WOODWARD

Product Manual 35012
(Revision New, 6/2015)
Original Instructions

Intelligent Gateway

Control Part Numbers 8273-587

Installation and Operation Manual

General Precautions

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.

Practice all plant and safety instructions and precautions.

Failure to follow instructions can cause personal injury and/or property damage.

Revisions

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26455*, *Customer Publication Cross Reference and Revision Status & Distribution Restrictions*, on the *publications page* of the Woodward website:

www.woodward.com/publications

The latest version of most publications is available on the *publications page*. If your publication is not there, please contact your customer service representative to get the latest copy.

Proper Use

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. Be sure to check manual *26455*, *Customer Publication Cross Reference and Revision Status & Distribution Restrictions*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

Revisions—Changes in this publication since the last revision are indicated by a black line alongside the text.

Manual 35012

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Warnings and Notices

Important Definitions

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**—indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING**—indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION**—indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- **NOTICE**—indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT**—designates an operating tip or maintenance suggestion.

WARNING

Overspeed / Overtemperature / Overpressure

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

WARNING

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- **Eye Protection**
- **Hearing Protection**
- **Hard Hat**
- **Gloves**
- **Safety Boots**
- **Respirator**

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

WARNING

Automotive Applications

On- and off-highway Mobile Applications: Unless Woodward's control functions as the supervisory control, customer should install a system totally independent of the prime mover control system that monitors for supervisory control of engine (and takes appropriate action if supervisory control is lost) to protect against loss of engine control with possible personal injury, loss of life, or property damage.

NOTICE

Battery Charging Device

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:

- **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).**
- **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**
- **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual *82715*, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
2. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
   - Do not touch any part of the PCB except the edges.
   - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
   - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

Regulatory Compliance

European Compliance for CE Marking:
These listings are limited only to those units bearing the CE Marking.

EMC Directive: Declared to 2004/108/EC COUNCIL DIRECTIVE of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and all applicable amendments.

ATEX - Potentially Explosive Atmospheres Directive: Declared to 94/9/EC COUNCIL DIRECTIVE of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres.
Zone 2, Category 3, Group II G, Ex nA IIC T4 X Gc

Other European and International Compliance:

IECEx: Ex nA IIC T4 Gc T4 temperature.
Certificate: IECEx CSA 15.0016x
IEC 60079-0: 2012 - Explosive Atmospheres – Part 0 Equipment General Requirements.
IEC 60079-15: 2010 - Electrical Apparatus for Explosive Gas Atmospheres; Part 15: Construction, Test and Marking Type of protection “n” electrical apparatus.

North American Compliance:
These listings are limited only to those units bearing the CSA identification.

CSA: CSA Listed for Class I, Division 2, Groups A, B, C, & D, T4 at 70 °C surrounding air temperature. For use in Canada and the United States.
CSA Certificate of Compliance 70027337

This product is certified as a component for use in other equipment. The final combination is subject to acceptance by the authority having jurisdiction or local inspection.

Special Conditions for Safe Use:
This equipment is intended to be installed in a metal cabinet or enclosure to provide protection against the entry of dust or water and to protect against mechanical impact.

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D per CSA for Canada and US or non-hazardous locations only The product has been certified as open type equipment to be installed in the enclosure of the final application and the final installation is subjected to the local authority having jurisdiction as listed on the CSA certificate.

This equipment is suitable for use in European Zone 2, Group IIC environments when installed in an IP-54 minimum rated enclosure per self-declaration to EN 60079-15. The interior of the enclosure shall not be accessible without the use of a tool.

ATEX/IECEx Explosive Atmosphere locations require the enclosure be coded *Ex nA* or *Ex e* and provide a minimum ingress protection IP54 per IEC 60529.

For ATEX compliance, this equipment must be protected externally against transient disturbances. Provisions shall be made to prevent the power input from being exceeded by transient disturbances of 119 V_{PEAK}.

Wiring must be in accordance with North American Class I, Division 2, (CEC and NEC) or European Zone 2, Category 3 wiring methods as applicable, and in accordance with the authority having jurisdiction.

A fixed wiring installation is required and a switch or circuit breaker shall be included in the building installation that is in close proximity to the equipment and within easy reach of the operator and that is clearly marked as the disconnecting device for the equipment. The switch or circuit breaker shall not interrupt the protective earth conductor.

Do not connect more than one Intelligent Gateway to any one fuse or circuit breaker.

Protective Earth Grounding is required by the input PE terminal (see Chapter 5, Installation).

For Communications wires, use wires with a temperature rating of at least 5 °C above surrounding ambient. All others use wires with a temperature rating of at least 10 °C above surrounding ambient.

The Intelligent Gateway contains a single-cell primary battery suitable for the life of the product. This battery is not to be charged and is not customer replaceable. If real-time clock functionality is interrupted, contact your Woodward representative.

The control is suitable for installation in pollution degree 2 environments.

Unmarked inputs are classified as permanently connected IEC measurement Category I. To avoid the danger of electric shock, do not use inputs to make measurements within measurement categories II, III, or IV. See individual inputs for additional information on transient overvoltage input ratings.

⚠WARNING

Explosion Hazard

EXPLOSION HAZARD Due to the Hazardous Location Listings associated with this product, proper wire type and wiring practices are critical to the operation.

⚠WARNING

Explosion Hazard

ENCLOSURE REQUIREMENT –
ATEX/IECEx Zone 2, Category 3G applications require the final installation location provide a minimum IP54 ingress protection enclosure against dust and water per IEC 60529. The enclosure must be coded Ex nA or Ex e.

⚠WARNING

Explosion Hazard

MOUNTING –
The control must be mounted in a vertical position inside the enclosure. The installer shall ensure the maximum surrounding air temperature of the control must not exceed +70 °C at the final location.

⚠WARNING

Explosion Hazard

Do not remove covers or connect/disconnect electrical connectors unless power has been switched off and the area is known to be non-hazardous.

⚠WARNING

Explosion Hazard

Substitution of components may impair suitability for Class 1, Division 2 or Zone 2.

⚠WARNING

Explosion Hazard

The external ground lugs shown on the installations drawing must be properly connected to ensure equipotential bonding. This will reduce the risk of electrostatic discharge in an explosive atmosphere. Cleaning by hand or water spray must be performed while the area is known to be non-hazardous to prevent an electrostatic discharge in an explosive atmosphere.

⚠WARNING

Explosion Hazard

Do not use test points on the power supply or control board unless the area is known to be non-hazardous.

⚠WARNING

Explosion Hazard

Do not make adjustments to the IP address DIP switch on the CAN board unless the area is known to be non-hazardous.

⚠AVERTISSEMENT

Risque d'explosion

Ne pas enlever les couvercles, ni raccorder / débrancher les prises électriques, sans vous en assurez auparavant que le système a bien été mis hors tension; ou que vous vous situez bien dans une zone non explosive.

⚠AVERTISSEMENT

Risque d'explosion

La substitution de composants peut render ce matériel inacceptable pour les emplacements de Classe I, Division 2 et/ou Zone 2.

⚠AVERTISSEMENT

Risque d'explosion

Ne pas utiliser les bornes d'essai du block d'alimentation ou des cartes des commande à moins de se trouver dans un emplacement non dangereux.

⚠CAUTION

Emergency Disconnecting Service

An emergency switch or circuit breaker shall be included in the building installation that is in close proximity to the equipment and within easy reach of the operator. The switch or circuit breaker shall be clearly marked as the disconnecting device for the equipment. The switch or circuit breaker shall not interrupt the Protective Earth (PE) conductor.

⚠ CAUTION

Risk of Calibration and Checkout

The calibration and checkout procedure should only be performed by authorized personnel knowledgeable of the risks posed by live electrical equipment.

⚠ CAUTION

Fuse Power Supply Mains

The power supply MAINS should be properly fused according to the NEC/CEC or authority having final jurisdiction per the Input Power Specifications.

IMPORTANT

The Intelligent Gateway is designed for installation in a standard metal cabinet or enclosure. If the cabinet door is open or the Intelligent Gateway is not installed in a metal cabinet, some degraded performance in the presence of radio wave energy may occur. Radio wave energy may be from transmitters such as cell phones or push to talk radios in very close proximity. The unit is designed not to be affected when the transmitter is more than 1.0 to 1.5 m away when keyed.

It is recommended that operation of such radio wave devices be kept more than 1.5 m (5 ft.) from the Intelligent Gateway control. Installation of the Intelligent Gateway in a metal enclosure, as intended, will also prevent performance degradation.


Both direct and alternating current


Alternating current


Direct current


Caution, risk of electrical shock


Caution, refer to accompanying documents


Protective conductor terminal


Frame or chassis terminal

Chapter 1.
General Information

Introduction

This manual describes the Woodward Intelligent Gateway Digital Control. It provides a variety of useful information for the user ranging from simple basic descriptions to detailed information on wiring, specifications, and functionality. Included are:

- General information on the Intelligent Gateway platform and available versions
- A physical description of the control hardware
- A description of all Intelligent Gateway modules
- A listing of accessories that may be used with the platform
- Information on Intelligent Gateway communications and distributed I/O interfaces
- Installation and maintenance
- Troubleshooting information
- For information on programming, networking, and communication protocols, refer to the software manual provided with the control.

Intelligent Gateway Control Description

At the heart of the Intelligent Gateway control is a 32-bit microprocessor that runs a powerful Real Time Operating System. This operating system is specifically designed to control the proper timing of all application code so that dynamic performance of the final control system is absolutely guaranteed. Each piece of the application code is “scheduled” under a Rate Group structure that ensures execution of the code at a predetermined time.

Application programming is accomplished via Woodward’s GAP Graphical Application Program. GAP is a pictures-to-code system that provides a high-level programming environment for users who have control expertise but do not have specific programming skills. Once the application program has been generated and loaded into the Intelligent Gateway control, the user can view variables and tune the control with a variety of Woodward service tools. Connection to other devices, such as an HMI, is accomplished by means of serial Modbus or Ethernet ports on the control. The desired information flow is programmed into the control via GAP. If required, distributed I/O can be connected using optional communication modules that support Profibus and DLE Communications.

The hardware platform is based on the industry-standard PC/104 bus structure. In the Intelligent Gateway control, the backplane is the SmartCore board. The second board stack includes the power bus and CANopen communication module. The control runs on low-voltage DC power (18–32 Vdc). Intelligent Gateway field wiring is accomplished via terminal blocks that plug into the control modules.

Control Accessories

The Intelligent Gateway digital control platform is designed to interface with several Woodward service tools and commercial software products. Available tools are listed below with a brief description of their functionality:

- **Monitor GAP**—an Ethernet connection to the control allows on-line GAP monitoring, debug, and tunable configuration.

- **Watch Window**—provides an Ethernet or serial connection to the control to allow 1) initial configuration of the unit; 2) monitoring and tuning of system variables; and 3) management of configuration and setpoints.

- **Control Assistant**—Ethernet connection to the control for Tunable Management, viewing of high-speed data captures, and other useful utilities.
- **Application Manager**—Ethernet access to the control for program loading, network configuration and support, and system diagnostics.

- **HMI (Human Machine Interface)**—commercially available HMI programs interface to the Intelligent Gateway control through Ethernet or serial connections to provide operator access and control of the application machinery.

Table 1-1. CAN Network Compatibility

RTCnet Modules*	LINKnet-HT Modules	Woodward Valves	CANopen Devices
Only Real-Time Network Connections	Woodward valves are recommended to be on their own network. LINKnet HT and other CANopen devices can share networks.		

* Modules/Devices configured as Real-Time cannot share a CAN network with devices configured as non-real-time.

Table 1-2. Gateway Compatibility

Module Description	Available for RTCnet series (Real-Time Control)	Available for LINKnet-HT series
RTD (8 channel)	X	X
AIO (8AI 4–20 mA, 2AO)	X	X
AIO (8AI 4–20 mA, 2AO 4–20 mA)	X	
DIN (16 channel)	X	X
DOUT (16 channel)	X	X
T/C (8 channel)	X	X
T/C HI ACCURACY (8 channel)	X	

Chapter 2.
Power Supply Board

General Description

Woodward's Intelligent Gateway consists of three PC boards: a Power Supply board (described in this chapter), a SmartCore CPU A5200 board and an 8-channel CAN bus board (both describe in Chapter 3). The Intelligent Gateway power supply contains the power supply and twelve discrete output driver channels. The discrete outputs are low-side drivers having short circuit and thermal shutdown protection. The discrete output drivers are not isolated from each other, and are powered by an external +12 Vdc or +24 Vdc. They are isolated from the internal power supplies of the Intelligent Gateway Control platform.

Input power connections are made to the power supply through terminals on the front of the power supply.

WARNING

The Intelligent Gateway power supply board must have the input power removed before installing or removing.

This equipment is suitable for use in Class 1, Division 2, Groups A, B, C, and D, Zone 2, Group IIC, or non-hazardous locations only.

Wiring must be in accordance with Class I, Division 2 or Zone 2 wiring methods and in accordance with the authority having jurisdiction.

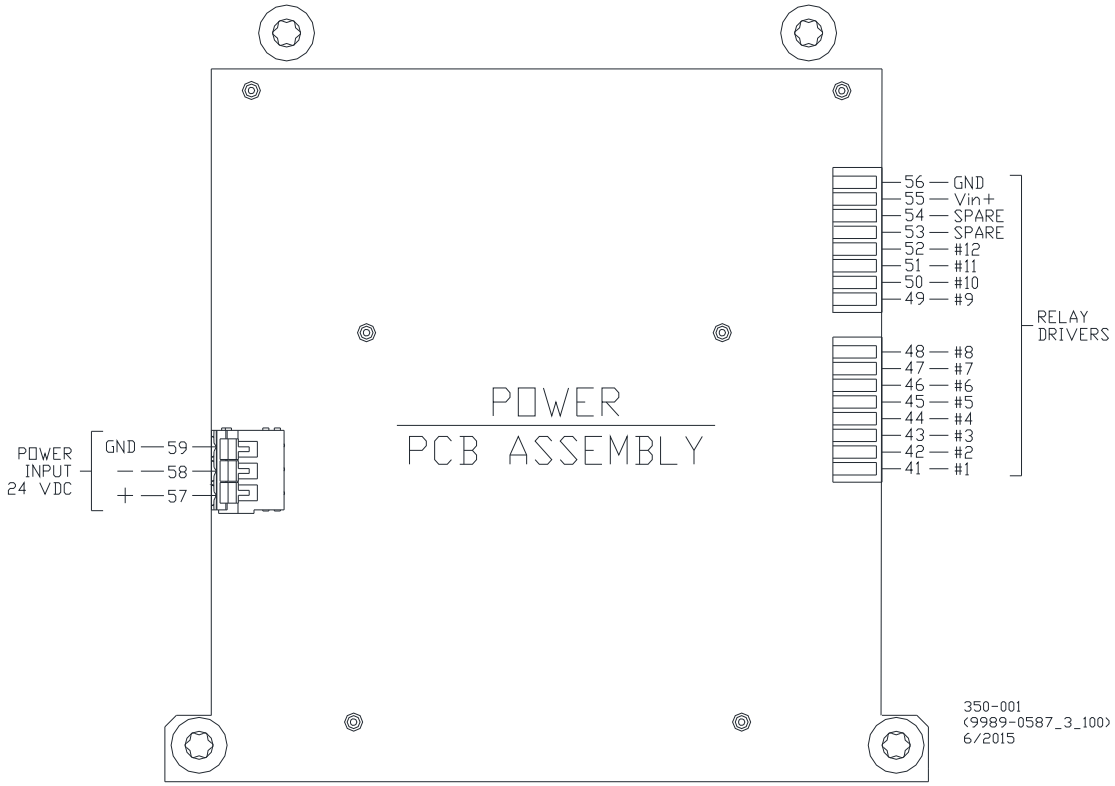


Figure 2-1. Intelligent Gateway Power Supply Board

Specifications

Power Supply Input (Power Supply Board)

Range	18–32 Vdc
Input Current	1.06 A @ 32 Vdc 1.38 A @ 24 Vdc 1.81 A @ 18 Vdc
Input Power	40 W maximum
Interrupt Time Holdup	8 ms @ ≥ 24 V
Efficiency	70% minimum over operating input voltage range
Reverse Polarity Protection	56 V
Input Wiring Constraints	The Intelligent Gateway control platform must be wired such that no other device receives power from the wiring between the Intelligent Gateway Control Platform and the power supply source.

Discrete Output Drivers (Power Supply Board)

Number of channels	12
Type	Low-side driver with short circuit and overvoltage protection
Current drive rating	200 mA
Discrete Output Supply Voltage	9–32 V

Power Supply Monitoring Circuit (Power Supply Board)

LVdc Maximum voltage measured	35 Vdc
Resolution in volts	0.15 Vdc
Maximum Error due to temperature change	1.0 Vdc
Maximum Error due to load change	1.0 Vdc
Total maximum error at 25 °C (over 15 to 35 V range)	1.2 Vdc

Electric Shock

The Intelligent Gateway control platform shall not present an electrical shock hazard to the operator or maintenance personnel when used in a normal manner per the National Electrical Code Handbook, ANSI/NFPA 70 HANDBOOK-1990. Safety is ensured by certification through the safety agencies specified in the “Regulatory Compliance” section of this document.

Troubleshooting Guide

Power Supply Checks

The following is a troubleshooting guide for checking areas, which may present difficulties. If these checks are made prior to contacting Woodward for technical assistance, system problems can be more quickly and accurately assessed.

- Is the input voltage within the control’s specified input voltage range (measured at control power supply input)?
- Is the input power free of switching noise or transient spikes?
- Is the power circuit dedicated to the Intelligent Gateway control only?

Discrete Output Checks

The Intelligent Gateway power supply contains twelve discrete output driver channels. The discrete outputs are low-side drivers having short circuit and thermal shutdown protection. The discrete output drivers are not isolated from each other, and are powered by an external +12 Vdc or +24 Vdc. They are isolated from the internal power supplies of the Intelligent Gateway Control platform.

- Is the input power within the range of 9–32 V?
- Is the input free of switching noise or transient spikes?
- Is the power circuit dedicated to the control only?
- Are the individual discrete output lines current limited by external series connected components (example: relay coils) to <200 mA?

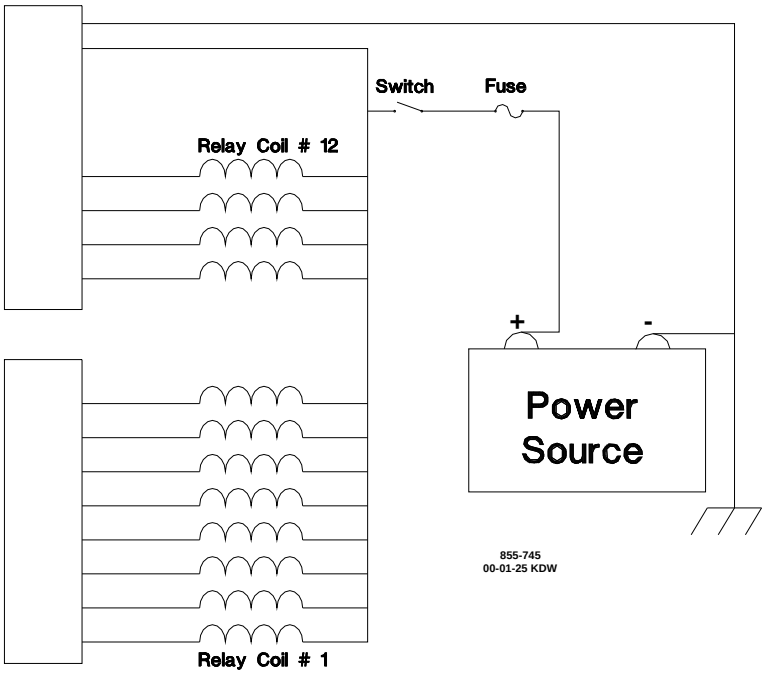


Figure 2-2. Discrete Output Wiring Example
(Discrete Output Interface Wiring to the Power Supply Board)

Configuration Notes

- Refer to Figure 2-2 for discrete output wiring.
- The discrete output commons are tied together, so each power supply board accepts only one voltage source.
- Power for the discrete outputs must be externally supplied, the external supply must be capable of supplying a voltage between 9–32 V while supplying up to 2.5 A. As specified in the Input Power Wiring Section, branch circuit protection of no more than 250% of the maximum rated current of the load (Discrete Output power input current plus 12 times the maximum Discrete Output channel current) shall be provided. Fuse current rating should not exceed 6.25 A (time delay fuses are recommended).

Chapter 3.
CPU A5200 and CAN Board

Intelligent Gateway General Description

Woodward's Intelligent Gateway consists of three PC boards: a SmartCore CPU A5200 board, an 8-channel CAN bus board, and a Power Supply board (described in Chapter 2). The Intelligent Gateway has the following features:

- 5 ms update rate
- On-board processor for automatic calibration of the I/O channels
- PowerPC 5200, low power version
- 64 MB DDR-266 MHz, DRAM
- 8/16 bit PC/104 Interface (ISA bus)

Communications Ports

- Four RJ45 10/100 Base-TX Ethernet (on the A5200 CPU board)
- Ten isolated CAN ports (eight on the CAN Communications board and two on the A5200 CPU board)
- Two isolated and configurable RS-232 / RS-422 / RS485 Serial ports, 115.2K baud rate maximum (on the A5200 CPU board)
- One isolated RS-232 Debug Service Port (on the A5200 CPU board)

Hardware I/O

- Twenty four Discrete inputs
- Two Speed Sensor Inputs (MPU / Proximity), 16-bit minimum resolution
- Six Analog inputs have 16-bit resolution
- Four Analog outputs have 15-bit resolution
- Two Actuator outputs with 15-bit resolution

SmartCore CPU A5200 board

The SmartCore CPU A5200 board contains 4 Ethernet communication ports as well as circuitry for 2 speed sensor inputs, 6 analog inputs, 4 analog outputs, 2 proportional actuator drivers, 2 CAN communication ports (CAN #9 and CAN #10), 2 isolated serial ports, 1 debug serial port (isolated), and 24 discrete inputs. Each speed sensor input may be either from a magnetic pick-up or a proximity probe. Analog input and output circuits are 4–20 mA. The actuator driver outputs may be configured as either 4–20 mA or 20–220 mA. The user serial ports are configurable as RS-232, RS-422, or RS-485.

