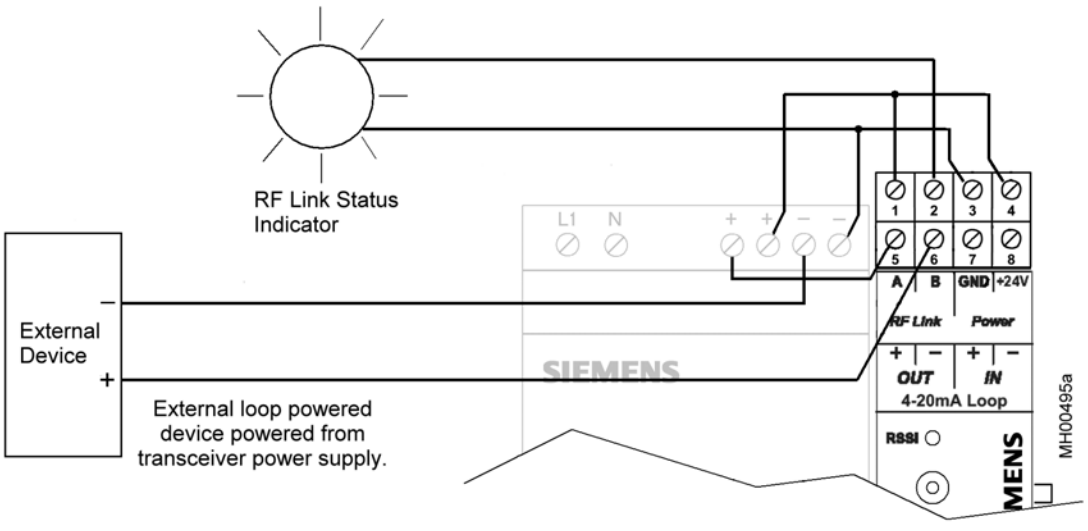


Figure 10 Transceiver Wiring, Analog Output Wiring for a Loop Powered Device

Transceiver RF Link and Output State Wiring Options

This section describes the transceiver RF link status relay and the analog output and digital output wiring options. A block diagram of the transceiver is shown in Figure 11.

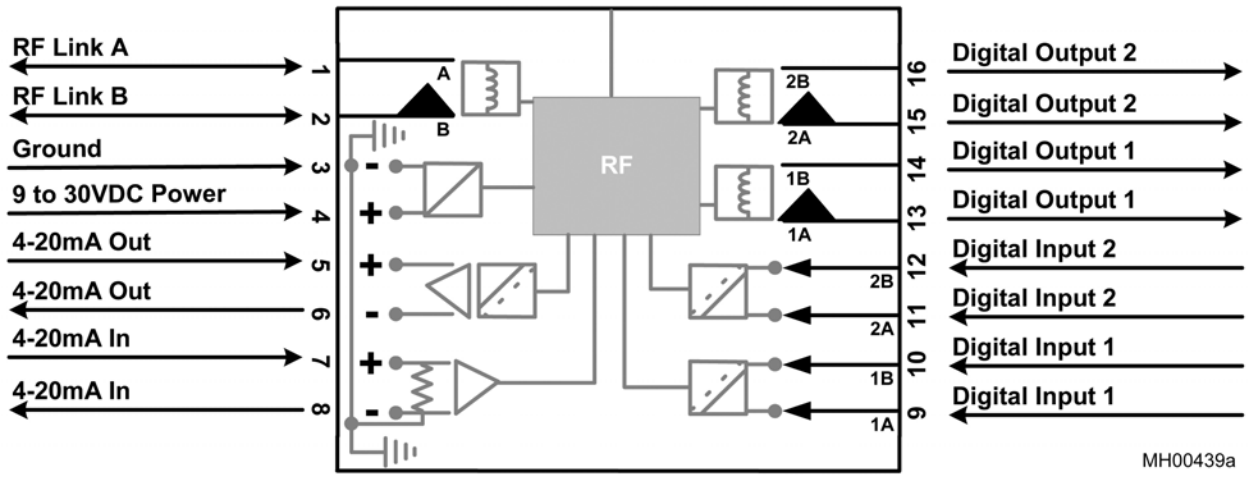


Figure 11 Transceiver Block Diagram

Transceiver RF Link

The RF Link relay has Form A, Normally Open (NO) contacts that close when the transceiver establishes an RF link with another transceiver. The contacts are often used to turn on a STATUS light, provide a digital status signal to a controller or PLC, or mechanically disconnect an analog or digital signal, as described below, when an RF link is lost. Refer to the Specifications section for relay contact rating.

For additional information about RF Link response, refer to Transceiver and I/O Expansion Module Status LEDs on page 30.

Transceiver Analog and Digital Output Last State Selection

The default state upon loss of RF link for the analog and digital outputs is MAINTAIN LAST STATE. Either an analog output or a digital output may be wired in series with the RF Link contact to provide a FAULT OFF status when an RF link is lost. Refer to the Specifications section for relay contact rating.

I/O Expansion Module Wiring Examples

I/O module wiring connections are shown in Figures 12 through 18 on the following pages.

