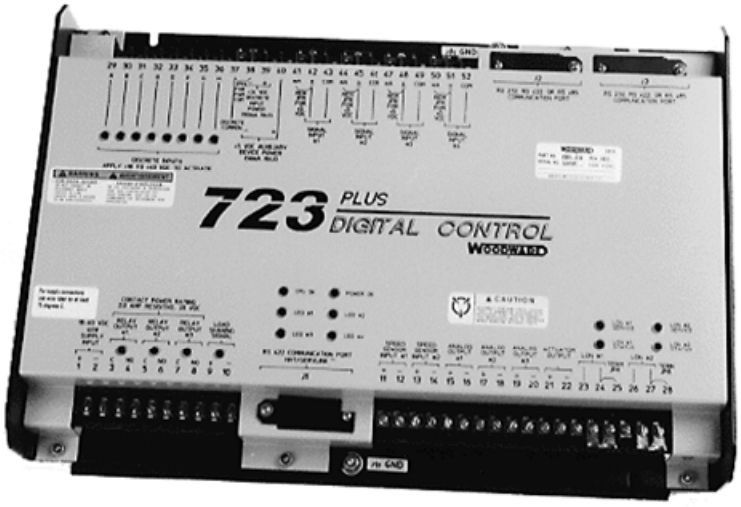
WOODWARD

Product Manual 91623
(Revision NEW)
Original Instructions



723PLUS Standard Generator Control
LON Load Sharing

8280-1099

Woodward manual 02877 is also required.

Application Manual

General Precautions

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

Practice all plant and safety instructions and precautions.

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

Revisions

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, on the *publications page* of the Woodward website:

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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 *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

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

Contents

Illustrations and Tables

Warnings and Notices

Important Definitions

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

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

⚠WARNING

Overspeed / Overtemperature / Overpressure

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

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

⚠WARNING

Personal Protective Equipment

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

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

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

⚠WARNING

Start-up

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

⚠WARNING

Automotive Applications

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

NOTICE

Battery Charging Device

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

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

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

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

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

Follow these precautions when working with or near the control.

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

List of Abbreviations

This is a list of abbreviations and terminology used in this manual:

AGLC	Automatic Generator Loading Control
ALM	Alarm—a warning signal
CB	Circuit Breaker
CPU	Central Processing Unit
DCS	Digital Control System
GCB	Generator Circuit Breaker
HSS	Depends on the context: —High speed shaft of the gearbox —High signal selector in software
kVar	Reactive Power
kW	Kilowatts
LED	Light Emitting Diode
LON	Woodward Local Operator Network
LOP	Local Operator Panel
LS	Load Sharing
LSL	Load Sharing Lines
LSS	Depends on the context: —Low speed shaft of the gearbox —Low signal selector in software
MPU	Magnetic Pick-up sensor
MSB	Main Switch Board
mA	Milliamps
mV	Millivolts
NC	Normally Closed
NO	Normally Open
PC	Personal Computer
PCB	Printed Circuit Board
PID	Proportional Integration Derivative
PLC	Programmable Logic Controller
PS	Port Side
PSU	Power Supply Unit
PTO	Power Take Off
rpm	Revolutions per Minute (can also be expressed as “1/s”)
RPS	Real Power Sensor
SD	Shutdown
SB	Starboard
SPM-A	Woodward Synchronizer Power Management Analog
TB	Terminal Block
TBR	Tie Breaker
UPCI	Universal PC Interface
Vac	Volts (alternating current)
Vdc	Volts (direct current)

Chapter 1.
General Information

Introduction

The Woodward part numbers belonging to the “Standard Generator Control LON Load Sharing” are the following:

- **System:** **8280-1099**
- Hardware: 723PLUS Low Voltage: 9906-619
- Application software: 9927-1680

The following drawings belong to the system:

- Functional block diagram: 9971-4050

The Woodward “Standard Generator Control LON Load Sharing” has the following functionality:

- Speed control (isochronous & droop)
- Load sharing control (via LON communication network), with up to 2 interconnect tie-breakers (3 bus-segments)
- Load sharing control (via legacy Load-Sharing lines)

Features:

- Configurable I/O ranges and assignment to I/O channels
- Multi dynamics
- Generator breaker & Speed derivative load rejection
- Charge air pressure fuel limiter
- Start fuel limiter
- Remote base-load setpoint
- SERVICE and CONFIGURE Menus for tuning and monitoring Hand Held Programmer (723PLUS serial port J1), Watch Window, and Servlink (723PLUS serial port J2, J1)
- Test/Override functionality for I/O signals
- Modbus® * communication available with extensive list of signals (723PLUS serial port J3)
- Communications are prepared for possible future graphic HMI software (723PLUS serial port J2), for instance Woodward Toolkit.

*—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 downloaded with the following link: **www.woodward.com/publications**.

Manual 02877, *723PLUS Digital Control Hardware*
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*
Product Specification 03202, *Woodward Watch Window Standard*
Application Note 83402, *PID Control*
TSP 14246, *Standard Generator Control LON Load Sharing*

Chapter 2.
Inputs and Outputs

Speed Sensor Inputs

The following analog input signals have been defined for this control:
- Engine Speed-Sensor Input #1
- Engine Speed-Sensor Input #2

These speed sensor inputs can be either passive (MPU) or active (PROXIMITY); The respective jumpers on the 723PLUS shall be set accordingly, see manual 02877.

Using the CONFIGURE Menu, the number of teeth for these inputs can be adjusted. Also the speed sensing strategy can be chosen, like HSS selection, Torsional Filtering, Master/Slave.

Analog Inputs

The following analog input signals have been defined for this control:
- Remote Speed Setpoint (4–20 mA)
- Synchronizer Speed Bias (–5 V ~ +5 V)
- Charge Air pressure (4–20 mA)
- Generator Load input (4–20 mA)
- Load Limiter input (4–20 mA)
- Remote Base-load Setpoint (4–20 mA)
- Reactive Power input
- Fuel Limiter input (4–20 mA)

Using the CONFIGURE Menu, these inputs can be enabled/disabled and assigned to any of the 4 analog inputs available on the 723PLUS. It is also possible to map these analog inputs to Modbus addresses, so they can be sent from an external PLC or DCS system.

Most of these signals can be configured for minor or major alarms when the signals fails (goes out of range).

Remote Speed Setpoint (4–20 mA)

The remote speed reference will be activated when both the Raise Speed and the Lower Speed contact inputs are closed, and it needs to be enabled in the DEBUG mode. Currently, this control feature is not used.

Synchronizer Speed Bias (–5 V ~ +5 V)

The synchronizer speed bias input is a bi-polar voltage input. The Woodward SPM-A synchronizer makes a suitable match for this control feature.

The voltage will be scaled into a bi-polar speed bias (rpm), with a corresponding “Synchronizer Gain” setting in the SERVICE Menus.

By default the “Synchronizer Gain” is 1.0 and the bias range is ±2% of rated speed reference.

Charge Air Pressure (4–20 mA)

The Charge Air Pressure (Boost pressure) input allows for a fuel limiter based on this pressure, to prevent overfueling and therefore smoke.

This fuel limiter is a multi-point curve, which can be adjusted in the SERVICE Menus.

Generator Load Input (4–20 mA)

The Generator Load must be a real power measurement input. The Woodward RPS is a suitable choice for this control input.

The generator load input is used extensively in the control for load sharing and droop operation.

Load Limiter Input (4–20 mA)

The Load Limiter input will define an active maximum when operating in load control only. It is not used in speed control or droop operation.

Remote Base-Load Setpoint (4–20 mA)

The Remote Base-Load Setpoint will define the load reference when operating in base-load control only. It is not used in speed control or droop operation.

The base-load control mode is activated when the control is in load control mode and both the Raise Load and the Lower Load contact inputs are closed.

Reactive Power Input (4–20 mA)

The Reactive Power input can be monitored in the SERVICE Menus, and is sent over Modbus and can be output on an analog output channel.

Fuel Limiter Input (4–20 mA)

The Fuel Limiter input will define an active fuel maximum, which is always active.

Analog Outputs

The following analog signals can be output on this control:

- Control PID out
- Control LSS out
- Control Actuator out
- Final Speed Reference
- Load Reference
- Selected Speed
- Speed Sensor #1
- Speed Sensor #2
- Remote Speed Reference
- Synchronizer Bias
- Charge Air Pressure
- Load
- Load Limiter
- Remote Base-Load Reference
- Reactive Power
- Fuel Limiter
- Average Load on this engine’s bus segment(s)
- Total Load-Sharing Load on all bus segments
- Total Load on all bus segments

Using the CONFIGURE Menu, these signals can be assigned to any of the 4 analog outputs available on the 723PLUS.

These analog signals are also available on the Modbus address list.

Control PID Out
This outputs the speed control's PID value [%].

Control LSS Out
This outputs the speed control's LSS value [%], which in non-limited steady state operation will be the same as the speed control's PID value.

Control Actuator Out
This outputs the speed control's Actuator output signal [%].

Final Speed Reference
This outputs the final speed reference [rpm]. This value is the main speed reference ramp, with all biases applied to it, like droop bias, synchronizer bias, load sharing control bias.

Load Reference
This outputs the main load reference ramp [%]. When not in load-sharing mode, this ramp will follow the actual load input.

Selected Speed
This outputs the selected speed value [rpm], which is used throughout this speed control system.

Speed Sensor #1
This outputs speed sensor #1 [rpm].

Speed Sensor #2
This outputs speed sensor #2 [rpm].

Remote Speed Reference
This copies and outputs the remote speed setpoint [rpm] input.

Synchronizer Bias
This copies and outputs the Synchronizer Bias [rpm] input.

Charge Air Pressure
This copies and outputs the Charge Air Pressure [bar] input.

Load
This copies and outputs the Generator Load input [%] or the calculated load (actuator position) when the input failed.

Load Limiter
This copies and outputs the Load Limiter [%] input

Remote Base-Load Reference
This copies and outputs the Remote Base-Load [%] input.

Reactive Power
This copies and outputs the Reactive Power [kVar] input.

Fuel Limiter
This copies and outputs the Fuel Limiter [%] input.

Average Load on This Engine's Bus Segment(s)
This outputs the average Load [%] on the bus segment for which this control has been defined on.

Total Load-Sharing Load on All Bus Segments
This outputs the total Load [%] of all engines participating in Load-Sharing mode on the 3 bus segments.

Total Load on All Bus Segments
This outputs the total Load [%] of all engines on all 3 bus segments, impendent of their operation mode.

Discrete Inputs

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

- Reset
- Run
- Stop
- Raise Speed
- Lower Speed
- Raise Load
- Lower Load
- Unload
- Base-Load
- Remote Speed
- Droop
- Isochronous
- Idle
- Rated
- GCB closed
- TBR #1 closed
- TBR #2 closed
- LON Reset command
- Dynamics #2 select
- Dynamics #3 select

Using the CONFIGURE Menu, these inputs can be enabled and assigned to any of the 8 discrete inputs available on the 723PLUS. It is also possible to map these digital inputs to Modbus addresses, so they can be sent from an external PLC or DCS system.

Each digital input can be set as close or open for action, so it is possible to map Run and Stop to the same contact input channel, one with open for action, and the other with close for action.

Reset
The reset can be used to reset Minor and Major Alarms. "Software Reset" from the SERVICE Menus performs the same function.

Run
Starts the engine if no Major Alarms are active.

Stop
Stops the engine, and overrides the Run action if selected.

Raise Speed
Raises the speed reference ramp. Active in Speed Control mode when above Idle speed. It overrides the Rated Speed feature.

Lower Speed
Raises the speed reference ramp. Active in Speed Control mode when above Idle speed. It overrides the Rated Speed feature.

Raise Load
Raises the load reference ramp. Active in Load Control mode and needs to be enabled in DEBUG mode. Currently, this control feature is not used.

Lower Load
Raises the load reference ramp. Active in Load Control mode and needs to be enabled in DEBUG mode. Currently, this control feature is not used.

Unload
Ramps the load reference ramp down to the Unload Setpoint with the Unload rate. Active in Load Control mode and overrides Base-Load or Load-Sharing mode.

Base-Load
The load reference ramp will follow the Remote Base-Load input. Active in Load Control mode.

This same function can also be enabled by closing both the Raise Load and Lower Load inputs.

Remote Speed
The speed reference ramp will follow the Remote Speed input. Active in Speed Control mode.

The same function can also be enabled by closing both the Raise Speed and Lower Speed inputs.

Droop
Droop mode selects Speed Control mode, and when the GCB is closed, it will apply a negative droop bias [rpm] based on the Load input.

If the Load input fails, the load will be calculated on actuator position; known as actuator droop. In the Service Menu the No Load and Full Load actuator positions need to be set correctly.

Isochronous
Isochronous mode selects Load Control mode when the GCB is closed. When a LON fault occurs, the control switches to Speed Control mode and Droop mode, even though this contact is closed.

Idle
Selects Idle speed when the GCB is open.

Rated
Selects Rated speed when the GCB is open.

GCB Closed
Feedback of the generator circuit breaker status. This signal must be as fast as possible for best load rejection performance.

TBR #1 Closed
Feedback of the tie-breaker #1 status.

TBR #2 Closed
Feedback of the tie-breaker #2 status.

LON Reset Command
Reset command for latched LON communication errors.

Dynamics #2 Select
This will select the dynamics set #2 for the PID speed control. It will override dynamics set #1, which is default.

Dynamics #3 Select
This will select the dynamics set #3 for the PID speed control. It will override dynamics set #2 and dynamics set #1 (which is default).

Relay Driver Outputs / LED driver Outputs

The following discrete signals can be output on this control:

- Minor Alarm
- Major Alarm
- Minor or Major Alarm
- Any I/O in Test/Override
- Analog Input #1 fault
- Analog Input #2 fault
- Analog Input #3 fault
- Analog Input #4 fault
- GCB closed
- TBR #1 closed
- TBR #2 closed
- Isochronous
- Speed control
- Base-Load control
- Load-Sharing control
- Load >=Limit
- Unloaded
- Stopped
- Speed >= Idle
- Speed >= Rated
- Speed >= Setpoint #1
- Speed >= Setpoint #2
- Any LON fault
- Speed sensor #1 fault
- Speed sensor #2 fault

Using the CONFIGURE Menu, these signals can be assigned to any of the 3 discrete outputs and/or any of the 4 LED's available on the 723PLUS.

