

## **In-Pulse™ Plus Electronic Fuel Injection Control**

**Installation and Operation Manual**

## IMPORTANT



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.

## DEFINITIONS

- **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

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.



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.



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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.

## 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.

## 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*.

Revisions—Text changes are indicated by a black line alongside the text.

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## Electrostatic Discharge Awareness

All electronic equipment is static-sensitive, some components more than others. To protect these components from static damage, you must take special precautions to minimize or eliminate electrostatic discharges.

Follow these precautions when working with or near the control.

1. Before doing maintenance on the electronic control, discharge the static electricity on your body to ground by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.).
2. 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.
3. Keep plastic, vinyl, and Styrofoam materials (such as plastic or Styrofoam cups, cup holders, cigarette packages, cellophane wrappers, vinyl books or folders, plastic bottles, and plastic ash trays) away from the control, the modules, and the work area as much as possible.
4. 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.

### **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*.

# Chapter 1.

## General Information

### Introduction

The primary purpose of the In-Pulse™ Plus Electronic Fuel Injection Control is to control the timing and duration of up to 20 cylinder injection events.

The speed and angular position of the engine are determined by the following sensor inputs:

- Top Dead Center (TDC)
- Phase (only used in 4-cycle engines)
- Engine Speed (angular position)

These signals are used to determine the timing and duration periods.

The In-Pulse Plus software uses the Applications Block Language Software (ABLS) to create applications using the Graphical Applications Programmer (GAP).

Tunable parameters can be changed via the service port by using a hand-held terminal.

Peripheral equipment must be suitable for the location where it is used.

### Accessories

The Hand Held Terminal (part number 9905-292) is used to configure the In-Pulse Plus control. It plugs into the RS-422 port (J5).

Please contact Woodward for the In-Pulse Plus control's requirements for speed, TDC, and phase signals.

A list of the range of valves that can be driven by the In-Pulse Plus is available from Woodward.

