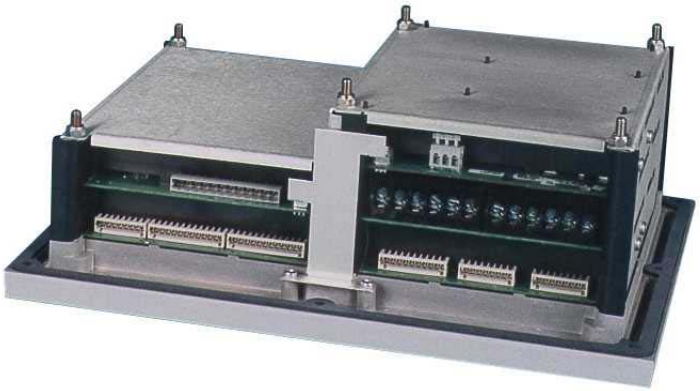
WOODWARD

Installation and Configuration Manual



AtlasSC™
Load + Speed Control for AZO Mexico

8237-1160

Manual 26401

WARNING—DANGER OF DEATH OR PERSONAL INJURY

WARNING—FOLLOW INSTRUCTIONS

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.

WARNING—OUT-OF-DATE PUBLICATION

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, be sure to check the Woodward website:

www.woodward.com/pubs/current.pdf

The revision level is shown at the bottom of the front cover after the publication number. The latest version of most publications is available at:

www.woodward.com/publications

If your publication is not there, please contact your customer service representative to get the latest copy.

WARNING—OVERSPEED PROTECTION

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—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.

CAUTION—POSSIBLE DAMAGE TO EQUIPMENT OR PROPERTY

CAUTION—BATTERY CHARGING

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.

CAUTION—ELECTROSTATIC DISCHARGE

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.**

IMPORTANT DEFINITIONS

- **A WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**
- **A CAUTION indicates a potentially hazardous situation which, if not avoided, could result in damage to equipment or property.**
- **A NOTE provides other helpful information that does not fall under the warning or caution categories.**

Contents

Contents

Illustrations and Tables

Regulatory Compliance

European Compliance for CE Mark:

EMC Directive	Declared to 89/336/EEC COUNCIL DIRECTIVE of 03 May 1989 on the approximation of the laws of the member states relating to electromagnetic compatibility.
Low Voltage Directive	Declared to the 73/23/EEC COUNCIL DIRECTIVE of 19 February 1973 on the harmonization of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits.
ATEX Directive	Declared to 94/9/EEC COUNCIL DIRECTIVE of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres. LCIE 03 ATEX 6077 X for Zone 2

North American Compliance:

UL	UL Listed for use in Class I, Division 2, Groups A, B, C, D and non-hazardous locations for the United States and Canada

NOTE—Wiring must be in accordance with the applicable electric codes with the authority having jurisdiction

Marine Compliance:

American Bureau of Shipping	ABS Rules 2003 SVR 4-2-1/7.3, 7.5.1/17, 4-9-4/23, 4-9-7/Table 9
Det Norske Veritas	Standard for Certification No. 2.4, 2001: Temp. Class B, Humidity Class B, Vibration Class C, EMC Class A
Lloyd's Register of Shipping	LR Type Approval System, Test Specification No. 1, 2002 for Environmental Categories ENV1, ENV2, and ENV3.

The AtlasSC Load+Speed Control is suitable for use in Class I, Division 2, Groups A, B, C, D per UL for Canada and US or non-hazardous locations only.

The AtlasSC Load+Speed Control is suitable for use in European Zone 2, Group IIC environments per DEMKO certification.

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

Field Wiring must be suitable for at least 90 °C. Grounding is required by the input PE terminal. These listings are limited only to those units bearing the UL, cUL, or CE logos.

WARNING—EXPLOSION HAZARD

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

Substitution of components may impair suitability for Class I, Division 2.

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

AVERTISSEMENT—RISQUE D'EXPLOSION

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

La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 2.

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

WARNING—PROTECTIVE EARTH

Protective Earth (PE) must be connected to the termination point on the back side of the unit next to the label with the ⏚ symbol (or 1 of 3 other like termination points without label) to reduce the risk of electric shock. This connection will be made using a thread-forming screw. The conductor providing the connection must have a properly sized ring lug and wire larger than or equal to 4 mm² (12 AWG).

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

The installation must include the following:

- **The power supply mains should be properly fused according to the installation instructions and the appropriate wiring requirements.**
- **A switch or circuit breaker must be included in the building installation in close proximity to the equipment and within easy reach of the operator, and must be clearly marked as the disconnecting device for the equipment. The switch or circuit breaker will only remove power to the unit—hazardous voltages may still be connected to other terminals on the unit.**

Electrostatic Discharge Awareness

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

Follow these precautions when working with or near the control.

1. Before doing maintenance on the electronic control, discharge the static electricity on your body to ground by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.).

2. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.

3. Keep plastic, vinyl, and Styrofoam materials (such as plastic or Styrofoam cups, cup holders, cigarette packages, cellophane wrappers, vinyl books or folders, plastic bottles, and plastic ash trays) away from the control, the modules, and the work area as much as possible.

4. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:

    - Do not touch any part of the PCB except the edges.

    - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.

    - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

CAUTION—ELECTROSTATIC DISCHARGE

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

Chapter 1.
General Information

Introduction

The AtlasSC™ Load+Speed Control can perform engine start/stop sequence and automatic transfer switch (ATS) control. For isolated bus operation the control will operate in isochronous, and can close the generator to a dead bus. In mains or bus parallel operation, the unit can operate in BaseLoad, peak shaving, or process control modes, communicating with the EGCP3-MC.

Input/Output Arrangement

The standard I/O (input/output) for this product is:

Type of Input	# of Inputs	Options/Details
DC Power Input		
Low Voltage dc input	1	18–32 Vdc, protected from reverse polarity
Analog Inputs		
Function Configurable Inputs	4	Current or Voltage
Configurable Alarm Input	7	2 Thermocouple, 2 4-20mA and 3 PT-100
Analog Input for MAP Limiter	1	Current
MPU Speed Sensor	2	100–20 000 Hz
Bus PT Input	1	3-phase ac input
Generator PT Input	1	3-phase ac input
Bus CT Input	1	3-phase ac input
Generator CT Input	1	3-phase ac input
Actuator Output	1	0-20mA, 4-20mA or 0-200mA
Analog Outputs		
Voltage Bias	1	±1 Vdc, ±3 Vdc, ±9 Vdc, 4–20 mA
Function Configurable outputs	4	Current
Discrete Inputs		
Configurable Switch or Contact inputs	16	Switch to + to activate, Isolated from input power
Contact alarm inputs only	3	Switch to + to activate, Isolated from input power
Discrete Outputs		
Relay Driver Outputs	12	Low side drivers
Communication Ports		
Serial Ports	3	(1)—RS-232, (2)—RS-232/422/485

Control Specifications

The AtlasSC Load+Speed Control power metering accuracies are listed to Appendix C, and the environmental specifications are listed inside the back cover.

Compliance Specifications

The AtlasSC Load+Speed Control is certified to the following standards. A compliance mark is applied to each unit.

Agency	Standard	Name	Mark
Underwriters Laboratories (UL)	UL508	Industrial Control Equipment	UL
	UL1604	Electrical Equipment for Use in Class I, Division 2 Hazardous Locations	
	CSA C22.2 No. 142-M1987	Process Control Equipment	cUL
	CSA C22.2 No. 213-M1987	Non-Incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations	
DEMKO	EN50021	Electrical Apparatus for Potentially Explosive Atmospheres–Type of Protection “n”	cUL
EEC	EMC Directive	89/336/EEC	CE
	Low Voltage Directive	72/23/EEC	
	ATEX Directive	94/9/EEC	
Marine	LR	LR Type Approval System Test Specification No. 1, 1996	
	DNV	Standard for Certification No. 2.4–Environmental Test Specification for Instrumentation and Automation Equipment	
	ABS	ABS Rules for Building and Classing Steel Vessels, 2003–Part 4	

Application And Functions

The AtlasSC Load+Speed Control is a microprocessor-based generator load control designed for use with a separate speed control and an automatic voltage regulator to provide synchronizing, paralleling, loading and unloading, and automatic load transfer switching. All transitions between AtlasSC Load+Speed Control functions are coordinated to provide smooth operation.

AtlasSC Load+Speed Control functions include:

- Local setup/monitoring or remote HMI
- Engine Start/Stop Sequence Control
- Master/Slave unit sequencing, individual unit protection
- Engine Protection and Monitoring
- Synchronizer with speed, phase, voltage matching, token passing for dead bus closure, and multiple unit synchronizing
- KW Control with automatic generator loading and unloading for bumpless load transfer
- Droop, BaseLoad, and isochronous load sharing control capability
- Frequency Trimming in Isochronous mode
- LON Communication with Master Control and other LS units
- Master/Slave Process control for cogeneration, import/export, pressure control, or other processes
- KVAR/PF Control and bus KVAR/PF sharing
- Individual generator stable timing
- Built in diagnostics
- Generator Protective Relaying
- Speed Control
- Generator and Utility Power and Energy Metering
- Modbus® * and ServLink communications

*—Modbus is a trademark of Modicon, Inc.

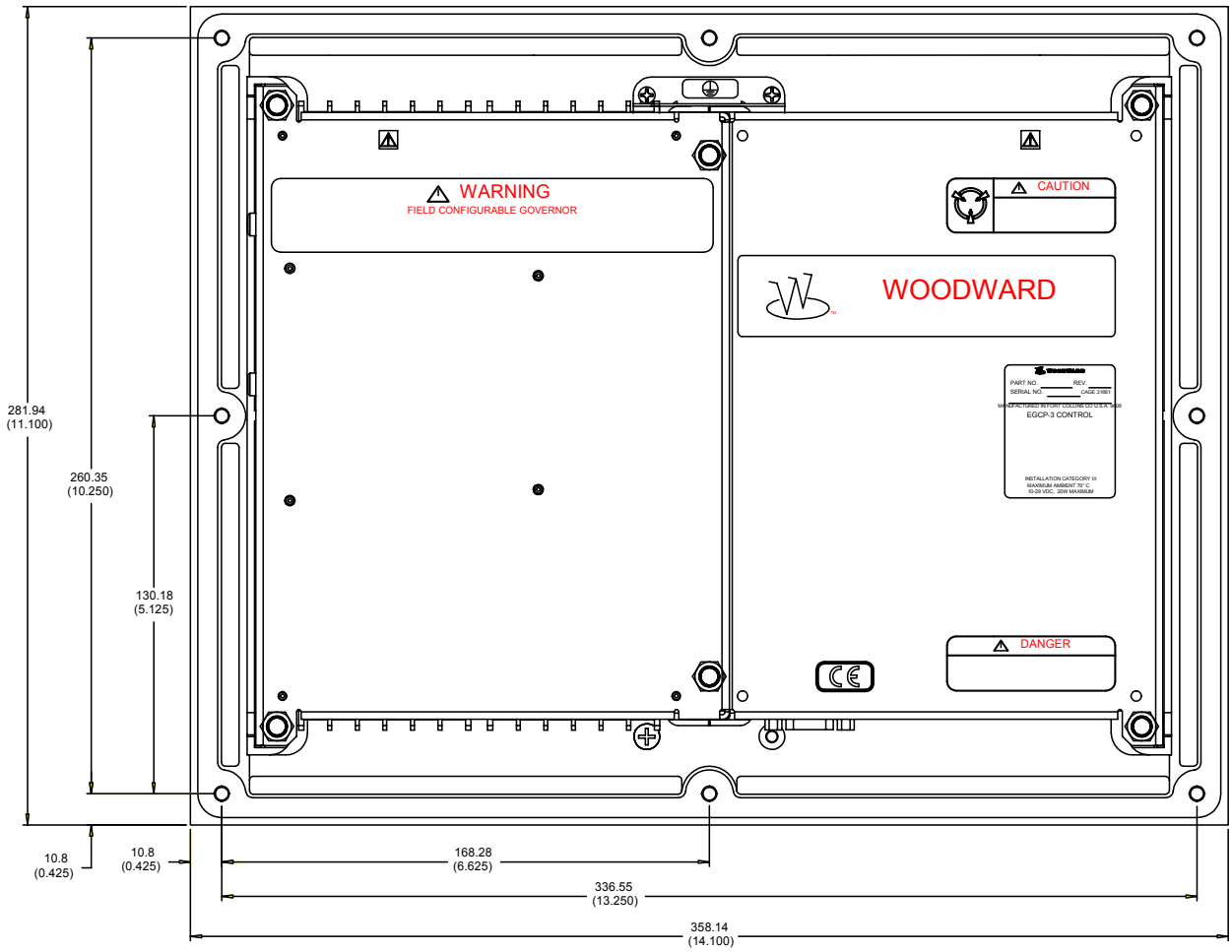


Figure 1-1a. AtlasSC Load+Speed Control Outline Drawing (back view)
(Dimensions are shown in mm with inches in parentheses below)

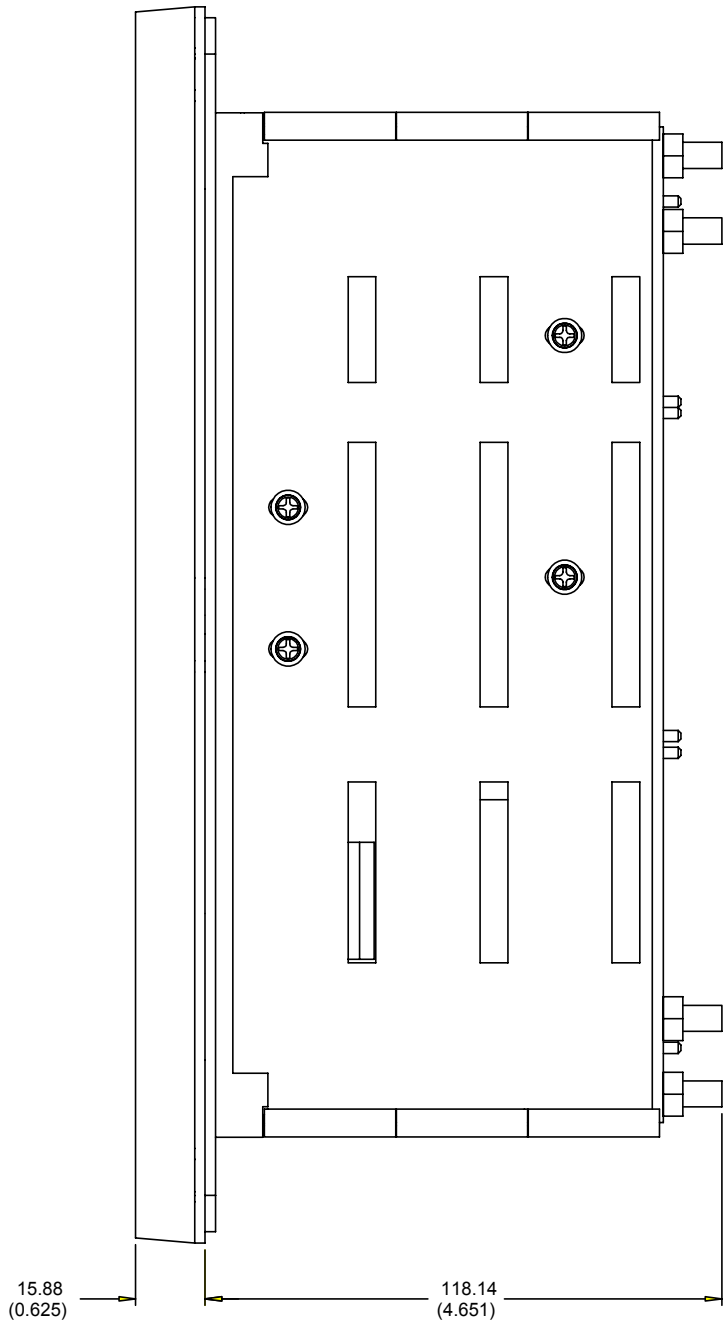


Figure 1-1b. AtlasSC Load+Speed Control Outline Drawing (side view)
(Dimensions are shown in mm with inches in parentheses below)

Chapter 2.
Installation

This chapter provides the general information for mounting location selection, installation, and wiring of the AtlasSC™ Load+Speed Control. Hardware dimensions for mounting, and electrical ratings, and requirements are given for wiring the AtlasSC Load+Speed Control in a specific application.

Unpacking the Shipping Carton

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

The AtlasSC Load+Speed Control was shipped from the factory in an anti-static foam-lined carton. This carton should always be used for transport of the AtlasSC Load+Speed Control when it is not installed. Read page iii, Electrostatic Discharge Awareness, before handling the AtlasSC Load+Speed Control.

Check for and remove all manuals, connectors, mounting screws, and other items before discarding the shipping box.

General Installation Notes and Warnings

When selecting a location for mounting the AtlasSC Load+Speed Control, consider the following:

- Protect the unit from direct exposure to water or to a condensation-prone environment.
- The operating range of the AtlasSC Load+Speed Control is –20 to +70 °C (–4 to +158 °F).
- Provide adequate ventilation for cooling. Shield the unit from radiant heat sources.
- Do not install near high-voltage or high-current devices.
- Allow adequate space around the unit for servicing.
- Do not install where objects can be dropped on the terminals.
- Ground the chassis for proper safety and shielding.
- When installing on a generator set package, provide vibration isolation.

Mounting

The AtlasSC Load+Speed Control is an integrated control package. All control hardware is contained in one compact enclosure. All field wiring connects to the AtlasSC Load+Speed Control through terminal blocks located on the top and bottom surfaces. Placement of the AtlasSC Load+Speed Control must allow sufficient room for wiring access. The AtlasSC Load+Speed Control weighs approximately 4.3 kg (9.5 pounds).

To mount the AtlasSC Load+Speed Control panel, use type M5 x 12 mm thread-forming screws. The AtlasSC Load+Speed Control is factory shipped with mounting screws included in the box. Eight screws are required for secure mounting (Woodward part number 1029-529). The screws are inserted from behind the panel, through a hole in the panel, and into the cast aluminum flange of the AtlasSC Load+Speed Control. The 12 mm screw length assumes a panel thickness of 1.2—4.2 mm (0.047—0.164 inches).

The AtlasSC Load+Speed Control is shipped with mating connectors for all terminals. However, for service and convenience, Woodward also carries an AtlasSC Load+Speed Control connector kit (P/N 8928-178) that contains all of the mating terminal blocks used on the AtlasSC Load+Speed Control. See Appendix A for mating connector information.

The AtlasSC Load+Speed Control must be mounted in an appropriate enclosure for the installed environment. This equipment is designed for installation within a control room panel or cabinet or in a vibration damped enclosure on a generator package. The AtlasSC Load+Speed Control is equipped with a sealing gasket behind the front flange. When properly installed within a NEMA 4X panel or cabinet, the seal and front panel of the AtlasSC Load+Speed Control will meet NEMA 4X ratings.

NOTE

When mounting into an enclosure, make sure the enclosure is vented to atmosphere through a Type 4 vent tube or unsealed conduit.

Figure 1-1 shows a physical outline drawing with dimensions of the AtlasSC Load+Speed Control for reference during the construction of mounting panels, etc. The enclosure size is 282 mm high x 358 mm wide x 134 mm deep (11.1 inches H x 14.1 inches W x 5.3 inches D).

Figure 2-1 is a panel cutout template that may be used to locate and size the cutout and through holes to be made when installing the AtlasSC Load+Speed Control.

Environmental Specifications

Please refer to Technical Specifications in Appendix C and inside the back cover of this manual for environmental characteristics. When installed on a generator package, the AtlasSC Load+Speed Control should be mounted in a suitable enclosure where the entire enclosure is isolated from engine and generator vibrations above 30 Hz.

Electrical Connections

Most inputs and outputs to the AtlasSC Load+Speed Control are made through “CageClamp” terminal blocks.

For noise suppression, it is recommend that all low-current wires be separated from all high-current wire.

See Appendix A for additional information on connector wiring.

Most of the AtlasSC Load+Speed Control’s terminal blocks are designed for removal by hand. After AtlasSC Load+Speed Control input power is disconnected, the pluggable terminal blocks can be removed one at a time by pulling them straight out. Be careful not to pull the plug out at an angle, as this will fracture the end terminal.

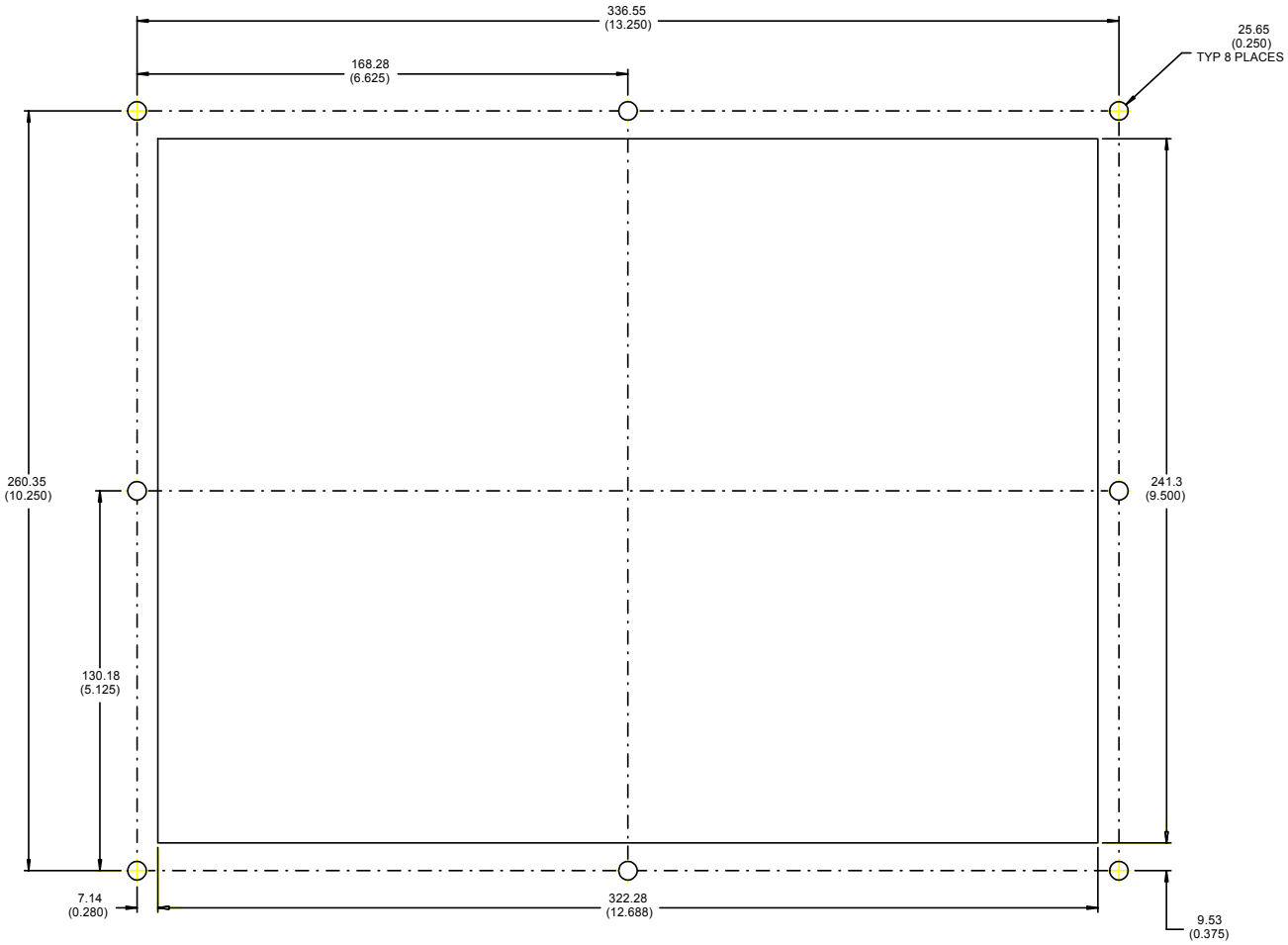
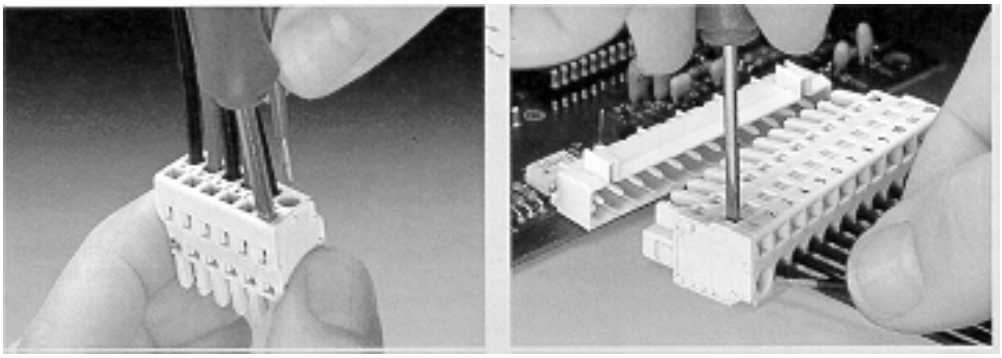


Figure 2-1. AtlasSC Load+Speed Control Panel Layout Template

Each Terminal block has a label (PS, PSEN, SCOR, ANA) to indicate which board it is used with, and terminal numbering to indicate which terminal block on that board to plug into. The board assemblies also are marked with a label to match with terminal block labels.

The pluggable terminal blocks are screwless CageClamp-style blocks. The spring clamp can be opened with a standard 2.5 mm (3/32 inch) flat bladed screwdriver (see Figure 2-2). The AtlasSC Load+Speed Control pluggable terminal blocks accept wire 28 to 18 AWG (0.08 to 0.8 mm²). One 18 AWG (0.8 mm²) wire, or two 20 AWG (0.5 mm²) wires, or three 22 AWG (0.3 mm²) wires can be easily installed in each terminal. Wires for the pluggable I/O terminals should be stripped 8 mm (0.3 inch).



Method #1
Free Hand (holds spring open)

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

Figure 2-2. Wiring of Pluggable Spring Clamp Terminals

The AtlasSC Load+Speed Control fixed terminal blocks used for the power supply input accept wires from 28 to 18 AWG (0.08 to 0.8 mm²). One 18 AWG (0.8 mm²) wire, or two 20 AWG (0.5 mm²) wires, or three 22 AWG (0.3 mm²) wires can be easily installed in each terminal. Wires for the fixed mounted power terminals should be stripped 5 mm (0.2 inch).

Figure 2-3. Wiring of Fixed Terminal

NOTE

Do not tin (solder) the wires that terminate at the AtlasSC Load+Speed Control terminal blocks. The spring-loaded CageClamp terminal blocks are designed to flatten stranded wire, and if those strands are tinned together, the connection loses surface area and is degraded.

All ac wiring for voltages and currents is done with fixed screw barrier blocks rather than pluggable terminal blocks. The fixed screw barrier blocks accept wires terminated into terminal lugs for #6 screws.

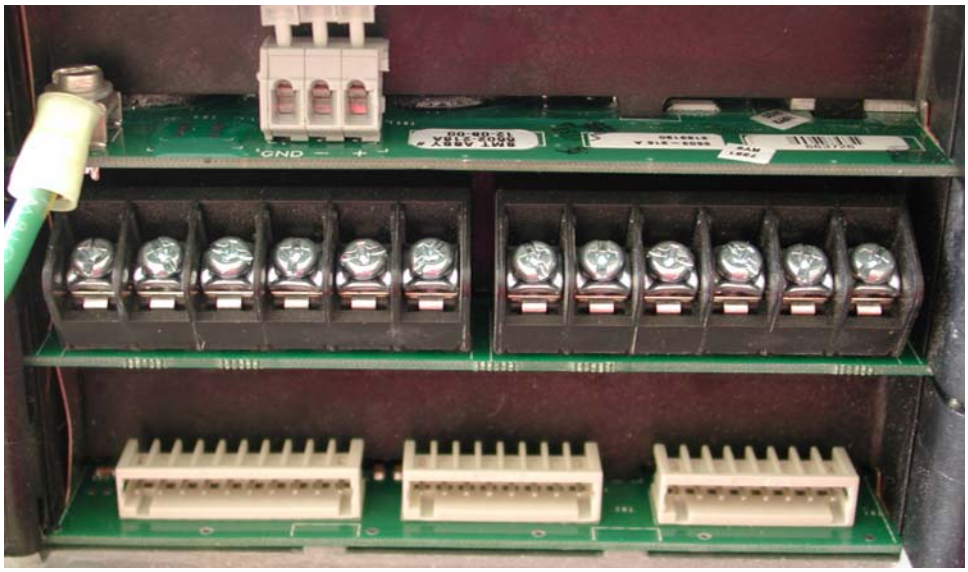
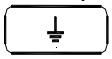


Figure 2-4. Fixed Ring Terminals

Grounding for Protection Against Electrical Shock

Protective Earth (PE) must be connected to the termination point on the backside of the unit next to the label with the symbol  (or 1 of 3 other like termination points without label) to reduce the risk of electric shock. This connection will be made using a thread-forming screw (M4 x 6 mm). The conductor providing the connection must have a properly sized ring lug and wire larger than or equal to 3.3 mm² (12 AWG).

Recommended Grounding Practices

Providing the proper ground for the AtlasSC Load+Speed Control is important. Improper connection of the AtlasSC Load+Speed Control chassis to the ground plane may lead to stray currents between the reference point for the ac signal sources (current and voltage transformers), and the reference point for the sensing inputs on the AtlasSC Load+Speed Control. Differences in potential between these two points results in equalizing current flow which then produces unacceptably high common mode voltages. Common mode voltages may result in improper readings for the sensed ac inputs, or even damage to the AtlasSC Load+Speed Control in extreme cases. To minimize this problem, it is necessary to provide a low resistance path between the ac signal reference point, and the chassis of the AtlasSC Load+Speed Control. Typically this point is the designated ground for the generator set and related instrument transformers.

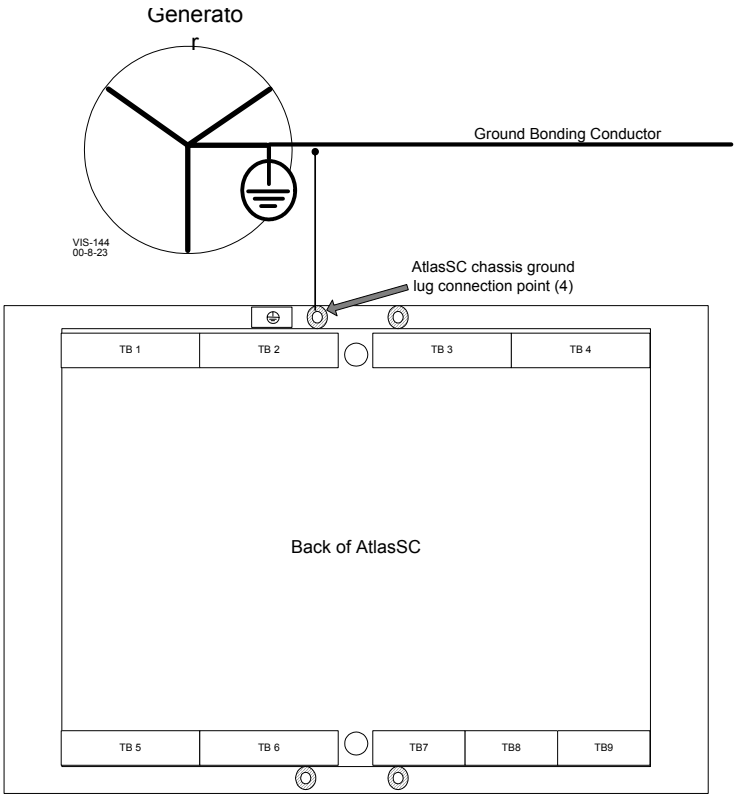


Figure 2-5. Recommended Single Point Grounding Scheme

Shields and Grounding

An individual shield termination is provided at the terminal block for each of the signals requiring shielding. These include all sensor wiring and ac signal inputs. Relay outputs, contact inputs, ac power inputs, and power supply wiring does not normally require shielding, but can be shielded if desired. All shielded cable must be a twisted conductor pair. Do not attempt to tin (solder) the braided shield. All signal lines should be shielded to prevent picking up stray signals from adjacent equipment. Wire exposed beyond the shield should be as short as possible, not exceeding 50 mm (2 inches). The other end of the shields must be left open and insulated from any other conductor.

The AtlasSC Load+Speed Control is designed for shield termination to earth ground at the AtlasSC Load+Speed Control. If intervening terminal blocks are used in routing a signal, the shield should be continued through the terminal block. If shield grounding is desired at the terminal block, it should be ac coupled to earth. All other shield terminations except at the AtlasSC Load+Speed Control should be ac coupled to earth through a capacitor. A 1000 pF, 500 V capacitor is sufficient. The intent is to provide a low impedance path to earth for the shield at frequencies of 150 kHz and up. Multiple direct connections of a shield to earth risk high levels of current to flow within the shield. See Woodward application note 50532, *Interference Control in Electronic Governing Systems*, for more information.

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

1. Strip outer insulation from both ends, exposing the braided or spiral wrapped shield. Do not cut the shield.
2. Using a sharp, pointed tool, carefully spread the strands of the shield.
3. Pull inner conductor(s) out of the shield. If the shield is the braided type, twist it to prevent fraying.
4. Remove 6 mm (1/4 inch) of insulation from the inner conductors.
5. Connect wiring and shield as shown in plant wiring diagram.

For noise suppression reasons, it is recommend that all low-current wires be separated from all high-current wires. Input power ground terminal should also be wired to earth ground. Installations with severe electromagnetic interference (EMI) may require additional shielding precautions, such as wire run in conduit or double shielding. Contact Woodward for more information.

Shields can be grounded at both ends (AtlasSC Load+Speed Control and load) if the cable length is sufficiently short (within a cabinet) to prevent ground loop current in the shield.

Cabinet Installations: If the AtlasSC Load+Speed Control is installed in a cabinet, shielded I/O can be terminated directly to the cabinet (earth ground) at the entry to the cabinet, as well as at the AtlasSC Load+Speed Control.

Terminal Locations

All terminals are located on the top and bottom of the AtlasSC Load+Speed Control. All but the PT and CT use either a cage clamp or a pluggable terminal strip for ease of connection. Figure 3-8 shows top and bottom views of the AtlasSC Load+Speed Control to help orient each of the three board positions within the control. Each boards Wiring Diagram is shown immediately following the top and bottom terminal views.

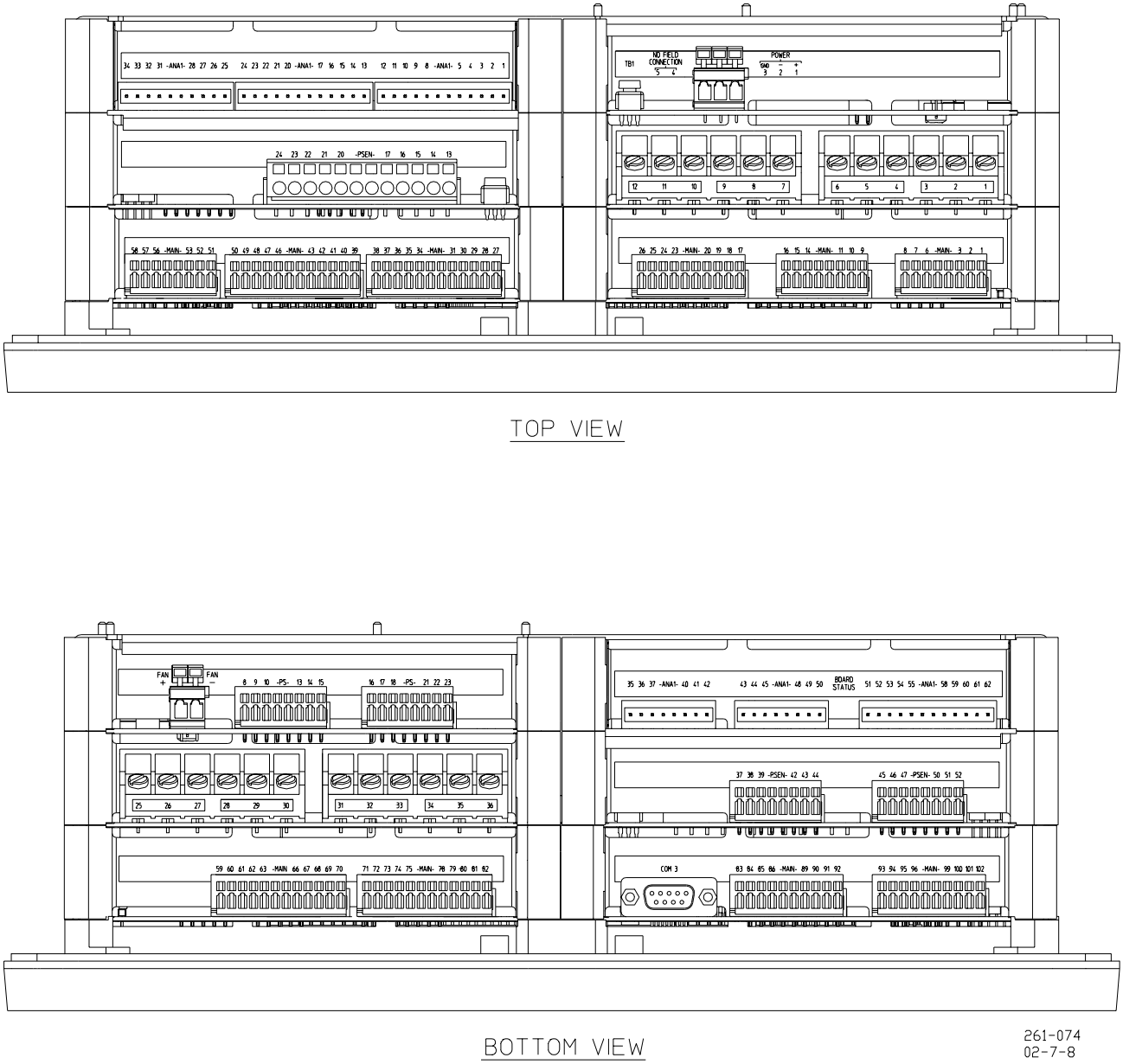


Figure 2-6. AtlasSC Load+Speed Control Terminal Strip Location View

AtlasSC Load+Speed Control Wiring Diagrams

Power Supply Board Wiring Pinout

Figure 2-8 shows the power supply board in the AtlasSC Load+Speed Control—it is the smaller board mounted away from the display. This board contains the power supply and twelve discrete output driver channels. The discrete outputs are low-side drivers having short circuit and thermal shutdown protection. The discrete output drivers are not isolated from each other, and are powered by an external +12 Vdc or +24 Vdc. They are isolated from the internal power supplies of the AtlasSC Load+Speed Control platform.

PowerSense Board Wiring Pinout

The PowerSense board is mounted between the Power Supply and the SmartCore board. The PowerSense Board inputs are the Mains and Generator power monitoring. Each PowerSense board contains the circuitry for two sets of three phase ac voltage (PT) and ac current (CT) inputs, as well as a speed bias output, a voltage bias output, and a LON communications port.

Features

- On-board processor for automatic calibration of the I/O channels
- PT and CT inputs provide fundamental as well as harmonic information
- PT and CT inputs are updated after 3 cycles, which is 50 ms at 60 Hz
- PT and CT inputs and bias outputs have 12 bit resolution
- PT inputs are software configurable for 70 V, 120 V, or 240 V ranges
- Each set of PT and CT inputs is isolated from the rest of the board and chassis
- Voltage Bias output is software configurable for 4–20 mA, ±1 V, ±3 V, and ±9 V
- Voltage bias output is isolated from the rest of the board
- LON communication port (with MC only)

SmartCore Board Wiring Pinout

The SmartCore board is mounted in the front side of the AtlasSC hardware. The SmartCore board contains circuitry for the speed sensor input, four analog inputs, four analog outputs, 3 serial ports, and 19 discrete inputs. The speed sensor input is from a magnetic pick-up, each Analog input may be 4–20 mA or 0–5 V, and two of the serial ports, may be RS-232, RS-422, or RS-485. The other serial port is a dedicated RS-232 port.

Features

- On-board processor for automatic calibration of the I/O channels
- Analog inputs have 14-bit resolution
- Analog outputs have 12-bit resolution
- Serial Ports are configurable

Analog Combo Board Wiring Pinout

The Analog Combo board is mounted in the back side of the AtlasSC hardware, side by side with the Power Supply board. It contains two Thermocouple Analog Inputs, two 4-20mA Analog Inputs used for monitoring and one Analog Input (4-20mA) for MAP limiter (if used) and three PT-100 Analog Inputs.

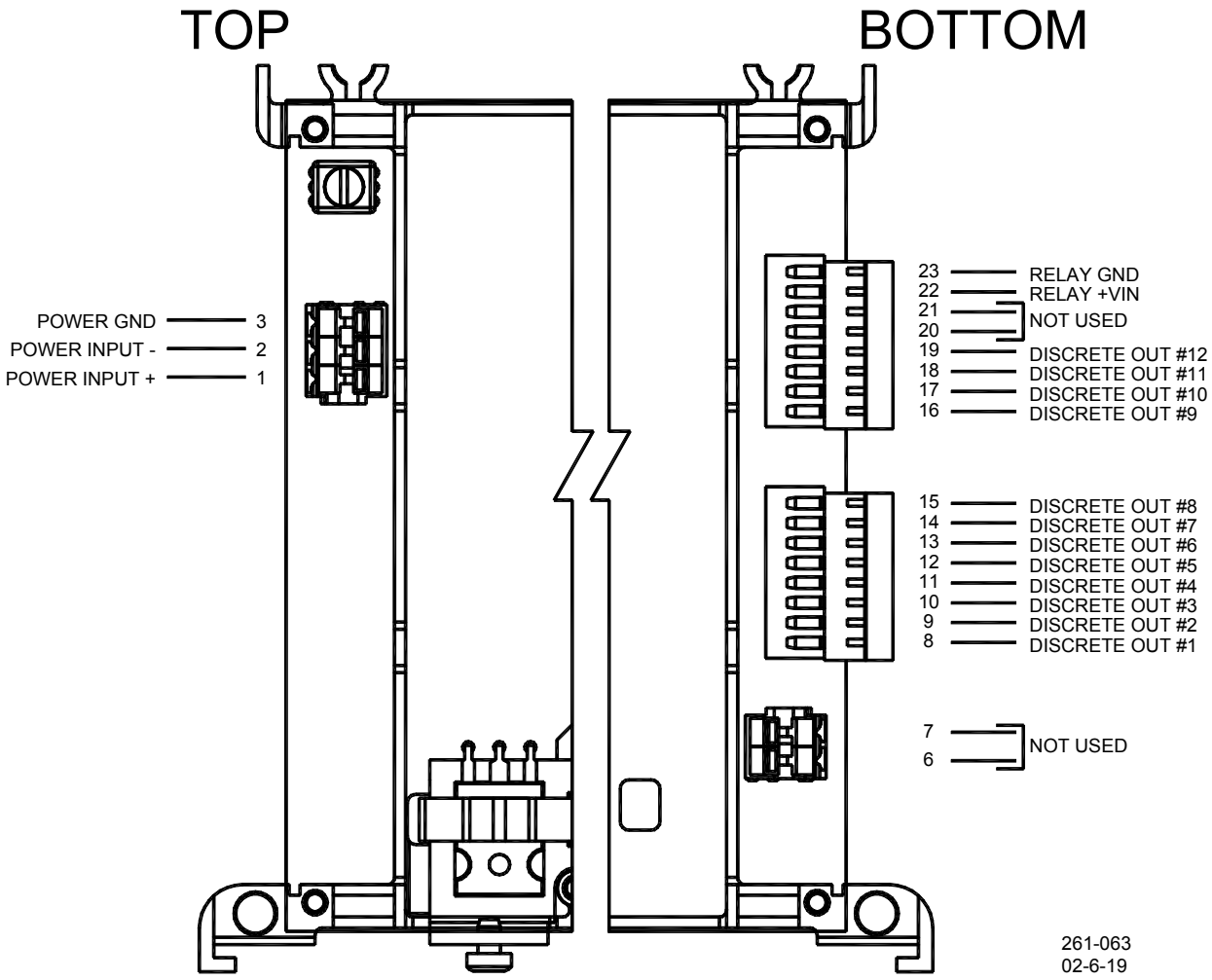


Figure 2-7. AtlasSC Load+Speed Control Power Supply Board Wiring

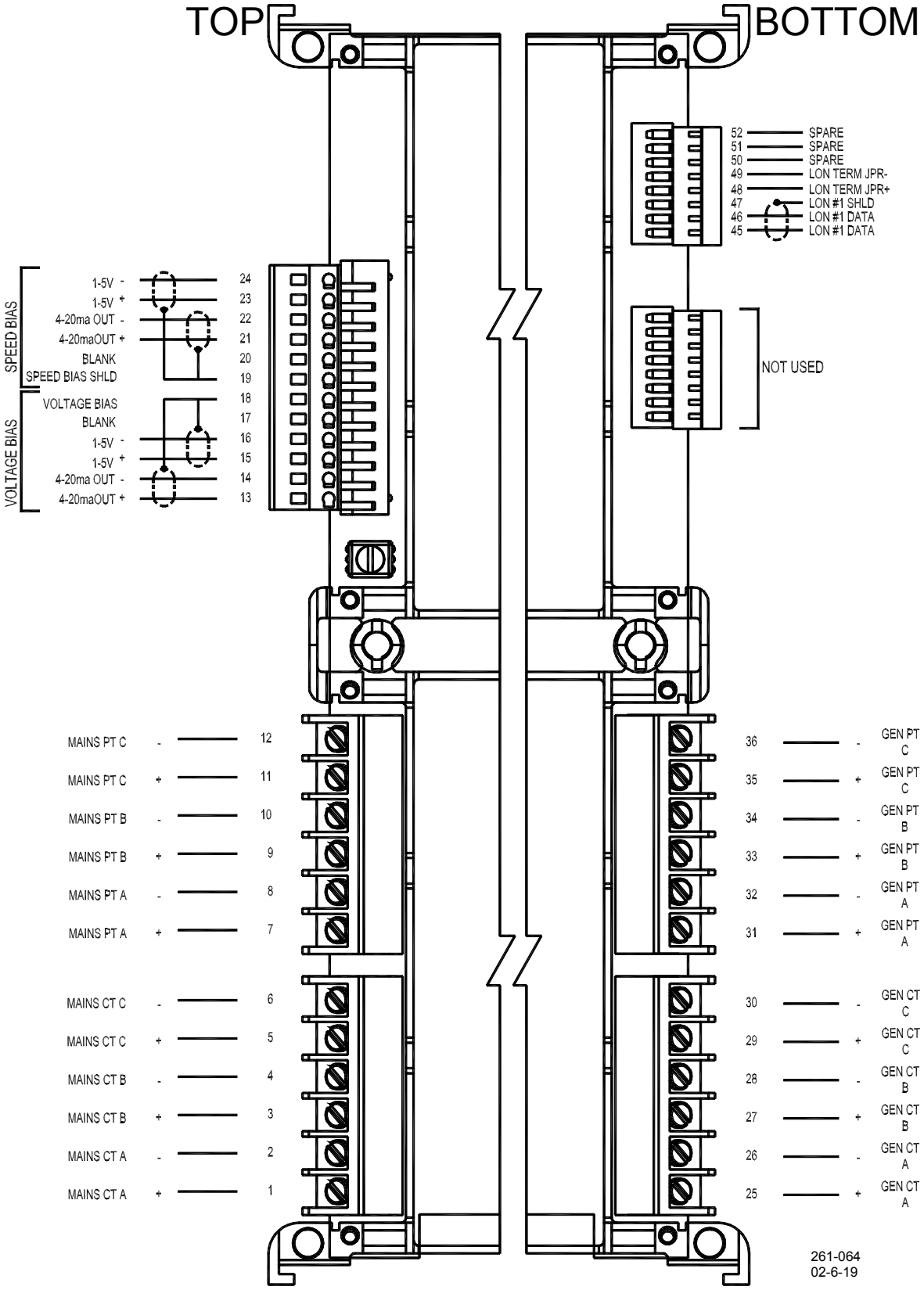


Figure 2-8. AtlasSC Load+Speed Control PowerSense Board Wiring

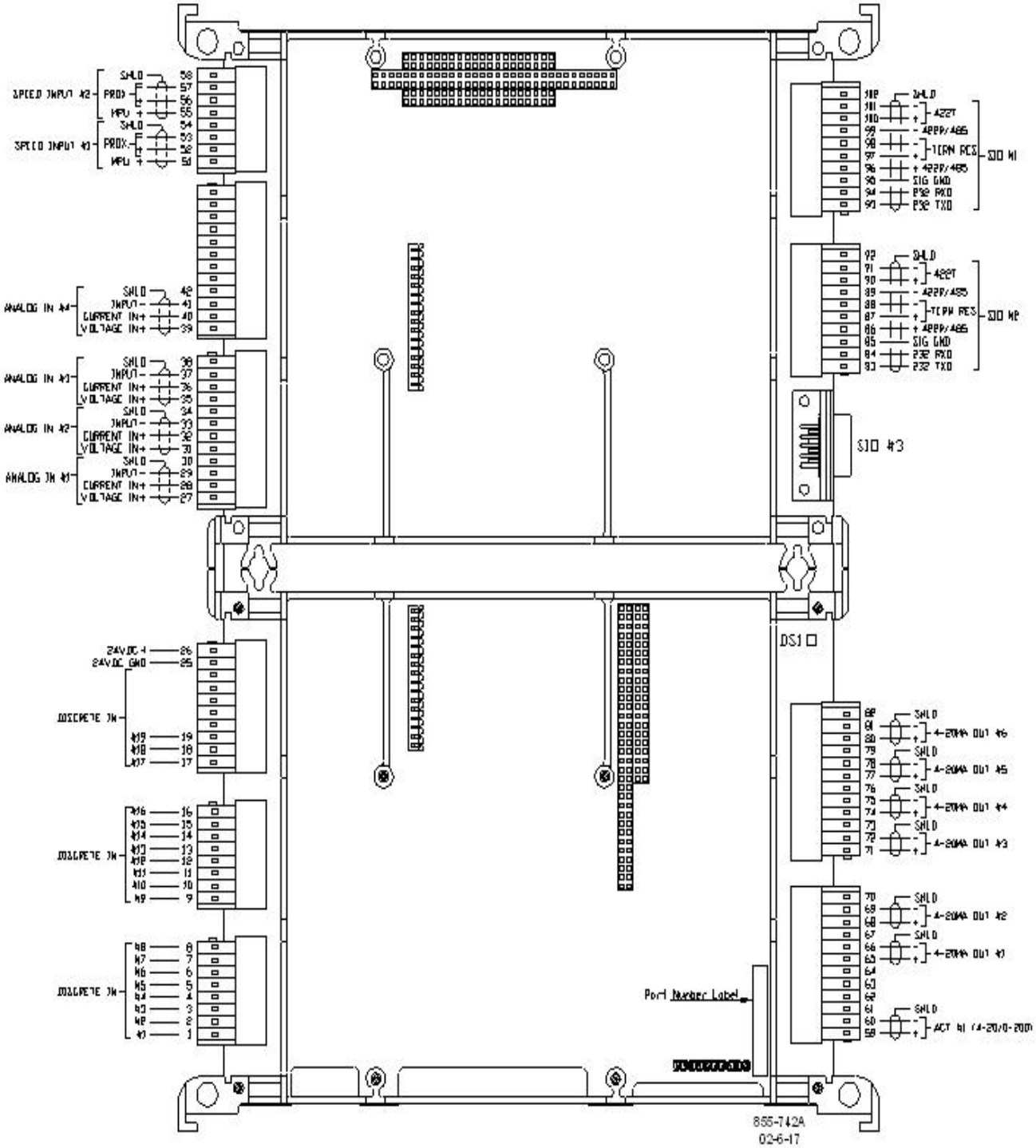


Figure 2-9. AtlasSC Load+Speed Control SmartCore Board Wiring

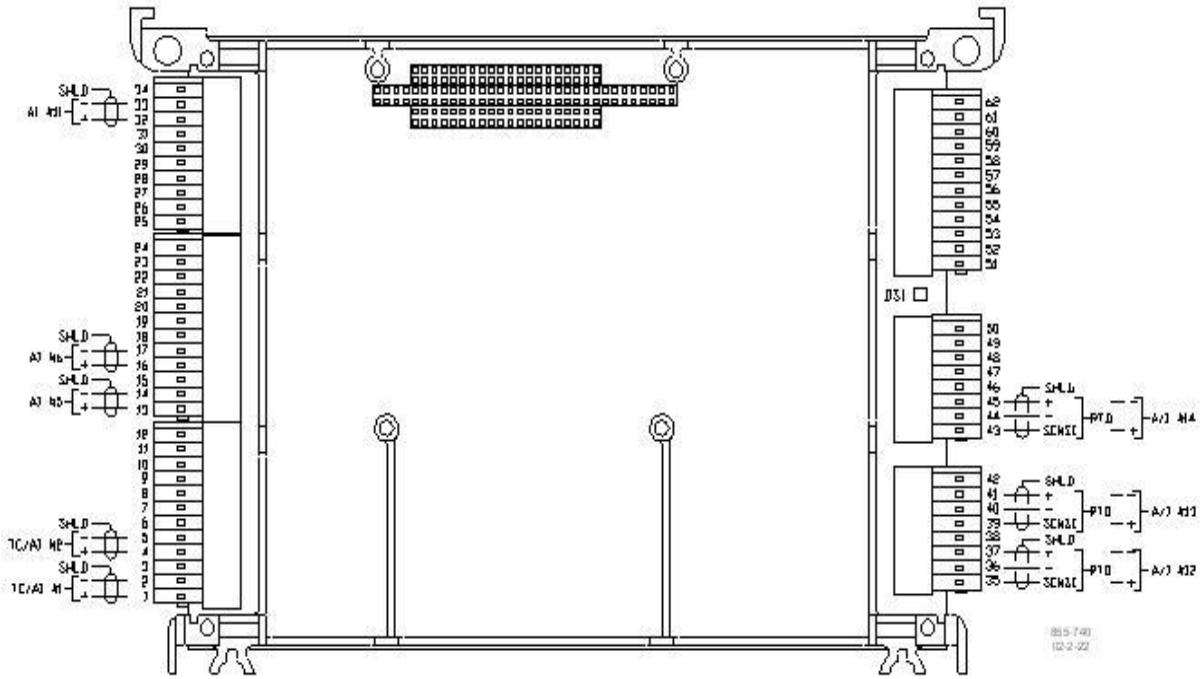


Figure 2-10. AtlasSC Load+Speed Control Analog Combo Board Wiring

Input Power

The AtlasSC Load+Speed Control requires a nominal voltage source of 18 to 32 Vdc, 22 W. Power to the control should be maintained whenever the generator set is available for service. The control will remain active when connected to engine cranking batteries during cranking.

CAUTION—START-UP

Power must be applied to the AtlasSC Load+Speed Control at least 60 seconds prior to expected use. The control must have time to do its power up diagnostics to become operational. Failure of the diagnostics will disable control function.

WARNING—POWER SUPPLY CONNECTIONS

The AtlasSC Load+Speed Control power supply board must have the input power removed before installing or removing any connectors or wiring.

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

The AtlasSC Load+Speed Control is suitable for use in European Zone 2, Group IIC environments per DEMKO certification.

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

Do not connect more than one main power supply to any one fuse or circuit breaker.

The input to the Power supply must be of a low impedance type for proper operation of the control. DO NOT power a control from a high voltage source containing dropping resistors and zener diodes. If batteries are used for operating power, an alternator or other battery-charging device is necessary to maintain a stable supply voltage.

Input Power Ratings

Voltage Range	18–32 Vdc
Maximum Voltage	40 Vdc
Minimum Voltage	9 Vdc (engine cranking only)
Input Current	0.9 A @ 24 Vdc 1.1 A @ 18 Vdc
Maximum Input Power	22 W
Typical Input Power	20 W @ 24 Vdc
Interrupt Time Holdup	8 ms @ >= 24 Vdc input voltage
Efficiency	70% minimum over operating input voltage range
Reverse Polarity Protection	100 Vdc
Input Wiring Constraints	The AtlasSC Load+Speed Control must be wired such that no other device receives power from the wiring between the AtlasSC Load+Speed Control and the power supply source.
Input Wire Size	12 AWG (2.5 mm²)
Input Fuse Rating	3 A (time delay with melting I2t □100A2 sec)

Significant inrush currents are possible when current is applied to the AtlasSC Load+Speed Control. The magnitude of the inrush current depends on the power source impedance, so Woodward cannot specify the maximum inrush current. Time-delay fuses or circuit breakers must be used to avoid nuisance trips.

Power Supply Monitoring Circuit

Maximum voltage measured	35 Vdc
Resolution in volts	0.15 Vdc
Maximum error due to temperature change	1.0 Vdc
Maximum error due to load change	1.0 Vdc
Total maximum error at 25 °C	1.2 Vdc

Input Power Wiring

Protective earth ground (PE) must be connected to the chassis at the ⏚ labeled termination point on the back of the display. See Figure 3-6 The power supply grounding terminals should also be connected to earth to ensure grounding of the power supply printed circuit boards. The grounding conductor must be the same size as the main supply conductors or the PT wires, whichever is larger.

Note that the control's power supplies are not equipped with input power switches. For this reason, some means of disconnecting input power to each main power supply must be provided for installation and servicing.

It is expected that the installation of this equipment will include overcurrent protection between the power source and the AtlasSC Load+Speed Control. This overcurrent protection may be accomplished by series connection of properly rated fuses or circuit breakers. Branch circuit protection of no more than 250% of the maximum AtlasSC Load+Speed Control power supply input current rating must be provided. Maximum fuse rating must meet the 250% UL listing requirements. The use of properly sized UL class CC, J, T, G, RK1, or RK5 fuses meet the requirements for branch circuit protection. Do not connect more than one AtlasSC Load+Speed Control to any one fuse. Use only the wire size specified above, or equivalent, that meets local code requirements. Time delay fuses should be used to prevent nuisance trips.

The power supply holdup time specification is the time the supply will continue to operate within specification after its input power is interrupted. This information may be useful in specifying uninterruptible power supply (UPS) systems.

NOTE

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

The minimum continuous input voltage allowed is 18 V at the power input of the control. The length, size of wire, and load current will determine the minimum supply output voltage. The minimum supply voltage measured at the source should always be greater than 18 V. Example: two (source and return) 20 foot (6 m) lengths of 14 AWG (2.5 mm²) wire carrying 1.2 A (maximum rated current) will result in a voltage drop from source output to control power input of approx. 0.16 volts. The resulting supply voltage from the example must be greater than 18.16 volts.

The AtlasSC Load+Speed Control will remain in operation when an electrical starter is engaged, if input power drops to no less than 9.0 V.

The power supply and ground connections are located on the top of the AtlasSC Load+Speed Control on the power supply board. The power supply board is the board on the top of the stack (furthest away from the display area).

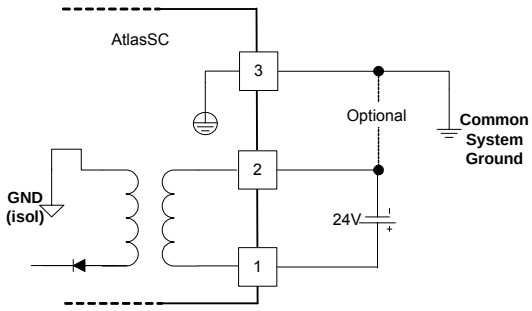


Figure 2-11. Input Power Wiring Diagram

Potential Transformer (PT) Inputs

The Generator and Mains ac voltage inputs can accept voltages up to 300 Vac RMS maximum between the positive and negative terminals of each input. The inputs may be connected line-to-line or line-to-neutral. For example, if the inputs are connected line-to-neutral, each input A-N, B-N, and C-N may have up to 300 Vac. Therefore, a 480 Vac generator may be wired to the AtlasSC Load+Speed Control using line-to-neutral connections resulting in 277 Vac at the inputs.

Input Voltage Range Selections	70, 120, 240 Vac RMS
Max. Input Voltage	300 Vac
Input Current	3 mA maximum
Input Frequency	40–70 Hz
Common Mode Rejection Voltage	±450 Vdc minimum
Common Mode Rejection Ratio	-63 dB minimum

The AtlasSC Load+Speed Control must be configured for a voltage range relative to the input (Potential Transformer secondary) provided. For example, if a phase (+) to phase (–) input to the AtlasSC Load+Speed Control is to be a nominal of 70 Vac, set the range to the 70 volt range. No change in wiring is necessary. This configuration setting maximizes the accuracy for the voltage level being sensed. There is also a voltage floor below which a voltage cannot be detected so setting the correct range is important for more than just accuracy. See the table below for the voltage floor at each range.

d Range	Dead bus Voltage Detected	Maximum Voltage Detected
70	27 Vac	100 Vac
120	40 Vac	150 Vac
240	80 Vac	300 Vac

If potential transformers are used, be careful to select an accurate transformer. The largest source of inaccuracy in the system will be the transformer, since even the most accurate transformer is less accurate than the ac voltage inputs to the AtlasSC Load+Speed Control. The calibration menu contains turns ratio compensation factors for each PT input. Follow the calibration procedure to negate much of the transformer error.