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

Any I/O in Test/Override
This signal indicates that any of the input or output signals has been forced manually to a test value using the SERVICE Menu.

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

GCB Closed
Feedback of the generator circuit breaker status.

TBR #1 Closed
Feedback of the tie-breaker #1 status.

TBR #2 Closed
Feedback of the tie-breaker #2 status.

Isochronous
Isochronous control mode is active.

Speed Control
Speed control mode is active.

Base-Load Control
Base-Load control mode is active.

Load-Sharing Control
Load-Sharing control mode is active.

Unloaded
Load reference ramp <=unload setpoint.

Stopped
Engine speed < stop speed setpoint

Speed > Setpoint # X
Engine speed >= respective setpoint

Any LON fault
Indicates any LON network communication failure (latched).

Speed Sensor #X Fault
Indicates a speed sensor failure (latched).

Chapter 3.
Description of Operation

Introduction

This chapter provides an overview of the features and operation of this 723PLUS control system.

The control defines 2 major operational modes:
- Speed control
- Load control

Within Load control, there are 3 sub modes:
- Base-Load control
- Load-Sharing control
- Unload mode

Speed Control

Speed control is active when the GCB is open, or when the Droop contact input is selected, or when any LON fault is present.

In this mode the Raise Speed and Lower Speed contacts can be used to change the main speed reference ramp. When the GCB is closed in this mode, the Speed Raise and Lower contacts will change the load as well, bus frequency shall be maintained by the operator or external DCS system.

When the GCB is closed, Droop will be based on the load sensor input. When the load sensor input fails or is not connected, droop will be based on an actuator based calculated load instead.

Load Control

Load control is active when the GCB is closed, the Isochronous contact is selected. In case of LON load-sharing, all LON communications need to be OK as well. When using the load-sharing lines (LSL) on the 723PLUS, the LON communication doesn't need to be used.

When the load sensor input fails, is not connected or is not configured, the control can go to droop or stay in Load Control, and will revert to an actuator based calculated load instead. This can be configured in the Service Menu's.

Base-Load Control

Load control is active when the GCB is closed, and the Isochronous contact is selected, and all LON communications are OK (not using the LSL) and the Base-Load contact is closed or both Raise & Lower Load are closed.

The Load reference ramp will follow the Remote Base-Load setpoint input until either the Unload setpoint is reached or any of the Load-Limits have been reached.

Load-Sharing Control (LON)

Load control is active when the GCB is closed, the Isochronous contact is selected, and all LON communications are OK and no Base-Load or Unload control modes have been selected.

The Load setpoint will be updated continuously, calculating the average load of this engine and the others (also in LS mode) on the same bus-segment(s).

When an engine wants to go into LS mode after closing its GCB, the engine will soft-load to the LS average setpoint. When the LS average setpoint has been reached, it will fully participate in LS mode, that is, let the others engine controls know. If this was the first unit in LS mode on this bus-segment, soft-loading will be reset immediately.

When an engine is running in LS mode, and one of the TBR's closes, all units on the connecting bus segments will start to soft-load to the new calculated LS average, which is now based on multiple bus-segments.

Load-Sharing Control (LSL)

For downward compatibility with legacy Woodward controls, one can configure this control to operate in load sharing mode using the Woodward Load Sharing Lines (LSL).

The LSL's shall be daisy chained from each engine control to an other.

The LON configuration shall be setup as a single engine only with NODE ID=1, all other NODEs shall have BUS ID of 0 and the LON network cabling shall not be connected.

External relays shall be used to connect LSL's of different bus segments together when an interconnect Tie Breaker closes.

IMPORTANT

Load-Sharing lines and LON load-sharing cannot be mixed together on the same bus networks. Select either LS mode for all 723PLUS engine controls.

Unload Control

Unload control is active when the GCB is closed, the Isochronous contact is selected, and all LON communications are OK and the Unload contact is closed.

The Load reference ramp will ramp down to the Unload setpoint. When this has been reached, it will stay at this load setpoint until either the Unload is deactivated or the GCB is opened.

Speed Sensing

The 723PLUS control has two speed sensor inputs, either MPU or Proximity type.

For each sensor, the #teeth and filtering can be adjusted in the SERVICE Menus.

Minor/major alarm can be selected for each sensor and for the speed difference becoming too high between both sensors.

One or two sensors can be used in this control, and the possible speed sensing strategies are:

- HSS selection
- Torsional Filtering
- Master/Slave

HSS selection is active when only one sensor is used, or one of the two sensors has failed. The selected speed is the highest of the two speed sensor inputs.

Torsional Filtering requires two speed sensor inputs that are OK. A Torsional percentage [α] can be adjusted from 0 to 100%. The validated speed will be:

$$\text{Speed} = \frac{\alpha\ \text{Speed\#1}}{100\%} + \frac{(1-\alpha)\text{Speed\#2}}{100\%}$$

The Master/Slave speed sensing strategy defines Speed#1 as the Master speed sensor. When this sensor fails, the control switches to Speed#2. When the speed difference between both sensors is too high (adjustable threshold), then the control switches to conventional HSS speed selection.

Start Sequence & Start Fuel Limiter

The start sequence is activated when there are no major alarms, and the Start contact is closed. The Speed Reference will ramp to the Idle speed setpoint.

When not using the Idle/Rated contacts, one can use the automatic startup to Rated speed feature. When Idle speed has been reached and speed control is stable, the control will automatically ramp up to rated speed after an adjustable time. Whenever a Speed Raise or Lower command is issued during this sequence, the automatic startup will be aborted.

When the Idle / Rated contacts have been configured, these will select between Idle and Rated speed setpoint. Do not configure the automatic startup to rated in this case.

During starting to Idle speed, a start-up fuel limiter is active. This start fuel limiter can limit the amount of overfueling the engine, therefore reducing excessive smoke. Setting the start fuel limiter curve too tight can result in failed starts. It is advised to adjust the points on this curve for a cold engine under coldest ambient conditions.

The start-fuel limiter is deactivated when Idle speed has been reached and the engine speed control is stable (does not jump into any limiter) for a few seconds. This prevents ramping on to rated speed if dynamic proportional gain is too high for example.

When the start-sequence is initiated, a startup timer is started. When this timer expires, the speed override is removed from both speed sensors. When speed is still below the minimum speed threshold, a major alarm will shutdown the engine, indicating this startup attempt has failed.

Synchronizing

Synchronizing to a (local) grid or one bus segment to another can be accomplished by connecting a bi-polar voltage from a synchronizer to the correct 723PLUS control input channel.

Note that one has to check the correct jumper settings on the 723PLUS control for voltage or current input. The ±5 Vdc from the synchronizer normally result in a speed bias of ±2% of rated speed setpoint.

A synchronizer gain can be adjusted in from the SERVICE Menu for stability or speed.

Fuel Limiters

There are several fuel limiters in this control that either protect against overloading or overfueling:

- Max Actuator
- Start Fuel Limiter
- Fuel Limiter input
- Charge Air pressure fuel limiter
- Jump & Rate limiter
- Load Limiter input

The Max Actuator limit can be set in the SERVICE Menu. When not using it, set it out of the way, that is at 100%

The Start Fuel Limiter is a 4-point curve based on speed input. This limiter is only active during startup to Idle speed setpoint.
The Fuel limiter input is an analog input from either hardware or Modbus. When not using it, configure this input as not used and set the default value out of the way, that is to 100%

The Charge air pressure fuel limiter is a 4-point curve based on Charge air pressure as input. This limiter is only active when the GCB is closed and the Charge air pressure signal is ok.

The Jump & Rate limiter can be used to limit the amount of over-fueling of the engine during positive load transients. The limiter can be enabled from the SERVICE Menu, and both the jump level and rate limits are adjustable. The Jump & Rate limiter is only active after the startup to Idle has finished, otherwise it could interfere during startup, resulting in failed starts.

The Load limiter input is not a true fuel limiter, since it does not operate on the LSS bus directly. It limits the Load reference ramp, and therefore is only active in Load control mode. There is also a Load limiter setpoint, adjustable from the SERVICE Menu.

Load Rejection

To help minimizing speed overshoots during part load or full load rejections, there are two Load Rejection tools available:

- **Actuator KickDown**
  Force an instant actuator limit position for a short while.
- **Speed Reference KickDown**
  Force an instant negative bias on the speed reference for a short while.

Both functions can be active simultaneously.
There are two triggers that can activate the load rejection KickDown functions:

- **GCB opening;**
  Worst case when engine is running at full load.
- **Speed derivative**
  Sudden engine speed acceleration can indicate a load rejection event.

When the GCB opens, the actuator position at that moment results in a certain time (4-point curve) that the selected KickDown function will be active.

When the acceleration threshold is exceeded, the KickDown can also be activated. Next, when the acceleration goes and stays below the reset level (typically around 0 rpm/s or lower) for a certain time, the KickDown will be deactivated.

To make sure the KickDown is always reset, there is a timeout period as well.

It may be hard to use the derivative trigger method. When the trigger derivative level is set too low, you may encounter false KickDown events due to speed derivative noise or acceleration after recovering from a load rejection. When the trigger derivative level is set too high, the KickDown might never be activated.

Dynamics

The dynamics selection is quite extensive, and allows the engine control to operate with the correct PID settings under many different operation modes.

Examples are PTO's that are switched on/off, dynamically changing inertia of the system when clutching in/out on gearbox, tandem operation etc.

There are three sets of dynamic parameters for the speed control PID.

- The DYNAMICS 1 set is default and active when the Dynamics Select set #2 & #3 input contacts are open.
- The DYNAMICS 2 set is active when the Dynamics Select set #2 input contact is closed and Dynamics Select set #3 input contact is open.
- The DYNAMICS 3 set is active when the Dynamics Select set #3 input contact is closed. It has the highest priority.

By default, the Dynamics Select set #2 input contact is mapped to the same I/O channel as the GCB input contact, enabling dynamics set #2 when the GCB closes.

For each Dynamic Set, The P, I and S_D_R can be setup as:

- a single figure, or
- a 6 point Curve based on Load input [%], or
- a 6 point Curve based on Actuator output [%],
- a 6 point Curve based on Speed input [%]

For the Proportional Gain there is also a 6 point Gain Multiplier Curve in each Dynamic Set. This Curve has the absolute speed error as an input and can be used to allow for higher P gains when the speed error is big and lower P gains when the speed error is small, potentially resulting is faster recovery times after load changes. By default, all P gains are set to 1.0, resulting in a constant P gain over the entire speed error range.

There are also a few dynamic parameters for the Load Control, which allows adjusting the system stability, and the balance between speed & load control.

IMPORTANT

The speed control PID operates with a "normalized" speed error (error is divided by RATED speed), typically resulting in higher P gains.

LON, Load Sharing, & Setup

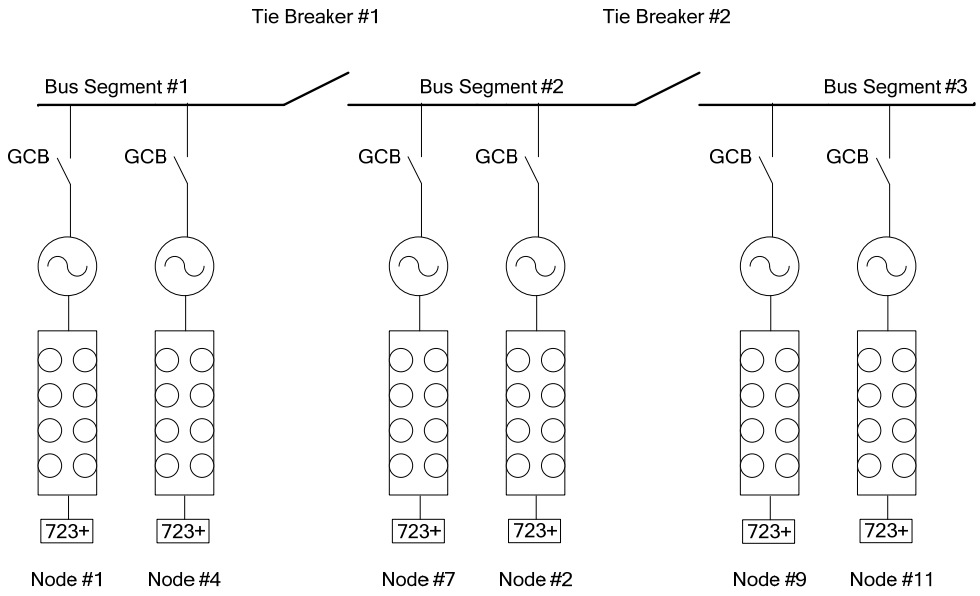
The LON communication wiring shall be daisy chained from each engine control to the other, TB-23 to TB-23 and TB-24 to TB-24 using shielded twisted pair cables, typically used for (high speed) communication networks.

IMPORTANT **Both the first and the last unit shall be terminated by having jumpers installed between TB-24 and TB-25.**

The LON Load Sharing is implemented by having each control exchange engine data with all the other controls that have been defined in the LON network.

IMPORTANT **Each control must get a unique LON Node ID.**

Up to 3 bus segments and 2 tiebreakers can be defined, and up to 16 nodes. In the CONFIGURE Menu, the bus segment has to be set for all 16 nodes.



Nodes set to bus segment 0 are defined as not being used.

Bus #1 is on the left side, Bus #2 the middle, and Bus #3 the right side bus.
Tie Breaker #1 connects the left side Bus #1 with the middle Bus #2.
Tie Breaker #2 connects the middle Bus #2 with the right side Bus #3.

In above example, the bus segment definition for all Nodes will be:

ID#1 = 1	*ID#5 = 0*	*ID#9 = 3*	*ID#13 = 0*
ID#2 = 2	ID#6 = 0	ID#10 = 0	ID#14 = 0
ID#3 = 0	ID#7 = 2	ID#11 = 3	ID#15 = 0
ID#4 = 1	ID#8 = 0	ID#12 = 0	ID#16 = 0

IMPORTANT **All engine controls must have the same system bus segment definition in order for the LON Load Sharing to work properly.**

Initializing the LON Network

When the 723PLUS controls are switched on, there will be LON communication errors, since other 723PLUS controls that have been defined in the network might still be switched off. When all 723PLUS controls are up and running, it is therefore necessary to perform a **LON reset**.

