



**733 Load Sharing Control
Cat ADEM**

8280-2076
Pon Power Mechanical Load Sharing Damen Shipyard
Woodward manual 26343 is also required.

Application 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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www.woodward.com/searchpublications.aspx

The current revision of all publications is shown in file "*current.pdf*".

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.



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*.

Woodward reserves the right to update any portion of this publication at any time. Information provided by Woodward is believed to be correct and reliable. However, no responsibility is assumed by Woodward unless otherwise expressly undertaken.

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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 Woodward part numbers for the 733 Load Sharing Control/Cat ADEM are:

- **System:** **8280-2076**
- Hardware: 733: 8237-1177
- Application Software: 733: 5601-2088

The following drawings belong to the system:

- Functional block diagram: 9989-4123

The Woodward 733 Load Sharing Control/Cat ADEM has the following functionality:

- Speed synchronization
- Load sharing control

Features:

- Configurable I/O ranges and assignment to I/O channels
- Use one or individual Speed-Reference inputs.
- Extensive Service and ToolKit Configure Menus for tuning via Woodward ToolKit (733 serial port #1 RS-232)
- Test/Override functionality for I/O signals
- Modbus[®] * communication available with extensive list of signals (733 serial port #2 RS-485)

*—Modbus is a trademark of Schneider Automation Inc.

Associated Publications

The following publications contain additional product or installation information on Load Sharing and Speed Controls, and related components. These can be ordered from any Woodward office. Manuals can be downloaded from:

www.woodward.com/searchpublications.aspx.

Manual 26343, *733 and 766 Digital Controls*

Manual 25070, *Electronic Governor Installation Guide*

Manual 26260, *Governing Fundamentals and Power Management*

Manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*

Application Note 83402, *PID Control*

General Safety Precautions

Obey the following safety precautions when you install the unit:

- Obey all cautions or warnings given in the procedures.
- Never bypass or override machine safety devices.

Chapter 2.

Inputs and Outputs

Speed Sensor Inputs

The following analog input signals have been defined for this control:

- Engine A Speed-Sensor Input #1
- Engine B Speed-Sensor Input #2

These speed sensor inputs can be either passive (MPU) or active (PROXIMITY).

Using the CONFIGURATION menu, the number of teeth for these inputs can be adjusted.

Analog Inputs

The following analog input signals have been defined for this control:

- Engine A Speed-Reference Input
- Engine A Load Input
- Engine B Speed-Reference Input
- Engine B Load Input

Using the CONFIGURATION menu, these inputs can be enabled and assigned to any of the 4 analog inputs available on the 733.

Engine A/B Speed-Reference Input

This input is the nominal Speed-Reference for engine A/B. The Speed Reference Input for both engines can be assigned to the same analog input channel.

Engine A/B Load Input

This input is the load input for engine A/B. This could be based on a real kW measurement, torque measurement, or fuel rack position.

NOTICE

The Load Inputs can also be obtained through the J1939 CAN bus interfaces.

Analog Outputs

The following analog signals can be output on this control:

- Fixed Value
- Reference To Engine A
- Reference To Engine B
- Total Load Analog Input 1
- Analog Input 2
- Analog Input 3
- Analog Input 4
- PID Output

Using the CONFIGURATION menu, these signals can be assigned to any of the 4 analog outputs available on the 733.

Fixed Value

Sets the output to fixed value.

Reference To Engine A/B

This outputs engine A/B Speed-Reference, biased from synchronization or load control.

Total Load

This outputs the total load of engine A and B

Analog Input 1 ~ 4

Any of these analog input signals can be output and assigned to any of the analog output signals.

PID Output

This outputs the load sharing control PID value.

Discrete Inputs

The following discrete input signals have been defined for this control:

- Engine A Clutch
- Engine A Raise
- Engine A Lower
- Engine A Unload
- Engine A Stop
- Reset
- Engine B Clutch
- Engine B Raise
- Engine B Lower
- Engine B Unload
- Engine B Stop

Using the CONFIGURATION menu, these inputs can be enabled and assigned to any of the 8 discrete inputs available on the 733.

Engine A/B Clutch

When this input contact is closed, the control assumes engine A/B is connected to the common gearbox.

Engine A/B Raise

When this input contact is closed, the control increases engine A/B speed-reference output, when not in load sharing mode. You can assign the Raise command for both engines to the same contact input.

Engine A/B Lower

When this input contact is closed, the control decreases engine A/B speed-reference output, when not in load sharing mode. You can assign the Lower command for both engines to the same contact input.

Engine A/B Unload

When this input contact is closed, the control tries to unload engine A/B, when in load sharing mode.

Engine A/B Stop

When this input contact is closed, the control outputs the minimal Speed-Reference (0%, 4 mA) for engine A/B. You can assign the Stop commands for both engines to the same contact input.

Reset

The reset can be used to reset Minor and Major Alarms. The reset is the same as the "Software Reset" using the ToolKit Service Menus.

Relay Driver Outputs

The following discrete signals can be output on this control:

- Fixed Value
- Minor Alarm
- Major Alarm
- Minor/Major Alarm
- Test Mode Active
- Analog Input Fault Channel #1
- Analog Input Fault Channel #2
- Analog Input Fault Channel #3
- Analog Input Fault Channel #4
- Clutch A in
- Clutch B in
- Unloaded A
- Unloaded B
- Load Sharing Active
- Speed A = Speed B

Using the CONFIGURATION menu, these signals can be assigned to any of the 4 discrete outputs on the 733.

Fixed Value

Sets a fixed output (energized or de-energized) for the respective output.

Minor Alarm

This signal indicates a Minor Alarm is active. A Reset command might reset this, unless the cause of this Minor Alarm persists.

Major Alarm

This signal indicates a Major Alarm is active. A Reset command might reset this, unless the cause of this Major Alarm persists.

Minor/Major Alarm

This signal indicates a Minor or Major Alarm active. A Reset command might reset this,

Test Mode Active

This signal indicates that any of the input or output signals has been forced manually to a test value using the ToolKit Service Menu.

Analog Input Fault Channel #1~4

These signals indicate an out of range failure (wire break) for analog input #1~4.

Clutch A/B in

This signal indicates the engine A/B Clutch status.

Unloaded A

The signal indicates the unload A/B contact is active and the engine's has reached its Unload Load setpoint.

Load Sharing Active

The signal indicates the load sharing control PID is active.

Speed A = Speed B

This signal indicates the absolute difference between Speed A and B is less than a tunable threshold [rpm], and stays less for a tunable delay time. The threshold and delay times can be set in the ToolKit Service Menus.

Chapter 3.

Description of Operation

Introduction

This chapter provides an overview of the features and operation of the 733 Load Sharing Control/Cat ADEM.

The control defines 4 operation modes:

- Stopped / Bypassed
- Speed-Reference Forward Mode
- Synchronization Mode
- Load Sharing Mode

Stopped / Bypassed

When the Engine A/B Stop command is used, closing of the respective contact forces the control to output minimum (0%, 4 mA) for Engine A/B Speed-Reference Output.

The Engine A/B Stop command will ignore any biases from either synchronization or load sharing control.

Speed-Reference Forward Mode

When both engine clutches are open, the control defaults to output each engine's speed-reference input directly to each engine's speed-reference output.

A CONFIGURE option is available to have just one common speed-reference for both engines. Engine B Speed-Reference will then follow the Engine A Speed-Reference input signal.

Engine A/B Raise and Lower commands are ignored. Engine A/B Load signals are ignored.

Synchronization Mode

When just one engine is clutched in, that is connected to the gearbox, the respective Raise and Lower contacts can be used to synchronize the speed of the other engine which is not clutched in.

The synchronization bias will be added to the nominal speed reference of the clutched out engine. This synchronization bias is volatile; once both engines are either clutched in or clutched out, the bias will be reset to 0.

When both speed signals from engine A and B are within a certain adjustable window, a Synchronize OK Check relay can be energized, which can be used as a clutch-in permissive.

Load Sharing Mode

When both engines are clutched in, that is, mechanically coupled to the gearbox, the control will try to load share between the two engines.

A PID controller generates speed biases for engine A and engine B such that each engine will load-share according to the required ratio which is defined normally as 50% of the total load.

Unequal load sharing is possible by adjusting the LOAD RATIO setting in the ToolKit Service Menu.

In steady state, the PID will have an output of 50%, equaling 0 rpm bias for each engine. An adjustable PID BIAS RANGE defines the absolute bias when the Load Sharing PID is at either 0% or 100%.

The Load Sharing bias for engine A and B are complementary; when engine A gets a positive bias, engine B gets the same bias negatively.

IMPORTANT

Changing the PID BIAS RANGE might require readjustment of the dynamic settings of the Load Sharing PID.

When the second engine clutches in, the control will soft-load this second engine with an adjustable rate to the required load (normally 50% of both engines total load). When the soft-loading has finished, normal load sharing is operational.

When an unload contact is received for either engine, the load set point for that engine is set to its UNLOAD SETPOINT. The control will unload the engine with an adjustable rate; the other engine will take the remaining load.

When the unload command is removed, soft-loading will be initiated. When the soft-loading has finished, normal load-sharing is operational again.

Load sharing mode will not be possible and be disabled in the following cases:

- Engine A or B Speed-Reference Input fault
- Engine A or B Load Input fault
- Engine A or B Stop command
- Engine A or B Clutch is open

To prevent gear wheel “hammering” at low loads, when both engines are clutch in, only one engine will take the load, and the other engine will stay at near zero load.

When the total load exceeds an adjustable level, the 2nd engine will start to soft-load and both engines will share the load.

When the total load decreases below another adjustable level, one of the engines shall be unloaded.

There is an option to alternate between engines (equal usage of engines) or always unload the engine that was clutched in last.

Chapter 4.

ToolKit Configure and Service Menus

ToolKit Introduction

This chapter describes the parameters that can be configured, tuned and monitored.

Throughout, the Woodward user interface program ToolKit is used to configure and operate the Single Point Dual Fuel – Fumigation System.

ToolKit can be downloaded from the www.woodward.com website. ToolKit has certain software requirements like Windows XP and higher, DOT NET 3.5 and higher etc. Please consult the Woodward download page for detailed instructions.