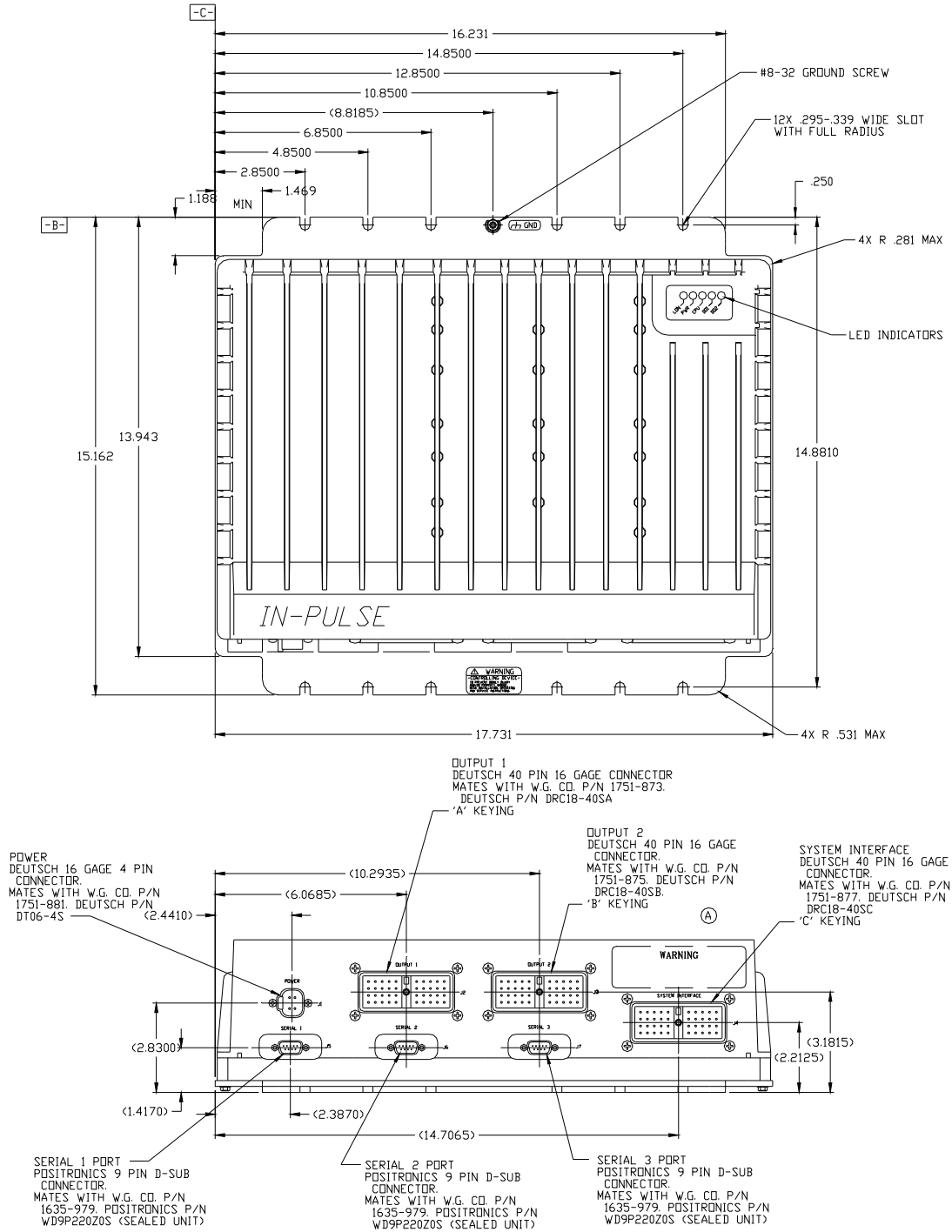
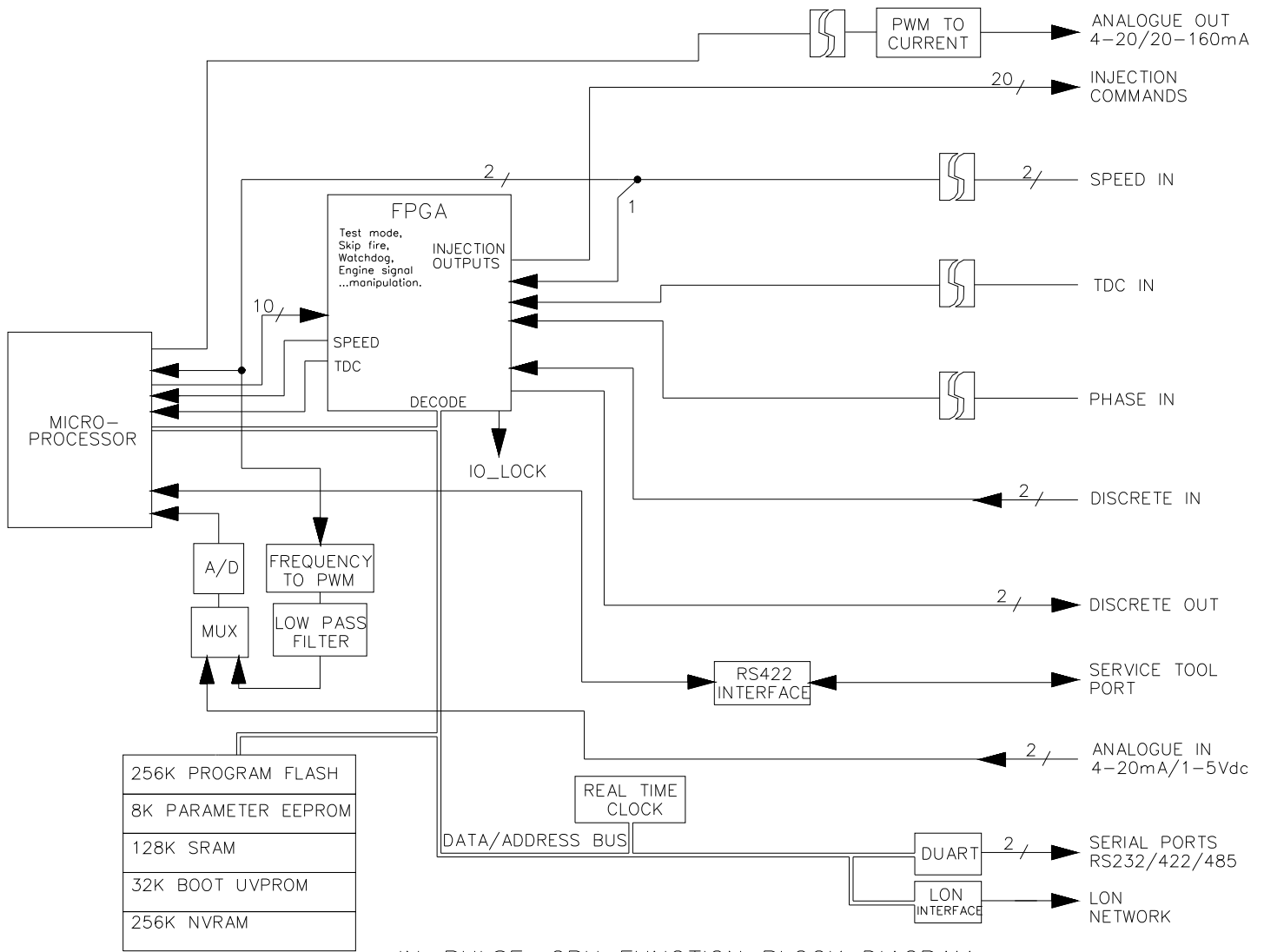
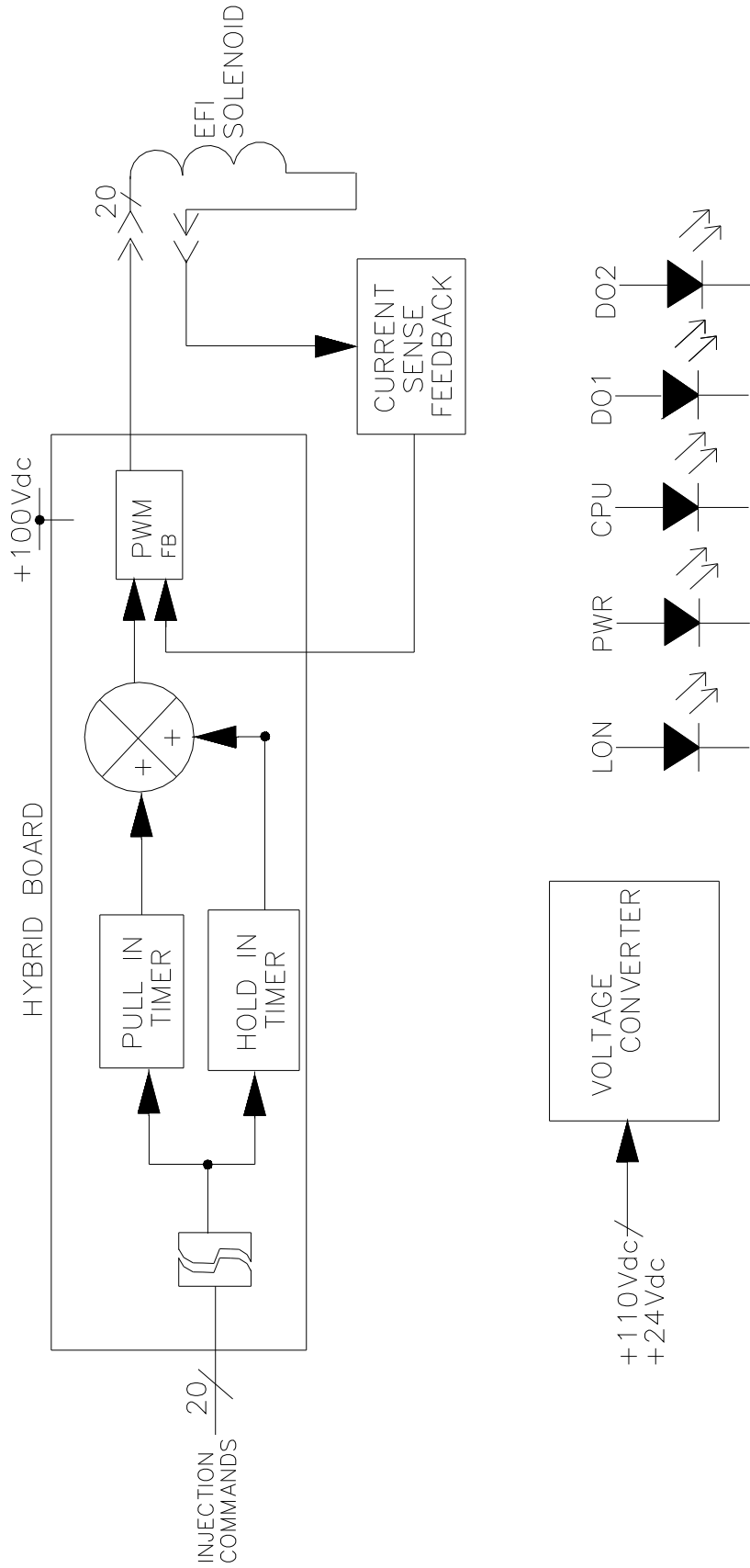