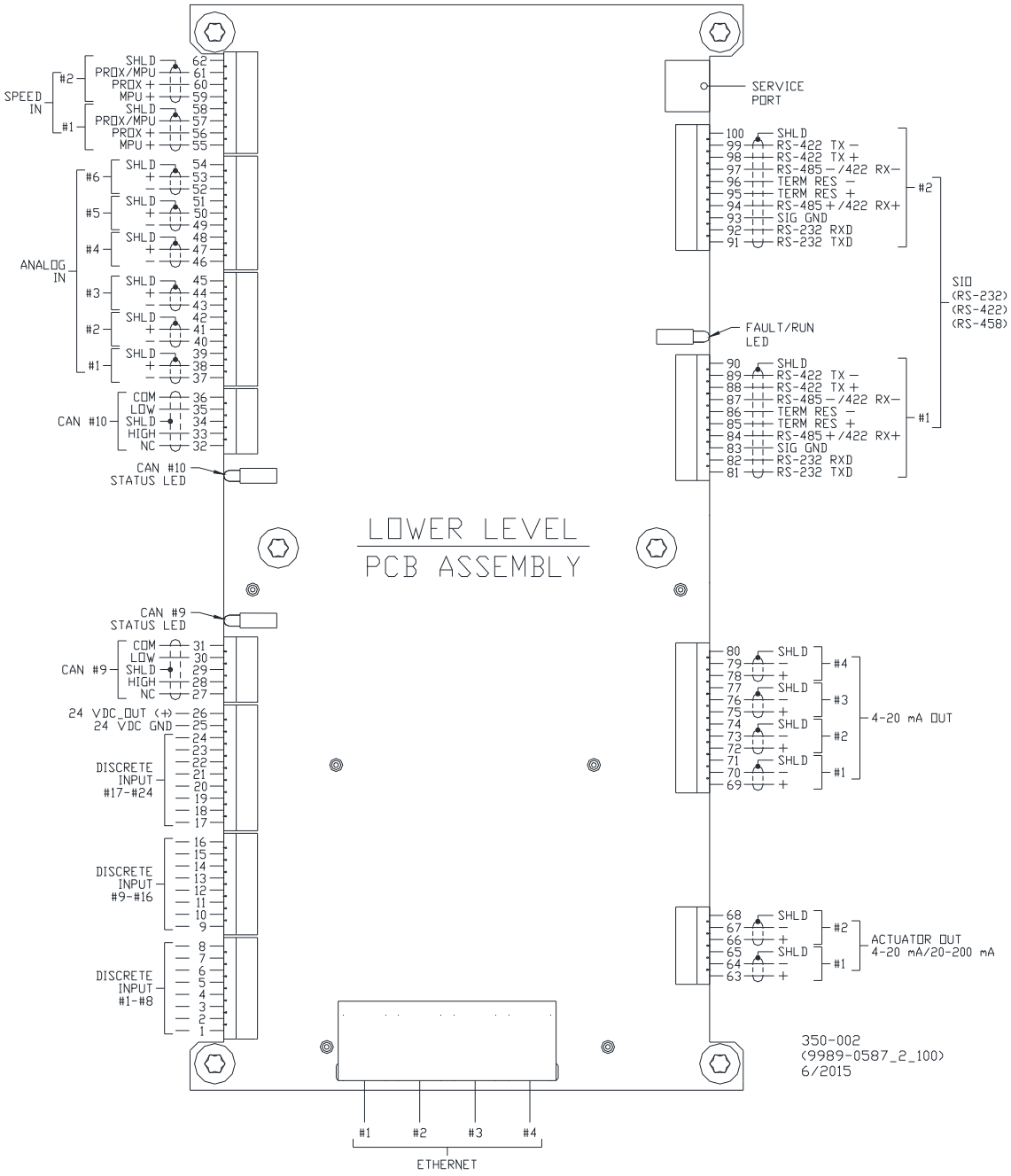


Figure 3-1. SmartCore CPU A5200 Board Connectors

SmartCore A5200 Block Diagram

The Intelligent Gateway boards connect to each other through either the PC/104 bus connectors or the power bus connectors. All of the boards are held together and to the chassis, by bolts. The SmartCore CPU A5200 board is the size of two analog boards.

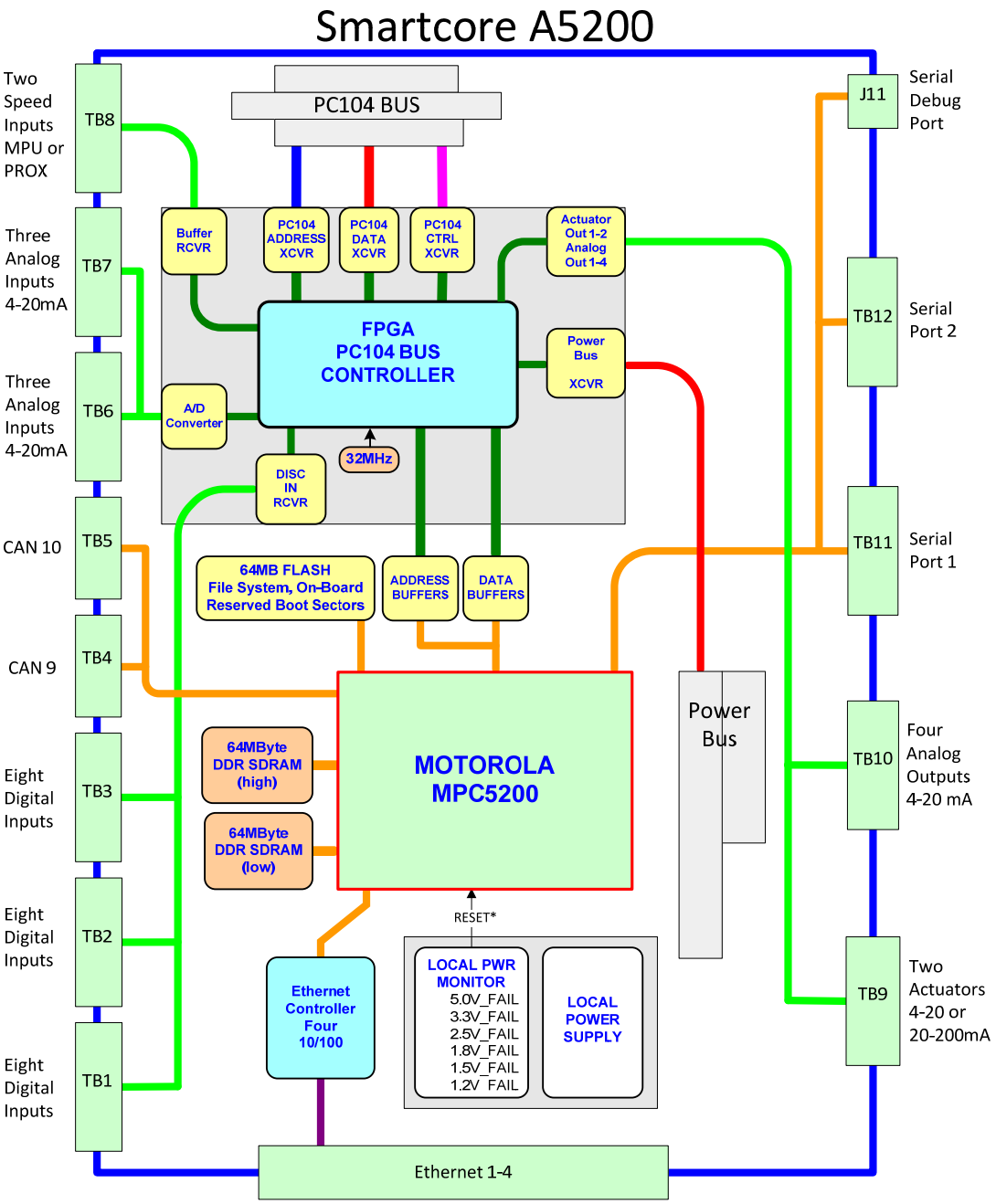


Figure 3-2. Block Diagram -- Intelligent Gateway SmartCore CPU A5200 Board

CAN Communications Board

The CAN Communication Board contains eight CAN communication ports (#1 to #8) through two separate processing units. In a redundant network configuration it is recommended to use CAN networks from different processing units to increase reliability. One processing unit manages CAN ports #1 to #4 and the second processing unit manages CAN ports #5 to #8.

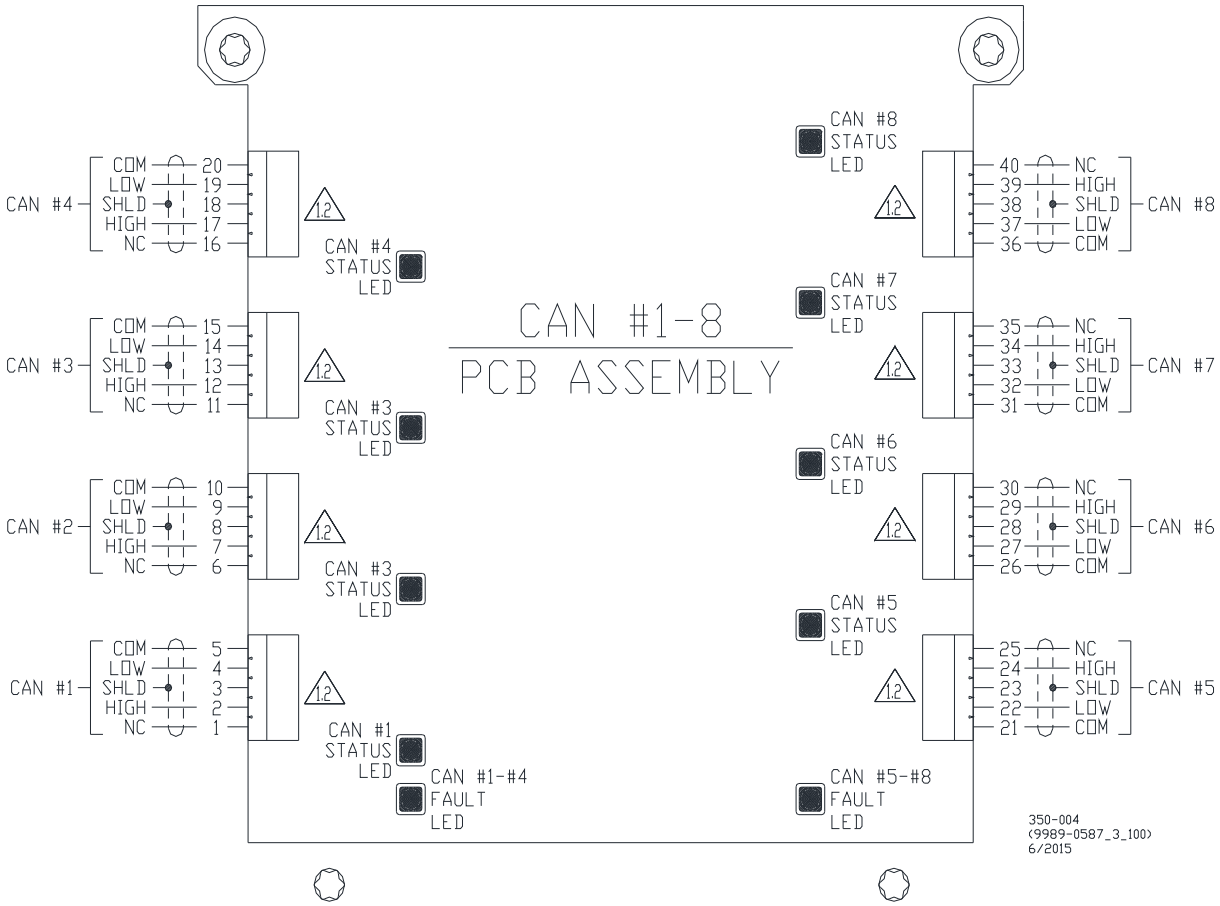


Figure 3-3. Eight Channel CAN Communication Board

CAN communications Board Block Diagram

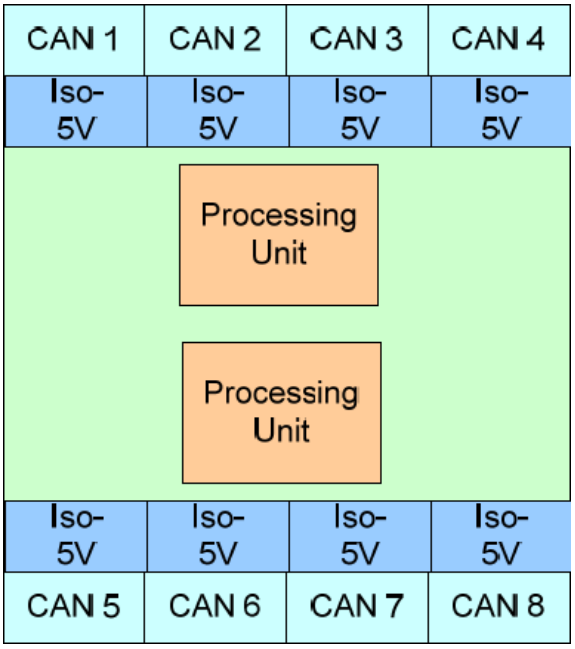


Figure 3-4. Block Diagram – Intelligent Gateway 8-Channel CAN Board

Intelligent Gateway Module Configuration

Network Configuration. Ethernet port #1 can be re-configured for the customer network as desired. See the on-site Network Administrator to define an appropriate I/P address configuration for port #1. Please note that each Ethernet port is required to be on a separate domain.

IMPORTANT

This module has been factory configured with fixed Ethernet IP addresses of:

- **Ethernet #1 = 172.16.100.20, Subnet Mask = 255.255.0.0**
- **Ethernet #2 = 192.168.128.20, Subnet Mask = 255.255.255.0**
- **Ethernet #3 = 192.168.129.21, Subnet Mask = 255.255.255.0**
- **Ethernet #4 = 192.168.130.22, Subnet Mask = 255.255.255.0**

Network Configuration Utility (AppManager)
Woodward's *AppManager* software can be used to load GAP Control software, monitor diagnostic faults, and configure Network settings. The *AppManager* utility can be downloaded from **www.woodward.com/software**. A PC to Intelligent Gateway connection must be made using an Ethernet cable and Ethernet port #1.

- Locate the Intelligent Gateway ControlName on the chassis and highlight it using *AppManager*.
- To VIEW the IP address configuration, select menu option CONTROL - CONTROL INFORMATION. Look for the Ethernet adapter addresses under the Footprint Description.
- To CHANGE the IP address configuration, select menu option CONTROL - CHANGE NETWORK SETTINGS.

Module Indicators (LEDs)

Table 3-1. SmartCore CPU A5200 LEDs.

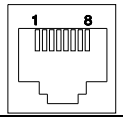
LED	Name	Description
RD FAULT GR RUN	FAULT	CPU FAULT (RED)—Active upon reset and flashes CPU fault codes as necessary.
	RUN	RUN (GREEN)—Active GREEN after the CPU Operating system is loaded and running.
ETH G LINK Y TX/RX	LINK	LINK ACTIVE (GREEN)—A valid Ethernet connection to another device exists
	TX/RX	TX/RX (YELLOW)—Active YELLOW when data is transmitted or received.
CAN LED's GR RD	CAN #1, #2	CAN #1, #2 (GREEN/RED)—Active GREEN or RED when data is transmitted or received through CAN port #1 or #2.

10/100 BaseT Ethernet Ports

There are four 10/100 BaseT Ethernet Ports (RJ45) available to the application software. These ports are full duplex, auto switching, and do not require the use of an Ethernet shield box.

IMPORTANT **Max cable length is 30 meters. Double shielded, Cat 5 Ethernet cables (SSTP) are required for customer installations.**

Table 3-2. Ethernet Port Pinout

Connector	Signal Mnemonic
RJ45F 	Shielded RJ45 female receptacle
1	RX+
2	RX-
3	TX+
4	Not used
5	Not used
6	TX-
7	Not used
8	Not used
Shield	Chassis EARTH

RS-232/422/485 Serial Ports

Two isolated, pluggable RS-232 / 422 / 485 serial ports (SIO1, SIO2) are available for customer use and can be configured by the GAP software application. The baud rate is selectable from 300 baud to 115.2 kBaud. Shielded cable is required when connecting to the CPU module's serial port. Using shielded cable will help ensure the robustness of the serial communications.

Pin 1 – RS-232 Transmit
Pin 2 – RS-232 Receive
Pin 3 – Signal Ground
Pin 4 – RS-485/422 Receive (+)
Pin 5 – Termination Resistor (+)
Pin 6 – Termination Resistor (–)
Pin 7 – RS-485/422 Receive (–)
Pin 8 – RS-422 Transmit (+)
Pin 9 – RS-422 Transmit (–)
Pin 10 – Chassis EARTH

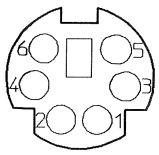
Figure 3-5. SmartCore CPU A5200 Communications Ports (SIO1, SIO2)

RS-232 Service Port

An isolated RS-232 service port is located near one corner of the A5200 CPU module. This port is for VxWorks operating system use only and cannot be configured for application software use. The communication settings are fixed at 38.4 kBaud, 8 data bits, no parity, 1 stop-bit, and no flow control.

For debug use, a null-modem cable and 5450-1065 Serial Adapter cable (PS2M to DB9F) is required to attach this port to a PC. This port is to be used by trained Field Service personnel only!

Shielded cable is required when connecting to the Service Port. Using shielded cable will help ensure the robustness of the serial communications.



Pin 1 – RS-232 Receive
Pin 2 – RS-232 Transmit
Pin 3 – Signal Ground
Pin 4 – Not Used
Pin 5 – Signal Ground
Pin 6 – Not Used
Connector Shell – Chassis EARTH

Figure 3-6. CPU Service Port (mini-DIN6F)

CAN Communication Ports

Ten CAN ports (5 pin pluggable connectors, screw down) are available for communication with Woodward Valves and other CAN devices. A maximum of 15 Woodward valves configured for operation in the 10 ms rate group may be used.

Pin 1 – not used
Pin 2 – CAN High (white)
Pin 3 – CAN Shield (14Meg + AC coupled to EARTH)
Pin 4 – CAN Low (blue)
Pin 5 – CAN Signal Ground (black)

Figure 3-7. CAN Communication Ports

CAN networks must include 120Ω terminations at each end of the trunk line. Drop cables connecting a device to the trunk line should be as short as possible and less than 6 meters. It is recommended to design the network to be less than 100 meters with a max cumulative drop length of less than 39 meters.

Table 3-3. Network Speed vs. Cable Length

Network Speed	Max Trunk Length (Thick cable)	Max Trunk Length (Thin cable)	Max Drop Length	Max Cumulative Drop Length
500 Kbps	100 m	100 m	6 m	39 m
250 Kbps	250 m	100 m	6 m	78 m
125 Kbps	500 m	100 m	6 m	156 m

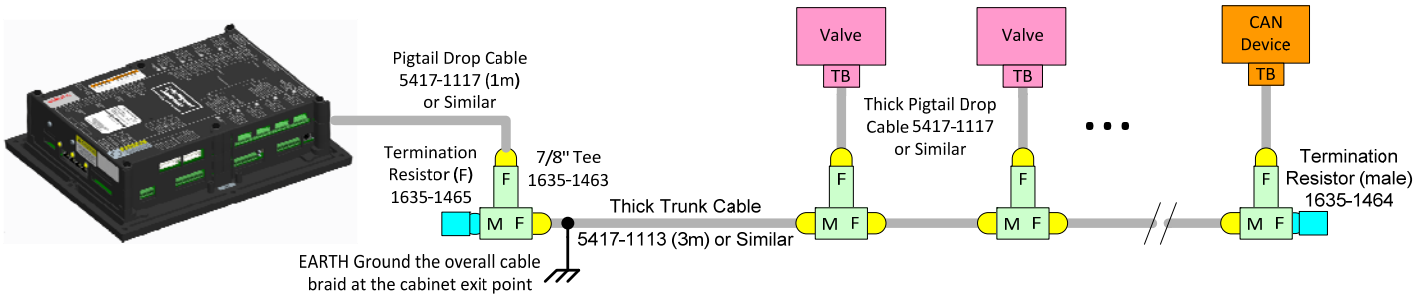


Figure 3-8 Network Cable Lengths

Hardware Specifications

Digital Speed Sensor Inputs

Table 3-4. Digital Speed Sensors

Number of channels	2, selectable as MPU or proximity probe, by terminal block wiring and correct software switches
Input frequency	100–25 000 Hz (MPU), 0.5-25 000 Hz (Prox) (25 kHz is the max reading available using the TSS_ATL GAP block)
Input frequency (max)	25 000 Hz
Resolution	Dependent on frequency, 16 bit minimum at maximum speed
Accuracy	Less than ±0.08% full scale from –40 to +85 °C internal temperature

Note: Shielded cable is required when connecting to the Digital Speed Sensor Inputs.