In order to run the user interface, ToolKit needs to open a .WTOOL file and a corresponding .SID file.

When the .WTOOL file is opened, one can connect to the 733 control on its serial port (RS-232) using a null-modem serial cable.

TX	←--→	RX
RX	←--→	TX
GND	←--→	GND

The communication for the serial port should be left at automatic.

A dedicated serial null-modem cable 5416-614 can be ordered at Woodward.



Disconnect/disable Wifi, Bluetooth etc. prior to connecting to ToolKit; Improperly implemented drivers of these devices may cause problems.

ToolKit will check the software version inside the 733 control with the .SID file which comes with the .WTOOL user interface tool. If these do not match, there is a mismatch between the 733 software version and the ToolKit tool.

For further details, please refer to the embedded Help included with the ToolKit program.

ToolKit Login / User Levels

There are three user login levels defined in the ToolKit tool:

- **Level 1** **Password = 1**
Monitoring level, freely accessible
- **Level 8** **Password = 1112**
Configure level, shall be limited to trained personnel.
- **Level 15** **Password = Consult Woodward**
Highest access level, limited to Woodward personnel.

Level 1 can be used by end-users to monitor parameters. It does not allow changing the configuration.

Level 8 allows changing almost all configuration parameters.

Level 15 is the highest access level. It allows changing any configuration parameter.

ToolKit Configure Pages

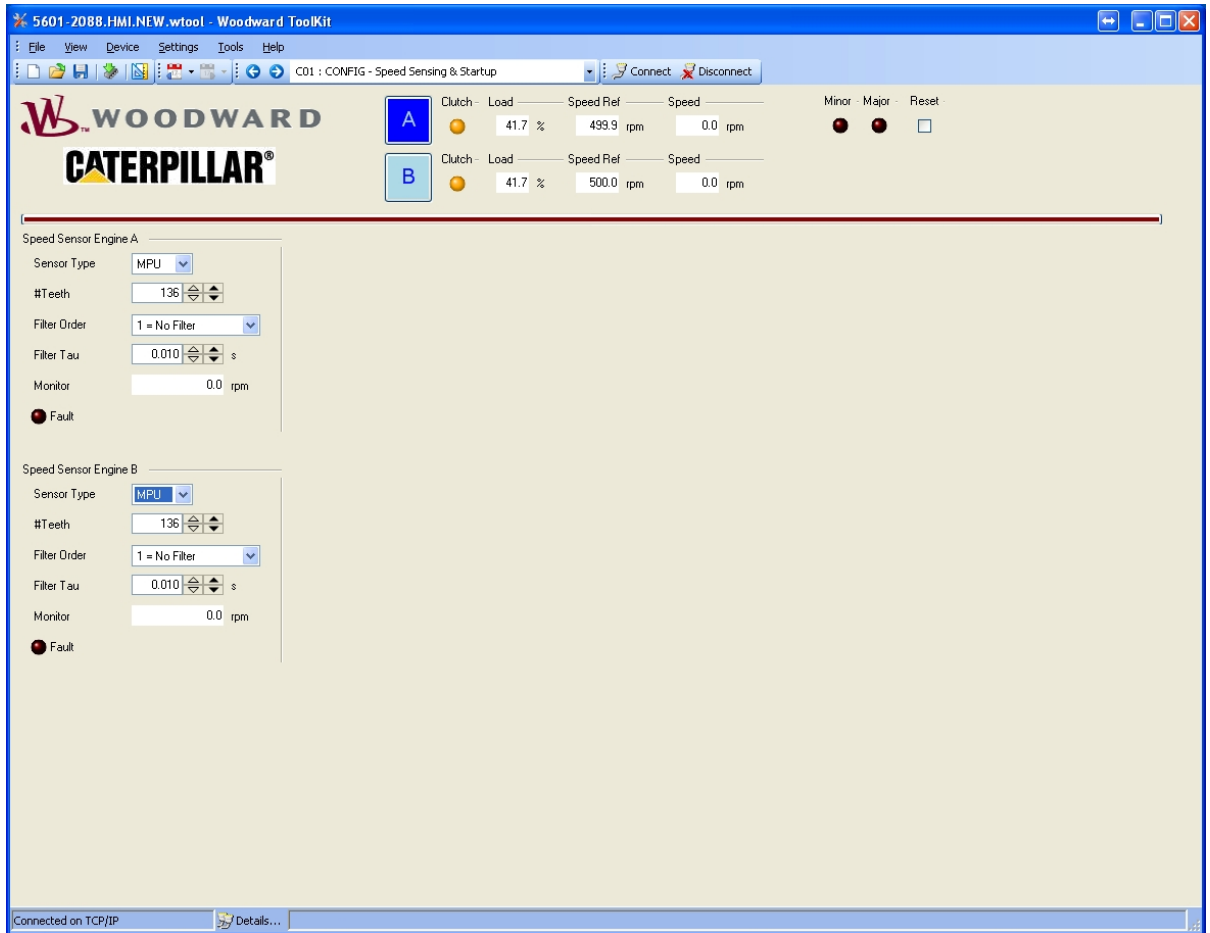
IMPORTANT

Engines must be stopped prior to making changes on the ToolKit Configure pages.

The following ToolKit Configure Pages are available:

- **C01 : CONFIG - Speed Sensing & Start-up**
- **C02 : CONFIG – Discrete Inputs**
- **C03 : CONFIG – Discrete Outputs**
- **C04 : CONFIG – Analog Inputs**
- **C05 : CONFIG – Analog Outputs**

C01 : CONFIG - Speed Sensing & Start-up

**Sensor Type**

Select between **MPU** or **PROX** for speed sensor engine A/B.

#Teeth

Sets the number of teeth for the gear-wheel for the engine A/B speed sensor, adjustable between 4 and 500 teeth.

Filter Order

Select the type of low-pass filtering for a speed sensor.
1 = No Filter, 2 = 1st Order Filter, 3 = 2nd Order Filter.

Filter Tau

Select the low-pass filter time constant, adjustable between 0 and 10 s.

Monitor

Monitor the current speed for each engine [rpm].

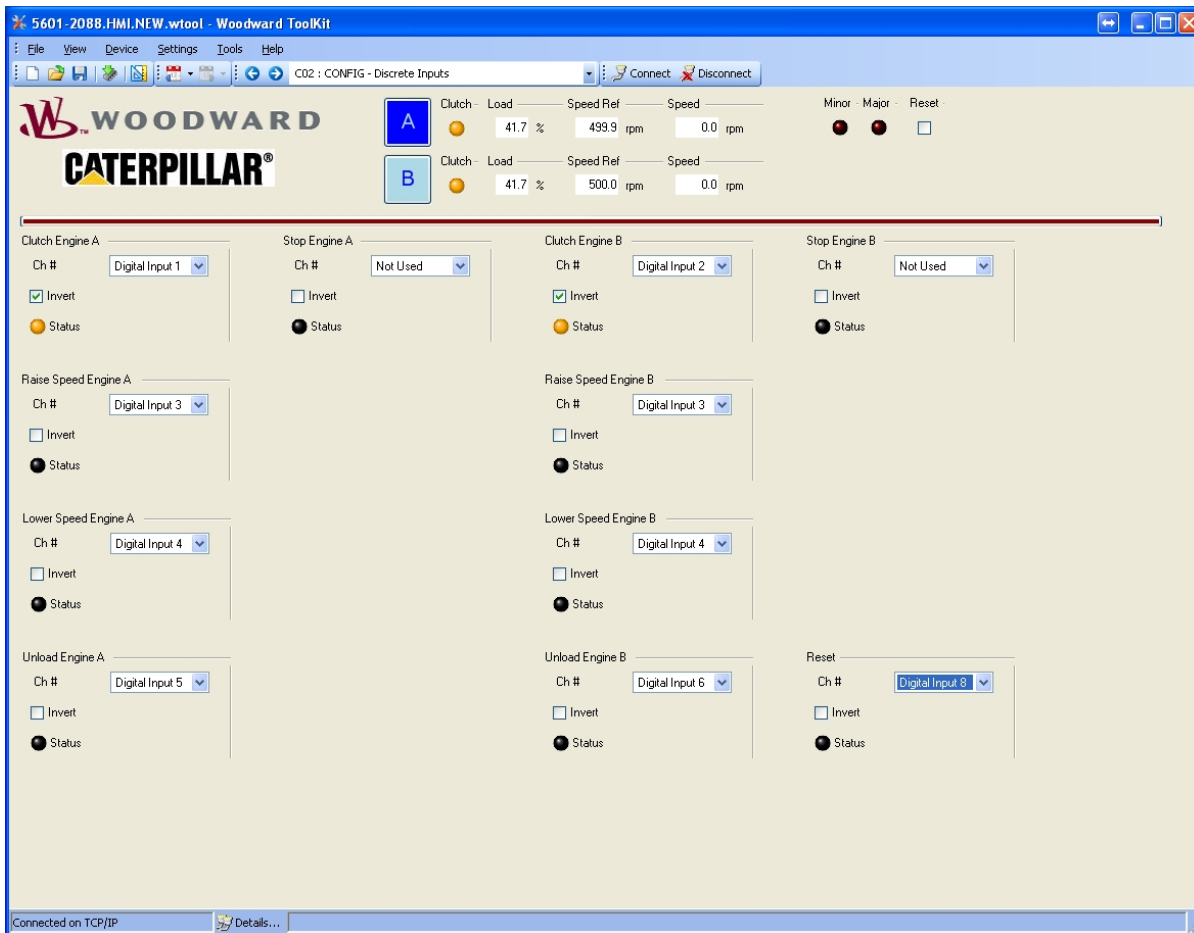
Fault

Monitor a speed sensor fault (not used).

IMPORTANT

Most of these settings require a reboot of the control for them to take effect. **SAVE** tunables prior to rebooting the control!

C02 : CONFIG – Discrete Inputs



Ch#

Select between **Not Used**, **Digital Input 1 .. 8** for each of the defined functions.