Figure 1-1. In-Pulse Plus Control Outline Drawing



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Figure 1-2. In-Pulse Plus CPU Functional Block Diagram



IN-PULSE: DRIVER FUNCTION BLOCK DIAGRAM

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Figure 1-3. In-Pulse Plus Driver Functional Block Diagram



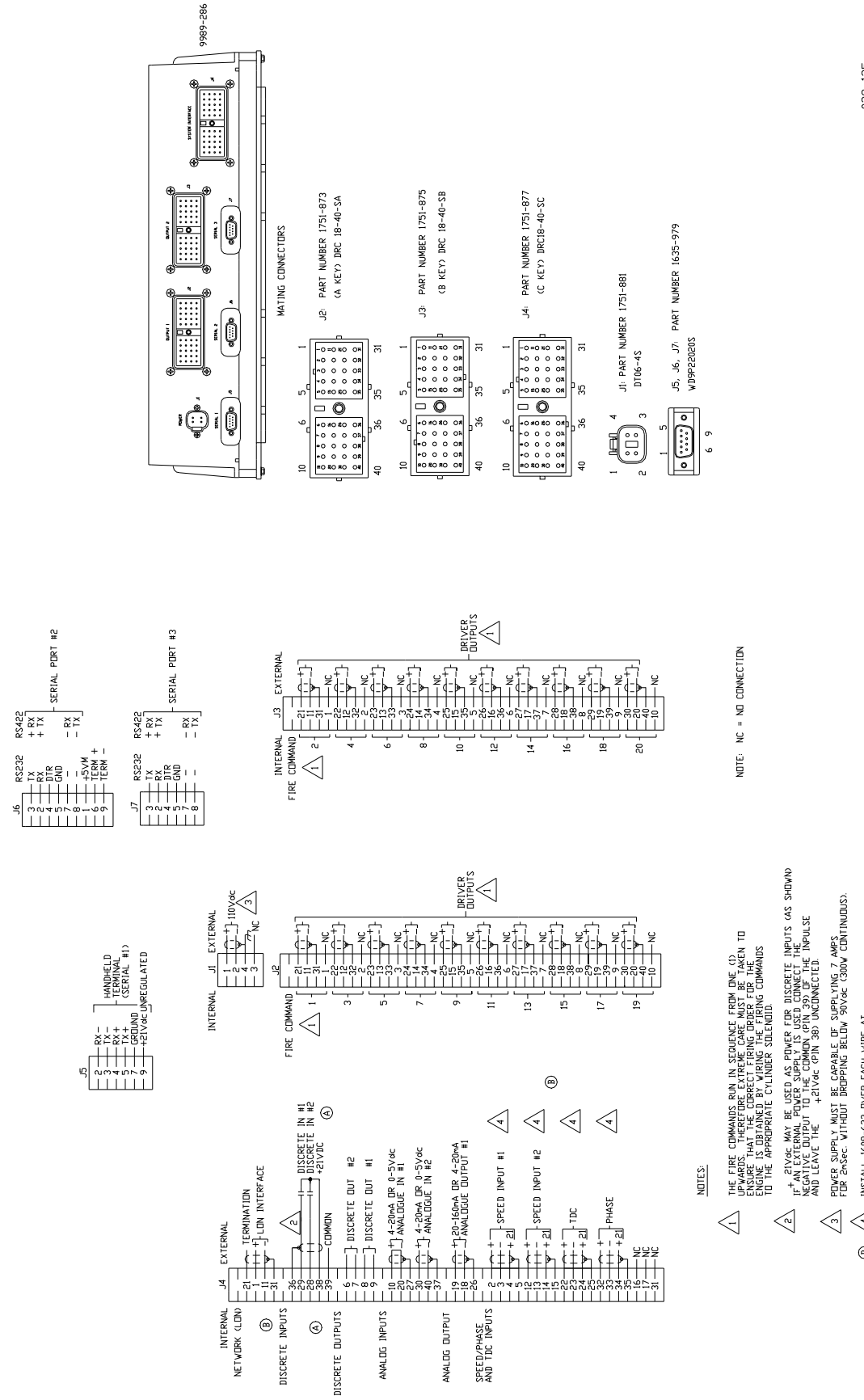


Figure 1-4. In-Pulse Plus Plant Wiring Diagram

## Chapter 2. Installation

### Scope

This chapter contains general installation instructions for the In-Pulse™ Plus control. Power requirements, temperature limits, and location considerations are included to help you determine the best location for the control. Additional information includes unpacking instructions, electrical connections, and the installation checkout procedure.

### Unpacking

Before handling the In-Pulse Plus control, read page ii, Electrostatic Discharge Awareness. Be careful when unpacking the control. Check the control for signs of damage such as bent panels, scratches, and loose or broken parts. If any damage is found, immediately notify the shipper.

### Power Requirements

#### High Voltage Version

The high voltage version of the In-Pulse Plus control requires a voltage source of between 90 and 140 Vdc (110 Vdc nominal). The voltage source must be capable of providing 7 A for 2 milliseconds without dropping below 90 Vdc. The control unit will consume a maximum of 420 W.

#### Low Voltage Version

The low voltage version of the In-Pulse Plus control requires a voltage source of between 18 and 32 Vdc (24 Vdc nominal). The voltage source must be capable of providing 14 A for 2 milliseconds without dropping below 18 Vdc. The control unit will consume a maximum of 384 W. [There is a limited number of In-Pulse Plus controls available in the low voltage version. Contact Woodward for more information.]

### Mounting the In-Pulse Plus Control

The In-Pulse Plus control is designed to operate within a temperature range of  $-40$  to  $+70$  °C ( $-40$  to  $+158$  °F). The control can be stored within a temperature range of  $-40$  to  $+85$  °C ( $-40$  to  $+185$  °F). A reduced life-span of the Real Time Clock can be expected if the In-Pulse Plus control is operated continuously at temperatures above  $+55$  °C ( $131$  °F). The maximum relative humidity permitted for the control is 95%, non-condensing, at  $-40$  to  $+70$  °C ( $-40$  to  $+158$  °F).