MPU Inputs

Table 3-5. MPU Inputs

Input magnitude (min)	See Figure 3-9
Input magnitude (max)	See Figure 3-10
Input impedance (typical)	See Figure 3-11
Input impedance (min)	1450 Ω at 1 Vrms and 100 to 25 000 Hz input
Input impedance (min)	450 Ω at 14.6 Vrms and 100 to 300 Hz input
Input impedance (min)	1450 Ω at 14.6 Vrms and 301 to 25 000 Hz input
Isolation voltage	500 Vac minimum, each channel is isolated from all other channels and from the Intelligent Gateway platform

IMPORTANT **When choosing to wire either a MPU or proximity speed input, make sure the unused MPU/PROX(+) terminal block input is shorted to MPU/PROX (–).**

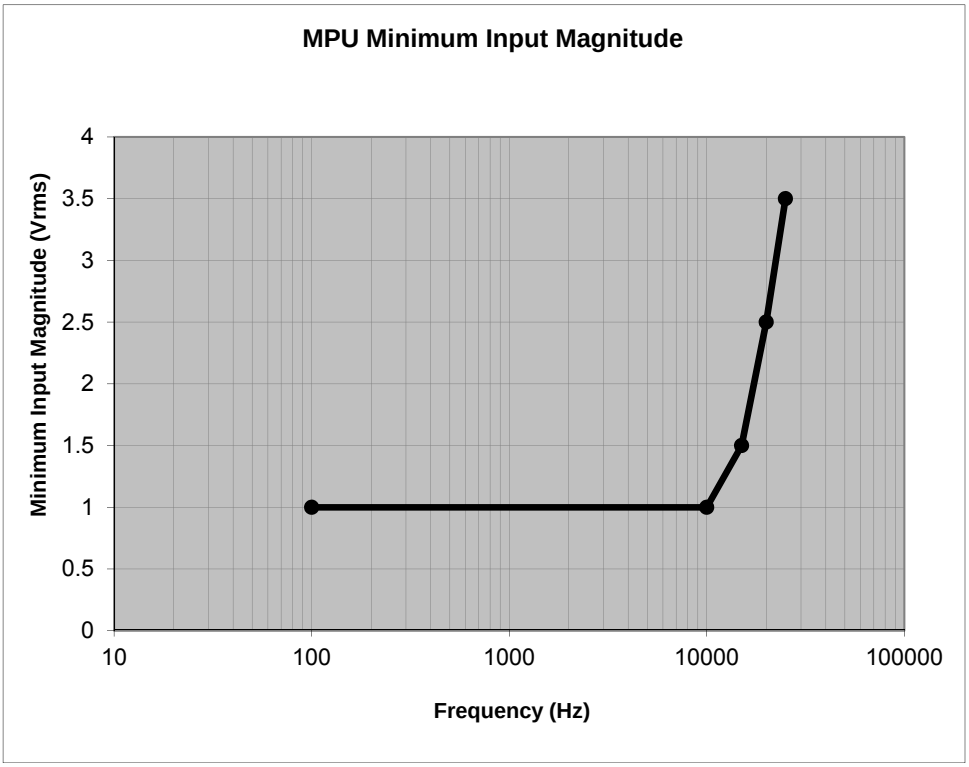


Figure 3-9. MPU Minimum Input Magnitude in Vrms
To convert to V peak to peak, multiply by 2.828.

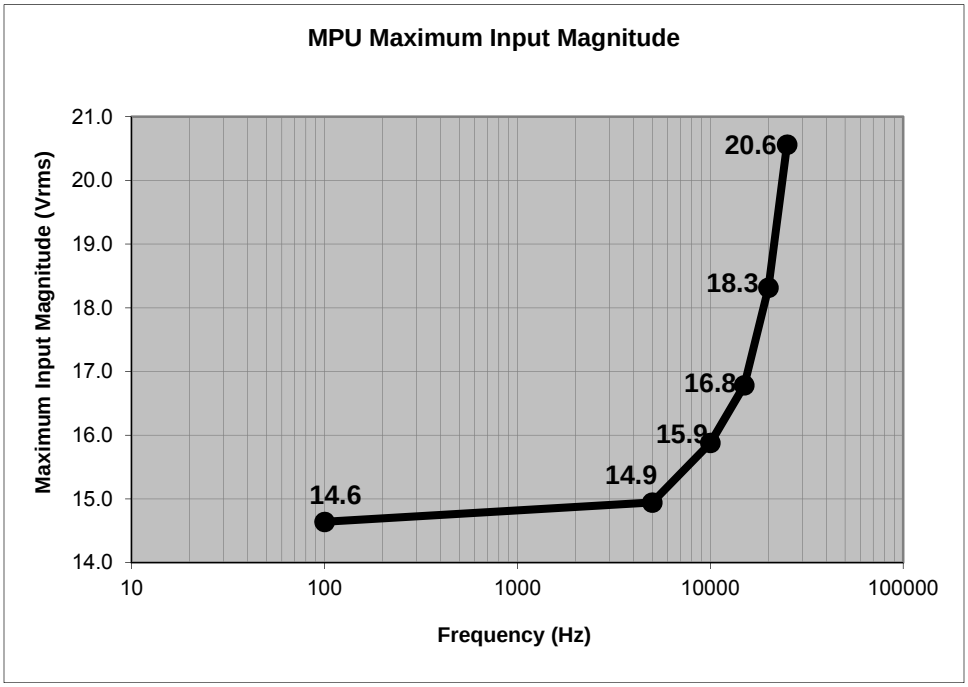


Figure 3-10. MPU Maximum Input Magnitude in Vrms
To convert to V peak to peak, multiply by 2.828.

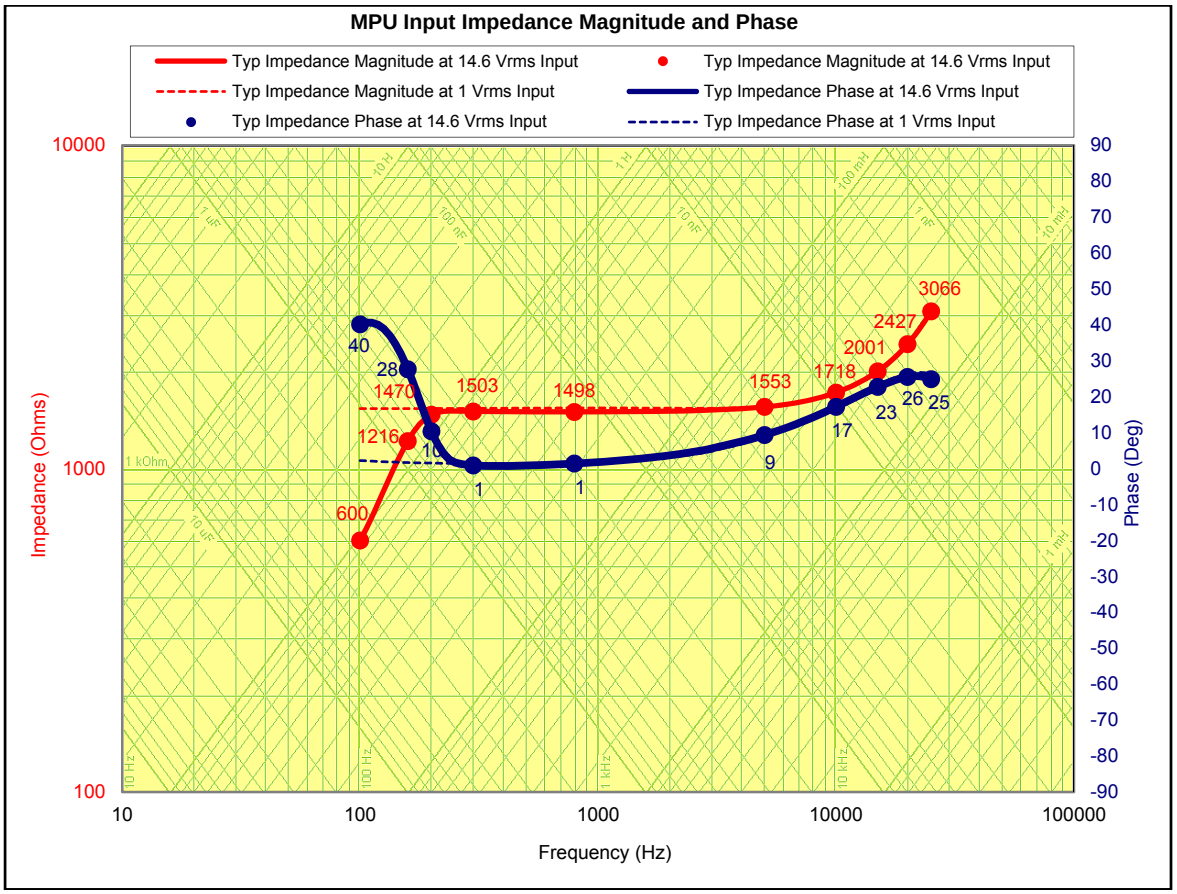


Figure 3-11. MPU Typical Input Impedance Magnitude and Phase

Proximity Probe Inputs

Table 3-6. Proximity Probe Inputs

Voltage threshold /duty cycle at 5 kHz	at 16 Vin, duty cycle = 3.5–96.5% at 24 Vin, duty cycle = 3.5–96.5% at 28 Vin, duty cycle = 3.5–96.5%
Voltage threshold /duty cycle at 25 kHz	at 16 Vin, duty cycle = 17.5-82.5% at 24 Vin, duty cycle = 17.5-82.5% at 28 Vin, duty cycle = 17.5-82.5%
Input threshold (V low)	< 8 Vdc
Input threshold (V high)	> 16 Vdc
Input voltage (V high range)	16–28 Vdc
Minimum Input Resistance @ 8V	37730 Ω
Minimum Input Resistance @ 16V	7160 Ω
Minimum Input Resistance @ 28V	4190 Ω
Available power	none
Isolation	500 Vac minimum, each channel is isolated from all other channels and from the Intelligent Gateway platform
Input frequency	0.5–25 000 Hz

- A derivative output is provided to the application software. Generally, the derivative error increases with frequency input. The typical six-sigma performance with input frequencies < 5000 Hz is better than 8 Hz/s. The typical six-sigma performance with input frequencies > 5000 Hz is better than 24 Hz/s. **Note:** Field wiring may introduce additional signal error due to cable length, cable routing, and other sources.
- No proximity probe power is provided.

IMPORTANT

When choosing to wire either a MPU or proximity speed input, make sure the unused MPU/PROX(+) terminal block input is shorted to MPU/PROX (–).

Analog Inputs

Table 3-7. Analog Inputs

Number of channels	6
Input type	4–20 mA , (full scale = 24 mA)
Max. input current	> 23 mA
Max. input voltage	24V @ 25 °C
Common mode rejection	80 dB minimum
Input common mode range	±40 V minimum
Safe input common mode volt	±40 V minimum
Input impedance	211 Ω (±1.3%)
Anti-aliasing filter (ch1-4)	2 poles at 10 ms
Anti-aliasing filter (ch5-6)	2 poles at 5 ms
Resolution	Greater than 16 bits
Accuracy @ 25 °C	less than ±0.1% of full scale
Temp Drift	171 ppm/°C, maximum (1.1% of full scale, 0.275 mA) 30 ppm/°C, typical (0.20% of full scale, 0.05 mA)
I/O Latency	1 ms

Note: Shielded cable is required when connecting to the Analog Inputs.

- Loop power for the analog inputs is NOT available
- Only 4–20 mA inputs are supported. This is a change from the previous SmartCore module that allowed both current and voltage inputs

IMPORTANT **External loop powered transducers must be individually protected with a 100 mA fuse on each channel.**

Analog Outputs

Table 3-8. Analog outputs

Number of channels	4
Output type	4–20 mA outputs, non-isolated, (full scale = 25mA)
Common Mode Voltage	15 Vdc ±10%
Max current output	25 mA ±5%
Min. load resistance	0 Ω
Max load resistance	300 Ω at 22 mA
Resolution	15 bits of full scale
Accuracy @ 25 °C	less than ±0.1% of full scale
Readback Accuracy @ 25 °C	±1% of full scale
Temperature Drift	140 PPM/°C, maximum (±0.23 mA) 70 ppm/°C, typical (±0.45% of full scale, 0.1125 mA)

Note: Shielded cable is required when connecting to the Analog Outputs.

Actuator Outputs

Table 3-9. Actuator Outputs

Number of channels	2	
Actuator Type	Proportional, non-isolated,	
Output Type	4-20 or 20-200 mA, software selectable (full scale = 31 mA or 233 mA)	
Isolation	None	
Max current output	27 mA +10% 218 mA +10%	(4-20 mA range) (20-200 mA range)
Min. load resistance	10 Ω	
Max load resistance	300 Ω at 22 mA 40 Ω at 200 mA	(4-20 mA range) (20-200 mA range)
Resolution	15 bits of full scale	
Accuracy @ 25 °C	less than ±0.1% of full scale 0.029 mA 0.220 mA	 (4-20 mA range) (20-200 mA range)
Readback Accuracy @ 25 °C	±1.0 % of full scale	
Temperature Drift	140 PPM/°C maximum 0.26 mA maximum 2.00 mA maximum 70 ppm/°C typical 0.13 mA 1.00 mA	 (4-20 mA range) (20-200 mA range) 0.45% of full scale, (4-20 mA range) (20-200 mA range)
Readbacks	Actuator source and return currents	
Dither Current	25 Hz, fixed duty cycle, software variable amplitude	

Note: Shielded cable is required when connecting to the Actuator Outputs.

Discrete Inputs

Table 3-10. Discrete Inputs

Number of channels	24
Input type	Optically isolated discrete input
Input thresholds	< 8 Vdc = “OFF”
	> 16 Vdc = “ON”
Input current	3 mA @ 24 Vdc
Contact voltage	24 Vdc isolated output (100 mA max, internally protected)
Max input voltage	28 Vdc
Isolation voltage	500 Vac, all channels are isolated from the Intelligent Gateway platform

- For EMC compliance, the on-board, isolated, +24 Vdc supply is recommended for use as power to contacts, 100 mA maximum.
- All channels are common to each other. Isolation is with respect to the Intelligent Gateway platform and other I/O types.

Serial I/O

Table 3-11 Serial I/O Channels

Number of channels	3 isolated ports, 115.2K max
Channel configuration	1 - RS-232 Debug Port (PS2 style, mini-DIN6F connector) 2 - RS-232/RS-485/RS-422 software configurable, terminal block connections
Termination Resistor	Located on the board and are accessible via field wiring. Termination resistors are provided for RS-485 and RS-422 Receive.
Isolation Voltage	500 Vdc

Note: Shielded cable is required when connecting to the Serial I/O.

SmartCore CPU A5200 Board Operation

This board includes no potentiometers and requires no field calibration.

Speed Sensor Inputs

The MPU and proximity probe inputs are read and the speed is provided to the application program. A derivative output is also provided. The speed sensor inputs are filtered by the SmartCore CPU A5200 board with the filter time constant being selectable in GAP software between 5 and 160 ms. Eight milliseconds should be acceptable for most turbine applications, while 16 milliseconds may be necessary for very slow speed applications. The speed range is selected in the application software and determines the maximum speed that the board will detect. The control output of the software will detect a minimum speed of one fiftieth of the speed range. This allows detection of failed speed sensors to help prevent overspeed due to slow update times at very low speeds. The monitor output of the GAP block will read down to 0.5 Hz, regardless of the speed range. An application may use any combination of accepted MPU and proximity probes, and any combination of speed ranges.

The SmartCore CPU A5200 board uses speed sensing probes mounted on a gear connected or coupled to the turbine's rotor to sense turbine rotor speed. Either of the A5200 board's speed channels accept passive magnetic pickup units (MPUs) or proximity probes.

It is not recommended that gears mounted on an auxiliary shaft coupled to the rotor be used to sense speed. Auxiliary shafts tend to turn more slowly than the rotor (reducing speed sensing resolution) and have coupling gear backlash, resulting in less than optimum speed control. For safety purposes, it is also not recommended that the speed sensing device sense speed from a gear coupled to a generator or mechanical drive side of a system's rotor coupling.

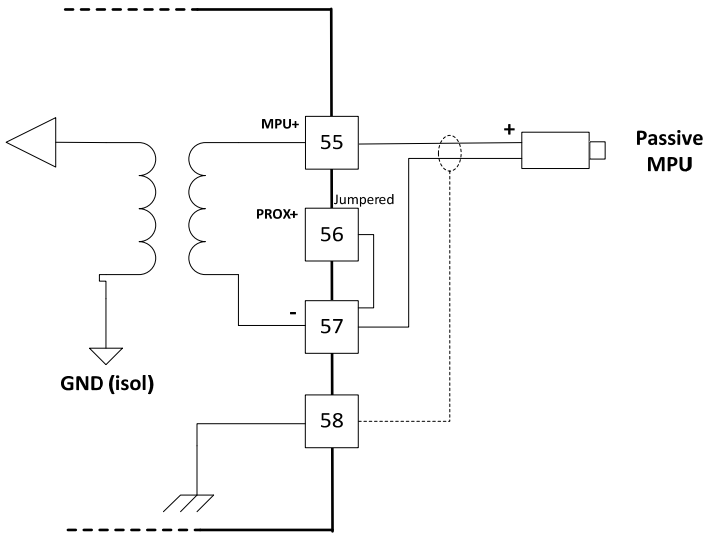


Figure 3-12. Wiring Example–MPU Interface to the SmartCore Board

A proximity probe may be used to sense very low speeds. With a proximity probe, speed can be sensed down to 0.5 Hz. When interfacing to open collector type proximity probes, a pull-up resistor is required between the supplied proximity probe voltage and the proximity probe input to the SmartCore CPU A5200 board.

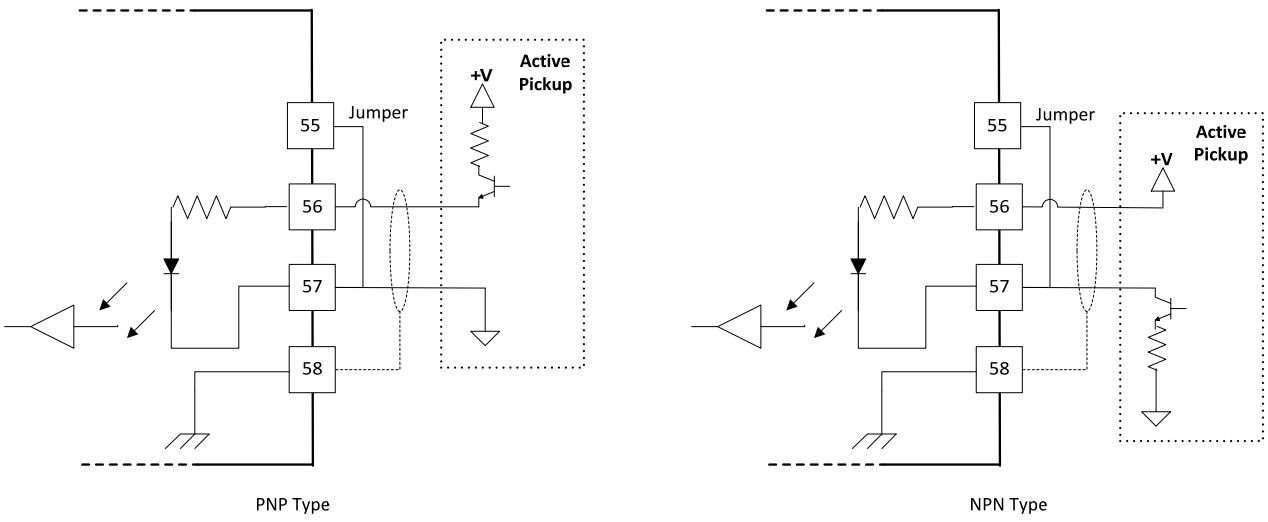


Figure 3-13. Wiring Example–Open Collector Proximity Probe to the SmartCore CPU A5200 Board

Configuration Notes

- Refer to Figures 3-10 and 3-11 for speed sensor wiring.
- Each speed input channel can only accept one MPU or one proximity probe.
- Proximity probe power is not provided.
- Proximity probes only—external pull-up resistors are required when interfacing to open collector type proximity probes.
- If the proximity probe inputs are used, the corresponding MPU inputs must be jumpered as shown.

Speed Sensor Input Software Configuration Limitations

- (TxMxR)/60 must be < 25 000 Hz
  T = gear teeth
  M = (overspeed test limit setting x 1.2)
  R = gear ratio

Analog Inputs

The analog inputs accepts a 4-20 mA current signal and may be used with two-wire ungrounded (loop powered) transducers or isolated (self-powered) transducers. All Analog inputs have greater than 40 Vdc of common mode rejection. If interfacing to a non-isolated device, which may have the potential of reaching over 40 Vdc with respect to the control's common, the use of a loop isolator is recommended to break any return current paths, which could produce erroneous readings.

For a 4–20 mA input signal, the SmartCore CPU A5200 board uses a 211 Ω resistor across the input.