The Bus PT inputs are required for the synchronization function. At least a single phase connection must be made if the AtlasSC Load+Speed Control is intended for synchronizing.

When the PT input to the control is conditioned with a transformer the generator and mains transformer ratio is entered into the AtlasSC Load+Speed Control. This is described in the Configuration section of the Operation Manual. The AtlasSC Load+Speed Control will use the PT ratio and the entered configured Range to calculate the actual system voltage(s).

EXAMPLE:

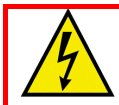
Hwd range = 120
PT ratio = 4
Measured PT secondary (input at terminals) = 112.5 Vac

The EGC-3 will display 450 Vac for this input voltage.

Hazardous Live

The following circuits are classified as Hazardous Live because they carry potential shock hazardous voltages during normal operation or under single fault conditions:

- Potential transformer (PT) inputs
- Current transformer (CT) inputs
- Voltage bias outputs



WARNING—HIGH VOLTAGE/CURRENT

Do not touch or make contact with the above inputs and outputs during system operation when such circuits are live. Possible serious personal injury or death could result.

These inputs and outputs are provided with 500 V of dielectric isolation from chassis ground. In addition, these inputs/outputs are isolated from safety extra-low voltage (SELV) circuits (such as serial communication, PC/104 circuits) by optoisolators or transformers provided with double insulation and 3 000 Vac of dielectric isolation.

PT—3∅ Wye, L-N, No Transformers

No transformers are necessary if the voltage input to the AtlasSC Load+Speed Control is less than 300 Vac at a given phase input. This diagram shows a system where both the generator and bus are less than 300 Vac measured line-to-neutral. Each is connected to the AtlasSC Load+Speed Control in a L-N mode without transformers (PT Ratio = 1:1). It is not required that both the mains and the generator inputs be connected in the same manner. One could be L-L and the other L-N if preferred. Also, one could use transformers and the other not. The diagram shown is simply an example of a typical system.

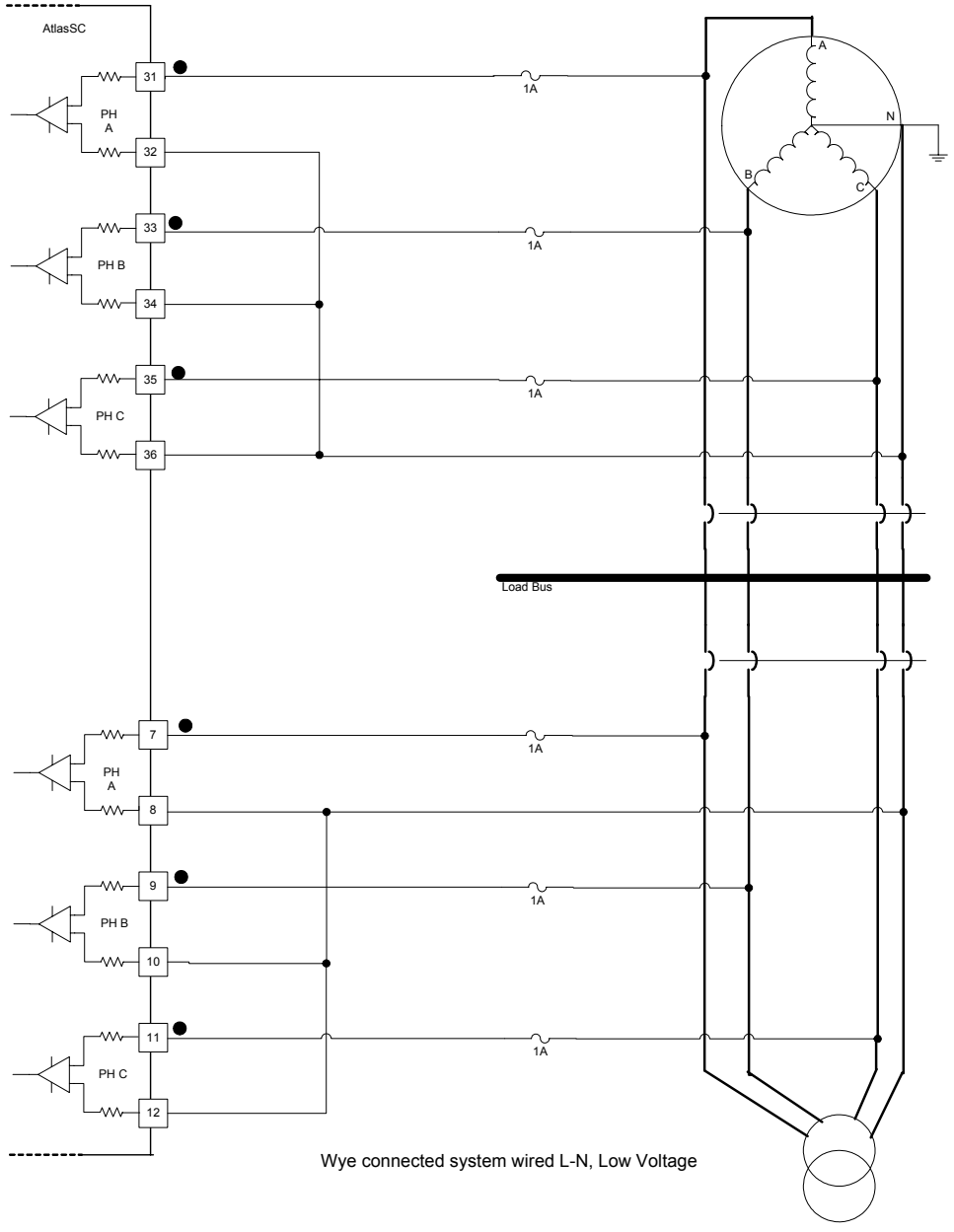
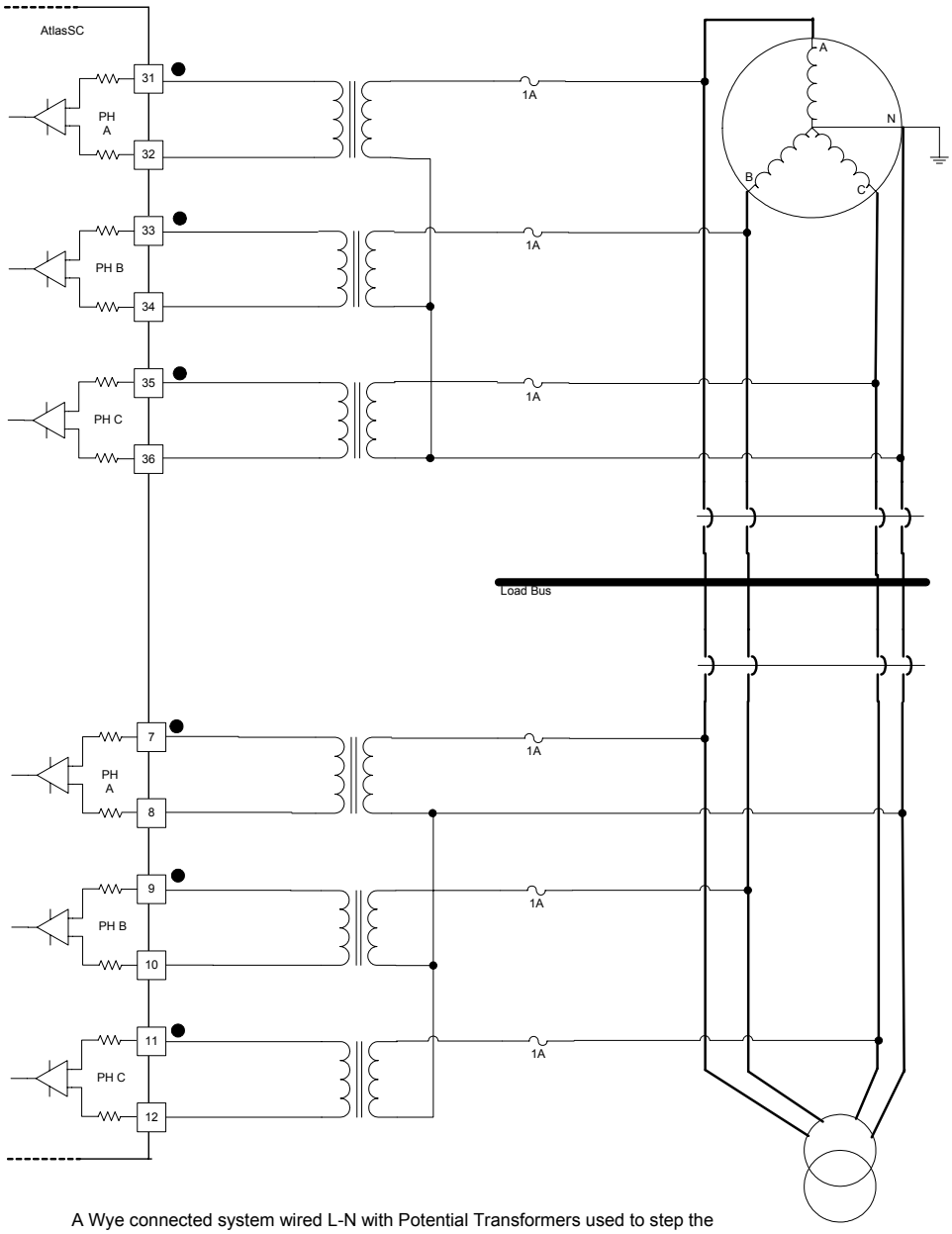


Figure 2-12. PT Wiring—3Ø Wye, L-N, without Transformer

PT—3∅ Wye, L-N, with Transformers

Transformers are necessary if the voltage input to the AtlasSC Load+Speed Control is greater than 300 Vac at a given phase input or a customer preference. This diagram shows a system where both the generator and bus utilize potential transformers. Each is connected to the AtlasSC Load+Speed Control in a L-N mode. It is not required that both the mains and the generator inputs be connected in the same manner. One could be L-L and the other L-N if preferred. Also, one could use transformers and the other not. The diagram shown is simply an example of a typical system.



A Wye connected system wired L-N with Potential Transformers used to step the voltage down.

Figure 2-13. PT Wiring—3Ø, Wye, L-N, with Transformer

PT—3∅ Wye, L-L, with Transformers

Transformers are necessary if the voltage input to the AtlasSC Load+Speed Control is greater than 300 Vac at a given phase input or a customer preference. This diagram shows a system where both the generator and bus utilize potential transformers. Each is connected to the AtlasSC Load+Speed Control in a L-L mode utilizing open delta wired transformers. It is not required that both the mains and the generator inputs be connected in the same manner. One could be L-L and the other L-N if preferred. Also, one could use transformers and the other not. The diagram shown is simply an example of a typical system. Notice for this configuration that the generator is a Wye, but the potential transformers are connected in a L-L fashion, so the AtlasSC Load+Speed Control should be configured as a Delta L-L.

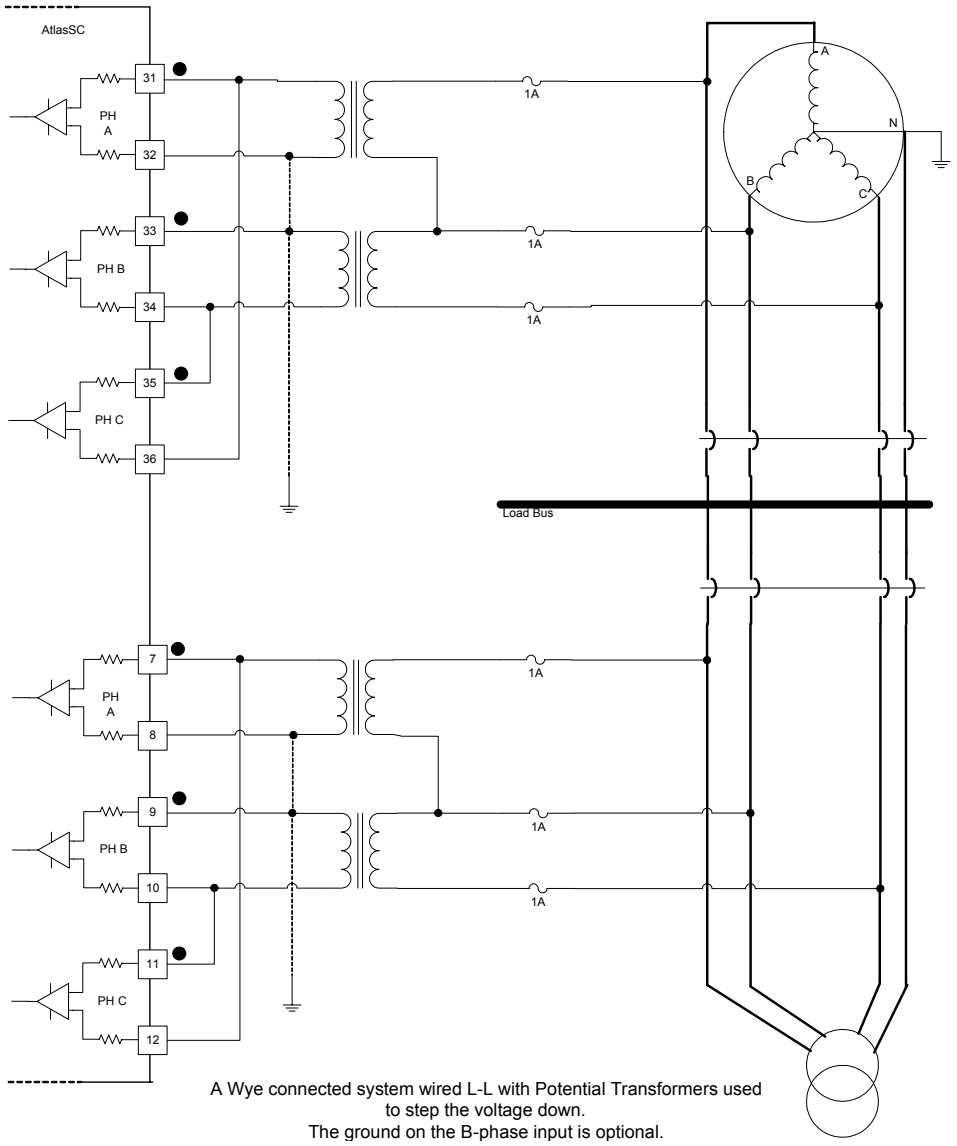


Figure 2-14. PT Wiring—3∅ Wye, L-L, with Transformers

PT—3∅ & 1∅ Inputs, Wye, L-L with Transformers

Transformers are necessary if the voltage input to the AtlasSC Load+Speed Control is greater than 300 Vac at a given phase input or a customer preference. A single phase monitoring system may be wired either L-L or L-N. The B and C phase inputs will be ignored and do not need to be wired. Single phase mode must then be selected in the software configuration.

The generator and mains do not have to be configured identically. One can use single phase and the other can use three phase if preferred. The below wiring diagram example shows the generator wired 3∅ with open delta transformers from a Wye system. It also shows the mains wired 1∅ with a step down transformer wired L-L.

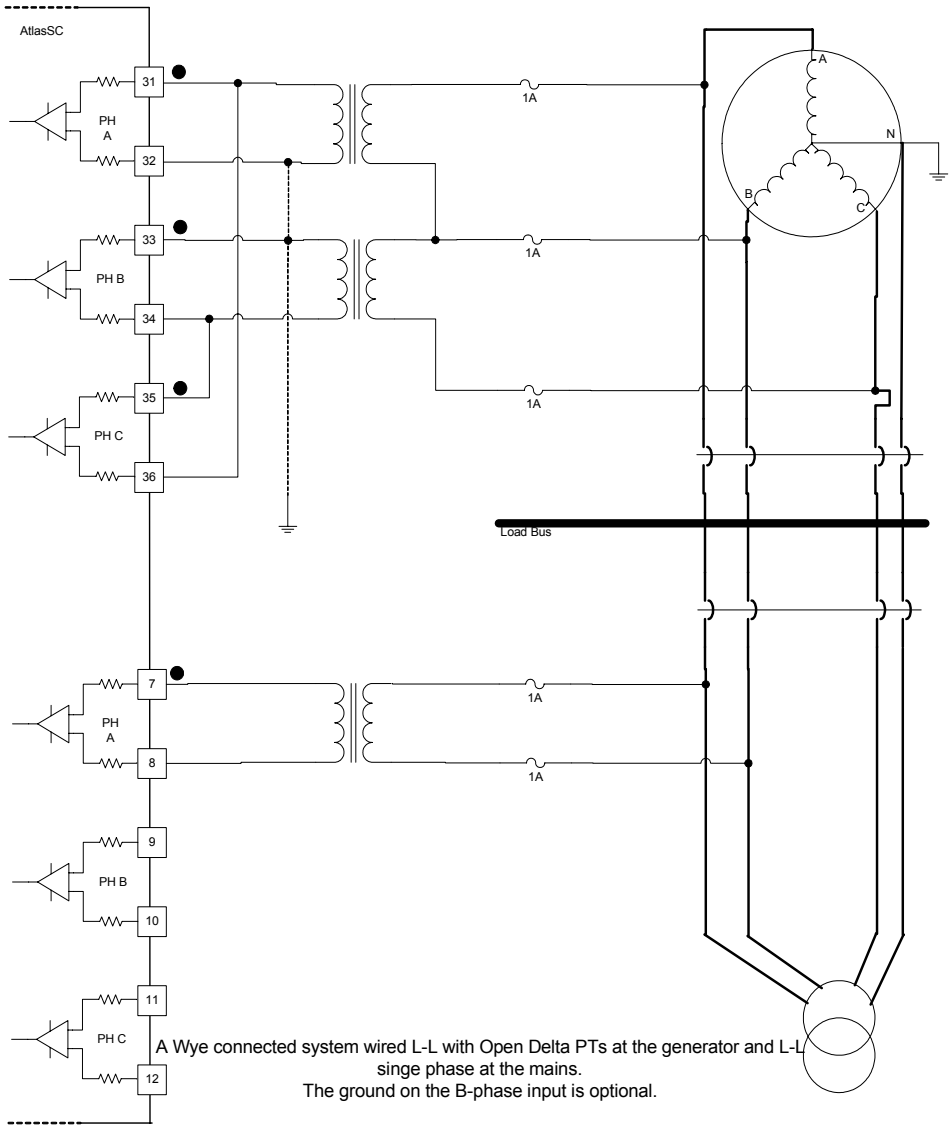


Figure 2-15. PT Wiring—3∅ Wye, & 1∅ Wye, L-L, with Transformers

PT—3∅ Input, Delta, L-L Connection with Transformers

Transformers are necessary if the voltage input to the AtlasSC Load+Speed Control is greater than 300 Vac at a given phase input or transformers may be used per customer preference. This diagram shows a system where both the generator and bus utilize potential transformers. Each is connected to the AtlasSC Load+Speed Control in a L-L mode utilizing open delta wired transformers. It is not required that both the mains and the generator inputs be connected in the same manner. One could use transformers and the other not. The diagram shown is simply an example of a typical system.

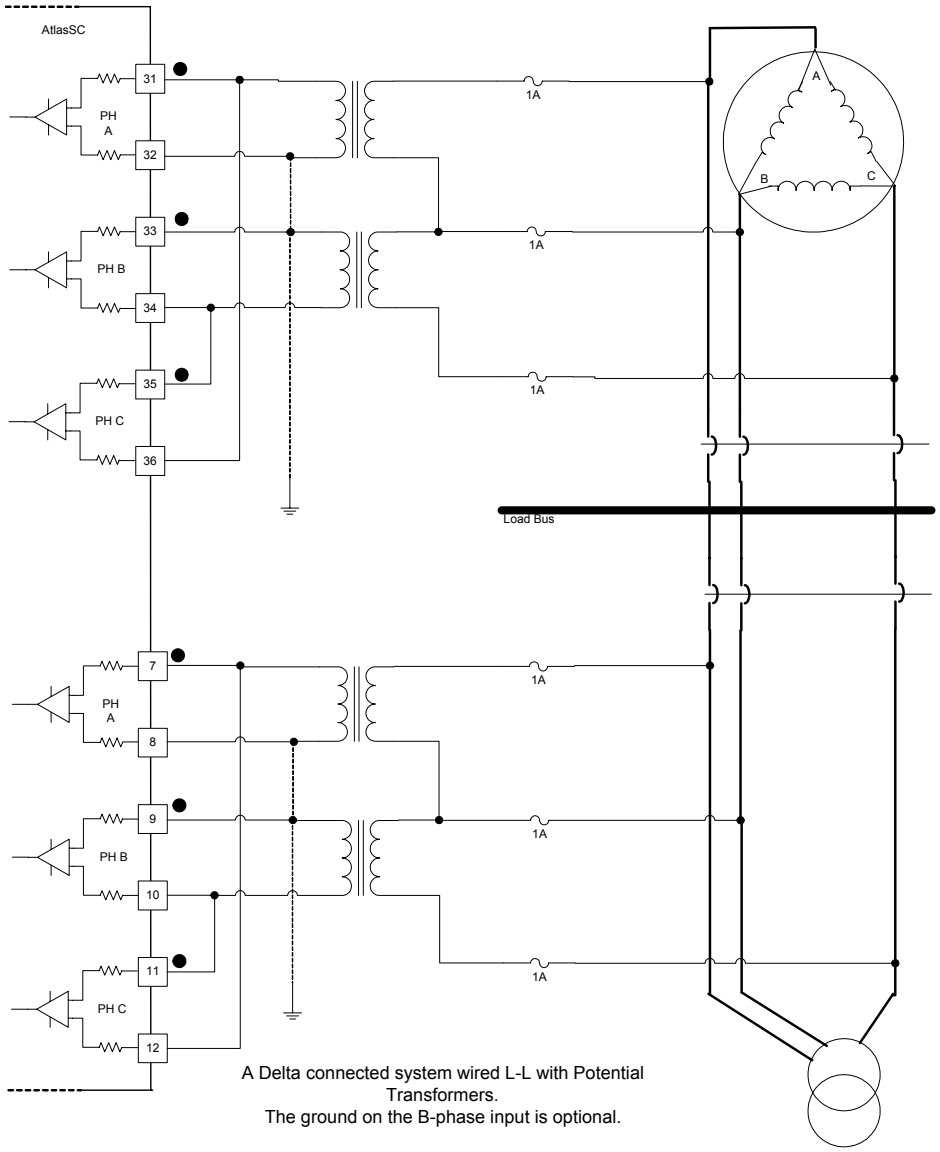


Figure 2-16. PT Wiring—3∅ Delta, L-L, with Transformers

PT—3∅ Input, Delta, L-L Connection without Transformers

Transformers are necessary if the voltage input to the AtlasSC Load+Speed Control is greater than 300 Vac at a given phase input or a customer preference. This diagram shows a system where the generator and the bus do not utilize potential transformers. Each is connected to the AtlasSC Load+Speed Control in a L-L mode. It is not required that both the mains and the generator inputs be connected in the same manner. One could use transformers and the other not. The diagram shown is simply an example of a typical system.

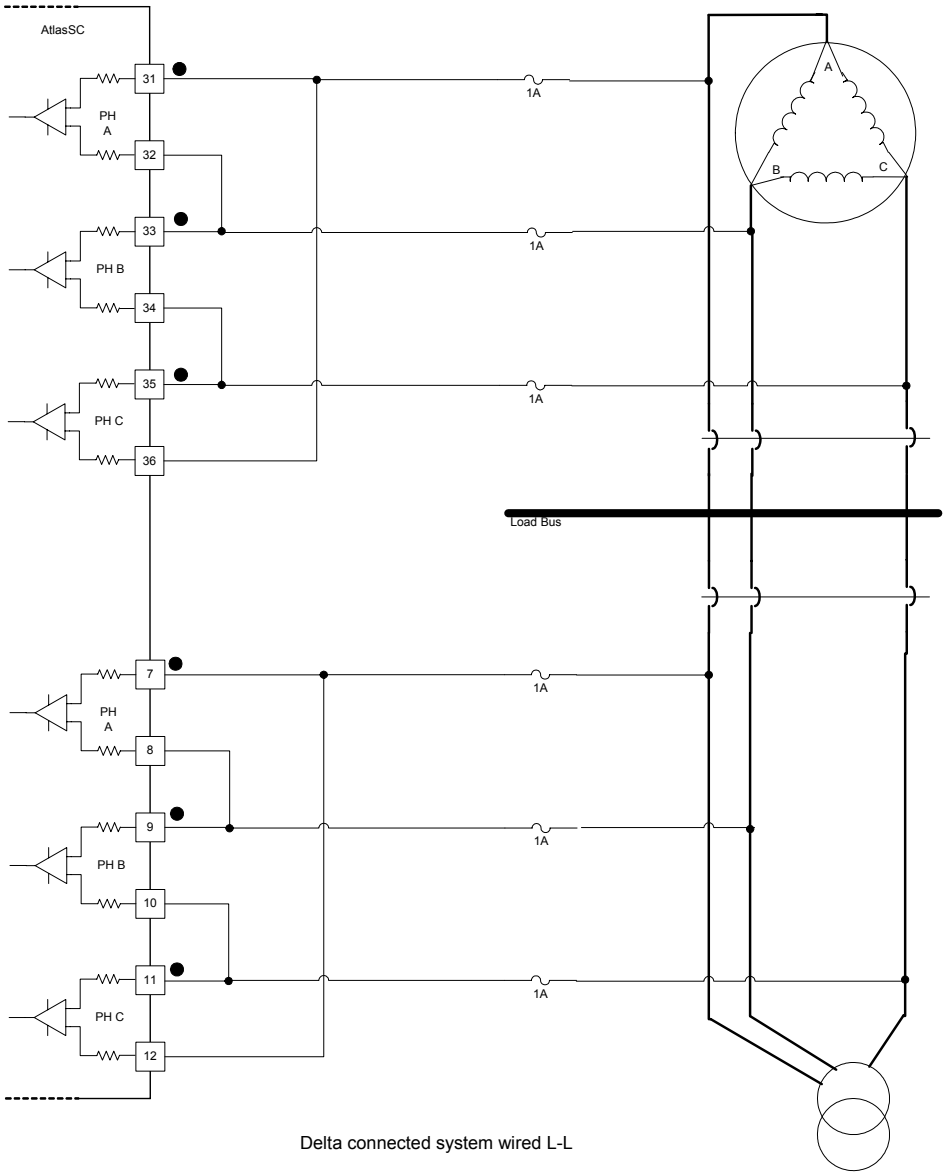


Figure 2-17. PT Wiring—3∅ Delta, L-L, without Transformers

PT—1∅ Input, Zig Zag Connection with Transformers

Transformers are necessary if the voltage input to the AtlasSC Load+Speed Control is greater than 300 Vac at a given phase input or a customer preference. This diagram shows a system where the generator and the bus do utilize potential transformers. Each is connected to the AtlasSC Load+Speed Control in a single phase zigzag mode. It is not required that both the mains and the generator inputs be connected in the same manner. One could use transformers and the other not. The diagram shown is simply an example of a typical system.

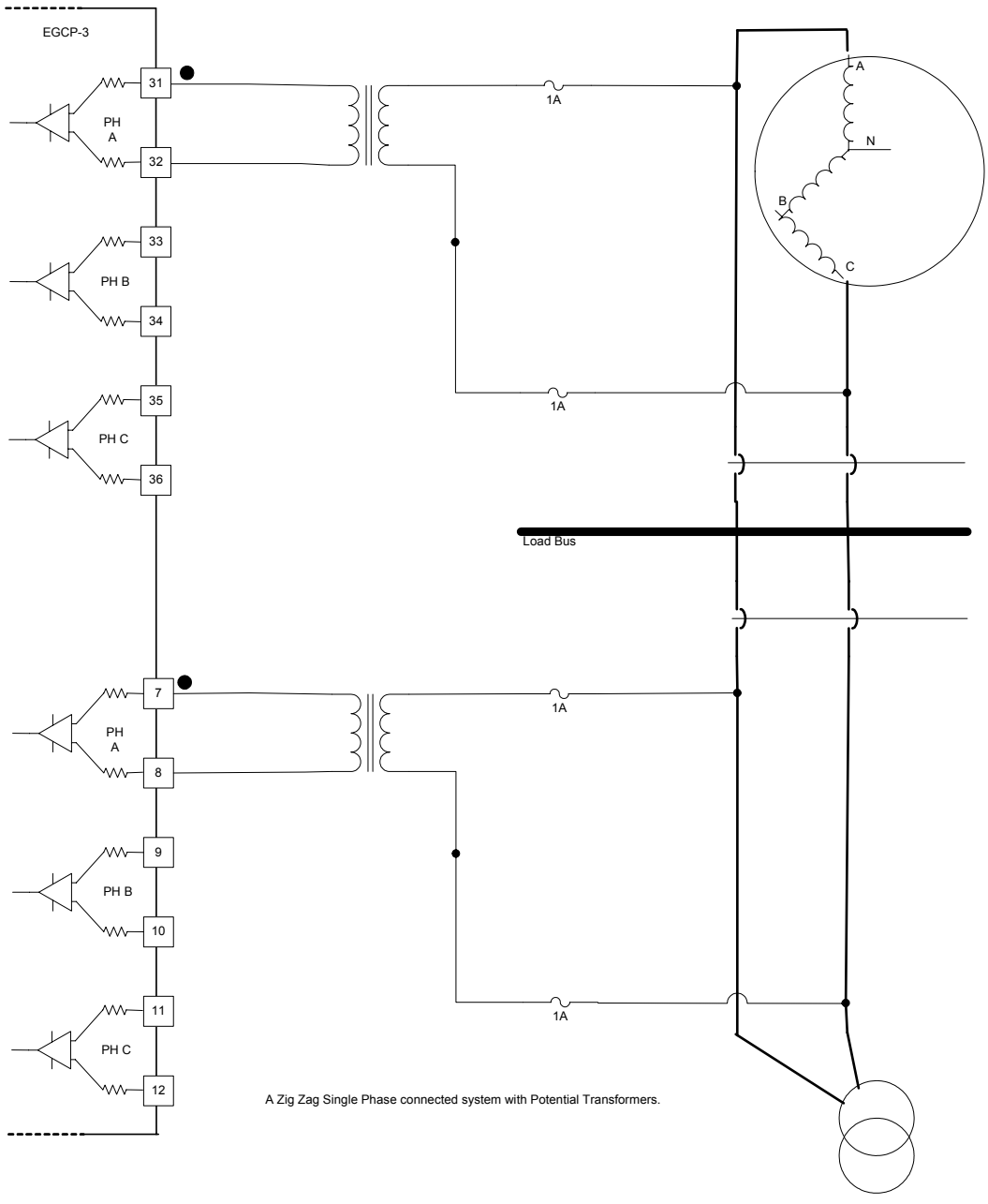


Figure 2-18. PT Wiring—1∅ Zig Zag

Current Transformer (CT) Inputs

The Generator and Mains ac current inputs can accept currents up to 7 A ac RMS maximum between the positive and negative terminals of each input. The CT inputs are rated at 5 A ac RMS nominal and function down to 50 mA. For optimum accuracy in the usable range, it is recommended to use 5 A secondary CTs (Do not use 1 A secondary CTs).

Input Current	5 A RMS full scale
Max. Transient Input Current (continuous)	7.07 A ac-rms
Max. Transient Input Current (1 sec.)	50 A ac-rms
Input Burden	0.15 VA
Input Frequency	40–70 Hz
Common Mode Voltage	±250 Vdc minimum
Common Mode Rejection Ratio	–63 dB minimum

Be careful to select an accurate current transformer. The largest source of inaccuracy in the system will be the transformer since even the most accurate transformer is less accurate than the AC current inputs to the AtlasSC Load+Speed Control. The calibration menu contains turns ratio compensation factors for each CT input. Follow the calibration procedure to negate much of the transformer linear error.

The AtlasSC Load+Speed Control does not require three phases for current calculations. The user can configure the AtlasSC Load+Speed Control for single phase, and all functionality will be modified accordingly. The phase input that must be provided is the A phase.

The Bus CT inputs are not required for operation. The Bus CT inputs are used for alarm functions only and are not used for any control functions.

The generator and mains Current Transformer ratio is entered into the AtlasSC Load+Speed Control. This is described in the Configuration section of the Operators Manual (26137). The AtlasSC Load+Speed Control will use the CT ratio to calculate the actual system current(s).

EXAMPLE:

CT ratio = 500

Measured CT secondary (input at terminals) = 3.9 A

The EGC-3 will display 1950 A ac for this input current.

For a full wiring connection, combine the Current Transformer (CT) wiring below with the Potential Transformer (PT) section above.

CT—3∅ Wye

This diagram shows the generator and mains in a wye configuration. The current transformers are placed on the leads connecting to the load. The diagram shown is simply an example of a typical system.

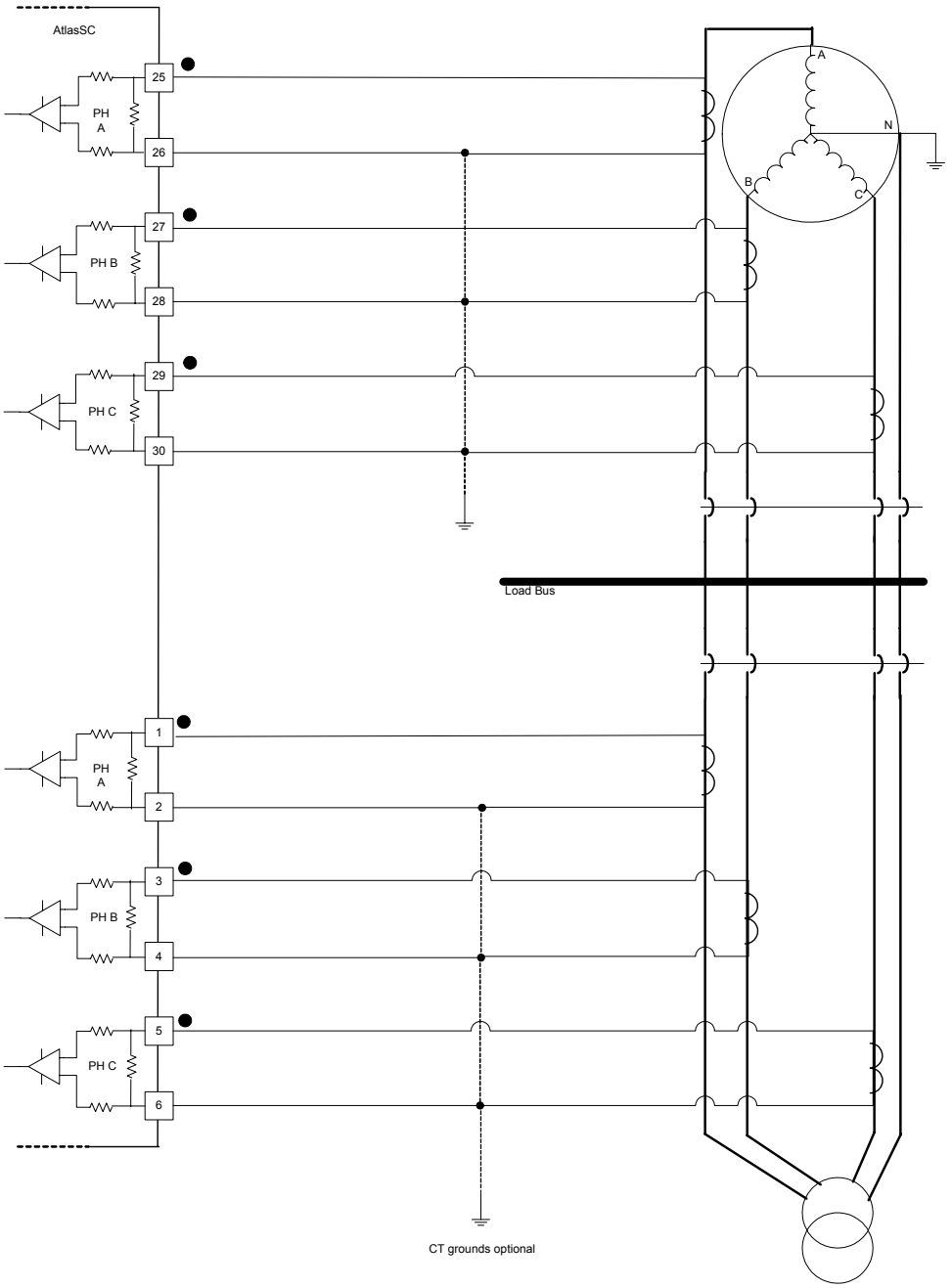


Figure 2-19. CT Wiring—3∅ Wye

CT—3∅ Delta

This diagram shows the generator and mains in a delta configuration. The current transformers are placed on the leads connecting to the load. The diagram shown is simply an example of a typical system.

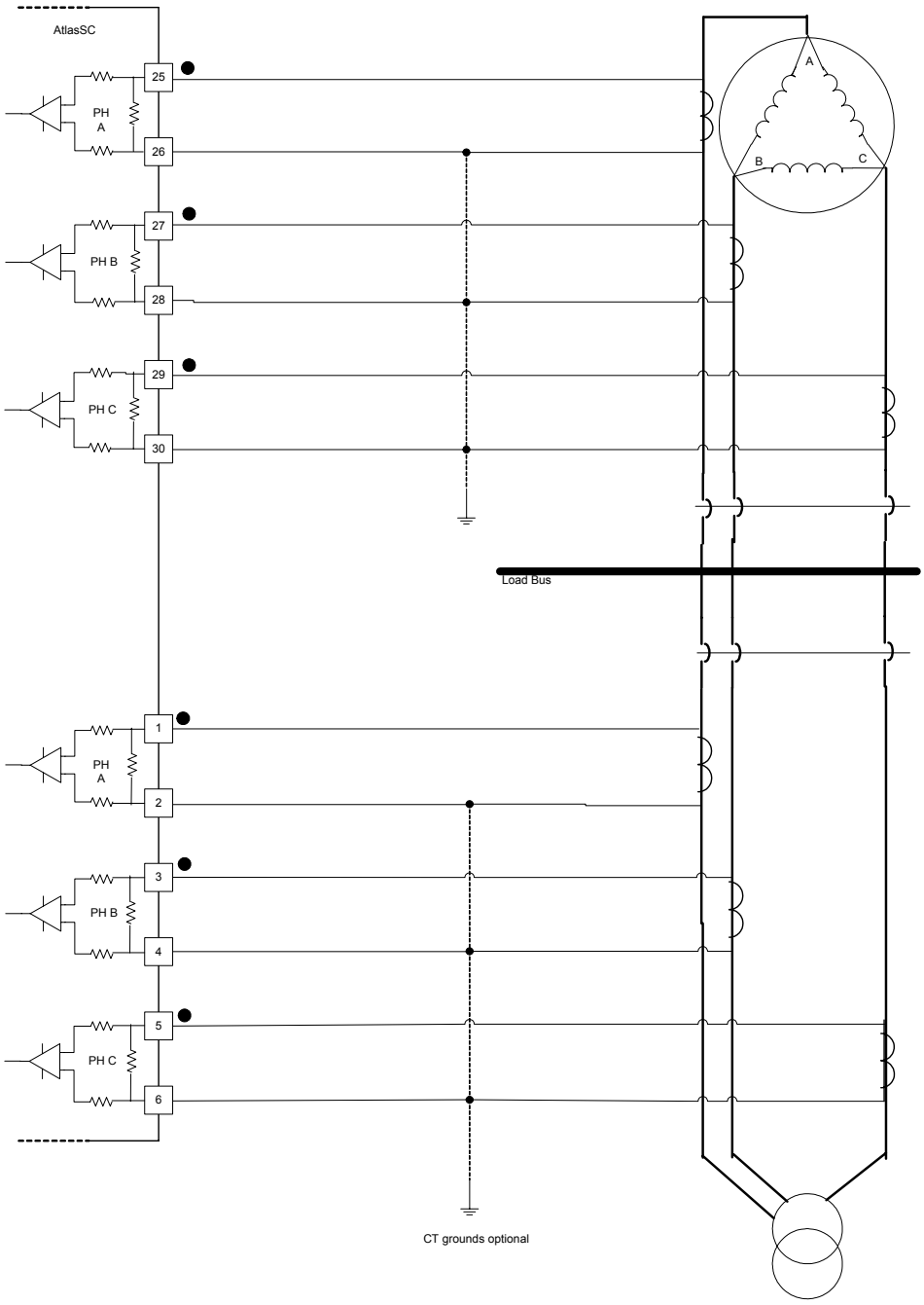


Figure 2-20. CT Wiring—3Ø Delta

CT—1∅ Zig Zag

This diagram shows the generator and mains in a delta configuration. The current transformers are placed on the leads connecting to the load. The diagram shown is simply an example of a typical system.

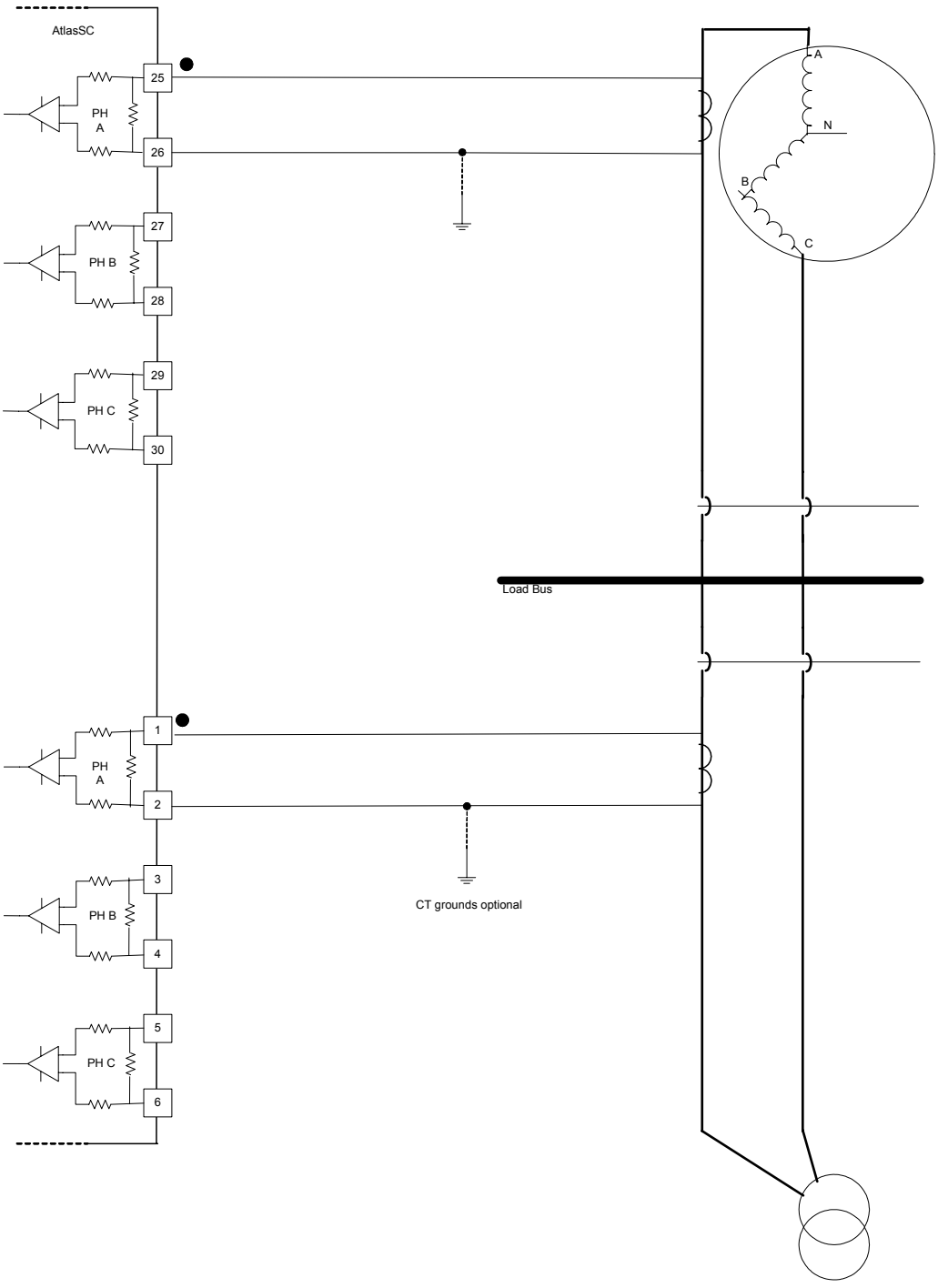


Figure 2-21. CT Wiring—1∅ Zig Zag

Single Phase Monitoring

In a single phase monitoring system, the AtlasSC Load+Speed Control will only use the A phase CT input. Anything connected to the B and C phase inputs will be ignored. The current transformer is placed on the A phase leads connecting to the load. See the appropriate diagram above and ignore the B and C phase inputs. For a single phase input, the PT and CT must be monitoring the same phase. During control Configuration the software must be selected to use Single Phase. The single phase monitoring is applied to 3 phase machines, it is not intended for single phase machines.

NOTE

The AtlasSC Load+Speed Control power calculations are based on a per-phase calculation. When a single phase input is used the displayed values will be 1/3 of the total device levels. Therefore the entered CT ratio or the total power level(s) for the mains or generator will have to be adjusted to display actual 3∅ device power levels.

MPU (Speed) Input

The AtlasSC Load+Speed Control accepts passive magnetic pickup (MPU) inputs for speed sensing. It is not recommended that gears mounted on an auxiliary shaft be used to sense speed. Auxiliary shafts tend to turn more slowly than the rotor or crankshaft (reducing speed sensing resolution) and have coupling gear backlash, resulting in less than optimum speed detection. For safety purposes, it is also not recommended that the speed sensing device sense speed from a gear coupled to a generator or mechanical drive side of a system.

Input frequency	100–24 950 Hz
Input amplitude	1–25 Vrms
Input impedance	2 k Ω
Isolation voltage	500 Vac minimum, each channel is isolated from all other channels
Resolution	Dependent on frequency, 13 bit minimum at maximum speed
Accuracy	Better than ±0.08% full scale from –40 to +85 °C internal temperature

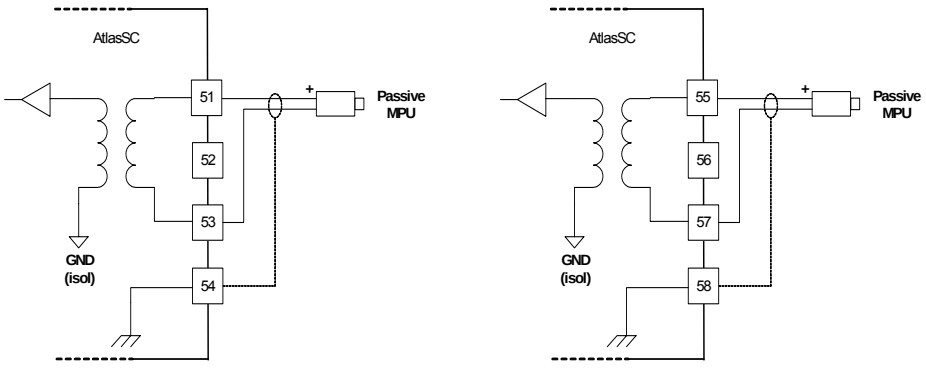


Figure 2-22. MPU Wiring Diagram

Analog Inputs

The Analog Inputs may be current or voltage type (only for SmartCore board). For the analog inputs from the Analog Combo board they can be thermocouple, current or RTD type. If a current input is used, a jumper is installed at the terminal block, and the software must be selected for current (only for SmartCore board). This allows the AtlasSC Load+Speed Control to use the applicable hardware calibration values. If a voltage input is needed, the jumper must be removed, and the software must be selected for voltage (only for SmartCore board).

When the AtlasSC Load+Speed Control inputs are configured, the engineering unit values are entered for the sensor at minimum (1 v or 4 mA) and at maximum (5 V or 20 mA) – for the 4-20 mA (1-5 V) inputs.

All analog inputs are calibrated using the entered engineering unit, and are not affected by the American or Metric selection.

The Analog Inputs may be used with a two-wire ungrounded (loop powered) transducer or isolated (self-powered) transducer. See transducer wiring below for typical wiring. If interfacing to a non-isolated device that may have the potential of reaching over 10 Vdc with respect to the control's common, the use of a loop isolator is recommended to break any return current paths, which could produce erroneous readings. Loop power must be provided from an external source.

Analog Inputs 4-20mA (SmartCore board)

Number of channels	6
Input type	4–20 mA or 0–5 V
Max. input current	25 mA ±5% if configured for 4–20 mA
Max. input voltage	5.0 V ±5% if configured for 0–5 V
Common mode rejection	80 dB minimum
Input common mode range	±11 V minimum
Safe input common mode volt	±40 V minimum
Input impedance	200 Ω (±1%)
Anti-aliasing filter	2 poles at 10 ms
Resolution	14 bits
Accuracy @ 25 °C	less than ±0.1% of full scale, 0.025 mA
Temp Drift	171 ppm/°C, maximum (1.1% of full scale, 0.275 mA) 30 ppm/°C, typical (0.20% of full scale, 0.05 mA)
I/O Latency	2 channels at 1 ms, 2 channels at 3 ms, and 2 channels at 5 ms

Thermocouple/4–20 mA Analog Inputs (Analog Combo board)

Number of channels	2 thermocouple and 3 4-20mA
Input type	4–20 mA, type J or type K, thermocouple (required)
Max. input current	24 mA if configured for 4–20 mA
Max. input voltage	±72.8 mV for thermocouples inputs
Thermocouple Range	Type E:–9.83 mV (–267.68 °C/–449.82 °F) to 72.8 mV (952.60 °C/1746.68 °F) Type J:–8.09 mV (–209.72 °C/–345.50 °F) to 69.55 mV (1199.94 °C/2191.89 °F) Type K:–6.45 mV (–263.95 °C/–443.11 °F) to 54.88 mV (1371.81 °C/2501.26 °F) Type N:–4.34 mV (–263.14 °C/–441.65 °F) to 47.51 mV (1299.92 °C/2371.86 °F) Type R:–0.22 mV (–48.27 °C/–54.89 °F) to 21.10 mV (1767.88 °C/3214.18 °F) Type S:–0.23 mV (–48.60 °C/–55.48 °F) to 18.69 mV (1767.76 °C/3213.97 °F) Type T:–6.25 mV (–265.71 °C/–446.28 °F) to 20.87 mV (399.97 °C/751.95 °F)
Common mode rejection	–80 dB minimum for analog inputs –96 dB typical for analog inputs –110 dB minimum for thermocouple inputs –120 dB typical for thermocouple inputs
Input common mode range	±11 V minimum
Safe input common mode volt	±40 V minimum
Input impedance	103 Ω (±1%) for 4–20 mA inputs
Anti-aliasing filter	2 poles at 10 ms (channel 11 has 2 poles at 5 ms)
Resolution	15 bits

RTD Analog Inputs (Analog Combo board)

Number of channels	3
Input type	100 or 200 Ω 3-wire
Max. input resistance	781 Ω
RTD range	European Curve (Type 385): 100 Ω RTD: 18.49 Ω (–200 °C/–328 °F) to 390.48 Ω (850 °C/1562 °F) 200 Ω RTD: 37.04 Ω (–200 °C/–328 °F) to 533.10 Ω (457 °C/854.6 °F) American Curve (Type 392): 100 Ω RTD: 59.57 Ω (–100 °C/–148 °F) to 269.35 Ω (457 °C/854.6 °F) 200 Ω RTD: 119.14 Ω (–100 °C/–148 °F) to 538.70 Ω (457 °C/854.6 °F)
Common mode rejection	–96 dB minimum for RTD inputs –115 dB typical for RTD inputs
Input common mode range	±11 V minimum
Safe input common mode volt	±40 V minimum
Anti-aliasing filter	2 poles at 10 ms
Resolution	15 bits

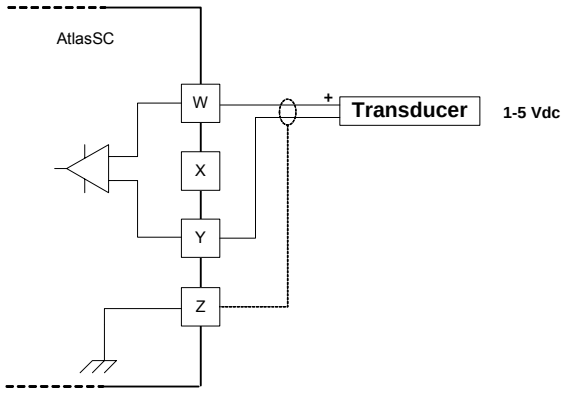


Figure 2-23. Analog Input Wiring Diagram, 1–5 V

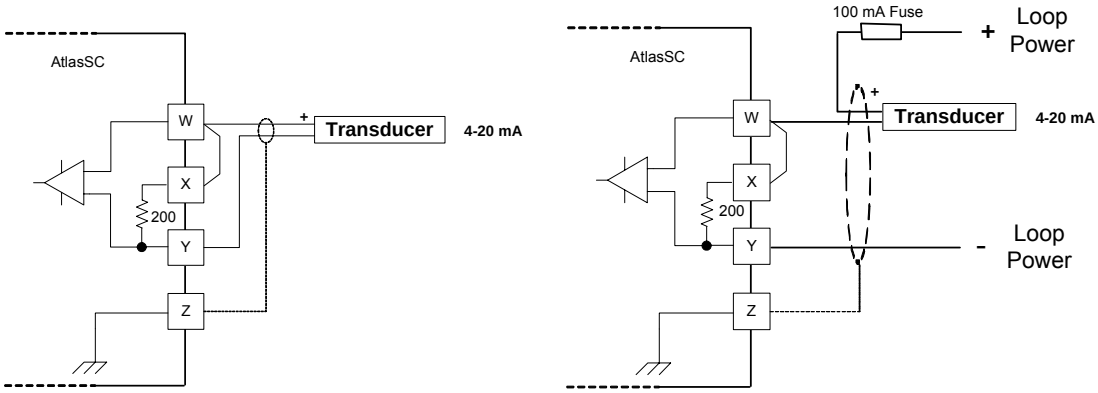


Figure 2-24. Analog Input Wiring Diagram; 4–20 mA or Thermocouple

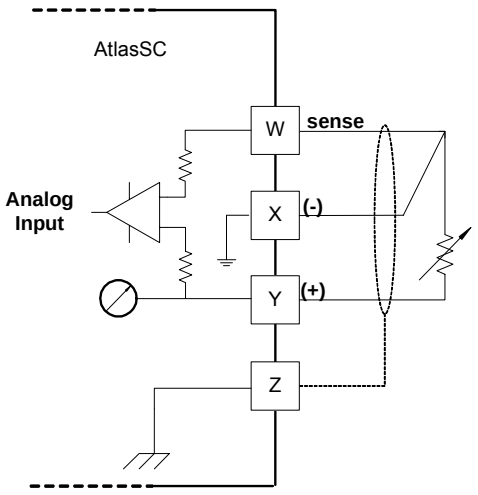


Figure 2-25. RTD Input Interface to the Analog Combo Board
(wiring example, inputs 12–15)

Terminal Reference	W	X	Y	Z
Analog Input 1 (*)	27	28	29	30
Analog Input 2 (*)	31	32	33	34
Analog Input 3 (*)	35	36	37	38
Analog Input 4 (*)	39	40	41	42
Analog Input 5 (**)	1	-	2	3
Analog Input 6 (**)	4	-	5	6
Analog Input 9 (**)	13	-	14	15
Analog Input 10 (**)	16	-	17	18
Analog Input 15 (**)	32	-	33	34
Analog Input 16 (**)	35	36	37	38
Analog Input 17 (**)	39	40	41	42
Analog Input 18 (**)	43	44	45	46

(*) Analog Inputs 1 to 4 refers to SmartCore board
(**) Analog Inputs 5 to 18 refers to Analog Combo board

The following table shows the function (pre-assigned or optional) of the first four Analog Inputs. The other nine analog inputs are used for alarm only (exception: Analog Input 15 that is used for MAP limiter):

Analog Input Channel #	Software Input
AI #1	Coolant Temperature
AI #2	Oil Pressure
AI #3	O, D = 4
AI #4	O, D = 6

“O” indicates an input can be configured for an item from the list below.
“D= x” indicates the default menu item (as shipped).

Menu Item	Software Input
7	Remote Analog Alarm
6	Remote VAR Reference
5	Remote PF Reference
4	Remote Process, Import/Export Reference
3	Process Control Input
2	Remote Baseload Reference
1	Not Used

Voltage Bias Output

The Voltage Bias allows the AtlasSC Load+Speed Control to vary the generator voltage level to control the reactive load on the generator. The MC model does not use the voltage bias output. The Voltage Bias can be configured one of four types of outputs: 4–20 mA, ±1 V, ±3 V, ±9 V. The output mode selected should be determined based on the voltage regulator specifications. Minimum to maximum voltage bias output change from the AtlasSC Load+Speed Control should be approximately ±10% change in rated generator voltage. Both the configuration and the wiring must be changed to switch between current and voltage outputs. Only the configuration must be changed to switch between the differing voltage outputs.

PWM frequency	3 kHz for current and voltage outputs
Current output	4–20 mA selected by software switch and wiring
Voltage output	±1, ±3, ±9 Vdc selectable by software switch and wiring
Max current output	
4–20 mA output	25 mA ±5%
Max voltage output	
±1, ±3, ±9 Vdc	±9 V limit ±5%
Isolation	See HAZARDOUS LIVE isolation requirement
Max load resistance	
4–20 mA	300 Ω at 24 mA
±1, ±3, ±9 Vdc	No maximum
Min load resistance	
4–20 mA	0 Ω
±1, ±3, ±9 Vdc output	7 kΩ
Resolution	
4–20 mA	12 bits
±1 V output	>7 bits
±3 V output	>9 bits
±9 V output	12 bits
Accuracy	Better than ±0.1% of full scale @ 25 °C
4–20 mA	±0.025 mA
±1 V, ±3 V, ±9 V output	±0.018 V
Temperature Drift	
Voltage outputs	330 ppm/°C, maximum
4–20 mA output	140 ppm/°C, maximum

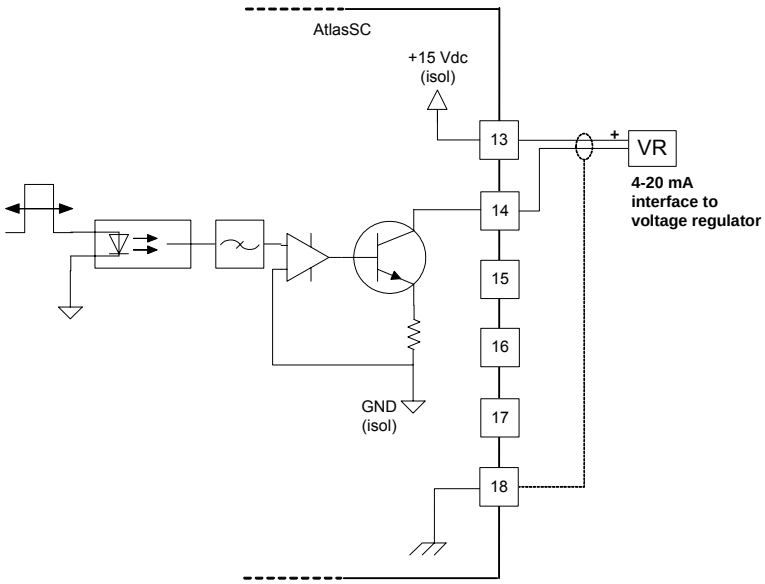


Figure 2-26. Voltage Bias Wiring Diagram, 4–20 mA Output

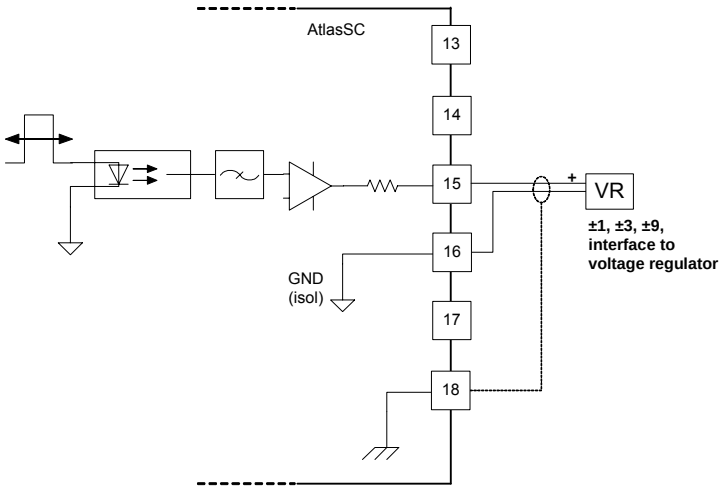


Figure 2-27. Voltage Bias Wiring Diagram, Bi-polar Voltage Output

Analog Outputs

There are four analog outputs that may be assigned to a number of functions. Each output is a 4–20 mA current source. The Analog Outputs may be used with a two-wire ungrounded device or isolated device. If interfacing to a non-isolated device, the use of a loop isolator is required. The chart below give the parameters that may be configured for analog output, The scale or range of each parameter can also be changed, i.e. a frequency read out may be set for 57 to 63 Hz, or 30 to 65 Hz.