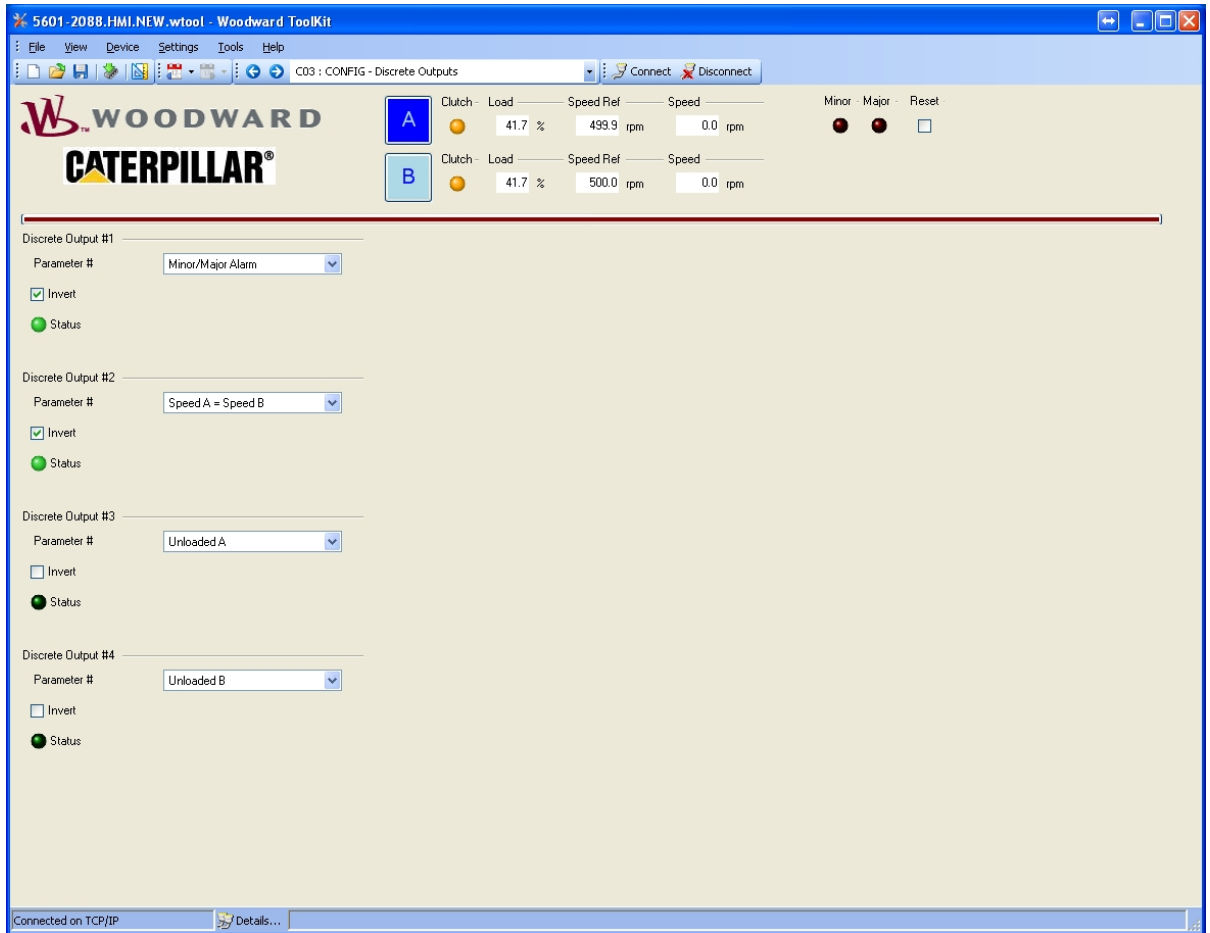
Invert

Check **Invert** to change the operation from Normally Open, Close for Action into Normally Closed, Open for Action for a digital input.

Status

LED is lit for an active function.

C03 : CONFIG – Discrete Outputs

**Parameter #**

For each Discrete Output, select from following list:

- Fixed Value
- Minor Alarm
- Major Alarm
- Minor/Major Alarm
- Test Mode Active
- Analog Input Fault Channel #1
- Analog Input Fault Channel #2
- Analog Input Fault Channel #3
- Analog Input Fault Channel #4
- Clutch A in
- Clutch B in
- Unloaded A
- Unloaded B
- Load Sharing Active
- Speed A = Speed B

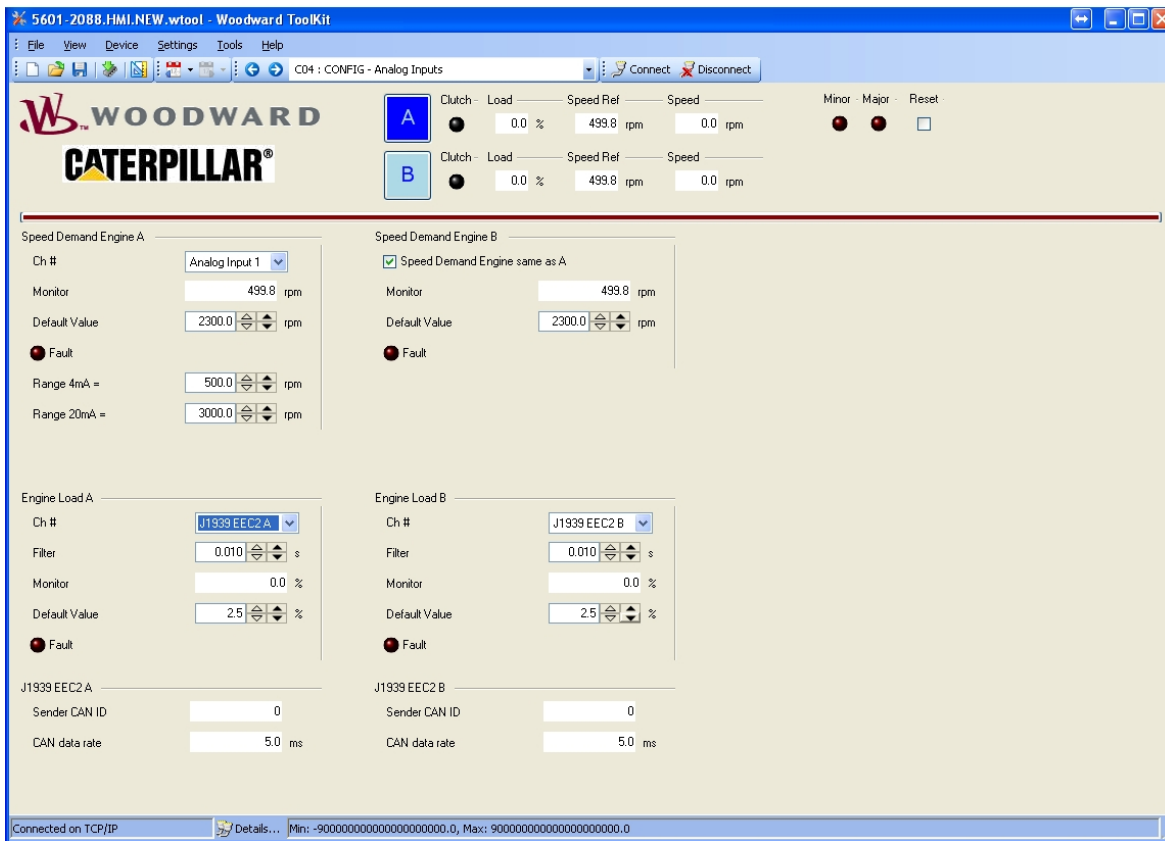
Invert

Check **Invert** to change the operation from Normally De-energized into Normally Energized.

Status

LED is lit when the selected parameter is active.

C04 : CONFIG – Analog Inputs

**Ch#**

Select between Fixed Value, Analog Input 1 .. 4 for a function.
For Engine Load A/B, additional options are J1939 EEC2 A/B.

Monitor

Monitor the Speed Demand or Engine Load.

Fault

LED will be lit when a 4–20 mA input is out of range or the J1939 CAN fails.

Range 4–20 mA =

Set the Speed Demand or Engine Load 4–20 mA value in engineering units.

Default Value

Default/backup value for Speed Demand or Engine Load when the input fails.

Speed Demand Engine same as A

Check to use a single speed demand input for both engine A and B.

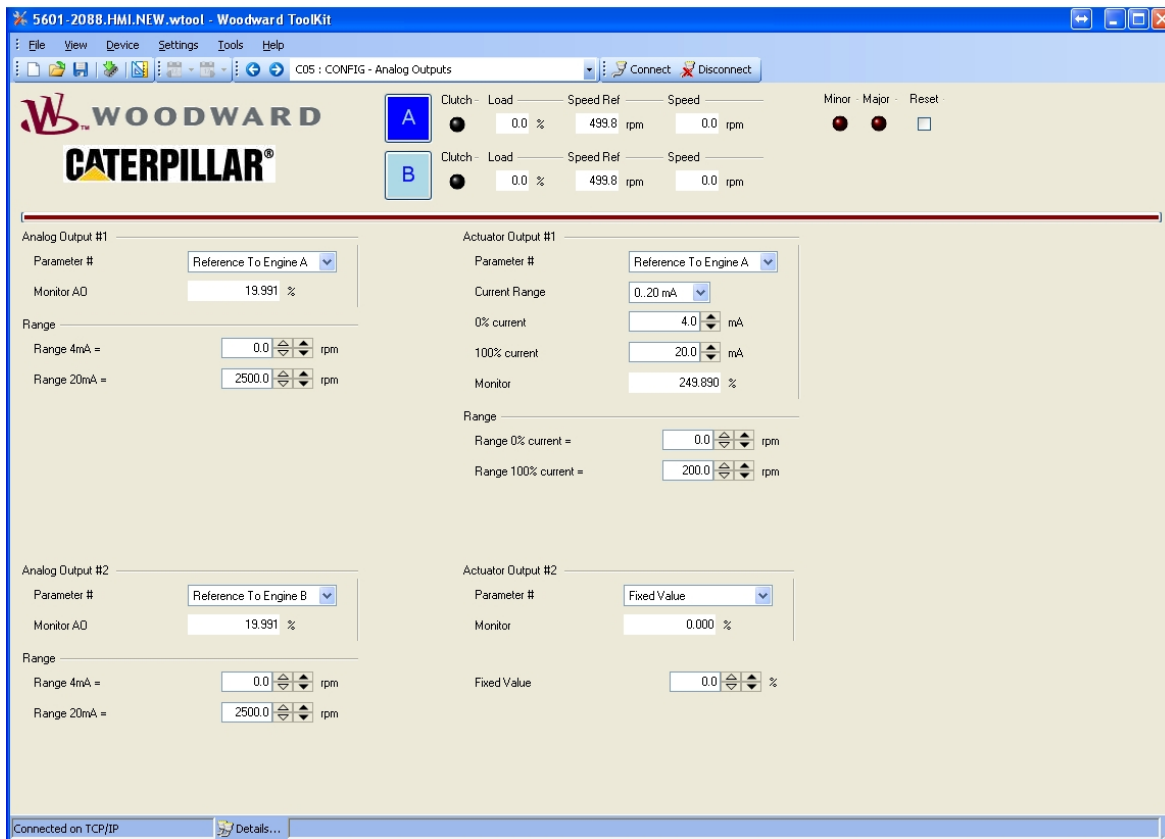
Sender CAN ID

Shows CAN ID of the device sending J1939 message EEC2 A/B

CAN data rate

Shows the cyclic update time for J1939 message EEC2 A/B.
J1939 specification lists 50 ms for J1939 message EEC2