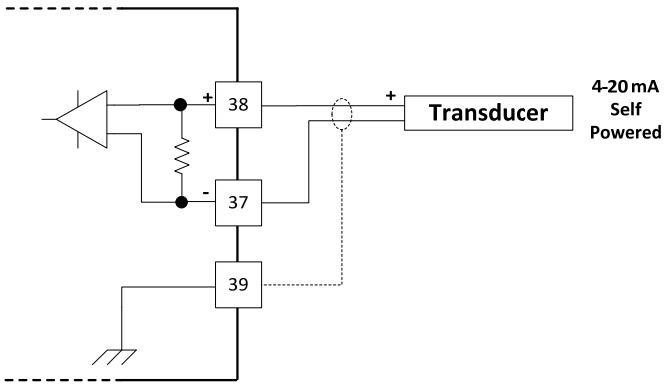


Figure 3-14a. Wiring Example–4–20 mA Input Interface to the SmartCore CPU A5200 Board

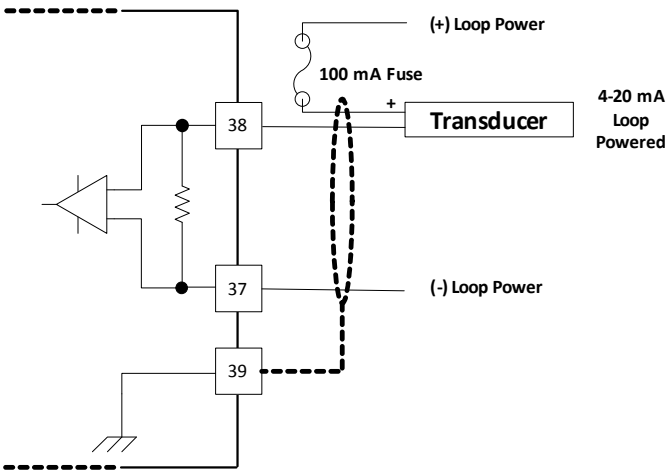


Figure 3-14b. Wiring Example–4–20 mA Input Interface using External Loop Power

Configuration Notes

- Refer to Figures 3-12a and 3-12b for analog input wiring.
- All 4-20 mA inputs have an input impedance of 211 Ω.
- Loop power is NOT provided by the control, it must be sourced externally.

IMPORTANT **External loop powered transducers must be individually protected with a 100 mA fuse on each channel.**

Analog Outputs

The analog outputs are 4–20 mA with a full scale range of 0–25 mA. The SmartCore CPU A5200 board has four analog outputs.

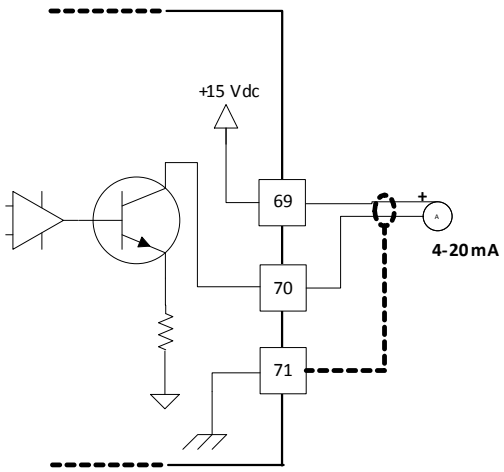


Figure 3-15. Wiring Example–Analog Output Interface to the SmartCore CPU A5200 Board

Configuration Notes

- Refer to Figure 3-15 for analog output wiring.
- Only 4–20 mA signals are output.
- See the specifications section for the maximum analog output load.
- Care should be taken to prevent ground loops and other faults when interfacing to non-isolated devices.
- Each output provides readback capability that can be used to detect field wiring or device faults as needed.
- The analog outputs have a 15 V common mode voltage, with respect to Intelligent Gateway control common.

NOTICE

Avoid misconnection of the Analog Output (+) to the Actuator Output (–). This will damage internal components, making the control inoperable.

NOTICE

Signal Isolators should be used when connecting to non-isolated field devices greater than 30 meters away.

Beware of Analog and Actuator output connections to non-isolated field devices that are located greater than 30 meters away from the Intelligent Gateway Control. Ground potentials between different locations can be severe enough under certain EMC/Surge events to cause control malfunction.

Actuator Outputs

The (2) proportional actuator driver outputs are software configurable as either 4-20 mA or 20-200 mA with a full scale range of 0–31 mA or 0-233 mA. Each driver output provides both current source and return readbacks that can assist in troubleshooting and detection of field wiring or device failures.

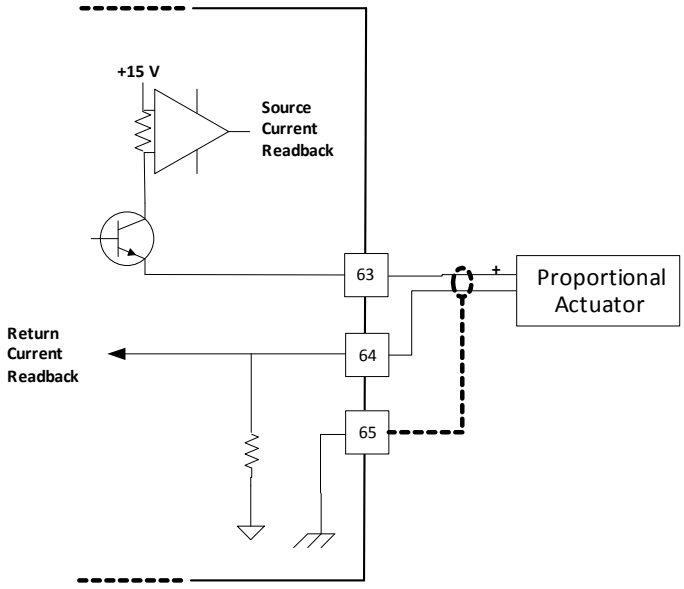


Figure 3-16. Wiring Example–Actuator Output Interface to the SmartCore CPU A5200 Board

Configuration Notes

- Refer to Figure 3-16 for actuator output wiring.
- 4–20 mA or 20-200 mA signals are output.
- See the specifications section for the maximum actuator output load.

- Care should be taken to prevent ground loops and other faults when interfacing to non-isolated devices.
- Application software selects the actuator type, the output range, and the dither amount.
- Each output provides readback capability that can be used to detect field wiring or device faults as needed.

NOTICE

Avoid misconnection of the Analog Output (+) to the Actuator Output (–). This will damage internal components, making the control inoperable.

NOTICE

Signal Isolators should be used when connecting to non-isolated field devices greater than 30 meters away.

Beware of Analog and Actuator output connections to non-isolated field devices that are located greater than 30 meters away from the Intelligent Gateway Control. Ground potentials between different locations can be severe enough under certain EMC/Surge events to cause control malfunction.

Discrete Inputs

The SmartCore CPU A5200 board accepts 24 discrete inputs. Contact wetting voltage may be supplied by the SmartCore CPU A5200 card. Optionally, an external 18–28 Vdc power source can be used to source the circuit wetting voltage.

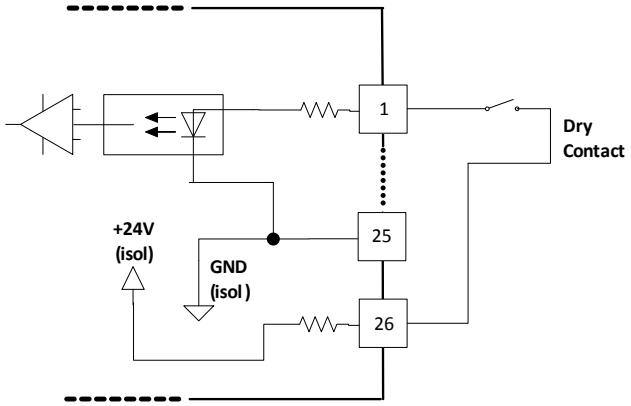


Figure 3-17. Wiring Example–Discrete Input Interface to the SmartCore CPU A5200 Board

Configuration Notes

- Refer to Figure 3-17 for discrete input wiring.
- The discrete input commons are tied together, so each SmartCore CPU A5200 board accepts only one voltage source, which can be internally or externally supplied.
- All contact inputs accept dry contacts.
- If an external power supply is used, it must be rated to 28 Vdc max from Class 2 type source for North America (SELV type source for applications outside North America). Power supply outputs must be fused with appropriately sized fuses (either a maximum current rating for the supply, or a current rating of 100/V (where V is the supply's rated voltage), or a 5 A fuse, whichever is less).
- The 24 V isolated contact power is protected by a 0.3 A poly switch that is rated for 0.1 A continuous use. This may not prevent interruption in control

operation due to a short in the field wiring, but should protect the control from damage. The poly switch will reset itself when the short condition is resolved.

- If unused (floated) Discrete Inputs have an extended cable length attached for future use, they must be ignored in software. Events such as large transient pulses near the unused cable can cause them to momentarily toggle.
- Marine Type Approval installations require Discrete Input cabling inside the cabinet to be shielded if it leaves the cabinet.

Serial I/O

The SmartCore CPU A5200 accepts (2) user serial I/O connections. Both isolated ports are configurable for RS-232, RS-422, or RS-485. RS-232 is specified to 50 feet (15 m) while RS-485 and RS-422 are specified to 4000 feet (1219 m).

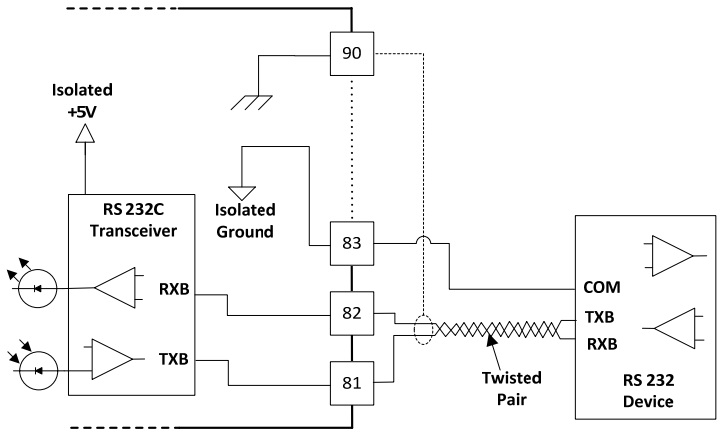


Figure 3-18. Serial #1–RS-232 Pinouts

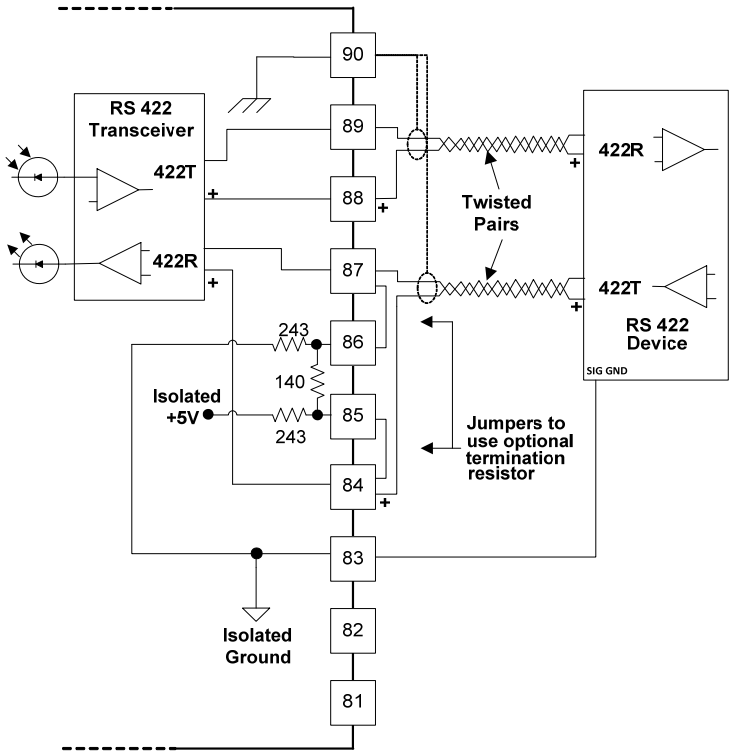


Figure 3-19. Serial #1–RS-422 Pinouts

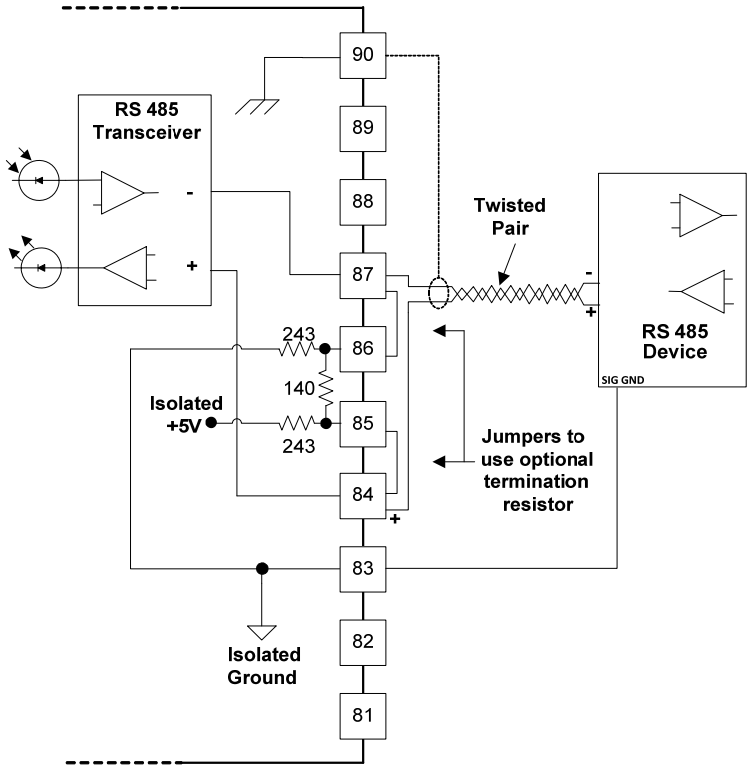


Figure 3-20. Serial #1–RS-485 Pinouts

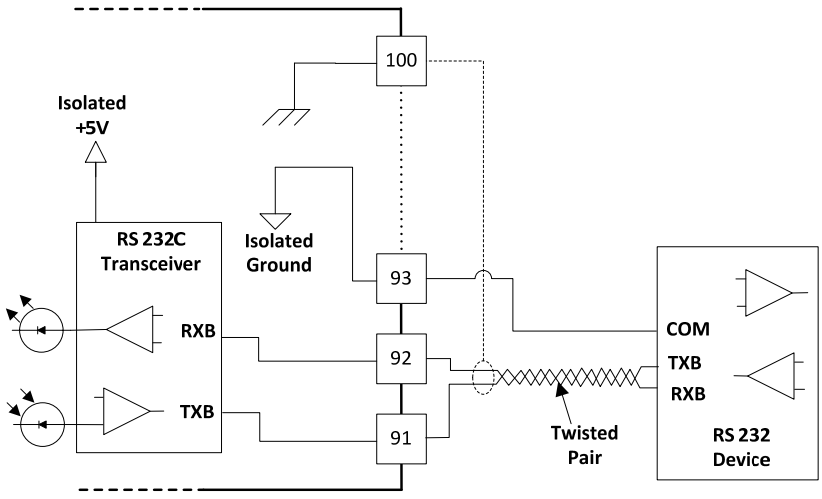


Figure 3-21. Serial #2–RS-232 Pinouts

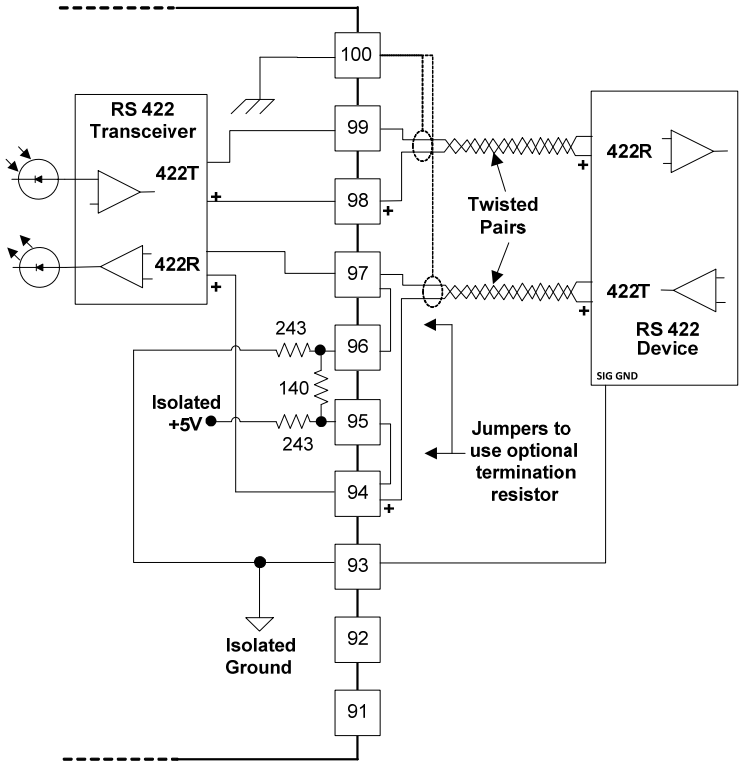


Figure 3-22. Serial #2–RS-422 Pinouts

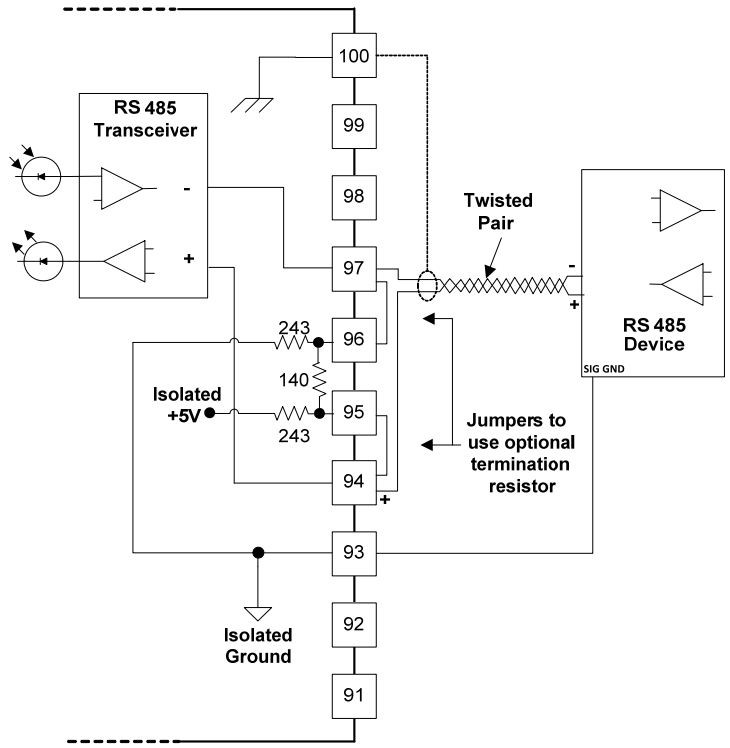


Figure 3-23. Serial #2–RS-485 Pinouts

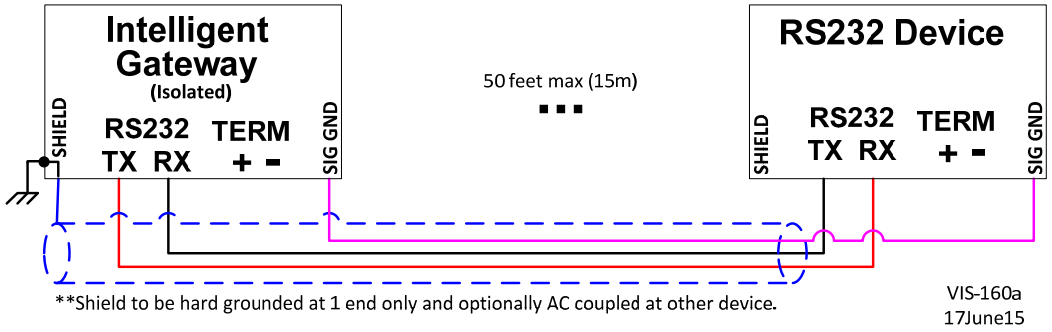


Figure 3-24. Wiring Example–RS-232 Interface to the SmartCore CPU A5200 Board

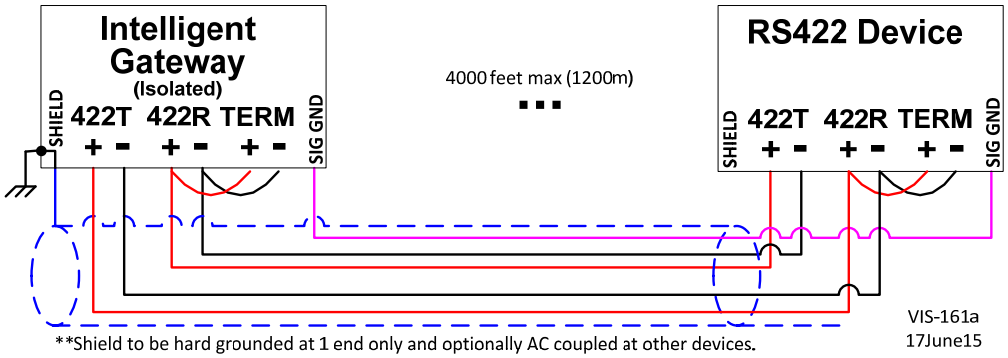


Figure 3-25. Wiring Example–RS-422 Interface to the SmartCore CPU A5200 Board

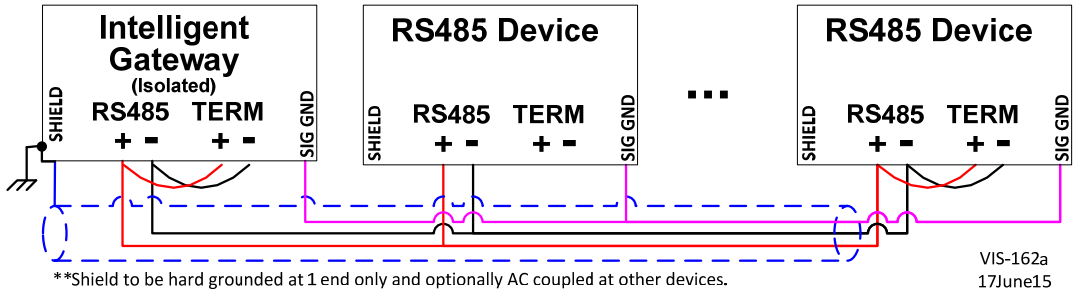


Figure 3-26. Wiring Example–RS-485 Interface to the SmartCore CPU A5200 Board

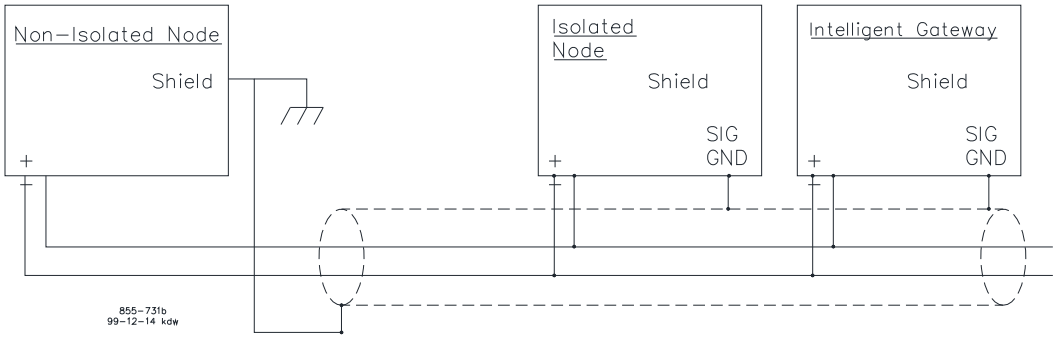


Figure 3-27. Wiring Example–Alternate Multipoint Wiring
(without a separate signal ground wire for the SmartCore CPU A5200 board)

Configuration Notes

- **RS-232.** Refer to Figure 3-24 for an RS-232 wiring example. The transmit data (TXD), receive data (RXD), and signal ground (SIG GND) must be properly connected as shown. In addition the shield (SHLD) should be connected in at least one location.
- **RS-422.** Refer to Figure 3-25 for an RS-422 wiring example. The transmit data pairs (422T+ and 422T-), receive data pairs (422R+ and 422R-), and signal ground (SIG GND) must be properly connected as shown. In addition, the shield (SHLD) should be connected in at least one location. Only the receiver at each end of the network should be terminated with a resistor.
- **RS-485.** Refer to Figure 3-26 for an RS-485 wiring example. The data lines (485+ and 485–) and signal ground (SIG GND) must be properly connected as shown. In addition, the shield (SHLD) should be connected in at least one location. The unit at each end of the network should be terminated with a resistor.
- **Termination Resistors.** The Intelligent Gateway has termination resistors (TERM RES) built into the SmartCore CPU A5200 board that can be jumpered-in as required for RS422 and RS485 communication networks.
- The serial ports must be properly configured in the application software for the appropriate communication parameters.