Number of channels	4, PWM outputs
Output type	4–20 mA outputs, non-isolated
PWM frequency	1.5 kHz
Common Mode Voltage	15 Vdc ±10%
Current output	4–20 mA
Max current output	25 mA ±5%
Min. load resistance	0 Ω
Max load resistance	300 Ω at 22 mA
Resolution	12 bits
Accuracy @ 25 °C	Better than ±0.1% of full scale, 0.025 mA
Temperature Drift	140 ppm/°C, 0.23 mA maximum
	70 ppm/°C, typical (0.45% of full scale, 0.11375 mA)

Each analog output has identical circuitry. There is no isolation between outputs and no isolation to the digital circuitry of the AtlasSC Load+Speed Control. Wiring for each is shown below but only the terminal numbers change for each output.

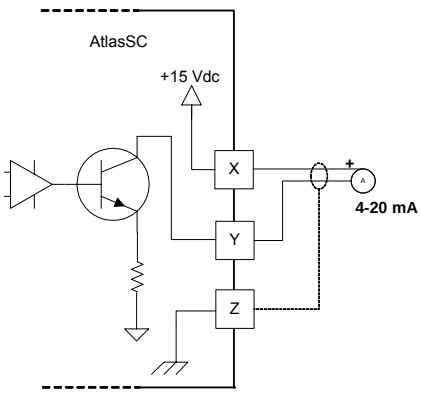


Figure 2-28. Analog Output Wiring Diagram

Analog Output Terminal	Analog Out 1	Analog Out 2	Analog Out 3	Analog Out 4
X	65	68	71	74
Y	66	69	72	75
Z	67	70	73	76

All four Analog Outputs are user configurable. The following table shows the function options available.

Menu Item	Software Analog Output
17	Speed Bias Reference (rpm)
16	Fuel Demand (%)
15	Speed Reference (rpm)
14	Bus KVAR
13	Bus KVA
12	Bus KW
11	Bus Current
10	Bus Voltage
9	Generator Power Factor
8	Generator Frequency
7	Generator KVAR
6	Generator KVA
5	Generator KW
4	Generator Current
3	Generator Voltage
2	Synchroscope
1	Not Used

Discrete Inputs

There are 19 discrete inputs; the first five are preconfigured for a fixed function, the last three ones are alarm only inputs and the remaining eleven may be configured as needed. All nineteen inputs are individually optically isolated; however, all sixteen share a common power supply return. The inputs expect 24 Vdc for an asserted state.

Number of channels	19
Input type	Optically isolated discrete input
Input thresholds	< 8 Vdc = “OFF”
	> 16 Vdc = “ON”
Input current	3 mA @ 24 Vdc
Contact voltage	24 Vdc isolated
Max input voltage	28 Vdc
Isolation voltage	500 Vac, all channels are isolated from the other I/O

An external 18–28 Vdc power source can be used to source the circuit wetting voltage for the discrete inputs. Due to circuit isolation, the external power supply common must be connected to the AtlasSC Load+Speed Control terminal 25 as shown in the wiring diagrams below. However, for EMC Compliance, the on board, isolated, +24 Vdc supply is recommended for use as the contact wetting voltage. The internal supply should only be used for the discrete inputs as shown in the diagrams; use in other, unrelated, circuits could overload the supply or create ground loops. The internal, isolated, supply is limited to approximately 300 mA maximum.

Pre-configured Inputs

The first five discrete inputs are pre-configured for a fixed function. They cannot be reprogrammed to another function. The operation of each is described in the appropriate section of the AtlasSC Load+Speed Control Operation manual. Two diagrams are shown; the one on the left shows use the internal wetting supply voltage, and the other uses an external supply. The two are mutually exclusive.

The E-stop input is Active Low, normally closed. It will generate an E-stop alarm if the connection is broken. The other inputs are Active High, normally open.

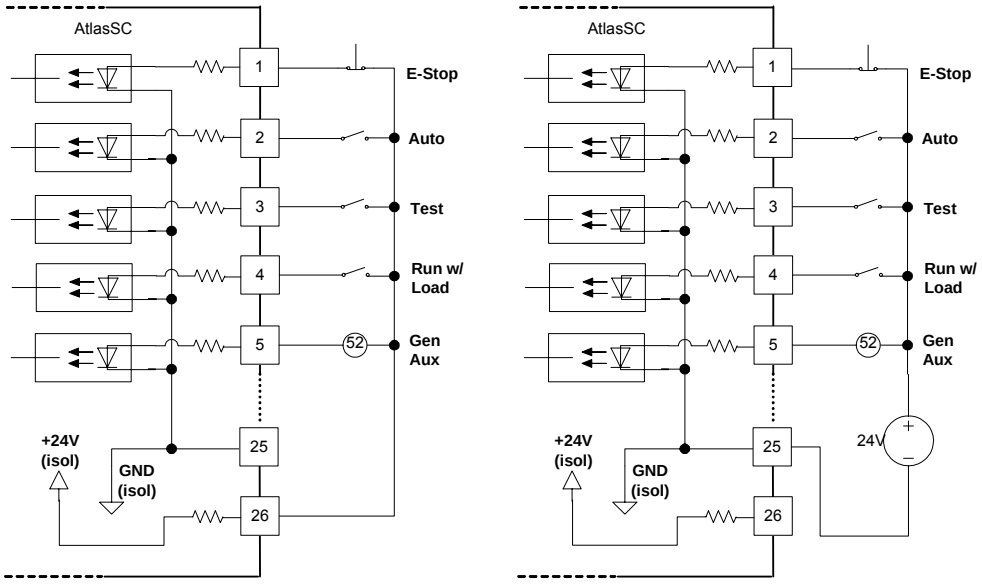


Figure 2-29. Discrete Input Wiring Diagram, Pre-configured

Configurable Inputs

The function of eleven discrete inputs may be configurable. The operation of each configurable function is described briefly in the table below and in more detail in appropriate chapter of this manual. The diagram below shows the typical connections of contactors, switches, etc for the default configuration. The actual configuration may be different. If using an external supply for the wetting voltage, see above diagram for connections. ALL discrete inputs must be connected to the wetting voltage in the same manner. Inputs that are configured for Remote Alarm input may also be configured to be active high or active low (Normally open or normally closed). The configuration check requires that only one input channel may be configured for a function selection.

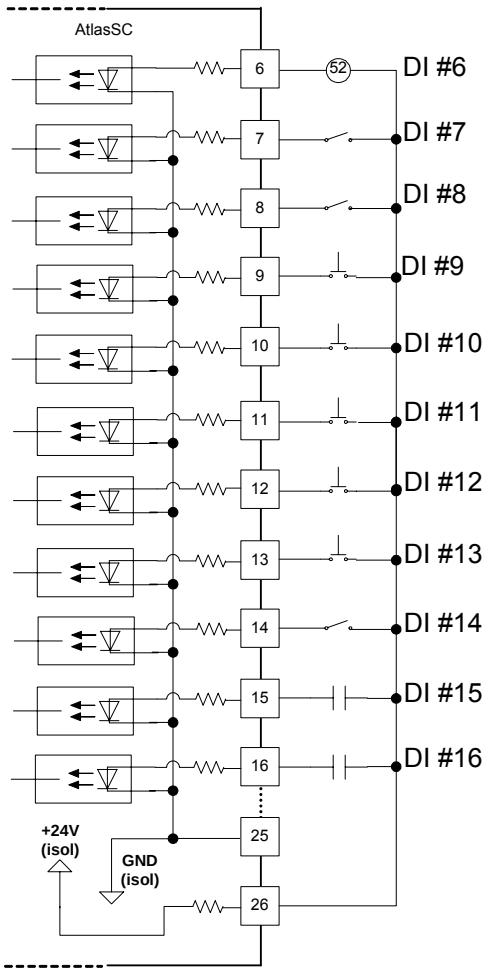


Figure 2-30. Discrete Input Wiring Diagram, Configurable

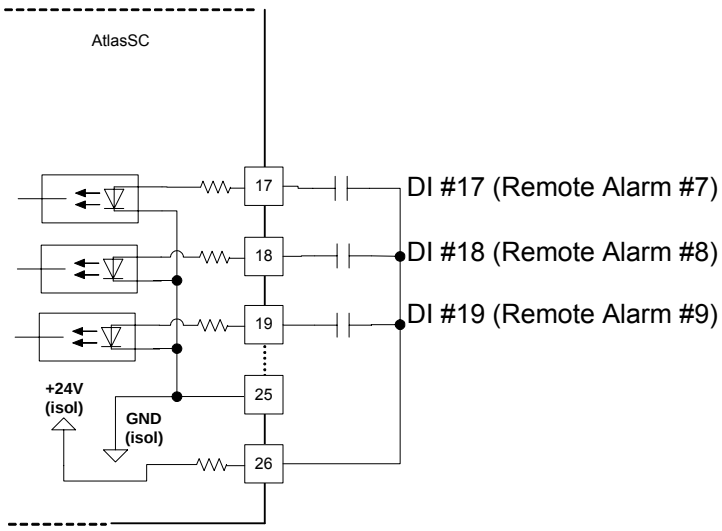


Figure 2-31. Discrete Input Wiring Diagram, Discrete Alarm Only

The following table shows the function (pre-assigned or optional) of the 19 discrete Inputs:

Discrete Input Channel # / Terminal	Software Discrete Input
DI #1/1	Emergency Stop
DI #2/2	Control Auto / Manual
DI #3/3	Control Test / Normal
DI #4/4	Control Run / Normal
DI #5/5	Generator Breaker Aux Contact
DI #6/6	O, D= 2
DI #7/7	O, D= 11
DI #8/8	O, D= 12
DI #9/9	O, D= 3
DI #10/10	O, D= 4
DI #11/11	O, D= 5
DI #12/12	O, D= 6
DI #13/13	O, D= 7
DI #14/14	O, D= 8
DI #15/15	O, D= 9
DI #16/16	O, D= 10
DI #17/17	Alarm Input #7
DI #18/18	Alarm Input #8
DI #19/19	Alarm Input #9

“O” indicates an input can be configured for an item from the list below.
“D= x” indicates the default function (as shipped).

Menu Item	Software Discrete Input
1	Not Used
2	Mains Breaker Aux Contact
3	Voltage/PF/VAR Raise Command
4	Voltage/PF/VAR Lower Command
5	Load / Speed Raise Command
6	Load / Speed Lower Command
7	Load Ramp Pause
8	Enable Process Control
9	Remote Alarm #1
10	Remote Alarm #2
11	Remote Alarm #3
12	Remote Alarm #4
13	Remote Alarm #5
14	Remote Alarm #6
15	Reset Alarm/Fault
16	Enable VAR/PF Control
17	Unload Command
18	W Breaker Aux Contact
19	X Breaker Aux Contact
20	Y Breaker Aux Contact
21	Z Breaker Aux Contact
22	BaseLoad Select
23	Reset to Internal Load Setting
24	Bus Segment A
25	Bus Segment B
26	Bus Segment C
27	Bus Segment D
28	Droop Track Select
29	KW De-Rate Select

Discrete Outputs

There are 12 discrete outputs. Some of which are preconfigured for a fixed function but the remaining may be configured as needed. All twelve outputs are individually optically isolated. However, all twelve share a common power supply and return circuit. Each output uses a thermally protected MOSFET that will pulse the circuit if the current limit is exceeded. An over-current condition on one output will not affect the other outputs. The output will be pulsed continuously until the current requirement is reduced, allowing the output to operate normally again.

Number of channels	12
Output type	Low-side driver with short circuit and over voltage protection
Current drive rating	<200 mA
Discrete Output supply voltage	9-32 Vdc
Isolation voltage	500 Vac, all channels are isolated from the other I/O

An external 9–32 Vdc power source must be provided to source the circuit voltage switched by the AtlasSC Load+Speed Control. Due to circuit isolation, the external power supply common must be connected to the AtlasSC Load+Speed Control terminal 23 as shown in the wiring diagrams below.

Preconfigured Outputs

The preconfigured outputs are set for a fixed function. They cannot be reprogrammed to another function. The operation of each is described in the appropriate section of the AtlasSC Load+Speed Control Operation manual All the functions shown are energized to activate the function.

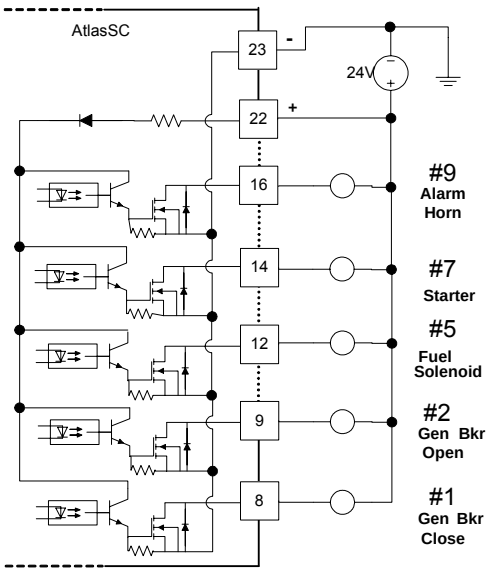


Figure 2-32. Discrete Output Wiring Diagram, Preconfigured

Configurable Outputs

The remaining discrete outputs may be reprogrammed to a function dependent on the application. The operation of each configurable function is described in the appropriate chapter of this manual. The diagram below shows the connection of indicator lamps, contactors, etc for the default configuration. The actual configuration may be different. All of the configurable discrete outputs may also be configured for normally energized or normally de-energized operation.

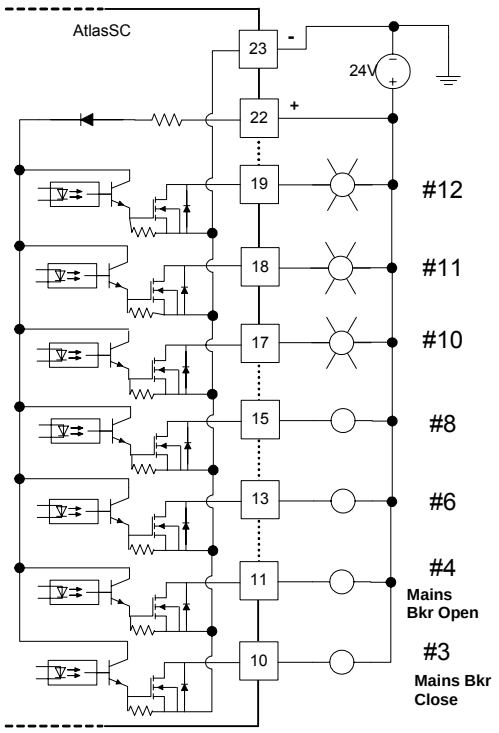


Figure 2-33. Discrete Output Wiring Diagram, Configurable

The following table shows the function (pre-assigned or optional) of the 12 Discrete Outputs:

Discrete Output Channel # / Terminal	Software Discrete Outputs
DO #1/8	Gen Breaker Close
DO #2/9	Gen Breaker Open
DO #3/10	O, D = 1
DO #4/11	O, D = 2
DO #5/12	Fuel Valve Solenoid
DO #6/13	O, D= 3
DO #7/14	Starter Solenoid
DO #8/15	O, D= 4
DO #9/16	Alarm Horn
DO #10/17	O, D= 19
DO #11/18	O, D= 20
DO #12/19	O, D= 21

“O” indicates an input can be configured for an item from the list below.
“D= x” indicates the default menu item (as shipped).

Menu Item	Software Discrete Outputs
1	Not Used
2	Bus Bkr Shunt Trip
3	Pre-Glow Command
4	Idle/Rated Command
5	Air Shutoff Solenoid
6	Spark Ignition Command
7	Speed Bias Raise
8	Speed Bias Lower
9	Voltage Bias Raise
10	Voltage Bias Lower
11	Engine Running
12	KW-hr pulse
13	Analog Alarm 3 Occurred
14	Analog Alarm 4 Occurred
15	EPS Supplying Load
16	KVA Switch
17	Analog Pre-Alarm 3 Occurred
18	Analog Pre-Alarm 4 Occurred
19	Warning Alarm
20	Soft Shutdown Initiated
21	Hard Shutdown Initiated
22	LON Node Number Mismatch
23	Loss Of Power (AtlasSC Load+Speed Control is operational)
24	Analog Alarm 5 Occurred
25	Analog Pre-Alarm 5 Occurred
26	Analog Alarm 6 Occurred
27	Analog Pre-Alarm 6 Occurred
28	Analog Alarm 9 Occurred
29	Analog Pre-Alarm 9 Occurred
30	Analog Alarm 10 Occurred
31	Analog Pre-Alarm 10 Occurred
32	Analog Alarm 16 Occurred
33	Analog Pre-Alarm 16 Occurred
34	Analog Alarm 17 Occurred
35	Analog Pre-Alarm 17 Occurred
36	Analog Alarm 18 Occurred
37	Analog Pre-Alarm 18 Occurred
38	Speed PID in Control
39	Speed Switch

Communication Ports

There are three serial ports on the AtlasSC Load+Speed Control. They may all be used simultaneously and may all be configured independently. Performance of any one port will depend on how many ports are in use and the port traffic. Ports 1 and 2 may be configured as RS-232, RS-422, or RS-485 to match the intended application. All ports are optically isolated from each other.

Any port configured as RS-232 will meet the RS-232C standard for communications. The wiring shall meet the requirements of EIA RS-232. This standard states a maximum cable length of 15 m (50 ft) with a total capacitance less than 2500 pF and a data rate not exceeding 56 kbps. All AtlasSC Load+Speed Control serial ports may be configured for data rates up to 115 200 bps but may not function properly at this high data rate when a full 15 meters of cable length is used. Do not leave an RS-232 null modem cable attached to the AtlasSC Load+Speed Control if it is removed from the PC, to avoid the possibility of EMC noise being introduced to the AtlasSC Load+Speed Control.

Any port configured as RS-422 or RS-485 meets the ANSI standards for this type of communications. The wiring shall be one continuous cable between nodes and shall meet the requirements of EIA RS-422 or EIA RS-485 for 500 kbps. However, one half of the cable length limits is recommended due to harsh environments typical of prime mover installations as follows:

Cable	Length	Example
Standard shielded twisted pair cable	30 m (100 ft)	
24 AWG, low-capacitance cable	75 m (250 ft)	Belden 9841
22 AWG, low-capacitance cable	120 m (400 ft)	Belden 3105A
20 AWG, low-capacitance cable	150 m (500 ft)	Belden 89207
Fiber optic cable with optical repeaters	> 150 m (500 ft)	

The last unit in the network chain, and only the last unit, should have its receiver terminated with a resistor. If the AtlasSC Load+Speed Control is the last unit, installing jumpers as shown on the following diagrams may use the internal resistors

Configurable Port (Serial 1)

This port may be configured to use the Modbus RTU protocol or Woodward's ServLink protocol. If it is configured as a Modbus RTU port, it will have the same address as the port 2 Modbus port described below. However, although they share the same address, all messaging is independent and they are physically and electrically isolated.

The RS-232 port configuration is defaulted at 57.6 kbps, no parity, 8 data bits, and 1 stop bit. The RS-422 and RS-485 port baud rate is shared with the RS-232 configuration and hence also defaults to 57.6 kbps.

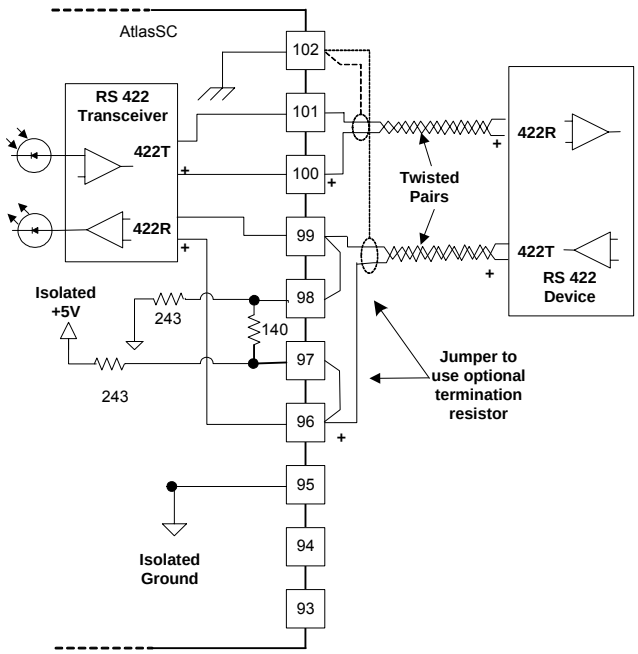


Figure 2-34. Serial 1 Wiring Diagrams, RS-422

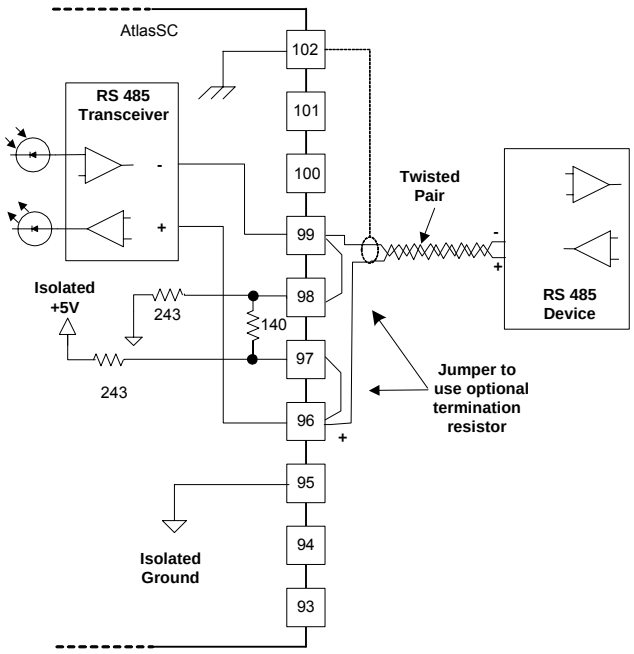


Figure 2-35. Serial 1 Wiring Diagrams, RS-485

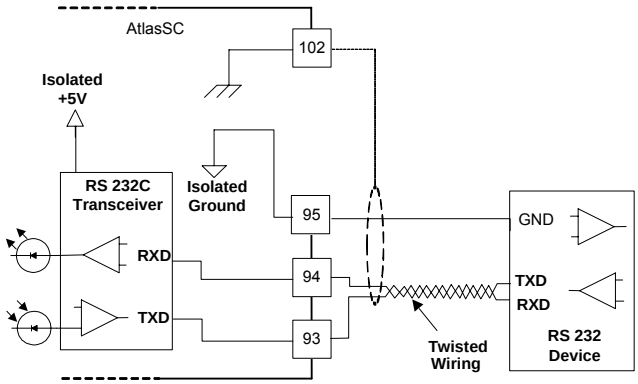


Figure 2-36. Serial 1 Wiring Diagrams, RS-232

Modbus Port (Serial 2)

This port may only be used as a Modbus RTU port. It will have the same address as the Serial 1 Modbus port described above, if that port is also configured to use Modbus. However, although they share the same address, all messaging is independent and they are physically and electrically isolated.

The port may be configured for RS-232, RS-422, or RS-485 by using the correct wiring connections and selecting the correct protocol mode. The RS-232 port configuration is defaulted at 9600 bps, no parity, 8 data bits, and 1 stop bit. The RS-422 and RS-485 port baud rate is shared with the RS-232 configuration and hence also defaults to 9600 kbps.

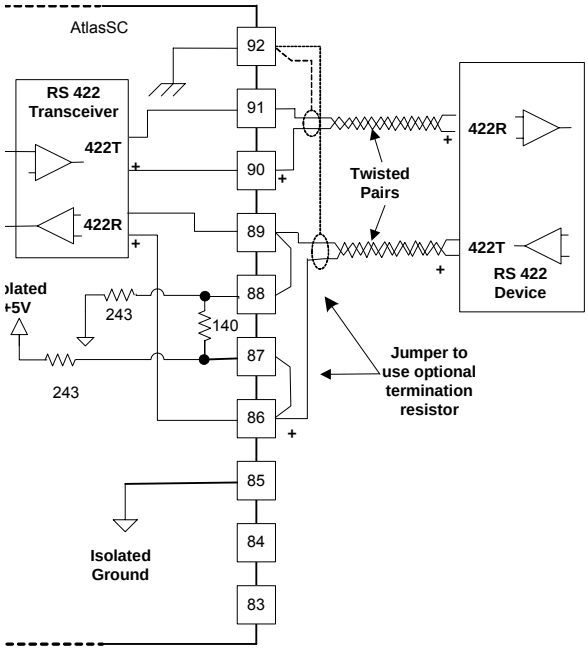


Figure 2-37. Serial 2 Wiring Diagrams, RS-422

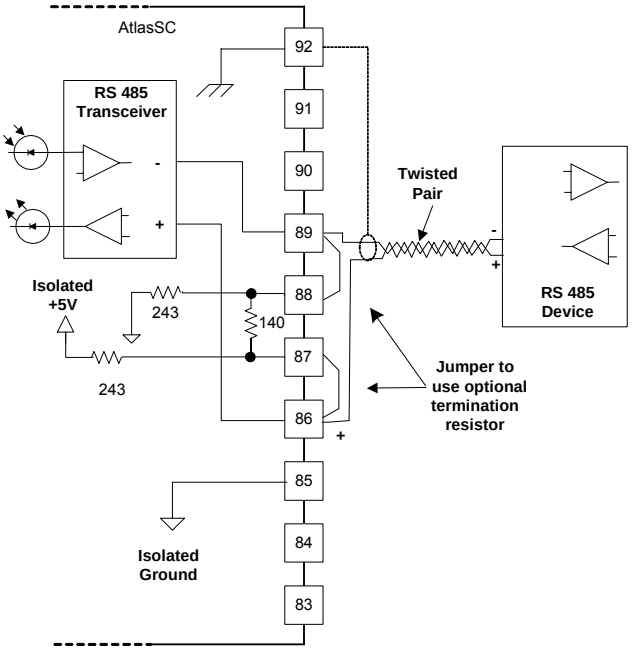


Figure 2-38. Serial 2 Wiring Diagrams, RS-485

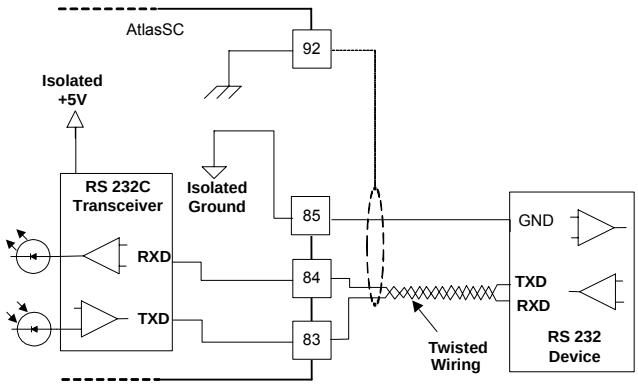


Figure 2-39. Serial 2 Wiring Diagrams, RS-232

RS-232 Configuration Port (Serial 3)

This port may only be used as a Woodward ServLink port. Its primary purpose is for configuration using a PC with Woodward's Watch Window. However, it may also be connected to a PC based HMI for local configuration and monitoring.

The port is fixed as an RS-232 port only. The RS-232 port configuration is defaulted at 115200 bps, no parity, 8 data bits, and 1 stop bit. A Null Modem cable must be used to connect to this port. The AtlasSC Load+Speed Control has a standard DB-9 Female receptacle. It is best to use a metal shell connector at both ends with the shell connected to the cable shield but isolated from the ground signal wire. The shell of the 9-pin D-sub on the AtlasSC Load+Speed Control is chassis grounded.

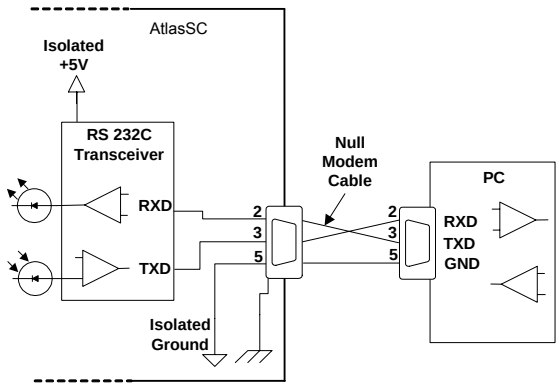


Figure 2-40. Serial 3 Wiring Diagram, RS-232

LON Communication Port

The LON port is used to communicate with up to 16 other AtlasSC Load+Speed Control devices. The LON allows controls to share start/stop sequencing, breaker status, and load share information between generator sets. When connected to an optional Master Control (MC) the LON is used to control the operation and sequencing of the LS unit. When an AtlasSC Load+Speed Control is the last device of the LON string, the termination jumper at 48 and 49 should be installed

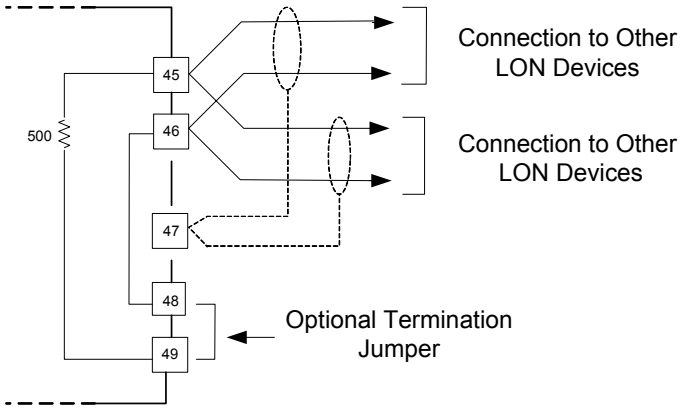


Figure 2-41. LON Connections

Use only recommended shielded cabling for LON network. Correct cable is available from Woodward, Belden, or other suppliers providing an equivalent cable.

Woodward part number 2008-349

Belden
PO Box 1980
Richmond IN 47375
Telephone (317) 983-5200

Belden Part Number	Description
9207	PVC 20 AWG shielded. NEC Type CL2, CSA Cert. PCC FT 1.
89207	Teflon 20 AWG shielded, Plenum version. NEC Type CMP, CSA Cert. FT 4.
YR28867	PVC 22 AWG shielded.
YQ28863	Plenum 22 AWG shielded.

Recommended cable length and stub length of LON network wiring.

System Ambient Temperature Range:	0 to 55 °C	–20 to +55 °C	–40 to +55 °C
Maximum Network Cable Length	150 m	150 m	50 m
Maximum Stub Length	300 mm	300 mm	300 mm

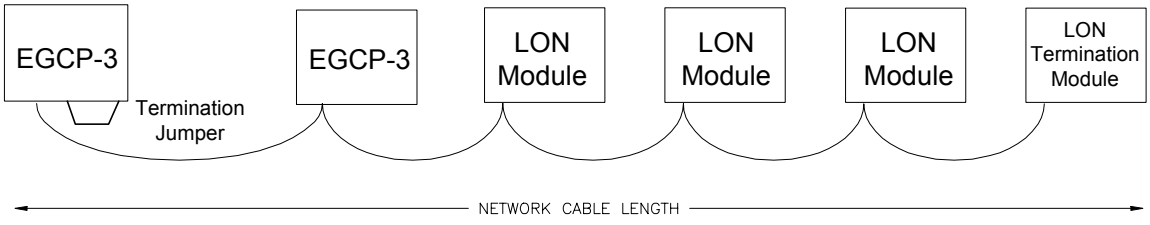


Figure 2-42. Direct Wired LON Network

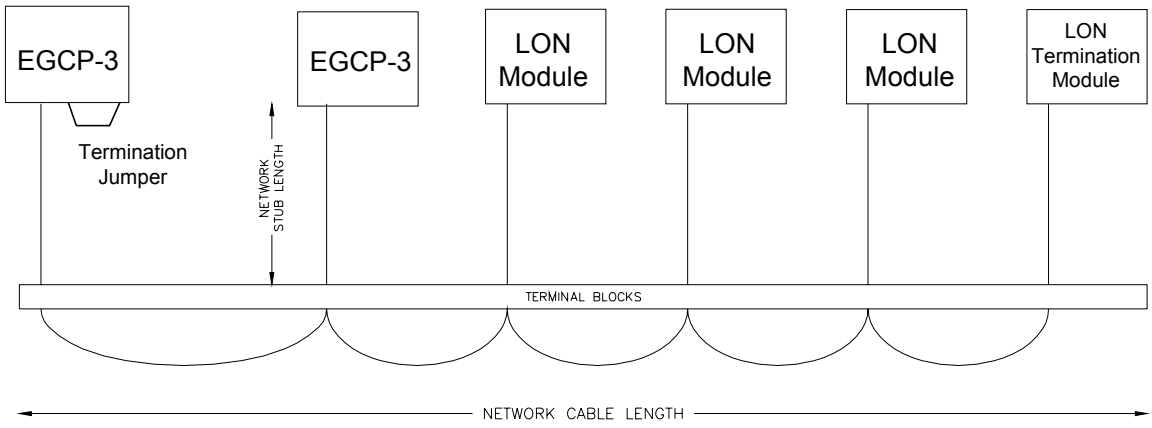


Figure 2-43. Stub Wired LON Network

Chapter 3.
Control Configuration

Introduction

The AtlasSC™ Load+Speed Control must be configured before it can be used. All configuration points that are necessary for standard operation are available from the front panel display. These configuration points plus additional points are available when using Watch Window software through the ServLink communications serial link. The additional configuration points enable additional features but are not required for basic operation. This chapter discusses AtlasSC Load+Speed Control setup using Watch Window user interface.

The Service and Configure sheets in Watch Window are designed to be an easy way to configure the equipment. This structure allows a user to utilize the Quick Configure feature of Watch Window to create logical and manageable sheets (tabs) of parameters. To create these sheets (menus), 'click' on the large **Q** near the left end of the Windows Menu-bar. The table below indicates the sheets that will be created by a Quick Configure agent. The agent will sort the Service sheets first followed by the Configure sheets in order from left to right as shown top to bottom in the table below. The window containing the Quick Configure sheets is referred to as an Inspector Window. Multiple inspectors can be used at once. Customized inspectors can be made by adding or deleting sheets, or parameter within a sheet.

Parameters are separated in Configure and Service blocks in Watch Window. All parameters that should not be changed while the engine is running are placed in Configure blocks. The parameters that can not be changed are in the following menus; First Time Startup, Digital Inputs, Relay Outputs. Configure blocks require IO Lock to be set in order to allow changes in a parameter.

Many of the Service sheets are intended to allow the user to monitor operation of the engine, generator and bus/mains. The sheets named STATUS01 – STATUS10 may be used for this purpose.

Below is a list of all Configure and Service sheets of this controller.

Watch Window Configure Sheet Names	Comments / Function
A# FIRST TIME CONFIG ##	System Configuration values at installation
B# DIGITAL INPUTS ##	Define Function of Configurable Discrete Inputs
C# RELAY OUTPUTS ##	Define Function of Configurable Relay Driver Outputs

Watch Window Service Sheet Names	Comments / Function
AA ENGINE PROTECTION	Engine Protection Setup
AB SHUTDOWN AND ALARMS	Define Alarm Thresholds
AC GENERATOR PROTECTION	Define Generator Trip Levels
AD ENGINE CONTROL	Setup Engine Start Sequence
AE SYNCHRONIZER	Define Synchronizer operating Parameters
AF REAL LOAD CONTROL	Set Load Control Parameters
AG REACTIVE LOAD CNTRL	Set Reactive Load Control Parameters
AH PROCESS CONTROL	Define Process Control Function, Parameters
AI TRANSFER SWITCH	Define Gen stable Timing
AJ SEQUENCING	Setup Auto Start/Stop Conditions
AK COMMUNICATIONS	Serial Port Setup Values
AL CALIBRATION	Set Clock and Hardware Input/Output Calibration
AM REMOTE ALARM INPUTS	Set Remote Discrete Alarm Functions
AN FORCE OUTPUTS	Enables test and manual operation of Discrete Outputs
AO ANALOG OUTPUTS	Define Function and Scaling of Analog Outputs
AP ANALOG INPUTS	Define Function and Scaling of Analog Inputs
AQ REMOTE CONTROL	Monitor ServLink Parameters
AR SEQUENCE STATES	Use to Observe the State of the AtlasSC Load+Speed Control engine Sequence
AS SPEED SETTINGS	Defines speed ramp rates and shows PID settings
AT DYNAMICS #1	Defines speed PID parameters for dynamic #1
AU DYNAMICS #2	Defines speed PID parameters for dynamic #2
AV DYNAMICS #1, 5 PT GAIN	Defines speed PID parameters for dynamic #1 if a 5 P-Gain map is used
AW DYNAMICS #2, 5 PT GAIN	Defines speed PID parameters for dynamic #2 if a 5 P-Gain map is used
AX FUEL LIMITERS 1/2	Defines the fuel limiters for speed control (1/2)
AY FUEL LIMITERS 2/2	Defines the fuel limiters for speed control (2/2)
AZ ACTUATOR BUMP SETUP	Used to simulate a block if a real load is not available
BA LOADPULSE SETTINGS	Defines the parameters for the load rejection logic
BB ANALOG INPUT 5	Defines the parameters for analog input 5 (Analog Combo)
BC ANALOG INPUT 6	Defines the parameters for analog input 6 (Analog Combo)
BD ANALOG INPUT 9	Defines the parameters for analog input 9 (Analog Combo)
BE ANALOG INPUT 10	Defines the parameters for analog input 10 (Analog Combo)
BF ANALOG INPUT 16	Defines the parameters for analog input 16 (Analog Combo)
BG ANALOG INPUT 17	Defines the parameters for analog input 17 (Analog Combo)
BH ANALOG INPUT 18	Defines the parameters for analog input 18 (Analog Combo)

BN FREQUENCY TEST	Used to simulate over/under frequency test
BO SPEED SWITCH CONFIG	Used to configure the values for speed switch
BP ANALG COMBO CALIBRATION	Used to calibrate the analog inputs of the Analog Combo board
BQ UNITS	Displays the Units (KW, MW) of the System
BR LON MESSAGING	Displays all LON Messages (for Load
BS APPLICATION INFO	Displays some information about the software
BT STATUS SYSTEM	Displays the System Operating Status and Values
BU STATUS ENGINE	Display the Engine Operating Status
BV STATUS GENERATOR	Displays the Generator Operation Values
BW STATUS BUS	Observe the Bus Operation Values
BX STATUS I/O	Displays AtlasSC Load+Speed Control Inputs and Outputs
BY STATUS SYNCHRONIZER	Displays Synchronizer States
BZ STATUS KW LOAD	Displays Load Control Values and Status
CA STATUS PF / KVAR	Displays VAR/PF control Values and Status
CB STATUS SEQUENCING	Displays Sequencing operation States
CC STATUS ALARMS	Displays Order of Alarm Occurrence and Times
CD STATUS - METERING	Displays the

Table 3-1. Watch Window Sheet

Parameter Descriptions

Within a given menu in the following sections, each parameter will be described in detail. Separating each parameter will be a quick reference block like the one shown below. Details for the parameter will follow the quick reference block.

Item	Display Name	Min	Max	Default	Units
Generator Over Voltage Alarm Level	GEN VOLT HI LVL	50	30000	600	Volts

The display name is the description used in Watch Window. The names may differ because the field is limited to 27 in Watch Window.

The Default value is the value that this parameter will be when shipped from the factory.

The Units column indicates the configuration units for a numerical parameter. For items in electrical units, an asterisk (*) will precede the unit in the table. This indicates that the units are variable (_, K, or M). The variable units depend on the configured CT Ratio, PT Ratio, Sensing Type, and Hardware Range for the generator or mains input. The appropriate units calculated by the AtlasSC Load+Speed Control are shown on the V UNITS sheet of Watch Window.

Alarm Action Definition

Below is the list of alarm actions. It is used in many places within the Configuration Menus.

Value	Alarm Actions Definition	Display	Notes
8	Trip Tie Breaker With Alarm	Trip Breaker w/Alarm	Opens the Bus Breaker, Initiates a start, adds an event to the alarm list.
7	Trip Tie Breaker	Trip Breaker	Opens the Bus Breaker, Initiates a start
6	Hard Shutdown	Hard Shutdown	Engine is shutdown immediately, same as an Emergency Shutdown
5	Soft Shutdown	Soft Shutdown	Non-critical shutdown, smooth unload, cooldown, then shutdown
4	Audible Alarm	Audible Alarm	A discrete output will be given, connected to an external audible device, An acknowledge from ALARM CLEAR will turn this output off.
3	Visual Alarm	Visual Alarm	A discrete output will be given, connected to an external visual indication device. This is not effected by an Acknowledge
2	Warning	Warning	An event will be shown on the alarm list only
1	Disabled	Disabled	No Action will be taken

Table 3-2. Alarm Action Definitions

Program Configuration Checks

In order to prevent improper configuration of the control, “sanity checks” are made automatically in software.

Safety related Parameters (values that could cause equipment damage) must be within a specified range, calculated from the following:

- Rated VA
- Number of Poles
- Rated Speed
- Rated Frequency
- Function selection of discrete inputs 6 through16
- Function selection of analog inputs 3 and 4

If an entered value does not pass the configuration check when compared to other entered values, an alarm will be logged in the Alarm/Event list and the control will not be available for operation (Hard Shutdown) until this value is corrected, and a reset/clear given. The STATUS01 SYSTEM sheet in Watch Window will indicate which configured item is entered incorrectly.

First Time Configure Menu

This menu is shown as a Configure sheet in Watch Window. Items in it can be viewed but not edited while the engine is running. Configure sheets are near the end (right side) of the Quick Configure agent tabs. When using Watch Window for Configuration, IO Lock must also be set. IO Lock will set all AtlasSC Load+Speed Control outputs to the same level/value as when input supply power is removed from the unit.

Every item in the First Time Startup menu must ALWAYS be checked and configured upon first usage of the control. The first 17 items in the Watch Window menu must be correctly configured prior to any other configuration.

Item	Display Name	Min	Max	Default	Units
Language	LANGUAGE	1	1	1=English	NA

1 = English, 2 = 2nd Language. Second Language is not available at this time.

Item	Display Name	Min	Max	Default	Units
Gen CT Ratio	GEN CT RATIO	5.0	30000.0	150	Ratio

This value represents a scalar for the generator ac current inputs. If a CT has a turns ratio of 1500:5, then the value to enter here is 1500. The value actually represents the Primary Turns on the transformer. The AtlasSC Load+Speed Control will multiply the sensed current at the input by this value to determine the actual current on the generator for the given phase.

Item	Display Name	Min	Max	Default	Units
Gen PT Ratio	GEN PT RATIO	1.0	1000.0	3.8	Ratio

This value represents a scalar for the generator ac voltage inputs. If a PT has a turns ratio of 13,800:120, then the value to enter here is 115. (13800 ÷ 120 = 115) The AtlasSC Load+Speed Control will multiply the sensed voltage at the input by this value to determine the actual voltage on the generator for the given phase. The AtlasSC Load+Speed Control will also need to know the next two parameters to fully define the voltage.

Item	Display Name	Min	Max	Default	Units
Gen Sensing Type	GEN SENSING TYPE	False	True	True=3∅	

This value can be either 1∅ or 3∅ with a default of 3∅. If set to 1∅, the AtlasSC Load+Speed Control will ignore any inputs on the B and C phase generator ac voltage inputs and current inputs, and set these phase values to zero. When 1Ø is selected the power measurements will be a per-phase value, and not the total.

Item	Display Name	Min	Max	Default	Units
Gen Hardware Range	GEN HW RANGE	1	3	2=120V	Volts

This value can be either 70, 120, or 240 Vac with a default of 240 Vac. This setting is important to the AtlasSC Load+Speed Control for both calibration accuracy as well as ability to measure the voltage. The range limits for each selection are indicated in the table below.

Value	Configured Range		Maximum Voltage
1	70		100 Vac
2	120		150 Vac
3	240		300 Vac

Item	Display Name	Min	Max	Default	Units
Bus CT Ratio	BUS CT RATIO	5.0	30000.0	500	

This value represents a scalar for the bus ac current inputs. If a CT has a turns ratio of 1500:5, then the value to enter here is 1500. The value actually represents the Primary Turns on the transformer. The AtlasSC Load+Speed Control will multiply the sensed current at the input by this value to determine the actual current on the bus for the given phase.

Item	Display Name	Min	Max	Default	Units
Bus PT Ratio	BUS PT RATIO	1.0	1000.0	3.8	

This value represents a scalar for the bus ac voltage inputs. If a PT has a turns ratio of 13,800:120, then the value to enter here is 115 (13800 ÷ 120 = 115). The AtlasSC Load+Speed Control will multiply the sensed voltage at the input by this value to determine the actual voltage on the bus for the given phase. The AtlasSC Load+Speed Control will also need to know the next two parameters to fully define the voltage.

Item	Display Name	Min	Max	Default	Units
Bus Sensing Type	BUS SENSING TYPE	False	True	True=3∅	

This value can be either 1∅ or 3∅ with a default of 3∅. If set to 1∅, the AtlasSC Load+Speed Control will ignore any inputs on the B and C phase bus ac voltage inputs and current inputs, and set these phase values to zero. When 1Ø is selected the power measurements will only be a per-phase value, and not the total.

Item	Display Name	Min	Max	Default	Units
Bus Hardware Range	BUS HW RANGE	1	3	2=120V	Volts

This value can be either 70, 120, or 240 Vac with a default of 240 Vac. This setting is important to the AtlasSC Load+Speed Control for both calibration accuracy as well as ability to measure the voltage. The range limits for each selection are listed in the table below. When the voltage drops below the Dead Bus value, the bus is considered dead. If the control is configured to perform Dead Bus breaker closing the breaker close command will be armed.

Value	Configured Range	Dead Bus Voltage Detected	Maximum Voltage
1	70	<27 Vac	100 Vac
2	120	<40 Vac	150 Vac
3	240	<80 Vac	300 Vac

CAUTION—CONFIGURE THESE ITEMS FIRST

It is very important that PT Ratio, CT Ratio, Sensing Type, and Hardware Range be configured for each bus prior to anything else. These values are used to determine the units for all other configurable parameters.

Item	Display Name	Min	Max	Default	Units
Number of Poles	NUMBER POLES	2	18	4	NA

This value is the number of poles on the generator. It is used to calculate the generators frequency. Then the measured speed from the MPU is compared with this frequency. The AtlasSC Load+Speed Control constantly watches to be sure the calculation for frequency and the sensed generator frequency match. This diagnostic is used to determine MPU failure, or generator excitation failure. It will also trigger a configuration error if values are not entered properly.

Item	Display Name	Min	Max	Default	Units
Number of Teeth	NUMBER TEETH	6	500	60	NA

This value is the number of teeth on the flywheel where the MPU sensor is located. Even if no MPU is provided, this must be properly configured in order to pass the configuration check. The AtlasSC Load+Speed Control assumes the MPU is located on a flywheel that spins at the same rate as the crankshaft and the generator. If this is not the case (for example, if there is a gear box between the engine and generator), then either the number of poles or the number of teeth must be adjusted so that the rpm reads correctly and the AtlasSC Load+Speed Control configuration check is also satisfied.

Item	Display Name	Min	Max	Default	Units
Disable MPU 2?	DISABLE MPU 2?	False	True	False	NA

This value asks if it will be used one or two pick-ups. If it will be used two pick-ups set this value to False. If only one pick-up is used set this value to True.

Item	Display Name	Min	Max	Default	Units
Speed to Start Control	SPD TO STRT CTRL (% RTD)	2	50	5	%

This value expressed in % of the rated speed is the speed that the speed control assume to start controlling speed. From this speed on the speed control assume that the engine is not stopped anymore and start controlling it.

Item	Display Name	Min	Max	Default	Units
Actuator Output Type	ACTUATOR OUT TYPE (1,3)	1	3	1	NA

Selects the current range of the actuator used:
1 = 0-200 mA
2 = 4-20 mA
3 = 0-20 mA

Item	Display Name	Min	Max	Default	Units
Reverse Acting Actuator?	REVERSE ACTING ACTUATOR?	False	True	False	NA

Set to TRUE for reverse-acting actuators and FALSE for forward-acting actuators. Forward-acting actuators require current increase to increase fuel. Reverse-acting actuators require current decrease to increase fuel (reverse-

acting actuators should always incorporate a mechanical ballhead backup governor, such as the Woodward EGB).

Item	Display Name	Min	Max	Default	Units
Shutdown Actuator on Internal Shutdown?	SD ACT ON INTERNAL SD	False	True	True	NA

This parameter is to be used in association with Reverse Acting Actuator. If this parameter is set to TRUE and the Reverse Acting Actuator is also set to TRUE when the engine is Shut Down the actuator goes to 100%. If this parameter is set to FALSE and the Reverse Acting Actuator is set to TRUE when the engine is Shut Down the actuator goes to 0%. If Reverse Acting Actuator is set to FALSE then this parameter has no function.

Item	Display Name	Min	Max	Default	Units
Rated Gen VA	RATED GEN VA	0.001	30000.0	156.00	*VA

This value is the nameplate Volt-Ampere (VA) rating for the generator set. Be careful to observe the indicated units when configuring this parameter. When using Watch Window, the units are in a separate Quick Configure Sheet labeled UNITS.

Item	Display Name	Min	Max	Default	Units
Rated Gen VAR	RATED GEN VAR	0.001	30000.0	35.0	*VAR

This value is the nameplate Volt-Ampere-Reactive (VAR) rating for the generator set. Be careful to observe the indicated units when configuring this parameter. When using Watch Window, the units are in a separate Quick Configure Sheet labeled UNITS.

Item	Display Name	Min	Max	Default	Units
Rated Gen Watts	RATED GEN W	0.001	30000.0	125.00	*Watts

This value is the nameplate Watt (W) rating for the generator set. Be careful to observe the indicated units when configuring this parameter. When using Watch Window, the units are in a separate Quick Configure Sheet labeled UNITS.

Item	Display Name	Min	Max	Default	Units
Rated Engine Speed	RATED ENGINE SPEED (RPM)	100	5000	1800	RPM

This is the rpm value when the engine is at synchronous speed. This value is used in the configuration check together with the number of teeth and rated frequency.

Item	Display Name	Min	Max	Default	Units
Rated Gen Voltage	RATED GEN VOLTAGE	0.001	30000.0	480.0	*Volts

This value is the nameplate Voltage of the generator set. This value is used to set up rated current of the machine for use in protection of the generator. Be careful to observe the indicated units when configuring this parameter. When using Watch Window, the units are in a separate Quick Configure Sheet labeled UNITS.

Item	Display Name	Min	Max	Default	Units
Gen Configuration	GEN PT CONFIGURATION	1	3	1=Delta(L-L)	NA

This value can be either 1=Wye (Star, Line-to-Neutral), 2=Delta (Line-to-Line), or 3=Zig Zag (single phase). If set to Wye, it indicates that the wiring between the generator and the AtlasSC Load+Speed Control is done in a L-N manner. It does NOT necessarily relate to how the generator is connected to the load. For example, the generator could be wired to the load as Wye but wired to AtlasSC

Load+Speed Control as Delta using Open Delta transformers. When the configuration is set for Zig Zag, the setting Gen Sensing type must also be set to False for single phase.

Item	Display Name	Min	Max	Default	Units
Bus Rated Watts	RATED BUS WATTS	0.001	30000.0	1000.0	*Watts

This value is the Watt (W) rating of the bus tie. It should be based on the bus side values seen by the PTs and CTs. Be careful to observe the indicated units when configuring this parameter. When using Watch Window, the units are in a separate Quick Configure Sheet labeled UNITS.

Item	Display Name	Min	Max	Default	Units
Bus Rated Voltage	RATED BUS VOLTAGE	0.001	30000.0	480.0	*Volts

This value is the voltage of the bus where the PTs are connected. Be careful to observe the indicated units when configuring this parameter. When using Watch Window, the units are in a separate Quick Configure Sheet labeled UNITS.

Item	Display Name	Min	Max	Default	Units
Bus Configuration	BUS PT CONFIGURATION	1	3	1=Delta (L-L)	

This value can be either 1=Wye (Star, Line-to-Neutral), 2=Delta (Line-to-Line), or 3=Zig Zag. If set to Wye, it indicates that the wiring between the bus and the AtlasSC Load+Speed Control is done in a L-N manner. It does NOT necessarily relate to the bus configuration.

Item	Display Name	Min	Max	Default	Units
System Frequency	SYSTEM FREQUENCY	1	2	2=60	Hertz

This value can be either 50Hz or 60Hz with a default of 60Hz. It applies to both the generator and bus inputs.

Item	Display Name	Min	Max	Default	Units
Voltage Bias Output Type	VOLTAGE BIAS TYPE	1	5	3= ±1	

Value	Output
5	Raise/Lower
4	±1 volt
3	±3 volt
2	±9 volt
1	4–20 mA

This value in the list above selects the type of voltage bias output compatible with the voltage regulator being used. This software selection will configure the Voltage Bias output hardware to provide the electrical characteristic selected.

Item	Display Name	Min	Max	Default	Units
Generator Breaker Type	GEN BREAKER TYPE	1	2	1=Breaker	NA

This value can be either Breaker or Contactor. If set to breaker, the AtlasSC Load+Speed Control operates two relay outputs. The shunt trip output will open the breaker, and the breaker close output will close the breaker. If set to contactor, the AtlasSC Load+Speed Control operates one relay output, the output is the breaker close it will toggle the output for open and close. When the contactor option, the Generator Shunt Trip output is not used.

Item	Display Name	Min	Max	Default	Units
Unit Number	UNIT NUMBER	1	16	1	NA

This is the LON network address for the AtlasSC Load+Speed Control. Each Unit must have a unique unit number. The Unit numbers in the system do not need to be consecutive. If an AtlasSC Load+Speed Control MC is used, it must also be assigned a unit number within the allowed range (1-16). The LS sets priorities for process master from the lower LS unit number. The MC sets priorities for Master in Control from the higher MC unit number.

Item	Display Name	Min	Max	Default	Units
Bus Segment Assignment	BUS SEGMENT	1	4	1=A Segment	

Enter the bus segment this AtlasSC Load+Speed Control is connected to via PT/CT and breaker wiring. The table below shows the different bus segment options. Application of Digital Input Selectable requires a digital input or multiple digital inputs to select the bus segment. This also limits the functionality of the W, X, Y, and Z tiebreaker feedback. Example: If an LS unit has digital inputs for Bus A and Bus B, and they are closed, the unit will be on bus AB even if tiebreaker W is open.

Value	Bus segment
1	A Segment
2	B Segment
3	C Segment
4	D Segment
5	Digital Input Selectable

Item	Display Name	Min	Max	Default	Units
ServLink Address	SERVLINK ADDRESS	0	15	0	

When the ServLink communication is configured for Multi-drop (multiple ServLink devices sharing the same information) enter the address of this control.

Item	Display Name	Min	Max	Default	Units
LON Start Sequencing	LON START SEQUENCING	False	True	True=Enabled	

This will enable the AtlasSC Load+Speed Control to initiate engine starts when a start is requested from the LON network.

Item	Display Name	Min	Max	Default	Units
Engine Start Sequencing	START SEQUENCING	False	True	True=Enabled	

This value is a True/False selection that can be either Enabled or Disabled. If set to Enabled, the AtlasSC Load+Speed Control will control engine cranking, fuel shutoff, and ignition shutoff, etc. If Disabled, the AtlasSC Load+Speed

Control will only provide a contact output for external equipment that provides the starting logic. A MPU is required when Start Sequencing is Enabled.

Item	Display Name	Min	Max	Default	Units
Process Action	PROCESS ACTION	False	True	True=Direct	

This value is a True/False selection that can be either Direct or Indirect. If set TRUE, the action is set to Direct, and an increase in process is proportional to an increase in kW. If set FALSE, the control action is set to Indirect, an increase in process is directly proportional to a decrease in kW.

Item	Display Name	Min	Max	Default	Units
Analog 3 Function	AI 3 FUNCTION	1	7	4=Proc Ref	

This value is detailed in the table below.

Value	Command	Display	Notes
7	Remote Analog Level Alarm	Analog Alarm	Transducer connection for alarm and value display
6	Remote KVAR Reference	VAR Reference	Overrides the internal VAR control configuration
5	Remote PF Reference	PF Reference	Overrides the internal PF control configuration
4	Remote Process Reference	Process Reference	Overrides the internal Process or Import/Export level configuration
3	Process Control Input	Proc Control Input	Transducer connection
2	Remote BaseLoad Reference	BaseLoad Reference	Overrides the internal BaseLoad configuration
1	Not Used	Not Used	

Item	Display Name	Min	Max	Default	Units
Analog 4 Function	AI 4 FUNCTION	1	7	5=PF Ref	

The function of Analog Input 4 can be selected from the list detailed in the table above with Analog 3.

Digital Input Menu

In Watch Window, the Digital Input Menu is a Configure menu located near the end (right) of the Quick Configure tabs following the First Time Startup Menu. When using Watch Window, IO Lock must be set.

FIXED INPUTS

Inputs	Function
Digital Input 1	Emergency Stop
Digital Input 2	Auto
Digital Input 3	Test
Digital Input 4	Run with Load
Digital Input 5	Generator Breaker (Auxiliary 52)

Units	Display Name	Min	Max	Default	
Digital Input 6	DIGITAL INPUT 6	1	29	2=Mains breaker aux contact	
Digital Input 7	DIGITAL INPUT 7	1	29	18= w Segment Breaker Aux	
Digital Input 8	DIGITAL INPUT 8	1	29	19= x Segment Breaker Aux	
Digital Input 9	DIGITAL INPUT 9	1	29	3=Voltage/PF/VAR Raise	
Digital Input 10	DIGITAL INPUT 10	1	29	4=Voltage/PF/VAR Lower	
Digital Input 11	DIGITAL INPUT 11	1	29	5=Load/Speed Raise	
Digital Input 12	DIGITAL INPUT 12	1	29	6=Load/Speed Lower	
Digital Input 13	DIGITAL INPUT 13	1	29	11= Remote Alarm Input #3	

Units	Display Name	Min	Max	Default	
Digital Input 14	DIGITAL INPUT 14	1	29	12= Remote Alarm Input #4	
Digital Input 15	DIGITAL INPUT 15	1	29	17= Unload Command	
Digital Input 16	DIGITAL INPUT 16	1	29	8= Enable Process Control	

The configurable functions are shown in the list below. The list is identical for all the configurable digital inputs. No two inputs should be configured to the same function. An error will result if two inputs are configured for the same function and the engine will not be allowed to start until it is corrected.

Value	Command	Notes
29	KW Derate Select	Changes the kW rating of the genset for loadsharing and sequencing
28	Droop Track Select	Switches the Load control mode to droop, without any speed change (bumpless)
27	Enable Bus Segment D	Puts control unit on bus D
26	Enable Bus Segment C	Puts control unit on bus C
25	Enable Bus Segment B	Puts control unit on bus B
24	Enable Bus Segment A	Puts control unit on bus A
23	Reset to Internal Load Setting	Should be a momentary switch Resets load or process to internal default
22	Enable BaseLoad	Load Control in BaseLoad mode
21	z Segment Breaker Aux	Breaker Connects Bus Seg D to A
20	y Segment Breaker Aux	Breaker Connects Bus Seg C to D
19	x Segment Breaker Aux	Breaker Connects Bus Seg B to C
18	w Segment Breaker Aux	Breaker Connects Bus Seg A to B
17	Unload Command	Ramp Load to minimum
16	Enable VAR/PF Control	Reactive Load Control Enabled
15	Reset Alarm/Fault	Should be a momentary switch. First contact silences the horn, second contact resets the fault.
14	Remote Alarm Input #6	See also Remote Alarm Menu
13	Remote Alarm Input #5	See also Remote Alarm Menu
12	Remote Alarm Input#4	See also Remote Alarm Menu
11	Remote Alarm Input #3	See also Remote Alarm Menu
10	Remote Alarm Input #2	See also Remote Alarm Menu
9	Remote Alarm Input #1	See also Remote Alarm Menu
8	Enable Process Control	Close to enable control for Process Master or Back-up Master
7	Load Ramp Pause	Should be a momentary switch
6	Load / Speed Lower Command	Should always be used together with Load/Speed Raise Command as a pair
5	Load / Speed Raise Command	Should always be used together with Load/Speed Lower Command as a pair
4	Voltage/PF/VAR Lower Command	Should always be used together with Voltage/PF/VAR Raise Command as a pair
3	Voltage/PF/VAR Raise Command	Should always be used together with Voltage/PF/VAR Lower Command as a pair
2	Mains Breaker Aux Contact	Only required when bus connected to the mains. Used for BaseLoad control or Process Master.
1	Not Used	

When a Discrete Input is selected to have a function of Remote Alarm 1-6, the alarm characteristics need to be configured in the REMOTE ALARM INPUT menu.