Mount the In-Pulse Plus control in a location with space for wiring access. Do not expose the control to sources of radiant heat such as exhaust manifolds or turbochargers. The mounting location of the control should provide protection from high-voltage or high-current devices, or devices which produce electromagnetic interference.

## Installation

See Figure 1-1 to determine the dimensions of the In-Pulse Plus control. Secure the control using the mounting slots provided.

## Wiring Instructions

See Figure 1-4. This figure shows the external wiring connections and shielding requirements for the In-Pulse Plus control. Carefully follow the instructions below when making the external wire connections to the control.

### NOTICE

The Driver outputs are labeled as Fire commands and are sequentially numbered from 1 through 20. Take great care to make sure that the correct firing order for the engine is obtained by wiring each fire command to the correct cylinder solenoid valve. The fire command 1 should be connected to the reference (No. 1) cylinder.

Connectors for the power and driver cables require 1.5 mm<sup>2</sup> (16 AWG) wire. Power and driver cables may have a maximum length of 30 m (98 ft). Wire connections are site specific. See the control wiring diagram for your system.

Electromagnetic interference (EMI) is the undesirable interaction of electronic circuits with each other and sometimes with themselves. Woodward has established procedures to prevent most EMI that can affect engine control circuits. Following these procedures is a slight extra expense in planning and installing electronic governing systems, but it is inexpensive insurance over the life of the electronic control system. Follow all of the shielding instructions below to ensure maximum efficiency and dependability of the electronic governing system.

## Software Downloading Instructions

1. Connect the download cable (Woodward part number 5416-870) from the PC to In-Pulse Plus control connector J5. Application file to be downloaded is needed. When the application is coded, a script file is generated (\*.scp).
2. The application is transferred to the control with the use of two software programs: ServLink.exe and WatchWindow.exe. These programs were installed with the ABL5 4.00 Installation Package. These programs are also available separately from the Installation Package (Woodward part number 9926-603).
3. ServLink.exe and WatchWindow.exe need to be run from Windows NT or Windows 95.
4. Start ServLink.exe, establish a connection with the control. Before communications can begin between the server and a control, you must first create a network definition file. To create a network definition file, choose New... under the File menu. Before the file can be created, the server will prompt you to set the network options. You must specify the port the control is connected to, the baud rate, and the mode of communications. (See Network Options for more information on these settings.) Once all the network options are set, click OK to begin the network scan. Once the symbol tables are read, the network definition file will be complete and can be saved for future retrieval.

5. After a connection is made, start WatchWindow.exe. Loading an application program into a control is done by invoking the Load Application Program Command in the Watch Window's Explorer Pop-up Menu. The pop-up menu is accessed by right clicking on the tab in the Explorer. If Inspector windows are open, the system will display a prompt asking for permission to close all of them. If the choice is made to proceed, the system will close all of the Inspector windows and display a prompt asking for the application program file name and location. The system will load the application in the control. During the Application Load the system will display the progress status and will not allow any other operations to be initiated. For additional information, refer to the ServLink and Watch Window help files.

## Shielded Wiring

All shielded cable must be twisted conductor pairs. Do not attempt to tin (solder) the braided shield. All signal lines should be shielded to prevent picking up stray signals from adjacent equipment. Connect the shields to the correct pin on the connectors. Wire exposed beyond the shield should be as short as possible, not exceeding 50 mm (2 inches). The other end of the shields must be left open and insulated from any other conductor. DO NOT run shielded signal wires along with other wires carrying large currents. See Woodward application note 50532, *Interference Control in Electronic Governing Systems*, for more information.

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.
2. Using a sharp, pointed tool, carefully spread the strands of the shield.
3. Pull the inner conductor(s) out of the shield. If the shield is the braided type, twist it to prevent fraying.
4. Remove 6 mm (1/4 inch) of insulation from the inner conductors.

## Chapter 3. Description of Operation

### Introduction to the In-Pulse™ Plus Control

The primary purpose of the In-Pulse™ Plus control is to control the timing and duration of the fueling event of up to 20 cylinders.

The angular position of the engine is determined from the speed, TDC (top dead center), and phase signals. In four-cycle applications, only the TDC pulse immediately following the phase pulse is passed on as a timing reference mark to the CPU. The CPU sets up the hardware for two- or four-cycle operation based on the application requirements set up in the ABLs EFIC Block. The phase pulse is not used in two-cycle engine applications.

Every time the ABLs EFIC Block runs, the SOI (Start of Injection) and EOI (End of Injection) points are calculated for every cylinder. The SOI and EOI can be varied in increments of 128th of a degree. The CPU has ten output lines used to generate 20 injection events. A CPU output line will contain two injection events every engine cycle. Because of this limitation, the duration of injection event must be less than half of an engine cycle. The software has limit checking to ensure that an injection event does not overlap the complementary injection event on a common CPU output line. When an injection pulse finishes, it sets up the SOI and EOI for its complementary cylinder. When the SOI occurs, the most recently calculated EOI value is loaded. The injection pulses are then de-multiplexed and passed on the driver board. The driver board then converts these logic level signals to high current and high voltage signals capable of driving the EFI solenoids.

The digital I/O and the analog I/O can be used for the functions set by the ABLs application. A LON interface is required to further expand the In-Pulse Plus control's I/O capability.

### CPU Functional Block Diagram Description

See Figure 1-2 for the In-Pulse Plus CPU Functional Block Diagram. The CPU executes the ABLs board software program to provide the various functions required of the control. The main outputs of this block diagram are injection commands to the drivers. The In-Pulse Plus control can accommodate up to 20 drivers. The In-Pulse Plus Driver Functional Block Diagram is shown in Figure 1-3, which displays the blocks necessary for one solenoid valve. See the In-Pulse Plus Driver Function Block Diagram Description below for more information on its operation.

#### LED Indications

The In-Pulse Plus control has five LEDs to give the user a status indication of the unit. They consist of the following:

Name	Description
LON	Illuminates to indicate activity on the Local Operator Network (LON).
PWR	Illuminates when +5 Vdc power is applied to the CPU board.
CPU	Illuminates when the CPU is running. Turns off when the CPU halts. Remains turned off until the CPU restarts.
DO1	Illuminates to indicate that Discrete Output DO1 is high.
DO2	Illuminates to indicate that Discrete Output DO2 is high.