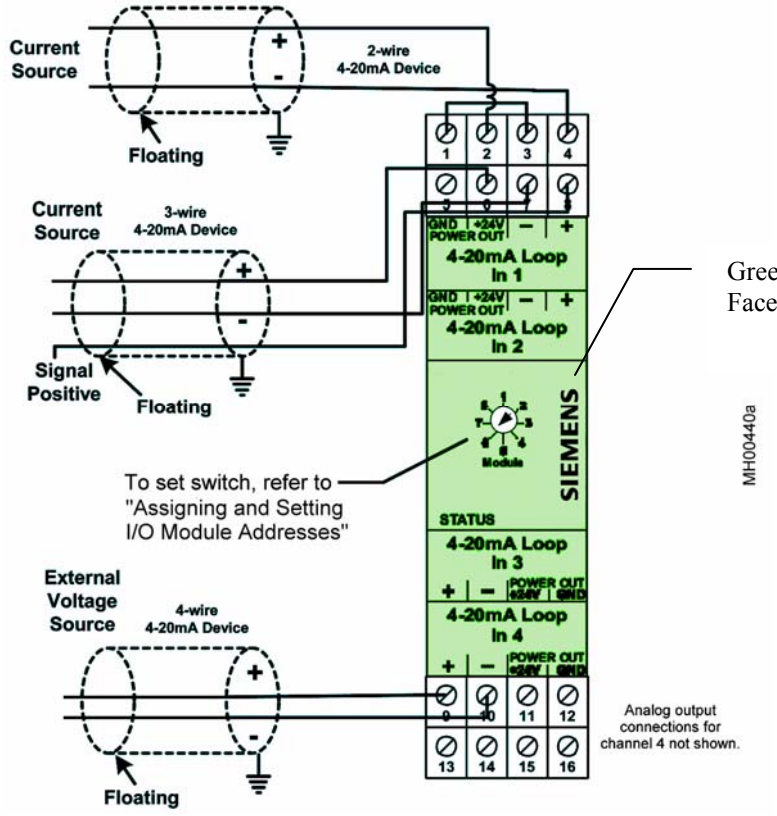


Figure 12 4-Channel Analog Input Module Wiring

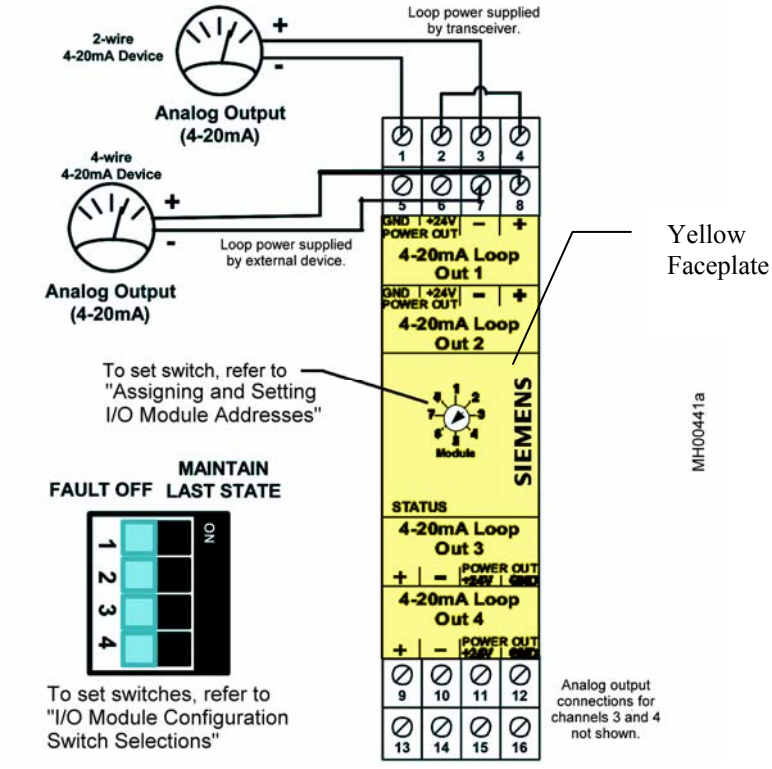


Figure 13 4-Channel Analog Output Module Wiring

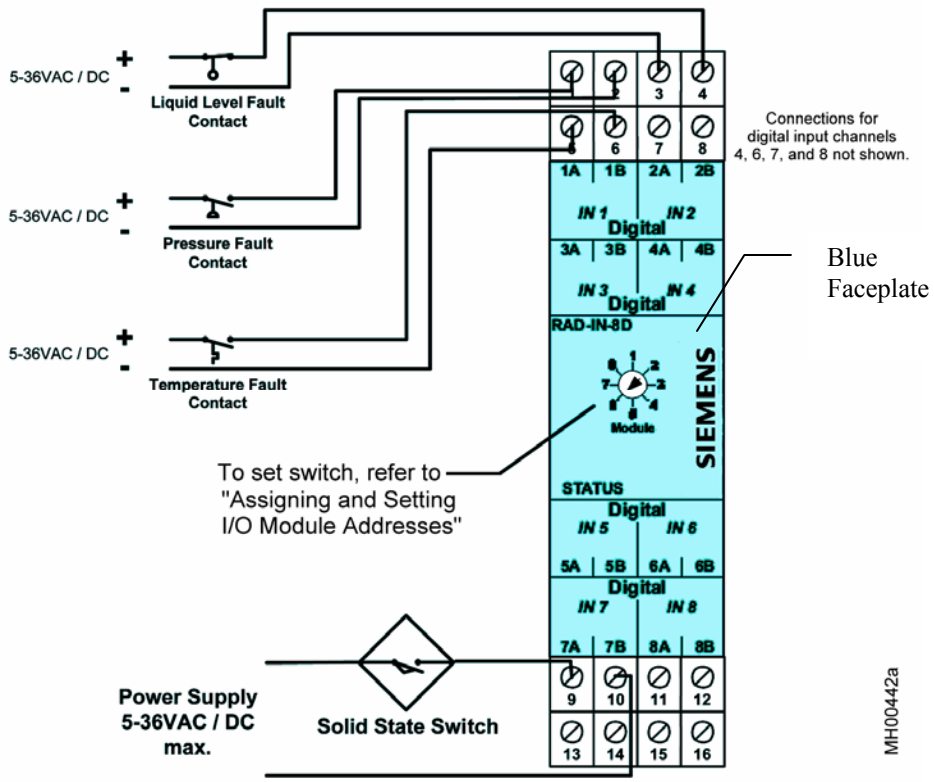


Figure 14 8-Channel Digital Input Module Wiring