Digital Output Menu

Configure: “C# RELAY OUTPUTS ## “ Watch Window menu is located at the end (right) of the Quick Configure tabs. Items in the menu can be viewed but not edited until the AtlasSC Load+Speed Control is in I/O Lock..

Output channels 1,2,5,7, and 9 are pre-configured outputs and cannot be changed.

The function list is identical for all the configurable digital outputs . It is possible to configure more than one digital output for the same function, and no error will result. The first table below are the outputs that can not be configured.

FIXED OUTPUTS

Output	Function
Digital Output 1	Generator Breaker Close
Digital Output 2	Generator Breaker Open
Digital Output 5	Fuel Solenoid
Digital Output 7	Starter
Digital Output 9	Alarm Horn (Audible Alarm)

CONFIGURABLE OUTPUTS

Item	Display Name	Min	Max	Default	Units
Digital Output 3	DIGITAL OUTPUT 3	1	39	1=Not Used	
Digital Output 4	DIGITAL OUTPUT 4	1	39	2=Bus Breaker Shunt Trip Command	
Digital Output 6	DIGITAL OUTPUT 6	1	39	3=Pre-Glow	
Digital Output 8	DIGITAL OUTPUT 8	1	39	4=Idle/Rated Command	
Digital Output 10	DIGITAL OUTPUT 10	1	39	19=Warning	
Digital Output 11	DIGITAL OUTPUT 11	1	39	20=Soft Shutdown Issued	
Digital Output 12	DIGITAL OUTPUT 12	1	39	21=Hard Shutdown Issued	

Each configurable digital output can be one of the 39 functions described in the enumeration table below.

Value	Command	Notes
39	Speed Switch	Active if a certain speed (configurable) is reached
38	Speed PID in Control	Active if the speed PID is controlling the engine
37	AI-18 Pre-Alarm Occurred	AI-18 (Analog Combo) Pre-Alarm Occurred
36	AI-18 Alarm Occurred	AI-18 (Analog Combo) Alarm Occurred
35	AI-17 Pre-Alarm Occurred	AI-17 (Analog Combo) Pre-Alarm Occurred
34	AI-17 Alarm Occurred	AI-17 (Analog Combo) Alarm Occurred
33	AI-16 Pre-Alarm Occurred	AI-16 (Analog Combo) Pre-Alarm Occurred
32	AI-16 Alarm Occurred	AI-16 (Analog Combo) Alarm Occurred
31	AI-10 Pre-Alarm Occurred	AI-10 (Analog Combo) Pre-Alarm Occurred
30	AI-10 Alarm Occurred	AI-10 (Analog Combo) Alarm Occurred
29	AI-9 Pre-Alarm Occurred	AI-9 (Analog Combo) Pre-Alarm Occurred
28	AI-9 Alarm Occurred	AI-9 (Analog Combo) Alarm Occurred
27	AI-6 Pre-Alarm Occurred	AI-6 (Analog Combo) Pre-Alarm Occurred
26	AI-6 Alarm Occurred	AI-6 (Analog Combo) Alarm Occurred
25	AI-5 Pre-Alarm Occurred	AI-5 (Analog Combo) Pre-Alarm Occurred
24	AI-5 Alarm Occurred	AI-5 (Analog Combo) Alarm Occurred
23	Self Test	This relay will be energized whenever the control is in operation.
22	Node Num Mismatch	Node numbers on LON do not match the expected node number in the sequencing menu

Value	Command	Notes
39	Speed Switch	Active if a certain speed (configurable) is reached
38	Speed PID in Control	Active if the speed PID is controlling the engine
37	AI-18 Pre-Alarm Occurred	AI-18 (Analog Combo) Pre-Alarm Occurred
36	AI-18 Alarm Occurred	AI-18 (Analog Combo) Alarm Occurred
35	AI-17 Pre-Alarm Occurred	AI-17 (Analog Combo) Pre-Alarm Occurred
34	AI-17 Alarm Occurred	AI-17 (Analog Combo) Alarm Occurred
33	AI-16 Pre-Alarm Occurred	AI-16 (Analog Combo) Pre-Alarm Occurred
32	AI-16 Alarm Occurred	AI-16 (Analog Combo) Alarm Occurred
31	AI-10 Pre-Alarm Occurred	AI-10 (Analog Combo) Pre-Alarm Occurred
30	AI-10 Alarm Occurred	AI-10 (Analog Combo) Alarm Occurred
29	AI-9 Pre-Alarm Occurred	AI-9 (Analog Combo) Pre-Alarm Occurred
28	AI-9 Alarm Occurred	AI-9 (Analog Combo) Alarm Occurred
27	AI-6 Pre-Alarm Occurred	AI-6 (Analog Combo) Pre-Alarm Occurred
26	AI-6 Alarm Occurred	AI-6 (Analog Combo) Alarm Occurred
25	AI-5 Pre-Alarm Occurred	AI-5 (Analog Combo) Pre-Alarm Occurred
24	AI-5 Alarm Occurred	AI-5 (Analog Combo) Alarm Occurred
21	Hard Shutdown Initiated	Active for any Hard Shutdown. Latches closed until alarm is cleared from the alarm log.
20	Soft Shutdown Initiated	Active for any Soft or Hard Shutdown. Latches closed until alarm is cleared from the alarm log.
19	Warning Alarm	Active for any Warning or higher alarm. Latches closed until alarm is cleared from the alarm log.
18	Analog Pre-Alarm 4 Occurred	Provides discrete indication of a configurable analog Pre-Alarm occurrence
17	Analog Pre-Alarm 3 Occurred	Provides discrete indication of a configurable analog Pre-Alarm occurrence
16	KVA Switch	Indicates when generator power output exceeds a configurable level
15	EPS Supplying Load	Indicates when the generator (only) is providing power to the load
14	Analog Alarm 4 Occurred	Provides discrete indication of an analog alarm occurrence
13	Analog Alarm 3 Occurred	Provides discrete indication of an analog alarm occurrence
12	KW-hr pulse	Pulses every 100 kW-hrs for 100msec duration
11	Engine Running	A “Run Relay” function
10	Voltage Bias Lower	Used in place of Voltage Bias Analog Output. Always use with Voltage Bias Raise as a pair.
9	Voltage Bias Raise	Used in place of Voltage Bias Analog Output. Always use with Voltage Bias Lower as a pair.
8	Speed Bias Lower	Used in place of Speed Bias Analog Output. Always use with Speed Bias Raise as a pair.
7	Speed Bias Raise	Used in place of Speed Bias Analog Output. Always use with Speed Bias Lower as a pair.
6	Spark Ignition Command	Used to enable an external ignition controller
5	Air Shutoff Solenoid	Used to starve air from engine inputs. This output activated by an emergency stop or overspeed will engage for 5 seconds and is non-latching.
4	Idle/Rated Command	Used to switch external governor modes
3	Pre-Glow Command	Used with glow plugs

Value	Command	Notes
39	Speed Switch	Active if a certain speed (configurable) is reached
38	Speed PID in Control	Active if the speed PID is controlling the engine
37	AI-18 Pre-Alarm Occurred	AI-18 (Analog Combo) Pre-Alarm Occurred
36	AI-18 Alarm Occurred	AI-18 (Analog Combo) Alarm Occurred
35	AI-17 Pre-Alarm Occurred	AI-17 (Analog Combo) Pre-Alarm Occurred
34	AI-17 Alarm Occurred	AI-17 (Analog Combo) Alarm Occurred
33	AI-16 Pre-Alarm Occurred	AI-16 (Analog Combo) Pre-Alarm Occurred
32	AI-16 Alarm Occurred	AI-16 (Analog Combo) Alarm Occurred
31	AI-10 Pre-Alarm Occurred	AI-10 (Analog Combo) Pre-Alarm Occurred
30	AI-10 Alarm Occurred	AI-10 (Analog Combo) Alarm Occurred
29	AI-9 Pre-Alarm Occurred	AI-9 (Analog Combo) Pre-Alarm Occurred
28	AI-9 Alarm Occurred	AI-9 (Analog Combo) Alarm Occurred
27	AI-6 Pre-Alarm Occurred	AI-6 (Analog Combo) Pre-Alarm Occurred
26	AI-6 Alarm Occurred	AI-6 (Analog Combo) Alarm Occurred
25	AI-5 Pre-Alarm Occurred	AI-5 (Analog Combo) Pre-Alarm Occurred
24	AI-5 Alarm Occurred	AI-5 (Analog Combo) Alarm Occurred
2	Bus Breaker Trip Command	Sources to open the breaker or contactor
1	Not Used	

The following items configure the action state of the relay driver.

Item	Display Name	Min	Max	Default	Units
Digital Output 3 Normal State	DIGITAL OUTPUT 3 ACTION	FALSE	TRUE	TRUE=Normally Open	
Digital Output 4 Normal State	DIGITAL OUTPUT 4 ACTION	FALSE	TRUE	TRUE=Normally Open	
Digital Output 6 Normal State e	DIGITAL OUTPUT 6 ACTION	FALSE	TRUE	TRUE=Normally Open	
Digital Output 8 Normal State	DIGITAL OUTPUT 8 ACTION	FALSE	TRUE	TRUE=Normally Open	
Digital Output 10 Normal State	DIGITAL OUTPUT 10 ACTION	FALSE	TRUE	TRUE=Normally Open	
Digital Output 11 Normal State	DIGITAL OUTPUT 11 ACTION	FALSE	TRUE	TRUE=Normally Open	
Digital Output 12 Normal State	DIGITAL OUTPUT 12 ACTION	FALSE	TRUE	TRUE=Normally Open	

The output state for discrete outputs can be Normally Open or Normally Closed. Each can be configured to close (energize) when active or open (de-energize) when active. These modes can mimic a Normally Open or Normally Closed relay. For safety, use caution when assigning the actions of the outputs.

Engine Protection Menu

Items in this menu can be viewed and edited with caution while the engine is running. Items in this menu are part of a Service block.

Refer to Table 3-2 for the list of alarm actions. It is used in many places within the Engine Protection Menu.

Item	Display Name	Min	Max	Default	Units
Coolant Temp. High Alarm	HIGH H20 TEMP AL	1	6	5=Soft Shutdown	
Coolant Temp. High	HIGH H20 TEMP LVL	75.0	300.0	145.0	°C

Item	Display Name	Min	Max	Default	Units
Alarm Level					

Coolant Temp. High Alarm Level should be set to a value higher than the Coolant Temperature High Pre-Alarm.

Item	Display Name	Min	Max	Default	Units
Coolant Temp. High Pre-Alarm	HIGH H20 TEMP PRE-ALM	1	6	1=Disabled	
Coolant Temp. High Pre-Alarm Level	HIGH H20 TEMP PRE-ALM LVL	75.0	300.0	125.0	°C

Coolant Temp. High Pre-Alarm Level should be set to a value lower than the Coolant Temp High Alarm.

Item	Display Name	Min	Max	Default	Units
Coolant Temp. Low Pre-Alarm	LO H20 TEMP PRE-ALM	1	6	1=Disabled	
Coolant Temp. Low Pre-Alarm Level	LO H20 TEMP PRE-ALM LVL	-40.0	100.0	30.0	°C

Coolant Temp Low Pre-Alarm should be set to a value higher than the Coolant Temp Low Alarm.

Item	Display Name	Min	Max	Default	Units
Coolant Temp. Low Alarm	LO H20 TEMP AL	1	6	4=Audible	
Coolant Temp. Low Alarm Level	LO H20 TEMP LVL	0.0	100.0	20.0	°C

Coolant Temp Low Alarm should be set to a value lower than the Coolant Temp Low Pre-Alarm.

Item	Display Name	Min	Max	Default	Units
Coolant Temp. Alarm Delay	H20 TEMP ALM DLY	0.0	300.0	0.5	s
Coolant Temp. Warning Delay	H20 TEMP WRN DLY	0.0	300.0	0.5	s

These parameters are the delays for the Coolant Alarm and Coolant Pre-Alarm to be active.

Item	Display Name	Min	Max	Default	Units
Idle Oil Pressure High Alarm	HI IDLE OIL PRES AL	1	6	2=Warning	
Idle Oil Pressure High Alarm Level	HI IDLE OIL PRES LVL	1.0	1000.0	60.0	

This alarm will operate if the oil pressure exceeds the set limit while speed is between 90% of idle speed and 90% of rated speed.

Item	Display Name	Min	Max	Default	Units
Idle Oil Pressure Low Alarm	LO IDLE OIL PRES AL	1	6	6=Hard Shutdown	
Idle Oil Pressure Low Alarm Level	LO IDLE OIL PRES LVL	1.0	1000.0	10.0	

This alarm will operate if the oil pressure is below the set limit while speed is between 90% of idle speed and 90% of rated speed.

Item	Display Name	Min	Max	Default	Units
Rated Oil Pressure High Alarm	HI RTD OIL PRES AL	1	6	2=Warning	
Rated Oil Pressure High Alarm Level	HI RTD OIL PRES LVL	1.0	1000.0	80.0	

This alarm will operate if the oil pressure exceeds the set limit and speed goes above 90% of rated speed and the Idle/Rated output is set to rated.

Item	Display Name	Min	Max	Default	Units
Rated Oil Pressure Low Pre-Alarm	LO RTD OIL PRES PRE-ALM	1	6	1=Disabled	
Rated Oil Pressure Low Pre-Alarm Level	LO RTD OIL PRES PALM LVL	1.0	1000.0	40.0	

This pre-alarm will operate if the oil pressure is below the set limit and engine speed goes above 90% of rated speed and the Idle/Rated output is set to rated.

Item	Display Name	Min	Max	Default	Units
Rated Oil Pressure Low Alarm	LO RTD OIL PRES AL	1	6	6=Hard Shutdown	
Rated Oil Pressure Low Alarm Level	LO RTD OIL PRES LVL	1.0	1000.0	30.0	

This alarm will operate if the oil pressure is below the set limit and engine speed goes above 90% of rated speed and the Idle/Rated output is set to rated.

Item	Display Name	Min	Max	Default	Units
Rated Oil Pressure Alarm Delay	RTD OIL PRES ALM DLY	0.0	300.0	0.5	s
Rated Oil Pressure Warning Delay	RTD OIL PRES WRN DLY	0.0	300.0	0.5	s
Idle Oil Pressure Alarm Delay	IDLE OIL PRESS ALM DLY	0.0	300.0	0.5	s

These parameters are the delays for the Rated Oil Pressure Alarm, Rated Oil Pressure Pre-Alarm and Idle Oil Pressure Alarm to be active.

Item	Display Name	Min	Max	Default	Units
Over Speed Alarm	OVER SPEED ALM	1	6	6=Hard Shutdown	
Over Speed Alarm Level	OVER SPEED ALM LVL	100	5000	1950	RPM

This alarm will operate if the engine speed is greater than the limit value set here and a MPU is provided.

Item	Display Name	Min	Max	Default	Units
MPU Maximum Difference Alarm	MPU MAXDIFF ALM	1	6	3=Visual Alarm	
MPU Maximum Difference Level	MPU MAXDIFF LEVEL	0.0	2000.0	200.0	RPM

This alarm will operate if two pickups are used and the difference between them is greater than the MPU Maximum Difference Level for at least 120ms.

Item	Display Name	Min	Max	Default	Units
Actuator Driver Fault Alarm	ACT DRIVER FAULT ALARM	1	6	6=Hard Shutdown	
Actuator Open Load Fault Alarm	ACT OPEN LOAD FLT ALARM	1	6	6=Hard Shutdown	

These alarms will detect faults in the actuator circuit. If the fault is on the driver the Actuator Driver Fault Alarm will be active. If the fault is on the load the Actuator Open Load Fault Alarm will de active.

Shutdowns and Alarms Menu

Items in this menu can be viewed and edited with caution while the engine is running. Items in this menu are part of a Service block.

Refer to Table 3-2 for the list of alarm actions. It is used in many places within the Shutdowns & Alarms Menu.

Item	Display Name	Min	Max	Default	Units
Battery Voltage High Alarm	BATT VOLT HIGH AL	1	6	4=Audible	
Battery Voltage High Alarm Level	BATT VOLT HIGH LVL	5.0	50.0	28.0	Vdc

This alarm will operate if the input supply voltage exceeds this level for 1.0 second. It is continuously enabled, except when the Starter relay is energized. It should be set to a value higher than the normal battery charging voltage.

Item	Display Name	Min	Max	Default	Units
Battery Voltage Low Alarm	BATT VOLT LOW AL	1	6	4=Audible	
Battery Voltage Low Alarm Level	BATT VOLT LOW LVL	5.0	50.0	18.0	Vdc

This alarm will operate if the input supply voltage is below this level for 1.0 second. It is continuously enabled, except when the Starter relay is energized. It should be set to a value lower than the nominal battery voltage.

Item	Display Name	Min	Max	Default	Units
Speed Adjust Limits Reached	SPD LMT REACHED AL	1	6	2=Warning	

This alarm is continuously enabled. It operates when the speed bias output is at its minimum or maximum value for 10.0 seconds.

Item	Display Name	Min	Max	Default	Units
Voltage Adjust Limits Reached	VLT LMT REACHED AL	1	6	2=Warning	

This alarm is continuously enabled. It operates when the voltage bias output is limited because the maximum or minimum generator voltage. This alarm will also activate when the voltage bias has been limited because the VAR limit of the generator has been reached. The alarm is delayed for 10 seconds after the bias has been limited.

Item	Display Name	Min	Max	Default	Units
PowerSense Board Fail Alarm	POWERSENSE FAIL ALM	1	6	6=Hard Shutdown	

This alarm is continuously enabled. It operates when the main CPU board detects a problem with the PowerSense board of the AtlasSC Load+Speed Control.

Item	Display Name	Min	Max	Default	Units
Analog Combo Board Fail Alarm	ANALOG COMBO FAIL ALM	1	6	6=Hard Shutdown	

This alarm is continuously enabled. It operates when the main CPU board detects a problem with the Analog Combo board of the AtlasSC Load+Speed Control.

Item	Display Name	Min	Max	Default	Units
Phase Rotation Mismatch	PHASE ROTATION MISMATCH	1	6	4=Audible Alarm	

This alarm is detected when the synchronizer is enabled. This alarm occurs when the control detects that generator and bus voltages are not rotating correctly. This is detected by a large occurrence of negative sequence voltage.

Item	Display Name	Min	Max	Default	Units
Phase Rotation Mismatch Level	PHASE ROT MM LEVEL	1	100	50 %	%

This is the level of negative phase sequence voltage that will trigger the phase rotation mismatch alarm.

Generator Protection Menu

Items in Generator Protection Menu can be viewed and edited with caution while the engine is running. Items in this menu are part of a Service block.

Refer to Table 3-2 for the list of alarm actions. It is used in many places within the Generator Protection Menu.

Item	Display Name	Min	Max	Default	Units
Generator Over Voltage Alarm	GEN VOLT HI ALM	1	6	6=Hard Shutdown	
Generator Over Voltage Alarm Level	GEN VOLT HI LVL	0	30000	600	*Volts

This alarm will operate when the highest phase voltage is continuously greater than the limit setting for the time delay setting. It is always enabled. It should be set to a value higher than the Generator Over Voltage Pre-Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Over Voltage Pre-Alarm	GEN VOLT HI PRE-ALM	1	6	1=Disabled	
Generator Over Voltage Pre-Alarm Level	GEN VOLT HI PRE-ALM LVL	0	30000	550	*Volts

This alarm input is also the highest phase voltage, and is always enabled. It should be set to a value lower than the Generator Over Voltage Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Under Voltage Pre-Alarm	GEN VOLT LO PRE-ALM	1	6	1=Disabled	
Generator Under Voltage Pre-Alarm Level	GEN VOLT LO PRE-ALM LVL	0	30000	400	*Volts

This alarm is only enabled when the generator breaker is closed. It should be set to a value lower than Rated Generator Voltage and higher than Generator Under Voltage Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Under Voltage Alarm	GEN VOLT LO ALM	1	6	5=Soft Shutdown	
Generator Under Voltage Alarm Level	GEN VOLT LO LVL	0	30000	300	*Volts

This alarm will operate when the lowest phase voltage (or AØ when 1Ø is selected) is less than the under voltage level for the time delay configured. It is only enabled when the generator breaker is closed. It should be set to a value lower than the Generator Under Voltage Pre-Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Voltage Pre-Alarm Delay	GEN VOLT PRE-ALM DELAY	0.1	120.0	5.0	Seconds

This value determines the amount of time that the generator voltage must be above the Generator Over Voltage Pre-Alarm Level or below the Generator Under Voltage Pre-Alarm Level before declaring an alarm.

Item	Display Name	Min	Max	Default	Units
Generator Voltage Alarm Delay	GEN VOLT ALM DELAY	0.1	120.0	10.0	Seconds

This value determines the amount of time that the generator voltage must be above the Generator Over Voltage Alarm Level, or below the Generator Under Voltage Alarm Level before declaring an alarm.

Item	Display Name	Min	Max	Default	Units
Generator Phase Over Current Alarm	GEN CURRENT HI ALM	1	6	6=Hard Shutdown	
Generator Phase Over Current Alarm Level	GEN CURRENT HI LVL	0	30000	1500	*Amps

This alarm is continuously enabled. It first selects the generator phase with the highest current. It will operate when that phase current exceeds the set limit. It should be set to a value higher than the Generator Phase Over Current Pre-Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Phase Over Current Pre-Alarm	GEN CURRENT HI PRE-ALM	1	6	1=Disabled	
Generator Phase Over Current Pre-Alarm Level	GEN CURRENT HI PRE-ALM LVL	0	30000	1000	*Amps

This alarm is continuously enabled. It will operate when a generator phase current exceeds the set limit. It should be set to a value lower than the Generator Phase Over Current Alarm but higher than Rated Generator Current.

Item	Display Name	Min	Max	Default	Units
Generator Phase Over Current Curve Shift	GEN CURR CURVE SHIFT	0.01	10.0	1.0	

This value acts to level shift the inverse time curve, defined by IEEE and IEC. The purpose of a level shift is to match a desired time delay to the specific trip set point. The higher the current is above rated value, the shorter the delay automatically becomes. Increasing the shift value above 1.0 will increase the time delay, below 1.0 will decrease the delay, without changing the shape of the curve. This shift value is NOT the amount of time that the generator current must be above the Generator Over Current Alarm Level before declaring an alarm. But, it is used to determine that delay time.

Item	Display Name	Min	Max	Default	Units
Generator Over Frequency Alarm	GEN FREQ HI ALM	1	6	6=Hard Shutdown	
Generator Over Frequency Alarm Level	GEN FREQ HI LVL	40.0	70.0	70.0	Hertz

This alarm is continuously enabled. It should be set to a value higher than the Generator Over Frequency Pre-Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Over Frequency Pre-Alarm	GEN FREQ HI PRE-ALM	1	6	1=Disabled	
Generator Over Frequency Pre-Alarm Level	GEN FREQ HI PRE-ALM LVL	40.0	70.0	65.0	Hertz

This alarm is continuously enabled. It should be set to a value lower than the Generator Over Frequency Alarm but higher than the System Rated Frequency.

Item	Display Name	Min	Max	Default	Units
Generator Under Frequency Pre-Alarm	GEN FREQ LO PRE-ALM	1	6	1=Disabled	
Generator Under Frequency Pre-Alarm Level	GEN FREQ LO PRE-ALM LVL	40.0	70.0	45.0	Hertz

This alarm is only enabled only when the generator breaker is closed. It should be set to a value lower than System Rated Frequency and higher than Generator Under Frequency Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Under Frequency Alarm	GEN FREQ LO ALM	1	6	5=Soft Shutdown	
Generator Under Frequency Alarm Level	GEN FREQ LO LVL	40.0	70.0	40.0	Hertz

This alarm is only enabled when the generator breaker is closed. It should be set to a value lower than the Generator Under Frequency Pre-Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Frequency Pre-Alarm Delay	GEN FREQ PRE-ALM DELAY	0.1	120.0	5.0	Seconds

This value determines the amount of time that the generator frequency must be above the Generator Over Frequency Pre-Alarm Level. This value also determines the amount of time that the generator frequency must be below the Generator Under Frequency Pre-Alarm Level before declaring an alarm.

Item	Display Name	Min	Max	Default	Units
Generator Frequency Alarm Delay	GEN FREQ ALM DELAY	0.1	120.0	10.0	Seconds

This value determines the amount of time that the generator frequency must be above the Generator Over Frequency Alarm Level before declaring an alarm. This value also determines the amount of time that the generator frequency must be below the Generator Under Frequency Alarm Level before declaring an alarm.

Item	Display Name	Min	Max	Default	Units
Generator Over Power Alarm	GEN PWR HI ALM	1	6	6=Hard Shutdown	
Generator Over Power Alarm Level	GEN PWR HI LVL	-30000	30000	1500	*Watts

This alarm is continuously enabled. It should be set to a value higher than the Generator Over Power Pre-Alarm. The Generator Over Power Level should also be set higher than the Rated Power in the First Time Configuration menu. The AtlasSC Load+Speed Control uses the lower of these two settings when calculating the System Load percentage for isolated load sharing.

Item	Display Name	Min	Max	Default	Units
Generator Over Power Pre-Alarm	GEN PWR HI PRE-ALM	1	6	1=Disabled	
Generator Over Power Pre-Alarm Level	GEN PWR HI PRE-ALM LVL	-30000	30000	1000	*Watts

This alarm is continuously enabled. It should be set to a value lower than the Generator Over Power Alarm but higher than Rated Generator Real Power.

Item	Display Name	Min	Max	Default	Units

Item	Display Name	Min	Max	Default	Units
Generator Reverse Power Pre-Alarm	GEN REV-PWR PRE-ALM			Disabled	
Generator Reverse Power Pre-Alarm Level	GEN REV-PWR PRE-ALM LVL	-30000	30000	-10	*Watts

This alarm is continuously enabled. It should be set to a value higher than the Generator Reverse Power Alarm but lower than Rated Generator Real Power.

Item	Display Name	Min	Max	Default	Units
Generator Reverse Power Alarm	GEN REV-PWR ALM	1	6	6=Hard Shutdown	
Generator Reverse Power Alarm Level	GEN REV-PWR LVL	-30000	30000	-50	*Watts

This alarm is continuously enabled. It should be set to a value lower than the Generator Reverse Power Pre-Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Directional Power Curve Shift	GEN PWR CURVE SHIFT	0.01	10.0	1.0	

This value acts to level shift the inverse time curve, defined by IEEE and IEC. The purpose of a level shift is to match a desired time delay to the specific trip set point. The higher the power is above rated value, the shorter the delay automatically becomes. Increasing the shift value above 1.0 will increase the time delay, below 1.0 will decrease the delay, without changing the shape of the curve. This shift value is NOT the amount of time that the generator power must be above the Generator Directional Power Alarm Level before declaring an alarm. But, it is used to determine that delay time.

Item	Display Name	Min	Max	Default	Units
Generator Over VAR Alarm	GEN VAR HI ALM	1	6	6=Hard Shutdown	
Generator Over VAR Alarm Level	GEN VAR HI LVL	-30000	30000	1500	*VAR

This alarm is continuously enabled. It should be set to a value higher than the Generator Over VAR Pre-Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Over VAR Pre-Alarm	GEN VAR HI PRE-ALM	1	6	1=Disabled	
Generator Over VAR Pre-Alarm Level	GEN VAR HI PRE-ALM LVL	-30000	30000	1000	*VAR

This alarm is continuously enabled. It should be set to a value lower than the Generator Over VAR Alarm but higher than Generator Rated VAR. The action is defined by Generator Over VAR Pre-Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Reverse VAR Pre-Alarm	GEN REV-VAR PRE-ALM	1	6	1=Disabled	
Generator Reverse VAR Pre-Alarm Level	GEN REV-VAR PRE-ALM LVL	-30000	30000	-10	*VAR

This alarm is continuously enabled. It should be set to a value higher than the Generator Reverse VAR Alarm but lower than Generator Rated VAR.

Item	Display Name	Min	Max	Default	Units
Generator Reverse VAR Alarm	GEN REV-VAR ALM	1	6	6=Hard Shutdown	
Generator Reverse VAR Alarm Level	GEN REV-VAR LVL	-30000	30000	-50	*VAR

This alarm is continuously enabled. It should be set to a value lower than the Generator Reverse VAR Pre-Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Directional VAR Pre-Alarm Delay	GEN VAR PRE-ALM DELAY	0.1	120.0	5.0	Seconds

This value determines the amount of time that the generator VAR must be above the Generator Over VAR Pre-Alarm Level before declaring an alarm. This value also determines the amount of time that the generator VAR must be below the Generator Reverse VAR Pre-Alarm Level before declaring an alarm.

Item	Display Name	Min	Max	Default	Units
Generator Directional VAR Alarm Delay	GEN VAR ALM DELAY	0.1	120.0	10.0	Seconds

This value determines the amount of time that the generator VAR must be above the Generator Over VAR Alarm Level before declaring an alarm. This value also determines the amount of time that the generator VAR must be below the Generator Reverse VAR Alarm Level before declaring an alarm.

Item	Display Name	Min	Max	Default	Units
Generator Negative Phase Sequence Over Voltage Alarm	GEN NEG SQ V HI AL	1	6	1=Disabled	
Generator Negative Phase Sequence Over Voltage Alarm Level	GEN NEG SQ V HI LV	0	30000	150	*Volts

This alarm is continuously enabled. It should be set to a value higher than the Generator Negative Phase Sequence Over Voltage Pre-Alarm but lower than Generator Rated Voltage.

Item	Display Name	Min	Max	Default	Units
Generator Negative Phase Sequence Over Voltage Pre-Alarm	GEN NEG SEQ-V HI PRE-ALM	1	6	1=Disabled	
Generator Negative Phase Sequence Over Voltage Pre-Alarm Level	GEN NEG SEQ V HI PALM LV	0	30000	100	*Volts

This alarm is continuously enabled. It should be set to a value lower than the Generator Negative Phase Sequence Over Voltage Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Negative Phase Sequence Over Voltage Pre-Alarm Delay	GEN NSEQ-V HI PALM DLY	0.1	120.0	5.0	Seconds

This value determines the amount of time that the generator Negative Phase Sequence voltage must be above the Generator Negative Phase Sequence Over Voltage Pre-Alarm Level before declaring an alarm.

Item	Display Name	Min	Max	Default	Units
Generator Negative Phase Sequence Over Voltage Alarm Delay	GEN NEG SEQ V HI ALM DL	0.1	120.0	10.0	Seconds

This value determines the amount of time that the generator Negative Phase Sequence voltage must be above the Generator Negative Phase Sequence Over Voltage Alarm Level before declaring an alarm.

Item	Display Name	Min	Max	Default	Units
Generator Negative Phase Sequence Over Current Alarm	GEN NEG SQ I HI AL	1	6	1=Disabled	
Generator Negative Phase Sequence Over Current Alarm Level	GEN NEG SQ I HI LV	0	30000	150	*Amps

This alarm is continuously enabled. It should be set to a value higher than the Generator Negative Phase Sequence Over Current Pre-Alarm but lower than Generator Rated Current.

Item	Display Name	Min	Max	Default	Units
Generator Negative Phase Sequence Over Current Pre-Alarm	GEN NEG SEQ-I HI PALM	1	6	1=Disabled	
Generator Negative Phase Sequence Over Current Pre-Alarm Level	GEN NEG SEQ-I HI PALM LVL	0	30000	100	*Amps

This alarm is continuously enabled. It should be set to a value lower than the Generator Negative Phase Sequence Over Current Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Negative Phase Sequence Over Current Pre-Alarm Delay	GEN NEG SEQ-I HI PALM DL	0.1	120.0	5.0	Seconds

This value determines the amount of time that the generator Negative Phase Sequence Current must be above the Generator Negative Phase Sequence Over Current Pre-Alarm Level before declaring an alarm.

Item	Display Name	Min	Max	Default	Units
Generator Negative Phase Sequence Over Current Alarm Delay	GEN NEG SEQ-I HI DL	0.1	120.0	10.0	Seconds

This value determines the amount of time that the generator Negative Phase Sequence Current must be above the Generator Negative Phase Sequence Over Current Alarm Level before declaring an alarm.

Item	Display Name	Min	Max	Default	Units
Generator Phase Current Differential Alarm	GEN DIFF CURRENT ALM	1	6	5=Soft Shutdown	
Generator Phase Current Differential Alarm Level	GEN DIFF CURRENT LVL	0	30000	150	*Amps

This alarm is continuously enabled in 3Ø installations. It should be set to a value higher than the Generator Phase Current Differential Pre-Alarm but lower than Rated Generator Current.

Item	Display Name	Min	Max	Default	Units
Generator Phase Current Differential Pre-Alarm	GEN DIFF CURRENT PRE-ALM	1	6	1=Disabled	
Generator Phase Current Differential High Pre-Alarm Level	GEN DIFF CURRENT PREALM LVL	0	30000	100	*Amps

This alarm is continuously enabled in 3Ø installations. It should be set to a value lower than the Generator Phase Current Differential Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Phase Current Differential Curve Shift	GEN DIFF CURR SHIFT	0.01	10.0	1.0	

This value acts to level shift the inverse time curve, defined by IEEE and IEC. The purpose of a level shift is to match a desired time delay to the specific trip set point. The higher the current is above rated value, the shorter the delay automatically becomes. Increasing the shift value above 1.0 will increase the time delay, below 1.0 will decrease the delay, without changing the shape of the curve. This shift value is NOT the amount of time that the generator current must be above the Generator Over Current Alarm Level before declaring an alarm. But, it is used to determine that delay time.

Item	Display Name	Min	Max	Default	Units
Generator Breaker Feedback Error Alarm	GEN BRK FDBK ERROR ALM	1	8	1=Disabled	

This alarm is continuously enabled. The alarm activates when a current is sensed, and the generator breaker does not show closed.

Item	Display Name	Min	Max	Default	Units
Generator Breaker Shunt Trip Error Alarm	GEN BRK SHUNT TRP ER ALM	1	8	2=Warning	

This alarm is continuously enabled. The alarm activates when a breaker open command is given, and the breaker feedback does not show open within 5 seconds.

Item	Display Name	Min	Max	Default	Units
Generator Voltage Restrained Phase Over Current Alarm	GEN RES CURR HI ALM	1	6	5=Soft Shutdown	
Generator Voltage Restrained Phase Over Current Alarm Level	GEN RES CURR HI LVL	0	30000	1500	*Amps

This alarm is continuously enabled. It should be set to a value higher than the Generator Voltage Restrained Phase Over Current Pre-Alarm.

Item	Display Name	Min	Max	Default	Units
Generator Voltage Restrained Phase Over Current Pre-Alarm	GEN RES CURR HI PRE-ALM	1	6	3=Visual Alarm	
Generator Voltage Restrained Phase Over Current Pre-Alarm Level	GEN RES CURR HI PALM LVL	0	30000	1000	*Amps

This alarm is continuously enabled. It should be set to a value lower than the Generator Voltage Restrained Phase Over Current Alarm but higher than Rated Generator Current.

Item	Display Name	Min	Max	Default	Units
Generator Voltage Restrained Phase Over Current Curve Shift	GEN RES CURR SHIFT	0.01	10	1.0	

This value acts to level shift the inverse time curve. The purpose of a level shift is to fine-tune the tripping characteristics at a specific trip level that can be located on the inverse time trip curve. This value is NOT the amount of time that the Generator current must be above the Generator Voltage Restrained Phase Over Current Pre-Alarm Level before declaring an alarm.

Engine Control Menu

Items in Engine Control Menu can be viewed and edited with caution while the engine is running. Items in this menu are part of a Service block.

Refer to Table 3-2 for the list of alarm actions. It is used in a few places within the Engine Control Menu.

Item	Display Name	Min	Max	Default	Units
Preglow Time	PREGLOW TIME	0	1200	0	Seconds

This value sets the length of time to engage glow plugs in a diesel engine prior to starter motor engagement. The output will stay on until the starter motor has been disengaged. This feature is active regardless of the engine coolant temperature as long as Start Sequencing is Enabled. If Start Sequencing is Disabled, it will never be activated.

Item	Display Name	Min	Max	Default	Units
Fuel on Delay Time	FUEL ACTIVATION DELAY	0.0	240.0	0.2	Seconds

Typically for use on Gas Engines. This is the time delay between energizing the crank relay and energizing the fuel solenoid relay. This feature is only active when Start Sequencing is Enabled.

Item	Display Name	Min	Max	Default	Units
Crank Active Time	CRANK TIME	1	240	10	Seconds

This value sets the length of time the starter will be engaged. If the engine has not started prior to expiration of this time, the starter motor will be disengaged and one start attempt will be considered used. If Start Sequencing is Disabled, this time is ignored and the Start Motor Crank output will never be engaged.

Item	Display Name	Min	Max	Default	Units
Crank Cutout Speed	CRANK CUTOUT	5	5000	550	RPM

This value sets the speed at which to disengage the starter motor. This feature is only active when Start Sequencing is Enabled.

Item	Display Name	Min	Max	Default	Units
Retry Crank Delay	CRANK DELAY	1	240	30	Seconds

This value sets the amount of time to wait between start attempts. This feature is only active when Start Sequencing is Enabled.

Item	Display Name	Min	Max	Default	Units
Crank Repeats	CRANK REPEATS	0	20	3	

This value defines the number of start attempts that will be made after the first attempt (2 repeats = 3 attempts). This feature is only active when Start Sequencing is Enabled.

Item	Display Name	Min	Max	Default	Units
Crank Fail Alarm Action	CRANK FAIL	1	6	5=Soft Shutdown	

This value defines the action taken when all start attempts are exhausted without the engine starting. This feature is only active when Start Sequencing is Enabled.

Item	Display Name	Min	Max	Default	Units
No Speed Crank Delay	NO SPEED CRANK DELAY	0.1	30.0	3.0	Seconds

This value sets the amount of time to wait before a speed signal is expected. If there is no speed signal detected the crank attempt will be stopped after this delay, and the crank relay will be opened.

Item	Display Name	Min	Max	Default	Units
Use Failsafe Override?	USE FAILSAFE OVERRIDE?	False	True	False	NA

This parameter is used to bypass the actuator limiter while the speed is below Speed to Start Control (the default value is 5% of the rated speed).

Item	Display Name	Min	Max	Default	Units
Use Idle Speed?	USE IDLE SPEED?	False	True	False	NA

This parameter is used to select if Idle Speed will be used or not.

Item	Display Name	Min	Max	Default	Units
Idle Speed	IDLE SPEED	5	5000	1200	RPM

This value indicates to the AtlasSC Load+Speed Control what speed the external speed control will control at when Idle is selected. The AtlasSC Load+Speed Control needs to know this speed so that it can determine when the engine has reached 90% of idle. This feature is only active when Start Sequencing is Enabled.

Item	Display Name	Min	Max	Default	Units
Idle Time	IDLE TIME	0	1200	20	Seconds

This value sets the amount of time the AtlasSC Load+Speed Control will hold the engine at Idle before energizing the Rated Speed Relay output. This timer does not start until 90% of idle speed has been detected unless Start Sequencing is Disabled. If Start Sequencing is Disabled, the Idle/Rated relay is energized immediately when the start command is given so the Glow Plug Time, Cranking Time, and Idle Time is skipped.

APPLICATION NOTE

Set the assigned relay action to Normally Closed and the relay will energize at Idle (an Idle Relay vs. a Rated Relay), and de-energize to ramp to rated.

Item	Display Name	Min	Max	Default	Units
Cooldown Time	COOLDOWN TIME	0	2400	15	Seconds

This value sets the amount of time the AtlasSC Load+Speed Control will run the engine prior to shutdown if it was loaded above the Cooldown Power Limit. This feature is active regardless of Start Sequencing Enable/Disable.

Item	Display Name	Min	Max	Default	Units

Item	Display Name	Min	Max	Default	Units
Cooldown Enable Power Limit	COOLDOWN ENABLE LIMIT	0	30000	20	*VA

This value sets the load level that must be exceeded during the active running sequence before Cooldown will be used when a shutdown command is received. If the genset is started, but shutdown before being loaded to this level, the Cooldown time will be skipped. This feature is active regardless of Start Sequencing Enable/Disable.

Item	Display Name	Min	Max	Default	Units
Cooldown Speed Selection	COOLDOWN SPEED	FALSE	TRUE	TRUE=Rated	

This value can be set for either Idle or Rated. If Cooldown is initiated, the engine will be told to run at either Idle or Rated speed during the Cooldown period, based upon this parameter. This feature is active regardless of Start Sequencing Enable/Disable.

Item	Display Name	Min	Max	Default	Units
Reset Engine Run Time	RESET ENG RUN TIME	FALSE	TRUE	FALSE	

This parameter will initialize the Engine Run Hour clock to the values that are programmed in the next 2 settings. There is one setting for thousands of hours and one for hundreds of hours. It is useful if the AtlasSC Load+Speed Control is retrofitted to a new engine or newly rebuilt engine.

Item	Display Name	Min	Max	Default	Units
Preset the engine run hours Hundreds place	ENG RUN HOURS (HUN)	0.0	999	0.0	Hrs

This parameter is used to program in a preset engine run hour time. For example, if the AtlasSC Load+Speed Control were installed on an existing generator, it may be necessary to preset the running hours to a certain value.

Item	Display Name	Min	Max	Default	Units
Preset the engine run hours Thousands place	ENG RUN HOURS (THSND)	0.0	999	0.0	Hrs

This parameter is used to program in a preset engine run hour time. For example, if the AtlasSC Load+Speed Control were installed on an existing generator, it may be necessary to preset the running hours to a certain value.

Item	Display Name	Min	Max	Default	Units
Reset Generator KW Hours	RESET GEN KW HOURS	FALSE	TRUE	FALSE	

This parameter will set the Megawatt-Hours to meter to a value determined by the next 5 settings. There is one setting for Single hours, one for Hundreds of hours, one for Thousands of hours, one for Millions of hours, and one for Billions of hours. It is useful if the AtlasSC Load+Speed Control is retrofitted to a new engine or newly rebuilt genset.

Item	Display Name	Min	Max	Default	Units
Preset the gen kW hours	GEN KW HOURS (ONES)	0.0	99.0	0.0	KW Hrs

This parameter is used to program in a preset the gen kW hours. For example, if the AtlasSC Load+Speed Control were installed on an existing generator, it may be necessary to preset the kW hours to a certain value.

Item	Display Name	Min	Max	Default	Units
Preset the gen kW hours hundreds place	GEN KW HOURS (HUN)	0.0	999.0	0.0	KW Hrs

This parameter is used to program in a preset number of gen kW hours. For example, if the AtlasSC Load+Speed Control were installed on an existing generator, it may be necessary to preset the kW hours to a certain value.

Item	Display Name	Min	Max	Default	Units
Preset the gen kW hours Thousands place	GEN KW HOURS (THSND)	0.0	999.0	0.0	KW Hrs

This parameter is used to program in a preset number of gen kW hours. For example, if the AtlasSC Load+Speed Control were installed on an existing generator, it may be necessary to preset the running hours to a certain value.

Item	Display Name	Min	Max	Default	Units
Preset the gen kW hours Millions place	GEN KW HOURS (MEGA)	0.0	999.0	0.0	MW Hrs

This parameter is used to program in a preset number of megawatt hours. For example, if the AtlasSC Load+Speed Control were installed on an existing generator, it may be necessary to preset the MW hours to a certain value.

Item	Display Name	Min	Max	Default	Units
Preset the gen kW hours Billions place	GEN KW HOURS (GIGA)	0.0	999.0	0.0	GW Hrs

This parameter is used to program in a preset number of gigawatt hours. For example, if the AtlasSC Load+Speed Control were installed on an existing generator, it may be necessary to preset the GW hours to a certain value.

Item	Display Name	Min	Max	Default	Units
Reset Bus KW Hours	RESET GEN KW HOURS	FALSE	TRUE	FALSE	

This parameter will set the Bus Kilowatt-Hours meter to a value determined by the next 4 settings. There is one setting for Hundreds of hours, one for Thousands of hours, one for Millions of hours, and one for Billions of hours. It is useful if the AtlasSC Load+Speed Control is retrofitted to a new engine or newly rebuilt genset.

Item	Display Name	Min	Max	Default	Units
Preset the Bus kW hours hundreds place	BUS KW HOURS (HUN)	0.0	999.0	0.0	KW Hrs

This parameter is used to program in a preset number of Bus kW hours. For example, if the AtlasSC Load+Speed Control were installed on an existing generator, it may be necessary to preset the kW hours to a certain value.

Item	Display Name	Min	Max	Default	Units
Preset the Bus kW hours Thousands place	BUS KW HOURS (THSND)	0.0	999.0	0.0	KW Hrs

This parameter is used to program in a preset Bus kW hours. For example, if the AtlasSC Load+Speed Control were installed on an existing generator, it may be necessary to preset the Bus kW hours to a certain value.

Item	Display Name	Min	Max	Default	Units
Preset the Bus kW hours Millions place	BUS KW HOURS (MEGA)	0.0	999.0	0.0	MW Hrs

This parameter is used to program in a preset number of Bus MW hours. For example, if the AtlasSC Load+Speed Control were installed on an existing generator, it may be necessary to preset the MW hours to a certain value.

Item	Display Name	Min	Max	Default	Units
Preset the Bus kW hours Billions place	BUS KW HOURS (GIGA)	0.0	999.0	0.0	GW Hrs

This parameter is used to program in a preset number of Bus gigawatt hours. For example, if the AtlasSC Load+Speed Control were installed on an existing generator, it may be necessary to preset the GW to a certain value.

Item	Display Name	Min	Max	Default	Units
Fail to Reach Idle Alarm	FAIL TO REACH IDLE ALM	1	6	2=Warning	

This value defines the action taken when the engine has exceeded the crank-cutout speed but does not reach or sustain idle speed within the Fail to Reach Idle Delay Time after disengaging the starter motor. This feature is active only when Start Sequencing is Enabled.

Item	Display Name	Min	Max	Default	Units
Fail to Reach Idle Delay Time	FAIL TO REACH IDLE DLY	1.0	600.0	10.0	

This value determines the amount of time the control waits before issuing a Fail to Reach Idle Alarm.

Item	Display Name	Min	Max	Default	Units
Fail to Reach Rated Alarm	FAIL TO REACH RATED ALM	1	6	2=Warning	

This value defines the action taken when the engine has reached idle speed but does not reach or sustain running at rated speed within the Fail to Reach Rated Delay Time after engaging the rated speed output. This feature is active only when Start Sequencing is Enabled. The Idle to Rated ramp time is a function of the external speed control, to stop nuisance alarms from this function the speed ramp should be set to less than the alarm delay time.

Item	Display Name	Min	Max	Default	Units
Fail to Reach Rated Delay Time	FAIL TO REACH IDLE DLY	1.0	600.0	10.0	

This value determines the amount of time the control waits before issuing a Fail to Reach Idle Alarm.

Synchronizer Menu

Items in Synchronizer Menu can be viewed and edited with caution while the engine is running. Items in this menu are part of a Service block.

Refer to Table 3-2 for the list of alarm actions. It is used in a few places within the Synchronizer Menu.

Item	Display Name	Min	Max	Default	Units
Synchronizer Mode	SYNC MODE	1	4	4=Run/Auto	

This value is used to select the synchronizer control mode. It may be Off, Check, Permissive, or Run/Auto. The mode may be selected by the front panel display, Watch Window menu, or Modbus HMI. The last mode selected by any of these interface methods will be the mode of operation used.

Off mode, the AtlasSC Load+Speed Control performs no synchronization functions, The running sequence would stop with the engine at rated speed, and an external function would be required to close the breaker and continue the sequence.
Check mode is used to confirm that the synchronizer works properly by allowing synchronizing to be performed but not closing the breaker. The Synchronizer status screen can be used to observe the Slip, Phase, and voltage indication, (Displays ++ when matched). In the Check mode these indication must match external metering and wiring before allowing the breaker to close.
Permissive mode is used to replace a sync check relay function, the bias outputs are passive, but the breaker command will be given when speed, phase, and voltage parameters are within the window.
Run/Auto mode is the normal mode with active synchronizing and breaker control.

NOTE
Due to delays in communication to the display or Watch Window the phase information and breaker closing indication may be inaccurate or delayed from actual values. This would be most obvious in systems configured with large slip windows.

Item	Display Name	Min	Max	Default	Units
Synchronizer Gain	SYNC GAIN	0.01	100.00	0.15	

This value is the proportional gain of a P-I controller. It determines how fast the synchronizer responds to an error in speed or phase. Adjust this gain to provide stable control during synchronizing. Lower the value to slow the response.

Item	Display Name	Min	Max	Default	Units
Synchronizer Integral Gain	SYNC INTEGRAL	0.00	20.00	0.55	Repeats/sec

This value is the integral gain of a P-I controller. It determines how quickly the synchronizer responds to a large error in synchronism and prevents low frequency hunting and damping (overshoot or undershoot) when the synchronizer is first enabled or when a speed transient occurs during synchronizing. Lower the value to slow the response.

A monitor value of the phase angle, or Synchroscope is provided in Watch Window to observe the response and assist with dynamic adjustment.

Item	Display Name	Min	Max	Default	Units
Voltage Matching	VOLTAGE MATCHING	False	True	True=Enabled	

This value will Enabled or Disabled the voltage matching function of the synchronizer. When enabled, the synchronizer output will match the bus and generator voltages.

Item	Display Name	Min	Max	Default	Units
Voltage Match Window	VOLTAGE WINDOW	0.1	10.0	1.0	Percent (%)

When voltage matching is enabled, this value is the allowable percent the generator voltage may be above or below the bus voltage for the synchronizer to initiate breaker closure.

Item	Display Name	Min	Max	Default	Units
Type of Synchronizer Action	SYNC TYPE	1	3	1=Phase Matching	

This value is an enumerated list that indicates Phase Matching (=1), Slip Frequency (=2), or Off/None (=3). When Phase Matching is selected, the synchronizer will match the generator phase to the bus phase and hold the

phase error to minimum. When the phase error is within the configured error window, for a time based on the slip window, the synchronizer will issue a breaker close command. When Slip Frequency is selected, the synchronizer will create a frequency error between the bus and generator where the generator is moving faster than the bus by a configured amount, the breaker close command will be given when phase error is within the phase window.

Item	Display Name	Min	Max	Default	Units
Phase Match Window	PHASE WINDOW	2.0	20.0	10.0	Degrees

This value is the maximum allowable electrical phase angle between the bus and generator when the synchronizer initiates breaker closure. This parameter is used when either type of synchronizing is selected.

Item	Display Name	Min	Max	Default	Units
Slip Window	SLIP WINDOW	-0.3	0.3	0.1	Hertz

This value is the maximum allowed deviation in slip (frequency difference) from the slip frequency reference when initiating breaker closure. For phase control, it determines the maximum rate through the phase window. For slip control, it determines the error in slip frequency from the reference.

Item	Display Name	Min	Max	Default	Units
Slip Frequency Reference	SLIP FREQUENCY	-0.3	0.3	0.1	Hertz

This value specifies the positive (fast) slip frequency reference (generator frequency higher than bus frequency). This parameter is used when slip frequency synchronizing is selected. For Phase Matching type, this value is internally set to 0.0.

Item	Display Name	Min	Max	Default	Units
Close Attempts	CLOSE ATTEMPTS	1	20	3	

This value is the number of attempts the synchronizer will make to close the circuit breaker. The synch fail alarm (if enabled) will be activated and the synchronizer will enter the auto-off mode if the breaker fails to close in the specified number of tries. Woodward suggests setting Close Attempts to 2 or greater for any application.

Item	Display Name	Min	Max	Default	Units
Reclose Delay	RECLOSE DELAY	1	1200	5	Seconds

This value is the number of seconds between attempts to close the circuit breaker. If the CB Aux contact remains closed for one reclose delay interval, synchronization is assumed to have occurred. If the CB Aux contact opens during the reclose delay interval, it is considered a failed closed attempt. The AtlasSC Load+Speed Control will remain in the selected operating mode (run, check, or permissive) during the Reclose Delay interval.

Item	Display Name	Min	Max	Default	Units
Generator Reclose Alarm	GEN RECLOSE ALARM	1	6	2=Warning	

This value defines the action taken when the synchronizer has exhausted its reclose attempts without successfully closing the breaker. It applies to the generator breaker closure only.

Item	Display Name	Min	Max	Default	Units
Synchronizer Timeout	SYNC TIMEOUT	0	1200	0	Seconds

This value is the interval over which the synchronizer will attempt to get synchronization. A value of 0 seconds disables the Sync Timeout function. The

interval begins when generator voltage is detected above the Dead Bus value and synchronization is activated. Failure to get a CB Aux contact closure within the specified time will result in a synch timeout alarm. This time includes the reclose delay and should always be longer than the reclose delay.

Item	Display Name	Min	Max	Default	Units
Synchronizer Timeout Alarm	SYNC TIMEOUT ALM	1	5	2=Warning	

This value defines the action taken when the synchronizer has exhausted the timeout without successfully closing the generator breaker.

Item	Display Name	Min	Max	Default	Units
Dead Bus Closure	DEADBUS CLOSURE	False	True	True=Enabled	

This value enables or disables the synchronizer's automatic dead-bus detection and breaker closure functions. When enabled, the synchronizer will insure a breaker closure signal when a dead-bus is detected and the genset is ready to assume load. When disabled, the synchronizer will not be allowed to close onto a dead bus. A dead bus is when the input voltage is less than the value given in the hardware voltage range description.

Item	Display Name	Min	Max	Default	Units
Breaker Hold Time	BREAKER HOLD TIME	0.0	5.0	1.0	Seconds

This value specifies the maximum elapsed time the synchronizer will maintain the breaker closure relay driver output. Failure to receive the CB Aux contact signal during this interval results in a failed close attempt. The breaker closure relay driver is de-energized when: the CB Aux contact signal is received, the specified time expires, the generator is out of the phase window, the generator exceeds the slip window, or the generator voltage exceeds the voltage window (if voltage matching is enabled).

Item	Display Name	Min	Max	Default	Units
Generator Breaker Close Delay Time	GEN C B CLOSE DLY	0.01	2.0	0.10	Seconds

This value specifies the time required for the circuit breaker contacts to engage after receiving a closure command. It is normally found in the circuit breaker manufacturer’s specifications. The AtlasSC Load+Speed Control will automatically subtract this time from the calculated time to initiate breaker closure in order to maintain proper phase alignment when performing slip frequency synchronizing.

Item	Display Name	Min	Max	Default	Units
Bus Synchronizing Rate	BUS SYNC RATE	0	50	2.0	Seconds

This value is used to change the rate of the sync bias signal. The rate is changed also by the SYNC GAIN FACTOR. This value is multiplied by the SYNC GAIN FACTOR then taken to the “X” power. The “X” is equal to the number of LS units on the active bus.

Item	Display Name	Min	Max	Default	Units
Synchronizer Gain Factor	SYNC GAIN FACTOR	0.8	1.0	0.8	

This value specifies change in proportional gain when synchronizing a multi-genset bus to another bus, based on the single genset gain.

Item	Display Name	Min	Max	Default	Units
Synchronizer Voltage Gain	SYNC VOLTAGE GAIN	0.1	10.0	1.0	

This value is used to increase or decrease the rate of the voltage change during the synchronization process.

Item	Display Name	Min	Max	Default	Units
Enable Synchronizer Test	ENABLE SYNC TEST	Disabled	Enabled	Disabled	

This selects the synchronizer into test. When this value is true the synchronizer is turned on for verifying voltages and phases. When enabled the synchronizer is in the check operating mode, and the breaker close command is disabled.

Real Load Control Menu

Items in Real Load Control Menu can be viewed and edited with caution while the engine is running. Items in this menu are part of a Service block.

Refer to Table 3-2 for the list of alarm actions. It is used in a few places within the Real Load Control Menu.

Item	Display Name	Min	Max	Default	Units
Load Control Mode	LOAD CTRL MODE	False	True	True=Isoch	

This selects the control mode. It may be Droop or Isochronous. Droop mode is used only if load sharing, BaseLoad, or process functions are not desired. The normal method is Isochronous which provides closed loop regulation of frequency and/or load control.

Item	Display Name	Min	Max	Default	Units
Load Control Proportional Gain	LOAD CTRL GAIN	0.001	20.00	0.20	

This value is the proportional gain of the P-I-D load controller in Droop, BaseLoad, or Process Control. It determines how fast the load control responds to a load error. Lower the value to slow the response.

Item	Display Name	Min	Max	Default	Units
Load Sharing Proportional Gain	LOAD SHARE GAIN	0.01	2.00	0.20	

This value is the proportional gain of a P only controller when in Isochronous load share mode. It determines how fast the load control responds to a load error. Lower the value to slow the response.

Item	Display Name	Min	Max	Default	Units
Load Integral Gain	LOAD INTEGRAL	0.00	20.00	0.15	Repeats/sec

This value is the integral gain of the P-I-D load controller. It determines how fast the load control responds to a load error. It prevents slow hunting and controls damping (overshoot or undershoot) after a load change. Lower the value to slow the response. In Isochronous load share mode, this value is not used, the controller is then proportional only. See section on PID tuning.

Item	Display Name	Min	Max	Default	Units
Load Derivative Gain	LOAD DERIVATIVE	0.01	100.00	100.00	

This value is the derivative gain of the P-I-D load controller. It determines the response of the load control for a rate of load error. In Isochronous load share mode, this value is not used. See section on PID tuning.

Item	Display Name	Min	Max	Default	Units
Load Control Filter	LOAD CTRL FILTER	0.01	10.00	1.00	Hertz

This value adjusts the bandwidth of the low pass filter at the load input for the load controller. Higher frequency settings than default result in faster control response, but also more response to system noise. Lower frequency settings result in slower control response and less response to noise.

Item	Display Name	Min	Max	Default	Units
BaseLoad Reference	BASELOAD REFERENCE	0	30000	50	*Watts

This value is the default BaseLoad set point. This setting must be greater than the Unload Trip set point. It is the generator load level when in BaseLoad mode. This value is part of the calculation for initial loading rate.

Item	Display Name	Min	Max	Default	Units
Unload Trip Level	UNLOAD TRIP LEVEL	-10	30000	10	*Watts

This value is the real load level where the breaker open command is given when the generator is being automatically unloaded. It is also the load reference level used when the Unload Switch is engaged. This value is part of the calculation for automatic unloading rate.

Item	Display Name	Min	Max	Default	Units
Load Droop	LOAD DROOP	0	50	5	%

This value is the percent speed reference bias, for full load operation when is the droop mode of load control. Droop is the default mode when load is applied to the generator but the CB Aux contact input indicates open. [The Load Droop setting is only approximate due to dependence on the gain (RPM speed change per unit of bias input) of the speed control's bias input.]

Item	Display Name	Min	Max	Default	Units
Load Time	LOAD TIME	1	7200	10	Seconds

This value is the time required to automatically ramp the load from the zero load to the internal BaseLoad set point. The same rate is used after first closing the breaker when the units are load sharing. This rate is used to soft load the units until the load is within 2% of the load sharing signal. The Load Rate is used for manually changing load.

Item	Display Name	Min	Max	Default	Units
Unload Time	UNLOAD TIME	1	7200	10	Seconds

This value is the time required to automatically ramp the load from the internal BaseLoad set point to the unload trip level. This rate is used when the unit is being unloaded by sequencing or soft shutdown. The Load Rate is used for manually changing load.

Item	Display Name	Min	Max	Default	Units
Load Rate	LOAD RATE	0.01	100.00	2.00	%KW / Sec

This value is the rate at which the load is increased when the load is manually raised.

Item	Display Name	Min	Max	Default	Units
Unload Rate	UNLOAD RATE	0.01	100.00	2.00	%kW / Sec

This value is the rate at which the load is decreased when the load is manually lowered.

NOTE

The following Load Level switches are not intended to be Generator Protection Functions.

Item	Display Name	Min	Max	Default	Units

Item	Display Name	Min	Max	Default	Units
High Load Level Alarm	HIGH LOAD LIMIT ALM	1	6	2=Warning	

This value defines the alarm action taken when the genset load exceeds the configured High Load Level.

Item	Display Name	Min	Max	Default	Units
High Load Alarm Level	HIGH LOAD LIMIT LEVEL	0	30000	300	*VA

This value is the highest load that should be carried by the genset. It may be lower than the genset Rated VA but should not be higher.

Item	Display Name	Min	Max	Default	Units
Low Load Level Alarm	LOW LOAD LIMIT ALM	1	6	1=Disabled	

This value defines the alarm action taken when the genset load drops below the configured Low Load Level.

Item	Display Name	Min	Max	Default	Units
Low Load Alarm Level	LOW LOAD LIMIT LEVEL	0	30000	5	*VA

This value is the lowest load that should be carried by the genset. It may be lower than the configured Unload Trip, if set higher will cause nuisance alarms on every unload.

Item	Display Name	Min	Max	Default	Units
KVA Switch High Level	VA SWITCH HIGH LVL	0	30000	30	*VA

This value is the load level at which the KVA Switch Discrete Output (if configured) and/or KVA Switch Alarm (if configured) will be activated. Any load at or above this level will latch the output active. The output will remain active even below this level until it reaches the KVA Switch Low Level.