## CPU

The Central Processor Unit (CPU) executes your applications program. The applications program is stored in the flash memory.

## FPGA

The Field Programmable Gate Array (FPGA) performs the following functions:

- De-multiplexes the driver signals from the CPU.
- Manipulates the SPEED, TDC, and PHASE signals.
- Skip Fire Calculations.
- Watchdog Timer that monitors the condition of the program. If it detects a fault, it will halt the CPU and issue an I/O\_LOCK out which will force all the outputs into a non-active state.
- Test Mode Operation simulates an engine speed of 37.5 rpm 60 teeth to allow the solenoids to be tested with the ENGINE SHUTDOWN.
- Decode Function. This Function decodes set-up commands for the FPGA and also decodes for the memory mapped I/O.

## Driver Functional Block Diagram Description

See Figure 1-3. Each Driver Functions Block receives the fuel injection commands for its cylinder from the FPGA. The width of the command determines the time that the electronic fuel injection solenoid is energized. The driver develops the necessary power to energize the electronic fuel injection (EFI) solenoid and keep the solenoid energized for the time called for by the fuel injection command.

### Description of Blocks

See Figure 1-3. The Pull-In and Hold-In timers receive the fuel injection commands from the FPGA. The timers are activated at the beginning of these commands. The duration of the Pull-In timer varies from 1 to 4 milliseconds depending on the type of solenoid that your system requires. The Hold-In timer limits the maximum duration for the solenoid. This limit is set at 450 milliseconds and should never be exceeded under normal running conditions. It is intended to be a maximum limit to protect the driver from overcurrent conditions. This limit is too long to protect the engine from excessive durations.

Since the amount of current required to energize the EFI solenoid is greater than that required to hold in the solenoid, current sense feedback is applied to instruct the pulse width modulation (PWM) driver to reduce the pulse width to keep the solenoid current at hold-in value for the time required. Reducing the current limits the amount of heat generated and extends the life of the solenoid, and at the same time speeds up the response of the valve in the off direction.

If the current outputs need to be monitored, a dc current probe must be used. Otherwise, a distorted voltage measurement will be obtained due to the PWM method of driving the valves.

## Communications Ports

### LON

The In-Pulse Plus control uses the Local Operator Network (LON) to communicate with other devices that are connected to the network. The transmission media is:

- Twisted pair; 1.25 Mbs Manchester coded
- Message types:
  - Single variable message
  - Woodward proprietary structured message

### Isolated Serial Port

One isolated serial port (J6) can be used to communicate application-specific information to external devices. Characteristics are:

- RS-232/RS-422; 100 to 38 400 Baud; 7–8 Data Bits; None–Even Parity and 0–2 Stop bits
- Modbus® \* master/slave; ASCII
- General purpose ASCII out with XON/XOFF
- Woodward ServLink

\*—Modbus is a trademark of Schneider Automation Inc.

### Non-isolated Serial Port

One non-isolated serial port (J7) can be used to communicate application-specific information to external devices. Characteristics are:

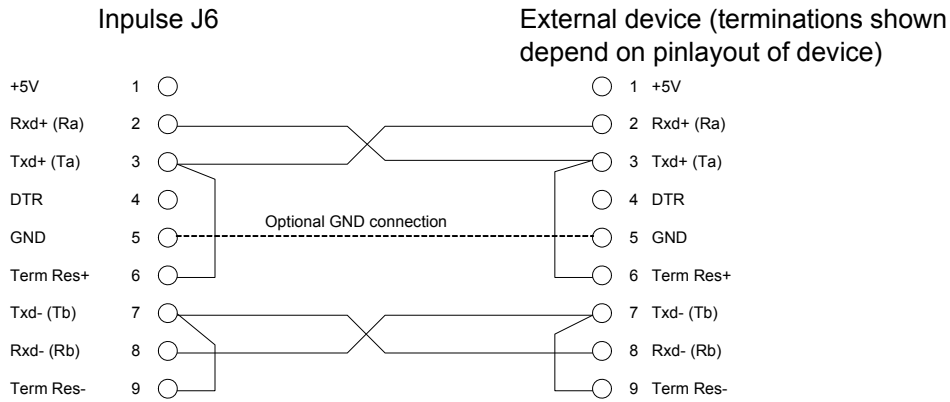
- RS-232/RS-422; 100 to 38 400 Baud; 7–8 Data Bits; None–Even Parity and 0–2 Stop bits
- Modbus master /slave; RTU/ASCII
- General purpose ASCII out with XON/XOFF
- Woodward ServLink

### Serial communication with In-Pulse

When using the serial communication ports J6 and J7 on the In-Pulse, be aware of the following:

- J6 is a galvanically isolated port, J7 is not.
- J6 can only work on Modbus ASCII. J7 can handle both ASCII and RTU. This means that for communication to external devices, where primarily Modbus RTU needs to be used, only J7 can be used.
- When using RS-422, it is usually necessary to terminate both sides of the link to avoid exception errors on the link. It sometimes works without termination when the lines are short, but can still give exception errors then (that might be acceptable).
- When terminating the In-Pulse side of the RS-422 link, it is important to know that only termination points are available on J6. This means only J6 or J7 can be terminated from the termination network on J6. It also means that only one link can be used as an RS-422. The other needs to be on RS-232.
- When using J7 as RS-422, the termination voltages are taken from J6. Here the Term+ is on pin 6 and the Term– is on pin 9 (see Figure 3-1).