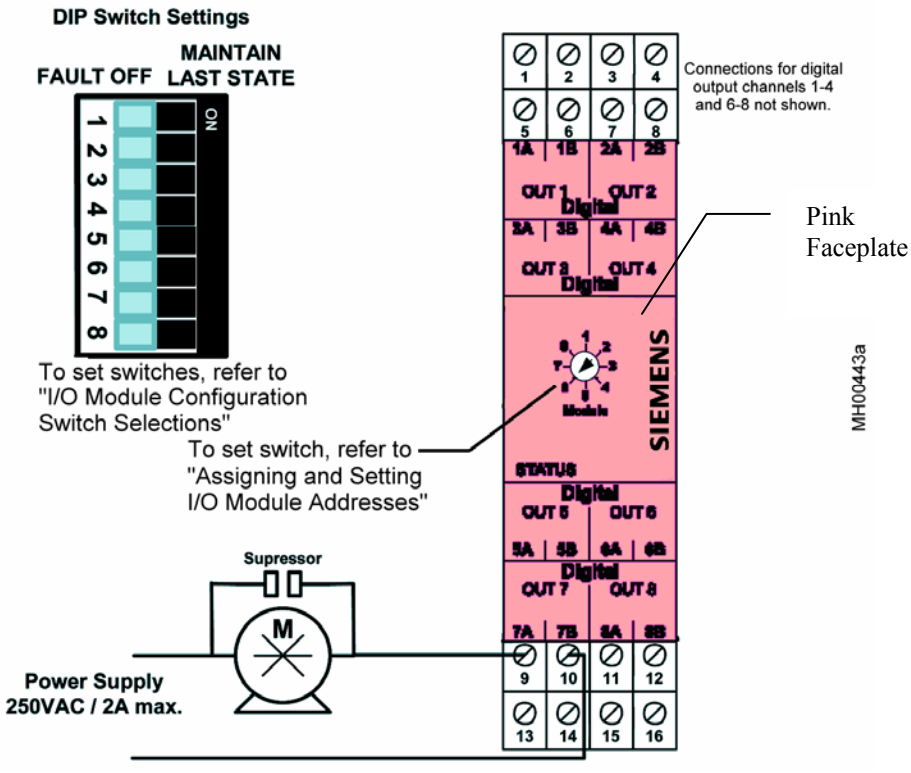


Figure 15 8-Channel Digital Output Module Wiring

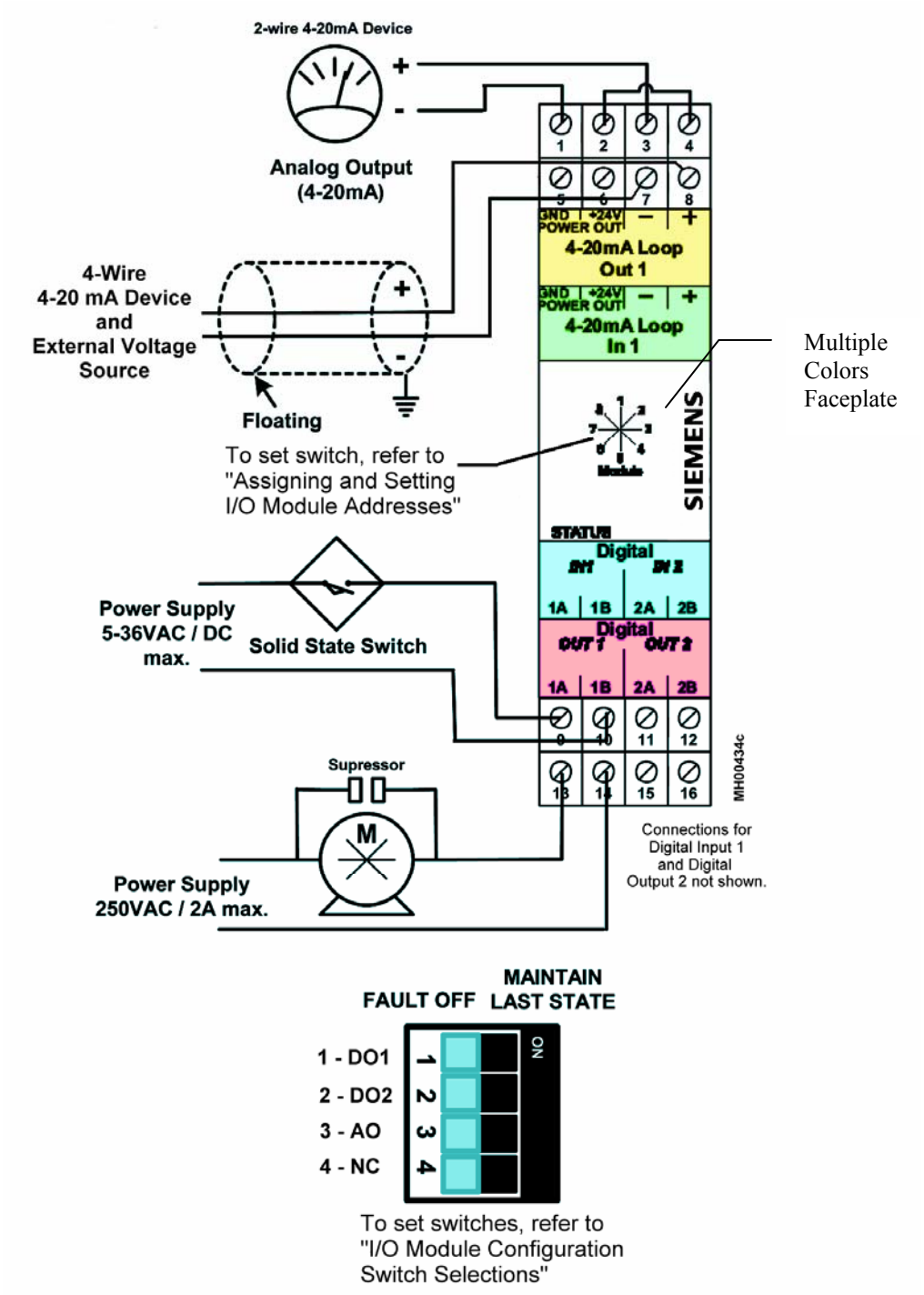


Figure 16 Combination Input and Output Module Wiring
(One Analog Input, One Analog Output, Two Digital Inputs, and Two Digital Outputs)