C05 : CONFIG – Analog Outputs

**Parameter #**

For each Analog Output, select from following list:

- Fixed Value
- Reference To Engine A
- Reference To Engine B
- Total Load
- Analog Input 1
- Analog Input 2
- Analog Input 3
- Analog Input 4
- PID Output

Range 4–20 mA =

Set the engineering units for the selected analog output.

Monitor AO

Displays the selected output value, as a percentage of the 4–20 mA output range.

Actuator Output #1 can be selected to have a range of **0–20 mA** or as **0–200 mA**.

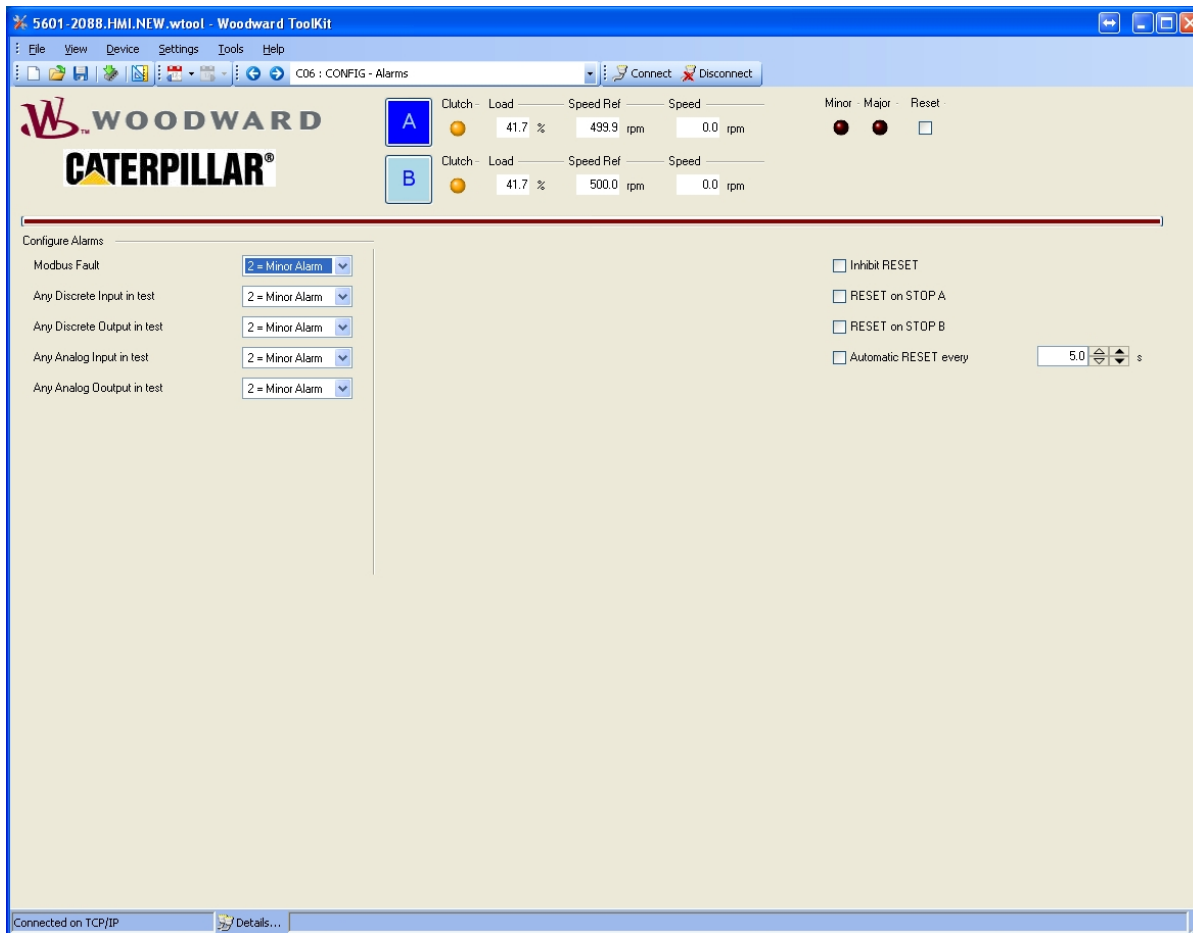
Range 0% current

Sets engineering units for the analog output, corresponding to **0% current**.

Range 100% current

Sets engineering units for the analog output, corresponding to **100% current**.

C06 : CONFIG – Alarms



Select either:

1 = No Alarm, 2 = Minor Alarm, 3 = Major Alarm for the defined alarm events.

Inhibit RESET

When checked, any reset command (ToolKit, Contact Input) will be disabled.

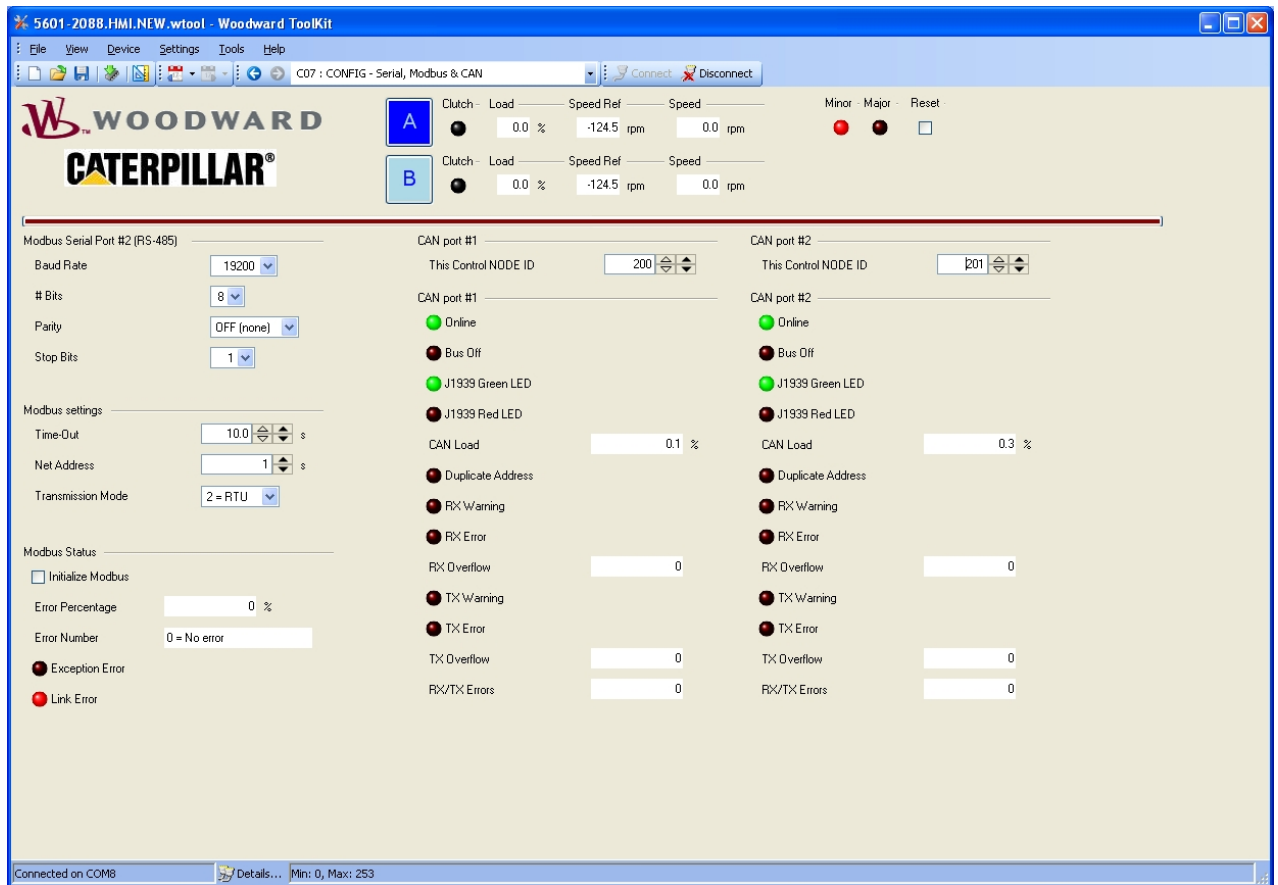
RESET on STOP A/B

When checked, will issue a reset command on a **STOP A/B** command.

Automatic RESET every XX s.

When checked, a reset command will be automatically issued every **XX** seconds.

C07 : CONFIG – Serial, Modbus & CAN



For the Modbus serial Port, the following parameters can be set:

Baud Rate	Adjustable between 110 and 115200 bits/s
# Bits	7 or 8
Parity	OFF (none), ODD or EVEN
Stop Bits	1, 1.5 or 2
Time-Out	Time-Out between 0 and 100 s. When expired, a Modbus alarm will be active
Net Address	Select the Modbus Net Address between 1 and 247
Transmission Mode	Select either 1 = ASCII or 2 = RTU
Initialize Modbus	Check and uncheck to reset the Modbus communications

For the CAN ports #1 & #2, the following parameters can be set:

Control NODE ID	Sets the J1939 CAN node ID for the 733 for each CAN network port.
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IMPORTANT

Most of the CAN settings require a reboot of the control for them to take effect. SAVE tunables prior to rebooting the control!