This can be done by using the SERVICE Menu, or by creating a **OPEN->CLOSE transition** (operator switch at MSB) with Discrete Input **LON RESET** for any of the engines. If LON communication is ok, this LON reset command propagates to all other engine control units.

No unit should have a LON communication failure alarm anymore.

When LON communication is ok for all engine 723PLUS engine controls, LON Load Sharing will be enabled. An engine will go into LS mode when GCB closes, Isochronous mode is selected and no Unload or Base-Load mode is selected.

Whenever any 723PLUS engine control detects a LON communication failure, it will try to “tell” the others and all units will be forced into Droop mode. The operator needs to investigate the problems and when solved needs to perform the LON reset to re-initialize the LON LS mode.

For maintenance purposes, it is possible to temporarily take 723PLUS engine controls out of the LON network, that is, switch off the PSU, while not interrupting the LON network cable or far end terminations.

Using the CONFIGURE Menu, select “**Exit from LON LS**” for the engine that needs to be taken out. Only select this option for an engine that is stopped! All other engines will now know that this engine is no longer participating in the LON LS.

To start participating again, start the control, perform a LON reset, and make sure all engine controls have LON communication OK. Once the CB for the previously decommissioned engine closes, it can participate in the Load Sharing again.

If engines need to be taken out for a longer time, we advise changing the Node ID & bus segment configuration. This has to be changed and kept the same for each 723PLUS control in the LON network.

Chapter 4.
Configure and Service Menus

Introduction

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

Where applicable, the nominal setting for each tunable is listed (the nominal values are provided only as a guideline). The actual settings are obtained from the engine manufacturer or determined during commissioning and should be noted in the Actual column for future reference.

CONFIGURE and SERVICE Menus can be accessed by either using the hand held programmer or using the software tools Watch Window and Servlink DDE Server. Refer to manual 02877, *723PLUS Digital Control Hardware Manual*, for more instructions how to use these tools.

Configure Mode

IMPORTANT **To access the Configure menus, the engine(s) must be stopped.**

The Configure Mode consists of these menus:

- *Configure SpdSensing*
- *Configure AI Ch# *
- *Configure AO Sel# *
- *Configure DI Ch# *
- *Configure DO Sel# *
- *Configure Alarms *
- *Configure LON & Load Sharing *
- *Configure Modbus *

*Configure SpdSensing *

Description	Range	Nominal	Actual
#Teeth SS #1	(6, 500)	60	
#Teeth SS B	(6, 500)	60	
SS #1 Filter Order	(0, 2)	2	
SS #1 Filter Tau [s]	(0, 10)	0.010	
SS #2 Filter Order	(0, 2)	2	
SS #2 Filter Tau [s]	(0, 10)	0.010	
SpdSensing Mode	(TRUE,FALSE)	TRUE	
Torsional Filtering ?	(TRUE,FALSE)	FALSE	
Torsional Ratio [%]	(0,100)	50	
Grid Frequency [Hz]	(0, 1000)	60	

#Teeth SS #1/2
Sets the number of teeth for the gear-wheel

SS #1/2 Filter Order
0=no filtering, 1=1st order filter. 2=2nd order filter

SS #1/2 Filter Tau [s]
Speed sensor filter time constant Tau in seconds.

SpdSensing Mode
TRUE = HSS speed selection, FALSE = Primary/Secondary speed selection.

Torsional Filtering ?
TRUE = Torsional Filtering speed selection (SpdSensing Mode Needs to be HSS)

Torsional Ratio [%]
Ratio for SS#1 to be used in Torsional Filtering speed selection.

Torsional Filtering ?
TRUE = Torsional Filtering speed selection (SpdSensing Mode Needs to be HSS)

Grid Frequency [Hz]
Sets the grid frequency for rated speed. Used for display & monitoring.

*Configure AI Ch# *

Description	Range	Nominal	Actual
Rem SpdRef Ch#	(0, 5)	0	
Rem SpdRef DfltVal [rpm]	(0.0, 5000)	514	
Synchronizer Ch#	(0, 5)	4	
Synchronizer DfltVal	(-100, 100)	0	
Charge Air Press Ch#	(0, 5)	1	
Charge Air Press DfltVal	(-25, 125)	10	
EngLoad Ch#	(0, 5)	2	
EngLoad DfltVal [kW]	(-5000, 50000)	50	
Load Limiter Ch#	(0, 5)	0	
Load Limiter DfltVal	(-25, 125)	100	
Rem LoadRef Ch#	(0, 5)	3	
Rem LoadRef DfltVal	(-25, 125)	2.5	
Reactive Pwr Ch#	(0, 5)	0	
Reactive Pwr DfltVal	(-25, 125)	2.5	
Fuel Limiter Ch#	(0, 5)	0	
Fuel Limiter DfltVal	(-25, 125)	100	

XXXXXXXX Ch#
Assigns the function XXXXXXXX tZo any of the 4 analog input channels. When set to 0, the function will output **XXXXXXXX DfltVal** and there will never be a signal failure.

When 5 is selected. the function will be mapped to its corresponding Modbus address. There will be a signal failure when the Modbus communication fails.

*Configure AO Sel# *

Description	Range	Nominal	Actual
AO1 Sel#	(0, 18)	#4	
AO1 DfltVal	(–25.0, 125.0)	0.0	
AO2 Sel#	(0, 18)	#5	
AO2 DfltVal	(–25.0, 125.0)	0.0	
ACT1 Sel#	(0, 18)	#6	
ACT1 DfltVal	(–25.0, 125.0)	0.0	
ACT2 Sel#	(0, 18)	#3	
ACT2 DfltVal	(–25.0, 125.0)	0.0	

The following list of signals (Scaled to 0~100% in the SERVICE Menu) can be output:

1. Speed control PID Output
2. Final Speed Control LSS
3. Actuator Output
4. Final Speed Reference
5. Load Reference
6. Selected Speed
7. Speed Sensor #1
8. Speed Sensor #2
9. Remote Speed Reference
10. Synchronizer Input
11. Charge Air Pressure
12. Actual Load
13. Load Limiter Input
14. Remote Load Reference
15. kVar Input
16. Fuel Limiter Input
17. Average Load on this Engines Bus Segment(s)
18. All Busses Total Load Sharing Load
19. All Busses Total Load

For all output channels, the output range is: 0% = 4 mA, 100% = 20 mA Scaling of individual signal engineering units to % can be performed in the SERVICE Menu.

The **XXXXXXXX DfltVal** will be output when the **AOX Sel#** is set to 0.

*Configure DI Ch# *

Description	Range	Nominal	Actual
Reset ch#	(0, 9)	#0	
Reset ch INVERT	(TRUE, FALSE)	FALSE	
Run ch#	(0, 9)	#1	
Run ch INVERT	(TRUE, FALSE)	FALSE	
Stop ch#	(0, 9)	#1	
Stop ch INVERT	(TRUE, FALSE)	TRUE	
Raise Spd ch#	(0, 9)	#2	
Raise Spd ch INVERT	(TRUE, FALSE)	FALSE	
Lower Spd ch#	(0, 9)	#3	
Lower Spd ch INVERT	(TRUE, FALSE)	FALSE	
Raise Load ch#	(0, 9)	#2	
Raise Load ch INVERT	(TRUE, FALSE)	FALSE	
Lower Load ch#	(0, 9)	#3	
Lower Load ch INVERT	(TRUE, FALSE)	FALSE	
Remote Speed ch#	(0, 9)	#0	
Remote Speed ch INVERT	(TRUE, FALSE)	FALSE	
Droop Mode ch#	(0, 9)	#8	
Droop Mode ch INVERT	(TRUE, FALSE)	TRUE	
Isochronous Mode ch#	(0, 9)	#8	
Isochronous Mode ch# INV	(TRUE, FALSE)	FALSE	
Idle Mode ch#	(0, 9)	#7	
Idle Mode ch INVERT	(TRUE, FALSE)	TRUE	
Rated Mode ch#	(0, 9)	#7	
Rated Mode ch INVERT	(TRUE, FALSE)	FALSE	
Unload ch#	(0, 9)	#7	
Unload ch INVERT	(TRUE, FALSE)	TRUE	
Base-Load ch#	(0, 9)	#0	
Base-Load ch INVERT	(TRUE, FALSE)	FALSE	
Generator CB ch#	(0, 9)	#4	
Generator CB ch INVERT	(TRUE, FALSE)	FALSE	
Tie Breaker #1 ch#	(0, 9)	#5	
Tie Breaker #1 ch INVERT	(TRUE, FALSE)	FALSE	
Tie Breaker #2 ch#	(0, 9)	#6	
Tie Breaker #2 ch INVERT	(TRUE, FALSE)	FALSE	
LON Reset ch#	(0, 9)	#8	
LON Reset ch INVERT	(TRUE, FALSE)	FALSE	
Dynamics #2 ch#	(0, 9)	#4	
Dynamics #2 ch INVERT	(TRUE, FALSE)	FALSE	
Dynamics #3 ch#	(0, 9)	#0	
Dynamics #3 ch INVERT	(TRUE, FALSE)	FALSE	

Assigns the function **XXXXXXXX** to any of the 8 digital input channels. When set to 0, the function will output **XXXXXXXX INVERT.** When 9 is selected. the function will be mapped to its corresponding Modbus address.

By default, inputs are NO/Close for action. When **XXXXXXXX INVERT** is TRUE, the discrete input function changes to NC/Open for action.

*Configure DO Sel# *

Description	Range	Nominal	Actual
DO1 Sel#	(0, 25)	#1	
DO1 NC/Open for Action ?	(TRUE, FALSE)	FALSE	
DO2 Sel#	(0, 25)	#2	
DO2 NC/Open for Action ?	(TRUE, FALSE)	FALSE	
DO3 Sel#	(0, 25)	#17	
DO3 NC/Open for Action ?	(TRUE, FALSE)	FALSE	
LED1 Sel#	(0, 25)	#2	
LED1 NC/Open for Action ?	(TRUE, FALSE)	FALSE	
LED2 Sel#	(0, 25)	#1	
LED2 NC/Open for Action ?	(TRUE, FALSE)	FALSE	
LED3 Sel#	(0, 25)	#9	
LED3 NC/Open for Action ?	(TRUE, FALSE)	FALSE	
LED4 Sel#	(0, 25)	#15	
LED4 NC/Open for Action ?	(TRUE, FALSE)	FALSE	

The following list of signals can be output:
1. Minor Alarm
2. Major Alarm
3. Minor or Major Alarm
4. Any IO in Test/Override
5. AI CH1 Hardware Fault
6. AI CH2 Hardware Fault
7. AI CH3 Hardware Fault
8. AI CH4 Hardware Fault
9. Generator CB is Closed
10. Tie Breaker #1 is Closed
11. Tie Breaker #2 is Closed
12. Isochronous Mode is Active
13. Speed Control is Active
14. Base-Load Control is Active
15. Load-Sharing Control is Active
16. Actual Load >= Load Limit
17. Unload Setpoint Reached
18. Engine is Stopped
19. Engine speed >= Idle
20. Engine speed >= Rated
21. Engine speed >= Speed Switch #1
22. Engine speed >= Speed Switch #2
23. Any LON Communication Failure
24. Speed Sensor #1 Fault
25. Speed Sensor #2 Fault

DOX Sel#
Assigns any of the above signals to relay output #1~3.
When 0 is selected, **DOX NC/Open for Action ?** will be output.

LEDX Sel#
Assigns any of the above signals to 723PLUS LED#1~4.
When 0 is selected, **LEDX NC/Open for Action ?** will be output.

Config Alarms

Description	Range	Nominal	Actual
AI in test	(0, 2)	1	
AO in test	(0, 2)	1	
DI in test	(0, 2)	1	
DO in test	(0, 2)	1	
Speed #1 Fault	(0, 2)	1	
Speed #2 Fault	(0, 2)	1	
Speed Diff Fault	(0, 2)	1	
Rem Speed Setp Fault	(0, 2)	1	
Synchronizer Fault	(0, 2)	1	
Charge Air Press Fault	(0, 2)	1	
Load Fault	(0, 2)	1	
Load Limit Fault	(0, 2)	1	
Rem Load Setp Fault	(0, 2)	1	
kVar Fault	(0, 2)	1	
Modbus Fault	(0, 2)	1	

0 = No Alarm, 1 = Minor Alarm, 2 = Major Alarm

*Config LON & LS *

Description	Range	Nominal	Actual
LS mode, 1=LON, 2=LSL	(1, 2)	1	
My Node ID#	(1, 16)	1	
Node01 Bus #	(0, 3)	1	
Node02 Bus #	(0, 3)	0	
Node03 Bus #	(0, 3)	0	
Node04 Bus #	(0, 3)	0	
Node05 Bus #	(0, 3)	0	
Node06 Bus #	(0, 3)	0	
Node07 Bus #	(0, 3)	0	
Node08 Bus #	(0, 3)	0	
Node09 Bus #	(0, 3)	0	
Node10 Bus #	(0, 3)	0	
Node11 Bus #	(0, 3)	0	
Node12 Bus #	(0, 3)	0	
Node13 Bus #	(0, 3)	0	
Node14 Bus #	(0, 3)	0	
Node15 Bus #	(0, 3)	0	
Node16 Bus #	(0, 3)	0	
Configuration Error		Monitor only	
Exit from LON LS	(TRUE, FALSE)	FALSE	

LS mode, 1=LON, 2=LSL selects the Load-Sharing operation mode.
When LSL is selected, the LON configuration shall be setup as a single engine only with NODE ID=1, all other NODEs shall have BUS ID of 0 and the LON network cabling shall not be connected.

My Node ID# sets the unique Node number for this engine control

NodeXX Bus # sets the bus number for each engine control. Set to 0 when not using certain node numbers. Keep this list the same for each engine control !

Configuration Error Is TRUE when this engine control has a bus # of 0.

Exit from LON LS Set to TRUE to temporarily decommission this engine control. It informs all other engine controls, so they will not give a LON communication failure when this engine control is powered off.