### RS422 on J6



### RS422 on J7

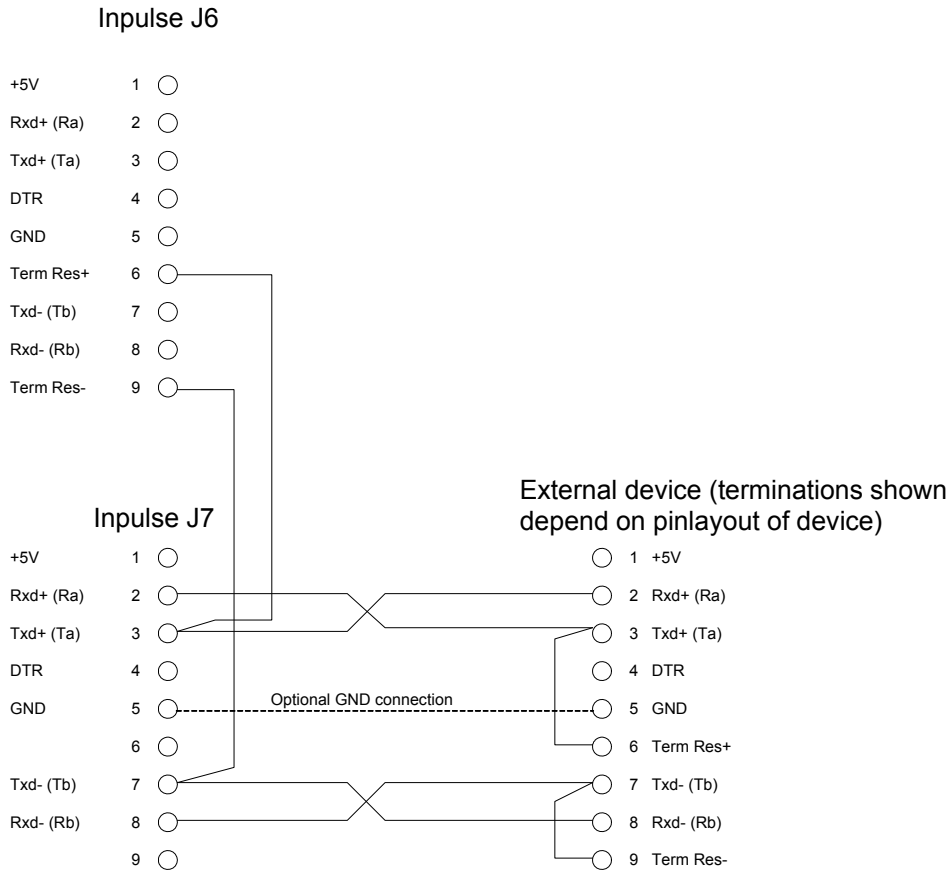


Figure 3-1. RS-422 Connections

### HHT or Service Tool Port

A serial port is provided for the Hand Held Tester or Service Tool. Characteristics are:

- RS-422 1200 Baud; 8 Data Bits; No Parity Bit; One Stop Bit



## Inputs

### Speed, Phase, and TDC Sensors

Two MPU inputs can detect the speed of your engine or turbocharger. Input #1 must be used to detect the speed of the engine which is using the EFI functions.

- Analog Speed Detection:  
50 to 2100 rpm  
380 to 17 500 Hz
- Digital Speed Detection:  
1 to 2100 rpm  
7.5 to 17 500 Hz
- Sensor Options:

#### Magnetic Pickup (MPU)

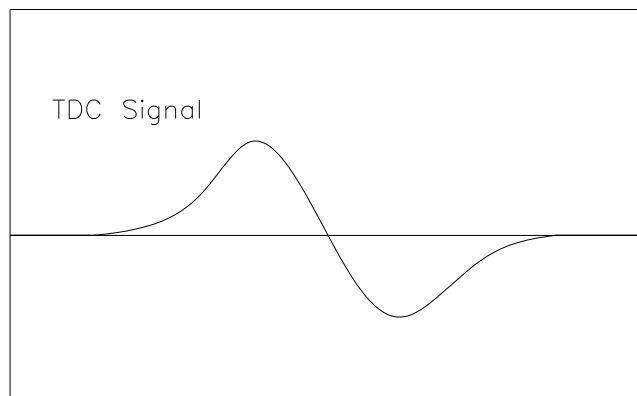
The wiring of the MPU needs to ensure that the polarity is correct. The positive pin of the MPU must be connected to the positive pin of the In-Pulse Plus input. The phase and TDC signal should look like Figure 3-2.

The polarity of the MPU signals is important due to the way that the MPU input circuitry inside the In-Pulse Plus control functions. The rising and falling edges are used to “arm and trip” the signal going to the CPU. The rising edge arms the event and the falling edge trips the event out of a comparator. The polarity is most important for phase and TDC signals because they only occur once or twice per engine cycle.

MPU Amplitude: 1 to 50 Vrms  
MPU Input Impedance: 10 kΩ ±15%

### IMPORTANT

When a magnet is being used to increase the amplitude of an MPU signal, the magnet should be mounted so that it attracts the sensor end of the MPU. The magnet should be installed into the flywheel or camshaft so that the north pole end of the magnet comes in contact with the MPU.



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Figure 3-2. Phase and TDC Signal

**Proximity Inputs** (ref. part numbers 1328-325, 1328-267, and 1328-268 or equivalent sensor)

This type of input is typically used by proximity probes or optical encoders. Typical optical encoders used generate a speed and TDC pulse. The encoder is mounted to the camshaft.

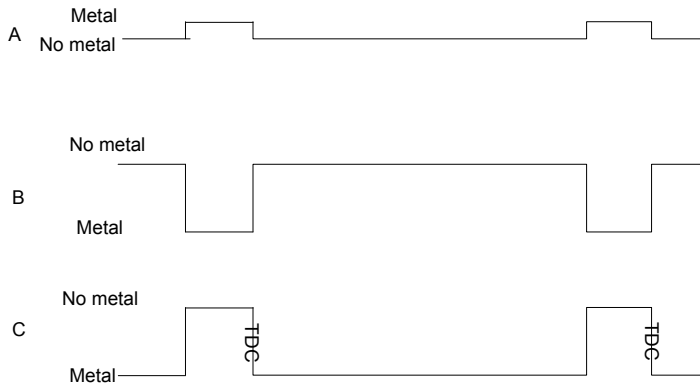
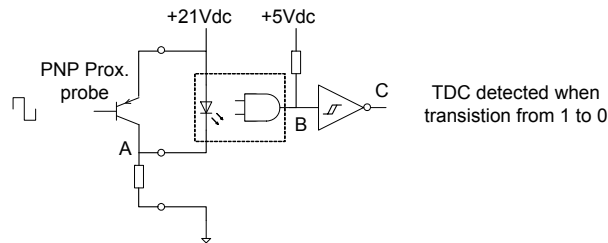
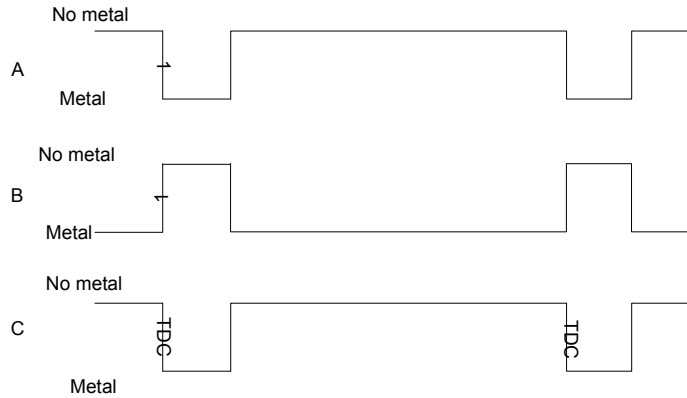
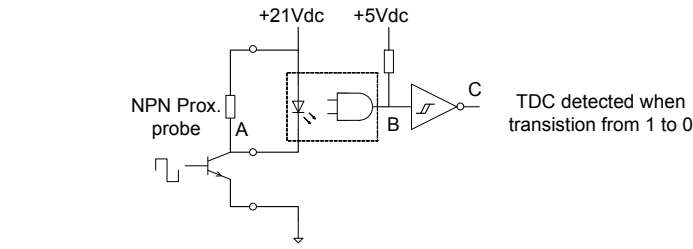