Item	Display Name	Min	Max	Default	Units
KVA Switch Low Level	VA SWITCH LOW LVL	0	30000	5	*VA

This value is the load level at which the KVA Switch Discrete Output (if configured) and/or KVA Switch Alarm (if configured) will be de-activated. Once inactive, the switch will remain inactive until again reaching the VA Switch High Level.

Item	Display Name	Min	Max	Default	Units
VA Switch Alarm Action	VA SWITCH ALM	1	6	1=Disabled	

This value defines the action taken when the genset load has activated the KVA switch.

NOTE

This configures an alarm function, and can be used to trigger a stored event. A Discrete Output configured for the KVA Switch will not be stored to the alarm list or alarm history.

Item	Display Name	Min	Max	Default	Units
Frequency Trim Enable	ENABLE FREQUENCY TRIM	False	True	True=Enabled	

Frequency trim is used primarily when the governor is operating in the droop mode. On isolated systems the frequency trim will maintain rated frequency. Typically not used with isochronous governor controls

Item	Display Name	Min	Max	Default	Units
Frequency Trim Deadband (Hz)	FRQ TRIM DEADBND(HZ)	0.001	5.0	0.1	Hz

This value determines how closely the Frequency trim function will keep the bus frequency to the rated frequency.

Item	Display Name	Min	Max	Default	Units
Speed Raise Lower Pulse Frequency	SPEED R/L FREQUENCY	0.15	10	0.5	Sec

This value sets the pulse frequency of the Raise and Lower discrete outputs for speed/load control. A setting of 1 means that every 1 second the AtlasSC Load+Speed Control will decide whether to make a raise or lower pulse. This setting is only applicable when the Speed Bias Type, in the First Time Config menu, is set for Raise/Lower.

Item	Display Name	Min	Max	Default	Units
Speed Raise Lower Pulse Duty Cycle	SPEED R/L DUTY CYCLE	1.0	99	50	%

This value sets the pulse length of the Raise and Lower discrete outputs for speed/load control. A setting of 50 means that pulse length will be 50% of the Frequency time above. If the Frequency is 1 second, then the pulse length will be 0.5 seconds, followed by a pause of 0.5 seconds. This setting is only applicable when the Speed Bias Type, in the First Time Config menu, is set for Raise/Lower.

Item	Display Name	Min	Max	Default	Units
Speed Raise Lower Pulse Deadband	SPEED R/L DEADBND(%)	0.01	100	1.0	%

The deadband setting is used to stop the raise lower pulses once the AtlasSC Load+Speed Control speed or load control has reached its correct value. This setting is a window around the speed bias variable of the AtlasSC Load+Speed Control which can be viewed on the I/O Display Screen. A setting of 1 means that the AtlasSC Load+Speed Control will not give any pulses if the speed bias is between –1% and 1%. This setting is only applicable when the Speed Bias Type, in the First Time Config menu, is set for Raise/Lower.

Item	Display Name	Min	Max	Default	Units
Rated kW Load Derate Value	RATED LOAD DE-RATE (%)	25.0	125.0	100.0	%

This setting is used in conjunction with the KW De-rate Select Discrete input and the Rated W setting in the First Time Config menu. When the KW De-rate input is closed, the Rated W setting is multiplied by this %. A value of 80% for a 1000 KW generator, means that the new Rated W setting will be 800 KW. This new rating is used for the load sharing calculations and for the start stop sequencing algorithms. It is not used for any alarms. All alarms, such as Overload, will remain at their same value.

Reactive Load Control Menu

Items in Reactive Load Control Menu can be viewed and edited with caution while the engine is running. Items in this menu are part of a Service block.

Refer to Table 3-2 for configuration of alarm action. It is used in a few places within the Real Load Control Menu.

Item	Display Name	Min	Max	Default	Units

Item	Display Name	Min	Max	Default	Units
VAR/PF Mode	VAR/PF MODE	1	4	3=PF control	

This value is used to select the control mode. It may be Manual, VAR control, PF control, or Remote control. Manual is only used if no automatic control is desired. Remote control is used if external equipment will control the VAR or PF through the AtlasSC Load+Speed Control. This may be useful in order to still have the ability for Raise/Lower switches and voltage matching during synchronizing. Power Factor or VAR control is used when in parallel with the mains.

Item	Display Name	Min	Max	Default	Units
VAR/PF Control Auto/Manual Enable	VAR/PF AUTO ENABLE	False	True	False= Contact Enable	

This value can be selected to enable reactive load control from an assigned discrete input, or enable reactive load control automatically whenever the generator breaker is closed.

Item	Display Name	Min	Max	Default	Units
VAR/PF Gain	VAR/PF GAIN	0.01	20.00	0.20	

This value is the proportional gain of the reactive load P-I-D controller for all modes of operation other than VAR/PF Sharing. This value determines how fast the VAR/PF control responds to an error between kVAR/PF and VAR or PF reference. The gain is set to provide stable control of kVAR or power factor. Lower the value to slow the response.

Item	Display Name	Min	Max	Default	Units
Voltage Reference Ramp Time	VOLTAGE REF RAMP TIME	0.0	1000.0	80.0	Second

This value specifies the time required to ramp the reactive load setpoint over its full range, PF control, VAR control, Remote control, and Manual control.

Item	Display Name	Min	Max	Default	Units
VAR/PF Sharing Proportional Gain	VAR/PF SHARING GAIN	0.001	20.00	0.20	

This value is the proportional gain of the reactive load P-I-D controller when VAR/PF sharing is the active control mode. This value determines how fast the VAR/PF control responds to an error between kVAR/PF and VAR or PF reference. The gain is set to provide stable control of kVAR or power factor. Lower the value to slow the response.

Item	Display Name	Min	Max	Default	Units
VAR/PF Integral Gain	VAR/PF INTEGRAL GN	0.00	20.00	0.10	Repeats/Sec

This value is the integral gain of the reactive load P-I-D controller. It determines how fast the reactive load control responds to an error between kVAR/PF and VAR or PF reference. It prevents slow hunting and controls damping (overshoot or undershoot) after a load disturbance. Lower the value to slow the response.

Item	Display Name	Min	Max	Default	Units
KVAR Reference	KVAR REFERENCE	-30000	30000	10	*VAR

This value specifies the desired VAR load at which to control in the VAR control mode. It is active when Reactive Load Control is active, and the mode is selected as VAR control. For monitor purposes, Watch Window displays the VAR load on the generator.

Item	Display Name	Min	Max	Default	Units
PF Reference	PF REFERENCE	-0.5	0.5	0.0	PF

This value specifies a value representing the PF at which to control in the PF control mode. This value is continuous over the tunable range (lag = negative) of –0.50 <-> 0.0 <-> +0.50. Where values on a Power Factor meter are discontinuous at unity (0.5 LAG <-> 1.0 .<-> 0.5 LEAD). For monitor purposes, Watch Window displays the PF Reference converted to values as seen on a PF meter, and displays the measured generator average PF.

Item	Display Name	Min	Max	Default	Units
PF Deadband	PF DEADBAND	0.000	1.000	0.0	PF

This value specifies an error window about the measured PF input, inside of which the power factor control will not adjust the voltage regulator. Deadband is especially useful in systems using a MOP to adjust voltage.

Item	Display Name	Min	Max	Default	Units
Operation Voltage	OPERATION VOLTAGE	0.001	30000	480.0	(_,k,M) Volts

This is the voltage that the generator will excite to during start or voltage trim to during isolated operation. Example: Used on systems where the rated voltage of the generator is different from the utility or system voltage (A 13.8 kV generator operating with a 13.2 kV utility). To activate this value after a change a reset trigger must be given.

Item	Display Name	Min	Max	Default	Units
RESET OPERATING VOLTAGE	RESET OPERATING VOLTAGE	False	True	False	

This value is used as a trigger to command the AtlasSC Load+Speed Control to use the Operating Voltage setting above. Normally this value would be False. The user would change the value to True to set the trigger and then back to False again.

Item	Display Name	Min	Max	Default	Units
Voltage Trim Enable	VOLT TRIM ENABLE	False	True	True=Enabled	

Voltage trim is used to compensate for the droop of the voltage regulator. On isolated systems the voltage trim will maintain the operating voltage.

Item	Display Name	Min	Max	Default	Units
Voltage Trim Rate	VOLT TRIM RATE	0.0	10.	1.0	N/A

When the Voltage Trim is active, this rate can be used to make the trim function faster or slower. Adjusting this value will depend on how quickly the voltage regulators in the system can smoothly adjust the voltage. Settings that are too high will tend to cause instability in the Power Factor sharing. Settings that are too low will cause a very slow return to the operating voltage after a load change to the system.

Item	Display Name	Min	Max	Default	Units
Voltage Trim Deadband	VOLT TRIM DEADBAND	0.01	100	1.0	%

This value determines how closely the Voltage trim function will keep the bus frequency to the rated frequency.

Item	Display Name	Min	Max	Default	Units
Voltage Raise Lower Pulse Frequency	VOLT R/L FREQUENCY	0.15	10	0.5	Sec

This value sets the pulse frequency of the Raise and Lower discrete outputs for volt/VAR control. A setting of 1 means that every 1 second the AtlasSC

Load+Speed Control will decide whether to make a raise or lower pulse. This setting is only applicable when the Voltage Bias Type, in the First Time Config menu, is set for Raise/Lower.

Item	Display Name	Min	Max	Default	Units
Voltage Raise Lower Pulse Duty Cycle	VOLT R/L DUTY CYCLE	1.0	99	50	%

This value sets the pulse length of the Raise and Lower discrete outputs for volt/VAR control. A setting of 50 means that pulse length will be 50% of the Frequency time above. If the Frequency is 1 second, then the pulse length will be 0.5 seconds, followed by a pause of 0.5 seconds. This setting is only applicable when the Voltage Bias Type, in the First Time Config menu, is set for Raise/Lower.

Item	Display Name	Min	Max	Default	Units
Voltage Raise Lower Pulse Deadband	VOLT R/L DEADBND(%)	0.01	100	1.0	%

The deadband setting is used to stop the raise lower pulses once the AtlasSC Load+Speed Control voltage or VAR control has reached its correct value. This setting is a window around the voltage bias variable of the AtlasSC Load+Speed Control which can be viewed on the I/O Display Screen. A setting of 1 means that the AtlasSC Load+Speed Control will not give any pulses if the voltage bias is between –1% and 1%. This setting is only applicable when the Voltage Bias Type, in the First Time Config menu, is set for Raise/Lower.

Item	Display Name	Min	Max	Default	Units
Isolated Power Factor Control Threshold	PF CONTROL THRESHOLD	0.1	10.0	2.0	%

For isolated multi-unit systems, controlling the power factor at very low loads is not practical, because the power factor ratio can change so dramatically because Reactive Load (KVAR) is higher than the Real Load (KW). This threshold turns off the AtlasSC Load+Speed Control Power Factor control when the KVA reading is below this level. For example, a setting of 2 % means that the AtlasSC Load+Speed Control must measure at least 2% of its rated KVA setting before the Power Factor control is enabled on an isolated bus.

Process Control Menu

Items in Process Control Menu can be viewed and edited with caution while the engine is running. Items in this menu are part of a Service block.

Refer to Table 3-2 for the configuration of alarm action. It is used in a few places within the Process Control Menu.

Item	Display Name	Min	Max	Default	Units
Process Proportional Gain	PROCESS GAIN	0.001	20.00	0.05	

This value is the proportional gain of the Process P-I-D controller. It determines how fast the process control responds to an error between process variable and process reference. Lower the value to slow the response.

Item	Display Name	Min	Max	Default	Units
Process Integral	PROCESS INTEGRAL	0.00	20.00	0.3	Repeats/sec

This value is the integral gain of the process PID controller. It determines how fast the process control responds to an error between process variable and process reference. It prevents slow hunting and controls damping (overshoot or undershoot) after a disturbance. Lower the value to slow the response.

Item	Display Name	Min	Max	Defau	Units
Process Derivative	PROCESS DERIVATIVE	0.01	100.0	100.0	

This value is the derivative gain of the P-I-D load controller. It determines the response of the process control for a rate of change in the process error.

Item	Display Name	Min	Max	Default	Units
Process Deadband	PROCESS DEADBAND	-30000	30000	0	User units

This value specifies an error window about the measured process input, inside of which the process controller will not adjust its output. This is used for control of processes with a large noise component on the input. Set to 0 for normal, non-deadband control. It is configured in the same units as the process input.

Item	Display Name	Min	Max	Default	Units
Process Droop	PROCESS DROOP	0	50	5	%

This value is the process droop desired based on process level. It is typically only used on slow moving process.

Item	Display Name	Min	Max	Default	Units
Process Filter	PROCESS FILTER	0.01	10.00	1.00	Hz

This value adjusts the bandwidth of the low pass filter for the process controller. Higher frequency settings than default result in faster control response, but also more response to system noise. Lower frequency settings result in slower control response and less response to noise.

Item	Display Name	Min	Max	Default	Units
Process Control Setpoint	PROCESS REFERENCE	-30000	30000	0	User

This value is the reference used by process control. It is configured in the same engineering units as the analog input sensor was calibrated.

Item	Display Name	Min	Max	Default	Units
High Process Limit Alarm	PROC HI LVL ALM	1	6	1=Disabled	

This value defines the action taken when the process exceeds the configured High Process Level.

Item	Display Name	Min	Max	Default	Units
Process High Limit	PROCESS HIGH LVL	-30000	30000	10	User units

This value is the highest process that should be carried by the genset. If the monitored process exceeds this level, a High Process Limit Alarm will be issued (if configured).

Item	Display Name	Min	Max	Default	Units
Low Process Limit Alarm	PROC LOW LVL ALM	1	6	1=Disabled	

This value is an enumerated list that defines the action taken when the process drops below the configured Low Process Level.

Item	Display Name	Min	Max	Default	Units
Process Low Limit	PROCESS LOW LVL	-30000	30000	-10	User units

This value is the lowest process that should be carried by the genset. If the monitored process drops below this level, a Low Process Limit Alarm will be issued (if configured).

Transfer Switch Menu

Items in Transfer Switch Menu can be viewed and edited with caution while the engine is running. Items in this menu are part of a Service block.

Refer to Table 3-2 for the of alarm action. It is used in the Transfer Switch Menu.

Item	Display Name	Min	Max	Default	Units
Generator Stable Delay	GEN STABLE DELAY	1	30000	30	Seconds

This value is the amount of time the generator must be running stable at rated speed and rated voltage before the control will allow closing of the generator breaker (Dead Bus) or activating the synchronizer to close the generator breaker.

Item	Display Name	Min	Max	Default	Units
EPS Supplying Load Alarm	EPS SUP LOAD ALM	1	4	1=Disabled	

This value selects the action taken when the genset is supplying the load (Gen Breaker is closed) without the mains present (a configurable discrete input is selected as the Mains breaker aux input, and it is open).

Sequencing Menu

Items in Sequencing Menu can be viewed and edited with caution while the engine is running. Items in this menu are part of a Service block.

Refer to Table 3-2 for configuration of alarm action. It is used in a few places within the Sequencing Menu.

Item	Display Name	Min	Max	Default	Units
Start/Stop Sequencing logic	RUN TIME MANAGER	0	5	5=Unit Number	

The sequence function is performed between LS units on the same active bus segment. It may also be initiated by a Master Controller (MC) but the negotiation between units is performed by the slaves themselves with the start and stop order determined by the run-time mode. All modes require the next unit to also be in the Start Ready State. This value is used to select the run-time mode

0=Disabled: This unit will not be included in the auto stop/start sequence with other LS connected to the bus. In First Time Setup, the parameter ENABLE START SEQUENCE will have to be set to False to disable this control from responding to start/stop commands from a Master Control.

1=Staggered Run-Time: The next genset to start/stop will be based on the service hour time of each unit on the bus. When staggered is selected the control selects units so no more than one service hour meter reaches 0.0 at the same time. The next unit to start will therefore be the unit with the lowest Service hour meter. Next stop will be the unit with the highest service hour time meter

2=Equal Run-Time: Next unit to start will have the highest Service hours meter. Next stop will be the unit with the lowest service hours meter

3=Largest 1st: Will start the largest rated power unit next. Smallest power will stop first.

4=Smallest 1st: Will start the smallest rated power unit next. Largest power will stop first

5=Unit Number: the unit with the lowest unit number will started next, and stop first.

Item	Display Name	Min	Max	Default	Units
Start Delay above Max Load Level	MAX LOAD DELAY	1	1200	30	Sec

When this genset is at or above the Maximum Load Level for this delay time, a start command will be given to the next scheduled unit.

Item	Display Name	Min	Max	Default	Units
Start Delay above Rated Load Level	RATED LOAD DELAY	1	1200	2	Sec

When this genset is at or above 100% Load Level for this delay time, a start command will be given to the next scheduled unit.

Item	Display Name	Min	Max	Default	Units
Stop Delay below minimum Load Level	REDUCED LOAD DELAY	1	1200	30	Sec

When this genset is at or below the Minimum Load Level for this delay time, a stop command will be given to the next scheduled unit.

Item	Display Name	Min	Max	Default	Units
Maximum % Load to Trigger a Start	MAX LOAD LVL	1	100	80	%

The desired upper load level for this genset, when demand is above this level a start command will be given to the next scheduled unit

Item	Display Name	Min	Max	Default	Units
Minimum % Load to Trigger a Stop	MIN LOAD LVL	1	100	30	%

The desired lower load level for this genset, when demand is below this level a stop command will be given to the next scheduled unit

Item	Display Name	Min	Max	Default	Units
Time to Stop a Genset	STOP GENSET TIME	1	30000	3	Sec

After a stop command is issued, this is the amount of time the control waits to send out another stop command. If the commanded genset does not stop after the third attempt the failed to stop sequence alarm is triggered.

Item	Display Name	Min	Max	Default	Units
Time to Start a Genset	START GENSET TIME	1	30000	60	Sec

After a start command is issued, this is the amount of time the control waits to send another start command. If the commanded genset does not start after the third attempt the failed to start sequence alarm is triggered.

Item	Display Name	Min	Max	Default	Units
Interval for Next Scheduled Service	SERVICE INTERVAL	0	32000	0	Hrs

This value is the number of hours until the next scheduled service. When the Service Hour Meter counts down to 0.0 or below, a Service Hour Alarm will be activated.

Item	Display Name	Min	Max	Default	Units
Service Hour Clock Reset	RESET SERVICE HOURS	False	True	False	

Setting this value TRUE then False will initialize the Service Hour Meter to the Service Interval time. The service hour reset must be used every time the service hour meter is set.

Item	Display Name	Min	Max	Default	Units
Failed Auto Start Sequence Alarm Action	AUTO START SEQ ALM	1	4	2=Warning	

This value is the action taken when the genset fails to start when triggered from LON.

Item	Display Name	Min	Max	Default	Units
Failed Auto Stop Sequence Alarm Action	AUTO STOP SEQ ALM	1	4	2=Warning	

This value is the action taken when the genset fails to stop when triggered from LON.

Item	Display Name	Min	Max	Default	Units
Service Hour Alarm Action	SERVICE HOURS ALARM	1	5	1=Disabled	

This value is the action taken when the engine service hour meter has reached 0.0 and the genset is due for service.

The Watch Window K SEQUENCING sheet has Displays monitoring and troubleshooting information:
LON NODE NUMBER- This is a number that represents all nodes that are responding on the LON network.
LON FAULT STATUS- False when all there are no faults
TIE BREAKER STATUS- for W, X, Y, and Z segment breakers, true indicates a closed breaker
NODES ON ACTIVE BUS- Number of units communicating by LON that are on this units same bus segment
NODES ON NETWORK- Number units (LS and MC) communicating on the LON

Item	Display Name	Min	Max	Default	Units
Clear Failed deadbus close attempt	CLEAR DEADBUS ATTEMPTS	False	True	False	

If a node wins the arbitration to close onto a dead bus, and fails to close, this input field is used to determine the failed nodes arbitration status. If the “Clear Attempt” input field is FALSE, all other nodes will be allowed to close before the failing node is allowed back into the arbitration. If all nodes were to fail, all nodes would again be equal in the arbitration algorithm. If the “Clear Attempt” input field is TRUE, the failing node is allowed back into the arbitration at the same priority as all other nodes.

Item	Display Name	Min	Max	Default	Units
Enable Bus to Bus Synchronization	ENABLE EXT LS TIE SYNCH	False	True	False	

Needs to be enabled for the AtlasSC Load+Speed Control to react to contact inputs from an external synchronizer to perform bus to bus synchronizing. The LS unit then broadcasts a sync bias level to all LS units on the same bus segment.

Item	Display Name	Min	Max	Default	Units
Bus to Bus Synch Reset Time	LS TIE SYNC BIAS RESET	0.0	300.0	10.0	Sec

This timer resets the control after an attempt to synchronize bus to bus. Any speed or voltage change that was added from the sync attempt will be removed.

Item	Display Name	Min	Max	Default	Units
Bus to Bus Synch Frequency Gain	LS TIE SYNC FREQ GAIN	0.01	10.0	1.0	

This value is used to increase or decrease the affect of the bus to bus synchronization on the frequency adjustment. Larger values will give the Bus to Bus synchronizing more frequency change. Smaller values reduce the frequency change.

Item	Display Name	Min	Max	Default	Units
Bus to Bus Synch Voltage Gain	LS TIE SYNC VOLT GAIN	0.01	10.0	1.0	

This value is used to increase or decrease the affect of the bus to bus synchronization on the voltage adjustment. Larger values will give the Bus to Bus synchronizing more voltage change. Smaller values reduce the voltage change.

Item	Display Name	Min	Max	Default	Units
Auto Start With Trip Alarm	AUTO STRT W/TRIP TIE	False	True	False	

When enabled the LS will start automatically when any alarm is configured for **Trip Tie** or **Trip Tie with alarm**, and that alarm condition occurs. Only when the LS is in Auto. This feature is used primarily for isolated prime power systems where start stop sequencing is Enabled. If the Bus Undervoltage alarm for example were set to Trip Tie, then any AtlasSC Load+Speed Control units in Auto would start when this alarm occurred.

Item	Display Name	Min	Max	Default	Units
Expected Number of Nodes in the System	EXPECTED NODE NUMBER	1	16	1	

If the Net Nodes from the LON do not match this number, and a digital output is configured for LON Node Num Mismatch, the digital output will be set. Used to validate LON health.

Communications Menu

The Communications Menu is included in both the front panel display and Watch Window. Some items will only appear through Watch Window. Items in it can be viewed and edited with caution while the engine is running. Items in this menu are part of a Service block.

Item	Display Name	Min	Max	Default	Units
Serial 1 Type	SERIAL 1 TYPE	1	3	1=RS232	

This value is an enumerated list used to select the serial hardware interface for Serial Port 1. It may be RS232 =1, RS422 =2, or RS485 =3.

Item	Display Name	Min	Max	Default	Units
Serial 1 Mode	SERIAL 1 MODE	1	2	2=ServLink	

This value is an enumerated list used to select the software protocol interface for Serial Port 1. It may be Modbus =1 or ServLink =2. Selecting Modbus will enable the Modbus RTU slave serial protocol. Selecting ServLink will enable the Woodward ServLink server protocol.

Item	Display Name	Min	Max	Default	Units
Serial 1 Baud Rate	SERIAL 1 BAUD	7	12	11=57,600	

This value selects the serial baud rate for Serial Port1. The following table lists the possible baud rates:

Value	Baud Rate
12	115,200
11	57,600
10	38,400
9	19,200
8	9600
7	4800

Item	Display Name	Min	Max	Default	Units
Serial 1 Bits	SERIAL 1 BITS	1	2	2=8 bits	

This value is an enumerated list used to select the number of bits for Serial Port 1. It may be 1 = 7 Bits or 2 = 8 Bits.

Item	Display Name	Min	Max	Default	Units
Serial 1 Stop Bits	SERIAL 1 STOP BITS	1	3	1=1 Stop Bit	

This value is an enumerated list used to select the number of stop bits for Serial Port 1. It may be 1 = 1 stop bit or 2 = 2 stop bits or 3 = 1.5 stop bits.

Item	Display Name	Min	Max	Default	Units
Serial 1 Parity	SERIAL 1 PARITY	1	3	1=1 No Parity	

This value is an enumerated list used to select the parity for Serial Port 1. It may be 1 = No Parity or 2 = Odd or 3 = Even.

Item	Display Name	Min	Max	Default	Units
Serial 2 Type	SERIAL 2 TYPE	1	3	1=RS232	

This value is an enumerated list used to select the serial hardware interface for Serial Port 2. It may be RS232, RS422, or RS485.

Item	Display Name	Min	Max	Default	Units
Serial 2 Baud Rate	SERIAL 2 BAUD	7	12	11=57600	

This value selects the serial baud rate for Serial Port2. See Serial 1 Baud Rate for a list of possible choices.

Item	Display Name	Min	Max	Default	Units
Serial 2 Bits	SERIAL 2 BITS	1	2	2=8 bits	

This value is an enumerated list used to select the number of bits for Serial Port 2. It may be 1 = 7 Bits or 2 = 8 Bits.

Item	Display Name	Min	Max	Default	Units
Serial 2 Stop Bits	SERIAL 2 STOP BITS	1	3	1=1 Stop Bit	

This value is an enumerated list used to select the number of stop bits for Serial Port 2. It may be 1 = 1 stop bit or 2 = 2 stop bits or 3 = 1.5 stop bits.

Item	Display Name	Min	Max	Default	Units
Serial 2 Parity	SERIAL 2 PARITY	1	3	1=1 No Parity	

This value is an enumerated list used to select the parity for Serial Port 2. It may be 1 = No Parity or 2 = Odd or 3 = Even.

Item	Display Name	Min	Max	Default	Units
Serial 3 Baud Rate	SERIAL 3 BAUD	7	12	12=115200	

This value selects the serial baud rate for Serial Port3. See Serial 1 Baud Rate for a list of possible choices.

Item	Display Name	Min	Max	Default	Units
Serial 3 Bits	SERIAL 3 BITS	1	2	2=8 bits	

This value is an enumerated list used to select the number of bits for Serial Port 3. It may be 1 = 7 Bits or 2 = 8 Bits.

Item	Display Name	Min	Max	Default	Units
Serial 3 Stop Bits	SERIAL 3 STOP BITS	1	3	1=1 Stop Bit	

This value is an enumerated list used to select the number of stop bits for Serial Port 3. It may be 1 = 1 stop bit or 2 = 2 stop bits or 3 = 1.5 stop bits.

Item	Display Name	Min	Max	Default	Units
Serial 3 Parity	SERIAL 3 PARITY	1	3	1=1 No Parity	

This value is an enumerated list used to select the parity for Serial Port 3. It may be 1 = No Parity or 2 = Odd or 3 = Even.

Item	Display Name	Min	Max	Default	Units
Modbus Network Address	MODBUS ID	1	247	1	

This value is used when communicating to several Modbus items on the same serial cable. This number assigns an address to the Modbus for this unit.

Item	Display Name	Min	Max	Default	Units
Modbus Timeout	MODBUS TIMEOUT	0.1	100.0	3.0	Seconds

This value defines the amount of time that must pass without communication from the Master before announcing a Link Failure. The same timeout is used for Serial Port 2 and Serial Port 1 if Serial Port 1 is configured as a Modbus port. However, the alarms generated by this timeout are specific for each serial port.

Item	Display Name	Min	Max	Default	Units
Modbus Reset	MODBUS RESET	False	True	False	

This value when set true will reset the faults on the Modbus port.

Item	Display Name	Min	Max	Default	Units
Port 1 Timeout Alarm Action	PORT 1 TIMEOUT ALARM	1	6	1=Disabled	

This value defines the action taken when the Serial Port 1 fails to communicate within the time-out period.

Item	Display Name	Min	Max	Default	Units
Port 2 Timeout Alarm Action	PORT 2 TIMEOUT ALARM	1	6	1=Disabled	

This value defines the action taken when the Serial Port 2 fails to communicate within the time-out period.

Item	Display Name	Min	Max	Default	Units
Modbus Multiplier for Gen Voltage	MBUS MULT – GEN VOLT	1	4	1=1X Multiplier	
Modbus Multiplier for Gen Current	MBUS MULT – GEN CURRENT	1	4	1=1X Multiplier	
Modbus Multiplier for Gen Power	MBUS MULT – GEN POWER	1	4	1=1X Multiplier	
Modbus Multiplier for Bus Voltage	MBUS MULT – BUS VOLT	1	4	1=1X Multiplier	
Modbus Multiplier for Bus Current	MBUS MULT – BUS CURRENT	1	4	1=1X Multiplier	
Modbus Multiplier for 4-20mA Inputs	MBUS MULT – AN COMBO	1	4	1=1X Multiplier	
Modbus Multiplier for Baseload Reference	MBUS MULT - BASELOAD REF	1	4	1=1X Multiplier	
Modbus Multiplier for VAR Reference	MBUS MULT - VAR REF	1	4	1=1X Multiplier	

This value defines the multiplier used hen sending a value over Modbus. The multiplier moves the decimal of the value so Modbus can have more resolution. For example if the value was 2.0 kV, and you used a multiplier of 1000 the Modbus value would be 2000. See the table below for the multiplier list.

1	X 1
2	X10
3	X100
4	X1000

Calibration Menu

Items in Calibration Menu can be viewed and edited with caution while the engine is running. Items in this menu are part of a Service block.

Item	Display Name	Min	Max	Default	Units
Current year	UPDATE YEAR TO:	2000	2070	2001	

Numerical value of the present year.

Item	Display Name	Min	Max	Default	Units
Current month	UPDATE MONTH TO:	1	12	1=JAN	

The convention of the value is January = 1, February = 2, etc.

Item	Display Name	Min	Max	Default	Units
Current date	UPDATE DATE TO:	1	31	1	

Numerical entry of calendar date 1-31.

Item	Display Name	Min	Max	Default	Units
Current day of Week	UPDATE CURRENT DAY TO:	1	7	1=Sunday	

The convention of the value is Sunday = 1, Monday = 2, etc.

Item	Display Name	Min	Max	Default	Units
Set Calendar	UPDATE CALENDAR TRIGGER	FALSE	TRUE	FALSE	

Adjust the above calendar parameters to indicate the current date. The AtlasSC Load+Speed Control calendar will not change until the Up Date Calendar trigger is set TRUE, then FALSE.

Item	Display Name	Min	Max	Default	Units
Current time(hour)	UPDATE HOURS TO:	0	24	0	

Clock hours, 24 hour clock.

Item	Display Name	Min	Max	Default	Units
Current time (minutes)	UPDATE MINUTES TO:	0	59	0	

Clock minutes.

Item	Display Name	Min	Max	Default	Units
Set Clock	UPDATE CLOCK TRIGGER	FALSE	TRUE	FALSE	

Adjust the clock parameters above to the current time. The AtlasSC Load+Speed Control clock will be set to these values when the trigger is set TRUE, the seconds will be set to 0.0. The trigger must then be returned to FALSE.

The next lines on the sheet will display the current time, date and day-of-week from the AtlasSC Load+Speed Control to verify its setting.

Item	Display Name	Min	Max	Default	Units
Voltage Bias Offset	VOLTAGE BIAS OFFSET	-100	100	0	

The Offset of the Bias outputs can be used to adjust the “off” setting to give rated voltage or rated speed when the AtlasSC Load+Speed Control is not in control. See the Calibration Chapter of this manual.

Item	Display Name	Min	Max	Default	Units
Actuator Offset	ACTUATOR OFFSET	-100	100	0	

Adjust the valve’s output current for a minimum stop.

Item	Display Name	Min	Max	Default	Units
Actuator Gain	ACTUATOR GAIN	0.0	2.0	1.0	

Adjust the valve’s output current for a maximum stop.

Item	Display Name	Min	Max	Default	Units
Actuator Dither	ACTUATOR DITHER	0.0	3.0	0.0	

Enter the dither, in milliamps. Enter 0.0 if no dither is required. Woodward TM-type actuators typically require dither.

Item	Display Name	Min	Max	Default	Units
Generator A∅ Voltage Scale Factor	GEN A∅ VOLTAGE SCALE	0.5	1.5	1	
Generator B∅ Voltage Scale Factor	GEN B∅ VOLTAGE SCALE	0.5	1.5	1	
Generator C∅ Voltage Scale Factor	GEN C∅ VOLTAGE SCALE	0.5	1.5	1	
Generator A∅ Current Scale Factor	GEN A∅ CURRENT SCALE	0.5	1.5	1	
Generator B∅ Current Scale Factor	GEN B∅ CURRENT SCALE	0.5	1.5	1	
Generator C∅ Current Scale Factor	GEN C∅ CURRENT SCALE	0.5	1.5	1	
Bus A∅ Voltage Scale Factor	BUS A∅ VOLT SCALE	0.5	1.5	1	
Bus B∅ Voltage Scale Factor	BUS B∅ VOLT SCALE	0.5	1.5	1	
Bus C∅ Voltage Scale Factor	BUS C∅ VOLT SCALE	0.5	1.5	1	
Bus A∅ Current Scale Factor	BUS A∅ CURRENT SCALE	0.5	1.5	1	
Bus B∅ Current Scale Factor	BUS B∅ CURRENT SCALE	0.5	1.5	1	
Bus C∅ Current Scale Factor	BUS C∅ CURRENT SCALE	0.5	1.5	1	

The Scale setting is used to match the input value and the AtlasSC Load+Speed Control displayed value. From Watch Window the AtlasSC Load+Speed Control measured value is also monitored here to assist with calibration. These items are discussed in the Calibration Chapter of this manual.

Remote Alarm Menu

Items in Remote Alarm Menu can be viewed and edited with caution while the engine is running. Items in this menu are part of a Service block.

Refer to Table 3-2 for the enumerated list for configuration of alarm action. It is used in a few places within the Remote Alarm Menu.

Item	Display Name	Min	Max	Default	Units
Remote Alarm 1	REMOTE ALARM 1	1	8	1=Disabled	
Remote Alarm 1 Delay	REMOTE ALARM 1 DLY	0.0	300.0	0.0	Seconds
Remote Alarm 1 Level	REMOTE ALARM 1 LVL	False	True	True=Active High	
Remote Alarm 1 Label	REMOTE ALARM 1 LABEL		~~~~	REMOTE FAULT 1	ASCII
Remote Alarm 1 Engine Enable	RM1 COND W/ENGINE RUN	False	True	True=Wait for Engine Run	

This group of 4 configurable items is used to configure Remote Alarm #1. This group can be configured and used even if no Digital Input is configured for Remote Alarm #1. In the case where no Digital Input is configured for Remote Alarm #1, the Alarm can be activated and de-activated via Modbus by changing the “input state” of Remote Alarm Input #1 with Boolean Write commands. There are exceptions concerning Remote Alarm #7, #8 e #9. These faults cannot be set via Modbus. Remote alarm #7, #8 and #9 are located on the pins 17, 18 and 19 of the SmartCore board, respectively.

The Remote Alarm 1 value is the action taken when the input is activated.

The Remote Alarm 1 Delay value is the time to wait after activation of the input prior to announcing the alarm condition.

The Remote Alarm 1 Level is used to configure how the AtlasSC Load+Speed Control interprets the input state. If set to Active Low, the absence of an input at the Digital Input terminals will be considered an active alarm. This mode is useful for normally closed contacts. If configured to Active High, Application of voltage at the Digital Input terminals will be considered an active alarm. If using Modbus to set the alarm states, only High should be used.

The Remote Alarm 1 Label is used to provide a customized name for the actual device connected to the input.

The Remote Alarm 1 Engine Enable is used to disable the remote alarm until the engine is running. If this value is false, the remote alarm will always be active.

Item	Display Name	Min	Max	Default	Units
Remote Alarm 2	REMOTE ALARM 2	1	8	1=Disabled	
Remote Alarm 2 Delay	REMOTE ALARM 2 DLY	0.0	300.0	0.0	Seconds
Remote Alarm 2 Level	REMOTE ALARM 2 LVL	False	True	True=Active High	
Remote Alarm 2 Label	REMOTE ALARM 2 LABEL		~~~~	REMOTE FAULT 2	ASCII
Remote Alarm 2 Engine Enable	RM2 COND W/ENGINE RUN	False	True	True=Wait for Engine Run	

See Remote Alarm 1 above for configuration description.

Item	Display Name	Min	Max	Default	Units
Remote Alarm 3	REMOTE ALARM 3	1	8	1=Disabled	
Remote Alarm 3 Delay	REMOTE ALARM 3 DLY	0.0	300.0	0.0	Seconds
Remote Alarm 3 Level	REMOTE ALARM 3 LVL	False	True	True=Active High	
Remote Alarm 3 Label	REMOTE ALARM 3 LABEL		~~~~	REMOTE FAULT 3	ASCII
Remote Alarm 3 Engine Enable	RM3 COND W/ENGINE RUN	False	True	Tru=Wait for Engine Run	

See Remote Alarm 1 above for configuration description.

Item	Display Name	Min	Max	Default	Units
Remote Alarm 4	REMOTE ALARM 4	1	8	1=Disabled	
Remote Alarm 4 Delay	REMOTE ALARM 4 DLY	0.0	300.0	0.0	Seconds
Remote Alarm 4 Level	REMOTE ALARM 4 LVL	False	True	True=Active High	
Remote Alarm 4 Label	REMOTE ALARM 4 LABEL		~~~~	REMOTE FAULT 4	ASCII
Remote Alarm 4 Engine Enable	RM4 COND W/ENGINE RUN	False	True	True=Wait for Engine Run	

See Remote Alarm 1 above for configuration description.

Item	Display Name	Min	Max	Default	Units
Remote Alarm 5	REMOTE ALARM 5	1	8	1=Disabled	
Remote Alarm 5 Delay	REMOTE ALARM 5 DLY	0.0	300.0	0.0	Seconds
Remote Alarm 5 Level	REMOTE ALARM	False	True	True=Active	

Item	Display Name	Min	Max	Default	Units
	5 LVL			High	
Remote Alarm 5 Label	REMOTE ALARM 5 LABEL		~~~~	REMOTE FAULT 5	ASCII
Remote Alarm 5 Engine Enable	RM5 COND W/ENGINE RUN	False	True	True=Wait for Engine Run	

See Remote Alarm 1 above for configuration description.

Item	Display Name	Min	Max	Default	Units
Remote Alarm 6	REMOTE ALARM 6	1	8	1=Disabled	
Remote Alarm 6 Delay	REMOTE ALARM 6 DLY	0.0	300.0	0.0	Seconds
Remote Alarm 6 Level	REMOTE ALARM 6 LVL	False	True	True=Active High	
Remote Alarm 6 Label	REMOTE ALARM 6 LABEL		~~~~	REMOTE FAULT 6	ASCII
Remote Alarm 6 Engine Enable	RM6 COND W/ENGINE RUN	False	True	True=Wait for Engine Run	

See Remote Alarm 1 above for configuration description.

Item	Display Name	Min	Max	Default	Units
Remote Alarm 7	REMOTE ALARM 7	1	6	1=Disabled	
Remote Alarm 7 Delay	REMOTE ALARM 7 DLY	0.0	300.0	0.0	Seconds
Remote Alarm 7 Level	REMOTE ALARM 7 LVL	False	True	True=Active High	
Remote Alarm 7 Label	REMOTE ALARM 7 LABEL		~~~~	REMOTE FAULT 6	ASCII
Remote Alarm 7 Engine Enable	RM7 COND W/ENGINE RUN	False	True	True=Wait for Engine Run	

See Remote Alarm 1 above for configuration description.

Item	Display Name	Min	Max	Default	Units
Remote Alarm 8	REMOTE ALARM 8	1	6	1=Disabled	
Remote Alarm 8 Delay	REMOTE ALARM 8 DLY	0.0	300.0	0.0	Seconds
Remote Alarm 8 Level	REMOTE ALARM 8 LVL	False	True	True=Active High	
Remote Alarm 8 Label	REMOTE ALARM 8 LABEL		~~~~	REMOTE FAULT 6	ASCII
Remote Alarm 8 Engine Enable	RM8 COND W/ENGINE RUN	False	True	True=Wait for Engine Run	

See Remote Alarm 1 above for configuration description.

Item	Display Name	Min	Max	Default	Units
Remote Alarm 9	REMOTE ALARM 9	1	6	1=Disabled	
Remote Alarm 9 Delay	REMOTE ALARM 9 DLY	0.0	300.0	0.0	Seconds
Remote Alarm 9 Level	REMOTE ALARM 9 LVL	False	True	True=Active High	
Remote Alarm 9 Label	REMOTE ALARM 9 LABEL		~~~~	REMOTE FAULT 6	ASCII
Remote Alarm 9 Engine Enable	RM9 COND W/ENGINE RUN	False	True	True=Wait for Engine Run	

See Remote Alarm 1 above for configuration description.

Force Relay Menu

This menu is to be used for testing the outputs of the module.

The fist parameter, ENABLE RELAY FORCING, must be set to TRUE before the relays can be manually energized. To enable the test the genset must have these conditions True: Engine stopped, Fuel shutoff output off, and generator output off. If any of these condition become false, the relay test will return all relays to their normal conditions. The FORCING ENABLE should be returned to False when the test is completed. After 60 minutes, the force mode will be disabled.

Item	Display Name	Min	Max	Default	Units
Enable Relay Forcing Test	ENABLE RELAY FORCING	False	True	False	
Force DO 1	ENERGIZE RELAY 1	False	True	FALSE=off	
Force DO 2	ENERGIZE RELAY 2	False	True	FALSE=off	
Force DO 3	ENERGIZE RELAY 3	False	True	FALSE=off	
Force DO 4	ENERGIZE RELAY 4	False	True	FALSE=off	
Force DO 5	ENERGIZE RELAY 5	False	True	FALSE=off	
Force DO 6	ENERGIZE RELAY 6	False	True	FALSE=off	
Force DO 7	ENERGIZE RELAY 7	False	True	FALSE=off	
Force DO 8	ENERGIZE RELAY 8	False	True	FALSE=off	
Force DO 9	ENERGIZE RELAY 9	False	True	FALSE=off	
Force DO 10	ENERGIZE RELAY 10	False	True	FALSE=off	
Force DO 11	ENERGIZE RELAY 11	False	True	FALSE=off	
Force DO 12	ENERGIZE RELAY 12	False	True	FALSE=off	
Force AO 1	FORCE ANOUT 1	-30000	30000	0.0	
Force AO 2	FORCE ANOUT 2	-30000	30000	0.0	
Force AO 3	FORCE ANOUT 3	-30000	30000	0.0	
Force AO 4	FORCE ANOUT 4	-30000	30000	0.0	
Force Actuator Output (%)	FORCE ACTUATOR OUTPUT	0.0	100.0	0.0	

Analog Outputs Menu

This menu is used to configure the functions of the four available Analog Outputs.

Item	Display Name	Min	Max	Default	Units
Analog output 1 Function	ANOUT1 FUNCTION	1	17	2=Synchroscope	
Input Value at Max output	ANOUT1 HI CAL VALUE	-30000	30000	200	
Input Value at Minimum	ANOUT1 LO CAL VALUE	-30000	30000	-200	

The function of the analog input 1 can be obtained from the table on the next page. The Input Value at Max Output is the value of the variable for a 20mA output and the Input Value at Minimum is the value of a variable for a 4mA output.

Item	Display Name	Min	Max	Default	Units
Analog output 2 Function	ANOUT2 FUNCTION	1	17	1=Not Used	
Input Value at Max output	ANOUT2 HI CAL VALUE	-30000	30000	100	
Input Value at Minimum	ANOUT2 LO CAL VALUE	-30000	30000	0	

See Analog Output 1 above for configuration description.

Item	Display Name	Min	Max	Default	Units
Analog output 3 Function	ANOUT3 FUNCTION	1	17	1=Not Used	
Input Value at Max output	ANOUT3 HI CAL VALUE	-30000	30000	100	
Input Value at Minimum	ANOUT3 LO CAL VALUE	-30000	30000	0	

See Analog Output 1 above for configuration description.

Item	Display Name	Min	Max	Default	Units
Analog output 4 Function	ANOUT4 FUNCTION	1	17	1=Not Used	
Input Value at Max output	ANOUT4 HI CAL VALUE	-30000	30000	100	
Input Value at Minimum	ANOUT4 LO CAL VALUE	-30000	30000	0	

See Analog Output 1 above for configuration description.

The possible functions of the analog outputs are shown below.

Menu Item	Software Analog Output
17	Speed Bias Reference (rpm)
16	Fuel Demand (%)
15	Speed Reference (rpm)
14	Bus KVAR
13	Bus KVA
12	Bus KW
11	Bus Current
10	Bus Voltage
9	Generator Power Factor
8	Generator Frequency
7	Generator KVAR
6	Generator KVA
5	Generator KW
4	Generator Current
3	Generator Voltage
2	Synchroscope
1	Not Used

Item	Display Name	Min	Max	Default	Units
Speed Bias Max Limit	SPEED BIAS MAX LIMIT	-100	100	100	%
Speed Bias Min Limit	SPEED BIAS MIN LIMIT	-100	100	-100	%

The Min and Max limits for the speed bias signal can be used to clamp the output range. For example, if the Speed Bias Output is programmed for a ±3 Vdc signal, this could be clamped to a ±2 Vdc output by setting the Max to 66 and the Min to –66.

Analog Inputs Menu

Items in Analog Input Menu can be viewed and edited with caution while the engine is running. In this menu the configuration of each analog input of the SmartCore Board can be done.

Item	Display Name	Min	Max	Default	Units
Voltage or Current input Selection	ANALOG INPUT 1 TYPE	1	3	1=4–20 mA	
User Defined Label	ANALOG IN 1 LABEL		~~~~	H2O TEMP	ASCII
Sensor Value at Minimum Input	ANIN1 LOW CAL VALUE (C)	-30000	30000	0.0	Deg C
Sensor Value at Maximum Input	ANIN1 HIGH CAL VALUE (C)	-30000	30000	100.0	Deg C

The function of Analog Input 1 is the Engine Coolant temperature input. In this menu the user defines the input type and calibration values. For the input type 1=4–20 mA, 2=1–5 V, and 3=not used. The Sensor temperature for minimum (1.0 V or 4.0 mA) output, and the temperature for maximum output (5.0 V or 20.0 mA). The calibration values must be entered in degrees centigrade. The label may be changed to a user defined ASCII string.

Item	Display Name	Min	Max	Default	Units
Voltage or Current input Selection	ANALOG INPUT 2 TYPE	1	3	1=4–20 mA	
User Defined Label	ANALOG IN 2 LABEL		~~~~	OIL PRESS	ASCII
Sensor Value at Minimum Input	ANIN2 LOW CAL VALUE (C)	-30000	30000	0.0	
Sensor Value at Maximum Input	ANIN2 HIGH CAL VALUE (C)	-30000	30000	100.0	

The function of Analog input 2 is the Engine Lube Oil pressure input. In this menu the user defines the input type and calibration values. For the input type 1=4–20 mA, 2=1–5 V, and 3=not used. The Sensor pressure for minimum (1.0 V or 4.0 mA) output, and the pressure for maximum output (5.0 V or 20.0 mA). The label may be changed to a user defined ASCII string.

Item	Display Name	Min	Max	Default	Units
Voltage or Current input Selection	ANALOG INPUT 3 TYPE	1	3	1=4–20 mA	
User Defined Label	ANALOG IN 3 LABEL		~~~~	ANALOG IN 3	ASCII
Sensor Value at Minimum Input	ANIN3 LOW CAL VALUE	-30000	30000	0.0	User
Sensor Value at Maximum Input	ANIN3 HIGH CAL VALUE	-30000	30000	100.0	User
High Alarm Action	ANIN3 HIGH ALARM	1	8	1=Disabled	
High Alarm Level	ANIN3 HIGH ALARM LEVEL	-30000	30000	100.0	User
High Pre-alarm Action	ANIN3 HIGH PRE-ALARM	1	8	1=Disabled	
High Pre-alarm Action	ANIN3 HIGH PRE-ALARM LVL	-9999	9999	100.0	User
Low Pre-alarm Action	ANIN3 LOW PRE-ALARM	1	8	1=Disabled	
Low Pre-alarm Level	ANIN3 LOW PRE-ALARM LVL	-9999	9999	0.0	User
Low Alarm Action	ANIN3 LOW ALARM	1	8	1=Disabled	

Item	Display Name	Min	Max	Default	Units
Low Alarm Level	ANIN3 LOW ALARM LEVEL	-30000	30000	0.0	User
Pre Alarm Delay Time	ANIN3 PRE-ALARM DELAY	0.10	1200	5.0	Sec
Alarm Delay Time	ANIN3 ALARM DELAY	0.10	1200	10.0	Sec
AI 3 Engine Run Permissive	AI 3 ENGINE RUN PERM	False	True	False=Monitoring Always	

The configurable function of inputs 3 and 4 is selected in the First Time Configuration Menu. In this menu the user defines the input type and calibration values for all inputs. Inputs 3 and 4 the can be configured for an alarm function and the alarm action and alarm levels are set here. For the input type 1=4–20 mA, 2=1–5 V, and 3=not used. When analog input 3 or 4 is configured as process input or an external reference, the alarm action and level setpoints are configured for input out-of-range sensing.

Item	Display Name	Min	Max	Default	Units
Voltage or Current input Selection	ANALOG INPUT 4 TYPE	1	3	1=4–20 mA	
User Defined Label	ANALOG IN 4 LABEL		~~~~	ANALOG IN 4	ASCII
Sensor Value at Minimum Input	ANIN4 LOW CAL VALUE	-30000	30000	0.0	User
Sensor Value at Maximum Input	ANIN4 HIGH CAL VALUE	-30000	30000	100.0	User
High Alarm Action	ANIN4 HIGH ALARM	1	8	1=Disabled	
High Alarm Level	ANIN4 HIGH ALARM LEVEL	-30000	30000	100.0	User
High Pre-alarm Action	ANIN4 HIGH PRE-ALARM	1	8	1=Disabled	
High Pre-alarm Action	ANIN4 HIGH PRE-ALARM LVL	-9999	9999	100.0	User
Low Pre-alarm Action	ANIN4 LOW PRE-ALARM	1	8	1=Disabled	
Low Pre-alarm Level	ANIN4 LOW PRE-ALARM LVL	-9999	9999	0.0	User
Low Alarm Action	ANIN4 LOW ALARM	1	8	1=Disabled	
Low Alarm Level	ANIN4 LOW ALARM LEVEL	-30000	30000	0.0	User
Pre Alarm Delay Time	ANIN4 PRE-ALARM DELAY	0.10	1200	5.0	Sec
Alarm Delay Time	ANIN4 ALARM DELAY	0.10	1200	10.0	Sec
AI 4 Engine Run Permissive	AI 4 ENGINE RUN PERM	False	True	False=Monitoring Always	

Remote Control Menu

The Remote Control Menu contains items that can be tuned or configured from Watch Window, but would normally be set from an external device. They are included here as items that can be used during installation tests.

Item	Display Name	Min	Max	Default	Units
Acknowledge Cmd Input	ACKNOWLEDGE ALARMS	False	True	False	
Reset Command Input	RESET ALARMS	False	True	False	
Test Mode Switch Input	TEST COMMAND	False	True	False	
Run Mode Switch Input	RUN COMMAND	False	True	False	
Auto Mode Switch Input	AUTO COMMAND	False	True	False	
Process Mode Enable	PROCESS ENABLE COMMAND	False	True	False	
Reactive Load Enable	VAR\PF ENABLE COMMAND	False	True	False	
Unload Command Input	UNLOAD COMMAND	False	True	False	
Ramp Pause Input	LOAD RAMP PAUSE CMD	False	True	False	
Speed/Load Raise Input	SPEED RAISE COMMAND	False	True	False	
Speed/Load Lower Input	SPEED LOWER COMMAND	False	True	False	
Monitor Value	SPEED BIAS ANALOG OUTPUT	Monitor Value			
Voltage/PF/VAR Raise In	VOLTAGE RAISE COMMAND	False	True	False	
Voltage/PF/VAR Lower In	VOLTAGE LOWER COMMAND	False	True	False	
Monitor Value	VOLTAGE BIAS ANLG OUTPUT	Monitor Value			
Monitor Value	RMT BASELOAD REF	Monitor Value			
Read Phase A at Anout	METER PHASE A SELECT	False	True	False	
Read Phase B at Anout	METER PHASE B SELECT	False	True	False	
Reset Load Reference	RESET LOAD CMD	False	True	False	
Enable BaseLoad	BASE LOAD COMMAND	False	True	False	
Droop Track Command	DROOP TRACK COMMAND	False	True	False	
KW De-rate Command	KW DE-RATE COMMAND	False	True	False	

Speed and PID Settings

The Speed and PID Settings contains parameters of the speed ramp time and selected values of PID.

Item	Display Name	Min	Max	Default	Units
Accel Ramp Time	ACCEL RAMP TIME	1.0	300	10.0	s

The time required for the control to ramp the engine speed reference from idle speed to rated speed.

Item	Display Name	Min	Max	Default	Units
Decel Ramp Time	DECEL RAMP TIME	1.0	300	10.0	s

The time required for the control to ramp the engine speed reference from rated speed to idle speed.

Dynamics #1

Dynamic adjustments are settings that affect the stability and transient performance of the engine. Two sets of dynamics are provided. To disable the second set of dynamics go to Dynamics #2 and set the first prompt (Enable Dynamics 2 w/CB) to FALSE. The dynamics being used for control are selected by the CB Aux contact input. The control uses the 1st dynamics when the CB Aux contact input is open, and it uses the 2nd dynamics when the contact is closed.

Item	Display Name	Min	Max	Default	Units
Rated Proportional Gain 1	RATED PROP GAIN 1	0.001	100	5.0	

Determines how fast the control responds to an error in engine speed from the speed-reference setting. The gain is set to provide stable control of the engine at light or unloaded conditions.

Item	Display Name	Min	Max	Default	Units
Rated Integral Gain 1	RESET 1	0.01	100	1.0	

Compensates for the lag time of the engine. It adjusts the time required for the control to return the speed to zero error after a disturbance. Reset is adjusted to prevent slow hunting and to minimize speed overshoot after a load disturbance.

Item	Display Name	Min	Max	Default	Units
Rated Derivative Gain 1	ACTUATOR COMPENSATION 1	0.01	100	5.0	

Compensates for the actuator and fuel system time constant. Increasing Compensation increases actuator activity and transient performance.

Item	Display Name	Min	Max	Default	Units
Window Width 1	WINDOW WIDTH 1	1.0	2100	60.0	RPM

This is the magnitude (in rpm) of speed error at which the control automatically switches to fast response. The control uses the absolute value of speed error to make this switch. The absolute value is the difference between the speed reference and the speed. A window width that is too narrow results in cycling that always factors in the gain ratio.

Item	Display Name	Min	Max	Default	Units
Gain Ratio 1	GAIN RATIO 1	1.0	10	1.0	

The ratio of the gain setting at steady state to the gain setting during transient conditions. The gain ratio operates in conjunction with the window width and gain adjustments by multiplying the gain set point by the gain ratio when the speed error is greater than the window width. This makes the control dynamics fast enough to minimize engine-speed overshoot on start-up and to reduce the magnitude of speed error when loads are changing. This allows a lower gain at steady state for better stability and reduced steady-state actuator linkage movement.

Item	Display Name	Min	Max	Default	Units
Speed Filter Frequency 1	SPEED FILTER FREQ 1	4.0	20.0	20.0	Hz

Adjusts the cutoff frequency of a low-pass filter used on the engine speed sensing input. To use this feature set the cutoff frequency below 15.9 Hz. The

filter is used to attenuate engine firing frequencies. To calculate the desired filter cutoff point, use the following formulas:

camshaft frequency = (engine rpm)/60 [for 2-cycle engines]
= (engine rpm)/120 [for 4-cycle engines]

firing frequency = camshaft frequency x number of cylinders

Initially set the filter frequency to the firing frequency.

As the filter frequency is reduced, steady state stability improves but transient performance may worsen. As the filter frequency is increased, steady state stability worsens but transient performance may improve.

Item	Display Name	Min	Max	Default	Units
Bump Actuator Trigger	BUMP ACT TRIG (T THEN F)	False	True	False	

Allows you to test your dynamics settings by temporarily applying a decreased fuel demand transient to stimulate a control response. Both the magnitude (Act Bump Level) and duration (Act Bump Duration) of the transient may be set. The actuator bump must be enabled in the ACTUATOR BUMP menu. To initiate an actuator bump, toggle Bump Act to TRUE then back to FALSE while the engine is operating in a normal steady state loaded or unloaded condition.

Dynamics #2

The Dynamics #2 control parameters are adjusted the same as Dynamics #1 described above. To enable the use of two sets of dynamics, it is necessary to set Enable 2nd DYNAMICS w/CB below to TRUE. These parameters are in control only when the CB Aux contact input is closed.

Item	Display Name	Min	Max	Default	Units
Enable Dynamics 2 with CB_AUX	ENABLE DYNAMICS 2 W/ CB	False	True	False	

Item	Display Name	Min	Max	Default	Units
Delay Dynamics 2 Enable	DELAY DYN 2 ENABLE (SEC)	0.0	20.0	0.0	s

This is the delay time before dynamics #2 are used by the speed control when the "CB Aux contact" input is closed.

Item	Display Name	Min	Max	Default	Units
Delay Dynamics 1 Enable	DELAY DYN 1 ENABLE (SEC)	0.0	20.0	0.0	s

This is the delay time before dynamics #1 are used by the speed control when the "CB Aux contact" input is opened.

Item	Display Name	Min	Max	Default	Units
Rated Proportional Gain 2	RATED PROP GAIN 2	0.001	100	5.0	
Rated Integral Gain 2	RESET 2	0.01	100	1.0	
Rated Derivative Gain 2	ACTUATOR COMPENSATION 2	0.01	100	5.0	
Window Width 2	WINDOW WIDTH 2	1.0	2100	60.0	RPM
Gain Ratio 2	GAIN RATIO 2	1.0	10	1.0	
Speed Filter Frequency 2	SPEED FILTER FREQ 2	4.0	20.0	20.0	Hz
Bump Actuator Trigger	BUMP ACT TRIG (T THEN F)	False	True	False	

Dynamics #1 5 Pt Gain

This menu is useful in applications that have a non-linear fuel valve (such as butterfly valves). It is provided with a 5 Slope Gain Map that must be enabled (first item of this menu) and a function must be selected. The two functions possible are: Fuel Demand % (1) or engine speed (2). These two items are shown below.

Item	Display Name	Min	Max	Default	Units
Enable 5 Slope Gain Map	ENABLE 5 SLOPE GAIN MAP	False	True	False	
Select Gain Function	SEL GAIN FUNCTION (1,2)	1	2	1	

Item	Display Name	Min	Max	Default	Units
Breakpoint 1A (%Act or RPM)	BRKPOINT 1A (%LD OR RPM)	0.0	5000	99.6	%Act or RPM

Set at the min load point no-load fuel demand or 0.

Item	Display Name	Min	Max	Default	Units
Gain at Breakpoint 1A	GAIN @BREAKPOINT 1A	0.001	100	2.0	

The no load GAIN value.

Item	Display Name	Min	Max	Default	Units
Breakpoint 1B (%Act or RPM)	BRKPOINT 1B (%LD OR RPM)	0.0	5000	99.7	%Act or RPM

The Fuel demand % or speed at breakpoint B.

Item	Display Name	Min	Max	Default	Units
Gain at Breakpoint 1B	GAIN @BREAKPOINT 1B	0.001	100	2.0	

The GAIN value when the load is at breakpoint B.

Item	Display Name	Min	Max	Default	Units
Breakpoint 1C (%Act or RPM)	BRKPOINT 1C (%LD OR RPM)	0.0	5000	99.8	%Act or RPM

The Fuel demand % or speed at breakpoint C.

Item	Display Name	Min	Max	Default	Units
Gain at Breakpoint 1C	GAIN @BREAKPOINT 1C	0.001	100	2.0	

This is the GAIN value when the load is at breakpoint C.

Item	Display Name	Min	Max	Default	Units
Breakpoint 1D (%Act or RPM)	BRKPOINT 1D (%LD OR RPM)	0.0	5000	99.9	%Act or RPM

The Fuel demand % or speed at breakpoint D.

Item	Display Name	Min	Max	Default	Units
Gain at Breakpoint 1D	GAIN @BREAKPOINT 1D	0.001	100	2.0	

The GAIN value when the load is at breakpoint D.

Item	Display Name	Min	Max	Default	Units

Item	Display Name	Min	Max	Default	Units
Breakpoint 1E (%Act or RPM)	BRKPOINT 1E (%LD OR RPM)	0.0	5000	100.0	%Act or RPM

The Fuel demand % or speed at breakpoint E.

Item	Display Name	Min	Max	Default	Units
Gain at Breakpoint 1E	GAIN @BREAKPOINT 1E	0.001	100	2.0	

The GAIN value when the load is at breakpoint E.

Item	Display Name	Min	Max	Default	Units
Rated Integral Gain 1	RESET 1	0.01	100	1.0	

This compensates for the lag time of the engine. It adjusts the time required for the control to return the speed to zero error after a disturbance. Reset is adjusted to prevent slow hunting and to minimize speed overshoot after a load disturbance.

Item	Display Name	Min	Max	Default	Units
Rated Derivative Gain 1	ACTUATOR COMPENSATION 1	0.01	100	5.0	

Compensates for the actuator and fuel system time constant. Increasing Compensation increases actuator activity and transient performance.