*Configure Modbus *

Description	Range	Nominal	Actual
Modbus ASCII/RTU ?	(1, 2)	2	
Modbus Net Address	(1, 247)	1	

Modbus ASCII/RTU ?
1 = Modbus ASCII protocol, 2 = Modbus RTU protocol

Modbus Net Address
Defines the Modbus network address for this slave Modbus.

Service Mode

The Service Mode consists of these menus:

- *Monitor Analogs*
- *Monitor Discretes (Inputs)*
- *Monitor Minor Alarms*
- *Monitor Major Alarms*
- *Reset Logic *
- *Dynamics 1 * (and sub menu's)
- *Dynamics 2 * (and sub menu's)
- *Dynamics 3 * (and sub menu's)
- *Actuator Bump *
- *Speed (Control) Settings *
- *Starting Settings *
- *Jump&Rate Limiter *
- Load Rejection *
- *Limits *
- *Load (Control) Settings *
- *Define Range AI*
- *Define Range AO*
- *Modbus Settings*
- Port Setting J1 *

Monitor Analogs

Description	Range	Nominal	Actual
Speed Control PID [%]			
Final Speed Control LSS [%]			
Actuator Output [%]			
Speed [rpm]			
Speed #1 [rpm]			
Speed #2 [rpm]			
Speed Diff #1 , #2 [rpm]			
Speed Reference [rpm]			
Max Detected Speed [rpm]			
Speed Ref (biased) [rpm]			
Remote Speed Ref [rpm]			
Synchronizer [-1 +1]			
Charge Air Press [bar]			
Charge Air Press Lim [%]			
Load [%]			
Load [kW]			
Load Limit [%]			
Remote Load Ref [%]			
Reactive Power [kVar]			
Fuel Limit [%]			
My Busses Avg Load [%]			
Busses Total LS Load [%]			
All Busses Total Load [%]			

Monitor Discrete (Inputs)

Description	Range	Nominal	Actual
Reset			
Run			
Stop			
Raise Speed			
Lower Speed			
Raise Load			
Lower Load			
Remote Speed			
Droop			
Isochronous			
Idle			
Rated			
Unload			
Base-Load			
Generator CB closed			
Tie Breaker #1 closed			
Tie Breaker #2 closed			
Tie Breaker #1 (LON)			
Tie Breaker #2 (LON)			
Speed Control active			
Load Control active			
Isochronous Mode selected			
Droop Mode selected			
Load-Sharing Control active			
Base-Load Control active			
Dynamics Select set #2			
Dynamics Select set #3			

Monitor Minor Alarms

Description	Range	Nominal	Actual
Minor Alarm			
AI in Test/Override			
AO in Test/Override			
DI in Test/Override			
DO in Test/Override			
Speed #1 Fault			
Speed #2 Fault			
Speed Difference Fault			
Remote Speed Setpoint Fault			
Synchronizer Fault			
Charge Air Press Fault			
Load Fault			
Load Limit Fault			
Remote Load Setpoint Fault			
kVar Fault			
Fuel Limit Fault			
Modbus Fault			
NODE#01 LON Fault			
NODE#02 LON Fault			
NODE#03 LON Fault			
NODE#04 LON Fault			
NODE#05 LON Fault			
NODE#06 LON Fault			
NODE#07 LON Fault			
NODE#08 LON Fault			
NODE#09 LON Fault			
NODE#10 LON Fault			
NODE#11 LON Fault			
NODE#12 LON Fault			
NODE#13 LON Fault			
NODE#14 LON Fault			
NODE#15 LON Fault			
NODE#16 LON Fault			
Exit from LON Load Sharing			
Tie-Breaker #1 wire-break			
Tie-Breaker #2 wire-break			
Load Offset/GCB wire-break			
Reset Alarms[F,T,F]	(TRUE, FALSE)	FALSE	

Reset Alarms[F,T,F]
This software reset command can be used to clear (latching) alarms for which the cause has disappeared. The signal shall be toggled from FALSE to TRUE and back to FALSE to generate a reset pulse.

Monitor Major Alarms

Description	Range	Nominal	Actual
Major Alarm			
AI in Test/Override			
AO in Test/Override			
DI in Test/Override			
DO in Test/Override			
Speed #1 Fault			
Speed #2 Fault			
Speed Difference Fault			
Remote Speed Setpoint Fault			
Speed #1 & #2 Fault			
Overspeed Fault			
Remote Speed Setpoint Fault			
Synchronizer Fault			
Charge Air Press Fault			
Load Fault			
Load Limit Fault			
Remote Load Setpoint Fault			
kVar Fault			
Fuel Limit Fault			
Modbus Fault			
Reset Alarms[F,T,F]	(TRUE, FALSE)	FALSE	

Reset Alarms[F,T,F]
This software reset command can be used to clear (latching) alarms for which the cause has disappeared. The signal shall be toggled from FALSE to TRUE and back to FALSE to generate a reset pulse.

*Reset Logic *

Description	Range	Nominal	Actual
Minor Alarm			
Major Alarm			
Reset Alarms[F,T,F]	(TRUE, FALSE)	FALSE	
Inhibit all Reset commands	(TRUE, FALSE)	FALSE	
Reset on Start	(TRUE, FALSE)	FALSE	
Reset on Stop	(TRUE, FALSE)	FALSE	
Enable Auto Reset	(TRUE, FALSE)	FALSE	
Auto Reset Time [s]	(0, 600)	5	

Reset Alarms[F,T,F]
This software reset command can be used to clear (latching) alarms for which the cause has disappeared. The signal shall be toggled from FALSE to TRUE and back to FALSE to generate a reset pulse.
Inhibit all Reset Commands Inhibit all reset commands (alarm investigation).
Reset on Start Automatically issue Reset command on engine starting.
Reset on Stop Automatically issue Reset command on engine stopping.
Enable Auto Reset Control issues Reset commands automatically.
Auto Reset Time [s] Repetition time for the automatic Reset pulse feature.

*Dynamics 1 *

Description	Range	Nominal	Actual
Dyn#1 Curve select	(1, 4)	1	
Final Proportional Gain			
Final Integral Gain			
Final S_D_R			

Dynamics set #1 are active when none of the others Dynamics Set are selected.

Dyn#1 Curve Select Select where P, I and S_D_R are coming from:
1=single figures, 2=Load Curve, 3=Actuator Curve, 4=Speed Curve

IMPORTANT **Please refer to application note 83402, *PID Control*, to learn more about adjusting the dynamic settings for the load sharing PID.**

*Dynamics 1 (P Mult) *

Description	Range	Nominal	Actual
1-0 P Mult X1 [rpm]	(0.0, 500.0)	0	
1-0 P Mult Y1	(0.1, 10)	1.0	
1-0 P Mult X2 [rpm]	(0.0, 500.0)	2	
1-0 P Mult Y2	(0.1, 10)	1.0	
1-0 P Mult X3 [rpm]	(0.0, 500.0)	5	
1-0 P Mult Y3	(0.1, 10)	1.0	
1-0 P Mult X4 [rpm]	(0.0, 500.0)	10	
1-0 P Mult Y4	(0.1, 10)	1.0	
1-0 P Mult X5 [rpm]	(0.0, 500.0)	25	
1-0 P Mult Y5	(0.1, 10)	1.0	
1-0 P Mult X6 [rpm]	(0.0, 5000.0)	5000	
1-0 P Mult Y6	(0.1, 10)	1.0	

This 6 point Curve define the multiplier factor for the proportional gain for Dynamics #1. This multiplier factor is based on a curve where absolute speed error is the input.

*Dynamics 1-1 *

Description	Range	Nominal	Actual
1-1 Proportional Gain	(0.0, 1000)	5.0	
1-1 Integral Gain	(0.0, 50.0)	1.0	
1-1 S_D_R	(0.0, 100.0)	20.0	

This menu defines the single set P, I and S_D_R. These are applicable when **Dyn#1 Curve Select** has been set to 1 in menu ***Dynamics 1 ***

Speed PID Proportional Gain Sets proportional gain for the speed PID.
Speed PID Integral Gain Sets integral gain for the speed PID.
Speed PID S_D_R Sets the Speed Derivative Ratio for the speed PID.
When S_D_R = 1 to 100, D = 1 / (S_D_R x I), (PID is Feedback Dominant).
When S_D_R = 0.01 to 1, D = S_D_R / 1 (PID is Input Dominant).

*Dynamics 1-2 (P Curve) *

Description	Range	Nominal	Actual
1-2 P X1 [%,rpm]	(0.0, 5000.0)	0	
1-2 P Y1	(0.0, 1000.0)	5.0	
1-2 P X2 [%,rpm]	(0.0, 5000.0)	200	
1-2 P Y2	(0.0, 1000.0)	5.0	
1-2 P X3 [%,rpm]	(0.0, 5000.0)	400	
1-2 P Y3	(0.0, 1000.0)	5.0	
1-2 P X4 [%,rpm]	(0.0, 5000.0)	600	
1-2 P Y4	(0.0, 1000.0)	5.0	
1-2 P X5 [%,rpm]	(0.0, 5000.0)	800	
1-2 P Y5	(0.0, 1000.0)	5.0	
1-2 P X6 [%,rpm]	(0.0, 5000.0)	1000	
1-2 P Y6	(0.0, 1000.0)	5.0	

This menu defines the Curve based Proportional Gain. These are applicable when **Dyn#1 Curve Select** has been set to 2,3 or 4 in menu ***Dynamics 1 ***

*Dynamics 1-2 (I Curve) *

Description	Range	Nominal	Actual
1-2 I X1 [%,rpm]	(0.0, 5000.0)	0	
1-2 I Y1	(0.0, 50.0)	1.0	
1-2 I X2 [%,rpm]	(0.0, 5000.0)	200	
1-2 I Y2	(0.0, 50.0)	1.0	
1-2 I X3 [%,rpm]	(0.0, 5000.0)	400	
1-2 I Y3	(0.0, 50.0)	1.0	
1-2 I X4 [%,rpm]	(0.0, 5000.0)	600	
1-2 I Y4	(0.0, 50.0)	1.0	
1-2 I X5 [%,rpm]	(0.0, 5000.0)	800	
1-2 I Y5	(0.0, 50.0)	1.0	
1-2 I X6 [%,rpm]	(0.0, 5000.0)	1000	
1-2 I Y6	(0.0, 50.0)	1.0	

This menu defines the Curve based Integral Gain. These are applicable when **Dyn#1 Curve Select** has been set to 2,3 or 4 in menu ***Dynamics 1 ***

*Dynamics 1-2 (SDR Curve) *

Description	Range	Nominal	Actual
1-2 SDR X1 [%,rpm]	(0.0, 5000.0)	0	
1-2 SDR Y1	(0.0, 100.0)	20.0	
1-2 SDR X2 [%,rpm]	(0.0, 5000.0)	200	
1-2 SDR Y2	(0.0, 100.0)	20.0	
1-2 SDR X3 [%,rpm]	(0.0, 5000.0)	400	
1-2 SDR Y3	(0.0, 100.0)	20.0	
1-2 SDR X4 [%,rpm]	(0.0, 5000.0)	600	
1-2 SDR Y4	(0.0, 100.0)	20.0	
1-2 SDR X5 [%,rpm]	(0.0, 5000.0)	800	
1-2 SDR Y5	(0.0, 100.0)	20.0	
1-2 SDR X6 [%,rpm]	(0.0, 5000.0)	1000	
1-2 SDR Y6	(0.0, 100.0)	20.0	

This menu defines the Curve based S_D_R. These are applicable when **Dyn#1 Curve Select** has been set to 2,3 or 4 in menu ***Dynamics 1 ***

*Dynamics 2 *

Description	Range	Nominal	Actual
Dyn#2 Curve select	(1, 4)	1	
Final Proportional Gain			
Final Integral Gain			
Final S_D_R			

Dynamics set #2 are active when the corresponding input contact is closed and set #3 is not active.

Dyn#2 Curve Select Select where P, I and S_D_R are coming from:
1=single figures, 2=Load Curve, 3=Actuator Curve, 4=Speed Curve

IMPORTANT

Please refer to application note 83402, *PID Control*, to learn more about adjusting the dynamic settings for the load sharing PID.

*Dynamics 2 (P Mult) *

Description	Range	Nominal	Actual
2-0 P Mult X1 [rpm]	(0.0, 500.0)	0	
2-0 P Mult Y1	(0.1, 10)	1.0	
2-0 P Mult X2 [rpm]	(0.0, 500.0)	2	
2-0 P Mult Y2	(0.1, 10)	1.0	
2-0 P Mult X3 [rpm]	(0.0, 500.0)	5	
2-0 P Mult Y3	(0.1, 10)	1.0	
2-0 P Mult X4 [rpm]	(0.0, 500.0)	10	
2-0 P Mult Y4	(0.1, 10)	1.0	
2-0 P Mult X5 [rpm]	(0.0, 500.0)	25	
2-0 P Mult Y5	(0.1, 10)	1.0	
2-0 P Mult X6 [rpm]	(0.0, 5000.0)	5000	
2-0 P Mult Y6	(0.1, 10)	1.0	

This 6 point Curve define the multiplier factor for the proportional gain for Dynamics #2. This multiplier factor is based on a curve where absolute speed error is the input.

*Dynamics 2-1 *

Description	Range	Nominal	Actual
2-1 Proportional Gain	(0.0, 1000)	5.0	
2-1 Integral Gain	(0.0, 50.0)	1.0	
2-1 S_D_R	(0.0, 100.0)	20.0	

This menu defines the single set P, I and S_D_R. These are applicable when **Dyn#2 Curve Select** has been set to 1 in menu ***Dynamics 2 ***

Speed PID Proportional Gain Sets proportional gain for the speed PID.
Speed PID Integral Gain Sets integral gain for the speed PID.
Speed PID S_D_R Sets the Speed Derivative Ratio for the speed PID.
When S_D_R = 1 to 100, D = 1 / (S_D_R x I), (PID is Feedback Dominant).
When S_D_R = 0.01 to 1, D = S_D_R / 1 (PID is Input Dominant).