Reference Grounds

- The serial ports are individually isolated from each other, and from the rest of the Intelligent Gateway control. The RS-422 and RS-485 specifications state that a ground wire is needed if there is no other ground path between units. The preferred method for isolated ports is to include a separate wire in the ground cable that connects the circuit grounds together.
- Non-isolated nodes may not have a signal ground available. If signal ground is not available, use the alternate wiring scheme of connecting all circuit grounds of isolated nodes to the shield, and connecting the shield to earth ground at a non-isolated node.

Troubleshooting and Tuning

The SmartCore CPU A5200 module runs off-line and on-line diagnostics that display troubleshooting messages through the debug Service Port and AppManager. Off-line diagnostics run automatically on power-up and upon reset. On-line diagnostics run during normal Control System operation when the GAP application is active. More information on diagnostics tests, subsequent LED flash codes, and serial port messages is contained in the VxWorks manual.

Fault Detection (Board Hardware)

Each SmartCore CPU A5200 board has a red fault LED that is turned on when the system is reset. During initialization of a board, which occurs after every CPU reset, the CPU turns the Fault LED on. The CPU then tests the board using diagnostic routines built into the software. If the diagnostic test is not passed, the LED remains on or blinks. If the test is successful, the LED goes off. If the fault LED on a board is illuminated after the diagnostics and initialization have been completed, the SmartCore CPU A5200 board may be faulty.

A table of the CPU fault LED flash codes is shown below:

Table 3-12. SmartCore CPU A5200 Failure Codes

Failure	Flash Code
RAM Test Failure	1, 4
Real Time Clock Test Failure	2, 2
Floating Point Unit Test Failure	2, 3
Flash Test Failure	2, 4
HD1 Flash Test Failure	2, 5
I2C Bus Test Failure	2, 6
Module Installed in wrong slot	2, 7
Main Chassis CPU switch must be set to 0	3,5
Rate Group 5 Slip	3, 7
Rate Group 10 Slip	3, 8
Rate Group 20 Slip	3, 9
Rate Group 40 Slip	3, 10
Rate Group 80 Slip	3, 11
Rate Group 160 Slip	3, 12

Fault Detection (I/O)

In addition to detecting board hardware faults, the application program may detect I/O faults.

- Analog Input Faults—the application software may set a high and low latch set point to detect input faults.
- Speed Sensor Input Faults—the application software may set a high and low latch set point to detect input faults.
- Serial Port Faults—the system monitors the serial communications on the serial ports for various communication errors.
- Microcontroller Faults—the system monitors a software watchdog, a hardware watchdog, and a software watchdog on the PC/104 bus communications. All outputs are shut down in the event of a microcontroller fault.

Troubleshooting Guide

Speed Sensor Inputs

MPUs—if a magnetic pickup input is not functioning properly, verify the following:

- Check that the cable is shielded and the shield is properly grounded per the shields and grounding section in Chapter 5.
- Measure the input voltage on the terminal block. It should be greater than 1 Vrms.
- Verify that the signal waveform is clean and void of double zero crossings.
- Verify that no signal return to ground connections exist and that the 60 Hz signal resulting from ground loops is absent.
- Measure the frequency. Frequency should be in the range of 100 Hz to 25 kHz.
- Check the wiring. Look for a loose connection at the terminal blocks and disconnected or misconnected cables.
- Check the software configuration to ensure that the input is configured properly.

After verifying all of the above, the Intelligent Gateway should be returned for service.

Proximity Probes—if a proximity probe input is not functioning properly, verify the following:

- Check that the cable is shielded and the shield is properly grounded per the shields and grounding section in Chapter 5.
- Measure the input voltage on the terminal block. It should be in the range of 16–28 V peak, and the duty cycle should be within the specified range for the input voltage.
- Verify that the signal waveform is clean and void of double zero crossings.
- Verify that no signal return to ground connections exist and that the 60 Hz signal resulting from ground loops is absent.
- Measure the frequency. Frequency should be in the range of 0.5 Hz to 3 kHz.
- Check the wiring. Look for a loose connection at the terminal blocks and disconnected or misconnected cables. If an open collector probe is used, check to ensure that the pull-up resistor is installed properly.
- Check the software configuration to ensure that the input is configured properly.
- Verify that the corresponding MPU input is jumpered.

After verifying all of the above, the Intelligent Gateway should be returned for service.

Analog Inputs

If an Analog input is not functioning properly, verify the following:

- Check that the cable is shielded and the shield is properly grounded per the shields and grounding section in Chapter 5.
- Measure the input voltage on the terminal block. It should be in the range of 0–5 V.
- Verify that there are no or minimal AC components to the analog input signal. AC components can be caused by improper shielding or grounding.
- Check the wiring. If the inputs are reading 0 or the engineering units that correspond to 0 mA, look for a loose connection at the terminal blocks and disconnected or misconnected cables. If the unit is a 4–20 mA input, check for proper jumper installation on the terminal block.
- If all of the inputs are reading high, check that the power is not connected across the input directly.
- Check the software configuration to ensure that the input is configured properly.
- If the input is loop powered, ensure that power is provided externally, the control does not provide this power.

After verifying all of the above, the Intelligent Gateway should be returned for service.

Analog Outputs

If an Analog output is not functioning properly, verify the following:

- Check that the cable is shielded and the shield is properly grounded per the shields and grounding section in Chapter 5.
- Check the load resistance, ensure that it is less than the specification limit for the output current.
- Check to ensure that the load wiring is isolated.
- Check the wiring, look for a loose connection at the terminal blocks and disconnected or misconnected cables.

- Disconnect the field wiring and connect a resistor across the output. If the output is correct across the resistor, there is a problem with the field wiring.
- Check the software configuration to ensure that the output is configured properly.

After verifying all of the above, the Intelligent Gateway should be returned for service.

Proportional Actuator Outputs

If an Actuator output is not functioning properly, verify the following:

- Check that the cable is shielded and the shield is properly grounded per the shields and grounding section in Chapter 5.
- Check the load resistance, ensure that it is less than the specification limit for the output current.
- Check to ensure that the load wiring is isolated.
- Check the wiring, look for a loose connection at the terminal blocks and disconnected or misconnected cables.
- Disconnect the field wiring and connect a resistor across the output. If the output is correct across the resistor, there is a problem with the field wiring.
- Check the software configuration to ensure that the output is configured properly.

After verifying all of the above, the Intelligent Gateway should be returned for service.

Discrete Inputs

If a discrete input is not functioning properly, verify the following:

- Measure the input voltage on the terminal block. It should be in the range of 18–28 Vdc.
- If an external wetting voltage source is used, check the voltage source is referenced to the A5200 wetting-voltage common.
- Check the wiring, look for a loose connection at the terminal blocks and disconnected or misconnected cables.
- Check the software configuration to ensure that the input is configured properly.

After verifying all of the above, the Intelligent Gateway should be returned for service.

Serial I/O

If a serial port is not functioning properly, verify the following:

- Check the wiring, look for a loose connection at the terminal blocks and disconnected or misconnected cables.
- Check to be sure that termination resistors are properly installed where needed on the network.
- Check the software configuration to ensure that the input is configured properly.
    - Check that the cable is shielded and the shield is properly grounded per the shields and grounding section in Chapter 5.

After verifying all of the above, the Intelligent Gateway should be returned for service.

Chapter 4.
Specifications

Environmental Specifications

Operating Temperature
The Intelligent Gateway Control Platform operates in a specified ambient temperature of –40 to +70 °C (–40 to +158 °F).

NOTICE

Continuous operation with insufficient air flow or higher operating temperatures will lead to reduced reliability and possible damage to the control.

Storage Temperature
The Intelligent Gateway Control Platform is designed to be stored without applied power at the temperature range of –40 to +85 °C (–40 to +185 °F).

Component life is adversely affected by high-temperature, high-humidity environments. Room temperature storage is recommended for long life. If the unit is to be stored for a long period of time, operating power must be applied at least for one hour every 18 to 24 months.

Shock
The Intelligent Gateway was designed to meet the shock requirements specified by US MIL-STD-810F procedure 516.5, procedure 1 (40 G, 11 ms duration sawtooth pulse).

Vibration (with Isolator Kit P/N 8923-0382)
10–2000 Hz @ 0.04 G^2/Hz, 8.2 Grms for a period of 1.5 h/axis

Vibration (Hard Mounted)
10–500 Hz @ 0.015 G^2/Hz, 1.04 Grms for a period of 2 h/axis

Audible Noise Emission
The Intelligent Gateway does not emit an audible noise.

Enclosure Protection
In order to meet Zone 2 European Group IIC, the Intelligent Gateway must be mounted in an enclosure that meets or exceeds IP54 meeting the construction requirements of IEC 60079-15. The enclosure must be coded *Ex nA* or *Ex e*.

In order to ensure performance well within the EMC requirements for all configurations of Intelligent Gateway, the single or multiple Intelligent Gateway configuration must be mounted in a metal enclosure, with the enclosure grounded and cabling & installation recommendations followed.

Altitude
The Intelligent Gateway is designed to operate up to 3000 m / 9800 feet.

Weight
The Intelligent Gateway weighs 4.3 kg (9.5 lb).

Air Quality
Pollution degree 2

Installation Overvoltage Rating
Category II

Electromagnetic Compatibility (EMC)

The unit complies with the requirements of EN 61000-6-4 & EN 61000-6-2 per:

EN 61000-6-4 RF Emissions:

- Radiated Electromagnetic Emissions 30 MHz to 3000 MHz tested per CISPR 16
- Distributed Telecom Port Conducted RF Emissions Limits on RTN & CAN port cable shields 0.150 MHz to 30 MHz per CISPR 16

EN 61000-6-2 Immunity:

- Electrostatic Discharge (ESD) immunity to ±6 kV Contact and ±8 kV Air (arc) per IEC 61000-4-2, Except I/O pins
- Package & Handling and Operational Electrostatic Discharge (ESD) immunity to ±2 kV Contact to I/O pins
- Radiated RF Immunity to 10 V/m, 80 to 3000 MHz, per IEC 61000-4-3
- Electrical Fast Transients (EFT) Immunity to ±2.0 kV, 5 & 100 kHz rep rate, on I/O & Power input cabling per IEC 61000-4-4
- Surge Immunity to ±0.5 kV DM & ±1.0 CM on power input per IEC 61000-4-5
- Surge Immunity to ±1.0 line-earth on I/O lines per IEC 61000-4-5
- Conducted RF (CRF) Immunity to 10 VRMS, 0.150 to 80 MHz, per IEC 61000-4-6

Power Supply Input

Range	18–32 Vdc
Input Current	1.06 A @ 32 Vdc 1.38 A @ 24 Vdc 1.81 A @ 18 Vdc
Input Power	40 W maximum
Interrupt Time Holdup	8 ms @ ≥ 24 V
Efficiency	70% minimum over operating input voltage range
Reverse Polarity Protection	56 V
Input Wiring Constraints	The Intelligent Gateway control platform must be wired such that no other device receives power from the wiring between the Intelligent Gateway Control Platform and the power supply source.

Input Wiring Constraints
The Intelligent Gateway control platform must be wired such that no other device receives power from the wiring between the Intelligent Gateway Control Platform and the power supply source.

Power Supply Monitoring Circuit (Power Supply Board)
The Gateway will shut down or not boot if the power supply voltage to it is outside of a 15 Vdc to 35 Vdc range. Ensure that the power supply is within the operating range specified above over the operating temperature range.

Electric Shock

The Intelligent Gateway control platform shall not present an electrical shock hazard to the operator or maintenance personnel when used in a normal manner per the National Electrical Code Handbook, ANSI/NFPA 70 HANDBOOK-1990.

Safety is ensured by certification through the safety agencies specified in the “Regulatory Compliance” section of this document.

Protective Earth (PE) must be connected to the termination point on the right side of the unit next to the label with the symbol ⏚ to reduce the risk of electric shock. This connection will be made using a thread-forming screw (M4 x 6 mm). The conductor providing the connection shall have a properly sized ring lug and wire larger than or equal to 3.3 mm² (12 AWG).

⚠WARNING

The Intelligent Gateway must have input power removed before installing or removing.

This equipment is suitable for use in Class 1, Division 2, Groups A, B, C, and D, Zone 2, Group IIC, or non-hazardous locations only.

Wiring must be in accordance with Class I, Division 2 or Zone 2 wiring methods and in accordance with the authority having jurisdiction.

Chapter 5. Installation

Introduction

This chapter provides the general information for mounting location selection, installation, and wiring of the Intelligent Gateway. Hardware dimensions, ratings, and requirements are given for mounting and wiring the control in a specific application.

General Installation

When selecting a location for mounting the Intelligent Gateway, consider the following:

- Protect the unit from direct exposure to water or to a condensation-prone environment.
- The control is designed for installation in a protective metal enclosure such as a standard cabinet with ingress protection rating of IP54 or greater.
- Provide an ESD strap as ESD mitigation inside the cabinet for handling the equipment and plugging/unplugging the connectors.
- The operating range of the Intelligent Gateway is –40 to +70 °C (–40 to +158 °F). See the Environmental Specifications for more details.
- Provide adequate ventilation for cooling. Shield the unit from radiant heat sources.
- Do not install the unit or its connecting wires near inductive, high-voltage, or high-current devices. If this is not possible, shield both the system connecting wires and the interfering devices and/or wires.
- Allow adequate space around the unit for air flow, servicing, and wiring.
- Do not install where objects can be dropped on the terminals.
- Ground the chassis for proper safety and shielding effectiveness.
- When installing on a generator set package, provide vibration isolation.

Shipping Carton

Before unpacking the control, refer to the inside front cover and page 4 of this manual for WARNINGS and CAUTIONS. Be careful when unpacking the control. Check for signs of damage such as bent or dented panels, scratches, and loose or broken parts. If any damage is found, immediately notify the shipper.

The Intelligent Gateway was shipped from the factory in an anti-static foam lined carton. This carton should always be used for transport of the Intelligent Gateway or for storage when the Intelligent Gateway is not installed in the system.

Mounting

Figure 5-1 shows the Intelligent Gateway mounting pattern. The Intelligent Gateway is to be mounted in an appropriate enclosure for the installed environment. This equipment is designed for installation within a control room panel inside an enclosure/cabinet or standalone enclosure or cabinet.

WARNING

This equipment is intended to be installed in a metal cabinet or enclosure to provide protection against the entry of dust or water and to protect against mechanical impact. For ATEX compliance, a minimum ingress protection rating of IP54 is required for the enclosure. The interior of the enclosure shall not be accessible in normal operation without the use of a tool.

WARNING

The control must be mounted in a vertical position inside the enclosure. The installer shall ensure the maximum surrounding air temperature of the control must not exceed +70 °C at the final location.

The standard Intelligent Gateway package must be mounted to allow sufficient room for wiring access. Eight front panel mounting holes permit secure mounting. A minimum of 75 mm (3 inch) of clear space around the outer surfaces of the Intelligent Gateway is required for wiring and ventilation.

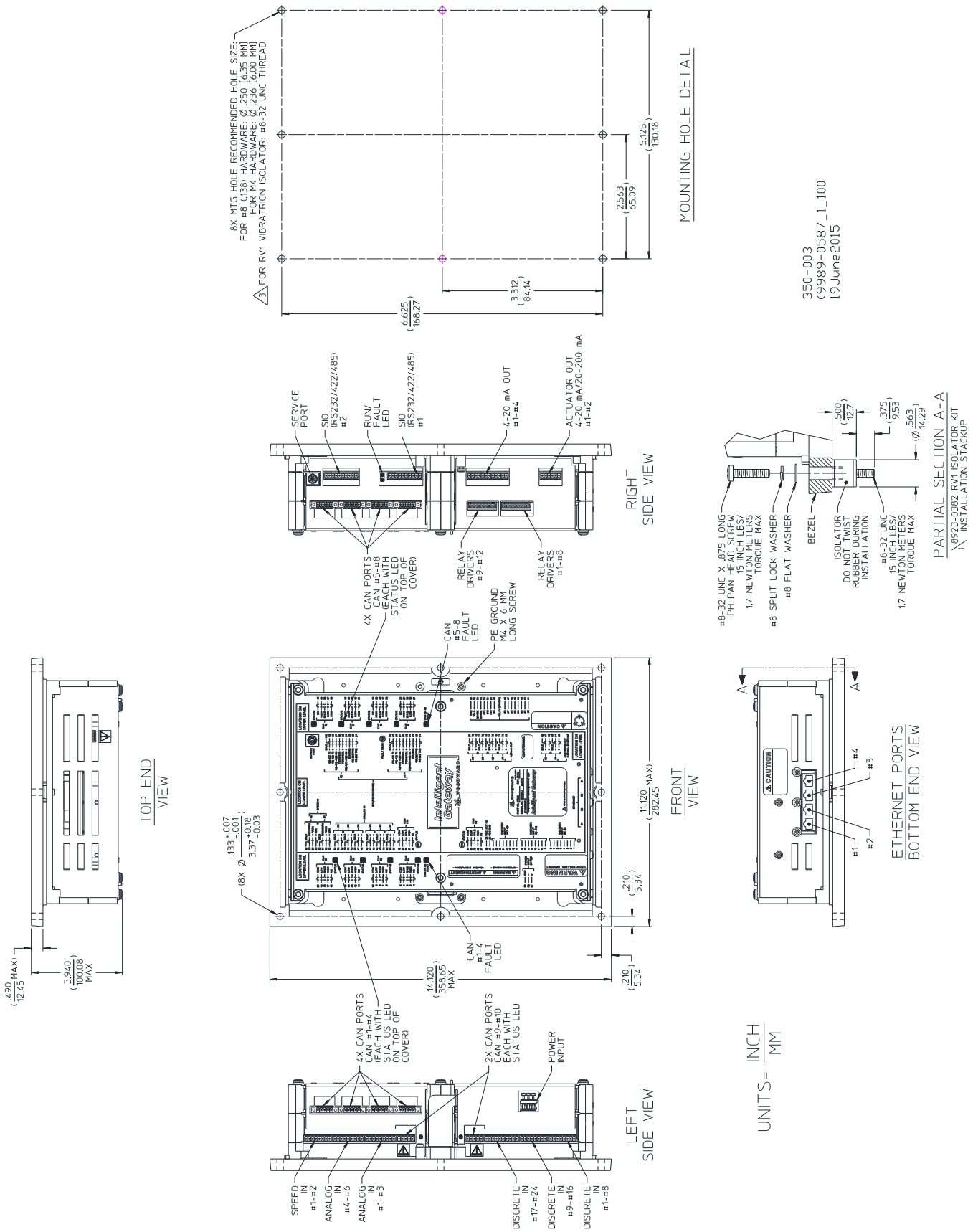


Figure 5-1. Optional RV1 Isolation Kit Installation

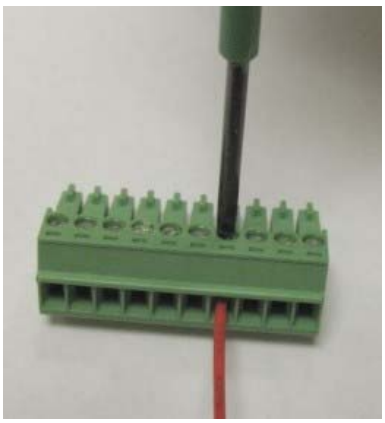
I/O Terminal Blocks

Most of the Intelligent Gatewaycontrol's terminal blocks are designed to be removed by hand. The Intelligent GatewayControl uses two different styles of pluggable terminal blocks: Screw Connection (limited to the A5200 SmartCore board) and "CageClamp".