Item	Display Name	Min	Max	Default	Units
Window Width 1	WINDOW WIDTH 1	1.0	2100	60.0	RPM

This is the magnitude (in rpm) of speed error at which the control automatically switches to fast response. The control uses the absolute value of speed error to make this switch. The absolute value is the difference between the speed reference and the speed. A window width that is too narrow results in cycling that always factors in the gain ratio.

Item	Display Name	Min	Max	Default	Units
Gain Ratio 1	GAIN RATIO 1	1.0	10	1.0	

The ratio of the gain setting at steady state to the gain setting during transient conditions. The gain ratio operates in conjunction with the window width and gain adjustments by multiplying the gain set point by the gain ratio when the speed error is greater than the window width. This makes the control dynamics fast enough to minimize engine-speed overshoot on start-up and to reduce the magnitude of speed error when loads are changing. This allows a lower gain at steady state for better stability and reduced steady-state actuator linkage movement.

Item	Display Name	Min	Max	Default	Units
Speed Filter Frequency 1	SPEED FILTER FREQ 1	4.0	20.0	20.0	Hz

Adjusts the cutoff frequency of a low-pass filter used on the engine speed sensing input. To use this feature set the cutoff frequency below 15.9 Hz. The filter is used to attenuate engine firing frequencies. To calculate the desired filter cutoff point, use the following formulas:

camshaft frequency = (engine rpm)/60 [for 2-cycle engines]
= (engine rpm)/120 [for 4-cycle engines]

firing frequency = camshaft frequency x number of cylinders

Initially set the filter frequency to the firing frequency.

As the filter frequency is reduced, steady state stability improves but transient performance may worsen. As the filter frequency is increased, steady state stability worsens but transient performance may improve.

Item	Display Name	Min	Max	Default	Units
Bump Actuator Trigger	BUMP ACT TRIG (T THEN F)	False	True	False	

Allows you to test your dynamics settings by temporarily applying a decreased fuel demand transient to stimulate a control response. Both the magnitude (Act Bump Level) and duration (Act Bump Duration) of the transient may be set. The actuator bump must be enabled in the ACTUATOR BUMP menu. To initiate an actuator bump, toggle Bump Act to TRUE then back to FALSE while the engine is operating in a normal steady state loaded or unloaded condition.

Dynamics #2 5 Pt Gain

The Dynamics 2 control parameters are adjusted the same as Dynamics 1 described above. These parameters are in control only when the CB Aux contact input is closed.

Item	Display Name	Min	Max	Default	Units
Enable 5 Slope Gain Map	ENABLE 5 SLOPE GAIN MAP	False	True	False	
Select Gain Function	SEL GAIN FUNCTION (1,2)	1	2	1	

These parameters have the same functions of the first ones of the menu Dynamics #1 5 Pt Gain.

Item	Display Name	Min	Max	Default	Units
Enable Dynamics 2 with CB_AUX	ENABLE DYNAMICS 2 W/ CB	False	True	False	

When TRUE, the second set of dynamics is enabled when the circuit breaker auxiliary contact is closed. When this prompt is FALSE, only Dynamics 1 with be used to set speed control response.

Item	Display Name	Min	Max	Default	Units
Delay Dynamics 2 Enable	DELAY DYN 2 ENABLE (SEC)	0.0	20.0	0.0	s

This is the delay time before dynamics #2 are used by the speed control when the "CB Aux contact" input is closed.

Item	Display Name	Min	Max	Default	Units
Delay Dynamics 1 Enable	DELAY DYN 1 ENABLE (SEC)	0.0	20.0	0.0	s

This is the delay time before dynamics #1 are used by the speed control when the "CB Aux contact" input is opened.

The following parameters are the same as the parameters of the last menu.

Item	Display Name	Min	Max	Default	Units
Breakpoint 2A (%Act or RPM)	BRKPOINT 2A (%LD OR RPM)	0.0	5000	99.6	%Act or RPM
Gain at Breakpoint 2A	GAIN @BREAKPOINT 2A	0.001	100	2.0	
Breakpoint 2B (%Act or RPM)	BRKPOINT 2B (%LD OR RPM)	0.0	5000	99.7	%Act or RPM
Gain at Breakpoint 2B	GAIN	0.001	100	2.0	

Item	Display Name	Min	Max	Default	Units
	@BREAKPOINT 2B				
Breakpoint 2C (%Act or RPM)	BRKPOINT 2C (%LD OR RPM)	0.0	5000	99.8	%Act or RPM
Gain at Breakpoint 2C	GAIN @BREAKPOINT 2C	0.001	100	2.0	
Breakpoint 2D (%Act or RPM)	BRKPOINT 2D (%LD OR RPM)	0.0	5000	99.9	%Act or RPM
Gain at Breakpoint 2D	GAIN @BREAKPOINT 2D	0.001	100	2.0	
Breakpoint 2E (%Act or RPM)	BRKPOINT 2E (%LD OR RPM)	0.0	5000	100.0	%Act or RPM
Gain at Breakpoint 2E	GAIN @BREAKPOINT 2E	0.001	100	2.0	
Rated Integral Gain 2	RESET 2	0.01	100	1.0	
Rated Derivative Gain 2	ACTUATOR COMPENSATION 2	0.01	100	5.0	
Window Width 2	WINDOW WIDTH 2	1.0	2100	60.0	RPM
Gain Ratio 2	GAIN RATIO 2	1.0	10	1.0	
Speed Filter Frequency 2	SPEED FILTER FREQ 2	4.0	20.0	20.0	Hz
Bump Actuator Trigger	BUMP ACT TRIG (T THEN F)	False	True	False	

Fuel Limiters 1/2

Fuel limiters restrain the fuel demand from the control to the actuator.

Item	Display Name	Min	Max	Default	Units
Start Fuel Limiter (%Act)	START FUEL LIMIT (%ACT)	0.0	100	10.0	%Act

This is the percent fuel demand when the engine is started. It means that for starting point to a certain speed (next parameter) the speed PID output will be switched for this value.

Item	Display Name	Min	Max	Default	Units
Maximum Speed for Fuel Limit	MAX SPEED FOR FUEL LIMIT	0.0	4000	400.0	RPM

This is the maximum speed for switching the speed PID output by the Start Fuel Limiter. From this speed on the speed PID output will be passed directly to the LSS (Low Signal Selector) that determines the fuel demand.

Item	Display Name	Min	Max	Default	Units
Maximum Fuel Limiter	MAX FUEL LIMIT	50.0	110	100.0	%Act

Sets the maximum percent fuel demand. This is an electronic rack stop which is active in all modes of operation.

Item	Display Name	Min	Max	Default	Units
Enable Idle Limiter?	ENABLE IDLE LIMITER?	False	True	False	
Idle Fuel Limiter	IDLE FUEL LIMITER	0.0	100	100.0	%Act

These parameters set a fuel limiter when the engine is on idle speed. The first one enables/disables this limiter and the second one sets the value of the limiter.

Item	Display Name	Min	Max	Default	Units
Enable Torque Limiter?	ENABLE TORQUE LIMITER?	False	True	False	

Set to TRUE to enable the TORQ LIMIT CURVE. Set to FALSE to remove (disable) the TORQUE LIMIT CURVE.

Item	Display Name	Min	Max	Default	Units
Minimum Speed Torque Limiter	MIN SPEED TORQUE LIMIT	0.0	4000	300.0	RPM

This sets the first break point of the TLC. It should be adjusted to the rpm which represents the first break point. Typically this is set at minimum speed. The limit on fuel demand below this point is extrapolated from this point and the SPEED BRKPOINT TORQ LIM below.

Item	Display Name	Min	Max	Default	Units
Torque Limiter Minimum Speed	TORQUE LIMIT MIN SPEED	0.0	100	100.0	%Act

This sets the maximum fuel demand at the minimum speed set point.

Item	Display Name	Min	Max	Default	Units
Speed Breakpoint Torque Limiter	SPEED BRKPOINT TORQ LIMIT	0.0	4000	800.0	RPM

This sets the speed break point of the TLC. It should be adjusted to the rpm which represents the torque limit breakpoint.

Item	Display Name	Min	Max	Default	Units
Torque Limiter Breakpoint	TORQUE LIMIT BREAKPOINT	0.0	100	100.0	%Act

This sets the maximum fuel demand at the speed break point.

Item	Display Name	Min	Max	Default	Units
Maximum Speed Torque Limiter	MAX SPEED TORQUE LIMIT	0.0	4000	1000.0	RPM

This sets the maximum speed point of the TLC. It should be adjusted to the maximum rpm which represents the maximum fuel break point.

Item	Display Name	Min	Max	Default	Units
Torque Limiter Maximum Speed	TORQUE LIMIT MAX SPEED	0.0	100	100.0	%Act

This sets the maximum fuel demand at the maximum speed point.

Fuel Limiters 2/2

If this Limiter is used a 4~20mA input must be installed on the Analog Input 11 of the Analog Combo Board. This input is dedicated for this function. If this Limiter is not used there's no need to connect anything on this input.

Item	Display Name	Min	Max	Default	Units
Use MAP Limiter?	USE MAP LIMITER?	False	True	False	

When set TRUE the Manifold Air pressure limiter is active.

Item	Display Name	Min	Max	Default	Units
MAP Limiter Input Minimum	MAP LIMITER INPUT MIN	-10000	10000	0.0	

This is the minimum value (in engineering units, representing pressure) of the MAP input.

Item	Display Name	Min	Max	Default	Units
MAP Limiter Input Maximum	MAP LIMITER INPUT MAX	-10000	10000	20.0	

This is the maximum value (in engineering units, representing pressure) of the MAP input.

Item	Display Name	Min	Max	Default	Units
Pressure X1	PRESSURE X1	-10000	10000	6.0	

This sets the pressure at the first breakpoint. The limit on fuel demand below this point is extrapolated from this point and the pressure X2 below.

Item	Display Name	Min	Max	Default	Units
MAP Limiter Y1	MAP LIMIT Y1	0.0	100	100.0	%Act

This sets the maximum fuel demand at the first pressure set point.

Item	Display Name	Min	Max	Default	Units
Pressure X2	PRESSURE X1	-10000	10000	8.0	

This sets the pressure at the second breakpoint.

Item	Display Name	Min	Max	Default	Units
MAP Limiter Y2	MAP LIMIT Y2	0.0	100	100.0	%Act

This sets the maximum fuel demand at the second pressure set point.

Item	Display Name	Min	Max	Default	Units
Pressure X3	PRESSURE X1	-10000	10000	10.0	

This sets the pressure at the third breakpoint.

Item	Display Name	Min	Max	Default	Units
MAP Limiter Y3	MAP LIMIT Y3	0.0	100	100.0	%Act

This sets the maximum fuel demand at the third pressure set point.

Item	Display Name	Min	Max	Default	Units
Pressure X4	PRESSURE X1	-10000	10000	15.0	

This sets the pressure at the fourth breakpoint.

Item	Display Name	Min	Max	Default	Units
MAP Limiter Y4	MAP LIMIT Y4	0.0	100	100.0	%Act

This sets the maximum fuel demand at the fourth pressure set point.

Item	Display Name	Min	Max	Default	Units
Pressure X5	PRESSURE X1	-10000	10000	20.0	

This sets the pressure at the maximum breakpoint.

Item	Display Name	Min	Max	Default	Units
MAP Limiter Y5	MAP LIMIT Y5	0.0	100	100.0	%Act

This sets the maximum fuel demand at the maximum pressure set point.

Actuator Bump Setup

This menu is used to simulate a load on the engine when the real load is not available.

Item	Display Name	Min	Max	Default	Units
Actuator Bump Enable?	ACTUATOR BUMP ENABLE	False	True	False	

Set to TRUE to enable the actuator bump for 60 minutes. Set to FALSE to disable this function. When this prompt is set FALSE, the Actuator Bump tunable in the Dynamics sections described above is disabled.

Item	Display Name	Min	Max	Default	Units
Actuator Bump Level	ACT BUMP LEVEL	0.0	25.0	1.0	%Act

This is the % fuel demand for the desired bump level.

Item	Display Name	Min	Max	Default	Units
Actuator Bump Duration	ACT BUMP DURATION	0.08	2.0	0.11	s

The desired bump duration in seconds.

Item	Display Name	Min	Max	Default	Units
Bump Actuator Trigger	BUMP ACT TRIG (T THEN F)	False	True	False	

Allows you to test your dynamic settings by temporarily applying a decrease fuel demand transient to stimulate a control response. To initiate an actuator bump, toggle Bump Act to TRUE then back to FALSE while the engine is operating in a normal steady state loaded or unloaded condition.

Loadpulse Settings

This is a load rejection menu. It helps the engine keeping stability when big load blocks are put or taken from the engine.

Item	Display Name	Min	Max	Default	Units
Enable Loadpulse	ENABLE LOADPULSE	False	True	False	

This parameter enables (TRUE) or disables (FALSE) the Loadpulse logic.

The Loadpulse logic measures how fast the engine speed changes in time. When a large increase in engine speed is detected, the speed reference is momentarily decreased. If a large decrease in engine speed is detected, the speed reference is momentarily increased.

Item	Display Name	Min	Max	Default	Units
Low Level On	LOW LVL ON	-10000	10000	-100.0	rpm/s

This represents the level (of change in speed measured in rpm/s) at which the Loadpulse logic is activated, for large load acceptances. When this level is reached, then value entered In ADD FRM SP is subtracted from the speed reference (or actuator output).

Item	Display Name	Min	Max	Default	Units
Low Level Off	LOW LVL OFF	-10000	10000	100.0	rpm/s

This represents the level (of change in speed measured in rpm/s) at which the Loadpulse logic is activated, for large load rejections. When this level is

reached, then value entered In SUBTR TO SP is added to the speed reference (or actuator output).

Item	Display Name	Min	Max	Default	Units
Offset	OFFSET	-100.0	100.0	0.0	rpm

This represents the value to which the SUBTR FRM SP or ADD TO SP will return. Normally, this value should be set at 0.0.

Item	Display Name	Min	Max	Default	Units
Rate to Setpoint	RATE TO SP	0.0	100.0	50.0	rpm/s

This determines how fast (in rpm/s for speed reference, or actuator %/s) the value entered in OFFSET is reached, from value entered in ADD TO SP or SUBTR FRM SP.

Item	Display Name	Min	Max	Default	Units
Subtract from Setpoint	SUBTR FRM SP	-100.0	100.0	-50.0	rpm

This represents the value that is subtracted from the current speed reference, or from the actuator output in case of a large load rejection. This step is momentary and will return to the value entered in OFFSET. The rate with which this happens can be modified in RATE TO SP.

Item	Display Name	Min	Max	Default	Units
Add to Setpoint	ADD TO SP	-100.0	100.0	50.0	rpm

This represents the value added to the current speed reference, or from the actuator output if a large load acceptance occurs. This step is momentary, and returns to the value entered in OFFSET. The rate at which this occurs can be modified in RATE TO SP.

Analog Input 5

This menu shows the configuration of the Analog Input 5 (1st input of the Analog Combo Board). This is a thermocouple input and should be used only for alarm.

Item	Display Name	Min	Max	Default	Units
Analog Input 5 Label	ANALOG INPUT 5 LABEL		~~~~	ANALOG INPUT 5	ASCII

By this parameter a desired name can be given to Analog Input 5.

Item	Display Name	Min	Max	Default	Units
Use Analog Input 5?	USE ANALOG INPUT 5?	False	True	False	

This parameter enables/disables Analog Input 5.

Item	Display Name	Min	Max	Default	Units
Analog Input 5 in Celsius?	ANIN 5 IN CELSIUS?	False	True	False	

This parameter sets the measured temperature in Fahrenheit (False) or Celsius (True).

Item	Display Name	Min	Max	Default	Units
Analog Input 5 Type	ANALOG INPUT 5 TYPE	1	7	3	

This parameter set the type of thermocouple sensor that will be used. Look at the table below:

Thermocouple number	Thermocouple type
1	E
2	J
3	K
4	N
5	R
6	S
7	T

Item	Display Name	Min	Max	Default	Units
Monitoring Only When Engine is running?	MONIT ONLY WHEN ENG RUN?	False	True	False	

This parameter is set to FALSE if it's wanted to monitor this Analog Input always or TRUE if it's wanted to monitor this Analog Input only when the engine is running.

Item	Display Name	Min	Max	Default	Units
Analog Input 5 High Alarm Level	AN INPUT 5 HI ALM LVL	-30000	30000	100.0	ºF or ºC

This is the temperature level to activate the Analog Input 5 High Alarm.

Item	Display Name	Min	Max	Default	Units
Analog Input 5 Low Alarm Level	AN INPUT 5 LO ALM LVL	-30000	30000	0.0	ºF or ºC

This is the temperature level to activate the Analog Input 5 Low Alarm.

Item	Display Name	Min	Max	Default	Units
Analog Input 5 Alarm Delay	AN INPUT 5 ALM DLY	0.1	1200	10.0	s

This parameter is the time delay needed to activate the High Alarm or Low Alarm. It means that if the temperature is higher than High Alarm Level or lower than Low Alarm Level for at least the Alarm Delay the High Alarm or Low Alarm will activate.

Item	Display Name	Min	Max	Default	Units
Analog Input 5 High Alarm	AN INPUT 5 HI ALM	1	6	1	

This parameter shows the action taken when a High Alarm is activated. Refer to Table 3-2 for the list of alarm actions.

Item	Display Name	Min	Max	Default	Units
Analog Input 5 Low Alarm	AN INPUT 5 LO ALM	1	6	1	

This parameter shows the action taken when a Low Alarm is activated. Refer to Table 3-2 for the list of alarm actions.

Item	Display Name	Min	Max	Default	Units
Analog Input 5 High Warning Level	AN INPUT 5 HI WRN LVL	-9999	9999	100.0	ºF or ºC

This is the temperature level to activate the Analog Input 5 High Warning.

Item	Display Name	Min	Max	Default	Units
Analog Input 5 Low Warning Level	AN INPUT 5 LO WRN LVL	-9999	9999	0.0	ºF or ºC

This is the temperature level to activate the Analog Input 5 Low Warning.

Item	Display Name	Min	Max	Default	Units
Analog Input 5 Warning Delay	AN INPUT 5 WRN DLY	0.1	1200	5.0	s

This parameter is the time delay needed to activate the High Warning or Low Warning. It means that if the temperature is higher than High Warning Level or lower than Low Warning Level for at least the Warning Delay the High Warning or Low Warning will activate.

Item	Display Name	Min	Max	Default	Units
Analog Input 5 High Warning	AN INPUT 5 HI WRN	1	6	1	

This parameter shows the action taken when a High Warning is activated. Refer to Table 3-2 for the list of alarm actions.

Item	Display Name	Min	Max	Default	Units
Analog Input 5 Low Warning	AN INPUT 5 LO WRN	1	6	1	

This parameter shows the action taken when a Low Warning is activated. Refer to Table 3-2 for the list of alarm actions.

Analog Input 6

This menu shows the configuration of the Analog Input 6 (2nd input of the Analog Combo Board). This is a thermocouple input and should be used only for alarm. It is configured the same way as Analog Input 5.

Item	Display Name	Min	Max	Default	Units
Analog Input 6 Label	ANALOG INPUT 6 LABEL		~~~~	ANALOG INPUT 6	ASCII
Use Analog Input 6?	USE ANALOG INPUT 6?	False	True	False	
Analog Input 6 in Celsius?	ANIN 6 IN CELSIUS?	False	True	False	
Analog Input 6 Type	ANALOG INPUT 6 TYPE	1	7	3	
Monitoring Only When Engine is running?	MONIT ONLY WHEN ENG RUN?	False	True	False	
Analog Input 6 High Alarm Level	AN INPUT 6 HI ALM LVL	-30000	30000	100.0	ºF or ºC
Analog Input 6 Low Alarm Level	AN INPUT 6 LO ALM LVL	-30000	30000	0.0	ºF or ºC
Analog Input 6 Alarm Delay	AN INPUT 6 ALM DLY	0.1	1200	10.0	s
Analog Input 6 High Alarm	AN INPUT 6 HI ALM	1	6	1	
Analog Input 6 Low Alarm	AN INPUT 6 LO ALM	1	6	1	
Analog Input 6 High Warning Level	AN INPUT 6 HI WRN LVL	-9999	9999	100.0	ºF or ºC
Analog Input 6 Low Warning Level	AN INPUT 6 LO WRN LVL	-9999	9999	0.0	ºF or ºC
Analog Input 6 Warning Delay	AN INPUT 6 WRN DLY	0.1	1200	5.0	s
Analog Input 6 High Warning	AN INPUT 6 HI WRN	1	6	1	
Analog Input 6 Low Warning	AN INPUT 6 LO WRN	1	6	1	

Analog Input 9

This menu shows the configuration of the Analog Input 9 (5th input of the Analog Combo Board). This is a 4~20mA input and should be used only for alarm.

Item	Display Name	Min	Max	Default	Units
Analog Input 9 Label	ANALOG INPUT 9 LABEL		~~~~	ANALOG INPUT 9	ASCII

By this parameter a desired name can be given to Analog Input 9.

Item	Display Name	Min	Max	Default	Units
Use Analog Input 9?	USE ANALOG INPUT 9?	False	True	False	

This parameter enables/disables Analog Input 9.

Item	Display Name	Min	Max	Default	Units
Analog Input 9 Low Value	ANALOG INPUT 9 LOW VALUE?	-30000	30000	0.0	User

This parameter sets the value of Analog Input 9 in engineering units when the input is 4mA.

Item	Display Name	Min	Max	Default	Units
Analog Input 9 High Value	ANALOG INPUT 9 HIGH VALUE?	-30000	30000	100.0	User

This parameter sets the value of Analog Input 9 in engineering units when the input is 20mA.

Item	Display Name	Min	Max	Default	Units
Monitoring Only When Engine is running?	MONIT ONLY WHEN ENG RUN?	False	True	False	

This parameter is set to FALSE if it's wanted to monitor this Analog Input always or TRUE if it's wanted to monitor this Analog Input only when the engine is running.

Item	Display Name	Min	Max	Default	Units
Analog Input 9 High Alarm Level	AN INPUT 9 HI ALM LVL	-30000	30000	100.0	User

This is the temperature level to activate the Analog Input 9 High Alarm.

Item	Display Name	Min	Max	Default	Units
Analog Input 9 Low Alarm Level	AN INPUT 9 LO ALM LVL	-30000	30000	0.0	User

This is the temperature level to activate the Analog Input 9 Low Alarm.

Item	Display Name	Min	Max	Default	Units
Analog Input 9 Alarm Delay	AN INPUT 9 ALM DLY	0.1	1200	10.0	s

This parameter is the time delay needed to activate the High Alarm or Low Alarm. It means that if the temperature is higher than High Alarm Level or lower than Low Alarm Level for at least the Alarm Delay the High Alarm or Low Alarm will activate.

Item	Display Name	Min	Max	Default	Units
Analog Input 9 High Alarm	AN INPUT 9 HI ALM	1	6	1	

This parameter shows the action taken when a High Alarm is activated. Refer to Table 3-2 for the list of alarm actions.

Item	Display Name	Min	Max	Default	Units
Analog Input 9 Low Alarm	AN INPUT 9 LO ALM	1	6	1	

This parameter shows the action taken when a Low Alarm is activated. Refer to Table 3-2 for the list of alarm actions.

Item	Display Name	Min	Max	Default	Units
Analog Input 9 High Warning Level	AN INPUT 9 HI WRN LVL	-30000	30000	100.0	User

This is the temperature level to activate the Analog Input 9 High Warning.

Item	Display Name	Min	Max	Default	Units
Analog Input 9 Low Warning Level	AN INPUT 9 LO WRN LVL	-30000	30000	0.0	User

This is the temperature level to activate the Analog Input 9 Low Warning.

Item	Display Name	Min	Max	Default	Units
Analog Input 9 Warning Delay	AN INPUT 9 WRN DLY	0.1	1200	10.0	s

This parameter is the time delay needed to activate the High Warning or Low Warning. It means that if the temperature is higher than High Warning Level or lower than Low Warning Level for at least the Warning Delay the High Warning or Low Warning will activate.

Item	Display Name	Min	Max	Default	Units
Analog Input 9 High Warning	AN INPUT 9 HI WRN	1	6	1	

This parameter shows the action taken when a High Warning is activated. Refer to Table 3-2 for the list of alarm actions.

Item	Display Name	Min	Max	Default	Units
Analog Input 9 Low Warning	AN INPUT 9 LO WRN	1	6	1	

This parameter shows the action taken when a Low Warning is activated. Refer to Table 3-2 for the list of alarm actions.

Analog Input 10

This menu shows the configuration of the Analog Input 10 (6th input of the Analog Combo Board). This is a 4~20mA input and should be used only for alarm. It is configured the same way as Analog Input 9.

Item	Display Name	Min	Max	Default	Units
Analog Input 10 Label	ANALOG INPUT 10 LABEL		~~~~	ANALOG INPUT 10	ASCII
Use Analog Input 10?	USE ANALOG INPUT 10?	False	True	False	
Analog Input 10 Low Value	ANALOG INPUT 10 LOW VALUE?	-30000	30000	0.0	User
Analog Input 10 High Value	ANALOG INPUT 10 HIGH VALUE?	-30000	30000	100.0	User
Monitoring Only When Engine is running?	MONIT ONLY WHEN ENG RUN?	False	True	False	

Item	Display Name	Min	Max	Default	Units
Analog Input 10 High Alarm Level	AN INPUT 10 HI ALM LVL	-30000	30000	100.0	User
Analog Input 10 Low Alarm Level	AN INPUT 10 LO ALM LVL	-30000	30000	0.0	User
Analog Input 10 Alarm Delay	AN INPUT 10 ALM DLY	0.1	1200	10.0	s
Analog Input 10 High Alarm	AN INPUT 10 HI ALM	1	6	1	
Analog Input 10 Low Alarm	AN INPUT 10 LO ALM	1	6	1	
Analog Input 10 High Warning Level	AN INPUT 10 HI WRN LVL	-30000	30000	100.0	User
Analog Input 10 Low Warning Level	AN INPUT 10 LO WRN LVL	-30000	30000	0.0	User
Analog Input 10 Warning Delay	AN INPUT 10 WRN DLY	0.1	1200	10.0	s
Analog Input 10 High Warning	AN INPUT 10 HI WRN	1	6	1	
Analog Input 10 Low Warning	AN INPUT 10 LO WRN	1	6	1	

Analog Input 16

This menu shows the configuration of the Analog Input 16 (12th input of the Analog Combo Board). This is a RTD input and should be used only for alarm.

Item	Display Name	Min	Max	Default	Units
Analog Input 16 Label	ANALOG INPUT 16 LABEL		~~~~	ANALOG INPUT 16	ASCII

By this parameter a desired name can be given to Analog Input 16.

Item	Display Name	Min	Max	Default	Units
Use Analog Input 16?	USE ANALOG INPUT 16?	False	True	False	

This parameter enables/disables Analog Input 16.

Item	Display Name	Min	Max	Default	Units
Analog Input 16 in Celsius?	ANIN 16 IN CELSIUS?	False	True	False	

This parameter sets the measured temperature in Fahrenheit (False) or Celsius (True).

Item	Display Name	Min	Max	Default	Units
Monitoring Only When Engine is running?	MONIT ONLY WHEN ENG RUN?	False	True	False	

This parameter is set to FALSE if it's wanted to monitor this Analog Input always or TRUE if it's wanted to monitor this Analog Input only when the engine is running.

Item	Display Name	Min	Max	Default	Units
Analog Input 16 High Alarm Level	AN INPUT 16 HI ALM LVL	-30000	30000	100.0	ºF or ºC

This is the temperature level to activate the Analog Input 16 High Alarm.

Item	Display Name	Min	Max	Default	Units
Analog Input 16 Low Alarm Level	AN INPUT 16 LO ALM LVL	-30000	30000	0.0	ºF or ºC

This is the temperature level to activate the Analog Input 16 Low Alarm.

Item	Display Name	Min	Max	Default	Units
Analog Input 16 Alarm Delay	AN INPUT 16 ALM DLY	0.1	1200	10.0	s

This parameter is the time delay needed to activate the High Alarm or Low Alarm. It means that if the temperature is higher than High Alarm Level or lower than Low Alarm Level for at least the Alarm Delay the High Alarm or Low Alarm will activate.

Item	Display Name	Min	Max	Default	Units
Analog Input 16 High Alarm	AN INPUT 16 HI ALM	1	6	1	

This parameter shows the action taken when a High Alarm is activated. Refer to Table 3-2 for the list of alarm actions.

Item	Display Name	Min	Max	Default	Units
Analog Input 16 Low Alarm	AN INPUT 16 LO ALM	1	6	1	

This parameter shows the action taken when a Low Alarm is activated. Refer to Table 3-2 for the list of alarm actions.

Item	Display Name	Min	Max	Default	Units
Analog Input 16 High Warning Level	AN INPUT 16 HI WRN LVL	-9999	9999	100.0	ºF or ºC

This is the temperature level to activate the Analog Input 16 High Warning.

Item	Display Name	Min	Max	Default	Units
Analog Input 16 Low Warning Level	AN INPUT 16 LO WRN LVL	-9999	9999	0.0	ºF or ºC

This is the temperature level to activate the Analog Input 16 Low Warning.

Item	Display Name	Min	Max	Default	Units
Analog Input 16 Warning Delay	AN INPUT 16 WRN DLY	0.1	1200	5.0	s

This parameter is the time delay needed to activate the High Warning or Low Warning. It means that if the temperature is higher than High Warning Level or lower than Low Warning Level for at least the Warning Delay the High Warning or Low Warning will activate.

Item	Display Name	Min	Max	Default	Units
Analog Input 16 High Warning	AN INPUT 16 HI WRN	1	6	1	

This parameter shows the action taken when a High Warning is activated. Refer to Table 3-2 for the list of alarm actions.

Item	Display Name	Min	Max	Default	Units

Item	Display Name	Min	Max	Default	Units
Analog Input 16 Low Warning	AN INPUT 16 LO WRN	1	6	1	

This parameter shows the action taken when a Low Warning is activated. Refer to Table 3-2 for the list of alarm actions.

Analog Input 17

This menu shows the configuration of the Analog Input 17 (13th input of the Analog Combo Board). This is a RTD input and should be used only for alarm. It is configured the same way as Analog Input 16.

Item	Display Name	Min	Max	Default	Units
Analog Input 17 Label	ANALOG INPUT 17 LABEL		~~~~	ANALOG INPUT 17	ASCII
Use Analog Input 17?	USE ANALOG INPUT 17?	False	True	False	
Analog Input 17 in Celsius?	ANIN 17 IN CELSIUS?	False	True	False	
Monitoring Only When Engine is running?	MONIT ONLY WHEN ENG RUN?	False	True	False	
Analog Input 17 High Alarm Level	AN INPUT 17 HI ALM LVL	-30000	30000	100.0	ºF or ºC
Analog Input 17 Low Alarm Level	AN INPUT 17 LO ALM LVL	-30000	30000	0.0	ºF or ºC
Analog Input 17 Alarm Delay	AN INPUT 17 ALM DLY	0.1	1200	10.0	s
Analog Input 17 High Alarm	AN INPUT 17 HI ALM	1	6	1	
Analog Input 17 Low Alarm	AN INPUT 17 LO ALM	1	6	1	
Analog Input 17 High Warning Level	AN INPUT 17 HI WRN LVL	-9999	9999	100.0	ºF or ºC
Analog Input 17 Low Warning Level	AN INPUT 17 LO WRN LVL	-9999	9999	0.0	ºF or ºC
Analog Input 17 Warning Delay	AN INPUT 17 WRN DLY	0.1	1200	5.0	s
Analog Input 17 High Warning	AN INPUT 17 HI WRN	1	6	1	
Analog Input 17 Low Warning	AN INPUT 17 LO WRN	1	6	1	

Analog Input 18

This menu shows the configuration of the Analog Input 18 (14th input of the Analog Combo Board). This is a RTD input and should be used only for alarm. It is configured the same way as Analog Input 16.

Item	Display Name	Min	Max	Default	Units
Analog Input 18 Label	ANALOG INPUT 18 LABEL		~~~~	ANALOG INPUT 18	ASCII
Use Analog Input 18?	USE ANALOG INPUT 18?	False	True	False	
Analog Input 18 in Celsius?	ANIN 18 IN CELSIUS?	False	True	False	
Monitoring Only When Engine is running?	MONIT ONLY WHEN ENG RUN?	False	True	False	
Analog Input 18 High Alarm Level	AN INPUT 18 HI ALM LVL	-30000	30000	100.0	ºF or ºC
Analog Input 18 Low	AN INPUT 18 LO	-30000	30000	0.0	ºF or ºC

Item	Display Name	Min	Max	Default	Units
Alarm Level	ALM LVL				
Analog Input 18 Alarm Delay	AN INPUT 18 ALM DLY	0.1	1200	10.0	s
Analog Input 18 High Alarm	AN INPUT 18 HI ALM	1	6	1	
Analog Input 18 Low Alarm	AN INPUT 18 LO ALM	1	6	1	
Analog Input 18 High Warning Level	AN INPUT 18 HI WRN LVL	-9999	9999	100.0	ºF or ºC
Analog Input 18 Low Warning Level	AN INPUT 18 LO WRN LVL	-9999	9999	0.0	ºF or ºC
Analog Input 18 Warning Delay	AN INPUT 18 WRN DLY	0.1	1200	5.0	s
Analog Input 18 High Warning	AN INPUT 18 HI WRN	1	6	1	
Analog Input 18 Low Warning	AN INPUT 18 LO WRN	1	6	1	

Frequency Test

This menu is used to simulate an overfrequency or underfrequency condition to test these protections. So don't use this menu in normal operation of the engine.

Item	Display Name	Min	Max	Default	Units
Use Frequency Test?	USE FREQUENCY TEST?	False	True	False	

This parameter is used to enable the under or overfrequency test.

Item	Display Name	Min	Max	Default	Units
Under or Overfrequency Test	UNDER OR OVER FREQ TEST	False	True	False	

This parameter selects if a under or an overfrequency test will be performed. If this parameter is FALSE and the frequency test is enabled an underfrequency test will be performed. If this parameter is TRUE and the frequency test is enabled an overfrequency test will be performed.

Item	Display Name	Min	Max	Default	Units
Underfrequency Pulse Time	UNDER PULSE TIME	0.1	10.0	1.0	s

The underfrequency test is performed by a square signal that slightly decreases the speed reference. The period of this square signal is determined by the parameter above. A pulse time of 1s means that the signal will be a square signal with a period of 2s, where during 1s the signal will be high (TRUE) and during 1s the signal will be low (FALSE).

Item	Display Name	Min	Max	Default	Units
Overfrequency Pulse Time	OVER PULSE TIME	0.1	10.0	1.0	s

The overfrequency test is performed by a square signal that slightly increases the speed reference. The period of this square signal is determined by the parameter above. A pulse time of 1s means that the signal will be a square signal with a period of 2s, where during 1s the signal will be high (TRUE) and during 1s the signal will be low (FALSE).

Item	Display Name	Min	Max	Default	Units
Underfrequency Rate	UNDER RATE	0.1	20.0	3.0	rpm/s

This parameter represents the rate of change of the speed reference of an underfrequency test during the time that the underfrequency pulse is high (TRUE).

Item	Display Name	Min	Max	Default	Units
Overfrequency Rate	OVER RATE	0.1	20.0	3.0	rpm/s

This parameter represents the rate of change of the speed reference of an overfrequency test during the time that the overfrequency pulse is high (TRUE).

Item	Display Name	Min	Max	Default	Units
Underfrequency Setpoint	UNDER SETPOINT	50.0	100.0	60.0	% rated

This is the minimum speed that the underfrequency test will achieve (measured in % of the rated speed).

Item	Display Name	Min	Max	Default	Units
Overfrequency Setpoint	OVER SETPOINT	100.0	200.0	140.0	% rated

This is the maximum speed that the overfrequency test will achieve (measured in % of the rated speed).

Speed Switch Config

This menu is used to configure the speed switch function, available on function 39 of the relays outputs.

Item	Display Name	Min	Max	Default	Units
Speed Switch On	SPEED SWITCH ON	-32000	32000	0.0	rpm

This parameter determines in which speed the speed switch will be on.

Item	Display Name	Min	Max	Default	Units
Speed Switch Off	SPEED SWITCH OFF	-32000	32000	0.0	rpm

This parameter determines in which speed the speed switch will be off.

Analog Combo Calibration

This menu is intended to make the calibration of the inputs of the Analog Combo Board.

Item	Display Name	Min	Max	Default	Units
Analog Input 5 Offset	ANALOG INPUT 5 OFFSET	-200	200	0.0	

This parameter sets the offset of the Analog Input 5.

Item	Display Name	Min	Max	Default	Units
Analog Input 5 Gain	ANALOG INPUT 5 GAIN	0.5	1.5	1.0	

This parameter sets the gain of the Analog Input 5.

Item	Display Name	Min	Max	Default	Units
Analog Input 6 Offset	ANALOG INPUT 6 OFFSET	-200	200	0.0	

This parameter sets the offset of the Analog Input 6.

Item	Display Name	Min	Max	Default	Units
Analog Input 6 Gain	ANALOG INPUT 6 GAIN	0.5	1.5	1.0	

This parameter sets the gain of the Analog Input 6.

Item	Display Name	Min	Max	Default	Units
Analog Input 9 Offset	ANALOG INPUT 9 OFFSET	-200	200	0.0	

This parameter sets the offset of the Analog Input 9.

Item	Display Name	Min	Max	Default	Units
Analog Input 9 Gain	ANALOG INPUT 9 GAIN	0.5	1.5	1.0	

This parameter sets the gain of the Analog Input 9.

Item	Display Name	Min	Max	Default	Units
Analog Input 10 Offset	ANALOG INPUT 10 OFFSET	-200	200	0.0	

This parameter sets the offset of the Analog Input 10.

Item	Display Name	Min	Max	Default	Units
Analog Input 10 Gain	ANALOG INPUT 10 GAIN	0.5	1.5	1.0	

This parameter sets the gain of the Analog Input 10.

Item	Display Name	Min	Max	Default	Units
Analog Input 15 Offset	ANALOG INPUT 15 OFFSET	-200	200	0.0	

This parameter sets the offset of the Analog Input 15.

Item	Display Name	Min	Max	Default	Units
Analog Input 15 Gain	ANALOG INPUT 15 GAIN	0.5	1.5	1.0	

This parameter sets the gain of the Analog Input 15.

Item	Display Name	Min	Max	Default	Units
Analog Input 16 Offset	ANALOG INPUT 16 OFFSET	-200	200	0.0	

This parameter sets the offset of the Analog Input 16.

Item	Display Name	Min	Max	Default	Units
Analog Input 16 Gain	ANALOG INPUT 16 GAIN	0.5	1.5	1.0	

This parameter sets the gain of the Analog Input 16.

Item	Display Name	Min	Max	Default	Units
Analog Input 16 Type	ANALOG INPUT 16 TYPE	1	2	1	

This integer input sets this channel as either a 100-Ohm RTD or a 200-Ohm RTD input. A value of 1 is 100 Ohm. A value of 2 is 200 Ohm.

Item	Display Name	Min	Max	Default	Units
Analog Input 16 Curve	ANALOG INPUT 16 CURVE	1	2	1	

This integer input determines what temperature coefficient the RTD sensor is calibrated. To use a RTD that is calibrated with an alpha = 0.00392 (American),

the input should be a 1. To use a RTD that is calibrated with an alpha = 0.00385 (European), the input should be a 2.

Item	Display Name	Min	Max	Default	Units
Analog Input 17 Offset	ANALOG INPUT 17 OFFSET	-200	200	0.0	

This parameter sets the offset of the Analog Input 17.

Item	Display Name	Min	Max	Default	Units
Analog Input 17 Gain	ANALOG INPUT 17 GAIN	0.5	1.5	1.0	

This parameter sets the gain of the Analog Input 17.

Item	Display Name	Min	Max	Default	Units
Analog Input 17 Type	ANALOG INPUT 17 TYPE	1	2	1	

This integer input sets this channel as either a 100-Ohm RTD or a 200-Ohm RTD input. A value of 1 is 100 Ohm. A value of 2 is 200 Ohm.

Item	Display Name	Min	Max	Default	Units
Analog Input 17 Curve	ANALOG INPUT 17 CURVE	1	2	1	

This integer input determines what temperature coefficient the RTD sensor is calibrated. To use a RTD that is calibrated with an alpha = 0.00392 (American), the input should be a 1. To use a RTD that is calibrated with an alpha = 0.00385 (European), the input should be a 2.

Item	Display Name	Min	Max	Default	Units
Analog Input 18 Offset	ANALOG INPUT 18 OFFSET	-200	200	0.0	

This parameter sets the offset of the Analog Input 18.

Item	Display Name	Min	Max	Default	Units
Analog Input 18 Gain	ANALOG INPUT 18 GAIN	0.5	1.5	1.0	

This parameter sets the gain of the Analog Input 18.

Item	Display Name	Min	Max	Default	Units
Analog Input 18 Type	ANALOG INPUT 18 TYPE	1	2	1	

This integer input sets this channel as either a 100-Ohm RTD or a 200-Ohm RTD input. A value of 1 is 100 Ohm. A value of 2 is 200 Ohm.

Item	Display Name	Min	Max	Default	Units
Analog Input 18 Curve	ANALOG INPUT 18 CURVE	1	2	1	

This integer input determines what temperature coefficient the RTD sensor is calibrated. To use a RTD that is calibrated with an alpha = 0.00392 (American), the input should be a 1. To use a RTD that is calibrated with an alpha = 0.00385 (European), the input should be a 2.

Item	Display Name	Min	Max	Default	Units
Thermocouple Group Fault	THERMOCOUPLE GROUP FAULT	1	6	1	

This parameter is used to configure the sensor fault of any of the thermocouple inputs in the Analog Combo board. Refer to Table 3-2 for the list of alarm actions.

Item	Display Name	Min	Max	Default	Units
4-20mA Group Fault	4-20mA GROUP FAULT	1	6	1	

This parameter is used to configure the fault of any of the 4~20mA inputs in the Analog Combo board. Refer to Table 3-2 for the list of alarm actions.

Item	Display Name	Min	Max	Default	Units
RTD Group Fault	RTD GROUP FAULT	1	6	1	

This parameter is used to configure the fault of any of the RTD inputs in the Analog Combo board. Refer to Table 3-2 for the list of alarm actions.

Chapter 4.
Monitoring by Watch Window

Introduction

The following page describe the Watch Window sheets that contain information used in monitoring the status of the Genset or to assist in troubleshooting procedures.

Sequence States Menu

The AtlasSC™ Load+Speed Control uses a state machine for determining its operating mode at any given time. The unit will step through these states from start to stop. Some states the control will skip or step through too quickly to see indication change.

Display Name	Item	Units
01 INITIALIZE POWER UP	Power has just came on, initializing parameters	T/F
02 S100 OUT OF OPERATION	Engine is off, waiting for a start command	T/F
03 S210 INITIALIZE START	Start command has been received, initializing timers	T/F
04 S220 GLOW PLUGS	The Glow plugs are on, waiting for timeout	T/F
05 S230 TURN ON STARTER	Engage starter motor, cranking engine	T/F
06 S240 STARTER COOL DOWN	Engine did not start, waiting for timeout	T/F
07 S250 AT IDLE SPEED	Engine is rung at idle speed	T/F
08 S260 IDLE OK START RAMP	Idle time complete, start ramp to rated	T/F
09 S270 RAMP TO RATED	Engine speed is between idle and rated	T/F
10 S280 AT RATED SPEED	Genset is at rated speed, no load	T/F
11 S290 GEN SYNCHRONIZE	Synchronizer is active	T/F
12 S300 SOFT LOAD CONTROL	Gen Breaker is closed, ramping into load control	T/F
13 S320 LOAD CONTROL	Normal running state. Controlling load in configured mode and level	T/F
14 S340 SOFT UNLOAD CONTROL	A normal stop has been received, ramping load to minimum	T/F
15 S350 GEN BREAKER OPENING	Opening generator breaker	T/F
16 S360 COOLDOWN	Running at no load and at cooldown speed, a normal shutdown will return to S100, out of operation.	T/F
17 S400 SOFT SHUTDOWN	A soft shutdown alarm is active, reset is required	T/F
18 S500 HARD SHUTDOWN	A hard Shutdown alarm is active, reset is required	T/F

Units Menu

The purpose of this data is to serve as units of measurement for all ac parameters in other Service and Configuration menus.

Display Name	Item	Units
GEN. POWER	Gen. Power Units	W, VA, VAR; KW, KVA, KVAR; MW, MVA, MVAR; GW, GVA, GVAR
GEN. VOLTAGE	Gen. Voltage Units	Volts, Kilovolt
GEN. CURRENT	Gen. Current Units	Amps, Kilamps
BUS VOLTAGE	Bus Voltage Units	Volts, Kilovolts

If a value of Kilovolt is observed, the related ac quantity is scaled by 1000. For example, if Bus Voltage Units is Kilovolt than a value of 4.160 in Bus Rated Voltage will be interpreted as 4160 volts.

If a value of MW, MVA, MVAR is observed, the related ac quantity is scaled by 1,000,000. For example, if Gen. Power Units is MW, MVA, MVAR than a value of 30.456 in Gen. Rated Watts will be interpreted as 30,456,000 watts or 30.456 megawatts.

LON Status Messaging Menu

A troubleshooting aid of the LON information
IN = Input from this application and sent to other LON Units
OUT= Output from other units and input into this application

Display Name	IN/OUT		Units
NODE NUM	IN	This units assigned unit/node number	#
UNIT PF	IN	Power Factor of this unit	#
UNIT LOAD	IN	Real Load on this unit	#
LOAD SHARE	OUT	Indicates that this unit is Load Sharing	T/F
PF SHARE	OUT	Indicates that this unit is PF sharing	T/F
PROC MSTR	OUT	Indicates this node is acting as the process master	T/F
BRK CLOSED	IN	Gen Breaker Closed	T/F
DEADBUS	IN	This unit sees the bus a being dead	T/F
DB REQUEST	IN	This unit would like to close onto the deadbus	T/F
CLR ATTEMPT	IN	Clear the Deadbus close failure for this unit	T/F
BUS SEG A	IN	Bus Segment A is Active	T/F
BUS SEG B	IN	Bus Segment B is Active	T/F
BUS SEG C	IN	Bus Segment C is Active	T/F
BUS SEG D	IN	Bus Segment D is Active	T/F
START RDY	IN	This genset is ready to start	T/F
START RQST	IN	Request to start next available genset	T/F
STOP RQST	IN	Request to stop next available genset	T/F
STOP RDY	IN	Genset Ready to be stopped	#
CAPACITY	IN	Rated Power of this genset	#
PWR UNITS	IN	Indicates the units (K, M, etc) of the active units power	#
SVC HOURS	IN	Hours remaining before service	#
MON TBKR	IN	Enables transmission of segment tie breakers to other units	T/F
TIE W	IN	W Tie Breaker Aux contact input	T/F
TIE X	IN	X Tie Breaker Aux contact input	T/F
TIE Y	IN	Y Tie Breaker Aux contact input	T/F
TIE Z	IN	Z Tie Breaker Aux contact input	T/F
SS ARB ALG	IN	Tell LON logic which algorithm to use for starting/stopping	#
IN S BIAS	IN	Value of unit synchronizer bias signal	#
SEND SYNC	IN	Enable send of the sync bias message	T/F
RAISE VOLT	IN	Message for all other units to raise their voltage	T/F
LOWER VOLT	IN	Message for all other units to lower their voltage	T/F
TIE BRKR W	OUT	W Tie Breaker is closed, two bus segments are connected	T/F
TIE BRKR X	OUT	X Tie Breaker is closed, two bus segments are connected	T/F
TIE BRKR Y	OUT	Y Tie Breaker is closed, two bus segments are connected	T/F
TIE BRKR Z	OUT	Z Tie Breaker is closed, two bus segments are connected	T/F
DEAD BUS GRANT	OUT	This unit has received ok to close onto the deadbus	T/F
PROC SLAVE	OUT	A process master controller is in control of the network	T/F
VOLT RAISE	OUT	A voltage raise command has been given by the master	T/F
VOLT LOWER	OUT	A voltage lower command has been given by the master	T/F
NET NODE	OUT	Number of LON devices on the network	#
SEG NODES	OUT	Number of nodes active on this bus segment	#
LS NODES	OUT	Indicates the number of units sharing load on this bus segment	#
STRT NODES	OUT	Number of Gensets ready to start on this bus	T/F
STOP NODES	OUT	Number of Gensets ready to stop on this bus	T/F
SYS_PF	OUT	indicates the system power factor	#
SYS LOAD	OUT	System Load %	#
SYNC BIAS	OUT	Indicates the master sync bias command value.	#

Display Name	IN/OUT		Units
ONLINE DMD	OUT	Total power being generated by all the generator sets on the same active bus segment who have their breakers closed	#
OL D UNITS	OUT	Indicates the units (K, M, etc) of the active units ONLINE_DMD	#
ONLINE CAP	OUT	Maximum total power output capable of being generated by all the generator sets on the same active bus segment who have their breakers closed	#
OL C UNITS	OUT	Indicates the units (K, M, etc) of the active units ONLINE_CAP	#
START CMD	OUT	Start this genset	T/F
STOP CMD	OUT	Stop this genset	T/F
START DONE	OUT	The requested genset has finished starting	T/F
STOP DONE	OUT	The requested genset has finished stopping	T/F
NEXT START	OUT	Displays which unit/node number will get the next start cmd	#
NEXT STOP	OUT	Displays which unit/node number will get the next stop cmd	#
SYS NUM ID	OUT	This number, when decoded, give the node numbers that are active	#
ERR FLAG	OUT	Indicates an error has occurred with the LON communication	T/F
MSTART CMD	OUT	Tells all units to initiate a start	T/F
MSTOP CMD	OUT	Tells all units to initiate a stop	T/F
ERROR NUMBER	OUT	This value is a coded number for troubleshooting the LON network	#
SYNC MSTR IN CONTROL	OUT	Indicates that this unit is the unit that is the master synching unit	

Application Info Menu

This menu gives information of the software, such as P/N, revision and name.

Display Name	Item	Units
APP SOFTWARE NUMBER	Application Software Number	NA
APP SOFTWARE REVISION	Application Software Revision	NA
APPLICATION NAME	Application Name	NA

Status System Menu

An overview of the system operation.

Display Name	Item	Units
01 ALARMS:	Displays the number of active alarms on the unit	#
02 UNIT	Displays the number of this unit	#
03 GEN	Stable (++), Stable timing (+-), Out of Spec(--)	
04 BUS	Stable (++),Out of Spec(--)	
05 ENGINE:	Shows the operating state of the engine	
06 GENERATOR SET STATE:	Shows the state of the genset as a whole, how/why the unit started	
07 HZ	The frequency of the generator set	Hz
08 KW	The total kW load on the generator	W
09 GEN PF:	The average three phase power factor of the generator set	NA
10 PF DIRECTION	Lead / Lag	
11 WATT-HOURS	The total accumulated Watt hours produced by the generator set	MW-HR
12 RUN-TIME HUN	The total accumulated run time of the generator set in hours. (NOT Service Hours)	Hours
13 RUN-TIME THSND	The total accumulated run time of the generator set in hours. (NOT Service Hours)	Hours
14 CONFIGURATION STATUS	Source of error causing a Configuration Alarm	
15 CONTACT IN CONFIGURE ERR	Displays which input channels are configured wrong.	
16 DEAD BUS	Displays if the bus segment is dead	T/F

Status Engine Menu

An overview of the Engine state and operating parameters.

Display Name	Item	Units
01 DATE / TIME	Current Date and Time of the AtlasSC Load+Speed Control Clock	Y/M/D H:M:S
02 ENGINE:	The state of the engine control function	
03 RPM MPU1:	Speed seen by Pickup1	RPM
04 RPM MPU2:	Speed seen by Pickup2	RPM
05 RPM TO CONTROL:	Engine speed to control	RPM
06 MPU MAXDIFF ALARM:	Shows the status of MPU maximum difference alarm	
07 FUEL DEMAND:	Actuator output	%
08 SPEED REFERENCE	Shows actual speed reference including Speed Bias	RPM
09 SPEED BIAS	Shows actual speed bias reference	RPM
10 FUEL CONTROL MODE	Shows which fuel limiter is active at the moment	
11 BATTERY VOLT:	Battery Voltage	Volts dc
12 ENGINE TEMP:	Coolant Temperature	User
13 OIL PRESSURE:	Oil Pressure	User
14 GEN BREAKER:	The Status of the generator breaker	Opn/Clsd
15 GEN	Stable (++), Stable timing (+-), Out of Spec(--)	
16 PREGLOW:	Shows OFF or PREGLOW	
17 CRANK:	Shows OFF or CRANKING	
18 FUEL:	Shows OFF or ON	
19 IGNITION:	Shows OFF or ON	
20 AIR:	Shows TRIPPED or OPEN	
21 CONTROL:	Shows IDLE or RATED	

Status Generator Menu

An overview of the generator outputs.

Display Name	Item	Units
01 GEN VOLT LINE-LINE	Average Volts L-L.	V*
02 GEN VOLT LINE-NEUTRAL	Average Volts L-N	V*
03 GENERATOR FREQUENCY	Generator Frequency	Hz
04 GEN AMPS	Average Amps	A*
05 GEN VOLT-AMP	Total KVA reading.	VA*
06 GEN WATT	Total kW readings	W*
07 GEN VAR	Total kVAR reading.	VAR*
08 GEN PWR-FACTOR	Average Power Factor; with +/- Lag or Lead	-
09 GEN VA, PHS A	Phase A KVA reading	VA*
10 GEN VA, PHS B	Phase B KVA reading	VA*
11 GEN VA, PHS C	Phase C KVA reading	VA*
12 GEN WATT, PHS A	Phase A kW readings	W*
13 GEN WATT, PHS B	Phase B kW readings	W*
14 GEN WATT, PHS C	Phase C kW readings	W*
15 GEN VAR, PHS A	Phase A kVAR reading	VAR*
16 GEN VAR, PHS B	Phase B kVAR reading	VAR*
17 GEN VAR, PHS C	Phase C kVAR reading	VAR*
18 GEN VOLT, PHS A	Phase A Volts reading	Volt*
19 GEN VOLT, PHS B	Phase B Volts reading	Volt*
20 GEN VOLT, PHS C	Phase C Volts reading	Volt*
21 GEN AMP, PHS A	Phase A Amps reading	Amp*
22 GEN AMP, PHS B	Phase B Amps reading	Amp*
23 GEN AMP, PHS C	Phase C Amps reading	Amp*
24 GEN PF PHS A	Phase A Power Factor reading	-
25 PF A DIRECTION	Direction of phase A Power Factor Lead/Lag	
26 GEN PF PHS B	Phase B Power Factor reading	-
27 PF B DIRECTION	Direction of phase B Power Factor Lead/Lag	
28 GEN PF PHS C	Phase C Power Factor reading	-
29 PF C DIRECTION	Direction of phase C Power Factor Lead/Lag	
30 GEN CURR, THD	Total Harmonic Distortion of the Current	%
31 GEN CURR, 3RD HARM	Third Current Harmonic	%

Display Name	Item	Units
32 GEN CURR, 4TH HARM	Fourth Current Harmonic	%
33 GEN CURR, 5TH HARM	Fifth Current Harmonic	%
34 GEN CURR, 6TH HARM	Sixth Current Harmonic	%
35 GEN CURR, 7TH HARM	Seventh Current Harmonic	%
36 GEN CURR, 9TH HARM	Ninth Current Harmonic	%
37 GEN CURR, 11TH HARM	Eleventh Current Harmonic	%
38 GEN CURR, 13TH HARM	Thirteenth Current Harmonic	%
39 GEN VOLT, THD	Total Harmonic Distortion of the Voltage	%
40 GEN VOLT, 3RD HARM	Third Voltage Harmonic	%
41 GEN VOLT, 4TH HARM	Fourth Voltage Harmonic	%
42 GEN VOLT, 5TH HARM	Fifth Voltage Harmonic	%
43 GEN VOLT, 6TH HARM	Sixth Voltage Harmonic	%
44 GEN VOLT, 7TH HARM	Seventh Voltage Harmonic	%
45 GEN VOLT, 9TH HARM	Ninth Voltage Harmonic	%
46 GEN VOLT, 11TH HARM	Eleventh Voltage Harmonic	%
47 GEN VOLT, 13TH HARM	Thirteenth Voltage Harmonic	%
48 GEN NEG-PHS-SEQ VOLT	Negative Phase Sequence Voltage	Amp*
49 GEN NEG-PHS-SEQ AMP	Negative Phase Sequence Current	Amp*

Status Bus Menu

An overview of inputs from or outputs to the bus.

Display Name	Item	Units
01 BUS VOLT LINE-LINE	Average Volts L-L.	V*
02 BUS VOLT LINE-NEUTRAL	Average Volts L-N	V*
03 BUS FREQUENCY	Bus Frequency	Hz
04 BUS VOLT, PHS A	Phase A Volts reading	Volt*
05 BUS VOLT, PHS B	Phase B Volts reading	Volt*
06 BUS VOLT, PHS C	Phase C Volts reading	Volt*
07 BUS PF PHS A	Phase A Power Factor reading	-
08 PF A DIRECTION	Direction of phase A Power Factor Lead/Lag	
09 BUS PF PHS B	Phase B Power Factor reading	-
10 PF B DIRECTION	Direction of phase B Power Factor Lead/Lag	
11 BUS PF PHS C	Phase C Power Factor reading	-
12 PF C DIRECTION	Direction of phase C Power Factor Lead/Lag	
13 BUS PWR-FACTOR	Average Power Factor; with +/- Lag or Lead	-
14 BUS PF DIRECTION	Direction of Power Factor Lead/Lag	
15 BUS CURR, THD	Total Harmonic Distortion of the Current	%
16 BUS NEG-PHS-SEQ VOLT	Negative Phase Sequence Voltage	Amp*
17 BUS NEG-PHS-SEQ AMP	Negative Phase Sequence Current	Amp*

Status I/O Menu

The monitor menu for all inputs to the AtlasSC Load+Speed Control and its outputs to the system.

Display Name	Item	Units
01 DI - IN 1 STATE	Input 1 Open or Closed	
02 DI - IN 2 STATE	Input 2 Open or Closed	
03 DI - IN 3 STATE	Input 3 Open or Closed	
04 DI - IN 4 STATE	Input 4 Open or Closed	
05 DI - IN 5 STATE	Input 5 Open or Closed	
06 DI - IN 6 STATE	Input 6 Open or Closed	
07 DI - IN 7 STATE	Input 7 Open or Closed	
08 DI - IN 8 STATE	Input 8 Open or Closed	
09 DI - IN 9 STATE	Input 9 Open or Closed	
10 DI - IN 10 STATE	Input 10 Open or Closed	
11 DI - IN 11 STATE	Input 11 Open or Closed	
12 DI - IN 12 STATE	Input 12 Open or Closed	
13 DI - IN 13 STATE	Input 13 Open or Closed	

Display Name	Item	Units
14 DI - IN 14 STATE	Input 14 Open or Closed	
15 DI - IN 15 STATE	Input 15 Open or Closed	
16 DI - IN 16 STATE	Input 16 Open or Closed	
17 DI - IN 17 STATE	Input 17 Open or Closed	
18 DI - IN 18 STATE	Input 18 Open or Closed	
19 DI - IN 19 STATE	Input 19 Open or Closed	
20 RELAY OUT 1 STATE	Output 1 is On or Off	
21 RELAY OUT 2 STATE	Output 2 is On or Off	
22 RELAY OUT 3 STATE	Output 3 is On or Off	
23 RELAY OUT 4 STATE	Output 4 is On or Off	
24 RELAY OUT 5 STATE	Output 5 is On or Off	
25 RELAY OUT 6 STATE	Output 6 is On or Off	
26 RELAY OUT 7 STATE	Output 7 is On or Off	
27 RELAY OUT 8 STATE	Output 8 is On or Off	
28 RELAY OUT 9 STATE	Output 9 is On or Off	
29 RELAY OUT 10 STATE	Output 10 is On or Off	
30 RELAY OUT 11 STATE	Output 11 is On or Off	
31 RELAY OUT 12 STATE	Output 12 is On or Off	
32 VOLT BIAS OUT %:	Voltage bias output (±100% range)	%
33 SPEED BIAS OUT %:	Speed bias output (±100% range).	%
34 LOAD REF:	load reference used in the Real Load Controller	W
35 LOAD MODE:	Load Control Mode of the Real Load controller	na
36 ANALOG OUT 1 MA:	Current being output at analog output 1	mA
37 ANALOG OUT 2 MA:	Current being output at analog output 2	mA
38 ANALOG OUT 3 MA:	Current being output at analog output 3	mA
39 ANALOG OUT 4 MA:	Current being output at analog output 4	mA
40 ANALOG IN 1 (V/MA)	Electrical units Input of Analog Input 1	V/mA
41 ANALOG IN 1 (EU):	Scaled units of Analog Input 1	EU
42 ANALOG IN 2(V/MA):	Electrical units Input of Analog Input 2	V/mA
43 ANALOG IN 2 (EU):	Scaled units of Analog Input 2	EU
44 ANALOG IN 3 (V/MA):	Electrical units Input of Analog Input 3	V/mA
45 ANALOG IN 3 (EU):	Scaled units of Analog Input 3	EU
46 ANALOG IN 4 (V/MA):	Electrical units Input of Analog Input 4	V/mA
47 ANALOG IN 4 (EU):	Scaled units of Analog Input 4	EU
48 ANALOG IN 5 (EU):	Scaled units of Analog Input 5	EU
49 ANALOG IN 6 (EU):	Scaled units of Analog Input 6	EU
50 ANALOG IN 9 (EU):	Scaled units of Analog Input 9	EU
51 ANALOG IN 10 (EU):	Scaled units of Analog Input 10	EU
52 ANALOG IN 16 (EU):	Scaled units of Analog Input 16	EU
53 ANALOG IN 17 (EU):	Scaled units of Analog Input 17	EU
54 ANALOG IN 18 (EU):	Scaled units of Analog Input 18	EU
55 COM PORT 1	Status of com port 1 normal/alarm	
56 COM PORT 2	Status of com port 2 normal/alarm	
57 COM PORT 3	Status of com port 3 normal/alarm	
58 LON STATUS	Normal or Alarm	
59 TIE BREAKER “W”	Status of tie breaker “W” open or closed	
60 TIE BREAKER “X”	Status of tie breaker “X” open or closed	
61 TIE BREAKER “Y”	Status of tie breaker “Y” open or closed	
62 TIE BREAKER “Z”	Status of tie breaker “Z” open or closed	
63 A BUS	Active or Not Active (bus compared to this unit)	
64 A BUS	Active or Not Active (bus compared to this unit)	
65 A BUS	Active or Not Active (bus compared to this unit)	
66 A BUS	Active or Not Active (bus compared to this unit)	
67 MAINS BREAKER STATUS	Open/Closed	
68 GEN BREAKER STATUS	Open/Closed	

Status Synchronizer Menu

Monitoring menu of the synchronizing function and states.