*Dynamics 2-2 (P Curve) *

Description	Range	Nominal	Actual
2-2 P X1 [%,rpm]	(0.0, 5000.0)	0	
2-2 P Y1	(0.0, 1000.0)	5.0	
2-2 P X2 [%,rpm]	(0.0, 5000.0)	200	
2-2 P Y2	(0.0, 1000.0)	5.0	
2-2 P X3 [%,rpm]	(0.0, 5000.0)	400	
2-2 P Y3	(0.0, 1000.0)	5.0	
2-2 P X4 [%,rpm]	(0.0, 5000.0)	600	
2-2 P Y4	(0.0, 1000.0)	5.0	
2-2 P X5 [%,rpm]	(0.0, 5000.0)	800	
2-2 P Y5	(0.0, 1000.0)	5.0	
2-2 P X6 [%,rpm]	(0.0, 5000.0)	1000	
2-2 P Y6	(0.0, 1000.0)	5.0	

This menu defines the Curve based Proportional Gain. These are applicable when **Dyn#2 Curve Select** has been set to 2,3 or 4 in menu ***Dynamics 2 ***

*Dynamics 2-2 (I Curve) *

Description	Range	Nominal	Actual
2-2 I X1 [%,rpm]	(0.0, 5000.0)	0	
2-2 I Y1	(0.0, 50.0)	1.0	
2-2 I X2 [%,rpm]	(0.0, 5000.0)	200	
2-2 I Y2	(0.0, 50.0)	1.0	
2-2 I X3 [%,rpm]	(0.0, 5000.0)	400	
2-2 I Y3	(0.0, 50.0)	1.0	
2-2 I X4 [%,rpm]	(0.0, 5000.0)	600	
2-2 I Y4	(0.0, 50.0)	1.0	
2-2 I X5 [%,rpm]	(0.0, 5000.0)	800	
2-2 I Y5	(0.0, 50.0)	1.0	
2-2 I X6 [%,rpm]	(0.0, 5000.0)	1000	
2-2 I Y6	(0.0, 50.0)	1.0	

This menu defines the Curve based Integral Gain. These are applicable when **Dyn#2 Curve Select** has been set to 2,3 or 4 in menu ***Dynamics 2 ***

*Dynamics 2-2 (SDR Curve) *

Description	Range	Nominal	Actual
2-2 SDR X1 [%,rpm]	(0.0, 5000.0)	0	
2-2 SDR Y1	(0.0, 100.0)	20.0	
2-2 SDR X2 [%,rpm]	(0.0, 5000.0)	200	
2-2 SDR Y2	(0.0, 100.0)	20.0	
2-2 SDR X3 [%,rpm]	(0.0, 5000.0)	400	
2-2 SDR Y3	(0.0, 100.0)	20.0	
2-2 SDR X4 [%,rpm]	(0.0, 5000.0)	600	
2-2 SDR Y4	(0.0, 100.0)	20.0	
2-2 SDR X5 [%,rpm]	(0.0, 5000.0)	800	
2-2 SDR Y5	(0.0, 100.0)	20.0	
2-2 SDR X6 [%,rpm]	(0.0, 5000.0)	1000	
2-2 SDR Y6	(0.0, 100.0)	20.0	

This menu defines the Curve based S_D_R. These are applicable when **Dyn#2 Curve Select** has been set to 2,3 or 4 in menu ***Dynamics 2 ***

*Dynamics 3 *

Description	Range	Nominal	Actual
Dyn#3 Curve select	(1, 4)	1	
Final Proportional Gain			
Final Integral Gain			
Final S_D_R			

Dynamics set #3 are active when the corresponding input contact is closed. This selection has priority over Dynamics set #2 selection.

Dyn#3 Curve Select Select where P, I and S_D_R are coming from:
1=single figures, 2=Load Curve, 3=Actuator Curve, 4=Speed Curve

IMPORTANT

Please refer to application note 83402, *PID Control*, to learn more about adjusting the dynamic settings for the load sharing PID.

*Dynamics 3 (P Mult) *

Description	Range	Nominal	Actual
3-0 P Mult X1 [rpm]	(0.0, 500.0)	0	
3-0 P Mult Y1	(0.1, 10)	1.0	
3-0 P Mult X2 [rpm]	(0.0, 500.0)	2	
3-0 P Mult Y2	(0.1, 10)	1.0	
3-0 P Mult X3 [rpm]	(0.0, 500.0)	5	
3-0 P Mult Y3	(0.1, 10)	1.0	
3-0 P Mult X4 [rpm]	(0.0, 500.0)	10	
3-0 P Mult Y4	(0.1, 10)	1.0	
3-0 P Mult X5 [rpm]	(0.0, 500.0)	25	
3-0 P Mult Y5	(0.1, 10)	1.0	
3-0 P Mult X6 [rpm]	(0.0, 5000.0)	5000	
3-0 P Mult Y6	(0.1, 10)	1.0	

This 6 point Curve define the multiplier factor for the proportional gain for Dynamics #3. This multiplier factor is based on a curve where absolute speed error is the input.

*Dynamics 3-1 *

Description	Range	Nominal	Actual
3-1 Proportional Gain	(0.0, 1000)	5.0	
3-1 Integral Gain	(0.0, 50.0)	1.0	
3-1 S_D_R	(0.0, 100.0)	20.0	

This menu defines the single set P, I and S_D_R. These are applicable when **Dyn#3 Curve Select** has been set to 1 in menu ***Dynamics 3 ***

Speed PID Proportional Gain Sets proportional gain for the speed PID.
Speed PID Integral Gain Sets integral gain for the speed PID.
Speed PID S_D_R Sets the Speed Derivative Ratio for the speed PID.
When S_D_R = 1 to 100, D = 1 / (S_D_R x I), (PID is Feedback Dominant).
When S_D_R = 0.01 to 1, D = S_D_R / 1 (PID is Input Dominant).

*Dynamics 3-2 (P Curve) *

Description	Range	Nominal	Actual
3-2 P X1 [%,rpm]	(0.0, 5000.0)	0	
3-2 P Y1	(0.0, 1000.0)	5.0	
3-2 P X2 [%,rpm]	(0.0, 5000.0)	200	
3-2 P Y2	(0.0, 1000.0)	5.0	
3-2 P X3 [%,rpm]	(0.0, 5000.0)	400	
3-2 P Y3	(0.0, 1000.0)	5.0	
3-2 P X4 [%,rpm]	(0.0, 5000.0)	600	
3-2 P Y4	(0.0, 1000.0)	5.0	
3-2 P X5 [%,rpm]	(0.0, 5000.0)	800	
3-2 P Y5	(0.0, 1000.0)	5.0	
3-2 P X6 [%,rpm]	(0.0, 5000.0)	1000	
3-2 P Y6	(0.0, 1000.0)	5.0	

This menu defines the Curve based Proportional Gain. These are applicable when **Dyn#3 Curve Select** has been set to 2,3 or 4 in menu ***Dynamics 3 ***

*Dynamics 3-2 (I Curve) *

Description	Range	Nominal	Actual
3-2 I X1 [%,rpm]	(0.0, 5000.0)	0	
3-2 I Y1	(0.0, 50.0)	1.0	
3-2 I X2 [%,rpm]	(0.0, 5000.0)	200	
3-2 I Y2	(0.0, 50.0)	1.0	
3-2 I X3 [%,rpm]	(0.0, 5000.0)	400	
3-2 I Y3	(0.0, 50.0)	1.0	
3-2 I X4 [%,rpm]	(0.0, 5000.0)	600	
3-2 I Y4	(0.0, 50.0)	1.0	
3-2 I X5 [%,rpm]	(0.0, 5000.0)	800	
3-2 I Y5	(0.0, 50.0)	1.0	
3-2 I X6 [%,rpm]	(0.0, 5000.0)	1000	
3-2 I Y6	(0.0, 50.0)	1.0	

This menu defines the Curve based Integral Gain. These are applicable when **Dyn#3 Curve Select** has been set to 2,3 or 4 in menu ***Dynamics 3 ***

*Dynamics 3-2 (SDR Curve) *

Description	Range	Nominal	Actual
3-2 SDR X1 [%,rpm]	(0.0, 5000.0)	0	
3-2 SDR Y1	(0.0, 100.0)	20.0	
3-2 SDR X2 [%,rpm]	(0.0, 5000.0)	200	
3-2 SDR Y2	(0.0, 100.0)	20.0	
3-2 SDR X3 [%,rpm]	(0.0, 5000.0)	400	
3-2 SDR Y3	(0.0, 100.0)	20.0	
3-2 SDR X4 [%,rpm]	(0.0, 5000.0)	600	
3-2 SDR Y4	(0.0, 100.0)	20.0	
3-2 SDR X5 [%,rpm]	(0.0, 5000.0)	800	
3-2 SDR Y5	(0.0, 100.0)	20.0	
3-2 SDR X6 [%,rpm]	(0.0, 5000.0)	1000	
3-2 SDR Y6	(0.0, 100.0)	20.0	

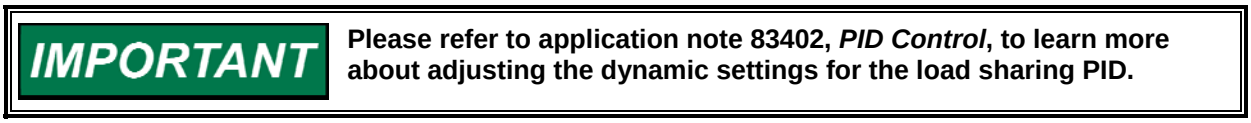
This menu defines the Curve based S_D_R. These are applicable when **Dyn#3 Curve Select** has been set to 2,3 or 4 in menu ***Dynamics 3 ***

*Actuator Bump *

Description	Range	Nominal	Actual
Single Actuator Bump	(TRUE, FALSE)	FALSE	
Actuator Bump [%]	(-100, 100)	-5.0	
Cyclic Actuator Bump	(TRUE, FALSE)	FALSE	
Cycle Time Bump [s]	(0, 600)	5.0	

Toggle **Single Actuator Bump** from False to True to False to shortly introduce an error on the actuator output of **Actuator Bump [%]**.
When **Cycle Actuator Bump** is set to TRUE, there will be a cyclic disturbance on the actuator output signal, repeated each **Cycle Time Bump [s]**.

These features can be used to optimize the PID settings while running the engine in a steady state condition.



Please refer to application note 83402, *PID Control*, to learn more about adjusting the dynamic settings for the load sharing PID.

*Speed (Control) Settings *

Description	Range	Nominal	Actual
Idle Setpoint [rpm]	(0, 5000)	300	
Rated Setpoint [rpm]	(0, 5000)	514	
Maximum Setpoint [rpm]	(0, 5000)	565	
Overspeed Test Setpoint [rpm]	(0, 5000)	585	
Overspeed Setpoint [rpm]	(0, 5000)	580	
Stop Speed Setpoint [rpm]	(0, 5000)	50	
Droop [%]	(0, 15)	5	
Droop when Load fails ?	(TRUE, FALSE)	TRUE	
Droop Filter [s]	(0, 9)	0.010	
Actuator No Load pos [%]	(0, 100)	20	
Actuator Full Load pos [%]	(0, 100)	80	
Actuator Tau [s]	(0, 10)	0.0	
Start rate [rpm/s]	(1, 50)	20	
Idle - Rated rate [rpm/s]	(1, 50)	20	
Analog SpdSet rate [rpm/s]	(1, 50)	5	
Digital SpdSet rate [rpm/s]	(1, 50)	5	
Synchronizer Gain	(0.01, 100)	1	
R/L speed in Load Control ?	(TRUE, FALSE)	FALSE	

Idle Setpoint [rpm]
The Idle setpoint is the lowest normal operational speed for an engine. It needs to be set higher than the starting speed setpoints, and below the rated speed.

Rated Setpoint [rpm]
The Rated setpoint is the normal operational speed for an engine (typically fixed speed propulsion or generator set applications). It needs to be set higher than the idle speed setpoint, and below the maximum speed.

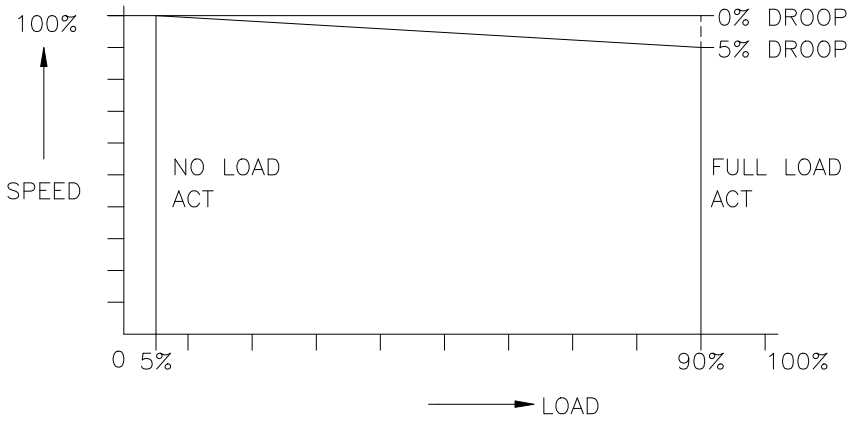
Maximum Setpoint [rpm]
The Maximum setpoint defines the maximum the speed reference can reach when using the Raise Speed input contacts. Temporary speed biases like from synchronizer & load control can still be added to this maximum.
For generator applications, typically the maximum setpoint is 100%+Droop% or a little higher.

Overspeed Test Setpoint [rpm]
Defines the maximum reference possible when the overspeed test is enabled. It shall be set higher than the Maximum Setpoint.

Overspeed Setpoint [rpm]
When the actual speed becomes higher than this threshold, an engine shutdown will be initiated due to overspeed detection.
The Overspeed Setpoint shall be set between Rated Setpoint and Overspeed Test Setpoint.

Stop Speed Setpoint [rpm]
When the engine speed drops below this threshold for 5 seconds, the engine is considered stopped and only now it is possible to reset major alarms.

Droop [%]
The Droop % defines the percentage the speed reference will decrease when running at 100% load in droop mode. In droop mode, the speed reference at 0% load starts of at Rated speed and at 100% load the speed reference will have decreased to (100% - Droop %) of rated speed.



