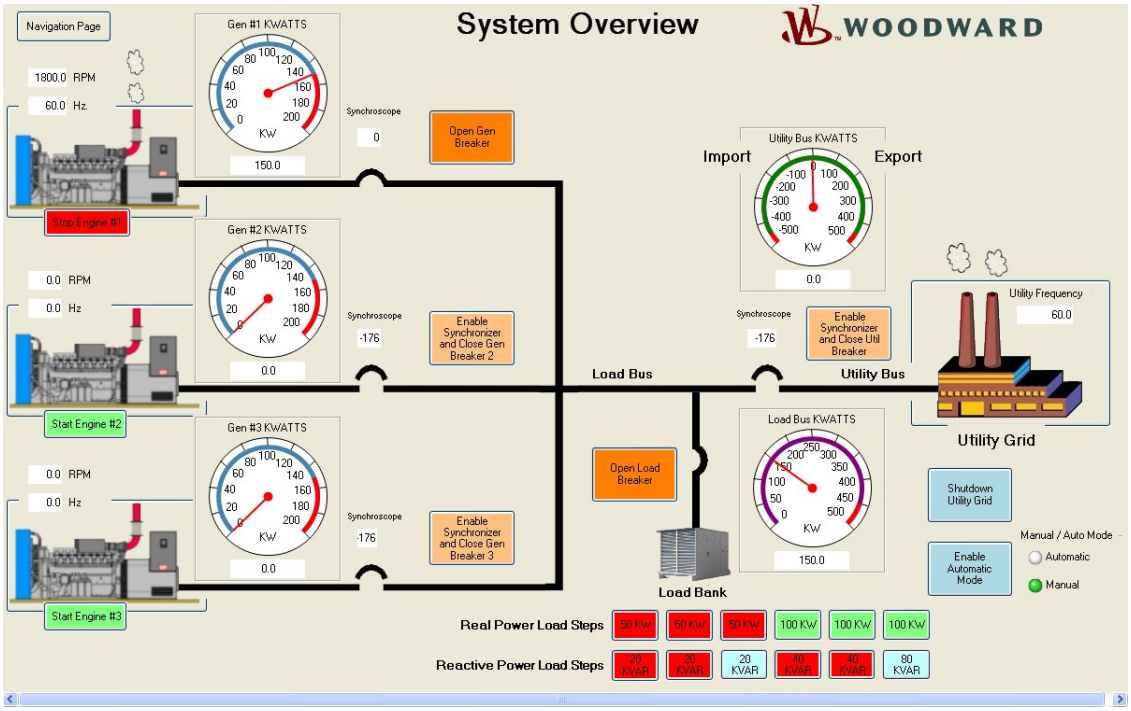
WOODWARD

Application Note 51474
(Revision C, 02/2020)
Original Instructions



Power Generation Learning Module

Quick Start Guide

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 Out-of-date translations are marked with ⚠.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— A bold, black line alongside the text identifies changes in this publication since the last revision.

Application Note 51474

Contents

Illustrations and Tables

Warnings and Notices

Important Definitions

This is the safety alert symbol 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.

IMPORTANT

External wiring connections for reverse-acting controls are identical to those for direct-acting controls.

Chapter 1.
General Information

Introduction

This Power Generation Learning Module was created to help students learn the basics of the following items:

- Engine speed control fundamentals
- Speed control dynamic tuning—PID (proportional, integral, and derivative)
- Generator automatic voltage regulation fundamentals
- Electrical power generation and the basics of voltage, current, watts, volt-amps, volt-amps-reactive (VARs, circulating currents)
- Power factor and VAR control
- Synchronizing
- Various load control schemes consisting of:
  - Isochronous
  - Droop
  - Droop—Droop Load Control
  - Isochronous Load Sharing
  - Droop Baseload
  - Isochronous Baseload
  - Import / Export Control
  - Fully Automatic Control for emergency backup generators

The module consists of three engine-generators, rated at 150 kW, with resistive and reactive load banks, associated generator breakers, and a utility grid. The engines have start–stop capability with overspeed protection, and run at a synchronous speed of 1800 rpm. The generators are capable of automatically synchronizing to each other and to the utility grid (mains), and are protected for reverse power, over-current, and overload.