Figure 3-3. Proximity Probe Use

**IMPORTANT** The maximum speed along with other parameters will affect the temperature rating of the In-Pulse Plus control. For more information, please contact Woodward.

### Non-isolated Analog Inputs

Two non-isolated analog inputs are available for use as control, feedback, or monitoring functions. Transducers will need to be powered from an external source. The analog inputs are rated at:

- 4 to 20 mA @ 250  $\Omega$  (factory setting)
- 1 to 5 Vdc @ 10 k $\Omega$

### Discretes

Two discrete inputs are available for use as start/stop sequencing, operator controls, or other site logic. The discrete inputs are rated at (dependent on hardware configuration):

- 21 Vdc nominal @ 3 mA (factory setting)
- 75 Vdc nominal @ 3 mA
- 110 Vdc nominal @ 3 mA

## Outputs

### Valve Solenoid Energizing Signals

Up to twenty valve solenoid energizing signal outputs are available.

### Analog Output

One analog output is available for use as a control or monitoring function:

- 4 to 20 mA maximum load of 600  $\Omega$
- 20 to 160 mA maximum load of 50  $\Omega$  (factory setting)

### Discrete Outputs

Two discrete outputs are available for use as start/stop sequencing, indication, or other site logic:

- 0.6 A @ 115 Vac breaking
- 4 A @ 28 Vdc breaking

### Use of Hand Held Terminal

The Hand Held Terminal can communicate with the In-Pulse Plus control through a serial port to service and maintain the control.

### Alarms

Alarms are application-dependent. Refer to your system manual for a list of alarms.

### Shutdowns

Shutdowns are application-dependent. Refer to your system manual for a list of shutdowns.

### Troubleshooting

Troubleshooting is application-dependent. Refer to your system manual troubleshooting guide.

If the current outputs need to be monitored, a dc current probe must be used. Otherwise, a distorted voltage measurement will be obtained due to the PWM method of driving the valves.

## Chapter 4. Specifications

Woodward Part Number(s): 8402-1xx

### Power Supply

Power Rating (high voltage): 90–140 Vdc (110 Vdc nominal)  
 Power Consumption (high volt.): 420 W maximum. The voltage source must be capable of providing 7 A for 2 ms without dropping below 90 Vdc.  
 Power Rating (low voltage): 18–32 Vdc (24 Vdc nominal)  
 Power Consumption (low volt.): 384 W maximum. The voltage source must be capable of providing 14 A for 2 ms without dropping below 18 Vdc.

### Analog Input Channels

Number of Channels: 2  
 Input Signal Range: 4–20 mA @ 250  $\Omega$  or 1–5 Vdc @ 10 k $\Omega$

### Analog Output Channel

Number of Channels: 1  
 Rating: 4–20 mA @ 600  $\Omega$  max or 20–160 mA @ 50  $\Omega$  max

### Serial Communications Ports

Number of Ports: 2  
 Can be Configured to: RS-232 or RS-422

### Other Communications Ports

Number of Ports: 1  
 Type: LON Network

### Discrete Inputs

Number of Inputs: 2  
 Ratings: 21 Vdc nominal @ 3 mA  
 75 Vdc nominal @ 3 mA  
 110 Vdc nominal @ 3 mA

### Discrete Outputs

Number of Outputs: 2  
 Ratings: 0.6 A @ 115 Vac breaking  
 4 A @ 28 Vdc breaking

### Temperature Ranges

Ambient Operating Temperature: –40 to +70 °C (–40 to +149 °F)  
 Storage Temperature: –40 to +85 °C (–40 to +185 °F)

### Ratings

EMI/RFI Specification: EN50081-2, EN50082-2

# Chapter 5.

## Using ServLink with Watch Window

### Using Watch Window

Here are brief instructions for using the Watch Window in conjunction with ServLink to view the variables for your In-Pulse™ Plus control on a PC (personal computer). These instructions are meant to be introductory only. Full on-line help is available in each application. It is assumed that you already have ServLink and Watch Window installed. The default installation location can be found by clicking the START icon (Microsoft Windows 95 or later) on the main menu bar and then clicking the PROGRAMS menu item. Look for an icon called WOODWARD WATCH WINDOW.

1. Make sure that all other programs that may access your computer communications port are shut down.
2. Get the right cable to talk from your PC to the control (5416-614 will work for J6 and J7, 5416-870 for J5, J6, and J7).
3. Start the ServLink server and open a new file. Select the proper COM port for your PC, verify that POINT TO POINT communications mode is selected, and verify that the baud rate matches the baud rate of the In-Pulse Plus. The default baud rate is 19 200. See the on-line help file if you have been changing the port settings of your control.
4. Select OK. If everything is working right, you should see an animated picture of a string of "1"s and "0"s flying from the control to the PC on your screen. You now have a network definition file whose default name is NET1. You should save this file as "your filename.NET" (use FILE/SAVE AS). Link this name to your control part number, as it will work only with that application. For instance, if the upper level control number is 9907-031, you could save the file as 9907031.NET. Do not disconnect the server.
5. In the ServLink window you will now have another dialog window titled "your filename.net". In this window you will see a ballhead icon and a control identifier name. Unless you have given the control a serial number (or name) with the SLSN.EXE program, this name will display as "<unidentified>".
6. Start the Watch Window application. When Watch executes, you will have a screen displaying three windows entitled Watch Window, Explorer, and Inspector.
7. The Explorer window will have two groups displayed, SERVICE and CONFIGURE. Double clicking on either of these will expand them to show groups of values. Explorer is used only to locate a tunable or monitor value. In order to change a value or monitor a value, you must drag and drop a value from the Explorer window into the Inspector window.