Droop when Load Fails ?
When set to TRUE, the control always switches to (actuator) droop mode when the load sensor fails. When set to FALSE, the control stays in isochronous (when in isochronous Load Sharing mode) and uses a calculated load based on actuator position.

Droop Filter [s]
Time constant for a 1st order low pass filter on the calculated droop portion.

Actuator No Load Pos [%]
Actuator position when at engine is running at 0% load (typically rated speed, GCB open, warmed up engine).

Used for calculating the load when the load sensor has failed or is not present.

Actuator Full Load Pos [%]
Actuator position when at engine is running at 100% load.
Used for calculating the load when the load sensor has failed or is not present.

Actuator Tau [s]
Time constant for a 1st order low pass filter on the calculated load based on actuator position.

Start Rate [rpm/s]
This is the speed reference rate during the startup phase of the engine.

Idle - Rated Rate [rpm/s]
This is the speed reference rate when going from Idle to Rated speed by either contact input or start sequence.

Analog SpdSet Rate [rpm/s]
This is the speed reference rate when remote speed setpoint is activated.

Digital SpdSet Rate [rpm/s]
This is the speed reference rate when Raise/Lower discrete inputs are used.

Synchronizer Gain
When using the analog synchronizer input, if synchronization speed bias changes too slow, increase this gain. If synchronization speed bias changes too fast, decrease this gain.

R/L speed in Load Control ?
Set TRUE to enable Speed Raise & Speed Lower input contacts in isochronous LSL mode.

*Starting Settings *

Description	Range	Nominal	Actual
Start Failure Time [s]	(0,60)	10	
Auto start to Rated	(TRUE, FALSE)	FALSE	
Auto start to Rated Delay [s]	(0, 60)	5	
Start Limit #1 Speed [rpm]	(0, 5000)	0	
Start Limit #1 Perc [%]	(0, 100)	20	
Start Limit #2 Speed [rpm]	(0, 5000)	100	
Start Limit #2 Perc [%]	(0, 100)	30	
Start Limit #3 Speed [rpm]	(0, 5000)	200	
Start Limit #3 Perc [%]	(0, 100)	40	
Start Limit #4 Speed [rpm]	(0, 5000)	0300	
Start Limit #4 Perc [%]	(0, 100)	50	

Start Failure Time [s]
This timer starts when reaching the Start Lim #2 point. It determines how long the actuator can remain at that fuel position before a Shutdown is issued.

Auto start to Rated
Set to TRUE to automatically accelerate to Rated speed when start-up to Idle speed has completed.

Auto start to Rated Delay [s]
Delay time at Idle speed before automatically accelerating to Rated speed.

Start Lim #X Speed [rpm] / Perc [%]
Defines the 4-point start fuel limit curve.
Engine speed is the input to this curve and each next speed point shall be higher than the previous speed point.
Per speed point an adjustable fuel limit [%] can be set.

*Jump&Rate Limiter *

Description	Range	Nominal	Actual
Enable Jump&Rate	(TRUE, FALSE)	FALSE	
F=JR on ACT, T=JR on GCB	(TRUE, FALSE)	FALSE	
Jump 1 [%/LSS]	(0, 100)	35	
Rate Jump 1 [1/sec]	(0, 10)	0.5	
Enbl Jmp2 at % Actuator	(0, 100)	50	
Jump 2 [%/LSS]	(0, 100)	40	
Rate Jump 2 [1/sec]	(0, 10)	2	

F=JR on ACT, T=JR on GCB
FALSE = Jump&Rate #2 activated on % actuator threshold,
TRUE = Jump&Rate #2 activated when Generator CB is closed.

*Load Rejection *

Description	Range	Nominal	Actual
KickDown Act on GCB ?	(TRUE, FALSE)	TRUE	
KickDown Act on deriv ?	(TRUE, FALSE)	FALSE	
KickDown Actuator Limit [%]	(0, 100)	0	
Actuator return rate [%/s]	(1, 10000)	50	
KickDown SpdRef on GCB ?	(TRUE, FALSE)	FALSE	
KickDown SpdRef on deriv ?	(TRUE, FALSE)	FALSE	
SpdRef Bias Level [rpm]	(-1000, 0)	-50	
SpdRef return rate [rpm/s]	(0.1, 10000)	10	
Load Rejection #1 Act [%]	(0, 100)	0	
Load Rejection #1 Pulse [s]	(0, 9)	0.0	
Load Rejection #2 Act [%]	(0, 100)	40	
Load Rejection #2 Pulse [s]	(0, 9)	0.0	
Load Rejection #3 Act [%]	(0, 100)	50	
Load Rejection #3 Pulse [s]	(0, 9)	1.0	
Load Rejection #4 Act [%]	(0, 100)	80	
Load Rejection #4 Pulse [s]	(0, 9)	3.0	
KickDown SET deriv [rpm/s]	(0, 10000)	125	
KickDown RST deriv [rpm/s]	(-1000, 1000)	0	
KickDown SET deriv time [s]	(0, 10)	5	
KickDown RST deriv time [s]	(0, 10)	0.25	

KickDown Act on GCB ?
Set TRUE to activate the actuator KickDown function when the GCB opens.

KickDown Act on Deriv ?
Set TRUE to activate the actuator KickDown function when the speed derivative exceeds the value **KickDown SET deriv [rpm/s].**

KickDown Actuator Limit [%]
Sets the actuator limit during the activation of the KickDown function.

Actuator Return Rate [%/s]
Sets the rate at which the KickDown actuator limit ramps out of the way and normal PID control can take over again, when KickDown gets deactivated.

KickDown SpdRef on GCB ?
Set TRUE to activate the Speed Reference KickDown function when the GCB opens.

KickDown SpdRef on Deriv ?
Set TRUE to activate the Speed Reference KickDown function when the speed derivative exceeds the value **KickDown SET deriv [rpm/s].**

SpdRef Bias Level [rpm]
Sets the Speed Reference negative bias that will be added during the activation of the KickDown function.

SpdRef Return Rate [rpm/s]
Sets the rate at which the KickDown Speed Reference bias returns back to 0, when KickDown gets deactivated.

Load Rejection #X Act [%], Load Rejection #1 Pulse [s]
Defines the 4 point curve of actuator position versus KickDown pulse time for the GCB opening load rejection event.

KickDown SET Deriv [rpm/s]
Threshold for triggering the speed derivative based KickDown function.

KickDown RST Deriv [rpm/s]
Threshold for resetting the speed derivative based KickDown function.

KickDown RST Deriv Time [s]
Derivative needs to be below the **KickDown RST deriv [rpm/s]** for at least this time before the speed derivative based KickDown is reset.

KickDown SET Deriv Time [s]
Maximum time the speed derivative based KickDown function will be active.

*Limits *

Description	Range	Nominal	Actual
Maximum Actuator Limit [%]	(0, 100)	80	
Charge Air Limit #1 [bar]	(0, 10)	0	
Charge Air Limit #1 [%]	(0, 100)	20	
Charge Air Limit #2 [bar]	(0, 10)	1	
Charge Air Limit #2 [%]	(0, 100)	33	
Charge Air Limit #3 [bar]	(0, 10)	2	
Charge Air Limit #3 [%]	(0, 100)	45	
Charge Air Limit #4 [bar]	(0, 10)	3	
Charge Air Limit #4 [%]	(0, 100)	100	

Maximum Actuator Limit [%]
Defines the absolute maximum actuator position for this engine, active in droop and in isochronous load sharing mode.

Charge Air Limit#X [bar], Charge Air Limit#X [%]
Defines the 4 point curve of Boost pressure versus fuel limit, to try to minimize overfueling the engine.

*Load (Control) Settings *

Description	Range	Nominal	Actual
Load Reference [%]			
Load Setpoint Limit [%]	(0, 100)	100	
Unload Setpoint [%]	(-12.5, 112.5)	2.5	
Fast Load rate [%/s]	(0, 1000)	1000	
Soft Load rate [%/s]	(0, 50)	1.0	
Unload rate [%/s]	(0, 50)	2.5	
Load Control P-Gain	(0.01, 100)	0.7	

Load Reference [%]
Displays the final load reference as being used in the load controller.

Load Setpoint Limit [%]
Defines the maximum load setpoint when the engine is running in load control mode. Can be used for example to de-rate an engine after overhauling to run it in.
This will not limit load in droop mode ! Use Maximum Actuator Limit [%] for this.

Unload Setpoint [%]
Defines the minimum load setpoint possible in Base-Load mode.
Defines the minimum load setpoint when the engine is unloaded by the unload contact in isochronous Load Sharing mode.
When the unload setpoint has been reached, a contact output can be activated to open GCB for example.

Fast Load Rate [%/s]
Defines the Load reference rate in normal load control operation.
Typically set high for fast tracking in isochronous load sharing mode.

Soft Load Rate [%/s]
Defines the Load reference rate when an engine switches into isochronous load sharing mode, in base load control, or when a tie-breaker closes. This limits large load transients between engines.

Unload Rate [%/s]
This is the unload rate at which the load reference will ramp down to the Unload Setpoint, when the unload function is active.

Load Control P-Gain
Adjust for stable Load Control & Load Sharing operation
When the speed control PID settings have been optimized for droop operation in a multiple engine system, when switching to load control mode, the P-Gain shall be adjusted for stable load control.

Define Range AI

Description	Range	Nominal	Actual
Remote SpdRef 4 mA [rpm]	(0, 5000)	0	
Remote SpdRef 20 mA [rpm]	(0, 5000)	900	
Remote SpdRef Inp [rpm]			
Charge Air Press 4 mA [bar]	(-9999, 9999)	0	
Charge Air Press 20 mA [bar]	(-9999, 9999)	10	
Charge Air Press Inp [bar]			
EngLoad 4 mA [kW]	(-5000, 50000)	0	
EngLoad 20 mA [kW]	(-5000, 50000)	5000	
EngLoad Inp [kW]			
EngLoad @ 0% [kW]	(-5000, 50000)	0	
EngLoad @ 100% [kW]	(-5000, 50000)	2500	
EngLoad [%]			
Load Limiter 4 mA [%]	(-9999, 9999)	0	
Load Limiter 20 mA [%]	(-9999, 9999)	100	
Load Limiter Inp [%]			
Rem LoadRef 4 mA [%]	(-9999, 9999)	0	
Rem LoadRef 20 mA [%]	(-9999, 9999)	100	
Rem LoadRef Inp [%]			
Reactive Pwr 4 mA [%]	(-9999, 9999)	0	
Reactive Pwr 20 mA [%]	(-9999, 9999)	100	
Reactive Pwr Inp [%]			
Reactive Pwr 0% [kVar]	(-5000, 50000)	0	
Reactive Pwr 100% [kVar]	(-5000, 50000)	2000	
Reactive Pwr Inp [kVar]			
Fuel Limiter 4 mA [%]	(-9999, 9999)	0	
Fuel Limiter 20 mA [%]	(-9999, 9999)	100	
Fuel Limiter Inp [%]			

EngLoad [%]
Displays the final load as being used in the load controller.

This can be the EngLoad input signal, but also the actuator based calculated backup load when the EngLoad input has failed or is not configured.

Define Range AO

Description	Range	Nominal	Actual
Speed Ref 4 mA [rpm]	(-9999, 9999)	0	
Speed Ref 20 mA [rpm]	(-9999, 9999)	2500	
Load Ref 4 mA [%]	(-9999, 9999)	0	
Load Ref 20 mA [%]	(-9999, 9999)	100	
Speed 4 mA [rpm]	(-9999, 9999)	0	
Speed 20 mA [rpm]	(-9999, 9999)	2500	
Speed#1 4 mA [rpm]	(-9999, 9999)	0	
Speed#1 20 mA [rpm]	(-9999, 9999)	2500	
Speed#2 4 mA [rpm]	(-9999, 9999)	0	
Speed#2 20 mA [rpm]	(-9999, 9999)	2500	
Remote SpdRef 4 mA [rpm]	(-9999, 9999)	0	
Remote SpdRef 20 mA [rpm]	(-9999, 9999)	2500	
Synchronizer 4 mA [%]	(-9999, 9999)	-1	
Synchronizer 20 mA [%]	(-9999, 9999)	+1	
Charge Air Press 4 mA [bar]	(-9999, 9999)	0	
Charge Air Press 20 mA [bar]	(-9999, 9999)	10	
Load 4 mA [%]	(-9999, 9999)	0	
Load 20 mA [%]	(-9999, 9999)	100	
Load Limit 4 mA [%]	(-9999, 9999)	0	
Load Limit 20 mA [%]	(-9999, 9999)	100	
Remote Load Ref 4 mA [%]	(-9999, 9999)	0	
Remote Load Ref 20 mA [%]	(-9999, 9999)	100	
Reactive Pwr 4 mA [kVar]	(-5000, 50000)	0	
Reactive Pwr 20 mA [kVar]	(-5000, 50000)	2000	
Fuel Limit 4 mA [%]	(-9999, 9999)	0	
Fuel Limit 20 mA [%]	(-9999, 9999)	100	
My Busses Avg Load 4 mA [%]	(-9999, 9999)	0	
My Busses Avg Load 20 mA [%]	(-9999, 9999)	100	
Busses Tot LS Load 4 mA [%]	(-9999, 9999)	0	
Busses Tot LS Load 20 mA [%]	(-9999, 9999)	2000	
Busses Total Load 4 mA [%]	(-9999, 9999)	0	
Busses Total Load 20 mA [%]	(-9999, 9999)	2000	

Modbus Settings

Description	Range	Nominal	Actual
HW Configuration	(1, 3)	1	
Baud Rate	(1, 7)	6	
Stop Bits	(1, 3)	1	
Parity	(1, 3)	1	
Modbus TimeOut [s]	(0.0, 60.0)	5.0	

HW Configuration
1 = RS-232, 2 = RS-422, 3 = RS-485

Baud Rate
1 = 1200, 2 = 1800, 3 = 2400, 4 = 4800, 5 = 9600, 6 = 19200, 7 = 38400

Stop Bits
1 = 1 stop bit, 2 = 1.5 stop bit, 3 = 2 stop bits

Parity
1 = Off, 2 = Odd, 3 = Even

Modbus TimeOut [s]
Defines the delay before a Modbus communication fault will be initiated.