The student has the capability to start / stop engines, synchronize generators and close breakers, and dynamically tune Engine #1 active speed dynamics on the speed control. This will help in understanding the closed loop speed control of the PID (proportional gain, integral gain, and derivative) algorithm. Trending is available to see the effects of the PID during transient load conditions.

Quick Start

The student must have the following items:

- The “Power Generation Learning Module” USB flash memory drive part number 8447-1012
- A computer with Windows XP, Windows Vista, or Windows 7, 8, or 10

The USB flash memory drive contains the following files (follow the instructions below to install the software):

1. An install executable file, part number 9927-2187.
2. A Woodward folder. This folder contains the license for the NetSim software.
3. Woodward manual 26736, *Power Generation Learning Module Guide*, in PDF format. Adobe Acrobat is required to open this file format.
4. Woodward product specification 03412, *Power Generation Learning Module*, in PDF format.
5. Woodward Quick Start Guide 51474, *Power Generation Learning Module – Quick Start Guide, i*n PDF format.

IMPORTANT **The NetSim Control Executive software is licensed to the USB flash memory drive and cannot be moved or transferred to another computer or other flash memory devices.**

First Time Start Procedure

(Please follow these instructions exactly)

Software Installation

1. This procedure only needs to be performed once. The install will load two software programs onto your computer. After the files are installed on your computer, the normal start procedure can be followed.

2. Double click on the **9927-2187.exe** file. This will load the NetSim Control Executive software and the Toolkit software to your computer using a Power System Setup Wizard. Microsoft .NET Framework version 4.0 or greater is required for the NetSim Control Executive software to run. Please load the Microsoft .NET Framework software, if required, from the Internet. Install the software in the location specified by the install program.

3. Click on the "**Start Power Gen Model**" icon 

(on your desktop) to automatically start the module and ToolKit. The memory stick must be present in the USB drive to run. There is a license required on it to run.