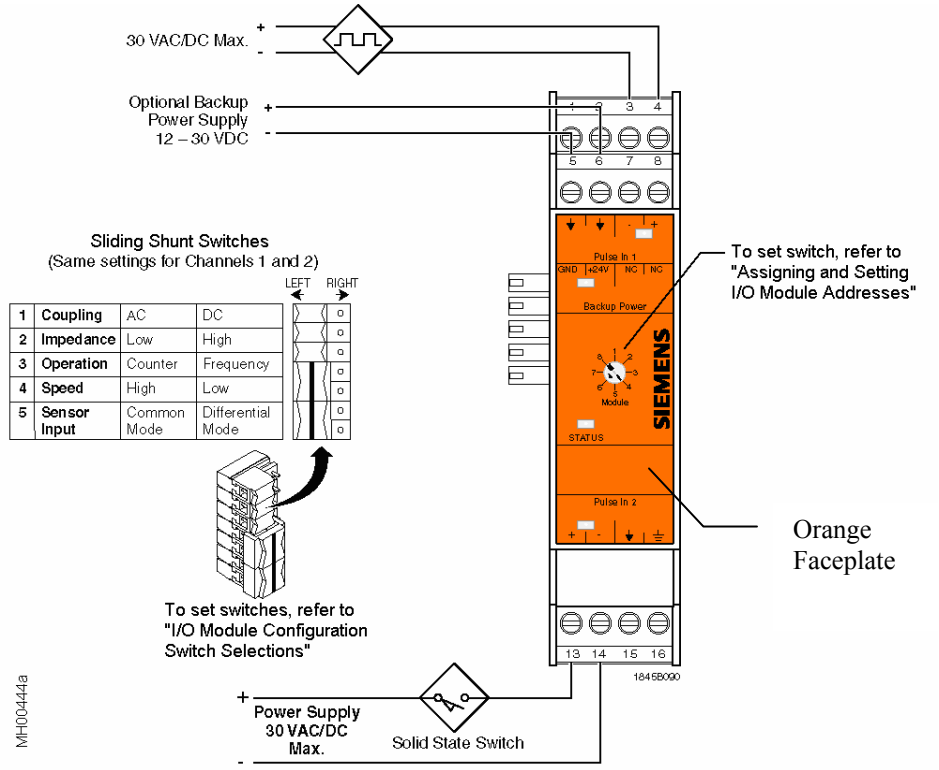


Figure 17 2-Channel Pulse Input Module Wiring

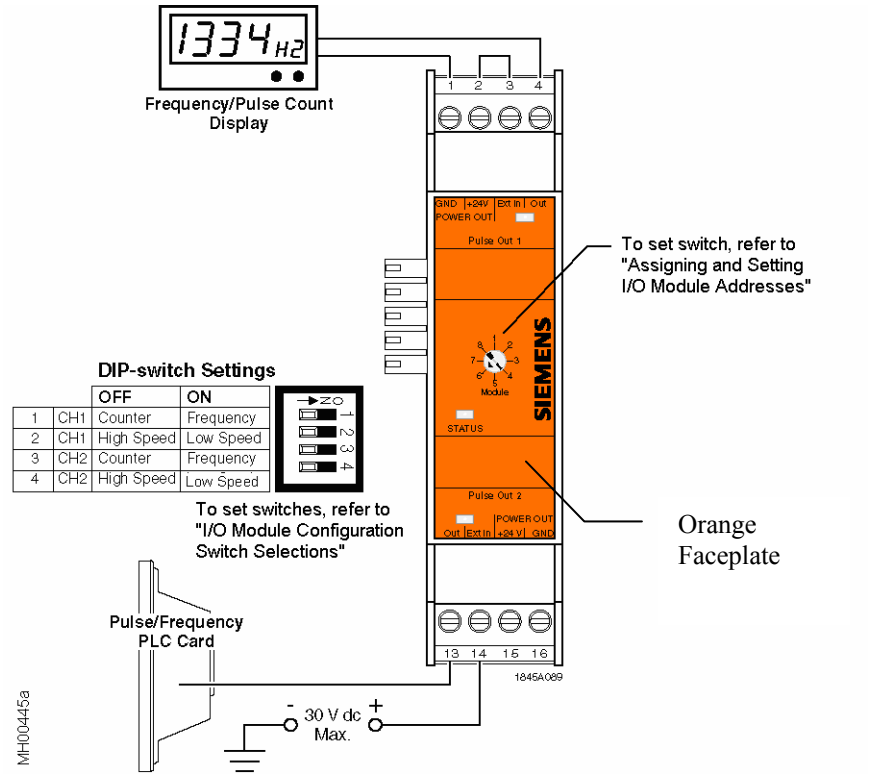


Figure 18 2-Channel Pulse Output Module Wiring

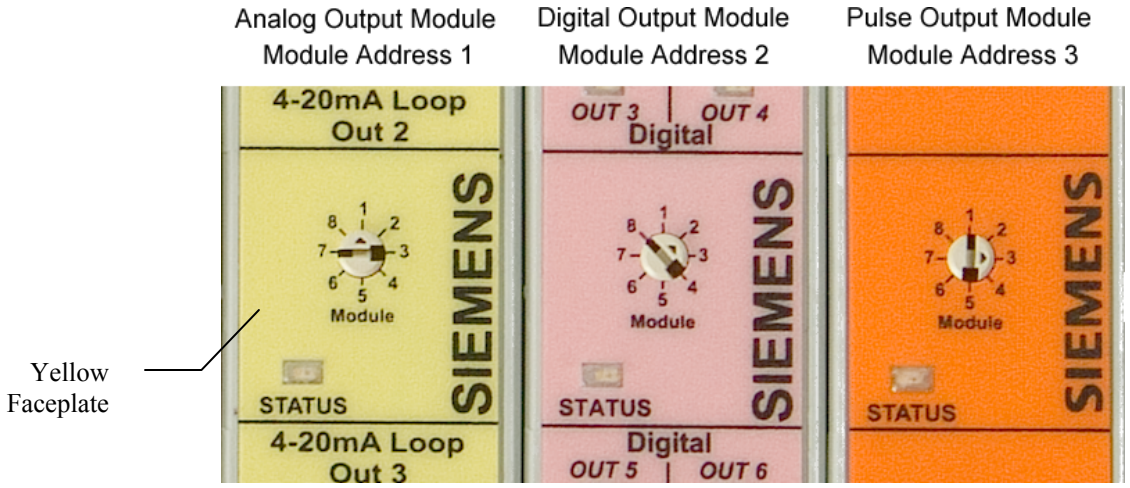
ASSIGNING AND SETTING I/O MODULE ADDRESSES

Module addresses are 1 through 8, as shown on the module faceplates in Figure 19. The top row in the figure shows three I/O modules at a location (for example, at a remote location). The lower row shows the complementary I/O modules at another location (for example, at the control room); transceivers are not shown. Note that the modules in each complementary pair are set to the same address. For example, the Analog Output Module at the remote location (yellow faceplate) and the complementary Analog Input Module at the control room (green faceplate) are set to address 1. The small triangle symbol points to the selected module address.