* Port Setting J1 *

Description	Range	Nominal	Actual
Set Download Mode ?	(1, 2)	2	

Set Download Mode ?
This sets the 723PLUS com port J1 usage setting:
1 = Servlink, 2 = Hand-Held

IMPORTANT **After every reboot of the 723PLUS control, Set Download Mode ? is set back to 2, which is Hand-Held usage.**

Chapter 5.
Functional Block Diagram

This chapter contains Functional Block Diagram 9971-4050.

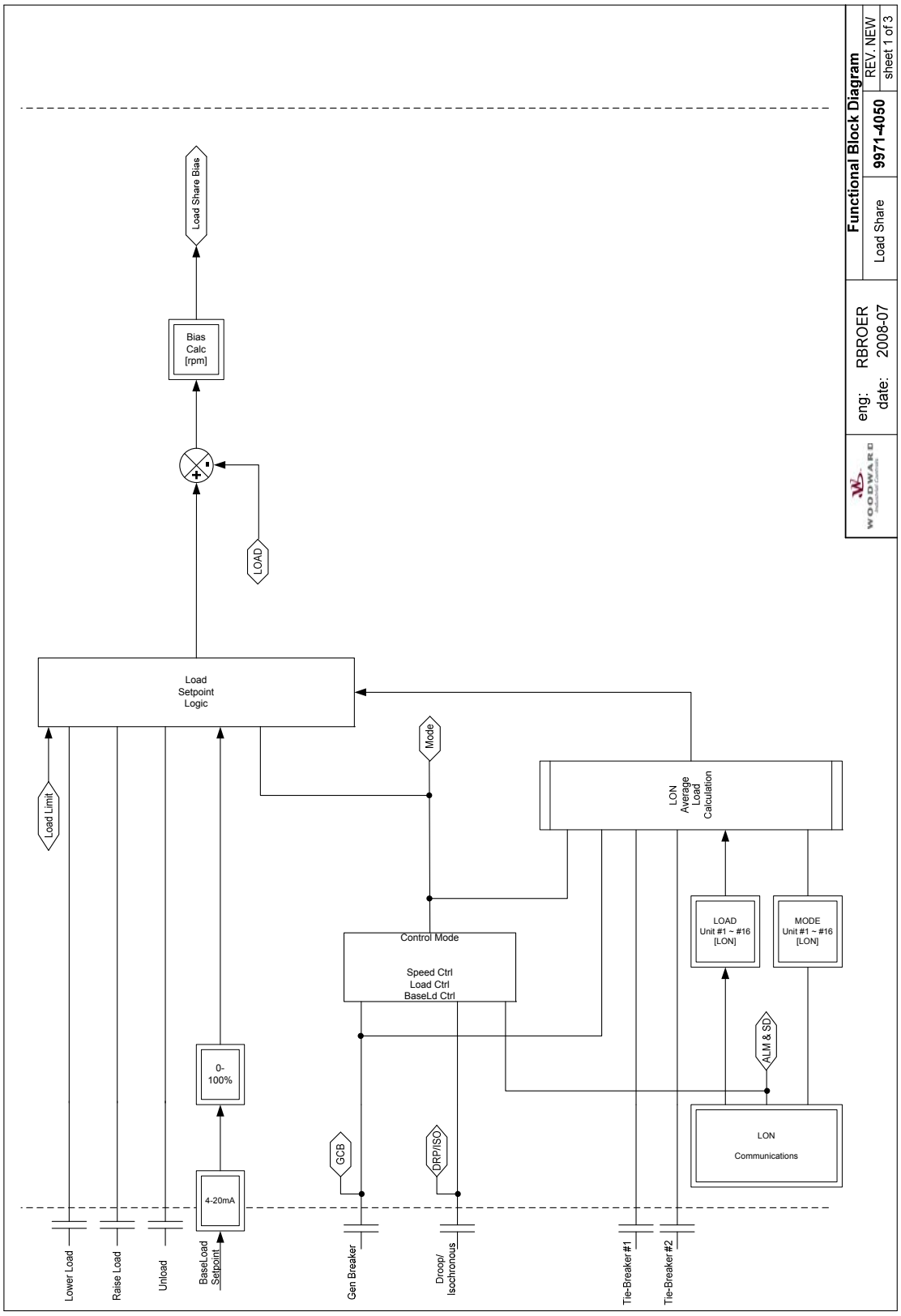


Figure 5-1a. Functional Block Diagram 9971-4050

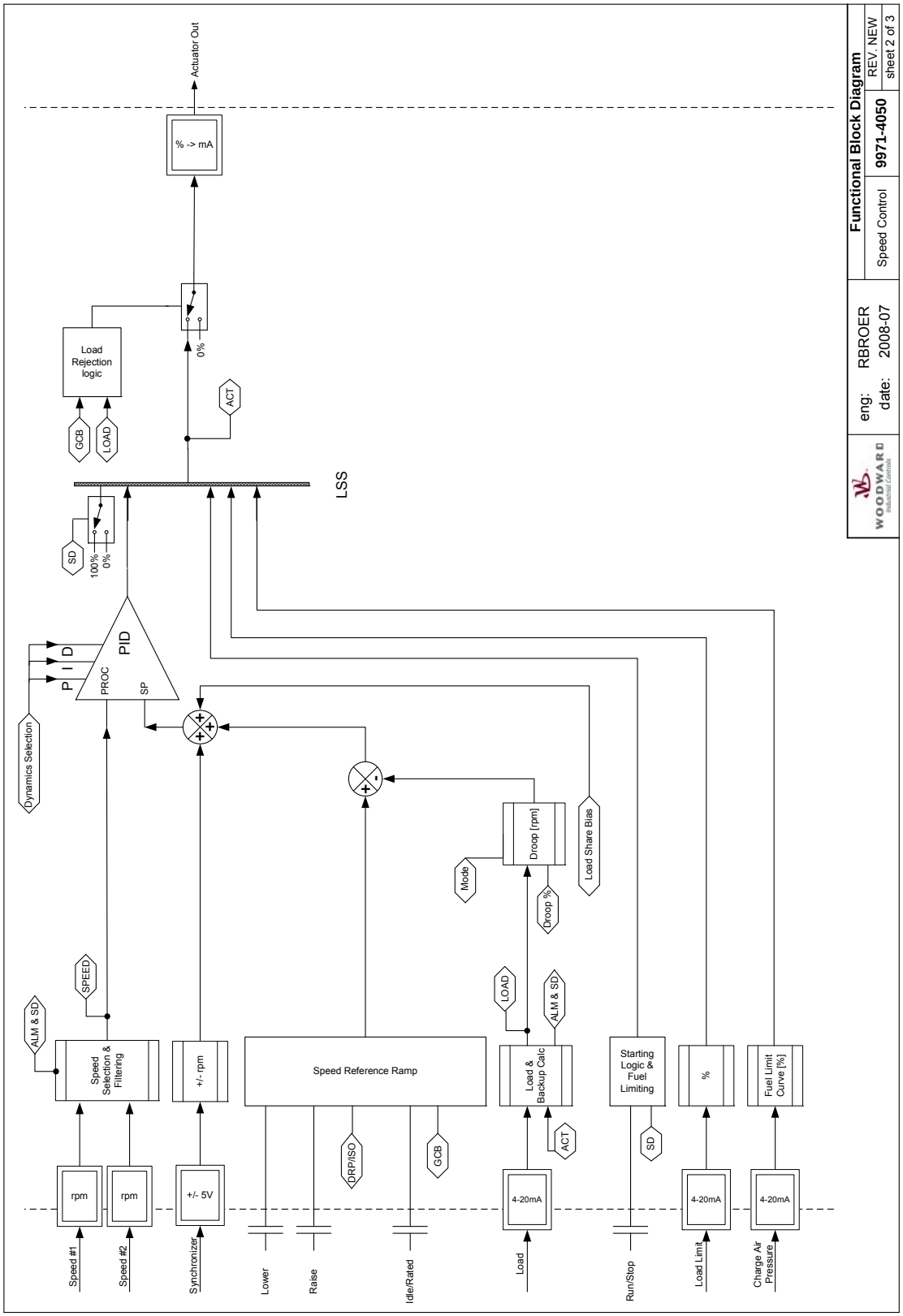


Figure 5-1b. Functional Block Diagram 9971-4050

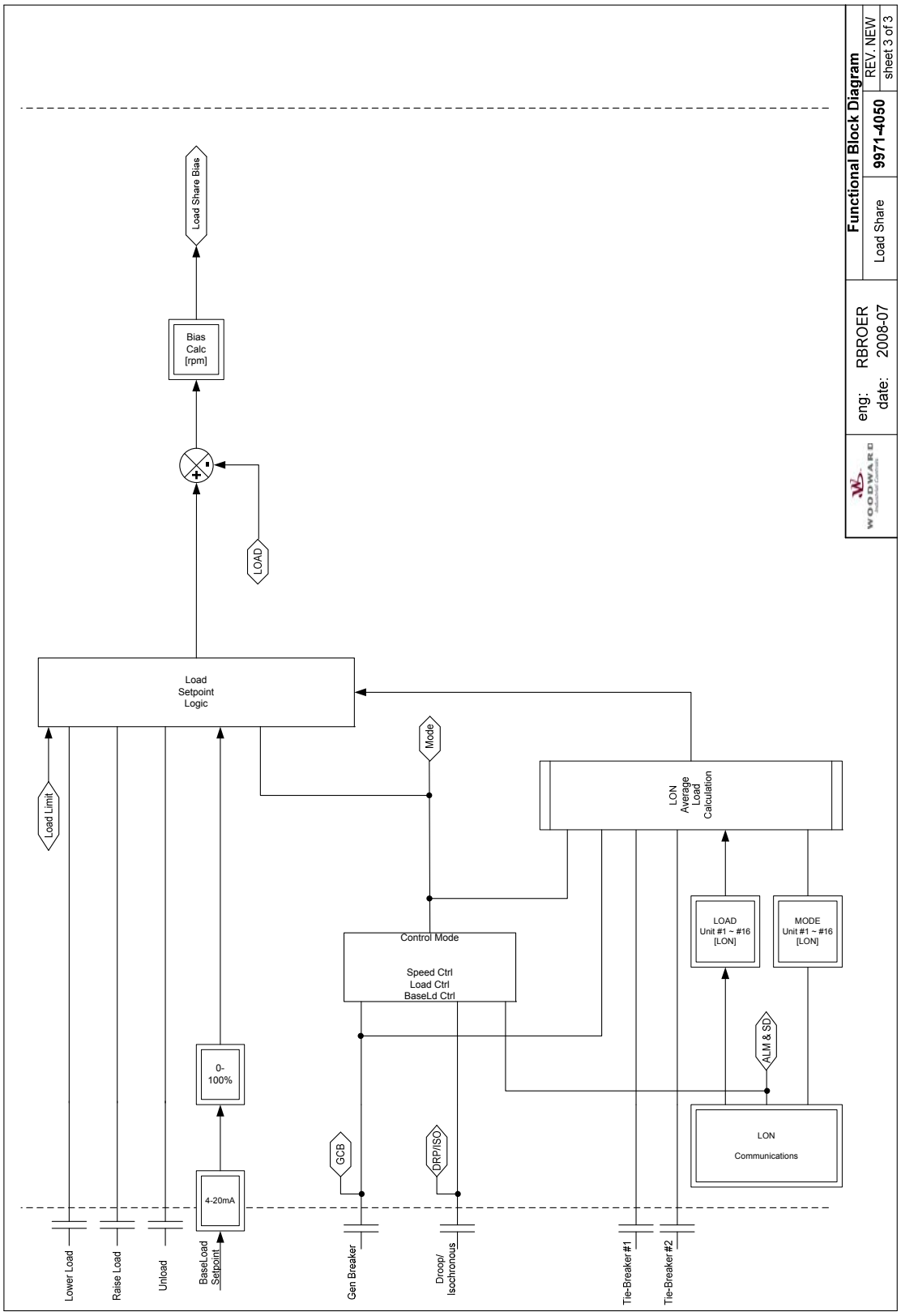


Figure 5-1c. Functional Block Diagram 9971-4050

Chapter 6.
Modbus Signals List

This chapter lists the Modbus List with Standard Generator Control LON Load Sharing system parameters which are available for monitoring & control by external systems like SCADA, PLC etc.

The 723PLUS Modbus is always “slave”.