4. After ToolKit starts, Click on the ***Connect*** button, as shown in Figure 1-1.:

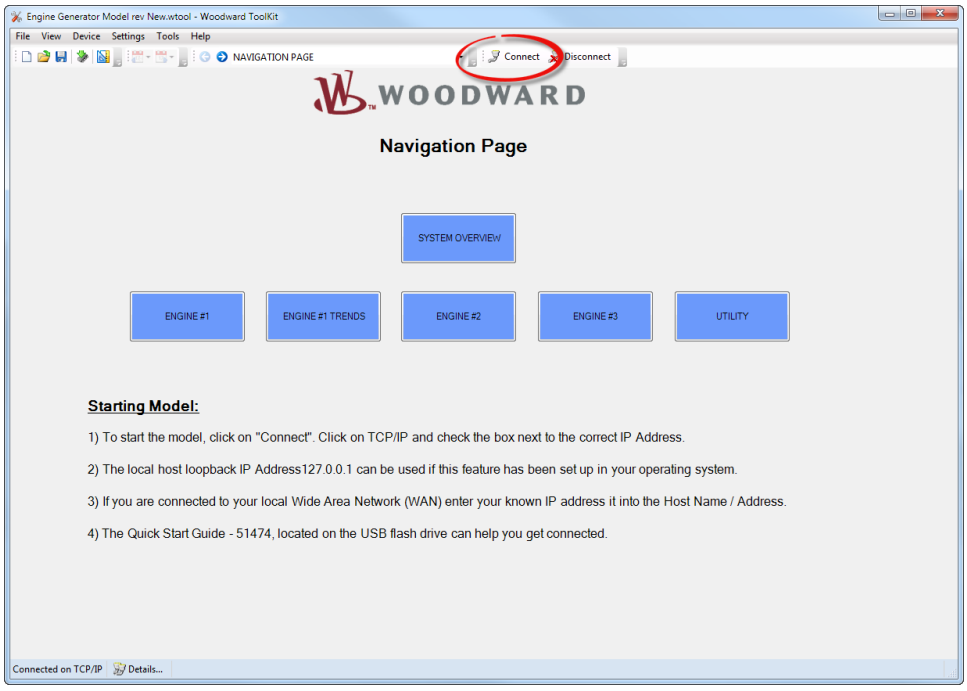


Figure 1-1. Connect Button on Navigation Page

5. The module can use the loopback IP address of 127.0.0.1 to run or your local LAN (Local Area Network).

You don't have to be on a LAN network to run the module. If your computer's operating system is Windows XP, follow these directions:

1. Type in 127.0.0.1 into the Host Name / Address.
2. Select Add.
3. Select Connect.

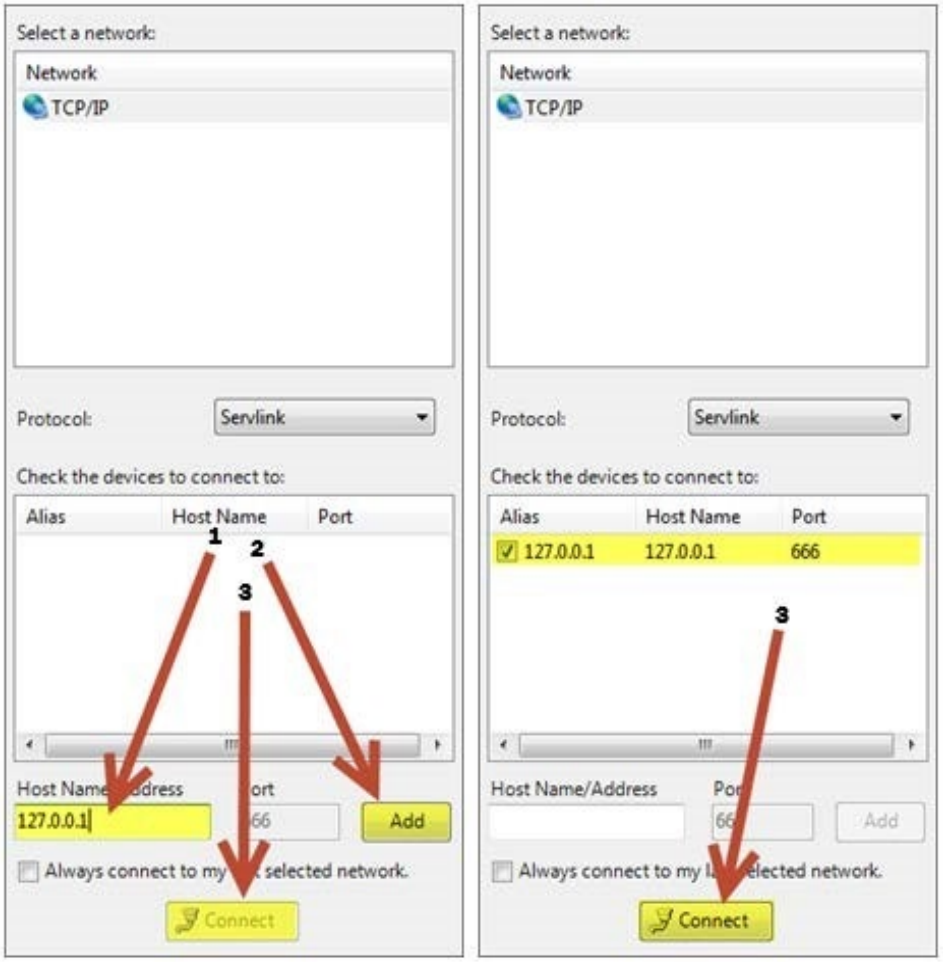


Figure 1-2. Connection to a Network Screen

To add the Microsoft Loopback Adapter in **Windows 7**, follow these instructions:

1. Click on the Start Menu.
2. Type "Cmd" into the search engine.
3. Enter "hdwwiz.exe"
4. In the "Welcome to the Add Hardware Wizard", click Next.
5. Select "Install the hardware that I manually select from a list (Advanced)" and click Next.
6. Scroll down and select "Network adapters" and click Next.
7. Under Manufacturer, select "Microsoft", then select "Microsoft Loopback Adapter" under Network Adapter and click Next.