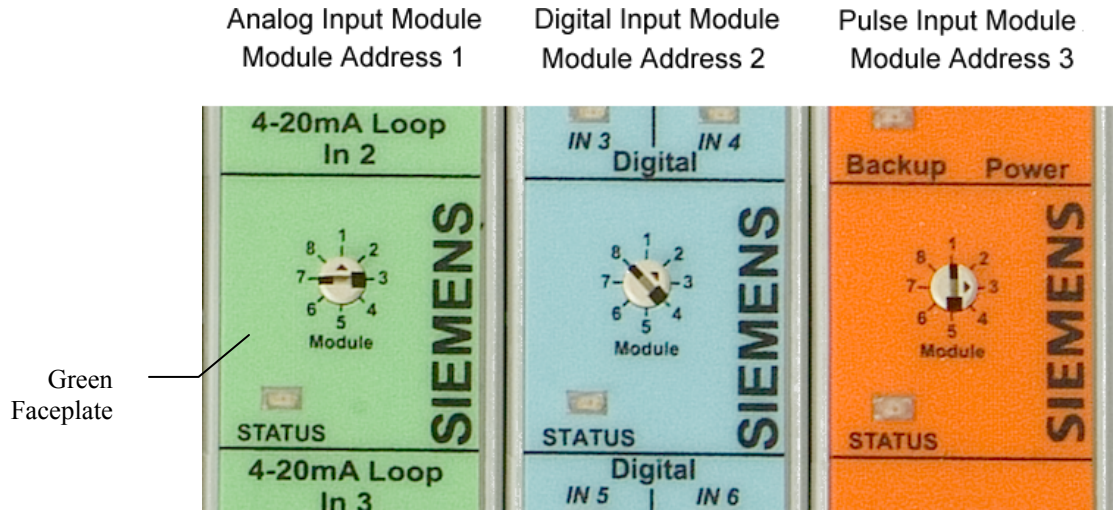
When assigning I/O module addresses:

- Assign a module address to each complementary pair of I/O modules on a wireless network.
- An address may be used for only ONE complementary pair on each wireless network.

If module addresses conflict or are improperly set within a complimentary pair, the STATUS LED will light; see the Transceiver and I/O Expansion Module Status LED Indications section on page 30.



A. Three I/O Modules (Remote Location)



B. Three Complementary I/O Modules (Control Room)

Figure 19 I/O Module Address Selection Switch

HAZARD LABEL

A label, similar to that shown here, is included in a WiPS shipment. The installer or user should post this label in an appropriate, highly visible location near the WiPS modules. Possible label mounting locations include: on the outside of an enclosure housing WiPS modules or inside that enclosure adjacent to the modules.