Boolean Writes

Address	Input	Description
0:0001		RESET command
0:0002		RUN command
0:0003		STOP command
0:0004		RAISE Speed (& Load) command
0:0005		LOWER Speed (& Load) command
0:0006		RAISE Load command
0:0007		LOWER Load command
0:0008		UNLOAD command
0:0009		BASELOAD command
0:0010		IDLE speed select
0:0011		RATED speed select
0:0012		DROOP mode select
0:0013		ISOCHRONOUS mode select
0:0014		Generator CB closed
0:0015		Tie Breaker #1 closed
0:0016		Tie Breaker #2 closed
0:0017		LON Reset command
0:0018		Select Dynamics set #2 command
0:0019		Select Dynamics set #3 command
0:0020		Remote Speed command

Boolean Reads

Address	Description
1:0001	Discrete Inputs - Reset
1:0002	Discrete Inputs - Run
1:0003	Discrete Inputs - Stop
1:0004	Discrete Inputs - Speed Raise
1:0005	Discrete Inputs - Speed Lower
1:0006	Discrete Inputs - Load Raise
1:0007	Discrete Inputs - Load Lower
1:0008	Discrete Inputs - Droop
1:0009	Discrete Inputs - Isochronous
1:0010	Discrete Inputs - Idle
1:0011	Discrete Inputs - Rated
1:0012	Discrete Inputs - Unload
1:0013	Discrete Inputs - BaseLoad
1:0014	Discrete Inputs - GCB Closed

Address	Description
1:0015	Discrete Inputs - TBR1 Closed
1:0016	Discrete Inputs - TBR2 Closed
1:0017	Discrete Inputs - TBR1 Closed (LON)
1:0018	Discrete Inputs - TBR2 Closed (LON)
1:0019	Discrete Inputs – LON Reset command
1:0020	Discrete Inputs – Select Dynamics #2
1:0021	Discrete Inputs – Select Dynamics #3
1:0022	Discrete Inputs – Remote Speed
1:0023	Discrete Inputs -
1:0024	Discrete Inputs -
1:0025	Discrete Inputs -
1:0026	Discrete Inputs -
1:0027	Discrete Inputs -
1:0028	Discrete Inputs -
1:0029	Discrete Inputs -
1:0030	Discrete Inputs -
1:0031	ALM - Minor Alarm
1:0032	ALM - IO in Test/Override
1:0033	ALM - AI1 Hardware Fault
1:0034	ALM - AI2 Hardware Fault
1:0035	ALM - AI3 Hardware Fault
1:0036	ALM - Speed #1 Fault
1:0037	ALM - Speed #2 Fault
1:0038	ALM - Speed Diff Fault
1:0039	ALM - Rem Speed Setp Fault
1:0040	ALM - Synchronizer Fault
1:0041	ALM - Charge Air Press Fault
1:0042	ALM - Load Fault
1:0043	ALM - Load Limit Fault
1:0044	ALM - Rem Load Setp Fault
1:0045	ALM - kVar Fault
1:0046	ALM - Fuel Limit Fault
1:0047	ALM - Modbus Fault
1:0048	ALM - LON Fail - Force Droop
1:0049	ALM - LON Fault NODE01
1:0050	ALM - LON Fault NODE02
1:0051	ALM - LON Fault NODE03
1:0052	ALM - LON Fault NODE04
1:0053	ALM - LON Fault NODE05
1:0054	ALM - LON Fault NODE06
1:0055	ALM - LON Fault NODE07
1:0056	ALM - LON Fault NODE08
1:0057	ALM - LON Fault NODE09
1:0058	ALM - LON Fault NODE10
1:0059	ALM - LON Fault NODE11
1:0060	ALM - LON Fault NODE12
1:0061	ALM - LON Fault NODE13
1:0062	ALM - LON Fault NODE14
1:0063	ALM - LON Fault NODE15
1:0064	ALM - LON Fault NODE16

Address	Description
1:0065	ALM - Exit from LON Load Sharing
1:0066	ALM - Tie-Breaker #1 wire-break
1:0067	ALM - Tie-Breaker #2 wire-break
1:0068	ALM - Load offset or GCB wire-break
1:0069	ALM -
1:0070	ALM -
1:0071	SD - Major Alarm
1:0072	SD - IO in Test/Override
1:0073	SD - AI1 Hardware Fault
1:0074	SD - AI2 Hardware Fault
1:0075	SD - AI3 Hardware Fault
1:0076	SD - Speed #1 Fault
1:0077	SD - Speed #2 Fault
1:0078	SD - Speed Diff Fault
1:0079	SD - Speed #1 & #2 Fault
1:0080	SD - Overspeed Fault
1:0081	SD - Rem Speed Setp Fault
1:0082	SD - Synchronizer Fault
1:0083	SD - Charge Air Press Fault
1:0084	SD - Load Fault
1:0085	SD - Load Limit Fault
1:0086	SD - Rem Load Setp Fault
1:0087	SD - kVar Fault
1:0088	SD - Fuel Limit Fault
1:0089	SD - Modbus Fault
1:0090	SD -
1:0091	SD -
1:0092	SD -
1:0093	SD -
1:0094	SD -
1:0095	SD -
1:0096	SD -
1:0097	SD -
1:0098	SD -
1:0099	SD -
1:0100	Control Mode ISOCHRONOUS
1:0101	Control Mode DROOP
1:0102	Control Mode Base-Load
1:0103	Control Mode Load-Sharing
1:0104	Control Mode Load-Control
1:0105	Control Mode Speed-Control
1:0106	SEQUENCE - Starting/Started
1:0107	SEQUENCE - Stopped
1:0108	SEQUENCE - Starting to Idle
1:0109	SEQUENCE - Running >= Idle
1:0110	LoadRef - Load at Limit
1:0111	LoadRef - Unloaded
1:0112	LoadRef - Soft-Loading
1:0113	Control - Speed in control
1:0114	Control - Max Actuator Lim in control

Address	Description
1:0115	Control - Stop in control
1:0116	Control - Start Lim in control
1:0117	Control - Max Fuel Lim in control
1:0118	Control - Boost Lim in control
1:0119	Control - Load Rejection in control
1:0120	Status -
1:0121	Status -
1:0122	Status -
1:0123	Status -
1:0124	Status -
1:0125	Status -
1:0126	Status -
1:0127	Status -
1:0128	Status -
1:0129	Status -
1:0130	Status -
1:0131	LoadSharing mode NODE01
1:0132	LoadSharing mode NODE02
1:0133	LoadSharing mode NODE03
1:0134	LoadSharing mode NODE04
1:0135	LoadSharing mode NODE05
1:0136	LoadSharing mode NODE06
1:0137	LoadSharing mode NODE07
1:0138	LoadSharing mode NODE08
1:0139	LoadSharing mode NODE09
1:0140	LoadSharing mode NODE10
1:0141	LoadSharing mode NODE11
1:0142	LoadSharing mode NODE12
1:0143	LoadSharing mode NODE13
1:0144	LoadSharing mode NODE14
1:0145	LoadSharing mode NODE15
1:0146	LoadSharing mode NODE16
1:0147	BaseLoad mode NODE01
1:0148	BaseLoad mode NODE02
1:0149	BaseLoad mode NODE03
1:0150	BaseLoad mode NODE04
1:0151	BaseLoad mode NODE05
1:0152	BaseLoad mode NODE06
1:0153	BaseLoad mode NODE07
1:0154	BaseLoad mode NODE08
1:0155	BaseLoad mode NODE09
1:0156	BaseLoad mode NODE10
1:0157	BaseLoad mode NODE11
1:0158	BaseLoad mode NODE12
1:0159	BaseLoad mode NODE13
1:0160	BaseLoad mode NODE14
1:0161	BaseLoad mode NODE15
1:0162	BaseLoad mode NODE16
1:0163	SpeedControl mode NODE01
1:0164	SpeedControl mode NODE02

Address	Description
1:0165	SpeedControl mode NODE03
1:0166	SpeedControl mode NODE04
1:0167	SpeedControl mode NODE05
1:0168	SpeedControl mode NODE06
1:0169	SpeedControl mode NODE07
1:0170	SpeedControl mode NODE08
1:0171	SpeedControl mode NODE09
1:0172	SpeedControl mode NODE10
1:0173	SpeedControl mode NODE11
1:0174	SpeedControl mode NODE12
1:0175	SpeedControl mode NODE13
1:0176	SpeedControl mode NODE14
1:0177	SpeedControl mode NODE15
1:0178	SpeedControl mode NODE16
1:0179	Soft-Loading NODE01
1:0180	Soft-Loading NODE02
1:0181	Soft-Loading NODE03
1:0182	Soft-Loading NODE04
1:0183	Soft-Loading NODE05
1:0184	Soft-Loading NODE06
1:0185	Soft-Loading NODE07
1:0186	Soft-Loading NODE08
1:0187	Soft-Loading NODE09
1:0188	Soft-Loading NODE10
1:0189	Soft-Loading NODE11
1:0190	Soft-Loading NODE12
1:0191	Soft-Loading NODE13
1:0192	Soft-Loading NODE14
1:0193	Soft-Loading NODE15
1:0194	Soft-Loading NODE16
1:0195	GCB Closed NODE01
1:0196	GCB Closed NODE02
1:0197	GCB Closed NODE03
1:0198	GCB Closed NODE04
1:0199	GCB Closed NODE05
1:0200	GCB Closed NODE06
1:0201	GCB Closed NODE07
1:0202	GCB Closed NODE08
1:0203	GCB Closed NODE09
1:0204	GCB Closed NODE10
1:0205	GCB Closed NODE11
1:0206	GCB Closed NODE12
1:0207	GCB Closed NODE13
1:0208	GCB Closed NODE14
1:0209	GCB Closed NODE15
1:0210	GCB Closed NODE16

Analog Reads

Address	Description	Units	Multiplier
3:0001	Selected Engine Speed [rpm]	rpm	10
3:0002	Speed Input Ch. 1 [rpm]	rpm	10
3:0003	Speed Input Ch. 2 [rpm]	rpm	10
3:0004	Speed Difference 1 & 2 [rpm]	rpm	10
3:0005	Speed Reference Ramp [rpm]	rpm	10
3:0006	Final Speed Reference [rpm]	rpm	10
3:0007	Remote Speed Reference [rpm]	rpm	10
3:0008	Synchronizer Bias [rpm]	rpm	10
3:0009	Charge Air Pressure [bar]	bar	1000
3:0010	Charge Air Pressure Lim [%]	%	100
3:0011	Actual Load [%]	%	100
3:0012	Actual Load [kW]	kW	10
3:0013	Load Reference [%]	%	100
3:0014	Load Limiter [%]	%	100
3:0015	Remote Load Ref [%]	%	100
3:0016	Actual Reactive Power [%]	%	100
3:0017	Actual Reactive Power [kVar]	kVar	10
3:0018	Fuel Limiter [%]	%	100
3:0019	Speed Control PID [%]	%	100
3:0020	Final Speed Control LSS [%]	%	100
3:0021	Actuator Output [%]	%	100
3:0022	Final Proportional Gain	[ ]	1000
3:0023	Final Integral Gain	[ ]	1000
3:0024	Final S_D_R	%	100
3:0025	BUS1 Load [%]	%	100
3:0026	BUS2 Load [%]	%	100
3:0027	BUS3 Load [%]	%	100
3:0028	BUS1 #Nodes in LS mode	[ ]	1
3:0029	BUS2 #Nodes in LS mode	[ ]	1
3:0030	BUS3 #Nodes in LS mode	[ ]	1
3:0031	My Busses AVG Load [%]	%	100
3:0032	#Nodes in LS mode in MY_BUS segment(s)	[ ]	1
3:0033	All Busses Total LS Load [%]	%	100
3:0034	All Busses Total LS Count	[ ]	1
3:0035	All Busses Total Load [%]	%	100
3:0036	Value -		
3:0037	Value -		
3:0038	Value -		
3:0039	Value -		
3:0040	Value -		
3:0041	Value -		
3:0042	Value -		
3:0043	Value -		
3:0044	Value -		
3:0045	Value -		
3:0046	Value -		
3:0047	Value -		
3:0048	Value -		
3:0049	Value -		

Address	Description	Units	Multiplier
3:0050	Value -		
3:0051	LON - Speed [rpm] NODE01	rpm	10
3:0052	LON - Speed [rpm] NODE02	rpm	10
3:0053	LON - Speed [rpm] NODE03	rpm	10
3:0054	LON - Speed [rpm] NODE04	rpm	10
3:0055	LON - Speed [rpm] NODE05	rpm	10
3:0056	LON - Speed [rpm] NODE06	rpm	10
3:0057	LON - Speed [rpm] NODE07	rpm	10
3:0058	LON - Speed [rpm] NODE08	rpm	10
3:0059	LON - Speed [rpm] NODE09	rpm	10
3:0060	LON - Speed [rpm] NODE10	rpm	10
3:0061	LON - Speed [rpm] NODE11	rpm	10
3:0062	LON - Speed [rpm] NODE12	rpm	10
3:0063	LON - Speed [rpm] NODE13	rpm	10
3:0064	LON - Speed [rpm] NODE14	rpm	10
3:0065	LON - Speed [rpm] NODE15	rpm	10
3:0066	LON - Speed [rpm] NODE16	rpm	10
3:0067	LON - Load [%] NODE01	%	100
3:0068	LON - Load [%] NODE02	%	100
3:0069	LON - Load [%] NODE03	%	100
3:0070	LON - Load [%] NODE04	%	100
3:0071	LON - Load [%] NODE05	%	100
3:0072	LON - Load [%] NODE06	%	100
3:0073	LON - Load [%] NODE07	%	100
3:0074	LON - Load [%] NODE08	%	100
3:0075	LON - Load [%] NODE09	%	100
3:0076	LON - Load [%] NODE10	%	100
3:0077	LON - Load [%] NODE11	%	100
3:0078	LON - Load [%] NODE12	%	100
3:0079	LON - Load [%] NODE13	%	100
3:0080	LON - Load [%] NODE14	%	100
3:0081	LON - Load [%] NODE15	%	100
3:0082	LON - Load [%] NODE16	%	100
3:0083	LON - Grid Frequency [Hz] NODE01	Hz	100
3:0084	LON - Grid Frequency [Hz] NODE02	Hz	100
3:0085	LON - Grid Frequency [Hz] NODE03	Hz	100
3:0086	LON - Grid Frequency [Hz] NODE04	Hz	100
3:0087	LON - Grid Frequency [Hz] NODE05	Hz	100
3:0088	LON - Grid Frequency [Hz] NODE06	Hz	100
3:0089	LON - Grid Frequency [Hz] NODE07	Hz	100
3:0090	LON - Grid Frequency [Hz] NODE08	Hz	100
3:0091	LON - Grid Frequency [Hz] NODE09	Hz	100
3:0092	LON - Grid Frequency [Hz] NODE10	Hz	100
3:0093	LON - Grid Frequency [Hz] NODE11	Hz	100
3:0094	LON - Grid Frequency [Hz] NODE12	Hz	100
3:0095	LON - Grid Frequency [Hz] NODE13	Hz	100
3:0096	LON - Grid Frequency [Hz] NODE14	Hz	100
3:0097	LON - Grid Frequency [Hz] NODE15	Hz	100
3:0098	LON - Grid Frequency [Hz] NODE16	Hz	100

Analog Writes

Address	Description	Units	Multiplyer
4:0001	Remote Speed Ref [%]	%	1
4:0002	SPMA [%]	%	1
4:0003	Charge Air Press [%]	%	1
4:0004	Load [%]	%	1
4:0005	Load Limit [%]	%	1
4:0006	Remote Load Ref [%]	%	1
4:0007	Reactive Power [%]	%	1
4:0008	Fuel Limit [%]	%	1

Chapter 7.
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 published at **www.woodward.com/directory**.

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

Products Used In Electrical Power Systems

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

Products Used In Engine Systems

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

Products Used In Industrial Turbomachinery Systems

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

For the most current product support and contact information, please visit our website directory at **www.woodward.com/directory**.

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.

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 91623.

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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.

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