To add the Microsoft Loopback Adapter in **Windows 8**, follow these instructions:

1. From Control Panel, select "Device Manager" under the "Devices and Printers" section of the "Hardware and Sound" tab.
2. Right-click the name of the computer at the top of the tree, and choose "Add Legacy Hardware".
3. In the "Welcome to the Add Hardware Wizard" window, click Next.
4. In the "The wizard can help you install other hardware" window, choose "Install the hardware that I manually select from a list" option and click Next.
5. In the "The wizard did not find any new hardware on your computer" window, click Next.

6. In the "From the list below, select the type of hardware you are installing" window, select "Network Adapters" from the list and click Next.
7. In the "Select Network Adapter" window, from the Manufacturer list, choose Microsoft, then in the Network Adapter window, choose "Microsoft KM-TEST Loopback Adapter", then click Next.
8. In the "The wizard is ready to install your hardware" window, click Next.
9. In the "Completing the Add Hardware Wizard" window, click Finish.

To add the Microsoft Loopback Adapter in **Windows 10**, follow these instructions:

1. Right-click the Start menu (lower left corner of screen) and left-click Run to bring up a window.
2. Type “hdwwiz” and click OK.
3. Confirm the pop-up on User Account Control if it appears.
4. In the "Welcome to the Add Hardware Wizard” window, click Next.
5. In the "The wizard can help you install other hardware” window, choose ‘Install the hardware that I manually select from a list (Advanced)’.
6. In the "From the list below, select the type of hardware you are installing" window, select "Network Adapters" from the list and click Next.
7. In the "Select Network Adapter" window, from the Manufacturer list, choose Microsoft, then in the Network Adapter window, choose "Microsoft KM-TEST Loopback Adapter", then click Next.
8. In the "The wizard is ready to install your hardware" window, click Next.
9. In the "Completing the Add Hardware Wizard" window, click Finish.

The ToolKit software should say **Connected on TCP/IP** in the lower left corner.

If your computer is connected to a LAN, you can use your computer’s IP Address for the host name above. To find the IP Address of your computer, select run from your command window, type in cmd, and execute the window. Type in the command; IPCONFIG. The IP Address should show up under your Ethernet Network Adapter. For example, the Address should look something like this: 192.168.79.1.

The first time you run the module it will ask you to select the Tool Device, shown in Figure 1-3.