Display Name	Item	Units
01 SLIP FREQ:	The slip frequency of the generator in relation to the bus.	HZ
02 SLIP WINDOW:	Matched (++), Controlling (+-), Out of window (--)	na
03 PHASE ERROR:	The phase angle difference between the generator and the bus	deg
04 PHASE WINDOW:	Matched (++), Controlling (+-), Out of window (--)	na
05 VOLTAGE ERROR:	The voltage differential between the generator and the bus	%
06 VOLTAGE WINDOW:	Matched (++), Controlling (+-), Out of window (--)	
07 BUS DEAD ?	Indicates if the bus PT input is less than minimum	T/F
08 SYNCHRONIZER MODE	Displays the synchronizer's configured mode	
09 VOLT BIAS %:	Voltage Bias Output	%
10 SPEED BIAS %	Speed Bias Output	%
11 GEN AVG VOLTS	Average Voltage of the generator	V*
12 BUS AVG VOLTS	Average Voltage of the mains.	V*
13 SYNC STATE	The operating state of the synchronizer	na
14 NUMBER OF ATTEMPTS	Number of synchronization attempts (will always be ≤ Close Attempts set point)	na
15 SEC BEFORE TIMEOUT	Time left on the Timeout timer. If disabled, the field will display '– – –'.	sec

StatusKW Load Menu

An overview of the Real Load control.

Display Name	Item	Units
01 GEN LOAD:	Generator real power output (1Ø or 3Ø sum)	W*
02 % RATING	Percent of unit rating	%
03 SYSTEM LOAD	Percent of system loading	%
04 LOAD REFERENCE:	The load reference for the generator	W*
05 PROCESS ACTUAL IN %:	The actual process level as seen by the AtlasSC Load+Speed Control	%
06 PROCESS REF %:	The process reference for the process control	%
07 LOAD MODE:	The current load control mode in operation	na
08 LOAD STATE:	The state of the load controller	na
09 KVA SWITCH:	Status of the KVA level switch	T/F

Status PF/KVAR Menu

An overview of the reactive Power control.

Display Name	Item	Units
01 MODE:	The actual control mode	na
02 VOLT CNTRL STATE:	The state of the VAR/PF controller	na
03 PWR FACTR REF:	The PF control reference value. Shows --- if PF control is not used	na
04 VAR REF:	The VAR control reference value. Shows --- if VAR control is not used	VAR*
05 GENERATOR PF:	The average three phase PF of the generator	-
06 PF DIRECTION	The direction of PF lead/lag	
07 BUS PF:	The average three phase PF of the bus	-
08 GENERATOR VAR:	The total VAR reading for the generator.	VAR*
10 VOLT BIAS OUTPUT %:	Voltage Bias Output	%

Status Sequencing Menu

A monitoring menu of the functions and operation of the sequencer.

Display Name	Item	Units
01 UNIT NUMBER	Network Address of this unit	na
02 STATE	Indicates the availability of the genset: Ready, Alarm, Off	na
03 GEN BREAKER CLOSED	The status of the generator breaker as determined by the generator CB aux discrete input.	na
04 SEQUENCE MODE	The Sequencing Mode for starts and stops is selected from the configure menu. All modes require the next unit to also be in the Start Ready State	na
05 SERVICE HOURS	Number of hours left on the service mete	-
06 NEXT UNIT ON	Unit Number of next unit to be sequenced onto the network	-
07 START TIMER ACTIVE	True when conditions indicate a start should be given, but waiting for delay to expire.	T/F
08 START TIMER	Amount of time before the genset will start.	-
09 NEXT UNIT OFF	Unit Number of next unit to be sequenced off the network	-
10 STOP TIMER ACTIVE	True when conditions indicate a stop should be given, but waiting for delay to expire.	T/F
11 STOP TIMER	Amount of time before the genset will stop.	-
12 UNITS ON LOAD	Total number of units operating in isochronous load sharing.	-
13 SEGMENT UNITS	Number of units on the active bus segment	-
14 SERVICE HOURS REMAINING	Number of service hours left before service is required	
15 READY TO START UNITS	Number of units on the active bus ready to start	-
16 READY TO STOP UNITS	Number of units on the active bus ready to stop	-
17 LS UNITS	Number of load share units on the active bus.	-
18 TIE "W" CLOSED	Status Tie of breaker W	T/F
19 TIE "X" CLOSED	Status Tie of breaker X	T/F
20 TIE "Y" CLOSED	Status Tie of breaker Y	T/F
21 TIE "Z" CLOSED	Status Tie of breaker Z	T/F
22 BUS "A" ACTIVE	Bus A is part of the active bus	T/F
23 BUS "B" ACTIVE	Bus B is part of the active bus	T/F
24 BUS "C" ACTIVE	Bus C is part of the active bus	T/F
25 BUS "D" ACTIVE	Bus D is part of the active bus	T/F
26 MAINS BREAKER CONFIGURED	Indicates a Mains Breaker is being used	T/F
27 NETWORK UNITS	Number of units communicating on the LON network	-

Status Alarms Menu

A monitor of the alarm condition of the genset.

Display Name	Item	Units
01 CURRENT DATE / TIME	Current Date & Time of internal clock	Y/M/D H:M:S
02 NUMBER OF ALARMS ACTIVE	Number of Active or un-cleared alarms	-
03 VISUAL ALARM ACTIVE	True/False	-
04 AUDIBLE ALARM ACTIVE	True/False	-
05 SOFT SHUTDOWN ACTIVE	True/False	-
06 HARD SHUTDOWN ACTIVE	True/False	-
07 ALARM EVENT _#1	Description of the alarm that occurred first	-
08 TIME OF EVENT #1	Date and Time of the first alarm	Y/M/D H:M:S
09 ALARM EVENT _#2	Description of the alarm that occurred second	-
10 TIME OF EVENT #2	Date and Time of the second alarm	Y/M/D H:M:S
11 ALARM EVENT _#3	Description of the alarm that occurred third	-
12 TIME OF EVENT #3	Date and Time of the third alarm	Y/M/D H:M:S
13 ALARM EVENT _#4	Description of the alarm that occurred fourth	-
14 TIME OF EVENT #4	Date and Time of the fourth alarm	Y/M/D H:M:S
15 ALARM EVENT _#5	Description of the alarm that occurred fifth	-
16 TIME OF EVENT #5	Date and Time of the fifth alarm	Y/M/D H:M:S

Status Metering Menu

Display Name	Item
01 GENERATOR	Total Watt-Hours Meter of Generator
02 GENERATOR W_UNITS	Units (KW, MW, GW) of the Generator l W-Hr number above
04 GENERATOR W_K	000 000 **000** 000.00 Thousands portion of the W-Hr
05 GENERATOR W_M	000 **000**,000,000.00 Mega portion of the W-Hr
06 GENERATOR W_G	**000,**000,000,000.00 Giga portion of the W-hr
10 BUS W_K	000 000 **000** 000.00 Thousands portion of the W-Hr
11 BUS W_M	000 **000**,000,000.00 Mega portion of the W-Hr
12 BUS W_G	**000,**000,000,000.00 Giga portion of the W-hr

Chapter 5.
Modbus Communications

General Information

The Serial 1 port is open to customer use for a variety of applications. It will communicate with the MODBUS RTU protocol or the Woodward ServLink protocol, and may be configured to do so using RS-232, RS-422, or RS-485 to match the customer's hardware. The Serial 2 port will only communicate with the MODBUS RTU protocol and may be configured to do so using RS-232, RS-422, or RS-485 to match the customer's hardware. This chapter addresses the Modbus functionality of serial port 1 and 2.

The Modbus ID (node address) may be configured to suit the customer's application. It is adjustable from 1 to 247. This address identifies the Modbus Slave to the Modbus Master. The Modbus address chosen for any particular AtlasSC™ Load+Speed Control panel should be unique from any other devices on the Modbus network. This address is also used as the Modbus address when Serial 1 is configured as a Modbus port.

A Modbus Time-out is configurable from Watch Window. This item is the time, in seconds, which the AtlasSC Load+Speed Control panel will wait before either receiving a valid message from the Modbus master, or indicating a Modbus failure. If Serial 1 is configured as a Modbus port, it will use the same timeout. An alarm can be configured to give an indication or shutdown when a Port Failure (failure to receive a valid message from the master) occurs. The Port Failure is a latching-type indication, and requires the Modbus Reset menu item to be toggled from True to False in order to reset. The Modbus Reset is located in the Communications service menu. It is used to reset any failures indicated on the Modbus serial communications, and also to restart the Modbus Time-out timer. The Modbus Reset should be left at FALSE, and only turned to TRUE to provide a reset action on the Modbus. Once the reset is accomplished, the Modbus Reset must be taken back to False once again. Reply Time-out, Delay, and Number of Retries for the Modbus Master must be configured to meet the requirements of the entire Modbus network and the devices communicating on that network. Both Serial 2 and Serial 1 will be reset (if Serial 1 is configured for Modbus) when a Reset is performed.

Both Serial 2 and Serial 1 ports will have access to the same data. The timeout, reset, and Modbus ID configurations are shared between Serial 1 and Serial 2.

All serial ports have independently configurable baud rates. They may only be configured from Watch Window. They support baud rates from 4800 baud to 115 200 baud. However, no two ports should be set to 115 200 simultaneously. Two or more ports may be set to 57 600 simultaneously.

The sections below describe what is found in the Modbus tables. The actual tables are found in Appendix D for the AtlasSC Load+Speed Control.

Communication Configuration

The configuration elements for the serial ports capable of Modbus are shown in the tables below.

Item	Semantics	Min	Max	Default
Serial 1 Type	RS-232, RS-422, RS-485			RS-422
Serial 1 Mode	Modbus, ServLink	Modbus	ServLink	Modbus
Serial 1 Baud Rate	See table below	7	12	11
Serial 2 Type	RS-232, RS-422, RS-485			RS-485
Serial 2 Baud Rate	See table below	7	12	8
Serial Modbus ID	Module ID	1	247	1
Modbus Timeout	Seconds	0.1	20.0	3.0
Modbus Reset	True, False	True	False	False

Value	Baud Rate
12	115,200
11	57,600
10	38,400
9	19,200
8	9600
7	4800

Boolean Write

Using Modbus, it is possible for the master to send commands to the AtlasSC Load+Speed Control slave. The commands that are allowed are shown in the Boolean Write table below. For safety, when changing the Mode Switch position over Modbus, the physical switch must be in the auto position; otherwise the AtlasSC Load+Speed Control will not relinquish control to Modbus. All BW data are Boolean data types.

A physical discrete input will always take precedence over the Modbus command for that same function. The exception here is the Auto input of the mode switch must be maintained and the Modbus can select a different mode. When a Control mode or Load mode is selected, the last command will remain active until the disable command is received. The control will select the OFF mode, until the external switch is moved, or another mode is enabled through Modbus. The last synchronizer mode selected from the HMI or Modbus will remain the active mode.

A command to raise or lower voltage/speed will be treated as if it were a physical digital input. A raise/lower command is given as long as the switch input is “True”, and turned off when the next Modbus write indicates a “False”. If another Modbus write is not seen within 1 second, the command is considered “False”.

Boolean Read

The Boolean read table contains Boolean values such as alarm states, digital inputs status, etc. The interpretation of a 0 or 1 in response is indicated in the semantics field. Functions that appear to indicate a physical switch position will indicate the functional position even if not mapped to a physical I/O point. All BR data is Boolean data type.

Alarm states indicate ‘Active’ when the alarm conditions have been met unless that alarm is configured for “disabled”. An alarm condition could become active and deactivate again within a single Modbus update time depending on the frequency at which the master is polling. Therefore, to avoid confusion, all alarm conditions will be latched for one second or one Modbus poll cycle after the occurrence of the alarm (whichever comes first) as seen from Modbus. If the alarm condition no longer exists after this poll cycle, the Modbus alarm indication will reset to ‘Not Active’ as the alarm condition is no longer true.

Analog Read

The analog read table contains integer values such as Voltages, Currents, etc that are scaled to eliminate decimal places. The scaling (if any) is described in the scale field. Minimum and maximum values indicated are shown with scaling. Values with scaling have been multiplied by the value indicated before being transmitted, and should be divided by the same scale value (by the receiving device) in order to represent the actual value. A blank in this column is a scale of 1.0. Some scaled values are scaled by the value in another parameter, and flagged by “Note A” through “Note F”. The Notes at the end of the table gives the address (30xxx) of the scale to use for the flagged values. Those special cases are individually described or described in the Units section following the table. All AR data is integer data type (16-bits, signed).

The definitions of values used to communicate the Mode, State and Alarm Action of the AtlasSC Load+Speed Control are also described. The semantics column will flag the table containing the applicable definition.

Analog Write

The analog write table contains integer values such as load references or process references that are scaled to eliminate decimal places. The scaling (if any) is described in the scale field. Minimum and maximum values indicated are shown with scaling. All AW data is integer data type (16-bits, signed) and must be sent as such. Data sent to a scaled address must first be multiplied by the indicated amount because the AtlasSC Load+Speed Control will divide the value by the indicated amount upon receipt.

Enumerated Lists

The following lists and tables define the enumerated values and their respective definition. These values are used by an HMI for display of representative wording for the function, mode, or state being displayed.

Units

All metered voltage, current, and power values are provided without scaling and need to be multiplied by a scaling value. The scaling is dependent on the units for the measured parameter. For example, if the units are 'kilo', the parameter should be multiplied by 1000 to represent the actual value (KW, KV, KA). If the units are 'Mega', the parameter should be multiplied by 1 000 000 to represent the actual value.

All values that report voltage will use the same units as defined by the voltage units.

All values that report current will use the same units as defined by the current units.

All power values (Watts, VAR, VA) will use the same units as defined by the power units.

Unit Value	Unit Modifier	Units Definition
1	None	No scaling
2	Kilo	Multiply by 1000
3	Mega	Multiply by 1 000 000
4	Giga	Multiply by 1 000 000 000

Alarm Action Definition (LS)

The alarm actions are simply the selected action or response for the given alarm. The actions cannot be changed through Modbus, but its configuration may be read.

Value	Alarm Actions Definition	Display	Notes
8	Loss of Mains With Alarm	LOM w/Alarm	Initiates LOM engine start, adds an event to the alarm list.
7	Loss of Mains	LOM	Initiates an LOM start, no alarm is added to the alarm list
6	Hard Shutdown	Hard Shutdown	Engine is shutdown immediately, same as an Emergency Shutdown
5	Soft Shutdown	Soft Shutdown	Non-critical shutdown, smooth unload, cooldown, then shutdown
4	Audible Alarm	Audible Alarm	A discrete output will be given, connected to an external audible device, An acknowledge from ALARM CLEAR will turn this output off.
3	Visual Alarm	Visual Alarm	A discrete output will be given, connected to an external visual indication device. This is not effected by an Acknowledge
2	Warning	Warning	An event will be shown on the alarm list only
1	Disabled	Disabled	No Action will be taken

Synchroscope Definition

Phase Angle: The Phase Angle reading is a value from 0 (phase matched at 12:00 on a synchroscope) to ±180 degrees. Negative degree measurements occur in the right half of the synchroscope, while positive degree measurements occur in the left half of the synchroscope. Therefore, a generator with a positive slip frequency (clockwise synchroscope rotation) would display a sequence of numbers such as ….0, –30, –60, –90, –120, –150, –180, 150, 120, 90, 60, 30, 0....

Synchronizer Mode Definition

The Synchronizer has a selected mode for how it will operate. In order to communicate to a user and to external equipment, the mode will be provided in an enumerated list.

Value	Sync Mode Definition
0	Error
1	Off
2	Permissive
3	Check
4	Run

Error = This state should not occur. If it does, there is a problem.
Off-Permissive-Check-Run = This is the selected operation mode of the synchronizer. See the Synchronizer section in the Operation Manual for details.

Synchronizer State Definition

During genset operation, the synchronizer will perform numerous actions. Each action is a state. In order to communicate to a user and to external equipment, the state will be provided in an enumerated list. The display will show the words, but communication links will provide the values.

Value	Sync State Definition
0	Error
1	Off
2	In Synch
3	Synchronizing Generator
4	Synchronizing Mains
5	Gen Stable Timer
6	Mains Stable Timer

- Error = This state should not occur. If it does, there is a problem.
- Off = The generator is off or the breaker is closed so synchronization is not needed.
- In Sync = Gen Breaker/Mains Breaker Closed Successfully, and held for synch timer.
- Synchronizing Generator = The generator is being actively synchronized to the bus/mains.
- Synchronizing Mains = The generator is being actively synchronized to a returned mains.
- Gen Stable Timer = Waiting for timer to expire.
- Main Stable Timer = Waiting for timer to expire.

Genset State Definition

The genset mode represents the present selected operation of the system. The mode will represent why or what the genset is presently doing.

Value	Genset State	Displayed State
0	Error	ERROR
1	Off	OFF
2	Test Engine	TEST ENGINE
3	Test ATS	TEST ATS
4	Run with Load	RUN WITH LOAD
5	Auto	AUTO
6	Mains Demand	MAINS DEMAND
7	Peak Timer	PEAK TIMER
8	Loss of Mains	LOM START
9	Network Start	NET START

- Off = The Test/Run/Auto switches are all off.
- Test Engine = The Test switch (only) was asserted and the engine is running in Droop.
- Test ATS = The Test and Auto switches were asserted so the ATS is performing a test either OT or CT depending on its configuration.
- Run with Load = The Run switch (only) was asserted and the engine is running either in Droop (gen breaker only is closed) or Baseload/Process (the mains breaker was manually closed) or Load Share if an LS with other units present.
- Auto = The Auto switch (only) is asserted and the AtlasSC Load+Speed Control is waiting for a LOM, Demand, or the Demand timer.
- Mains Demand = The engine started due to a high load demand.
- Peak Timer = The engine started due to a configured peaking time.
- Loss of Mains = The engine started due to a Loss of Mains condition.
- Network Start = The engine started due to a start command from another AtlasSC Load+Speed Control

Engine Control State Definition

The Engine Controller goes through multiple states when starting or stopping the engine. In order to communicate to a user and to external equipment, these states will be provided in an enumerated list.

Value	State	Displayed State
0	Error	ERROR
1	Disabled	DISABLED
2	Off	OFF
3	Preglow	PREGLOW
4	Crank	CRANK
5	Run	RUN
6	Cooldown	COOLDOWN
7	Spindown	SPINDOWN
8	Retry	RETRY
9	Idle	IDLE

- Error = This state should not occur. If it does, there is a problem.
- Disabled = The engine controller is disabled in the configuration, Start/Stop logic is external to the AtlasSC Load+Speed Control.
- Off = The engine is off (can be due to an alarm, the control switch, or Modbus).
- Preglow = During a start routine, the preglow prior to crank is active.
- Crank = The starter motors are being engaged.

- Run = The starter motors are disengaged and the engine is running at rated speed.
- Cooldown = The cooldown timer is running.
- Spindown = The fuel solenoid is “off” and the engine is coasting to a stop.
- Retry = The engine controller is waiting for the crank retry timer to expire before attempting another start. The last start failed.
- Idle = The engine is waiting at idle for the idle timer to expire before going to rated. This state only occurs during start. If the engine is told to idle during cooldown, the state will show cooldown.

Real Load Mode Definition

The Real Load Controller has a configured mode for how it will control load, as do the Process Controller, the ATS controller, and the Peaking Controller. Since the resulting load mode is dependent on all of these, the Load Mode reported to the user has more definition than just the Load Mode Configuration setting by itself. In order to communicate to a user and to external equipment, the combined mode will be provided in an enumerated list.

Value	Load Control Mode Definition
0	Error
1	Off
2	Droop
3	Isochronous
4	BaseLoad
5	Import/Export Process
6	Temp/Press Process
7	Remote Process
8	Peaking
9	Remote BaseLoad
10	Remote Import/Export Process
11	Load Share
12	Process Slave

- Error = This mode should not occur. If it does, there is a problem.
- Off = The load controller is off because the engine is off.
- Droop = Droop Load Control Setpoint Selected and Generator on load.
- Isochronous = Normal or Soft Transfer Load Control Setpoint Selected, and Gen CB is closed, but not in parallel with mains.
- Baseload = Gen on load and in parallel with mains at the internal configured kW level.
- Import/Export Process = Controlling KW and KVAR in Import/Export mode.
- Temp/Press Process = Controlling using Temperature or Pressure Process input.
- Remote Process = Controlling based on Temperature/Pressure process input and a process reference from elsewhere.
- Peaking = Controlling based on demand level.
- Remote BaseLoad = Controlling in parallel with the mains to a reference provided on an analog input.
- Remote Import/Export Process = Controlling based on calculated Import/Export levels and a process reference from elsewhere.
- Load Share = 2 or more units are sharing real load, not paralleled to mains. Not used in MC.
- Process Slave = An LS unit is closed to the same bus as another AtlasSC Load+Speed Control in the process mode. The first unit on the bus is the process master, it’s Load Control mode is Process Control.

Reactive Load Mode Definition

The Reactive Load Controller has a configured mode for how it will operate. However, the process controller and load share controllers may override this with a mode of their own. In order to communicate to a user and to external equipment, the mode will be provided in an enumerated list. The display will show the words, but communication links will provide the values.

Value	Load Control Mode Definition
0	Error
1	Off
2	Voltage Trim
3	PF Sharing (not used)
4	PF Control
5	KVAR Control
6	Remote KVAR/PF Control
7	Manual
8	Import/Export PF
9	Import/Export VAR

- Error = This mode should not occur. If it does, there is a problem.
- Off = The reactive load controller is off, voltage bias output is zero.
- Voltage Trim = The AtlasSC Load+Speed Control is trimming voltage to rated. The regulator is assumed to be using Droop if in parallel.
- PF Sharing = This state is not used in this version of the AtlasSC Load+Speed Control.
- PF Control = Gen in parallel with mains and AtlasSC Load+Speed Control is biasing to control PF.
- KVAR Control = Gen in parallel with mains and AtlasSC Load+Speed Control is biasing to control KVAR.
- Remote Control = AtlasSC Load+Speed Control is responsible for biasing the regulator but another device is doing the control.
- Manual = A manual override is selected so the user controls voltage bias using panel raise/lower switches.
- Import/Export PF = The process controller is actively controlling imp/exp levels and the mode was configured for PF control.
- Import/Export VAR = The process controller is actively controlling imp/exp levels and the mode was configured for VAR control.

Load Control State Definition

Both the Real and Reactive Load Controllers have a selected mode of operation. During operation, the controllers will perform numerous actions regardless of the controlling mode. Each action is a state. In order to communicate to a user and to external equipment, the state will be provided in an enumerated list. There is a separate state for the Real and Reactive load controllers but both uses the same enumeration.

Value	Load Control State Definition
0	Error
1	Ramping Up
2	Pause
3	Ramping Down
4	At Reference
5	Off / Auto
6	Manual

- Error = This state should not occur. If it does, there is a problem.
- Off / Auto = The engine is stopped so the load controller does not need to function.
- Ramping Up = The load is being automatically or manually increased at the configured ramp rate.
- Pause = A user has manually (or through Modbus) stopped a load ramp.
- Ramping Down = The load is being automatically or manually decreased at the configured ramp rate.
- At Reference = The load has reached the configured level and is tracking.
- Manual = The load controller was placed in a manual mode and load is being controlled by external inputs.

ATS State Definition

The ATS has a configured mode for how it will transfer load. During the transfer of load, the ATS controller will perform numerous actions. Each action is a state. In order to communicate to a user and to external equipment, the state will be provided in an enumerated list.

Value	ATS State Definition
0	Error
1	LOM Delay
2	Starting
3	Gen Delay
4	Fast Delay
5	Mains Delay
6	Running
7	Stopping
8	Synchronizing
9	Off / Auto

- Error = This state should not occur. If it does, there is a problem.
- LOM Delay = currently waiting for the LOM delay timer to expire.
- Starting = currently starting the engine.
- Gen Delay = currently waiting for the Gen Stable delay timer to expire.
- Fast Delay = currently waiting for the Fast Transfer delay timer to expire.
- Mains Delay = currently waiting for the Mains Stable delay timer to expire.
- Running = Genset supplying the load.
- Stopping = Engine has been told to stop – may be in cooldown.
- Synchronizing = Delay timers may be expired but synchronism is not achieved yet.
- Off / Auto = Waiting for a reason to start or configured Off.

Chapter 6.
Alarm and Diagnostic Summary

Introduction

All Alarms can be configured to perform a specific action when detected. The complete list of actions that can be taken are described below. Some alarms cannot be configured for all Alarm Actions on the list. An action is available only when the listed actions are appropriate.

Disabled
The AtlasSC™ Load+Speed Control will not look for the alarm condition. No alarm will be logged or sent over a communication link.

Warning
When the AtlasSC Load+Speed Control detects the event/alarm condition, the alarm will be added to the current event list and the alarm history log. If a discrete output is configured to indicate a warning alarm condition, the output will be asserted. The communication links will indicate a warning alarm condition exists. The generator set will remain active without changing its operation. The alarm item will remain in the active alarm list until the condition is removed and an alarm reset is received.

Visual Alarm
When the AtlasSC Load+Speed Control detects the event/alarm condition, the alarm will be added to the current event list. The communication links will indicate a visual alarm condition exists. If a discrete output is configured to indicate a visual alarm condition, the output will be asserted. This type of alarm configuration can be used as an additional warning alarm condition. The visual alarm output will remain active until all visual alarms have been reset. The generator set will remain active without changing its operation. The alarm item will remain in the active alarm list until the condition is removed and an alarm reset is received.

Audible Alarm
When the AtlasSC Load+Speed Control detects the event/alarm condition, the alarm will be added to the current event list and the alarm history log. If a discrete output is configured as an alarm horn, the output will be asserted. The communication links will indicate an audible alarm condition exists. Momentarily asserting the Reset Alarm/Fault discrete input (if configured) will turn off the Alarm Horn output. The horn alarm output will remain off until any other audible alarm condition becomes active. The horn output will turn off without resetting the alarm. The alarm item(s) will remain in the active alarm list until the condition is removed and an alarm reset is received. The generator set will remain active without changing its operation.

Soft Shutdown
When the AtlasSC Load+Speed Control detects the event/alarm condition, the alarm will be added to the current event list. If a discrete output is configured to indicate a soft shutdown alarm condition, the output will be asserted. The communication links will indicate a soft shutdown alarm condition exists. The generator set will unload in the configured manner, open the generator breaker, cool down (if conditions met) and stop. It will remain stopped and not restart unless all configured shutdown alarms are cleared.

Hard Shutdown
When the AtlasSC Load+Speed Control detects the event/alarm condition, the alarm will be added to the current event list. If a discrete output is configured to indicate a Herd Shutdown alarm condition, the output will be asserted. The communication links will indicate a hard shutdown alarm condition exists. The generator set will immediately open the generator breaker and stop according to the Emergency Stop procedure. It will remain stopped and not restart unless all configured shutdown alarms are cleared.

Trip Tie Breaker
When the AtlasSC Load+Speed Control detects the event/alarm condition, the alarm will not be added to the current event list. If a discrete output is configured to indicate a trip tie alarm condition, the output will be asserted. The Modbus and LON communication links will indicate a Trip Tie Breaker condition exists. The AtlasSC Load+Speed Control will immediately open the tie breaker.

Trip Tie Breaker w/ Alarm
When the AtlasSC Load+Speed Control detects the event/alarm condition, the alarm will be added to the current event list. If a discrete output is configured to indicate a visual alarm condition, the output will be asserted. The Modbus and LON communication links will indicate a trip tie alarm condition exists. The AtlasSC Load+Speed Control will immediately open the tie breaker.

NOTE
If the control is set to Auto Start on TRIP TIE or TRIP TIE w/alarm, the control will automatically start. This could be used for a black bus start. Configure the Bus under voltage (or something similar) for Trip tie of Trip tie w/ alarm action. When the alarm occurs the unit will start if in Auto. To stop the unit the input alarm must be cleared, and you must open the Auto input.

Alarm Action list

Value	Alarm Actions Definition	Display
8	Trip Tie Breaker With Alarm	Trip Breaker w/Alarm
7	Trip Tie Breaker	Trip Breaker
6	Hard Shutdown	Hard Shutdown
5	Soft Shutdown	Soft Shutdown
4	Audible Alarm	Audible Alarm
3	Visual Alarm	Visual Alarm
2	Warning	Warning
1	Disabled	Disabled

Alarm List

The following table is a list of all alarms generated by the AtlasSC Load+Speed Control. The value of Alm# can be found on Analog Read #281 (30281). So if a alarm log via Modbus can be done by reading this value. A value of zero indicates no alarms.

Alm #	Event Name
1	Battery Voltage High
2	Battery Voltage Low
3	Coolant Temp High
4	Pre Coolant Temp Hi
5	Coolant Temp Low
6	Pre Coolant Temp Low
7	Crank Fail
8	Emergency Stop
9	EPS Supplying Load
10	Fail to Sync
11	Not Used
12	Not Used
13	Gen Breaker Feedback Error
14	Gen Brk Shunt Trip Error
15	Gen Neg. Phase Overcurrent
16	Pre Gen Neg. Phase Overcurrent
17	Gen Neg. Phase Overvoltage
18	Pre Gen Neg. Phase Overvoltage
19	Gen Overfrequency
20	Pre Gen Overfrequency
21	Gen Underfrequency
22	Pre Gen Underfrequency
23	Gen Overvoltage
24	Pre Gen Overvoltage
25	Gen Undervoltage
26	Pre Gen Undervoltage
27	Gen Overpower
28	Pre Gen Overpower
29	Gen Reverse Power
30	Pre Gen Reverse Power
31	Gen Over VARs
32	Pre Gen Over VARs
33	Gen Reverse VARs
34	Pre Gen Reverse VARs
35	Gen Phase Diff Current
36	Pre Gen Diff Current
37	Gen Phase Over Current
38	Pre Gen Phase Over Current
39	Not Used
40	KVA Switch
41	Load High Limit
42	Load Low Limit
43	Not Used
44	Trip Tie Breaker

Alm #	Event Name
45	Not Used
46	Not Used
47	Not Used
48	Not Used
49	Not Used
50	Not Used
51	Not Used
52	Not Used
53	Not Used
54	Not Used
55	Not Used
56	Not Used
57	Not Used
58	Not Used
59	Not Used
60	Not Used
61	Not Used
62	Not Used
63	Not Used
64	Not Used
65	Not Used
66	Not Used
67	Not Used
68	Not Used
69	Not Used
70	Not Used
71	Not Used
72	Not Used
73	Gen Volt. Restrained Over Current
74	Pre Gen V-Restrained Over Current
75	Over Speed
76	Phase Rotation Mismatch
77	Process High Limit
78	Process Low Limit
79	Oil Press High (Idle)
80	Oil Press Low (Idle)
81	Oil Press High (Rated)
82	Oil Press Low (Rated)
83	Pre Oil Press Low (Rated)
84	Remote Alarm 1
85	Remote Alarm 2
86	Remote Alarm 3
87	Remote Alarm 4
88	Remote Alarm 5
89	Remote Alarm 5
90	Prog. Config. Error
91	Analog Input 1 High
92	Not Used
93	Analog Input 1 Low
94	Not Used

Alm #	Event Name
95	Analog Input 2 High
96	Not Used
97	Analog Input 2 Low
98	Not Used
99	Analog Input 3 High
100	Pre Analog Input 3 High
101	Analog Input 3 Low
102	Pre Analog Input 3 Low
103	Analog Input 4 High
104	Pre Analog Input 4 High
105	Analog Input 4 Low
106	Pre Analog Input 4 Low
107	Gen Breaker Sync Timeout
108	Bus Breaker Sync Timeout
109	Gen Sync Reclose
110	Bus Sync Reclose
111	Speed/Frequency Mismatch
112	Speed Range
113	Voltage Range
114	Crank Denied
115	Fail to Reach Idle
116	Fail to Reach Rated
117	Modbus Port 1 Failed
118	Modbus Port 2 Failed
119	Analog Input 1 Failed
120	Analog Input 2 Failed
121	Analog Input 3 Failed
122	Analog Input 4 Failed
123	EGCP3 Power Board Fault
124	LON Auto Start Fault
125	LON Auto Stop Fault
126	Service Hours Expired
127	Analog Input 5 High
128	Analog Input 5 Low
129	Pre Analog Input 5 High
130	Pre Analog Input 5 Low
131	Analog Input 6 High
132	Analog Input 6 Low
133	Pre Analog Input 6 High
134	Pre Analog Input 6 Low
135	Analog Input 7 High
136	Analog Input 7 Low
137	Pre Analog Input 7 High
138	Pre Analog Input 7 Low
139	Analog Input 8 High
140	Analog Input 8 Low
141	Pre Analog Input 8 High
142	Pre Analog Input 8 Low
143	Thermocouple In Failed (Analog Combo)
144	Analog Input 9 High

Alm #	Event Name
145	Analog Input 9 Low
146	Pre Analog Input 9 High
147	Pre Analog Input 9 Low
148	Analog Input 10 High
149	Analog Input 10 Low
150	Pre Analog Input 10 High
151	Pre Analog Input 10 Low
152	Analog Input 11 High
153	Analog Input 11 Low
154	Pre Analog Input 11 High
155	Pre Analog Input 11 Low
156	Analog Input 12 High
157	Analog Input 12 Low
158	Pre Analog Input 12 High
159	Pre Analog Input 12 Low
160	Analog Input 13 High
161	Analog Input 13 Low
162	Pre Analog Input 13 High
163	Pre Analog Input 13 Low
164	Analog Input 14 High
165	Analog Input 14 Low
166	Pre Analog Input 14 High
167	Pre Analog Input 14 Low
168	4_20mA In Failed (Analog Combo)
169	Analog Input 16 High
170	Analog Input 16 Low
171	Pre Analog Input 16 High
172	Pre Analog Input 16] Low
173	Analog Input 17 High
174	Analog Input 17 Low
175	Pre Analog Input 17 High
176	Pre Analog Input 17 Low
177	Analog Input 18 High
178	Analog Input 18 Low
179	Pre Analog Input 18 High
180	Pre Analog Input 18 Low
181	Analog Input 19 High
182	Analog Input 19 Low
183	Pre Analog Input 19 High
184	Pre Analog Input 19 Low
185	RTD Input Failed (Analog Combo)
186	Analog Combo Hardware Fault
187	Actuator Driver Fault
188	Actuator Open Load Fault
189	MPU Maximum Difference Alarm
190	Remote Alarm 7
191	Remote Alarm 8
192	Remote Alarm 9

Protective Relay Descriptions

The PT and CT inputs were designed for accurate voltage and current monitoring in applications of display and control. They are not designed for high speed,
sub-cycle, or cycle-to-cycle protective relaying though time delay protective relaying can be used.

WARNING—OVERSPEED/OVERCURRENT

The AtlasSC Load+Speed Control should not be used as the only means for detecting voltage or current disturbances, dead bus conditions, or overcurrent conditions. The generator should be equipped with a sync check relay, circuit breaker, and other fast acting protective relays as required by local codes and practices to protect against damage to the generator with possible personal injury, loss of life, or property damage. The sync check relay, circuit breaker, and other fast-acting protective relays must be totally independent of the AtlasSC Load+Speed Control.

The table below gives some summary information about each type of protective relay function provided. Details for each follow the table. Note that the Alarm and Pre-Alarm Time Delays are used for both high and low conditions.

Name	Functionality	Type
Generator Under/Over Voltage (27,59)	Alarm and Pre-Alarm capability	Definite Time
Generator Over/Under Frequency (81O, 81U)	Alarm and Pre-Alarm capability	Definite Time
Generator Directional Power Relay (32)	Alarm and Pre-Alarm capability	Inverse Time
Generator Negative Phase Sequence Over Current (46)	Alarm and Pre-Alarm capability	Definite Time
Generator Negative Phase Sequence Over Voltage (47)	Alarm and Pre-Alarm capability	Definite Time
Generator Phase Over Current (51)	Alarm and Pre-Alarm capability	Inverse Time
Generator Voltage Restrained Phase Over Current (51V)	Alarm and Pre-Alarm capability	Inverse Time
Generator Directional VAR Relay	Alarm and Pre-Alarm capability	Definite Time
Generator Phase Current Differential Imbalance relay (87)	Alarm and Pre-Alarm capability	Inverse Time
Sync Check (25)	True / False (no alarm)	Definite Time
Voltage (VAR/PF) Adjust Limits Reached	High and Low Alarms	Definite Time
Speed (Load) Adjust Limits Reached	High and Low Alarms	Definite Time
Over Speed Alarm (12)	Alarm only	Definite Time
Battery Voltage	Alarm only	Definite Time
Coolant Temperature	Alarm and Pre-Alarm capability	Definite Time
Rated Oil Pressure	Alarm and Pre-Alarm capability	Definite Time
Idle Oil Pressure	Alarm only	Definite Time
Remote Fault1	Alarm only	Definite Time
Remote Fault2	Alarm only	Definite Time
Remote Fault3	Alarm only	Definite Time
Remote Fault4	Alarm only	Definite Time
Remote Fault5	Alarm only	Definite Time
Remote Fault6	Alarm only	Definite Time
Remote Fault7	Alarm only	Definite Time
Remote Fault8	Alarm only	Definite Time
Remote Fault9	Alarm only	Definite Time
Spare Analog Alarm 3	Alarm and Pre-Alarm	Definite Time
Spare Analog Alarm 4	Alarm and Pre-Alarm	Definite Time
Spare Analog Alarm 5	Alarm and Pre-Alarm	Definite Time
Spare Analog Alarm 6	Alarm and Pre-Alarm	Definite Time
Spare Analog Alarm 9	Alarm and Pre-Alarm	Definite Time

Name	Functionality	Type
Spare Analog Alarm 10	Alarm and Pre-Alarm	Definite Time
Spare Analog Alarm 16	Alarm and Pre-Alarm	Definite Time
Spare Analog Alarm 17	Alarm and Pre-Alarm	Definite Time
Spare Analog Alarm 18	Alarm and Pre-Alarm	Definite Time
Speed / Frequency Mismatch	Alarm only	Definite Time

Over and Under Voltage

The Over and Under Voltage protective relay is definite time. It operates by comparing the actual voltage to the level set points for this relay. The highest voltage of the 3 phase inputs is always used for the Over Voltage protective relay. Likewise, the lowest voltage of the 3 phase inputs is always used for the Under Voltage protective relay. Once an alarm is issued, it is latched until the AtlasSC Load+Speed Control is reset. The generator Under Voltage relay is automatically disabled anytime the generator breaker is open. The Generator Over Voltage relay is not inhibited by breaker position.

The action to be taken for an Over Voltage Pre-Alarm, Over Voltage Alarm, Under Voltage Pre-Alarm, and Under Voltage Alarm are all independently configurable. There are separate Delay times for Pre-Alarm and Alarm. The delay times for Over Voltage and Under Voltage are identical.

The Alarm and Pre-Alarm trigger levels for an Over Voltage Pre-Alarm, Over Voltage Alarm, Under Voltage Pre-Alarm, and Under Voltage Alarm are all independently configurable. The worst case phase voltage must exceed the configured level continuously for the delay time before the Alarm or Pre-Alarm action is taken.

The diagram below shows how the Pre-Alarm and final Alarm events are envisioned to operate. Note that the delay times are identical between Over and Under Voltage event examples but the trigger levels are all separately configurable.

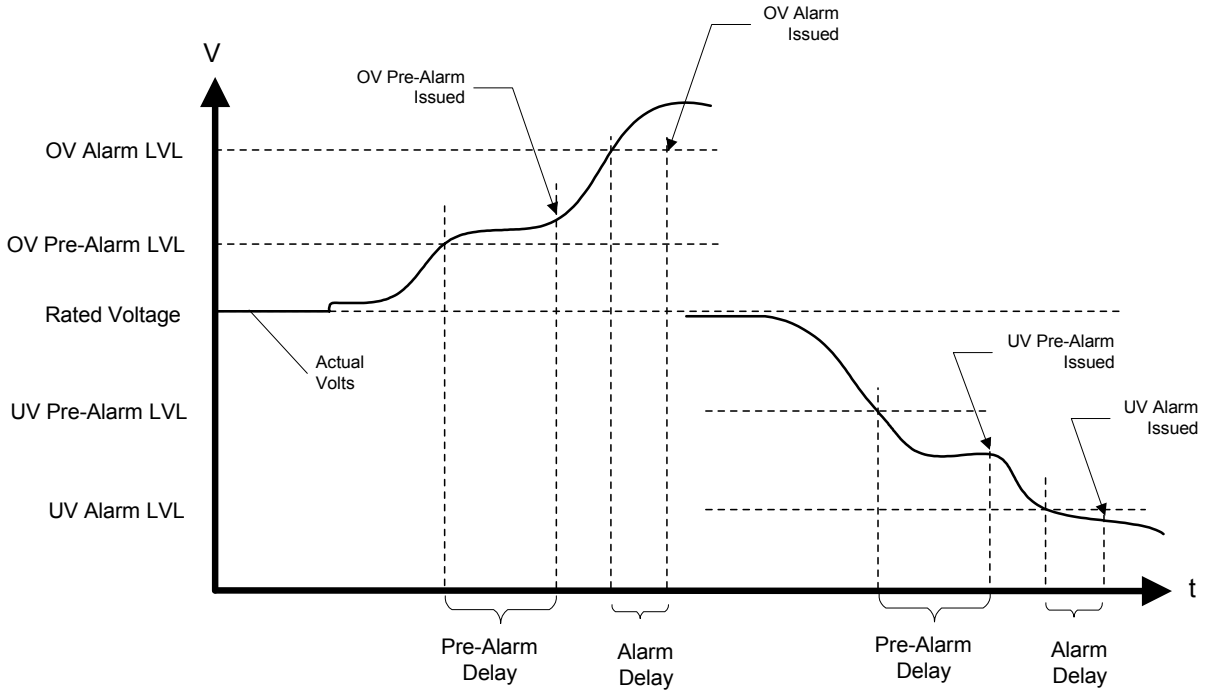


Figure 6-1. Over Voltage/Under Voltage Alarm

Over and Under Frequency

The Over and Under Frequency protective relay is definite time. It operates by comparing the actual frequency to the level set points for this relay. Once an alarm is issued, it is latched until the AtlasSC Load+Speed Control is reset. The generator Under Frequency relay is automatically disabled anytime the generator breaker is open. The Generator Over Frequency relay is not inhibited by breaker position.

The action to be taken for an Over Frequency Pre-Alarm, Over Frequency Alarm, Under Frequency Pre-Alarm, and Under Frequency Alarm are all independently configurable. There are separate Delay times for Pre-Alarm and final Alarm. The delay times for Over Frequency and Under Frequency are identical.

The Alarm and Pre-Alarm trigger levels for an Over Frequency Pre-Alarm, Over Frequency Alarm, Under Frequency Pre-Alarm, and Under Frequency Alarm are all independently configurable. The frequency must exceed the level continuously for the delay time before the Alarm or Pre-Alarm action is taken.

The diagram in Over and Under Voltage above shows how the Pre-Alarm and final Alarm events are envisioned to operate. The Over and Under Frequency protective relay function operates in the same manner as the Over and Under Voltage protective relay function.

Directional Power

The Over and Reverse Power protective relays are inverse time. They operate by comparing the actual real power to the level set point for this relay. Only real power is of interest for this protection. Over power for the generator is power flowing out of the generator (produced by the generator).

A configurable time delay setting is provided to shift the inverse time curve along the time axis. This movement allows adjustment of the minimum trip time at the configured level. The same shifted curve is used for Pre-Alarms and Alarms so a time shift done for one will affect the other as well. The same shift is also applied to both the Over Power and the Reverse Power protective relays.

The power level must exceed the level continuously for the calculated delay time before the Alarm or Pre-Alarm action is taken. The delay time is recalculated each time the power level changes. Once an alarm is issued, it is latched until the AtlasSC Load+Speed Control is reset. The Directional Power relays are continuously enabled.

The below graph shows how the Pre-Alarm and final Alarm settings relate to actual and rated power levels. Notice the delay time for the over power pre alarm is longer than the delay time for the over power alarm. This time difference results from the difference in the actual power compared to the pre-alarm and alarm set points. A long time delay is seen when the actual power is only slightly higher than the pre-alarm level. When the actual power goes above the alarm level it goes noticeably higher so the time delay is shorter. In order to determine the calculated delay and to see how the curve shift is used, refer to the second graph below.

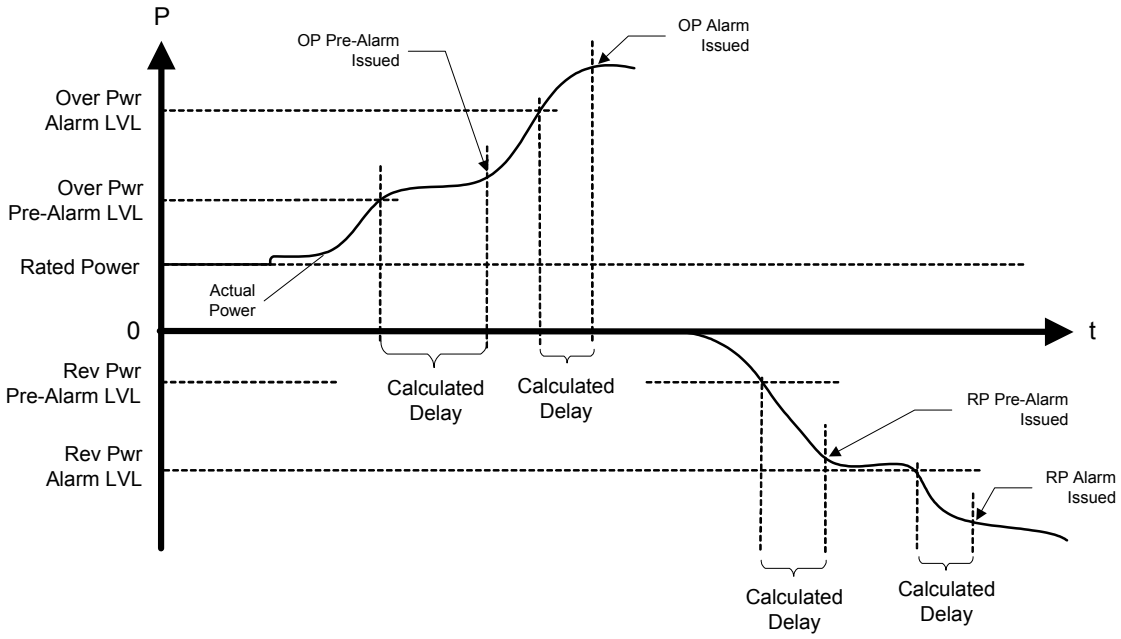


Figure 6-2. Over Power/Reverse Power

The graph below shows how the inverse time curve is applied to the directional power protective relay. Note the same curve shift applies to both Over and Reverse Power.

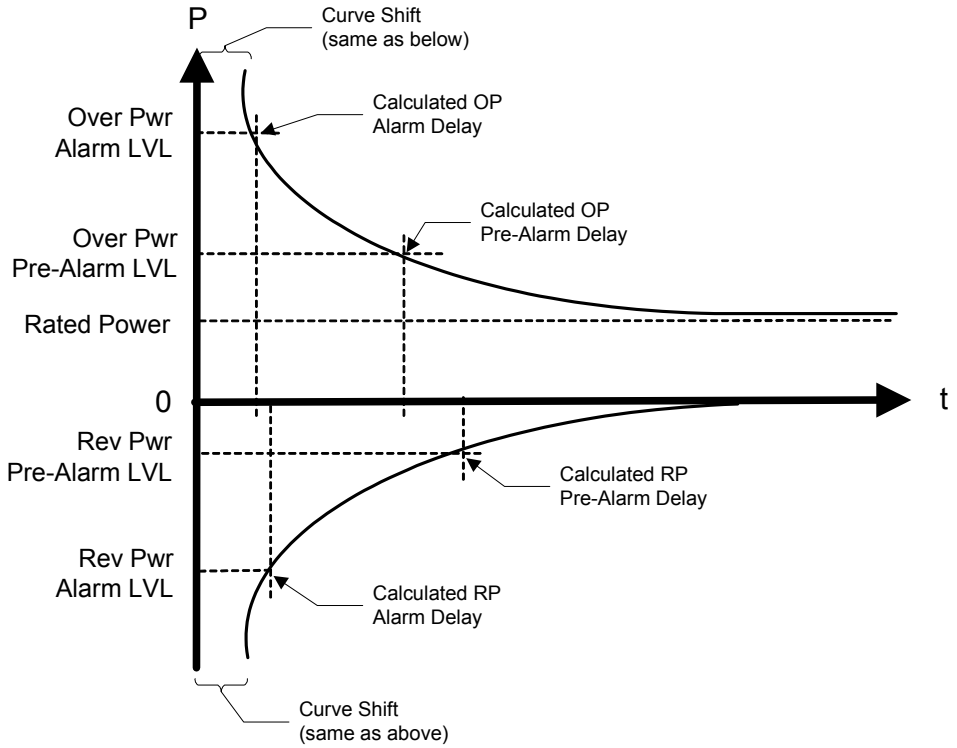


Figure 6-3. Over Power/Reverse Power Time Delay

Negative Phase Sequence Over Voltage

Negative Phase Sequence Voltage (NPS) is a measure of the imbalance in a three phase system. Any imbalance due to unequal voltage amplitude of the three phases or a phase angle error between phases creates NPS voltage. A completely balanced system with positive phase sequence generates 0% NPS voltage. Complete loss of one phase results in 50% NPS voltage, a 100% NPS voltage would result from a balanced system with reversed phase sequence. The NPS protection function must know the correct (expected) phase rotation in order to function properly.

Typical causes of voltage unbalance are large unbalanced loads (single phase loads in the system) and unbalances in the supply due to transformer designs or other customer loads in the power system. The most common effect of voltage unbalance (detected by NPS voltage) is rotor overheating on 3-phase motors.

For installations where significant regenerated EMF may occur (lifts, cranes, or similar), a sensitivity of 5%-7% is recommended above what is necessary for the system unbalance. To avoid tripping on system transient disturbances, this relay should be configured with a timeout from 2 to 4 seconds.

This Negative Phase Sequence Over Voltage protective relay is a definite time relay. As the name implies, it tracks levels ABOVE a configured setting. It operates by comparing the actual Negative Phase Sequence Voltage with the level set point for this relay. Once an alarm is issued, it is latched until the AtlasSC Load+Speed Control is reset. The Negative Phase Sequence Over Voltage relays are continuously enabled.

The actions to be taken for a Negative Phase Sequence Over Voltage Pre-Alarm or a Negative Phase Sequence Over Voltage Alarm are both independently configurable. The Negative Phase Sequence Over Voltage trigger levels are also independently configurable for the Pre-Alarm and Alarm. There are separate Delay times for Pre-Alarm and Alarm. The Negative Phase Sequence Voltage must exceed the trigger level continuously for the delay time before the Alarm or Pre-Alarm action is taken.

The diagram in Over and Under Voltage above shows how the Pre-Alarm and final Alarm events are envisioned to operate. Only the Over Voltage portion of the diagram is used. The Negative Phase Sequence Over Voltage protective relay function operates in the same manner as the Over Voltage protective relay function.

Negative Phase Sequence Over Current

This Negative Phase Sequence Over Current protective relay is a definite time relay. The negative phase sequence over current is derived the same as the voltage above. Once an alarm is issued, it is latched until the AtlasSC Load+Speed Control is reset. The Negative Phase Sequence Over Current relays are continuously enabled.

The actions to be taken for a Negative Phase Sequence Over Current Pre-Alarm or a Negative Phase Sequence Over Current Alarm are both independently configurable. The Negative Phase Sequence Over Current trigger levels are also independently configurable for the Pre-Alarm and Alarm. There are separate Delay times for Pre-Alarm and Alarm. The Negative Phase Sequence Current must exceed the trigger level continuously for the delay time before the Alarm or Pre-Alarm action is taken.

The diagram in Over and Under Voltage above shows how the Pre-Alarm and Alarm events are envisioned to operate. Only the Over Voltage portion of the diagram is used. The Negative Phase Sequence Over Current protective relay function operates in the same manner as the Over Voltage protective relay function.

Phase Over Current

The Phase Over Current protective relay is an inverse time relay. It operates by comparing the actual phase current to the level set point for this relay. The highest current of the 3 phase inputs is always used for the Phase Over Current protective relay. Total current is not evaluated. This protective relay is NOT meant to replace a breaker.

A configurable time delay setting is provided to shift the inverse time curve along the time axis. This movement allows adjustment of the minimum trip time at the configured level. The same shifted curve is used for Pre-Alarms and Alarms so a time shift done for one will affect the other as well.

The worst case current level must exceed the configured level continuously for the calculated delay time before the Alarm or Pre-Alarm action is taken. The delay time is always being recalculated for the present current level input. Once an alarm is issued, it is latched until the AtlasSC Load+Speed Control is reset. The Phase Over Current protective relay is continuously enabled.

The diagram in Directional Power above shows how the Pre-Alarm and final Alarm events are envisioned to operate as well as the interaction with the inverse time curve. Only the Over Power portion of the diagram is used. The Phase Over Current protective relay function operates in the same manner as the Over Power protective relay function.

Voltage Restrained Phase Over Current

The Voltage Restrained Phase Over Current protective relay is an inverse time relay. It operates by comparing the highest current of the 3 phase inputs to the level set point for this relay. The generator average voltage is used to determine the amount of restraint. Total current is not evaluated.

A configurable time delay setting is provided to shift the inverse time curve along the time axis. This movement allows adjustment of the minimum trip time at the configured level. The same shifted curve is used for Pre-Alarms and Alarms so a time shift done for one will affect the other as well.

The protective relay uses the average of the generator phase voltages to modify the Pre-Alarm and Alarm trigger levels. The phase current event trigger level is adjusted proportional to the voltage. The relationship is a 1:1 scaling. For example, if the generator voltage is at 100% of rated, the trigger level is unmodified. However, if the voltage is at 25% of rated, the phase current trigger level will also be scaled to 25% of the configured trigger level. A simple proportional multiplier is used for this purpose multiplying both the Pre-Alarm level and the Alarm level by the voltage derived scalar. The figure below shows the relationship between the current alarm level multiplier and the voltage level.

The scaled worst case current level must exceed the level continuously for the calculated delay time before the Alarm or Pre-Alarm action is taken. The delay time is always being recalculated for the present current level input. Once an alarm is issued, it is latched until the AtlasSC Load+Speed Control is reset. The Voltage Restrained Phase Over Current protective relay is continuously enabled.

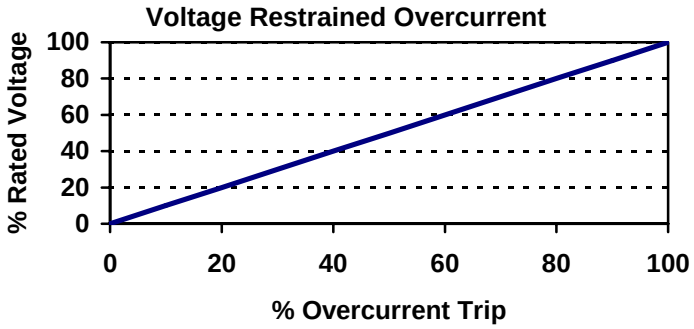


Figure 6-4. Voltage Restrained Over Current

The diagram in Directional Power above shows how the Pre-Alarm and Alarm events are envisioned to operate as well as the interaction with the inverse time curve. Only the Over Power portion of the diagram is used. The Voltage Restrained Phase Over Current protective relay function operates in the same manner as the Phase Over Current protective relay function except that the trigger level is automatically scaled proportional to the bus voltage.

Directional VAR

The Over and Reverse VAR protective relay is definite time. It operates by comparing the actual reactive power to the level set points for this relay. Only reactive power is of interest for this protection. Over VAR for the generator is reactive power flowing out of the generator (produced by the generator) and is representative of lagging power factor. Once an alarm is issued, it is latched until the AtlasSC Load+Speed Control is reset.

The action to be taken for an Over VAR Pre-Alarm, Over VAR Alarm, Reverse VAR Pre-Alarm, and Reverse VAR Alarm are all independently configurable. There are separate Delay times for Pre-Alarm and Alarm. The delay times for Forward and Reverse VAR are.

The Alarm and Pre-Alarm trigger levels for an Over VAR Pre-Alarm, Over VAR Alarm, Reverse VAR Pre-Alarm, and Reverse VAR Alarm are all independently configurable. The reactive power level must exceed the trigger level continuously for the delay time before the Alarm or Pre-Alarm action is taken.

Phase Current Imbalance

The Phase-balance Current protective relay is an inverse time relay. It operates by comparing the actual current between each phase to the level set point for this relay. The highest differential current of the 3 comparisons is always used for the Phase Current Imbalance protective relay.

A configurable time delay setting is provided to shift the inverse time curve along the time axis. This movement allows adjustment of the minimum trip time at the configured level. The same shifted curve is used for Pre-Alarms and Alarms so a time shift done for one will affect the other as well.

The worst case current differential must exceed the trigger level continuously for the calculated delay time before the Alarm or Pre-Alarm action is taken. The delay time is always being recalculated for the present current imbalance level input. Once an alarm is issued, it is latched until the AtlasSC Load+Speed Control is reset. The Phase Current Differential protective relay is continuously enabled.

The graph below shows how the Pre-Alarm and Alarm settings relate to actual current imbalance levels. The current imbalance levels are internally normalized against the rated current. This provides the inverse time function with a valid comparison because the IEEE definition is only valid above 1 per unit. Nevertheless, the configuration values for the Alarm and Pre-Alarm Level are to be entered as the actual allowed difference. The AtlasSC Load+Speed Control will automatically add Rated Current to the configured value.

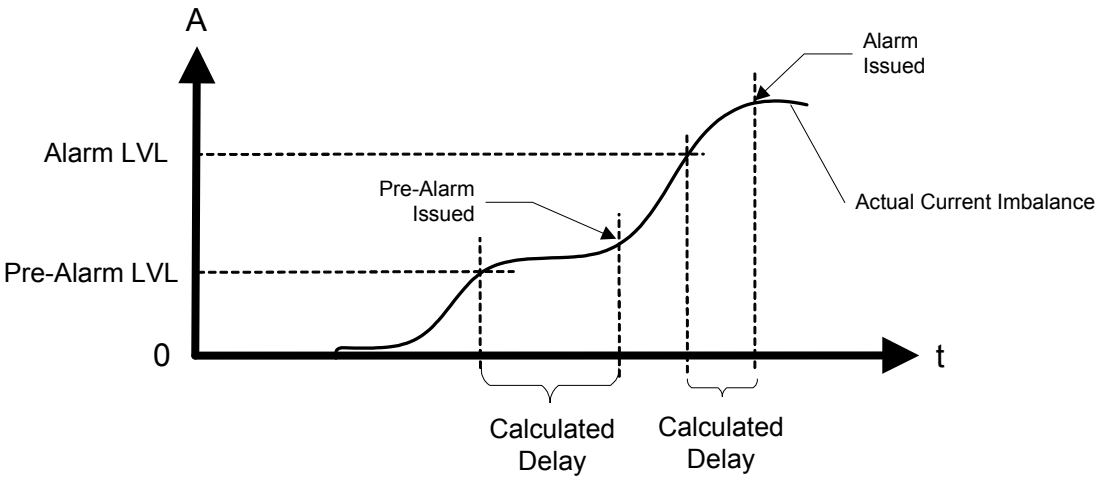


Figure 6-5. Phase Current Imbalance

In order to determine the calculated delay and to see how the curve shift is used, refer to the graph below. The Phase Current Imbalance protective relay function operates in nearly the same manner as the Over Power protective relay function except that rated current is automatically added into the percentage calculation for the IEEE inverse time curve input. The information is provided in case an exact trip time must be calculated.