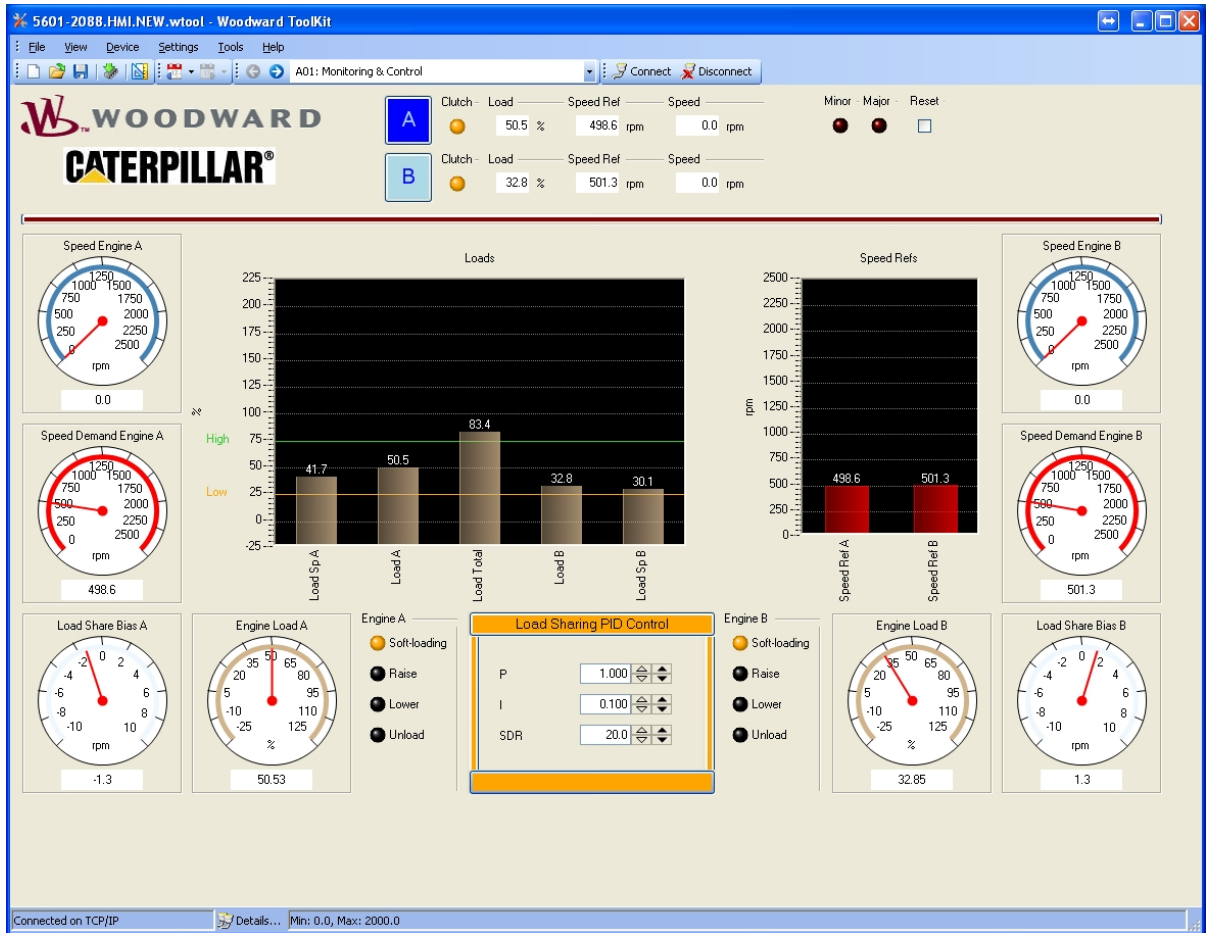
ToolKit Operation & Service Pages

The following ToolKit Operation & Service Pages are available:

- **A01 : Monitoring & Control**
- **A02 : Load Sharing & Clutch**

- **B01 : Diagnostics - Alarms**
- **B02 : Diagnostics – System Information**

A01 : Monitoring & Control



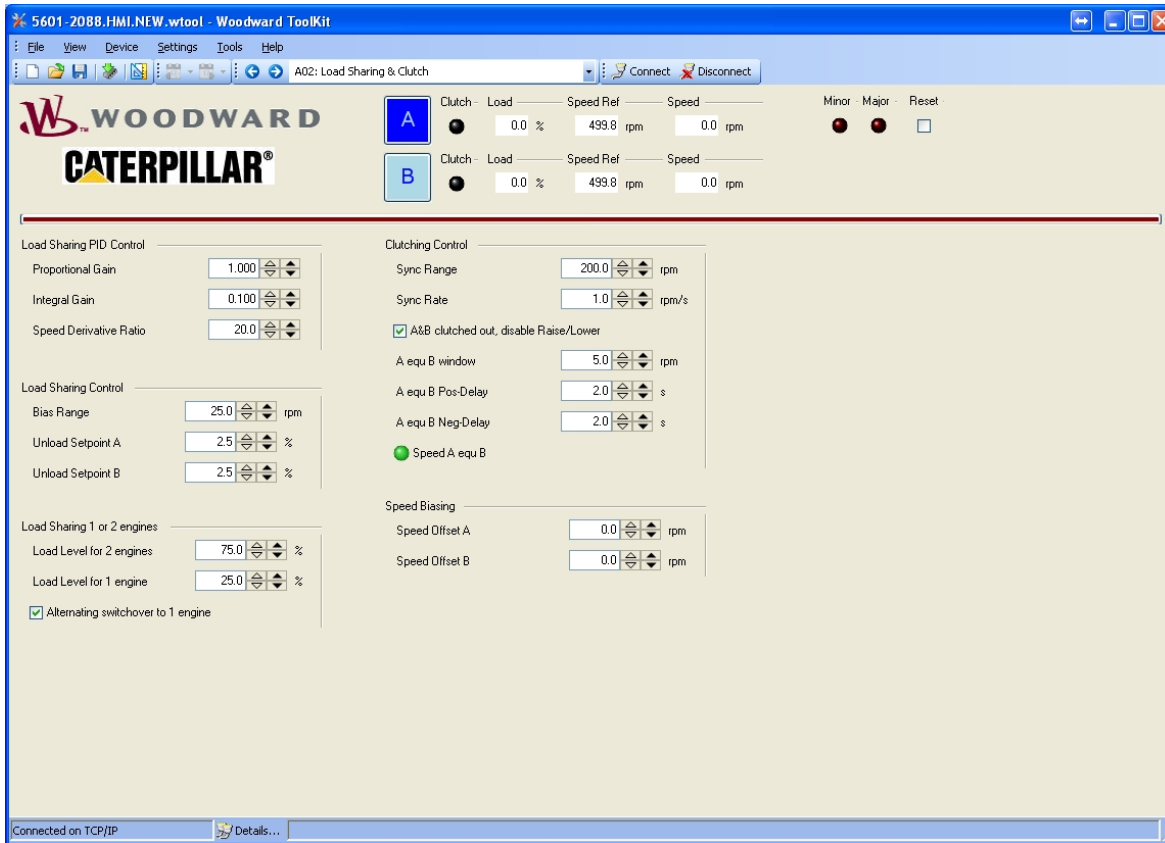
This is the main page showing details for both engines, clutches & load sharing.

Load Sharing PID control:

- P** Proportional Gain [0 ... 100]
- I** Integral Gain [0 ... 50]
- SDR** Speed Derivative Ratio [0 ... 100%]

Application Note 83402, PID Control gives more information how to adjust a PID.

A02 : Load Sharing & Clutch



P	Proportional Gain	[0 ... 100]
I	Integral Gain	[0 ... 50]
SDR	Speed Derivative Ratio	[0 ... 100%]

Application Note 83402, PID Control gives more information how to adjust a PID.

Bias Range Maximum load-sharing bias +/- that will be applied to each engine's speed reference output [0 ... 2000 rpm]

Unload Setpoint A/B Unload setpoint [0 ... 100%]

Load Level for 2 engines Above this total load level, both engines will load-share together [0.. 200%]

Load Level for 1 engine Below this total load level, only one engine will take all load, other will unload [0.. 200%]

Alternating switchover to 1 engine Check to enable the last engine that clutched in, to take all load when the total load drops below the **Load Level for 1 engine** value. Uncheck to enable the first engine that clutched in, to take all load when total load drops below the **Load Level for 1 engine** value.