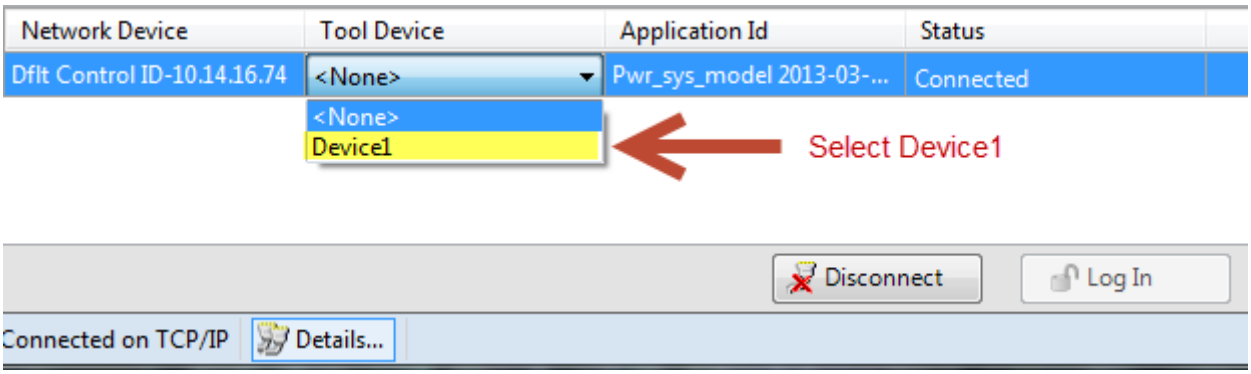


Figure 1-3. Tool Device Selection Screen

Select Device1.

If you don’t see “Device1” in the screen above, open up the NetSim Control Executive software and select Options, as shown in Figure 1-4.

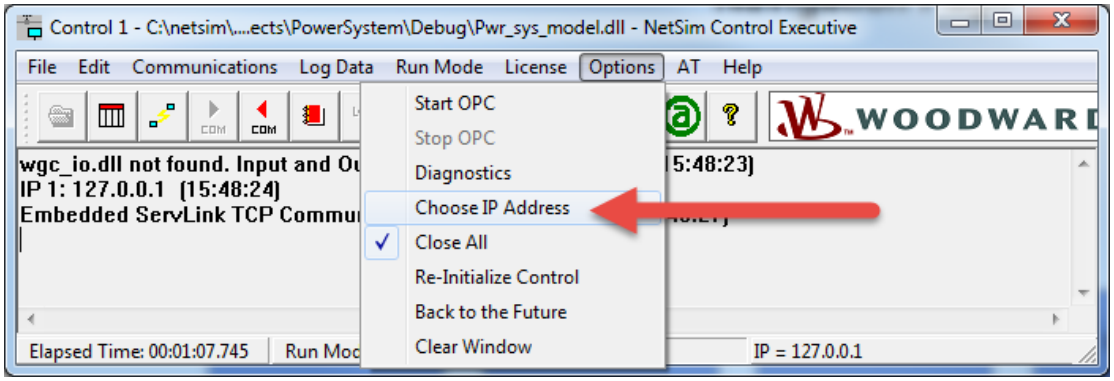


Figure 1-4. Choose IP Address Option Screen

Enter in the IP Address: 127.0.0.1, as shown in Figure 1-5:

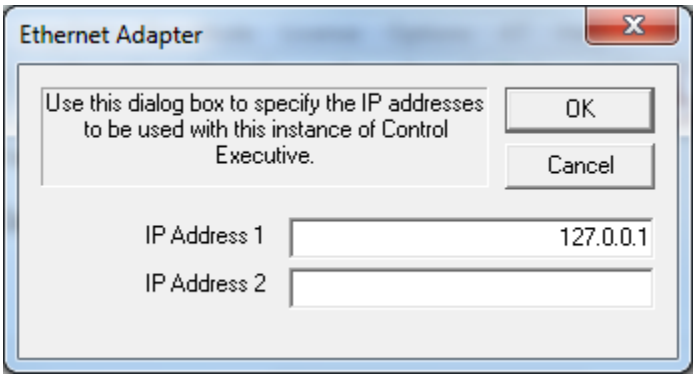


Figure 1-5. IP Address Dialog Box

Click on OK and close the NetSim Control Executive and the Toolkit. Start up the simulation model again and follow the steps above. This time the “Device1” should appear. If it doesn’t show up, it is usually an IP Address issue.

The module should be running, and you are ready to start the learning module.

Normal Start Procedure

After the software is installed, follow these directions:

1. Double click on this icon 

on the desktop to automatically start the module and the Toolkit.