ADDING A REMOTE OR SPARE TRANSCEIVER TO YOUR NETWORK

When WiPS transceivers are ordered, two or more transceivers are supplied as matched devices, meaning that they share the same electronic identifier and frequency hopping pattern. This data is stored in a Hop Key. The Hop Key in a transceiver can be removed and physically transferred to another transceiver producing a second matched transceiver. The original matched transceiver will retain its Hop Key data and operate normally even though the Key has been removed.

The following procedure describes transferring the Hop Key from a matched transceiver to an unmatched transceiver (e.g. spare transceiver part number TGX:16347-320) thereby producing another matched transceiver. The newly matched transceiver can then be used as a remote transceiver in a multipoint-to-point system, a spare transceiver, or a replacement (master *or* remote) transceiver. Once the Hop Key is installed in the transceiver and power is applied, the transceiver will memorize the identification, hop frequencies, and hop sequence of the matched transceiver. When power is removed, it will retain this information, even if the Hop Key is removed. The newly matched transceiver and the original matched transceiver will communicate with the other matched transceiver(s).

IMPORTANT

When replacing or adding a transceiver to a wireless network, remember that a network node can have one (1) master transceiver and up to eight (8) remote transceivers.

To Transfer a Hop Key

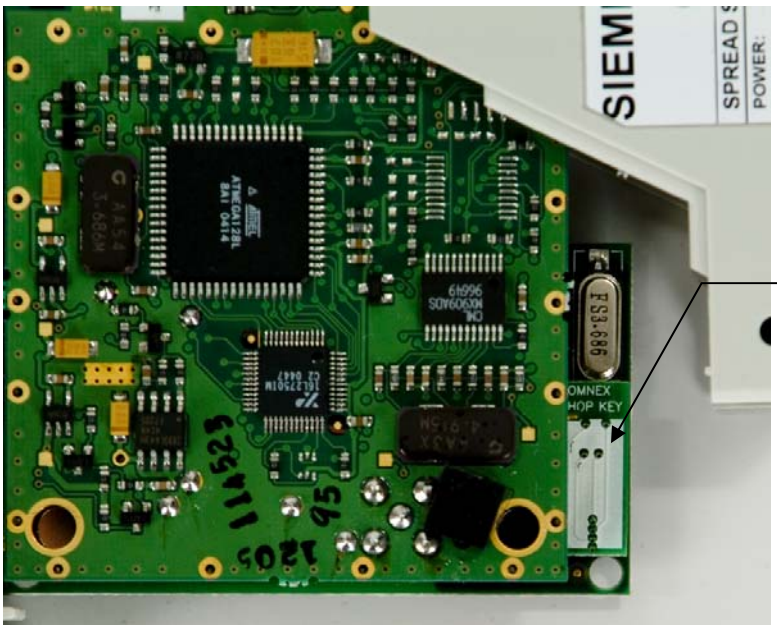
1. Place an anti-static wrist strap on your wrist and connect the strap's ground lead to a good ground.
2. If the transceiver is installed, remove power from the transceiver and all I/O connections.

   Remove the wired connector blocks from the transceiver; see Figure 5 on page 17 for photographs (alternatively, label each wire to facilitate reconnection and then disconnect the wires). Physically separate any connected I/O modules and remove the transceiver from the DIN rail.

3. Remove the faceplate/circuit board assembly locating a rectangular recess near the numbered terminals on the top of the transceiver cover (see Figure 4 on page 17 and Figure 20 below). With a small flat blade screwdriver, press the tab in the recess inward and pull that corner of the faceplate outward slightly. Repeat this process at the bottom of the transceiver. Carefully pull the faceplate/circuit board assembly from the cover.

Figure 20 Module Disassembly

4. Locate the Hop Key (a small circuit board) at the rear edge of the top circuit board, see the figure below. Unplug the Hop Key and set it aside.



5. Carefully insert the faceplate/circuit board assembly in its cover until it snaps into place. When inserting the assembly into its cover, be sure the circuit board enters the card guides in the cover and the circuit board card edge connector mates with the connector in the cover.
6. Remove the spare transceiver's cover as described above in step 3.
7. Insert the Hop Key from the original transceiver into the spare transceiver - carefully align the Hop Key connector with the main circuit board pins. Carefully insert the faceplate/circuit board assembly in the enclosure – review step 5 as needed to ensure correct orientation.
8. Label the spare transceiver with the Hop Key 5-digit ID number and suffix (M for master, S for remote).
9. If replacing the original transceiver, mount the spare transceiver on the DIN rail and complete all needed connections. Otherwise install the original transceiver and complete all needed connections.
10. Remove the anti-static wrist strap from your wrist.

When power is applied to the "spare" transceiver, it will memorize Hop Key data - allow a few seconds after power up for the data to transfer to transceiver memory.

POST INSTALLATION SIGNAL STRENGTH AND LED INDICATIONS

This section describes a method for determining whether received signal strength is adequate. It also provides status LED indications that will help to assess whether the wireless network is operating properly.

There are no user serviceable parts within a transmitter or receiver. Should service be needed, see the Product Support section to contact Siemens.

TRANSCEIVER RSSI

RSSI (Received Signal Strength Indicator) is measured using a DC voltmeter between the provided test point and power supply ground. The test point is accessed by inserting a positive meter probe into the RSSI receptacle on the face of the transceiver module and connecting the negative meter probe to the module's Ground terminal.

The RSSI graph in Figure 21 can be used to test the received signal strength. Ideally, the meter reading should be 2.5 Vdc or more. This represents a 90 dB signal loss and typically indicates that the transceiver has 20 dB fade margin left until loss of link. It is recommended that a transceiver be set up with no less than a 20 dB margin.