The pluggable terminal blocks on the SmartCore CPU A5200 board all utilize the Screw Connection style terminal blocks (see Figure 2-1 for torque and screwdriver requirements). The Screw Connection terminal blocks accept wires from 0.08–1.5 mm² (28–16 AWG). Two 0.8 mm² (18 AWG) wires or three 0.3 mm² (22 AWG) wires can be easily installed in each terminal.

The pluggable terminal blocks on the modules (other than the A5200 SmartCore) are screwless, CageClamp style blocks. The spring clamp can be actuated by using a standard 2.5 mm (3/32 inch) flat bladed screwdriver (see Figure 2-2). These terminal blocks accept wires from 0.08–1.1 mm² (28–18 AWG). Two 0.5 mm² (20 AWG) wires or three 0.3 mm² (22 AWG) wires can be easily installed in each terminal.

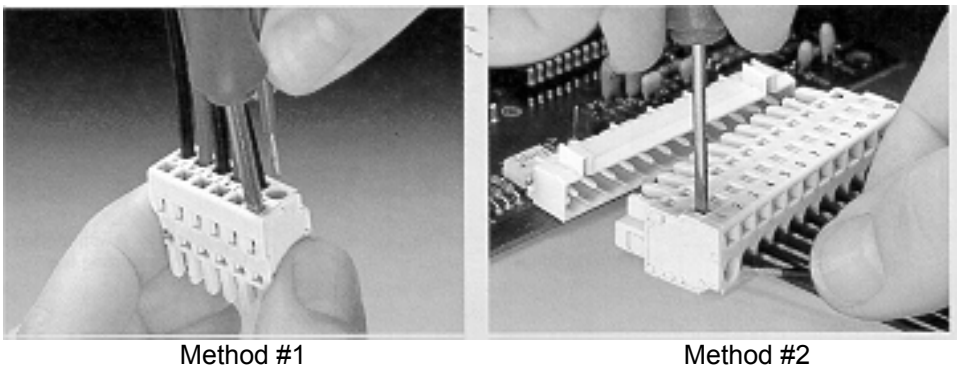
Most of the Intelligent Gatewaycontrol's terminal blocks are designed to be removed by hand. After Intelligent Gatewayinput power is disconnected, the terminal blocks can be removed one at a time by pulling them straight out. Be careful not to pull the plug out at an angle, as this will fracture the end terminal. Wires for the all the pluggable I/O terminal blocks should be stripped at 8 mm (0.3 inch).



Torque range for screws of Screw Connection Terminal Blocks: 0.22–0.25 N·m (1.95–2.21 lb-in).

Screwdriver blade: 0.4 X 2.5 mm (0.016 X 0.10 inch) Screwdriver available as Woodward PN 8992-005

Figure 5-2. Screw Connection Terminal Block Used on A5200 SmartCore Board



Method #1
Free Hand (holds spring open)

Method #2
Bench (momentarily opens spring while force is applied)

Figure 5-3. Spring Clamp Terminal Block

The Intelligent Gatewayfixed terminal blocks used for the power supply input accept wires from 0.08–1.1 mm² (28–18 AWG). Two 0.5 mm² (20 AWG) wires or three 0.3 mm² (22 AWG) wires can be easily installed in each terminal. Wires for the fixed mounted power terminals should be stripped 5 mm (0.2 inch).

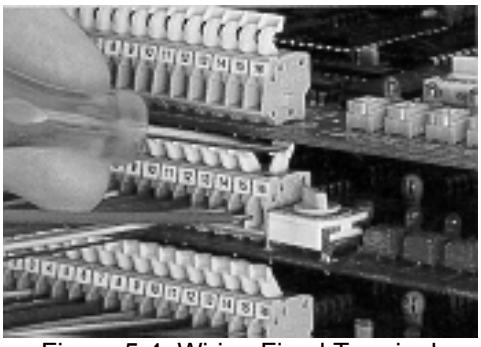


Figure 5-4. Wiring Fixed Terminal

CAN Terminal Blocks

The CAN ports utilize pluggable dual row CageClamp screwless style terminal blocks, with both screwless and with screw fastener retention mechanism. It is required that CAN ports #1-#8 utilize screw down fastener style CageClamp terminals due to the weight and routing of CAN cable to these ports. CAN ports #9-#10 are screwless type.

The spring clamp can be actuated by using a standard 2.5 mm (3/32 inch) flat bladed screwdriver (see Figure 5-2). These terminal blocks accept wires from 0.08–1.1 mm² (28–18 AWG). Two 0.5 mm² (20 AWG) wires or three 0.3 mm² (22 AWG) wires can be easily installed in each terminal. The spring clamps provide 2.6 in*lbs torque on the wires.

It is necessary for proper operation of CAN to install 120 Ω terminating resistor between the CANH and CANL connections on each end of the network, at the furthest apart ends of the network. Each CAN port used must have a 120 Ω resistor either at the port or within 1 m of cabling for the two furthest devices. The second row of connections is intended to be used for the termination resistor at the Intelligent Gateway end port. Final resistance from CANL to CANH should be ~60 Ω after both termination resistors are installed.

CAN Cabling must be shielded for proper operation during EMC events and to protect the environment from RF noise. CAN Common, CANH, & CANL wires may not be exposed by any more than 7.6 cm (3 inches) at junction terminal blocks and no more than 3.8 cm (1.5 inches) at the port plugs. Shielding is intended to be directly grounded to EARTH at the entrance to the enclosure. Directly ground each shield to EARTH within 30 cm (12 inches) of the enclosure entrance penetration. The PE connection will be the single point direct shield ground for the entire CAN network, each Woodward device port has an AC (capacitor) termination to PE inside it, which must also be connected to the shield.

Grounding

Protective Earth (PE) Ground (see Figure 5-1) must be connected to the termination point on the base plate of the unit next to the label with the symbol ⏚ to reduce the risk of electric shock. This connection will be made using a thread-forming screw (M4 x 6 mm). The conductor providing the connection shall have a properly sized ring lug and wire larger than or equal to 3.3 mm² (12 AWG).

The unit also needs low impedance grounding to earth, e.g. the cabinet or enclosure used. The low impedance ground can be accomplished by one or more of the following:

- A short 15 cm (6 inch) or shorter protective earth wire
- A 1.3 cm (0.5 inch) wide flat hollow braid less than 1 m (39 inch) long
- A 1.3 cm (0.5 inch) wide flat tin or lead/tin plated copper strap less than 1 m long
- The use of the eight mounting bolts and paint breaking washers.

⚠WARNING

Do not connect chassis ground or PE ground to signal common. Interference due to increased noise or circuit damage may occur if signal commons are connected to chassis ground or PE.

Safety Ground Wire Installation

- Safety wires must be routed against the grounded cabinet structure. Locate safety ground wire at least 150 mm (6 inches) from unshielded cabling and 75 mm (3 inches) from shielded cabling inside the cabinet, and 150 mm (6 inches) from any I/O cabling exiting the cabinet.

Recommended Grounding Practices

Providing the proper ground for the Intelligent Gateway control is important. Follow recommended shield termination practices. If the two opposite ends of the shields are directly grounded to Earth, differences in potential between these two points could result in equalizing current flow which then produces unacceptably high common mode noise voltages.

Input Power

The Intelligent Gateway control requires a nominal voltage source of 18 to 32 Vdc. Input power requirements vary depending on the control version. Table 4-1 contains information for the maximum configuration.

⚠WARNING

Power must be applied to the Intelligent Gateway control at least 90 seconds prior to expected use. The control must have time to do its power up diagnostics to become operational. Failure of the diagnostics will disable control function.

⚠WARNING

The Intelligent Gateway must have the input power removed before installing or removing.

This Equipment is Suitable For Use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only.

This equipment is suitable for use in European Zone 2, Group IIC environments.

Wiring must be in accordance with North American Class I, Division 2, or European Zone 2, Category 3 wiring methods as applicable, and in accordance with the authority having jurisdiction.

Do not connect more than one Intelligent Gateway to any one fuse or circuit breaker.

Communication wires must use wires with a temperature rating of at least 5 °C above surrounding ambient. All others use wires with a temperature rating of at least 10 °C above surrounding ambient.

⚠WARNING

ATEX compliance is dependent on this equipment being protected externally against transient disturbances. Make provisions to prevent the power input from being exceeded by transient disturbances of more than 119 V_{PEAK}.

The power supply output supplying the Intelligent Gateway must be of a low impedance type for proper operation of the control. DO NOT power a control from a high voltage source containing dropping resistors and zener diodes. If batteries are used for operating power, an alternator or other battery-charging device is necessary to maintain a stable supply voltage. The Intelligent Gateway also does not have protection from the load dump present on the power bus by disconnecting batteries from the charging alternator, if the alternator doesn't self-suppressed the load dump (clamp it).

NOTICE

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

IMPORTANT

If an alternator is used to charge batteries supplying the Intelligent Gateway power, the alternator must be a suppressed/clamped type or have external load dump transient suppression. The Intelligent Gateway does not have sufficient energy handling capability to suppress a full alternator load dump.

Significant inrush currents are possible when current is applied to the Intelligent Gateway control. The magnitude of the inrush current depends on the power source voltage level & impedance, so Woodward cannot specify the maximum inrush current. Time-delay fuses or circuit breakers must be used to avoid nuisance trips.

Input Power Wiring

Protective earth ground (PE) must be connected to the chassis at the termination point on the unit labeled with  . The power supply grounding terminals should also be connected to earth to ensure grounding of the power supply printed circuit boards. The grounding conductor must be the same size as the main supply conductors.

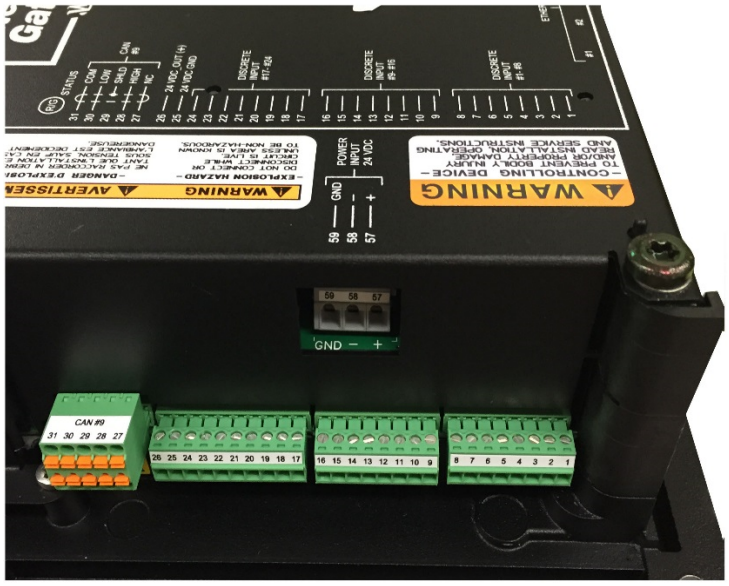


Figure 5-5. Input Power Wiring

WARNING

The controls' power supplies are not equipped with input power switches, for this reason, a fixed wiring installation is required. A switch or circuit breaker shall be included in the building installation that is in close proximity to the equipment, within easy reach of the operator, and that is clearly marked as the disconnecting device for the equipment. The switch or circuit breaker shall not interrupt the protective earth conductor and shall be rated for inrush current.

It is expected that the installation of this equipment will include over current protection between the power source and the Intelligent Gateway control. This over current protection may be accomplished by series connection of properly rated fuses or circuit breakers (including inrush rating). Branch circuit protection of no more than 250% of the maximum Intelligent Gateway power supply input current rating must be provided. See Table 5-1 below for maximum recommended fuse ratings. This value meets the 250% UL listing requirements. The use of properly sized UL class CC, J, T, G, RK1, or RK5 fuses meet the requirements for branch circuit protection. Do not connect more than one Intelligent Gateway control to any one fuse. Use only the wire size specified in Table 5-1 or equivalent metric size which meets local code requirements. Time delay fuses should be used to prevent nuisance trips.

Table 5-1 provides the power supply holdup time specification; which is the time the supply will continue to operate within specification after its input power is interrupted. This information may be useful in specifying uninterruptible power supply (UPS) systems.

Table 5-1. Power Supply Requirements

Input Voltage Range	Fuse (Current Rating)	Fuse (I^2t Rating)	Wire Size* **	Holdup Time
18–32 Vdc**	4 A ≤ I ≤ 9 A	> 100	2/4 mm² 12/14 AWG	8 ms

IMPORTANT

*** 4 mm² (12 AWG) is the largest wire gauge size that may be connected to the control power input terminal blocks.**

**** The minimum input voltage allowed is 18 V at the power input of the control. The length, size of wire, and load current will determine the minimum supply output voltage. The minimum supply voltage measured at the Intelligent Gateway should always be greater than 18 V. Example: Two (source and return) 20 foot (6 m) lengths of 14 AWG (2 mm²) wire carrying 1.2 A (maximum rated current) will result in a voltage drop from source output to control power input of approx. 0.16 volts. The resulting supply voltage from this example must be greater than 18.16 volts.**

***** A fuse or circuit breaker shall not interrupt the protective earth conductor.**

Input Power Wiring Diagram

The power supply and ground connections are located on the power supply board (see also Recommended Grounding Practices). The –24 V tie to the Common System Ground must be at the supply.

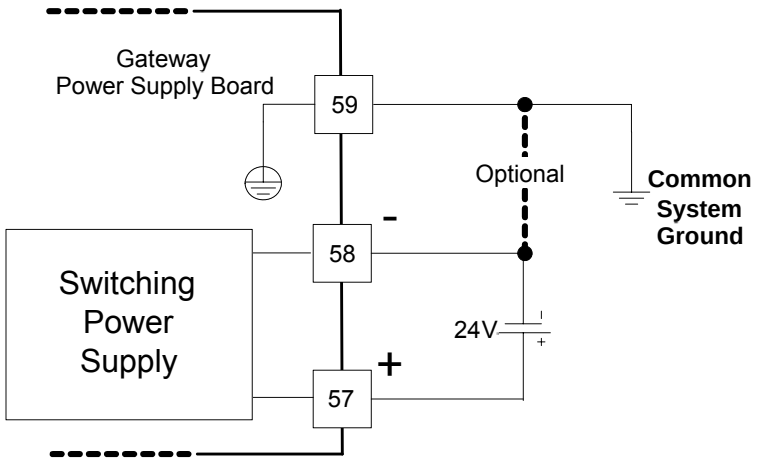


Figure 5-6. Input Power Wiring Diagram

CAN Cable Wiring

After Intelligent Gateway input power is disconnected, the terminal blocks can be removed one at a time by pulling them straight out. Be careful not to pull the plug out at an angle, as this will fracture the end terminal. Wires for the all the pluggable I/O terminal blocks should be stripped at 8 mm (0.3 inch).

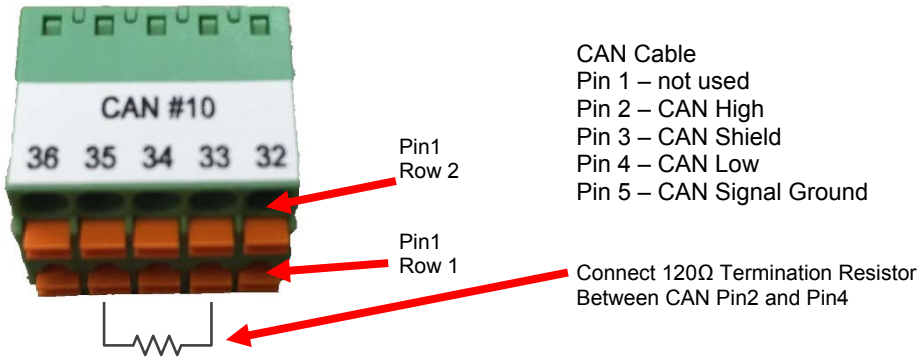


Figure 5-7. Spring Clamp Terminal Block

Row 1 and Row 2 Pins are electrically the same. This allows for easier connection of multiple CAN modules on a single CAN network.

IMPORTANT

Do not tin (solder) the wires that terminate at the Intelligent Gateway terminal blocks. The spring-loaded CageClamp terminal blocks are designed to flatten stranded wire, and if those strands are tinned together, the connection loses surface area and is degraded. The solder tinned wire end will also cold flow over time potentially further degrading the connection.

⚠WARNING

EXPLOSION HAZARD—Do not connect or disconnect while circuit is live unless area is known to be non-hazardous.

Shields and Grounding

All wiring, except for input power and discrete I/O, must be shielded to achieve proper EMC performance

All shielded cable must be twisted conductor pairs, triples or multiple pairs. The Intelligent Gateway control is designed with AC & direct shield terminations to earth ground at the control. Each of the CAN Cable shields have an AC (Capacitor) shield termination to earth, do not tin (solder) or attempt to tin the shield wire for connection into the terminal block. Wire exposed beyond the shield should be as short as possible, not exceeding 50 mm (1.5 inches). CAN shield wire termination should be made with the braided shield & drain wires combined to make the largest wire possible that will fit into the terminal block connector.

If intervening terminal blocks are used in routing a CAN signal, the shield should be continued through the terminal block. If shield grounding is desired at the terminal block, it should be AC (capacitor) coupled to earth, unless this is at the Intelligent Gateway enclose penetration where direct connections are required. It is suggested to limit the number of TB break points along the trunk length of cabling between the field device end and gateway end to a minimum, at least 1 m (39 inches) of cable with an intact shield should present between breaks in the trunk (not applicable at the gateway or field device ends). Using a 0.01 μF, 1500 V, capacitor at the shield break point for the TB is usually sufficient to compensate for the wiring exposed outside the shield, but care must be taken when using these (see below). CAN Common, CANH, & CANL wires may not be exposed outside the shield by any more than 7.6 cm (3 inches) at junction terminal blocks and no more than 3.8 cm (1.5 inches) at the port plugs. If the terminal block is at the enclosure entrance penetration the shield must be directly connected to earth. All shield terminations not at the entry into Intelligent Gateway's metal enclosure should be AC coupled to earth through a capacitor. (A 0.01 μF, 1500 V capacitor is typically sufficient. The intent is to provide a low impedance path to earth for the shield at frequencies of 150 kHz and higher.)

Multiple, spread out, direct or high capacitance connections of a shield to earth should be avoided. Multiple connections risks high levels of low frequency ground current, like 50/60 Hz, flowing within the shield. If there are multiple connections made, add the impedance of them up and make sure it is much greater than safety grounds impedance required by local laws.

Shield termination can be a deterministic process. AC shield connections (capacitors) may be dictated at the control, instead of the direct earth connection provided. Typically, shields at signal inputs are connected directly to earth, and shields at signal outputs are AC-coupled to earth or floating. All shields from the Intelligent Gateway must be directly terminated to earth at the exit penetration of the Intelligent Gateway enclosure. They must also be connected to dedicated termination points on the Intelligent Gateway. See Woodward application notes 50532, *Interference Control in Electronic Governing Systems*, and 51204, *Grounding and Shield Termination,* for more information.

Network Configuration Utility (AppManager)

Woodward's *AppManager* software can be used to load Control software (GAP), monitor diagnostic faults. The *AppManager* utility can be downloaded from **www.woodward.com/ic/software**. A PC connection must be made to the main CPU's Ethernet #1 (ENET1) using an RJ45 Ethernet cable.

10/100 BaseT Ethernet Ports

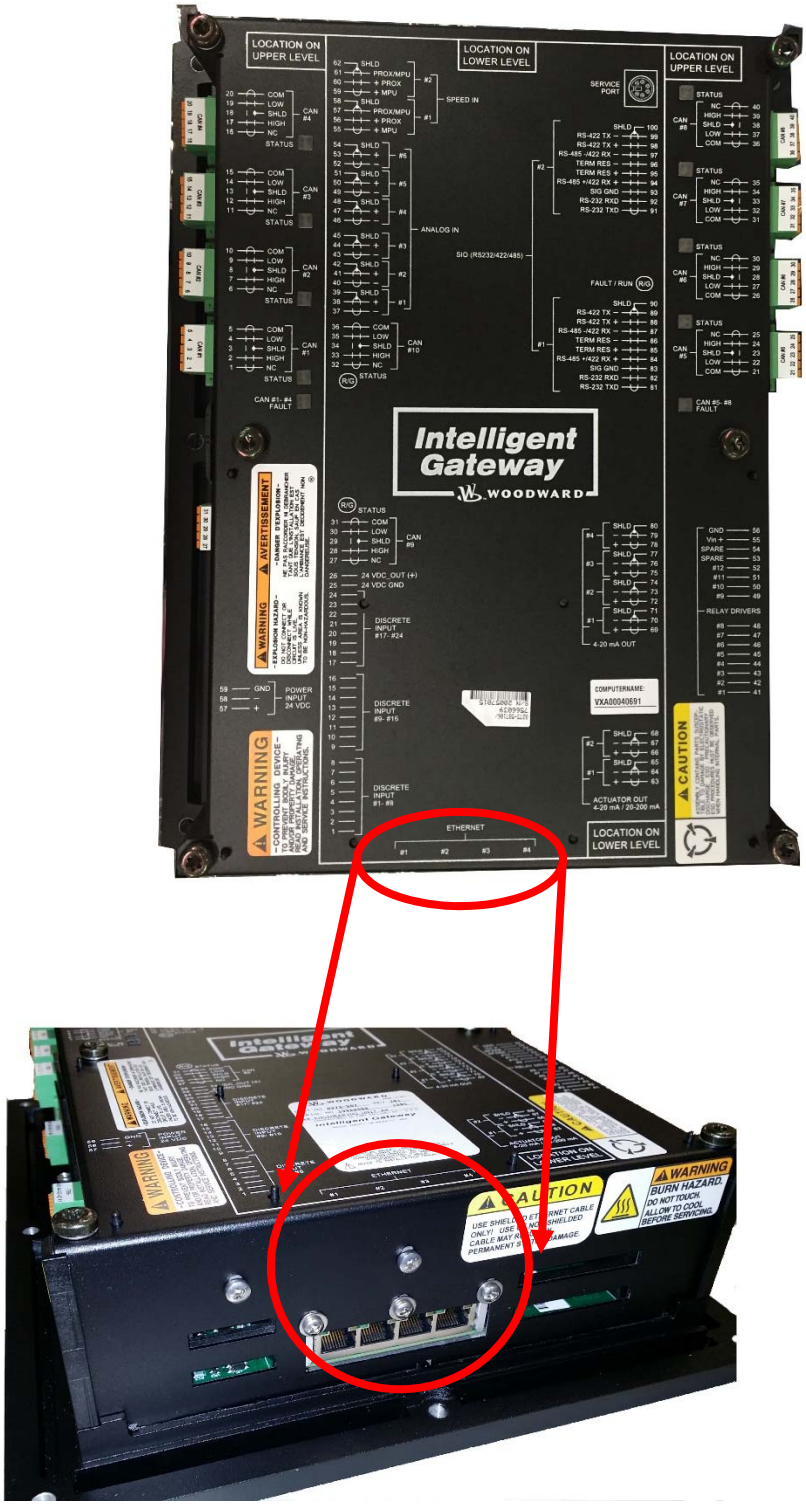
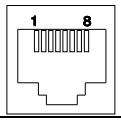


Figure 5-8. Ethernet Ports

The Intelligent Gateway has four Ethernet connectors arranged in one package. Ethernet ports are shielded. Cable shields are terminated directly at the Gateway end and cabinet entry/exit point. An Ethernet Field Termination Module (FTM), available from Woodward, may be used to break the shield path between the field device and the Intelligent Gateway.