2. After Toolkit starts, click on the Connect button, as seen below:

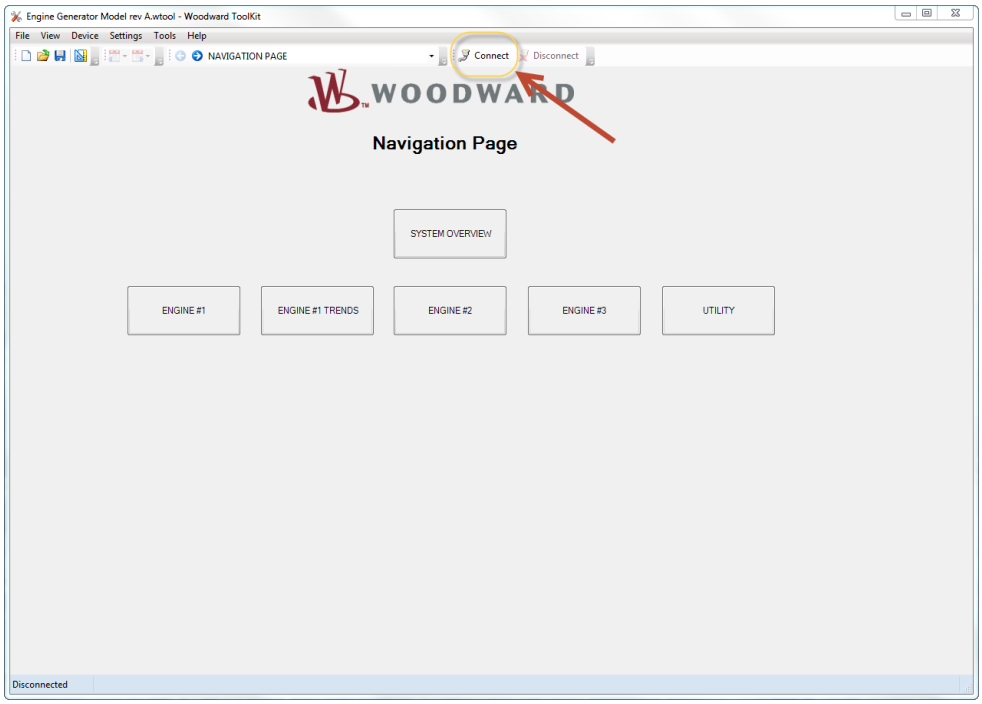


Figure 1-6. Normal Start Connection Screen

As long as the IP address does not change, the module will connect.

For problems, please check with your IT department or contact Woodward at the email address provided in Chapter 2.

This concludes the quick start guide. Please open the Learning Module Guide (manual 26736) to proceed through the training.

Chapter 2.
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:

1. Consult the troubleshooting guide in the manual.
2. Contact the **OE Manufacturer or Packager** of your system.
3. Contact the **Woodward Business Partner** serving your area.
4. Contact Woodward technical assistance via email (EngineHelpDesk@Woodward.com) with detailed information on the product, application, and symptoms. Your email will be forwarded to an appropriate expert on the product and application to respond by telephone or return email.
5. If the issue cannot be resolved, you can select a further 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 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 current list of Woodward Business Partners is available at www.woodward.com/directory.

Product Service Options

Depending on the type of product, the following options for servicing Woodward products may be available through your local Full-Service Distributor or the OEM or Packager of the equipment system.

- 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 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.

Flat Rate Repair: Flat Rate Repair is available for many of the standard mechanical products and some of the electronic 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.

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. 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 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's Full-Service Distributors offer various Engineering Services for our products. For these services, you can contact the Distributor by telephone or by email.

- 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.

Product Training is available as standard classes at many Distributor locations. Customized classes are also available, which can be tailored to your needs and held at one of our Distributor 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 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 one of the Full-Service Distributors listed at **www.woodward.com/directory**.

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 (124) 4399500
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 (124) 4399500
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 (124) 4399500
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 _____

Engine Model Number _____

Number of Cylinders _____

Type of Fuel (gas, gaseous, diesel, dual-fuel, 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.

Revision History

Changes in Revision A—

- Added Microsoft Loopback Adapter in Windows 10 instructions to Chapter 1

Released

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 51474.

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Email and Website—www.woodward.com

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.