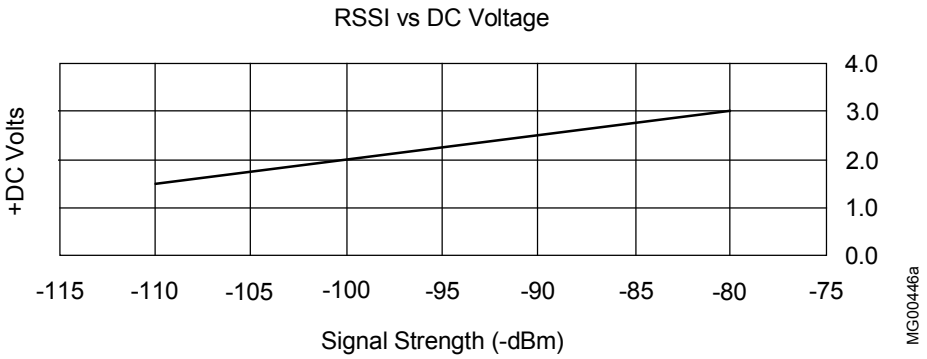


Figure 21 Received Signal Strength Graph

TRANSCEIVER AND I/O EXPANSION MODULE STATUS LED INDICATIONS

Power LED	Indicates the presence of power to the module. It is ON when power is present and OFF when there is no power.
Status LED	When flashing rapidly, it indicates an internal error or a module type mismatch. A module type mismatch occurs when the module address selection for two different modules (i.e. one digital modules and one analog module are set to the same address or two pairs of modules are sharing the same address).
RF Link LED	Flashes once every two seconds when there is no RF link. Note: At the Master transceiver, an RF Link failure will not be indicated by the master transceiver or the connected I/O Expansion Modules until the master has lost RF Link with *all* Remote transceivers. A Remote transceiver will indicate a loss of RF Link when it cannot communicate with the master transceiver. Flashes rapidly when signal strength is marginal (see the RSSI graph in the Servicing section of this guide. ON steady indicates an exceptionally strong RF link. Most systems will flash occasionally indicating the presence of intermittent interference in the area.
Digital Input/Output	OFF means that the digital input or output circuit is Open. ON means that the digital input or output circuit is Closed.

PULSE INPUT MODULE DIAGNOSTIC LED'S

There are 4 diagnostic LED's on the pulse input module:

Status LED: On solid when I/O is functional and flashing if there is a conflict with another module.

Backup Power LED: On solid when the backup power supply is powering the module. Off when primary power is powering the module.

Pulse Input 1 and 2 LEDs: These lights will flicker at a varying frequency when pulses are applied to each channel:

Frequency Range (Hz)	LED Flashing Frequency (Hz)
1 ≤ frequency ≤ 10	1
10 < frequency ≤ 100	4
100 < frequency ≤ 1000	8
1000 < frequency ≤ 32K	On solid

PULSE OUTPUT MODULE DIAGNOSTIC LED'S

There are 3 diagnostic LED's on the pulse output module:

Status LED: On solid when I/O is functional and flashing if there is a conflict with another module.

Pulse Input 1 and 2 LEDs: These lights will flicker at a varying frequency depending on the frequency of pulses being generated:

Frequency Range (Hz)	LED Flashing Frequency (Hz)
1 ≤ frequency ≤ 10	1
10 < frequency ≤ 100	4
100 < frequency ≤ 1000	8
1000 < frequency ≤ 32K	On solid

SPECIFICATIONS

Transceiver

Frequency ..... 902 to 928 MHz industrial, scientific, and medical (ISM) band
Technology ..... Frequency Hopping Spread Spectrum
Power Input ..... 9-30 Vdc; reverse polarity and surge protected
Power Consumption ..... 75 mA (average), 200 mA (peak) @ 24 Vdc during transmission (plus I/O modules), 5A (maximum)
Inputs
- Analog ..... 1, 4 to 20 mA (16-bit, 125 Ohms impedance
- Digital ..... 2, 5 to 36 Vac/Vdc (for 120 Vac digital inputs use relays to convert to specified voltage levels; consult factory for relay options)

Outputs
- Analog ..... 1, 4 to 20 mA, 12-bit resolution, short circuit protected
- Digital ..... 2, 250 Vac / 30 Vdc, 2A dry contact
- RF Link ..... 1, 250 Vac / 30 Vdc, 2A dry contact

Repeatability (4-20 mA Current Loop) 0.02%
Accuracy (4-20 mA Current Loop) ..... 0.2% full scale
Transmitter Power Output ..... 1 Watt (30 dBm)
Range
- Standard Omnidirectional Antenna ..... 600 to 1000 feet (183m to 305m) in-plant, obstructed LOS[6]
- Optional Omnidirectional Antenna ..... 4 to 5 miles (6.5 km to 8 km) clear LOS, flat terrain, raised antenna
- Optional Yagi Antenna ..... 15 to 20 miles (24 km to 32 km) clear LOS, flat terrain, professional propagation study and installation

Antenna Connector ..... MCX female, 50 Ohms
Operating Temperature Range ..... -40°C to 70°C (-40°F to 158°F)
Humidity ..... 20% to 90% non-condensing
Dimensions ..... 4.5" x 3.9" x 0.9" (114 mm x 99 mm x23 mm)
Faceplate Label Color ..... White
Weight ..... 5.3 oz (150g)
Environmental ..... NEMA 1, equivalent to IP 20
Approvals
- USA ..... FCC 47CFR15.247
- Canada ..... ISC RSS 210
- UL and CUL ..... Class I, Div. 2, Groups A, B, C, D; Temp. Code T5
- CSA ..... Approved