Table 5-2. Ethernet Port Pinout

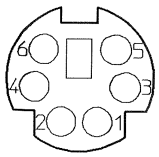
Connector	Signal Mnemonic
RJ45F 	Shielded RJ45 female receptacle
1	RX+
2	RX-
3	TX+
4	Not Used
5	Not Used
6	TX-
7	Not Used
8	Not Used
Shield	Chassis EARTH

RS-232 Service Port

An isolated RS-232 service port is located near one corner of the A5200 CPU module. This port is for VxWorks operating system use only and cannot be configured for application software use. The communication settings are fixed at 38.4 kBaud, 8 data bits, no parity, 1 stop-bit, and no flow control.

For debug use, a null-modem cable and 5450-1065 Serial Adapter cable (PS2M to DB9F) is required to attach this port to a PC. This port is to be used by trained Field Service personnel only!

Shielded cable is required when connecting to the Service Port. Using shielded cable will help ensure the robustness of the serial communications.



Pin 1 – RS-232 Receive
Pin 2 – RS-232 Transmit
Pin 3 – Signal Ground
Pin 4 – Not Used
Pin 5 – Signal Ground
Pin 6 – Not Used
Connector Shell – Chassis EARTH

Figure 5-9. CPU Service Port (mini-DIN6F)

CAN Communication Ports

Ten CAN ports are available for communication with Woodward Valves, RTCnet, LINKnet-HT, and other CAN devices. Ports #1-#8 are 5 pin pluggable connectors, screw down type. Ports #9-#10 are the same 5 pin pluggable connectors but are not required to be screw-down type to meet vibration specifications. Although it is recommended to secure all wiring.

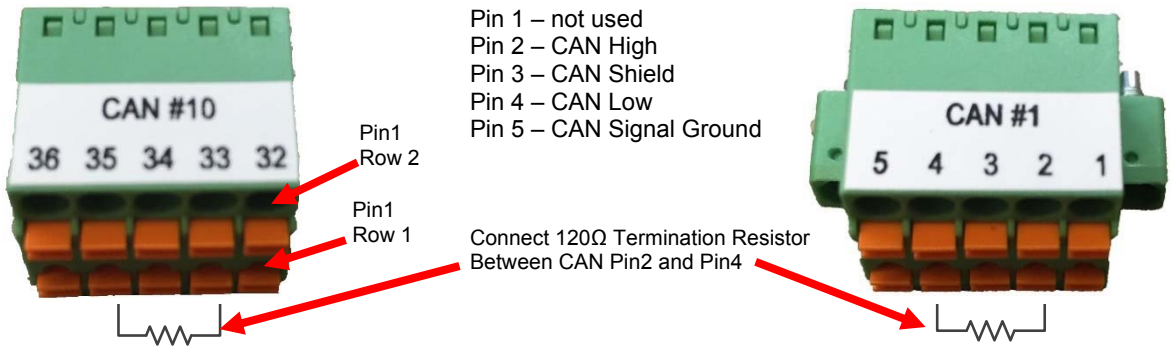


Figure 5-10. CAN Communication Ports

Table 5-3. Suggested CAN wiring colors

Pin#	Belden 3106A	High Temp Cable
1 - Not Used		
2 - CAN High	White	White with Orange stripe
3 - CAN Shield	Shield	Shield
4 - CAN Low	Blue	Orange with White stripe
5 - CAN Signal Ground	black	Blue with White stripe

CAN networks must include 120 Ω (1/4 W 10% recommended) terminations at each end of the trunk line. Drop cables connecting a device to the trunk line should be as short as possible and less than 6 meters.

Table 5-4. Network Speed vs. Cable length and Type

Network Speed	Max Trunk Length (Thick cable)	Max Trunk Length (Thin cable)	Max Drop Length	Max Cumulative Drop Length
1 Mbps	30 m	30 m	1 m	10 m
500 Kbps	100 m	100 m	6 m	20 m
250 Kbps	250 m	100 m	6 m	40 m
125 Kbps	500 m	100 m	6 m	80 m

IMPORTANT

Max trunk Length will be reduced by the sum of the cumulative drop cable length.

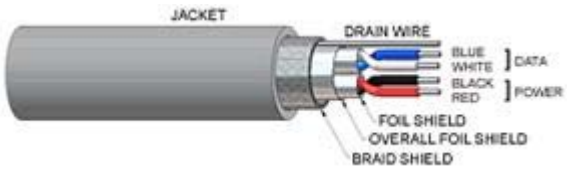
$L_{TrunkMax}$=(Max Trunk Length) – (Cumulative Drop Length)

CAN Cable Specification

Three types of cable are recommended by Woodward.

Thick cable is preferred and recommended for all uses. Most CAN / DeviceNet cable is not rated for temperatures above 80 °C so be careful during installation to avoid hot routing areas. Always use shielded cables for improved communications in industrial environments.

Table 5-5. CAN Cable Specifications



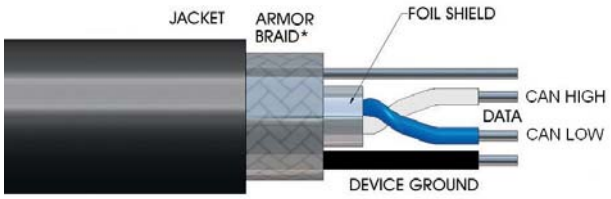
Impedance:	120 Ω ±10% at 1 MHz
DC resistance:	< 7Ω per 1000 ft.
Cable capacitance:	12 pF/ft. at 1 kHz
Propagation delay	1.36 ns/ft. (maximum)
Data Pair:	19 strands, 1.0 mm² corresponds to 18 AWG, individually tinned, 3 twists/foot
Power Pair:	19 strands, 1.5 mm² corresponds to 15 AWG, individually tinned, 3 twists/foot
Drain / Shield Wire:	19 strands Tinned Copper shielding braid or shielding braid and foil
Cable type:	Twisted pair cable. 2x2 lines
Bend Radius:	20x diameter during installation or 7x diameter fixed position
Signal attenuation:	0.13 dB/100 ft. @ 125 kHz (maximum) 0.25 dB/100 ft. @ 500 kHz (maximum) 0.40 dB/100 ft. @ 1000 kHz (maximum)

In addition some three wire cables acceptable for CAN communications is also available. These are available in a size between the standard thin and mid-sized cables specifically for DeviceNet. These come in a normal temp and high temp versions available for purchase directly from the supplier.

Recommended Bulk Cable

Cable manufacturer Turck and Belden are widely available in North America. Turck, Lumberg, and Lapp Cable products are available in Europe. All cables below are suitable for CANopen trunk and drop cabling. Be aware that cable vendors may not use the same wire colors on individual conductors.

Table 5-6. Recommended Cable for RTCnet and LINKnet-HT

Belden YR58684, bulk cable 	
Impedance:	120 Ω ±10% at 1 MHz
DC resistance:	17.5 Ω per 1000 ft.
Cable capacitance:	11 pF/ft. at 1 kHz
Data Pair:	22 AWG, 7 strands, individually tinned, FEP insulation (BLUE, WHITE twisted pair)
Ground:	22 AWG, 7 strands, individually tinned, FEP insulation (BLACK)
Drain / Shield Wire:	22 AWG, 7 strands, individually tinned
Shielding:	Foil 100% with outer Braid 65%
Jacket:	FEP Insulation, BLACK
Cable type:	1.5 pair, twisted shielded
Outer Diameter:	0.244 inches
Bend Radius:	2.5 inches
Temperature:	–70 to +125 C
Similar Cable:	Belden 3106A (different colors, low temperature)

*__Note:__ Turck and Lumberg can also provide custom length cord sets with connectors.

Table 5-7. Approved Cables

Manufacturer	part number	Website
Belden	3082A DeviceNet Thick Cable–Grey	www.belden.com
Belden	3083A DeviceNet Thick Cable–Yellow	www.belden.com
Lapp Cable	2710-250 Unitronic DeviceNet Thick	www.lappcable.com
Lumberg	STL 613	www.lumbergusa.com
Turck	Type 575, DeviceNet Thick Cable – Grey	www.turck.com

Note: Woodward manual 26640 provides detailed information regarding RTCnet and LINKnet-HT nodes.

Shielded Wire, Shield Termination Lead Preparation

Where shielded cable is required, cut the cable to the desired length and prepare the cable as instructed below.

1. Strip outer insulation from both ends, exposing the braided or spiral wrapped shield. Do not cut the shield or nick the wire inside the shield.
2. Using a sharply pointed tool, carefully spread the strands of the braided shield to form a hole.
3. Take hold of the inner conductor(s) wires insulation and pull the wires out of the shield one at a time.
    a. If the shield is the braided type, twist it to prevent fraying; twist it with the drain wire if one is present.
    b. Foil shields require the drain to be brought out and excess foil may be removed.
4. Remove 6 mm (1/4 inch) of insulation from the inner insulated signal conductors.
5. Connect wiring and shield as shown in plant wiring diagram.
6. If a shield connection is not required or desired, fold back and secure or remove the excess shield as needed. (If there is a connection point for the shield, it should be used to get optimal performance.)

General Wiring Guidance

For noise suppression reasons, it is recommend that all low-current and low voltage wires be separated from all high-current and/or high-voltage wiring.

Strain relief is recommended for CAN network cables connected to Ports 9 and 10 because they do not use screw down connectors. In general strain relief of cables is a wise practice.

Input power ground terminal, not power return, should also be wired/bonded to earth ground.

Installations with severe electromagnetic interference (EMI) may require additional shielding precautions, such as wire run in conduit or double shielding. Contact Woodward for more information.

Shields from the control to its loads or input sources can be directly grounded to earth at both ends, but only if the cable length is sufficiently short to prevent ground loop current in the shield (e.g. within a single cabinet or where the shortest straight line distance between earth connection points is no further than 10 m apart).

Enclosure Installations: If the control is installed in a metal enclosure, as intended, shielded I/O must be AC or DC terminated directly to the cabinet (earth ground) at the entry to the cabinet, as well as at the control shield pins.

Specifics are provided in each individual installation section.

Non-Marine Enclosure Application Information

Enclosure/Cabinet Structural Grounding – EMC Robustness Improvements

- The cabinet must be a six-sided metal enclosure.
  - Do not use cabinet doors with windows unless they are shielded — doors should be solid metal.
- The enclosure floor and/or top panels must provide holes for cable entry.
- Top and bottom cable entry areas must be restricted in size. Cable entry aperture sizes should be minimized to the extent possible, the largest dimension of any aperture (hole) is no greater than 152 mm (6 inches). This is particularly important when RF transmitters, like push to talk radios or cell phones, can be located near the cable access areas.
- An enclosed metal cable area or cable way joining to the cabinet may be thought of as part of the enclosure; if it has no holes larger than 152 mm (6 inches) and no RF transmitters can be present within it. This allows larger holes in the enclosure cable access plate. The enclosed cableway effectively becomes part of the enclosure.
- The cabinet enclosure frame and device mounting areas must be bonded (grounded) together.
- The frame shall be electrically connected at each structural interface (< 2.5 mΩ).
- Mounting plates shall be electrically connected to structural frame (<2.5 mΩ).
  - 4 corners minimum, 4 corners + 2 mid-points preferred so <3 ft. (90 cm) is the maximum distance between ground points.

- Doors must be electrically connected to the main structural frame (<2.5 mΩ).
  - 1 place minimum, 3 places preferred, use of 25 mm (1 inch) wide bond straps is preferred.
  - Optimally install bond straps at the locations that cables cross the door hinge. If no cables cross the hinge point, locate straps to break up the size of gaps or openings in the metal structure to door interface.
- Cover panels shall be electrically connected to structural frame (<10 mΩ).
  - 1 place minimum, 2 places preferred (placed at opposite corners).
- Floor and top panels must be electrically connected to structural frame (<2.5 mΩ).
  - 1 place minimum, 4 places at the corners is preferred.
- DIN rails must be electrically connected to structural frame (<2.5 mΩ).
  - Once every 20 cm (8 inches): use a minimum of 2 screws to bond a DIN rail to cabinet frame or mounting panel.
- The cabinet must provide a shield termination point for cables as they enter/exit the enclosure. Shielded I/O must be AC or DC terminated directly to the cabinet (earth ground) at the entry to the cabinet, as well as connected at the Intelligent Gateway shield pins.

IMPORTANT

The grounding section covers how to create shield terminations and when to ground shields: directly to earth or indirectly to earth through a capacitor. There must be one earth ground for each shield.

General Enclosure Application Information

Cable Entry Locations

- Cable shield termination hardware must be installed at cable entry points.
- Cable shield terminations must be electrically connected to structural frame and shall allow direct grounding (<2.5 mΩ) or AC (capacitor) grounding of cable shields as specified.
- Route each of the shielded cable types separately, by type. A minimum of 5 cm (2 inches) between types should be maintained.
- Maintain unshielded cables within 0-10 mm (0.0-0.4 inches) of the enclosure metal mounting panels, frame rails, etc., until they get close to the Intelligent Gateway. Approximately 152-203 mm (6-8 inches) near the Intelligent Gateway may be moved away from the enclosure ground by as much as needed to get to the connector.
- The cable shielding of shielded cables performs better if the shielded cables follow the same routing instructions given for unshielded cables, however this is not required.
- Intelligent Gateway cable shields termination pins, except for CAN shield (Ethernet), are designed connected directly to chassis. If this direct connection is used, cables at the cabinet's cable entry point should also be directly connected to the cabinet.
- All signal lines going outside the cabinet must be shielded while inside the cabinet to prevent picking up stray signals.

IMPORTANT

The grounding section covers how to create shield terminations and when to ground shields: directly to earth or indirectly to earth through a capacitor. There must be one earth ground on each shield.

Equipment Zoning (Segregation)

If equipment besides the Intelligent Gateway is present in the same enclosure, separate the equipment types inside the enclosure/cabinet, as possible:

- Analog equipment area
- Discrete I/O equipment areas
- Shielded I/O area
- Un-shielded I/O area
- Power
- AC mains PT & CT monitoring area
- Light Industrial EMC compliant equipment area
- Monitor/keyboard/pointing device (HMI if applicable)
- Other equipment area
- Maintain a minimum or 15 cm (6 inches) of separation between equipment type areas

IMPORTANT

Light Industrial equipment is defined as equipment that is designed and tested to comply with European Union (EU) directives (e.g. EN61000-6-1 and EN61000-6-3, or similar ITE Standards) for Light Industrial environments. Industrial compliant equipment is designed and tested for the EU directives to Heavy Industrial environments (e.g., EN61000-6-2 and EN61000-6-4).

Third Party Hardware Located Inside the Enclosure/Cabinet

- Use only CE Compliant or Marine Type Approved devices

  CE Compliant to Light Industrial Levels

  - Locate cables (to and from Light Industrial) away from all I/O cables that enter or exit the cabinet by 305 mm (12 inches)
  - Locate cables (to and from Light Industrial) away from all other cables not going outside the cabinet, separated by greater than 150 mm (6 inches).

  CE Complaint to Industrial Levels

  - Locate based on zoning restrictions

  Installation of Other Equipment, Fans, Meters, etc.

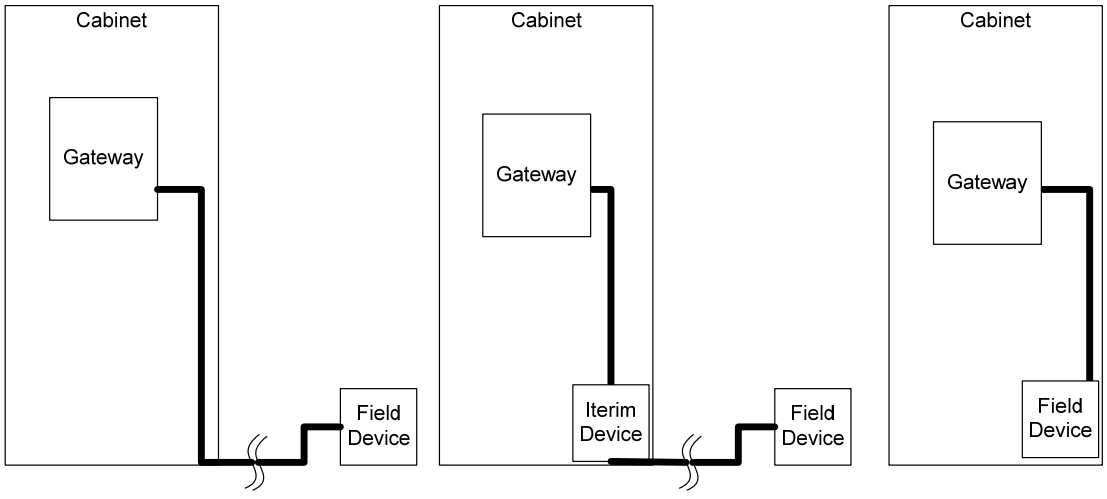
  - Follow general guidance above and segregate as needed. Keep these away from cabling leaving the enclosure or noise sources as specified above.

  Shield Termination Schemes

  - Follow general guidance above and see Application Note 51204 for this information.

Input Power Routing and Filtering

- Unshielded input power coming inside the enclosure/cabinet from outside it or going outside the cabinet from inside it must be routed separately from all other circuits as it enters the cabinet and while inside the cabinet.
- If input power feeding the Intelligent Gateway is ever outside the cabinet, it must be routed separately from all other circuits as it enters the cabinet and while inside the cabinet. Marine Type Approval applications also suggest input power that leaves the cabinet/enclosure to be shielded while inside the enclosure/cabinet. Shield termination at the cabinet entry point and just before the device input, shield may be used to segregate power.
- Route Intelligent Gateway power coming from outside the cabinet if it is routed directly against the mounting panel. All other I/O and internal cabling must be kept more than 152 mm (6 inches) away.
- Input power must route directly to controls that are “Industrial” compliant.
- Input power that must route to controls that are “Light Industrial” compliant must be filtered with a minimum of 20 dB filtering.
- Input power that must be routed near other cabling will be filtered prior to the point the cables follow a common path. Filter with a 20 dB filter.



Field Device: Actuator, Valve, Sensor, Meter, Profibus Head, etc.

Figure 5-11. Descriptions of Main Cabinet Cabling Options

Shielded Cable Routing & Shield Termination

WARNING

Do not connect chassis ground or PE ground to signal common. Interference due to increased noise or circuit damage may occur if signal commons are connected to chassis ground or PE.

Field Device not in Cabinet, No Interim Device (Left section, Figure 5-10)

- Use shielded cable from Intelligent Gateway to field device (Node/uNet).
- Route the cable from Intelligent Gateway to the enclosure/cabinet exit point with the cable against cabinet metal structure.
- DC or AC (AC is non-preferred) ground the cable shield at entry point to enclosure/cabinet and connect at the Intelligent Gateway shield termination pin.
- If the I/O cable is AC grounded or floated at the field device end of the cable, it must be directly ground at the enclosure/cabinet entrance and at the Intelligent Gateway shield termination point.
- If the I/O cable is directly grounded (DC coupled) at the field device end of the cable, it should be ground with a capacitor (AC ground) at the cabinet. AC ground it both at the Intelligent Gateway shield pin and at the cable entry point into the cabinet.
  - Two separate I/O cable shields: If over braided (two isolated shields), directly ground over braid shield to cabinet and shield pin—directly connect inner braids at field device termination point. The inner braid must have at least one point directly grounded to earth.

Field Device not in Cabinet, with Interim Device in the Cabinet (Center section, Figure 5-10)

- Locate interim device away from unshielded discrete areas > 152 mm (6 in.).
- Use shielded cable from Intelligent Gateway to field device (Isolator, FTM, Analog Driver, indicator meter, etc.)
- Route the cable from Intelligent Gateway to the interim device with the cable against cabinet metal structures.
- The interim device must have one AC shield and one DC shield connection. The following are the shield termination combinations, starting from outside the cabinet and working to the Intelligent Gateway.