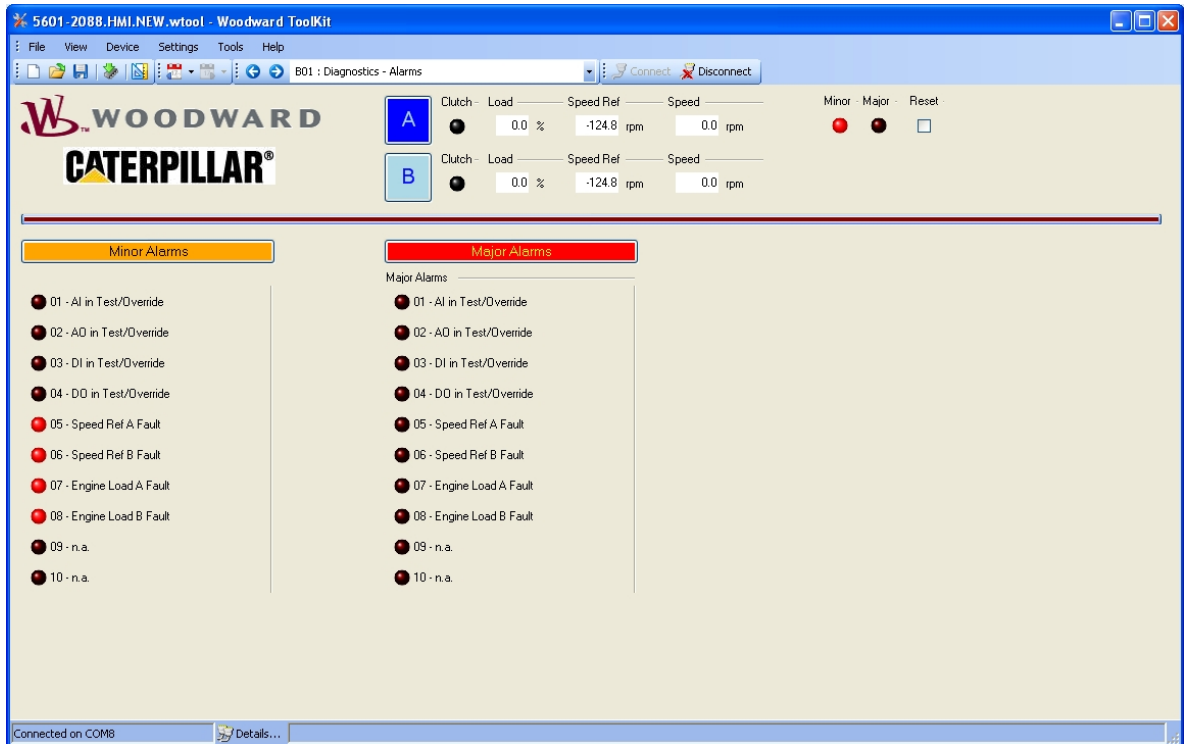
Sync Range Synchronization Raise/Lower range for engine to be clutched in [0 ... 2000 rpm]

Sync Rate Synchronization Raise/Lower rate for engine to be clutched in [0 ... 200 rpm/s]

A equ B window Speed difference window for engine A and B for clutch permissive [0 ... 250 rpm]

A equ B Pos/Neg-Delay Time delays for clutch permissive On/Off delays. [0 ... 60 s]

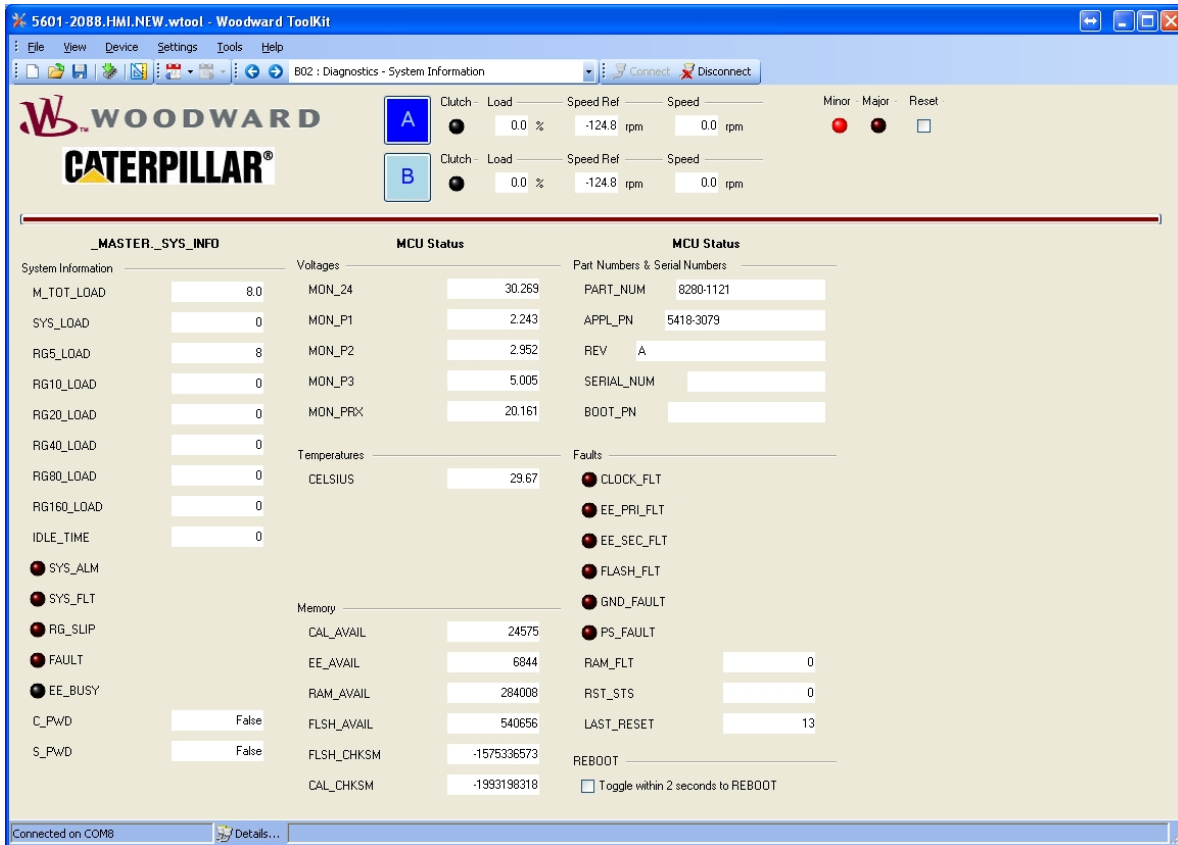
Speed Offset A/B Speed Ref A/B output offset [-250 ... 250 rpm]

B01 : Diagnostics – Alarms

The Alarm page displays active and latched alarms with red LED's.

Minor Alarms will not necessarily interrupt running operation mode of the load-sharing control.

B02 : Diagnostics – System Information

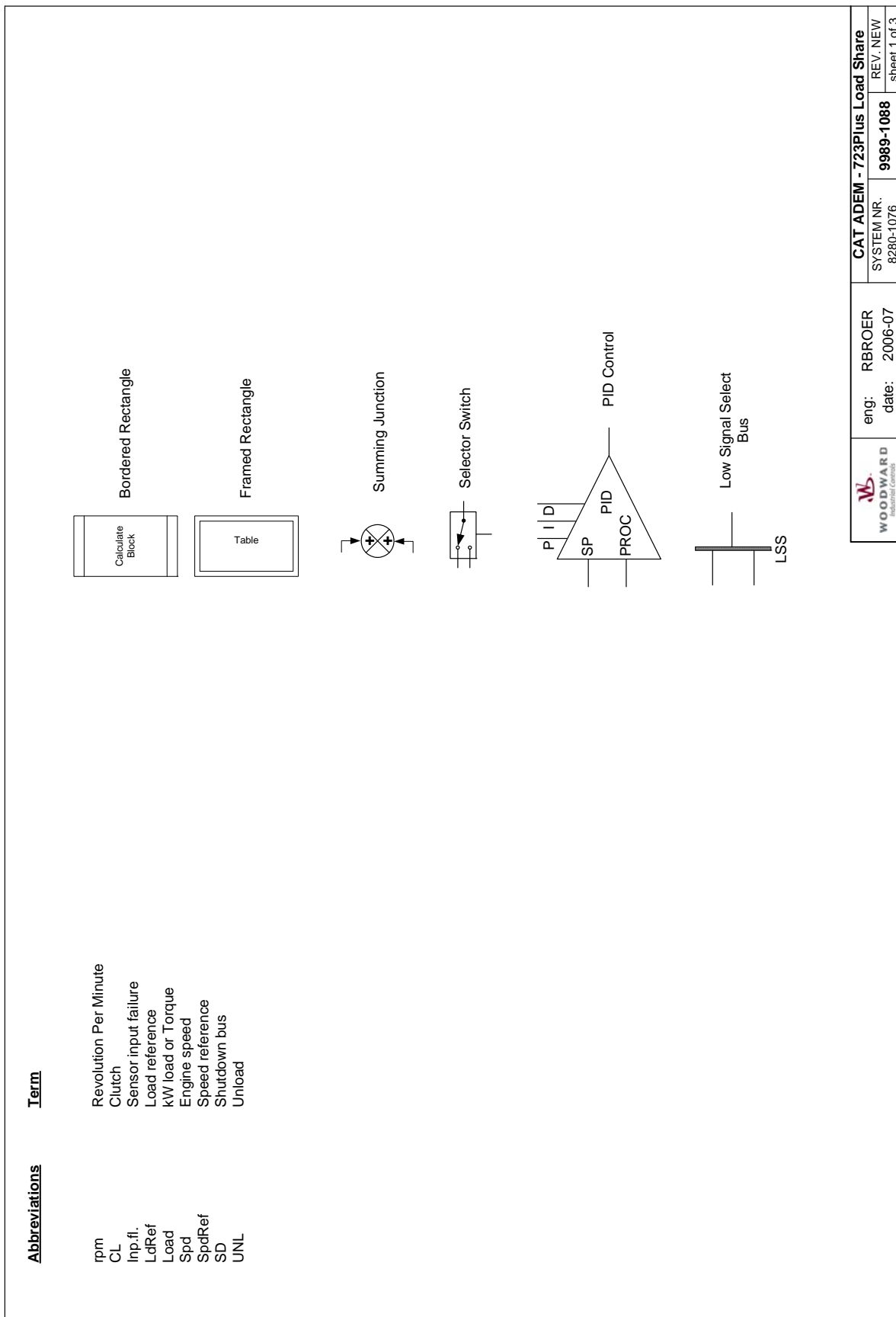


The System Information page will typically be not needed for normal operation of the EFI driver.

It contains low level detail data, that may be of use to Woodward.

Chapter 5. Functional Block Diagram

This chapter contains Functional Block Diagram 9989-4123.