8. Once a value is displayed in the Inspector, you can see several blocks of information. The most important blocks for a tunable value are the FIELD and VALUE blocks. The FIELD block is used to identify a particular value, and the VALUE block displays the current value of a variable. There are two types of values available in Watch. One is a monitor value, which is marked in the INSPECTOR window with a pair of glasses. This means it may only be looked at. The other value is a read/write value, which is marked with a pencil. The read/write type may be modified using the up and down arrows in the value block.

## Downloading to the In-Pulse Plus

### **IMPORTANT**

This is the only way to download to an In-Pulse Plus.

1. Make sure that all other programs that may access your computer's communication port are shut down.
2. Get the right cable to talk from your PC to the control J1 port (5416-870).
3. Start the ServLink server and open a new file. From the dialog window, select the proper COM port for your PC, select POINT TO POINT communications mode, and set the baud rate to 19200.
4. Select OK. If everything is working right, you should see an animated picture of a string of "1"s and "0"s flying from the control to the PC on your screen. You now have a network definition file whose default name is NET1. You should save this file. Link this name to your control part number as it will only work with that application. For instance if the upper level control number is 9907-031, you could save the file as 9907031.NET. Do not disconnect the server.
5. In the ServLink window you will now have another dialog window titled "your filename.net". In this window you will see a ballhead icon and a control identifier name. Unless you have given the control a serial number (or name) with the SLSN.EXE program, this name will display as "<unidentified>".
6. Start the Watch Window program. Under the title bar in the Explorer window you will find a tab with your network file and the control ID displayed. Right click this tab to display the pop-up menu, and select LOAD APPLICATION. This will close the Inspector window and open a new window where you will enter the name of the file you want to download. Once the filename is correct, click on the OPEN button. A Warning screen will ask you to make sure the engine is shut down before downloading. Downloading will proceed automatically once you accept the message to shut down the engine.

### **WARNING**

Be sure the engine is shut down before downloading. An engine overspeed is possible if the engine is running during the download process.

## Transferring Tunable Values between In-Pulse Plus Controls

1. Make sure that all other programs that may access your computer's communication port are shut down.
2. Get the right cable to talk from your PC to the control (5416-870 for J1, 5415-614 for J2 or J3).
3. Start the ServLink server and open a new file. From the dialog window, select the proper COM port for your PC, select POINT TO POINT communications mode, and set the baud rate to 19200.
4. Select OK. If everything is working right, you should see an animated picture of a string of "1"s and "0"s flying from the control to the PC on your screen. You now have a network definition file whose default name is NET1. You should save this file. Link this name to your control part number as it will only work with that application. For instance if the upper level control number is 9907-031, you could save the file as 9907031.NET. Do not disconnect the server.
5. In the ServLink window you will now have another dialog window titled "your filename.net". In this window you will see a ballhead icon and a control identifier name. Unless you have given the control a serial number (or name) with the SLSN.EXE program, this name will display as "<unidentified>".
6. Start the Watch Window program. Under the title bar in the Explorer window you will find a tab with your network file and the control id displayed. Right click this tab to display the pop-up menu, and select CONFIGURATION. If you want to take the configuration from a control, select SAVE TO FILE. If you want to download a new configuration to a control with an existing application, then select LOAD FROM FILE.
7. If you select SAVE TO FILE, you will have to provide the name of a file where you want to save the configuration. If your control has a part number of 9907-031 then you might want to call this file 9907031.cfg. Make the name meaningful so you can find it easily the next time you need it.
8. If you select LOAD FROM FILE you will get a confirmation warning telling you that the unit will be shut down. If you answer yes then you will be asked for the name of the configuration file that you want to download.

## Chapter 6. Service Options

### Product Service 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 and 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 Engine Retrofitter (RER)** is an independent company that does retrofits and upgrades on reciprocating gas engines and dual-fuel conversions, and can provide the full line of Woodward systems and components for the retrofits and overhauls, emission compliance upgrades, long term service contracts, emergency repairs, etc.
- 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/support/directory.cfm](http://www.woodward.com/support/directory.cfm).



## Woodward Factory Servicing 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/support](http://www.woodward.com/support).

## How to Contact Woodward

For assistance, call one of the following Woodward facilities to obtain the address and phone number of the facility nearest your location where you will be able to get information and service.

### 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) 78954-0
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

### Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany:	
Stuttgart	+49 (711) 78954-0
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

### Turbine 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
Poland	+48 12 295 13 00
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

You can also contact the Woodward Customer Service Department or consult our worldwide directory ([www.woodward.com/support/directory.cfm](http://www.woodward.com/support/directory.cfm)) for the name of your nearest Woodward distributor or service facility.

## Technical Assistance

If you need to telephone for technical assistance, you will need to provide the following information. Please write it down here before phoning:

Your Name \_\_\_\_\_

Site Location \_\_\_\_\_

Phone Number \_\_\_\_\_

Fax Number \_\_\_\_\_

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Engine/Turbine Model Number \_\_\_\_\_

Manufacturer \_\_\_\_\_

Number of Cylinders (if applicable) \_\_\_\_\_

Type of Fuel (gas, gaseous, steam, etc) \_\_\_\_\_

Rating \_\_\_\_\_

Application \_\_\_\_\_

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**Control/Governor #1**

Woodward Part Number & Rev. Letter \_\_\_\_\_

Control Description or Governor Type \_\_\_\_\_

Serial Number \_\_\_\_\_

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**Control/Governor #2**

Woodward Part Number & Rev. Letter \_\_\_\_\_

Control Description or Governor Type \_\_\_\_\_

Serial Number \_\_\_\_\_

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**Control/Governor #3**

Woodward Part Number & Rev. Letter \_\_\_\_\_

Control Description or Governor Type \_\_\_\_\_

Serial Number \_\_\_\_\_

*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.*

We appreciate your comments about the content of our publications.

Send comments to: [icinfo@woodward.com](mailto:icinfo@woodward.com)

Please reference publication **26053C**.



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Woodward has company-owned plants, subsidiaries, and branches,  
as well as authorized distributors and other authorized service and sales facilities throughout the world.

Complete address / phone / fax / email information for all locations is available on our website.