Table 5-8 Field Devices and Status

Field Device	Cabinet Entry	Interim Device (Field)	Interim Device (Interior)	Intelligent Gateway	Status
DC	AC	AC	DC	DC	Allowed / Preferred
AC	AC	AC	DC	DC	Allowed
AC	AC	AC	DC	AC	Allowed / Not Preferred
AC	DC	DC	AC	DC	Allowed / Not Preferred
AC	DC	DC	AC	AC	Allowed / Not Preferred
DC	AC or DC	DC	AC	AC or DC	Not allowed
DC	DC	DC	AC	AC or DC	Not allowed

- Two separate I/O cable shields: If over braided (two isolated shields), directly ground over braid shield to cabinet and shield pin—directly connect inner braids at field device termination point. The inner braid must have at least one point directly grounded to earth.

Field Device in Cabinet, No Interim Device (Right section, Figure 5-10)

- Locate field device away from unshielded discrete areas > 152 mm (6 in.).
- Use shielded cable from Intelligent Gateway to field device (Isolator, FTM, Analog Driver, indicator meter, etc.)
- Locate field device as close to the enclosure/cabinet I/O cable entry point as possible.
- Route the I/O cable against cabinet metal structures from entry point to field device.
- Ground the I/O cable shield directly at both ends.
  - If over braided (two isolated shields), directly ground over braid shield to cabinet—directly connect inner braids at field device termination point. The inner braid must have at least one point directly grounded to earth.
  - If single shield, ground the shield to the cabinet and/or shield pin at both ends.

Unshielded Cable Routing & Termination

Field Device not in Cabinet, No Interim Device (Left section, Figure 5-10)

- Route the I/O cable against the metal enclosure/cabinet structures, from cabinet entry point to the Intelligent Gateway.
- Limit the length of unshielded I/O cable inside the cabinet. Lengths over 915 mm (36 inches) are too long.
- If lengths greater than 915 mm (36 inches) are required, special considerations should be used to separate this unshielded wiring from other circuits and minimize electromagnetic coupling into or from the cable.
- Do not let other cables within 305 mm (12 inches) of unshielded cables if they are parallel for greater than 610 mm (24 inches).
- Do not let other cables within 150 mm (6 inches) of unshielded cables if they are parallel for less than 610 mm (24 inches).

Field Device not in Cabinet, with Interim Device in the Cabinet (Center section, Figure 5-10)

- Locate unshielded field devices > 152 mm (6 inches) away from other field devices.
- Locate field device as close to I/O cable entry point as possible.
- Route the I/O cable against the metal enclosure/cabinet structures, from cabinet entry point to the interim device.
- Route the I/O cable against the metal cabinet wall, from the interim device to the Intelligent Gateway.
- Limit the length of unshielded I/O cable inside the cabinet. Lengths over 915 mm (36 inches) are too long.
- If lengths greater than 915 mm (36 inches) are required, special considerations should be used to separate this unshielded wiring from other circuits and minimize electromagnetic minimize electromagnetic coupling into or from the cable.
- Do not let other cables within 305 mm (12 inches) of unshielded cables if they are parallel for greater than 610 mm (24 inches).
- Do not let other cables within 150 mm (6 inches) of unshielded cables if they are parallel for less than 610 mm (24 inches).

Field Device in Cabinet, No Interim Device (Right section, Figure 5-10)

- Locate field device as close to I/O cable entry point as possible.
- Route the I/O cable against the metal cabinet wall, from cabinet entry point to the Intelligent Gateway.
- Limit the length of unshielded I/O cable inside the cabinet. Length over 915 mm (36 inches) is too long and may couple.
- If lengths greater than 915 mm (36 inches) are required, special considerations should be used to separate this unshielded wiring from other circuits and minimize electromagnetic minimize electromagnetic coupling into or from the cable.
- Do not let other cables within 305 mm (12 inches) of unshielded cables if they are parallel for greater than 610 mm (24 inches).
- Do not let other cables within 150 mm (6 inches) of unshielded cables if they are parallel for less than 610 mm (24 inches).

Chapter 6.
General Start-up and Operating Instructions

General

Connect CAN modules to networks, and note shield configurations. Single-point shields should be terminated to Earth or the enclosure/cabinet at the cable exit/entrance point.

Connect the Ethernet cables to the Intelligent Gateway. Note: Very long Ethernet cables require galvanic isolation (Woodward has an FTM with an AC coupling shield on one side and a DC coupling on the opposite side to accomplish this). Connect and verify local I/O wiring to the Intelligent Gateway.

Apply power to the Intelligent Gateway.

Application Guidelines

The following items are general guidelines intended to educate the system integrator on potential installation and application issues that might arise when the Intelligent Gateway controller is applied.

CAN Network

The connectors used for CAN ports #1–#8 network cable connections are all identical and utilize screw-down type connectors. The connectors used for CAN ports #9–#10 network cable connections are all identical and do not utilize screw-down type connectors. It is recommended to add some strain relief to cables on CAN ports 9 and 10. It is possible for the end user to connect the wrong cable connector to the wrong input port, so the terminals are numbered to minimize the chance of this happening. The system integrator should take precautions to ensure that it is easy to view the terminal labels or design other methods to allow the user to easily identify the correct cable for each connector.

The CAN Network's cables are shielded, and the shields should be directly terminated to earth at only one point. The shield must be directly connected at the Intelligent Gateway end enclosure/cabinet entry/exit point. AC (capacitor) coupling is used everywhere else. The Intelligent Gateway's CAN shield pins are AC coupled to earth (chassis) internally and must be connected to the shield.

Ethernet Connectors

The Intelligent Gateway has four Ethernet connectors that are arranged in one connector assembly. These are designed to accept shielded Ethernet cabling, and the shield is directly connected to earth (chassis) inside the connector.

The physical spacing between connectors is limited. This can create a situation where it is easy to connect the wrong cable to the connector.

To reduce this risk, the system integrator should implement an Ethernet cable labeling process to allow the user to easily identify which Ethernet cable connects to each Ethernet port. The Intelligent Gateway also has application level checks that the system integrator should be aware of when designing a system.

Ethernet port cables must be shielded. Cable shields are terminated directly to earth at the Intelligent Gateway end and must also be terminated at the enclosure/cabinet entry/exit point. An Ethernet Field Termination Module (FTM), available from Woodward, may be used to break the shield path between the Intelligent Gateway field device and the master control, preferably at the Intelligent Gateway enclosure entry point, but somewhere near one of the ends. This should be done if the shortest distance between cabling grounds is more than 10 m.

Installation Functional Check Guidelines

In general, all IO points should be functionally tested prior to starting the prime mover. The IO points should be checked for ground loops and other possible sources of noise. I/O cabling should have isolation from other power sources that are not related to the specific IO circuit. These installation guidelines are given as general guidelines only. The system integrator / end user are responsible for understanding the application and defining a field checkout procedure that addresses the requirements of the system being installed.

IMPORTANT

When performing IO checkout, appropriate safety precautions must be taken to ensure that the devices being tested are properly locked out or that a safety issue is not created.

Ethernet Connections

The Ethernet connections should be removed one at a time, and expected faults should be verified in the GAP software blocks.

CAN Connections

- The CAN network connections should be verified to ensure that the correct networks are connected to the correct connector.
- Note: Due to the identical design of the 10 CAN ports and the potential for similar cables, labeling is important to ensure that the user can easily identify which network cable is connected to the CAN Port connectors.

Chapter 7.
Maintenance

There are no user-serviceable parts within the Intelligent Gateway that require routine maintenance.

Chapter 8.
Diagnostics and Troubleshooting

Status Indicators (LEDs)

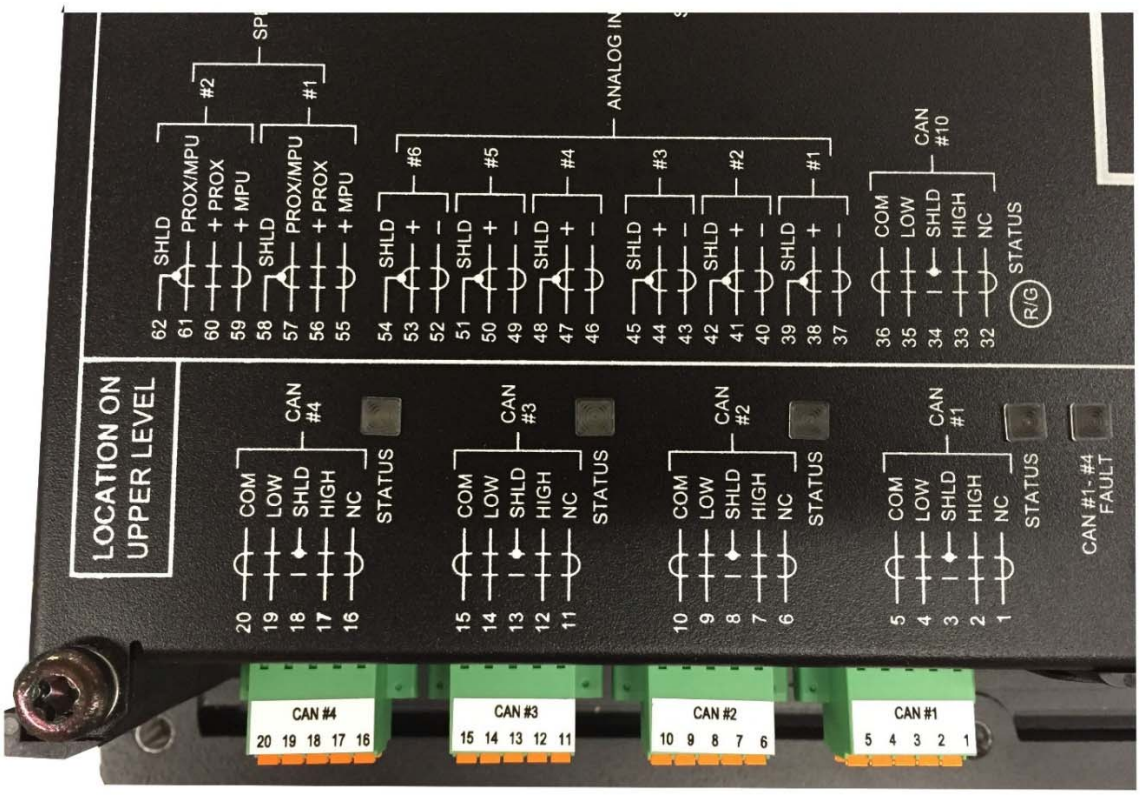


Figure 8-1. CAN Ports #1–#4 Status and Fault Indicators

Table 8-1. Ethernet LEDs and Status

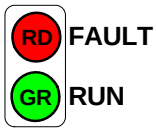
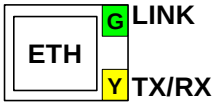
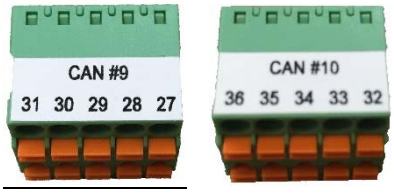
LED	Name	Description
	FAULT	CPU FAULT (RED)—Active upon reset and flashes CPU fault codes as necessary. See Table 8-2.
	RUN	RUN (GREEN)—Active GREEN after the CPU Operating system is loaded and running. See Table 8-2. 
	LINK	LINK ACTIVE (GREEN)—A valid Ethernet connection to another device exists
	TX/RX	TX/RX (YELLOW)—Active YELLOW when data is transmitted or received.
CAN Ports 	CAN Port Status	CAN Port Status LED for Ports #1-#8 Green: Active Red: Inactive
CAN FAULT 	CAN #1-4 FAULT	Fault with CAN ports #1-#4. See Table 8-4 for flash codes. 
CAN FAULT 	CAN #5-8 FAULT	Fault with CAN ports #5-#8. See Table 8-4 for flash codes. 
CAN LED's 	CAN #9, #10	 CAN #9, #10 (GREEN/RED)—Active GREEN or RED when data is transmitted or received through CAN port #9 or #10.

Table 8-2. CAN PORT STATUS Indicators

LED Status	Flash Code	State Description
Green	ON	Port Operational
RED	ON	CAN controller is bus off
OFF	OFF	No Error
GREEN	1	Stopped
GREEN	Blinking	Port Pre-Operational
RED	1	Too many frame errors
RED	2	Guard or Heartbeat error

Table 8-3. CAN FAULT Indicators

Failure	Flash Code
CPU FAIL	1
Unexpected Exception	2
RAM Error	3
Watchdog Timeout	4
EE Error	5
FLASH Error	6
OS Error	7
Overflow	8

Table 8-4. Gateway Unit Fault Codes

Failure	Flash Code
RAM Test Failure	1, 4
Real Time Clock Test Failure	2, 2
Floating Point Unit Test Failure	2, 3
Flash Test Failure	2, 4
HD1 Flash Test Failure	2, 5
I2C Bus Test Failure	2, 6
Module Installed in wrong slot	2, 7
Main Chassis CPU switch must be set to 0	3,5
Rate Group 5 Slip	3, 7
Rate Group 10 Slip	3, 8
Rate Group 20 Slip	3, 9
Rate Group 40 Slip	3, 10
Rate Group 80 Slip	3, 11
Rate Group 160 Slip	3, 12

Fault Detection (I/O)

In addition to detecting board hardware faults, the application program may detect I/O faults.

Microcontroller Faults—IOLOCK. When a CPU or I/O module fails, watchdog logic drives it into an IOLOCK condition where all output circuits and signals are driven to a known de-energized state as described below. The System MUST be designed such that IOLOCK and power OFF states will result in a SAFE condition of the controlled device.

- CPU and I/O module failures will drive the module into an IOLOCK state.
- CPU failure will assert an IOLOCK signal to all modules and drive them into an IOLOCK state.

The IOLOCK state is asserted under various conditions including:

- CPU and I/O module watchdog failures
- PowerUp and PowerDown conditions
- System reset and hardware/software initialization
- Entering configuration mode

IMPORTANT **Additional watchdog details and any exceptions to these failure states are specified in the related CPU or I/O module section of the manual.**

Troubleshooting Guide

Power Supply Checks

This troubleshooting guide checks areas which may present difficulties. If these checks are made prior to contacting Woodward for technical assistance, system problems can be more quickly and accurately assessed.

- Is the input voltage within the control's specified input voltage range (measured at control power supply input)?
- Is the input power free of switching noise or transient spikes?
- Is the power circuit dedicated to the Intelligent Gateway control only?

Reference Grounds

- Non-isolated nodes may not have a CAN signal ground available. If signal ground is not available, use the alternate wiring scheme of connecting all circuit grounds of isolated nodes to the shield, and connecting the shield to earth ground at a non-isolated node.
- If devices other than RTCnet or LINKnet-HT nodes are used on the same CAN network as the nodes, they may have non-isolated CAN ports. Non-Isolated CAN ports may not have a pin to terminate the signal common to. In this case a wire will need to be taken to the common of the supply input. This ensures that all ports are at the same reference with no degradation of capability present due to signal reference offset biasing.

Troubleshooting and Tuning

The Intelligent Gateway module runs off-line and on-line diagnostics that display troubleshooting messages through the debug Service Port and AppManager. Off-line diagnostics run automatically on power-up and upon reset. On-line diagnostics run during normal operation when the GAP application is active. More information on diagnostics tests, subsequent LED flash codes, and serial port messages is contained in the VxWorks manual.

Fault Detection (Unit Level)

Each Gateway has a red fault LED that is turned on when the system is reset. During initialization of the Gateway, which occurs after every CPU reset, the CPU turns the Fault LED on. The CPU then tests the Gateway using diagnostic routines built into the software. If the diagnostic test is not passed, the LED remains on or blinks. If the test is successful, the LED goes off.

Chapter 9.
Product Support and Service Options

Product Support Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact the manufacturer or packager of your system.
- Contact the Woodward Full Service Distributor serving your area.
- Contact Woodward technical assistance (see "How to Contact Woodward" later in this chapter) and discuss your problem. In many cases, your problem can be resolved over the phone. If not, you can select which course of action to pursue based on the available services listed in this chapter.

OEM or Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.
- A **Recognized Turbine Retrofitter (RTR)** is an independent company that does both steam and gas turbine control retrofits and upgrades globally, and can provide the full line of Woodward systems and components for the retrofits and overhauls, long term service contracts, emergency repairs, etc.

A current list of Woodward Business Partners is available at **www.woodward.com/directory**.

Product Service Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is originally shipped from Woodward or a service is performed:

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is a flat-rate program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned within 60 days, a credit for the core charge will be issued.

Flat Rate Repair: Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward Product and Service Warranty 5-01-1205) on replaced parts and labor.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in "like-new" condition and carry with it the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205). This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:

- return authorization number
- name and location where the control is installed
- name and phone number of contact person
- complete Woodward part number(s) and serial number(s)
- description of the problem
- instructions describing the desired type of repair

Packing a Control

Use the following materials when returning a complete control:

- protective caps on any connectors
- antistatic protective bags on all electronic modules
- packing materials that will not damage the surface of the unit
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material
- a packing carton with double walls
- a strong tape around the outside of the carton for increased strength

NOTICE

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Replacement Parts

When ordering replacement parts for controls, include the following information:

- the part number(s) (XXXX-XXXX) that is on the enclosure nameplate
- the unit serial number, which is also on the nameplate

Engineering Services

Woodward offers various Engineering Services for our products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact. Emergency assistance is also available during non-business hours by phoning Woodward and stating the urgency of your problem.

Product Training is available as standard classes at many of our worldwide locations. We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from many of our worldwide locations or from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact us via telephone, email us, or use our website: **www.woodward.com**.

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory at **www.woodward.com/directory**, which also contains the most current product support and contact information.

You can also contact the Woodward Customer Service Department at one of the following Woodward facilities to obtain the address and phone number of the nearest facility at which you can obtain information and service.

Products Used in Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany:	
Kempen	+49 (0) 21 52 14 51
Stuttgart	+49 (711) 78954-510
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Products Used in Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (711) 78954-510
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Products Used in Industrial Turbomachinery Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Technical Assistance

If you need to contact technical assistance, you will need to provide the following information. Please write it down here before contacting the Engine OEM, the Packager, a Woodward Business Partner, or the Woodward factory:

General

Your Name _____

Site Location _____

Phone Number _____

Fax Number _____

Prime Mover Information

Manufacturer _____

Turbine Model Number _____

Type of Fuel (gas, steam, etc.) _____

Power Output Rating _____

Application (power generation, marine, etc.) _____

Control/Governor Information

Control/Governor #1

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Control/Governor #2

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Control/Governor #3

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Symptoms

Description _____

_____

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

Appendix A.
Acronyms and Glossary of Terms

Acronyms

AC	Alternating Current
ADC	Analog-to-Digital Converter
AWG	American Wire Gauge (metric equivalent is mm²)
CAN	Controller Area Network
CE	The CE marking is a European proof of conformity and is also described as "passport" that allows manufacturers and exporters to circulate products freely within the EU. The letters "CE" (French for "Conformité Européenne") indicate that the manufacturer has satisfied all assessment procedures specified by law for its product.
CPU	Central Processing Unit. Executes the GAP application program.
CT	Current Transformer. Used to measure the generator or bus current.
DC	Direct Current
EEPROM	Electrically Erasable and Programmable Read Only Memory
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
GAP	Graphical Application Program
GW	Intelligent Gateway
I/O	Input/Output
LED	Light Emitting Diode
LON	Local Operating Network
MFT	Minor Frame Timer. Used by the CPU for scheduling execution of the software.
MTBF	Mean Time Between Failures
PC	Personal Computer
PCB	Printed Circuit Board
PT	Potential Transformer. Used to measure the generator or bus voltage.
RAM	Random Access Memory
RG	Rate Group. Defines how often software is executed.
RTD	Resistance Temperature Device
RTN	Real-Time Network
RXD	Receive Data Line
SRAM	Static Random Access Memory
SSTP	Shielded-Shielded Twisted Pair (or Double Shielded Ethernet Cables)
THD	Total Harmonic Distortion
TXD	Transmit Data Line

Glossary of Terms

Intelligent Gateway Chassis—A combination of pieces required to hold the boards together

Serial Port—A connection for RS-232

Revision History

None

Declarations

DECLARATION OF CONFORMITY

DoC No.:	00519-04-EU-02-01.DOCX
Manufacturer's Name:	WOODWARD INC
Manufacturer's Address:	1000 E. Drake Rd. Fort Collins, CO, USA, 80525
Model Name(s)/Number(s):	Intelligent Gateway
Conformance to Directive(s):	2004/108/EC COUNCIL DIRECTIVE of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and all applicable amendments. 94/9/EC COUNCIL DIRECTIVE of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres
Markings in addition to CE mark:	Ex Category 3 Group II G, Ex nA IIC T4 X Gc IP 20
Applicable Standards:	EN 61000-6-4 (2011): EMC Part 6-4: Generic Standards - Emissions for Industrial Environments EN 61000-6-2 (2005): EMC Part 6-2: Generic Standards - Immunity for Industrial Environments EN60079-0: (2012) - Explosive Atmospheres - Part 0: Equipment – General requirements EN60079-15: (2010) - Explosive Atmospheres - Part 15: Equipment protection by type of protection "n" EN61010-1, (2010): Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1:General Requirements
Last two digits of the year in which the CE marking was affixed for the first time:	15

This declaration of conformity is issued under the sole responsibility of the manufacturer
We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s).

MANUFACTURER

Signature

Christopher Perkins
Full Name

Engineering Manager
Position

Woodward, Fort Collins, CO, USA
Place

12-June-2015
Date

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 35012.

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Email and Website—www.woodward.com

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