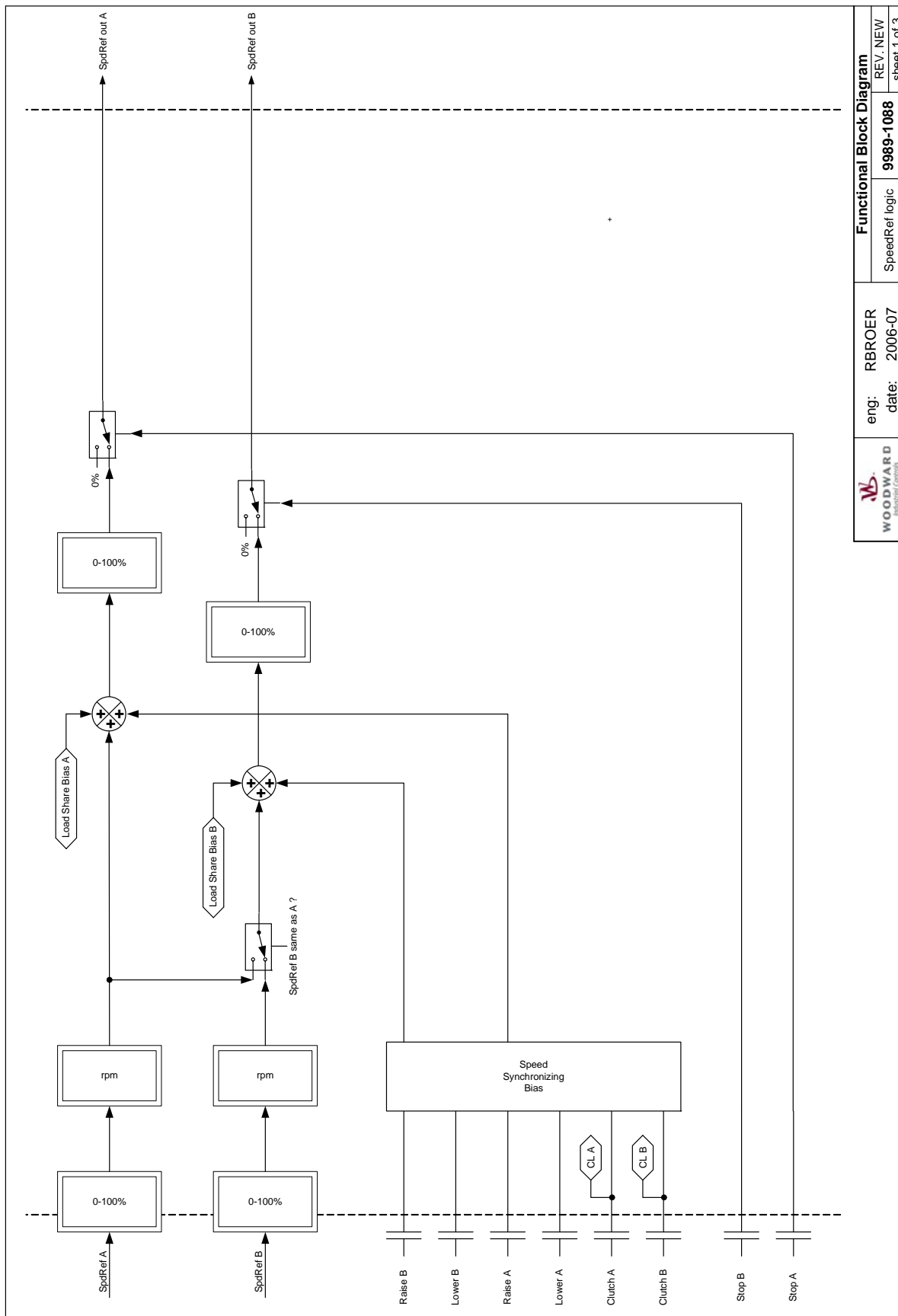
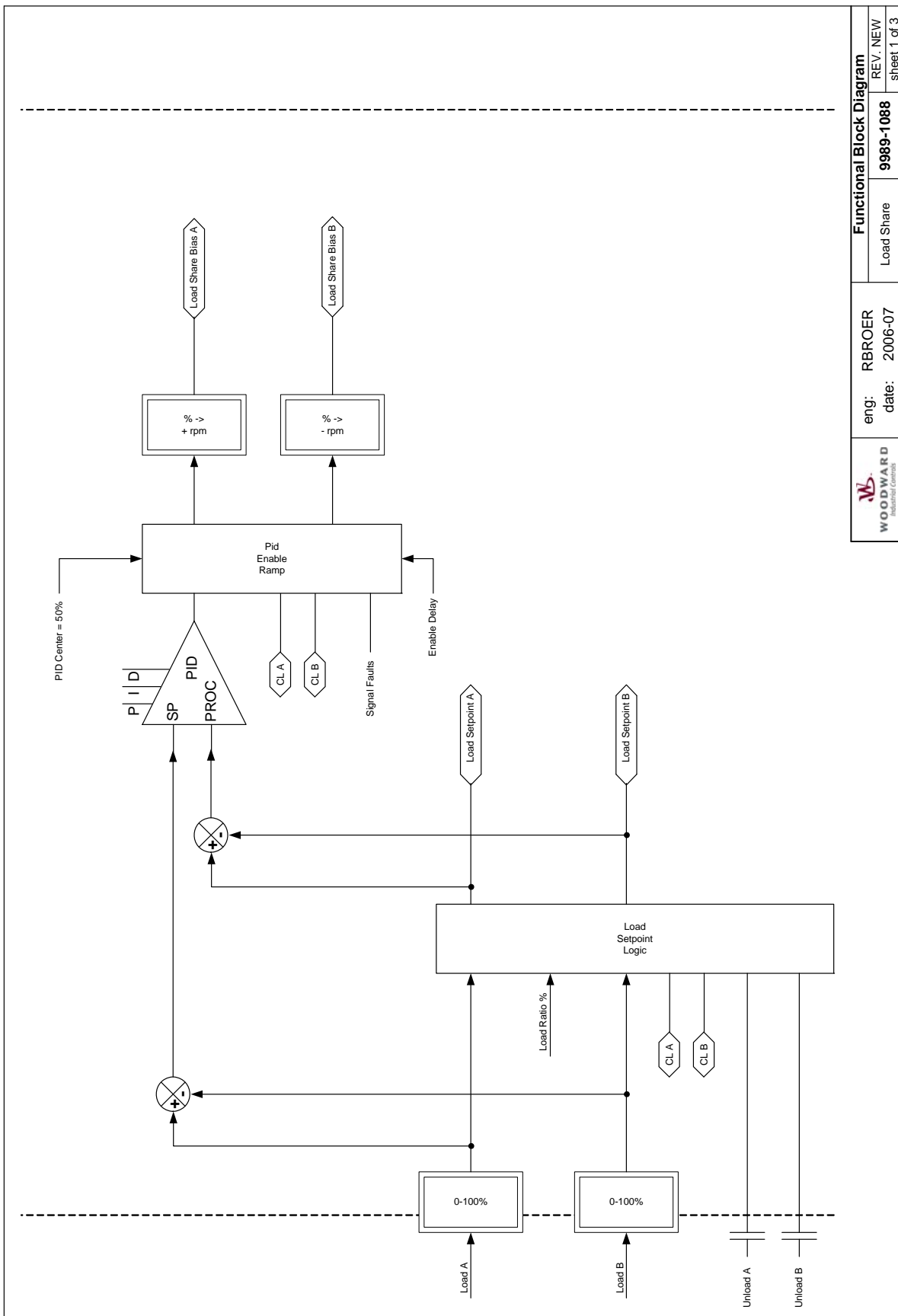
 WOODWARD Electrical Controls	eng: RBROER date: 2006-07	CAT ADEM - 723Plus Load Share SYSTEM NR. 8280-1076 REV. NEW 9989-1088	sheet 1 of 3
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Figure 5-1a. Functional Block Diagram 9989-4123



 WOODWARD Performance Controls	eng: RBROER	Functional Block Diagram REV. NEW sheet 1 of 3
	date: 2006-07	
SpeedRef logic		9989-1088

Figure 5-1b. Functional Block Diagram 9989-4123



 WOODWARD Industrial Controls	eng: RBROER date: 2006-07	Functional Block Diagram REV. NEW sheet 1 of 3
	Load Share 9989-1088	

Figure 5-1c. Functional Block Diagram 9989-4123

Chapter 6.

Modbus Signals List

This chapter lists the Modbus List with 733 Load Sharing Control/Cat ADEM system parameters which are available for monitoring by external systems (SCADA, PLC etc.)

The 733 Modbus is always “slave”.

Boolean Writes

Address	Description
0:0001	Not Applicable

Boolean Reads

Address	Description
1:0001	Discrete Input ch#1
1:0002	Discrete Input ch#2
1:0003	Discrete Input ch#3
1:0004	Discrete Input ch#4
1:0005	Discrete Input ch#5
1:0006	Discrete Input ch#6
1:0007	Discrete Input ch#7
1:0008	Discrete Input ch#8
1:0009	Engine A Clutch
1:0010	Engine B Clutch
1:0011	Engine A Raise
1:0012	Engine A Lower
1:0013	Engine B Raise
1:0014	Engine B Lower
1:0015	Engine A Unload
1:0016	Engine B Unload
1:0017	Engine A Unload
1:0018	Engine B Unload
1:0019	Reset Input
1:0020	
1:0021	
1:0022	
1:0023	Relay Out #1
1:0024	Relay Out #2
1:0025	Relay Out #3
1:0026	Relay Out #4
1:0027	Minor Alarm active
1:0028	Major Alarm active
1:0029	Any IO in Test/Override
1:0030	Load Sharing is active
1:0031	Engine A softload active
1:0032	Engine B softload active
1:0033	Analog input ch#1 fault
1:0034	Analog input ch#2 fault

Address	Description
1:0035	Analog input ch#3 fault
1:0036	Analog input ch#4 fault
1:0037	AI in Test/Override Minor Alarm
1:0038	AO in Test/Override Minor Alarm
1:0039	DI in Test/Override Minor Alarm
1:0040	DO in Test/Override Minor Alarm
1:0041	Speed-Ref A Minor Alarm
1:0042	Speed-Ref B Minor Alarm
1:0043	Engine Load A Minor Alarm
1:0044	Engine Load A Minor Alarm
1:0045	Modbus fault Minor Alarm
1:0046	AI in Test/Override Major Alarm
1:0047	AO in Test/Override Major Alarm
1:0048	DI in Test/Override Major Alarm
1:0049	DO in Test/Override Major Alarm
1:0050	Speed-Ref A Major Alarm
1:0051	Speed-Ref B Major Alarm
1:0052	Engine Load A Major Alarm
1:0053	Engine Load A Major Alarm
1:0054	Modbus fault Major Alarm
1:0055	Speed-A equal to B