[6] LOS – Line of Sight between transmitting and receiving antennas

Digital Input Module

Channels	8
Digital Input Voltage Range	5 to 30 Vac/Vdc, reverse polarity protected
Input Impedance	20k Ohms
Input Frequency	DC to 2 Hz
Channel Isolation	Optical
Over-Voltage Rating	100 Vac/Vdc maximum
Power Input	12-30 Vdc
Current Consumption	30 mA maximum
Operating Temperature Range	-40°C to 70°C (-40°F to 158°F)
Faceplate Label Color	Blue

Digital (Relay) Output Module

Channels	8
Output Terminal	Dry Contact, normally open
Contact Rating	250 Vac / 30 Vdc, 2A
Channel Isolation	Full
Power Input	12-30 Vdc
Current Consumption	160 mA maximum
Operating Temperature Range	-40°C to 70°C (-40°F to 158°F)
Faceplate Label Color	Pink

Analog Input Module

Channels	4
Range	4-20 mA
Resolution	16-bit
Input Impedance	<170 Ohms
Channel Isolation	None (power supply connections are common with transceivers)
Reverse Polarity Protected	Yes
Compatibility	2-wire, 3-wire, 4-wire devices
Over-Voltage Rating	42 Vdc maximum
Accuracy	0.2% of full scale
Repeatability	0.02% of full scale
Power Input	12-30 Vdc
Current Consumption	130 mA maximum
Operating Temperature Range	-40°C to 70°C (-40°F to 158°F)
Faceplate Label Color	Green

Analog Output Module

Channels	4
Range	4-20 mA
Resolution	16-bit
Channel Isolation	Optical
Short Circuit Protected	Yes
Compatibility	2-wire, 3-wire, and 4-wire devices
Accuracy	0.2% of full scale
Repeatability	0.02% of full scale
Power Input	9 to 30 Vdc
Current Consumption	130 mA maximum
Minimum Loop Voltage Drop	10 Vdc
Operating Temperature Range	-40°C to 70°C (-40°F to 158°F)
Faceplate Label Color	Yellow

Combination Input/Output Module

Channels	1 analog input 1 analog output 2 digital inputs 2 digital outputs
Channel Isolation	All (except for the analog input channel)
Reverse Polarity Protection	Yes
Analog Channel	
Range	4-20 mA
Input Impedance	<170 Ohms
Repeatability	0.2% of full scale
Resolution	16-bit
Compatibility	2-wire, 3-wire, 4-wire devices
Over-Voltage Rating	42 Vdc maximum
Digital Input Channel	
Input Impedance	20k Ohms
Over-Voltage Rating	100 Vac/Vdc maximum
Voltage	5 to 36 Vac/Vdc
Digital Output Channel	
Contact Rating	250 Vac / 30 Vdc, 2A
Type	Dry contact, normally open
Power Input	12 to 30 Vdc
Current Consumption	120 mA maximum
Operating Temperature Range	-40°C to 70°C (-40°F to 158°F)
Faceplate Label Colors	Analog In section – Green Analog Out section – Yellow Digital In section – Blue Digital Out section - Pink

Pulse Input Module

Channels	2
Input Voltage	3.6 Vdc minimum (Single Edge Mode), 100 mVac P-P (Differential Mode)
Input Frequency	0-32 kHz
Pulse Width	10 µSec minimum
Input Impedance	1k Ohms (low), 90k Ohms (high), Selectable
Coupling	AC or DC, Selectable
Channel Isolation	Optical
Reverse Polarity	Yes, protected
Power Input	12-30 Vdc
Backup Power Supply	12-30 Vdc
Current Consumption	50 mA maximum
Operating Temperature Range	-40°C to 70°C (-40°F to 158°F)
Faceplate Label Color	Orange

Pulse Output Module

Channels	2
Output	30 Vdc @ 250 mA maximum
External Voltage	30 Vdc maximum
Frequency	0-32 kHz
Duty Cycle	50%
Internal Pull-Up	1k Ohms
Channel Isolation	No
Power Input	12-30 Vdc
Power Consumption	120 mA maximum
Operating Temperature Range	-40°C to 70°C (-40°F to 158°F)
Faceplate Label Color	Orange

WARRANTY

(a) Seller warrants that on the date of shipment the goods are of the kind and quality described herein and are free of non-conformities in workmanship and material. This warranty does not apply to goods delivered by Seller but manufactured by others.

(b) Buyer's exclusive remedy for a nonconformity in any item of the goods shall be the repair or the replacement (at Seller's option) of the item and any affected part of the goods. Seller's obligation to repair or replace shall be in effect for a period of one (1) year from initial operation of the goods but not more than eighteen (18) months from Seller's shipment of the goods, provided Buyer has sent written notice within that period of time to Seller that the goods do not conform to the above warranty. Repaired and replacement parts shall be warranted for the remainder of the original period of notification set forth above, but in no event less than 12 months from repair or replacement. At its expense, Buyer shall remove and ship to Seller any such nonconforming items and shall reinstall the repaired or replaced parts. Buyer shall grant Seller access to the goods at all reasonable times in order for Seller to determine any nonconformity in the goods. Seller shall have the right of disposal of items replaced by it. If Seller is unable or unwilling to repair or replace, or if repair or replacement does not remedy the nonconformity, Seller and Buyer shall negotiate an equitable adjustment in the contract price, which may include a full refund of the contract price for the nonconforming goods.

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