Analog Reads

Address	Description	Multiplier
3:0001	Analog input ch#1 [%]	100
3:0002	Analog input ch#2 [%]	100
3:0003	Analog input ch#3 [%]	100
3:0004	Analog input ch#4 [%]	100
3:0005	Analog output ch#1 [%]	100
3:0006	Analog output ch#2 [%]	100
3:0007	Analog output ch#3 [%]	100
3:0008	Analog output ch#4 [%]	100
3:0009	Speed-Reference A Input [rpm]	1
3:0010	Speed-Reference B Input [rpm]	1
3:0011	Engine Load A Input [%]	100
3:0012	Engine Load B Input [%]	100
3:0013	Total Engine Load [0~200%]	100
3:0014	Engine A Load Setpoint [%]	100
3:0015	Engine B Load Setpoint [%]	100
3:0016	Load Ratio A versus B [%]	100
3:0017	Load Share PID output [%}	100
3:0018	Load Share Bias output [rpm}	100
3:0019	Load Share Bias A output [rpm}	100
3:0020	Load Share Bias B output [rpm}	100
3:0021	Synchronizing Bias A output [rpm}	100
3:0022	Synchronizing Bias B output [rpm}	100
3:0023	Speed-Reference A output [rpm]	1
3:0024	Speed-Reference B output [rpm]	1
3:0025	Speed-Reference A final output [%]	100

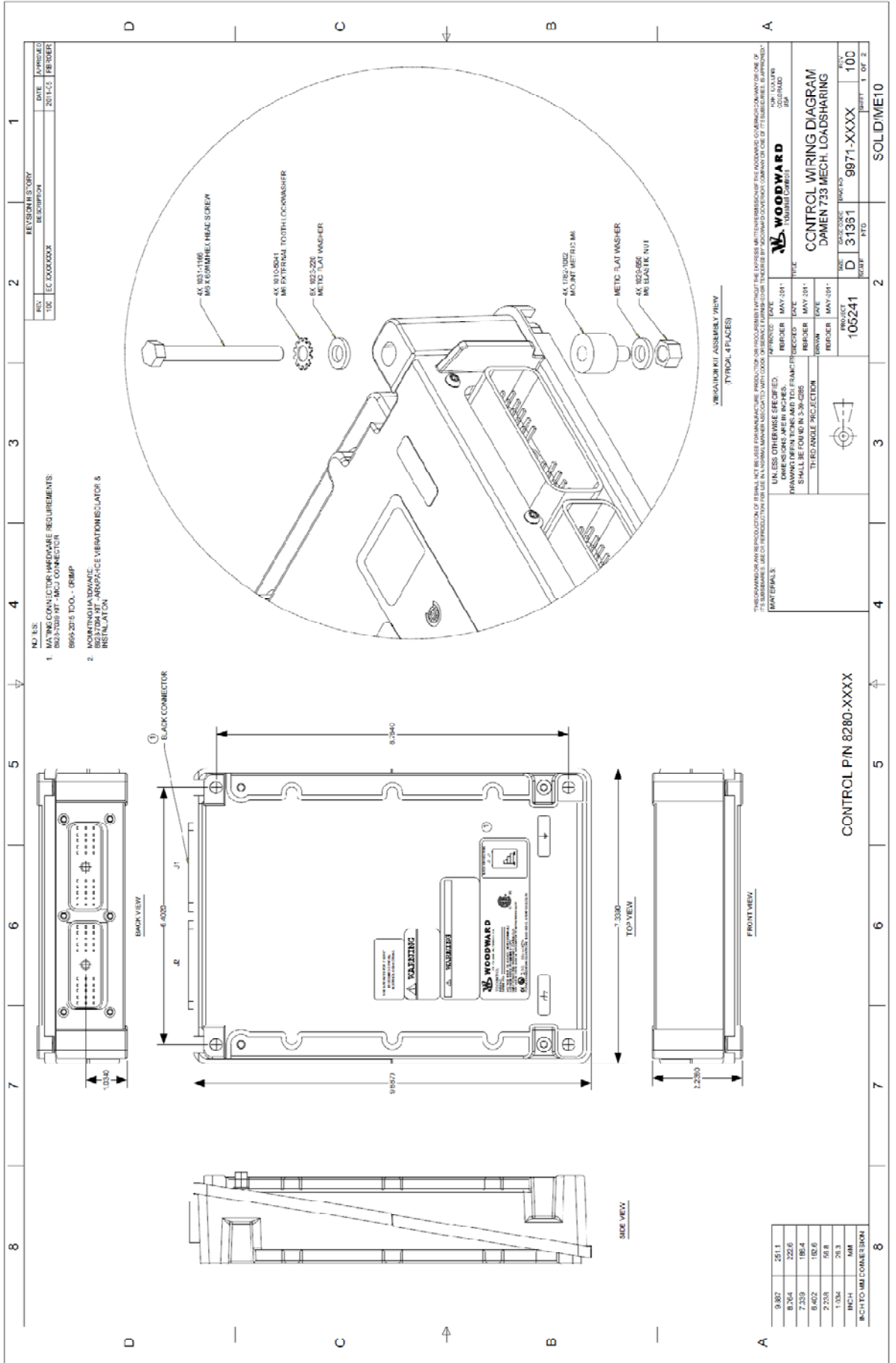
Address	Description	Multiplier
3:0026	Speed-Reference B final output [%]	100
3:0027	Engine Speed A [rpm]	1
3:0028	Engine Speed B [rpm]	1

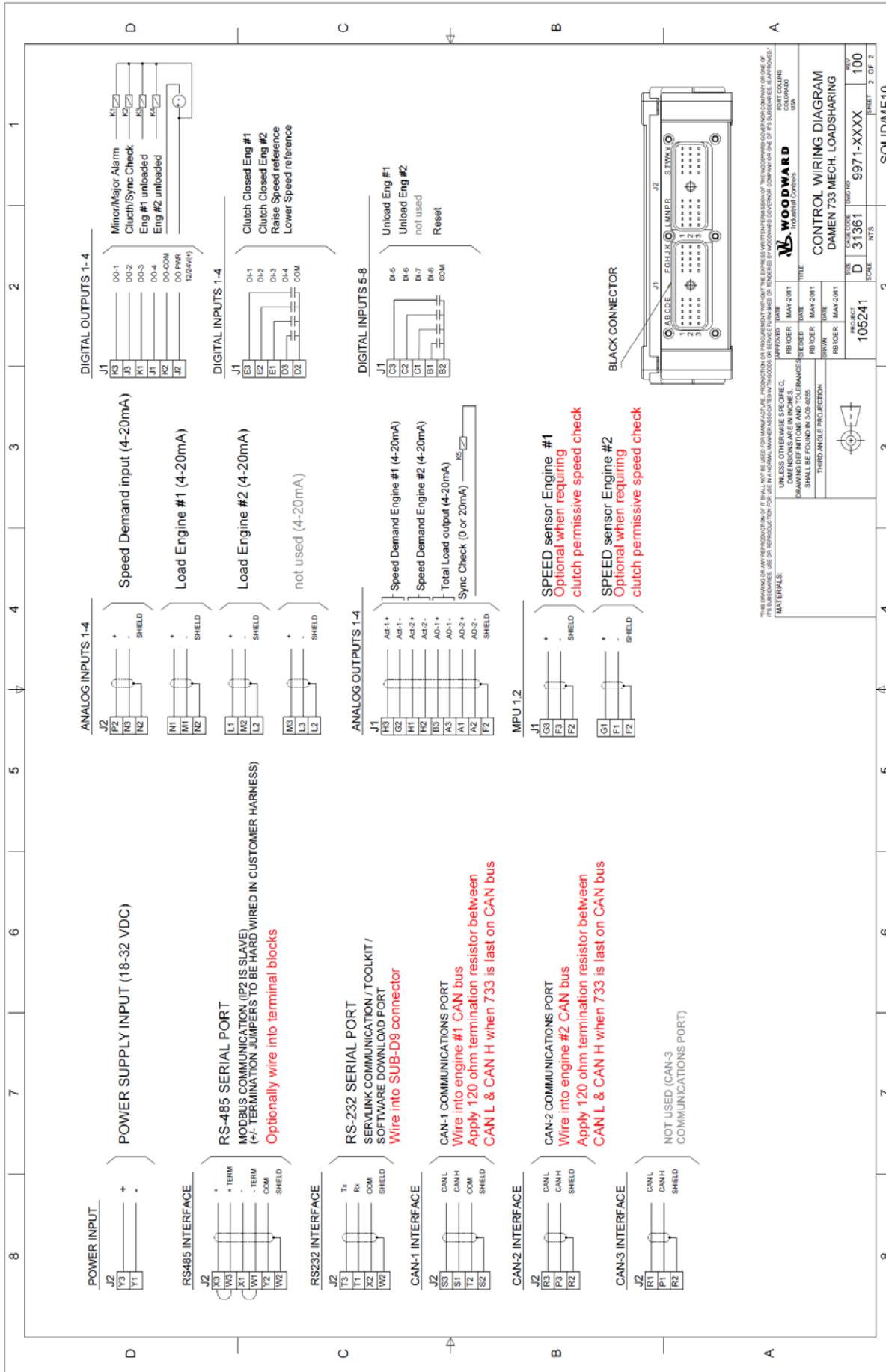
Analog Writes

Address	Description	Multiplier
4:0001	Not Applicable	

Chapter 7. Wiring Diagram

This chapter contains a typical wiring diagram for the 733.





Chapter 8.

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 by searching on "25225" or "*worldwide directory*" at:

www.woodward.com/searchpublications.aspx

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.

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	+49 (0) 21 52 14 51
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	+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
The Netherlands	+31 (23) 5661111
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

You can also contact the Woodward Customer Service Department or consult our worldwide directory (search on "**25225**" or "**worldwide directory**" at: www.woodward.com/searchpublications.aspx) 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 _____

Engine/Turbine Model Number _____

Manufacturer _____

Number of Cylinders (if applicable) _____

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

Rating _____

Application _____

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 _____

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

Please reference publication **26608**.



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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.