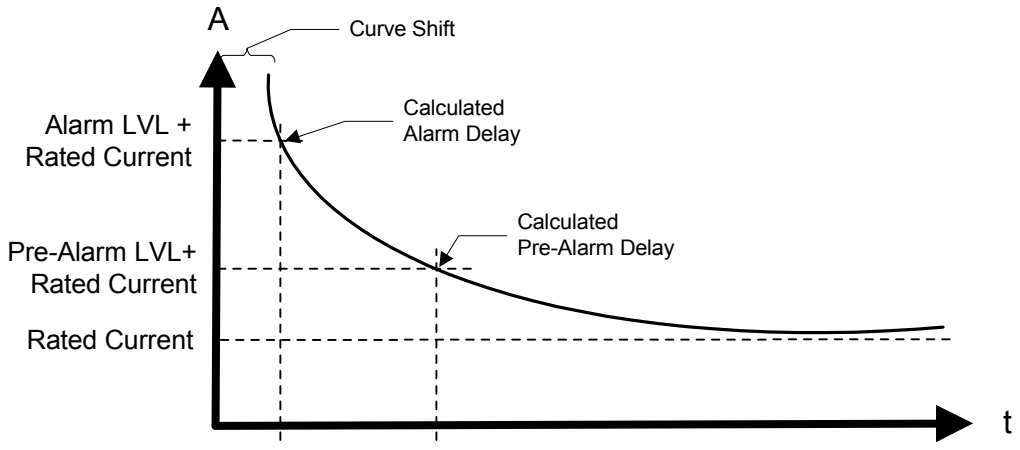


Figure 6-6. Phase-Balance Current, Inverse Time Delay

Sync Check

The AtlasSC Load+Speed Control synchronizer provides the Sync Check protective relay function. It is listed here due to its nature as a protective relay. It is enabled during synchronizing only. The synchronizer always performs a Sync Check function regardless of the configured mode since it will never assert the breaker close output unless the two A-phase inputs are in sync with each other. The synchronizer may also be placed in the Permissive Mode that mimics a typical ANSI 25 device by closing the output when the two sources are in sync.

Voltage (VAR/PF) and Speed (Load) Adjust Limits Reached

The Limits Reached alarm function applies to the two closed loop analog outputs – one for voltage adjust and the other for speed adjust. Each output has separate alarm due to exceeding the limits in the high direction or low direction. There is a fixed timeout of 10 seconds to ensure that a short bump into the limit does not cause an alarm. The alarm action is configurable.

This protection determines if the analog output or digital outputs (depending on configuration) have reached their limits. Since a digital output has no definite limit, the protection also reacts to the situation where the control is requesting more adjustment but the system is not responding. This condition would be indicative of reaching a limit.

Over Speed

The Over Speed protection watches the magnetic speed pickup input. It compares the scaled value of the MPU (the rpm value) to a single configurable set point for over speed. In order to provide a swift response, no delay is used. As soon as an over speed condition is detected, the alarm is issued. How the alarm reacts is configurable. If one of the digital outputs is programmed for Air Shutoff Solenoid, this relay will be energized by an overspeed alarm.

Battery Voltage

The Battery Voltage protection watches an internal measurement of 24vdc input supply voltage. One configurable high and one configurable low level trigger are provided. The low level alarm is disabled while the engine is cranking since the AtlasSC Load+Speed Control may be powered from the same set of batteries and would see a “normal” low voltage during this time. Otherwise, this protection is always enabled. It is a definite time protection with a fixed timeout period of 10 seconds. This timeout is used to ensure that voltage transients due to equipment power up do not cause erroneous alarms. How the alarms react is independently configurable.

Coolant Temperature

Analog Input #1 is reserved for a coolant temperature sensor. In addition to providing coolant temperature metering, the data can be used for protection and alarm. The Coolant Temperature Pre-Alarm and Alarms are definite time with a fixed timeout period of 10 seconds. This timeout period is used to ensure that noise or other disturbances do not cause erroneous alarms. If no coolant temperature sensor is provided, this protection is disabled. Once an alarm is issued, it is latched until the AtlasSC Load+Speed Control is reset.

The action to be taken for a High Coolant Temperature Pre-Alarm, High Coolant Temperature Alarm, Low Coolant Temperature Pre-Alarm, and Low Coolant Temperature Alarm are all independently configurable. The Alarm and Pre-Alarm trigger levels are also all independently configurable. The temperature must exceed the trigger level continuously for the delay time before the Alarm or Pre-Alarm action is taken.

The diagram below shows how the Pre-Alarm and Alarm events are envisioned to operate. The Coolant Temperature protection operates as a simple comparison between actual and the configured set points.

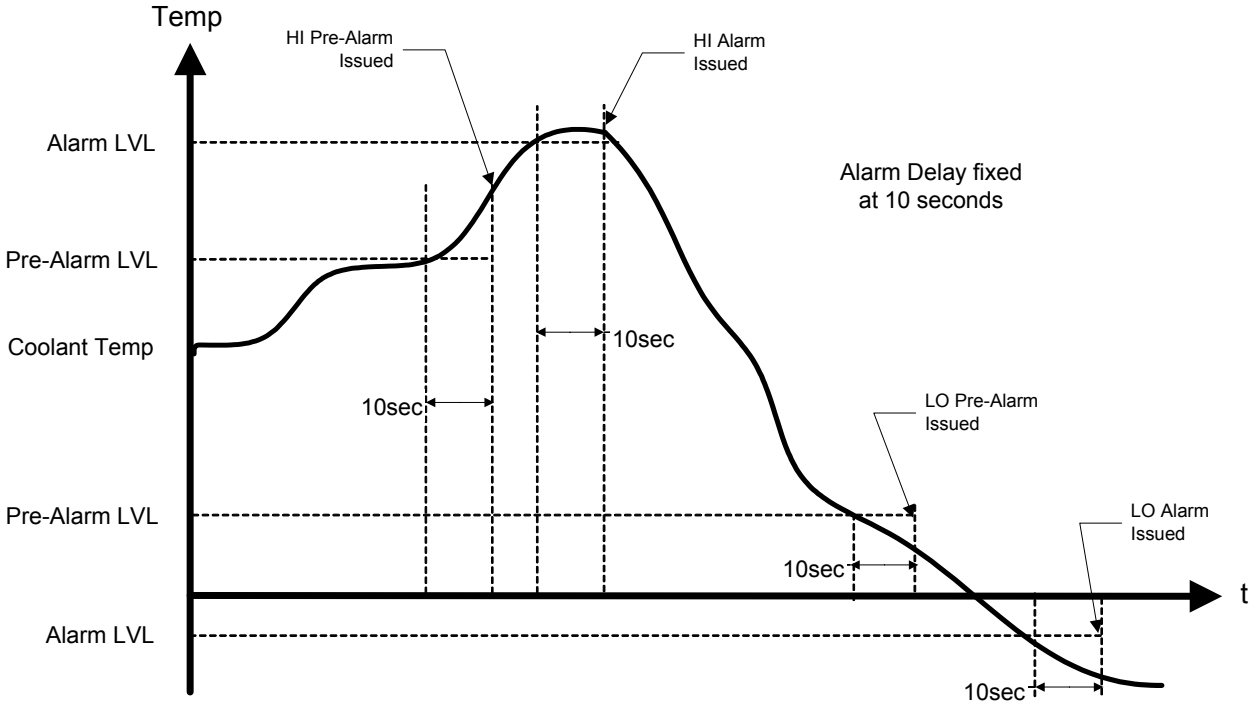


Figure 6-7. Coolant Level Alarm

Oil Pressure

Analog Input #2 is reserved for an oil pressure sensor. In addition to providing oil pressure metering, the data can be used for protection and alarm. There are three stages for oil pressure due to its natural tie to engine speed. The first stage is during Idle, the next is while ramping to rated, and the last while at Rated speed. If no oil pressure sensor is provided, this protection is disabled. Once an alarm is issued, it is latched until the AtlasSC Load+Speed Control is reset. Speeds are determined from the MPU. If no MPU is provided, the Idle Oil Pressure protection will not be able to operate.

Idle Oil Pressure Alarm

The Idle Oil Pressure Alarms are definite time delay with a fixed timeout period of 2 seconds. This timeout period is used to allow oil pressure to build-up after an engine start and to ensure that noise or other disturbances do not cause erroneous alarms.

The action to be taken and the Alarm trigger levels for a High Idle Oil Pressure Alarm and Low Idle Oil Pressure Alarm are each independently configurable. The pressure must exceed the trigger level (High Pressure), or be below the trigger level (Low Pressure) continuously for the delay time before the Alarm action is taken.

The diagram in below shows when the Idle Oil Pressure Alarms are enabled. During the ramp from Idle to Rated speed, the Low Idle Oil Pressure Alarm remains enabled.

Rated Oil Pressure Alarm
The Rated Oil Pressure Pre-Alarm and Alarms are definite time delay with a fixed timeout period of 2 seconds.

The action to be taken for a High Rated Oil Pressure Alarm, Low Rated Oil Pressure Pre-Alarm, and Low Rated Oil Pressure Alarm are all independently configurable. No High Rated Oil Pressure Pre-Alarm is provided.

The Alarm and Pre-Alarm trigger levels for a High Rated Oil Pressure Alarm, Low Rated Oil Pressure Pre-Alarm, and Low Rated Oil Pressure Alarm are all independently configurable. The pressure must exceed the trigger level continuously for the delay time before the Alarm or Pre-Alarm action is taken.

The diagram in Coolant Temperature above shows how the Pre-Alarm and Alarm events are envisioned to operate. The Rated Oil Pressure protection operates in the same manner as the Coolant Temperature protection function, with the exception that the time delay is only two seconds compared to ten. The graph below shows when the Rated Oil Pressure Alarms and Pre-Alarms are enabled as well as when the Idle Oil Pressure Alarms are enabled. During the ramp from Idle to Rated speed, the High Rated Oil Pressure Alarm is enabled but the Low Rated Oil Pressure Alarm and Pre-Alarm are not enabled.

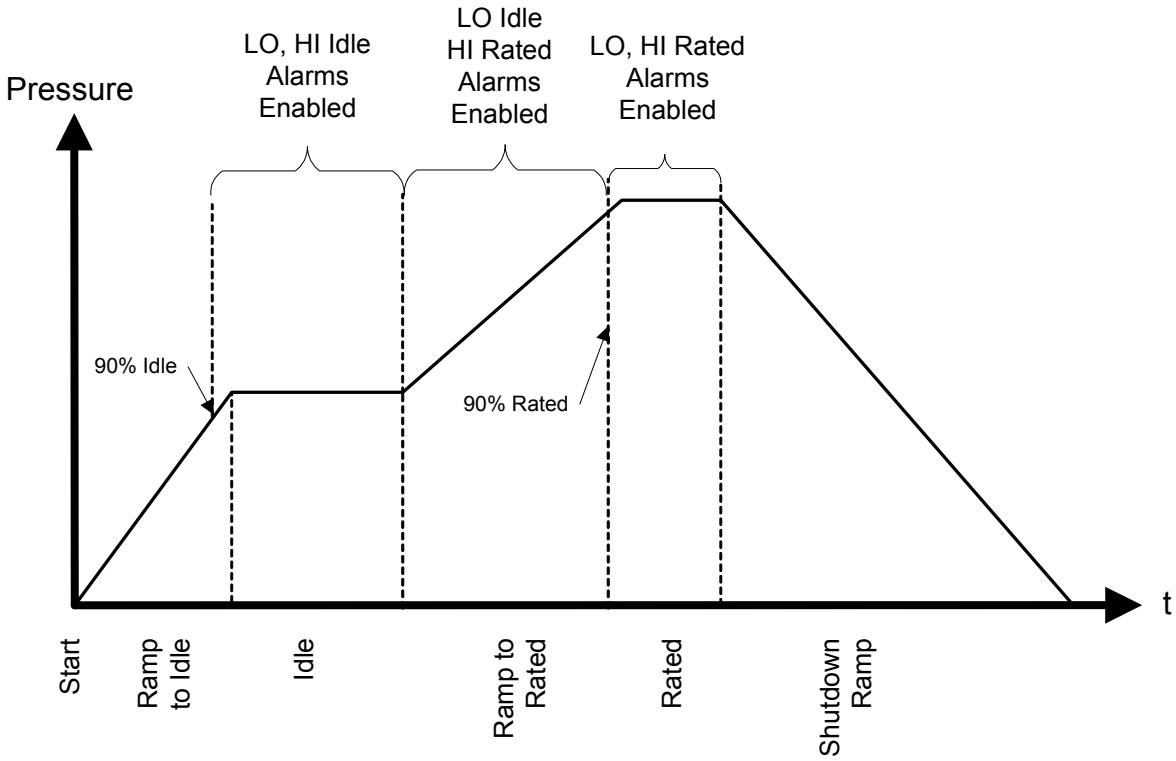


Figure 6-8. Oil Pressure Engine Protection

Remote Alarms

There are six (9) configurable alarms based on digital inputs. Each alarm is a definite time function with a configurable delay time. The action taken by each alarm is configurable for Disabled, Warning, Audible, Visual, Soft Shutdown, Hard Shutdown, Trip tie breaker, and Trip tie breaker with alarm (remote alarms 7, 8 and 9 don't have the options Trip tie breaker, and Trip tie breaker with alarm). Each input may be configured to consider the active condition as one with +24Vdc applied to the input (active high) or with the input floating (active low). The input must meet the active condition continuously for the delay time before the Alarm action is taken.

Remote Analog Alarm

There are two (9) configurable alarms based on the spare analog inputs. Four of them are 4-20mA analog inputs, two of them are thermocouple inputs and three of them are RTD inputs. Each has High Alarm and High Pre-Alarm level set points and Low Alarm and Low Pre-Alarm level set points. The action taken by the Alarms and Pre-Alarms are all configurable for Disabled, Warning, Audible, Visual, Soft Shutdown, Hard Shutdown, Trip tie breaker, and trip tie breaker with alarm (the seven analog inputs that are in the Analog Combo board don't have the options Trip tie breaker, and trip tie breaker with alarm).

The Spare Analog Alarms are all definite time alarms with configurable timeouts. Each is configured in the same manner as the Coolant Temperature Alarms described above except that the delay time is configurable.

Speed / Frequency Mismatch

The Speed/Frequency Mismatch protection watches the magnetic pickup speed input and the measured frequency on the generator input. It compares the scaled value of the MPU (the rpm value) to the frequency using a simple formula. The formula also depends on the configured number of generator poles.

$$Frequency = \frac{\#GenPoles \bullet RPM}{120}$$

The purpose of this protection is partly to identify an incorrect configuration for the number of teeth but primarily to diagnose a failed MPU signal or a generator failure. If the one of the signals fail, a mismatch will occur between the measured MPU speed and the measured generator frequency. Since over speed is determined from the MPU input, this protection is an important adder to the over speed protection.

A fixed delay of 5 seconds is incorporated. A one hertz margin is allowed. How the alarm reacts is configurable.

Inverse Time Curve

All protective relays that utilize inverse time trips will use the same curve shape as defined below. Each relay will be allowed to independently adjust the curve along the time axis. This adjustment does not alter the curve shape. The reason for the adjustment is to allow fine tuning of the alarm levels and timing.

The AtlasSC Load+Speed Control takes the ratio of the input being used (phase current, power, etc.) to the rated value of that unit. The inverse time curve always uses a ratio of rated for its data element.

The inverse time curve plotted below is defined in IEEE C37.112 as the Very Inverse formula

$$Time = \left(\frac{A}{x^p - 1} + B \right) * D$$

where:

Time	The amount of time to wait before an alarm is issued for the given value of x. As x increases, the time will decrease.
X	A ratio of the measured parameter in protection to rated value.
A	IEEE defined constant that affects the curve shape. It is fixed at **19.61.**
B	IEEE defined constant that affects the curve position. It is fixed at **0.491**
P	IEEE defined constant that defines the curve type. It is fixed at **2.**
D	Adjustable time delay. This allows the curve to be shifted along the time axis by a variable amount.**, 0.01 to 10.0, default =1.0**

For high alarms: If the input is less than the Alarm level and Pre-Alarm level, no action will be taken. When the input is above the Pre-Alarm level, the configured action will be taken for the pre-alarm after the timeout defined by the formula. When the input is above the Alarm level, the appropriate (and typically more severe) action will be taken after the (shorter) timeout defined by the formula.

For low alarms: If the input is greater than the Alarm level and Pre-Alarm level, no action will be taken. When the input is less than the Pre-Alarm level, the configured action will be taken for the pre-alarm after the timeout defined by the formula. When the input is less than the Alarm level, the appropriate (and typically more severe) action will be taken after the (shorter) timeout defined by the formula.

The IEEE curve implemented is the Very Inverse curve defined in IEEE C37.112 and also matches the IEC curve defined in IEC 255-03 except for the additional time shift (B) that is not defined in IEC. The formula will not function at rated or below rated for the parameter in protection. Therefore, if a trip value is set at or below rated, the timeout for these conditions will be fixed at 10 seconds. This causes a discontinuity in the curve at 100% rated. The values for A and B in the IEEE formula change at the discontinuity point. The constant A becomes 0 and the constant B becomes 10. Due to the location of the B constant and the D variable, the 10 second timeout will also adjust with the curve shift.

The figure below is a set of curves showing the IEEE Very Inverse formula plotted three times. The center plot is the default curve with no level shift, Shift value = 1.0. The upper plot is the same curve with a level shift of five. The lower plot is the same curve with a level shift of 0.1. Note the curve shape does not change. Also note the fixed timing at or below rated as shown by the straight horizontal line; and note how the fixed timing is varied with the curve shift. The AtlasSC Load+Speed Control curve does extend to the right beyond the time shown.
Also shown below is a figure with the Inverse Time Curve converted to linear axis scale. The values used in the AtlasSC Load+Speed Control extend above 25 second delay between 1.0 and 1.35, and also extend to the right beyond the ratio of 5.0.

Example: If the alarm set point is 150% of the rated (1.5 ratio) and the input is at this setpoint value and the shift = 1.0, the delay will be 16 seconds. When shift = 5, delay will be 80 seconds. When shift = 0.1, delay will be 1.6 seconds. As the input value exceeds the setpoint, the delay will become shorter.
Example: For an Over Current Trip Relay function: If Rated Phase Current is 500 Amps, and a trip delay of 5.0 second is desired at 700 Amp.
Ratio = 1.4, from formula (or reading from curve below) the Normalized Delay = 20.9 sec.
5.0 / 21.0 = 0.24

The curve shift value of 0.24 is required to meet the desired level and delay requirement.

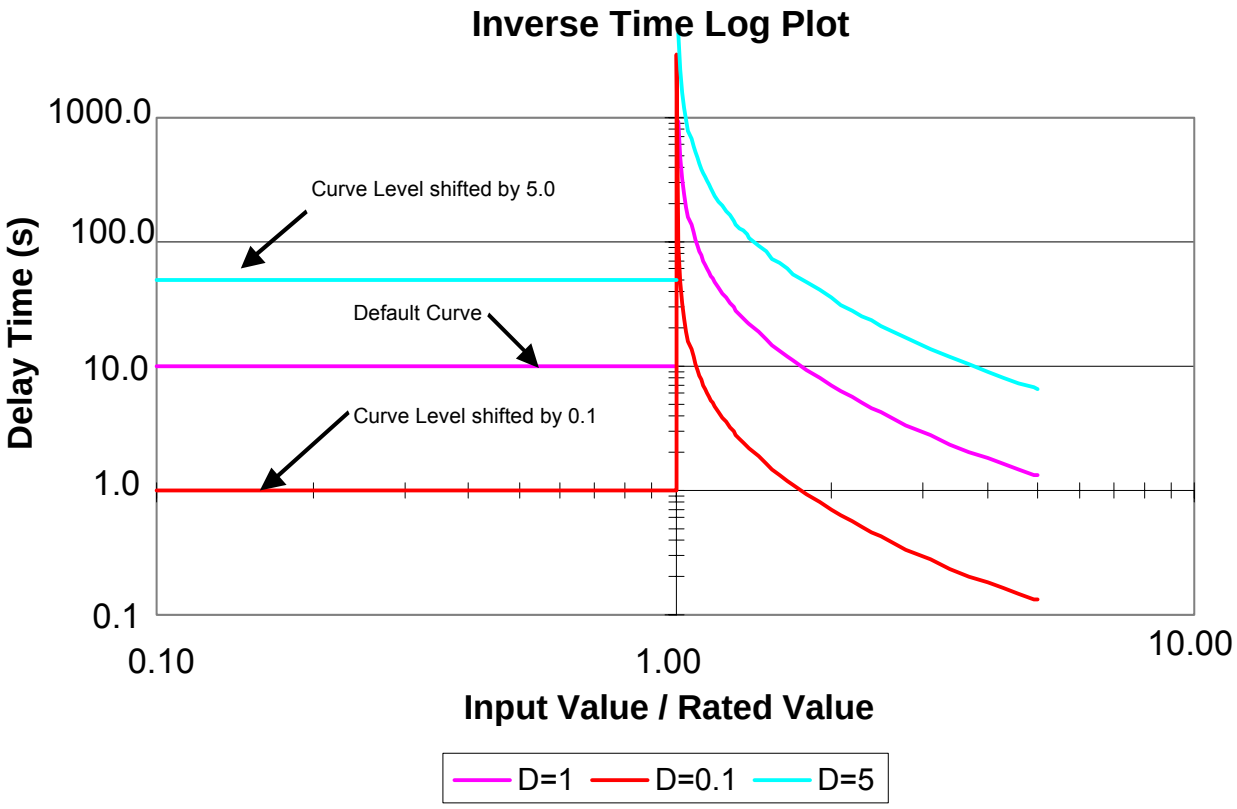


Figure 6-9. Inverse Curve Time Delay, Level Shift

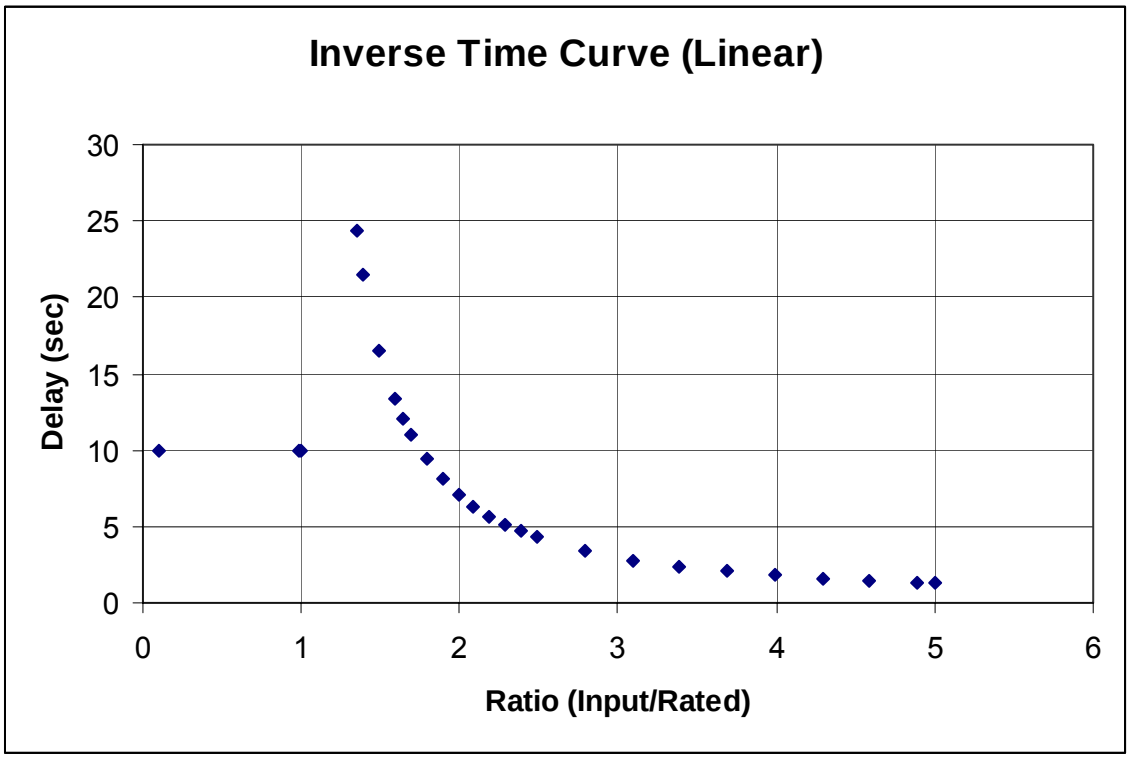


Figure 6-10. Inverse Curve Time Delay, Linear Graph

Chapter 7.
Service Options

Product Service Options

The following factory options are available for servicing Woodward equipment, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is purchased from Woodward or the service is performed:

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

If you are experiencing problems with installation or unsatisfactory performance of an installed system, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact Woodward technical assistance (see “How to Contact Woodward” later in this chapter) and discuss your problem. In most cases, your problem can be resolved over the phone. If not, you can select which course of action you wish to pursue based on the available services listed in this section.

Replacement/Exchange

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

This option allows you to call 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 Woodward facility as explained below (see “Returning Equipment for Repair” later in this chapter).

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned to Woodward within 60 days, Woodward will issue a credit for the core charge. [The core charge is the average difference between the flat rate replacement/exchange charge and the current list price of a new unit.]

Return Shipment Authorization Label. To ensure prompt receipt of the core, and avoid additional charges, the package must be properly marked. A return authorization label is included with every Replacement/Exchange unit that leaves Woodward. The core should be repackaged and the return authorization label affixed to the outside of the package. Without the authorization label, receipt of the returned core could be delayed and cause additional charges to be applied.

Flat Rate Repair

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

Flat Rate Remanufacture

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

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned to Woodward for repair, please contact Woodward in advance to obtain a Return Authorization Number. When shipping the item(s), attach a tag with the following information:

- 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.

CAUTION—ELECTROSTATIC DISCHARGE

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*.

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.

Return Authorization Number

When returning equipment to Woodward, please telephone and ask for the Customer Service Department [1 (800) 523-2831 in North America or +1 (970) 482-5811]. They will help expedite the processing of your order through our distributors or local service facility. To expedite the repair process, contact Woodward in advance to obtain a Return Authorization Number, and arrange for issue of a purchase order for the item(s) to be repaired. No work can be started until a purchase order is received.

NOTE

We highly recommend that you make arrangement in advance for return shipments. Contact a Woodward customer service representative at 1 (800) 523-2831 in North America or +1 (970) 482-5811 for instructions and for a Return Authorization Number.

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.

How to Contact Woodward

In North America use the following address when shipping or corresponding:

Woodward Governor Company
PO Box 1519
1000 East Drake Rd
Fort Collins CO 80522-1519, USA

Telephone—+1 (970) 482-5811 (24 hours a day)
Toll-free Phone (in North America)—1 (800) 523-2831
Fax—+1 (970) 498-3058

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

Facility	Phone Number
Brazil	+55 (19) 3708 4800
India	+91 (129) 4097100
Japan	+81 (476) 93-4661
The Netherlands	+31 (23) 5661111

You can also contact the Woodward Customer Service Department or consult our worldwide directory on Woodward's website (**www.woodward.com**) for the name of your nearest Woodward distributor or service facility.

Engineering Services

Woodward Industrial Controls Engineering Services offers the following after-sales support for Woodward products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Contact information:

Telephone—+1 (970) 482-5811
Toll-free Phone (in North America)—1 (800) 523-2831
Email—icinfo@woodward.com
Website—**www.woodward.com**

Technical Support is available through our many worldwide locations or our authorized distributors, depending upon the product. This service can assist you with technical questions or problem solving during normal business hours. Emergency assistance is also available during non-business hours by phoning our toll-free number and stating the urgency of your problem. For technical support, please contact us via telephone, email us, or use our website and reference ***Customer Services*** and then ***Technical Support***.

Product Training is available at many of our worldwide locations (standard classes). We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability. For information concerning training, please contact us via telephone, email us, or use our website and reference ***Customer Services*** and then ***Product Training***.

Field Service engineering on-site support is available, depending on the product and location, from one of our many worldwide locations or from one of our authorized 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 field service engineering assistance, please contact us via telephone, email us, or use our website and reference ***Customer Services*** and then ***Technical Support***.

Technical Assistance

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

General

Your Name _____
Site Location _____
Phone Number _____
Fax Number _____

Prime Mover Information

Engine/Turbine Model Number _____
Manufacturer _____
Number of Cylinders (if applicable) _____
Type of Fuel (gas, gaseous, steam, etc) _____
Rating _____
Application _____

Control/Governor Information

Please list all Woodward governors, actuators, and electronic controls in your system:

Woodward Part Number and Revision Letter _____

Control Description or Governor Type _____

Serial Number _____

Woodward Part Number and Revision Letter _____

Control Description or Governor Type _____

Serial Number _____

Woodward Part Number and Revision Letter _____

Control Description or Governor Type _____

Serial Number _____

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

Appendix A. Specifications

Accuracy Specifications

Element	Accuracy	Description
Voltage Metering	0.25% at rated voltage	At 23±5 °C and any PF between 0.5 lead and 0.5 lag
Current Metering	0.25% at 5 A	At 23±5 °C and any PF between 0.5 lead and 0.5 lag
Power Metering	0.5% at rated V & I	At 23±5 °C and any PF between 0.5 lead and 0.5 lag
Energy Metering	0.5 kW·h / month	At 23±5 °C
PF Metering	±0.003 PF	Across entire range of 0.5 lead to 0.5 lag
Frequency Metering	±0.05 Hz	Between 40 and 70 Hz
Speed Metering	±0.08% of 100 Hz–25 kHz	At any stable temperature within the operating range
Analog Inputs	±0.1% of 0–25 mA (±0.025 mA) ±0.1% of 1–5 V (±0.018 V)	At 23±5 °C
Analog Outputs	±0.1% of 0–25 mA (±0.025 mA)	At 23±5 °C
Voltage Bias Output	±0.1% of ±9 V (±0.018 V) ±0.1% of 0–25 mA (±0.025 mA)	At 23±5 °C
Typical Temperature Drift for AC inputs	0.3% for any 40 °C change	Within the operating range
Harmonics 2–7	1%	For each harmonic measured
Harmonics 9, 11, 13	2%	For each harmonic measured
Time / Date Clock	1 minute / month	At 23±5 °C

Environment Specifications

Environment	Details
Temperature	
Operating	–20 to +70 °C (–4 to +158 °F)
Storage	–30 to +80 °C (–22 to +176 °F)
Humidity	
Operating	95% at +60 °C (140 °F)
Mechanical Vibration	
Random Test	10–2000 Hz at 0.04 G^2/Hz and 8.2Grms PSD
Sine Test	5–2000 Hz at 2.5 g
Mechanical Shock	
Non-Operating	30 g peak, 11 ms duration
Enclosure Rating	
Ingress Protection	Meets IP54 per EN60529 when properly installed in an enclosure rated IP54 or greater
NEMA	Meets Type 4 requirements from the front panel and properly installed in an equivalent enclosure
Pollution Degree	2

Appendix B.
AtlasSC™ Load+Speed Control LS
Modbus List

Boolean Writes

Modbus ID	Item Function	Semantics
00001	ENABLE AUTO	Sets control mode to AUTO, 0=False, 1=True (Momentary)
00002	ENABLE TEST	Sets control mode to TEST, 0=False, 1=True (Momentary)
00003	ENABLE RUN W/ LOAD	Sets control mode to RUN, 0=False, 1=True (Momentary)
00004	VOLT/PF/VAR RAISE	0=False, 1=True
00005	VOLT/PF/VAR LOWER	0=False, 1=True
00006	LOAD/SPEED RAISE	0=False, 1=True
00007	LOAD/SPEED LOWER	0=False, 1=True
00008	ENABLE PROCESS	Sets Load mode to PROCESS control 0=False, 1=True (Momentary)
00009	REMOTE ALARM #1	0=Off, 1=On
00010	REMOTE ALARM #2	0=Off, 1=On
00011	REMOTE ALARM #3	0=Off, 1=On
00012	REMOTE ALARM #4	0=Off, 1=On
00013	REMOTE ALARM #5	0=Off, 1=On
00014	REMOTE ALARM #6	0=Off, 1=On
00015	RESET VAR/PF	0=False, 1=True
00016	COMMIT ALARM	Only performs horn silence
00017	LOAD RAMP PAUSE	0=False, 1=True
00018	NOT USED	
00019	NOT USED	
00020	RESET ALARM/FAULT	0=False, 1=True
00021	ENABLE VAR/PF CONTROL	Sets Load mode to VAR/PF control, 0=False, 1=True (Momentary)
00022	UNLOAD COMMAND	0=False, 1=True
00023	NOT USED	
00024	NOT USED	
00025	RESET LOAD	0=False, 1=True (Momentary)
00026	SYNCHRONIZER OFF MODE	Sets sync mode to OFF, 0=False, 1=True (Momentary)
00027	SYNCHRONIZER CHECK MODE	Sets sync mode to CHECK, 0=False, 1=True (Momentary)
00028	SYNCHRONIZER PERMISSIVE MODE	Sets sync mode to PERMISSIVE, 0=False, 1=True (Momentary)
00029	SYNCHRONIZER RUN MODE	Sets sync mode to RUN, 0=False, 1=True (Momentary)
00030	DISABLE AUTO	Removes AUTO control mode, 0=False, 1=True (Momentary)
00031	DISABLE TEST	Removes TEST control mode, 0=False, 1=True (Momentary)
00032	DISABLE RUN W/ LOAD	Removes RUN control mode, 0=False, 1=True (Momentary)
00033	DISABLE PROCESS	Removes PROCESS Load control mode, 0=False, 1=True (Momentary)
00034	DISABLE VAR/PF	Removes VAR/PF Load control mode, 0=False, 1=True (Momentary)
00035	ENABLE BASELOAD	Sets Load control mode to BaseLoad, 0=False, 1=True (Momentary)
00036	DISABLE BASELOAD	Removes BaseLoad control mode, 0=False, 1=True (Momentary)

Modbus ID	Item Function	Semantics
00037	ENABLE DROOP	Sets Load control mode to Droop, 0=False, 1=True (Momentary)
00038	DISABLE DROOP	Removes Droop control mode, 0=False, 1=True (Momentary)
00039	SERVICE HOURS RESET	Will reset the service hours back to the internal setting
00040	RESET OPERATION VOLTAGE	Trigger to make a new operation voltage setting active
00041	ENABLE KW DE-RATE	Sets Rated kW to a de-rated setting, 0=False, 1=True (Momentary)
00042	DISABLE KW DE-RATE	Sets Rated kW back to the Rated W setting, 0=False, 1=True (Momentary)

Boolean Reads

Modbus ID	Item	Semantics
10001	NOT USED	
10002	NOT USED	
10003	BUS STABLE INDICATION	0=Not stable, 1=Stable
10004	ALARM STATUS	0=No Alarms, 1=Active Alarm
10005	TRIP TIE BREAKER	0=No Alarms, 1=Active Alarm
10006	NOT USED	
10007	GEN BREAKER CLOSE DO STATUS	0=Open, 1=Closed
10008	ENGINE PREGLOW DO STATUS	0=Not Active, 1=Active
10009	FUEL SOLENOID DO STATUS	0=Not Active, 1=Active
10010	ENGINE CRANK DO STATUS	0=Not Active, 1=Active
10011	VISUAL ALARM STATUS	0=Not Active, 1=Active
10012	NOT USED	
10013	NOT USED	
10014	TIE BREAKER SHUNT TRIP DO STATUS	0=Not tripped, 1=Tripped
10015	GEN BREAKER SHUNT TRIP DO STATUS	0=Tripped, 1=Not Tripped
10016	AUDIBLE ALARM STATUS	0=Not Active, 1=Active
10017	IDLE/RATED DO STATUS	0=Idle, 1=Rated
10018	AUTO STATUS	0=False, 1=True
10019	TEST STATUS	0=False, 1=True
10020	RUN W/ LOAD STATUS	0=False, 1=True
10021	VOLT/PF/VAR RAISE STATUS	0=False, 1=True
10022	VOLT/PF/VAR LOWER STATUS	0=False, 1=True
10023	SPEED/LOAD RAISE STATUS	0=False, 1=True
10024	SPEED/LOAD LOWER STATUS	0=False, 1=True
10025	GEN BREAKER AUX DI STATUS	0=Open, 1=Closed
10026	MAINS BREAKER AUX DI STATUS	0=Open, 1=Closed
10027	PROCESS STATUS	0=False, 1=True
10028	REMOTE ALARM #1 STATUS	0=False, 1=True
10029	REMOTE ALARM #2 STATUS	0=False, 1=True
10030	REMOTE ALARM #3 STATUS	0=False, 1=True
10031	REMOTE ALARM #4 STATUS	0=False, 1=True
10032	REMOTE ALARM #5 STATUS	0=False, 1=True
10033	REMOTE ALARM #6 STATUS	0=False, 1=True
10034	SYNC TIMEOUT STATUS	0=No Alarm, 1=Active Alarm
10035	SYNC RECLOSE STATUS	0=No Alarm, 1=Active Alarm
10036	CRANK FAIL STATUS	0=No Alarm, 1=Active Alarm
10037	VOLTAGE RANGE ALARM STATUS	0=No Alarm, 1=Active Alarm

Modbus ID	Item	Semantics
10038	OVERSPEED STATUS	0=No Alarm, 1=Active Alarm
10039	GEN PHASE OVER CURR ALM STATUS	0=No Alarm, 1=Active Alarm
10040	GEN REVERSE POWER ALM STATUS	0=No Alarm, 1=Active Alarm
10041	GEN REVERSE VAR ALM STATUS	0=No Alarm, 1=Active Alarm
10042	SPEED/FREQ MISMATCH STATUS	0=No Alarm, 1=Active Alarm
10043	COOLANT TEMP HIGH ALM STATUS	0=No Alarm, 1=Active Alarm
10044	COOLANT TEMP LOW ALM STATUS	0=No Alarm, 1=Active Alarm
10045	RATED OIL PRESS HIGH ALM STATUS	0=No Alarm, 1=Active Alarm
10046	RATED OIL PRESS LOW ALM STATUS	0=No Alarm, 1=Active Alarm
10047	BATTERY VOLT LOW ALM STATUS	0=No Alarm, 1=Active Alarm
10048	BATTERY VOLT HIGH ALM STATUS	0=No Alarm, 1=Active Alarm
10049	GEN UNDER VOLT ALM STATUS	0=No Alarm, 1=Active Alarm
10050	GEN OVER VOLT ALM STATUS	0=No Alarm, 1=Active Alarm
10051	GEN OVER FREQ ALM STATUS	0=No Alarm, 1=Active Alarm
10052	GEN UNDER FREQ ALM STATUS	0=No Alarm, 1=Active Alarm
10053	GEN LOAD HIGH LIMIT STATUS	0=No Alarm, 1=Active Alarm
10054	GEN LOAD LOW LIMIT STATUS	0=No Alarm, 1=Active Alarm
10055	PROCESS HIGH LIMIT STATUS	0=No Alarm, 1=Active Alarm
10056	PROCESS LOW LIMIT STATUS	0=No Alarm, 1=Active Alarm
10057	REMOTE ALARM #1 STATUS	0=No Alarm, 1=Active Alarm
10058	REMOTE ALARM #2 STATUS	0=No Alarm, 1=Active Alarm
10059	REMOTE ALARM #3 STATUS	0=No Alarm, 1=Active Alarm
10060	REMOTE ALARM #4 STATUS	0=No Alarm, 1=Active Alarm
10061	REMOTE ALARM #5 STATUS	0=No Alarm, 1=Active Alarm
10062	REMOTE ALARM #6 STATUS	0=No Alarm, 1=Active Alarm
10063	LOAD SURGE ALM STATUS	0=No Alarm, 1=Active Alarm
10064	NOT USED	
10065	NOT USED	
10066	NOT USED	
10067	NOT USED	
10068	NOT USED	
10069	GEN STABLE INDICATION	0=False (wait for timeout), 1=True
10070	GEN VOLT SENSE CONFIG (T=L-L)	0=Wye (L-N), 1=Delta (L-L)
10071	PF INDICATOR (T=LAG)	0=Lag, 1=Lead
10072	SPEED RANGE ALM STATUS	0=No Alarm, 1=Active Alarm
10073	COOLANT TEMP HIGH PRE-ALM STATUS	0=No Alarm, 1=Active Alarm
10074	COOLANT TEMP LOW PRE-ALM STATUS	0=No Alarm, 1=Active Alarm
10075	RATED OIL PRESS LOW PRE-ALM STATUS	0=No Alarm, 1=Active Alarm
10076	GEN SENSING TYPE (3PH)	0=1 phase, 1=3 phase
10077	BUS SENSING TYPE (3PH)	0=1 phase, 1=3 phase
10078	BUS SENSING CONFIG (T=L-L)	0=Wye (L-N), 1=Delta (L-L)
10079	NOT USED	
10080	IDLE OIL PRESS HIGH ALM STATUS	0=No Alarm, 1=Active Alarm
10081	IDLE OIL PRESS LOW ALM STATUS	0=No Alarm, 1=Active Alarm
10082	GEN UNDER VOLT PRE-ALM STATUS	0=No Alarm, 1=Active Alarm
10083	GEN OVER VOLT PRE-ALM STATUS	0=No Alarm, 1=Active Alarm
10084	GEN OVER FREQ PRE-ALM STATUS	0=No Alarm, 1=Active Alarm
10085	GEN UNDER FREQ PRE-ALM STATUS	0=No Alarm, 1=Active Alarm
10086	GEN REVERSE VAR PRE-ALM STATUS	0=No Alarm, 1=Active Alarm
10087	GEN OVER POWER ALM STATUS	0=No Alarm, 1=Active Alarm
10088	GEN OVER POWER PRE-ALM STATUS	0=No Alarm, 1=Active Alarm

Modbus ID	Item	Semantics
10089	GEN REVERSE VAR PRE-ALM STATUS	0=No Alarm, 1=Active Alarm
10090	GEN OVER VAR ALM STATUS	0=No Alarm, 1=Active Alarm
10091	GEN OVER VAR PRE-ALM STATUS	0=No Alarm, 1=Active Alarm
10092	GEN PHASE OVER CURR PRE-ALM STATUS	0=No Alarm, 1=Active Alarm
10093	GEN PHASE CURR DIFF ALM STATUS	0=No Alarm, 1=Active Alarm
10094	GEN PHASE CURR DIFF PRE-ALM STATUS	0=No Alarm, 1=Active Alarm
10095	GEN NEG PHASE SEQ OVER CURR ALM STATUS	0=No Alarm, 1=Active Alarm
10096	GEN NEG PHASE SEQ OC PRE-ALM STATUS	0=No Alarm, 1=Active Alarm
10097	GEN NEG PHASE SEQ OVER VOLT ALM STATUS	0=No Alarm, 1=Active Alarm
10098	GEN NEG PHASE SEQ OV PRE-ALM STATUS	0=No Alarm, 1=Active Alarm
10099	NOT USED	
10100	NOT USED	
10101	NOT USED	
10102	NOT USED	
10103	NOT USED	
10104	NOT USED	
10105	NOT USED	
10106	NOT USED	
10107	NOT USED	
10108	NOT USED	
10109	NOT USED	
10110	NOT USED	
10111	NOT USED	
10112	NOT USED	
10113	NOT USED	
10114	NOT USED	
10115	NOT USED	
10116	NOT USED	
10117	NOT USED	
10118	NOT USED	
10119	NOT USED	
10120	NOT USED	
10121	ANALOG IN 1 HIGH PRE-ALM	0=No Alarm, 1=Active Alarm
10122	ANALOG IN 1 HIGH ALM	0=No Alarm, 1=Active Alarm
10123	ANALOG IN 1 LOW PRE-ALM	0=No Alarm, 1=Active Alarm
10124	ANALOG IN 1 LOW ALM	0=No Alarm, 1=Active Alarm
10125	ANALOG IN 2 HIGH PRE-ALM	0=No Alarm, 1=Active Alarm
10126	ANALOG IN 2 HIGH ALM	0=No Alarm, 1=Active Alarm
10127	ANALOG IN 2 LOW PRE-ALM	0=No Alarm, 1=Active Alarm
10128	ANALOG IN 2 LOW ALM	0=No Alarm, 1=Active Alarm
10129	ANALOG IN 3 HIGH PRE-ALM	0=No Alarm, 1=Active Alarm
10130	ANALOG IN 3 HIGH ALM	0=No Alarm, 1=Active Alarm
10131	ANALOG IN 3 LOW PRE-ALM	0=No Alarm, 1=Active Alarm
10132	ANALOG IN 3 LOW ALM	0=No Alarm, 1=Active Alarm
10133	ANALOG IN 4 HIGH PRE-ALM	0=No Alarm, 1=Active Alarm
10134	ANALOG IN 4 HIGH ALM	0=No Alarm, 1=Active Alarm
10135	ANALOG IN 4 LOW PRE-ALM	0=No Alarm, 1=Active Alarm
10136	ANALOG IN 4 LOW ALM	0=No Alarm, 1=Active Alarm
10137	EMERGENCY STOP LOGIC STATUS	0=No Alarm, 1=Active Alarm
10138	LOAD RAMP PAUSE LOGIC STATUS	0=False, 1=True
10139	NOT USED	

Modbus ID	Item	Semantics
10140	NOT USED	
10141	RESET ALARM/FAULT LOGIC STATUS	0=False, 1=True
10142	ENABLE VAR/PF LOGIC STATUS	0=False, 1=True
10143	UNLOAD COMMAND LOGIC STATUS	0=False, 1=True
10144	IGNITION COMMAND DO STATUS	0=Not Active, 1=Active
10145	ALARM HORN DO STATUS	0=Not Active, 1=Active
10146	SOFT SHUTDOWN DO STATUS	0=Not Active, 1=Active
10147	HARD SHUTDOWN DO STATUS	0=Not Active, 1=Active
10148	AIR SHUTOFF DO STATUS	0=Not Active, 1=Active
10149	ENGINE RUNNING DO STATUS	0=Not Active, 1=Active
10150	KW-HR PULSE	0=Not Active, 1=Active
10151	VA-HR PULSE	0=Not Active, 1=Active
10152	VAR-HR PULSE	0=Not Active, 1=Active
10153	NOT USED	
10154	NOT USED	
10155	GEN BREAKER SHUNT TRIP ERROR	0=No Alarm, 1=Active Alarm
10156	NOT USED	
10157	GEN BREAKER FEEDBACK ERROR	0=No Alarm, 1=Active Alarm
10158	NOT USED	
10159	FAIL TO START ERROR	0=No Alarm, 1=Active Alarm
10160	FAIL TO SYNCHRONIZE	0=No Alarm, 1=Active Alarm
10161	PHASE ROTATION MISMATCH	0=No Alarm, 1=Active Alarm
10162	CONFIGURATION CHECK ERROR	0=No Alarm, 1=Active Alarm
10163	KVA SWITCH STATUS	0=Off, 1=On
10164	CRANK DENIED ALARM	CRANK DENIED
10165	FAIL TO REACH IDLE	RAIL TO REACH IDLE
10166	FAIL TO REACH RATED	RAIL TO REACH RATED
10167	MODBUS LINK 1 ERROR	Slave response timeout
10168	MODBUS LINK 2 ERROR	Slave response timeout
10169	NOT USED	
10170	NOT USED	
10171	ANALOG IN 1 OUT OF RANGE	0=OK, 1=Fault
10172	ANALOG IN 2 OUT OF RANGE	0=OK, 1=Fault
10173	ANALOG IN 3 OUT OF RANGE	0=OK, 1=Fault
10174	ANALOG IN 4 OUT OF RANGE	0=OK, 1=Fault
10175	POWERSENSE BOARD FAULT	0=OK, 1=Fault
10176	DIGITAL INPUT #1 STATUS	0=Floating/Grounded, 1=Active
10177	DIGITAL INPUT #2 STATUS	0=Floating/Grounded, 1=Active
10178	DIGITAL INPUT #3 STATUS	0=Floating/Grounded, 1=Active
10179	DIGITAL INPUT #4 STATUS	0=Floating/Grounded, 1=Active
10180	DIGITAL INPUT #5 STATUS	0=Floating/Grounded, 1=Active
10181	DIGITAL INPUT #6 STATUS	0=Floating/Grounded, 1=Active
10182	DIGITAL INPUT #7 STATUS	0=Floating/Grounded, 1=Active
10183	DIGITAL INPUT #8 STATUS	0=Floating/Grounded, 1=Active
10184	DIGITAL INPUT #9 STATUS	0=Floating/Grounded, 1=Active
10185	DIGITAL INPUT #10 STATUS	0=Floating/Grounded, 1=Active
10186	DIGITAL INPUT #11 STATUS	0=Floating/Grounded, 1=Active
10187	DIGITAL INPUT #12 STATUS	0=Floating/Grounded, 1=Active
10188	DIGITAL INPUT #13 STATUS	0=Floating/Grounded, 1=Active
10189	DIGITAL INPUT #14 STATUS	0=Floating/Grounded, 1=Active
10190	DIGITAL INPUT #15 STATUS	0=Floating/Grounded, 1=Active

Modbus ID	Item	Semantics
10191	DIGITAL INPUT #16 STATUS	0=Floating/Grounded, 1=Active
10192	BASELOAD CONTROL STATUS	0=Not Active, 1=Active
10193	NOT USED	
10194	NOT USED	
10195	AUTO START SEQUENCE ALARM STATUS	0=Not Active, 1=Active
10196	AUTO STOP SEQUENCE ALARM STATUS	0=Not Active, 1=Active
10197	SERVICE HOURS EXPIRED ALM STATUS	0=Not Active, 1=Active
10198	LON ERROR FLAG	0=Not Active, 1=Active
10199	ANALOG IN 5 HIGH ALM	0=No Alarm, 1=Active Alarm
10200	ANALOG IN 5 LOW ALM	0=No Alarm, 1=Active Alarm
10201	ANALOG IN 5 HIGH PRE-ALM	0=No Alarm, 1=Active Alarm
10202	ANALOG IN 5 LOW PRE-ALM	0=No Alarm, 1=Active Alarm
10203	ANALOG IN 6 HIGH ALM	0=No Alarm, 1=Active Alarm
10204	ANALOG IN 6 LOW ALM	0=No Alarm, 1=Active Alarm
10205	ANALOG IN 6 HIGH PRE-ALM	0=No Alarm, 1=Active Alarm
10206	ANALOG IN 6 LOW PRE-ALM	0=No Alarm, 1=Active Alarm
10207	NOT USED	
10208	NOT USED	
10209	NOT USED	
10210	NOT USED	
10211	NOT USED	
10212	NOT USED	
10213	NOT USED	
10214	NOT USED	
10215	THERMOCOUPLE IN FAILED (ANALOG COMBO)	0=No Alarm, 1=Active Alarm
10216	ANALOG IN 9 LOW PRE-ALM	0=No Alarm, 1=Active Alarm
10217	ANALOG IN 9 HIGH PRE-ALM	0=No Alarm, 1=Active Alarm
10218	ANALOG IN 9 LOW ALM	0=No Alarm, 1=Active Alarm
10219	ANALOG IN 9 HIGH ALM	0=No Alarm, 1=Active Alarm
10220	ANALOG IN 10 LOW PRE-ALM	0=No Alarm, 1=Active Alarm
10221	ANALOG IN 10 HIGH PRE-ALM	0=No Alarm, 1=Active Alarm
10222	ANALOG IN 10 LOW ALM	0=No Alarm, 1=Active Alarm
10223	ANALOG IN 10 HIGH ALM	0=No Alarm, 1=Active Alarm
10224	NOT USED	
10225	NOT USED	
10226	NOT USED	
10227	NOT USED	
10228	NOT USED	
10229	NOT USED	
10230	NOT USED	
10231	NOT USED	
10232	NOT USED	
10233	NOT USED	
10234	NOT USED	
10235	NOT USED	
10236	NOT USED	
10237	NOT USED	
10238	NOT USED	
10239	NOT USED	

Modbus ID	Item	Semantics
10240	4_20mA IN FAILED (ANALOG COMBO)	0=No Alarm, 1=Active Alarm
10241	ANALOG IN 16 LOW PRE-ALM	0=No Alarm, 1=Active Alarm
10242	ANALOG IN 16 HIGH PRE-ALM	0=No Alarm, 1=Active Alarm
10243	ANALOG IN 16 LOW ALM	0=No Alarm, 1=Active Alarm
10244	ANALOG IN 16 HIGH ALM	0=No Alarm, 1=Active Alarm
10245	ANALOG IN 17 LOW PRE-ALM	0=No Alarm, 1=Active Alarm
10246	ANALOG IN 17 HIGH PRE-ALM	0=No Alarm, 1=Active Alarm
10247	ANALOG IN 17 LOW ALM	0=No Alarm, 1=Active Alarm
10248	ANALOG IN 17 HIGH ALM	0=No Alarm, 1=Active Alarm
10249	ANALOG IN 18 LOW PRE-ALM	0=No Alarm, 1=Active Alarm
10250	ANALOG IN 18 HIGH PRE-ALM	0=No Alarm, 1=Active Alarm
10251	ANALOG IN 18 LOW ALM	0=No Alarm, 1=Active Alarm
10252	ANALOG IN 18 HIGH ALM	0=No Alarm, 1=Active Alarm
10253	NOT USED	
10254	NOT USED	
10255	NOT USED	
10256	NOT USED	
10257	RTD INPUT FAILED (ANALOG COMBO)	0=No Alarm, 1=Active Alarm
10258	ANALOG COMBO HARDWARE FAULT	0=No Alarm, 1=Active Alarm
10259	ACTUATOR DRIVER FAULT	0=No Alarm, 1=Active Alarm
10260	ACTUATOR OPEN LOAD FAULT	0=No Alarm, 1=Active Alarm
10261	MPU MAXIMUM DIFFERENCE ALARM	0=No Alarm, 1=Active Alarm
10262	SPEED PID IN CONTROL	0=False, 1=True
10263	START LIMITER ACTIVE	0=False, 1=True
10264	MAXIMUM FUEL LIMIT	0=False, 1=True
10265	TORQUE LIMITER ACTIVE	0=False, 1=True
10266	MAP LIMITER ACTIVE	0=False, 1=True
10267	RATED SPEED STATE	0=False, 1=True
10268	IDLE SPEED STATE	0=False, 1=True
10269	SECOND DYNAMICS STATE	0=False, 1=True
10270	DIGITAL INPUT #17 STATUS	0=Floating/Grounded, 1=Active
10271	DIGITAL INPUT #18 STATUS	0=Floating/Grounded, 1=Active
10272	DIGITAL INPUT #19 STATUS	0=Floating/Grounded, 1=Active
10273	REMOTE ALARM #7 STATUS	0=No Alarm, 1=Active Alarm
10274	REMOTE ALARM #8 STATUS	0=No Alarm, 1=Active Alarm
10275	REMOTE ALARM #9 STATUS	0=No Alarm, 1=Active Alarm

Analog Reads

Modbus ID	Item	Semantics	Min	Max	Scale or Note
30001	BATTERY VOLTAGE	Ex: 240=24.0 Vdc	0	500	10
30002	ENGINE OIL PRESSURE	Ex: 128=12.8	0	1000	10
30003	ENGINE COOLANT TEMPERATURE	Units per configuration	-100	300	1
30004	ENGINE RUN TIME	Hours	0	32000	1
30005	NOT USED				
30006	ENGINE RPM	RPM	0	5000	1
30007	GEN A PHASE VOLTS (L-L)	Volts	0	32767	Note A
30008	GEN B PHASE VOLTS (L-L)	Volts	0	32767	Note A
30009	GEN C PHASE VOLTS (L-L)	Volts	0	32767	Note A

Modbus ID	Item	Semantics	Min	Max	Scale or Note
30010	GEN TOTAL WATTS	KW	-32768	32767	Note E
30011	GEN TOTAL VA	KVA	-32768	32767	Note E
30012	GEN PF	-500=0.5 Lead, 500=0.5 Lag, 0=1.0	-500	500	1000
30013	GEN A PHASE VAR	KVAR	-32768	32767	Note E
30014	GEN B PHASE VAR	KVAR	-32768	32767	Note E
30015	GEN C PHASE VAR	KVAR	-32768	32767	Note E
30016	GEN TOTAL VAR	KVAR	-32768	32767	Note E
30017	BUS FREQUENCY	Hertz x 100	0	700	100
30018	GEN FREQUENCY	Hertz x 100	0	700	100
30019	UNIT NODE NUMBER	LON Communication Bus	1	16	1
30020	SYNC TIMEOUT ACTION	See Alarm Action Def	0	7	1
30021	SYNC RECLOSE ACTION	See Alarm Action Def	0	7	1
30022	CRANK FAIL ACTION	See Alarm Action Def	0	7	1
30023	VOLTAGE RANGE ACTION	See Alarm Action Def	0	7	1
30024	OVERSPEED ACTION	See Alarm Action Def	0	7	1
30025	OVER CURRENT ACTION	See Alarm Action Def	0	7	1
30026	GEN REVERSE POWER ALM ACTION	See Alarm Action Def	0	7	1
30027	GEN REVERSE VAR ALM ACTION	See Alarm Action Def	0	7	1
30028	SPEED FREQ MISMATCH ACTION	See Alarm Action Def	0	7	1
30029	COOLANT TEMP HIGH ALM ACTION	See Alarm Action Def	0	7	1
30030	COOLANT TEMP LOW ALM ACTION	See Alarm Action Def	0	7	1
30031	OIL PRESS HIGH ALM ACTION	See Alarm Action Def	0	7	1
30032	OIL PRESS LOW ALM ACTION	See Alarm Action Def	0	7	1
30033	BATTERY VOLT LOW ALM ACTION	See Alarm Action Def	0	7	1
30034	BATTERY VOLT HIGH ALM ACTION	See Alarm Action Def	0	7	1
30035	GEN UNDER VOLT ALM ACTION	See Alarm Action Def	0	7	1
30036	GEN OVER VOLT ALM ACTION	See Alarm Action Def	0	7	1
30037	GEN OVER FREQ ALM ACTION	See Alarm Action Def	0	7	1
30038	GEN UNDER FREQ ALM ACTION	See Alarm Action Def	0	7	1
30039	GEN LOAD HIGH LIMIT ALM ACTION	See Alarm Action Def	0	7	1
30040	GEN LOAD LOW LIMIT ALM ACTION	See Alarm Action Def	0	7	1
30041	PROCESS HIGH LIMIT ALM ACTION	See Alarm Action Def	0	7	1
30042	PROCESS LOW LIMIT ALM ACTION	See Alarm Action Def	0	7	1
30043	REMOTE ALARM #1 ACTION	See Alarm Action Def	0	7	1
30044	REMOTE ALARM #2 ACTION	See Alarm Action Def	0	7	1
30045	REMOTE ALARM #3 ACTION	See Alarm Action Def	0	7	1
30046	REMOTE ALARM #4 ACTION	See Alarm Action Def	0	7	1
30047	REMOTE ALARM #5 ACTION	See Alarm Action Def	0	7	1
30048	REMOTE ALARM #6 ACTION	See Alarm Action Def	0	7	1
30049	NOT USED				
30050	NOT USED				
30051	NOT USED				
30052	NOT USED				
30053	NOT USED				

Modbus ID	Item	Semantics	Min	Max	Scale or Note
30054	TRIP TIE BREAKER ALM ACTION	See Alarm Action Def	0	7	1
30055	GEN A PHASE VOLTS (L-N)	Always Line-Neutral	0	32767	Note A
30056	GEN B PHASE VOLTS (L-N)	Always Line-Neutral	0	32767	Note A
30057	GEN C PHASE VOLTS (L-N)	Always Line-Neutral	0	32767	Note A
30058	BUS A PHASE VOLTS (L-N)	Always Line-Neutral	0	32767	Note C
30059	GEN A PHASE CURRENT	Amps	-32768	32767	Note B
30060	GEN B PHASE CURRENT	Amps	-32768	32767	Note B
30061	GEN C PHASE CURRENT	Amps	-32768	32767	Note B
30062	GEN A PHASE VA	KVA	-32768	32767	Note E
30063	GEN B PHASE VA	KVA	-32768	32767	Note E
30064	GEN C PHASE VA	KVA	-32768	32767	Note E
30065	VOLTAGE BIAS ANALOG INPUT	% Output where 0=0 bias, 100=100% raise, -100=100% lower	0	100	1
30066	SPEED BIAS ANALOG INPUT	% Output where 0=0 bias, 100=100% raise, -100=100% lower	0	100	1
30067	REAL LOAD CONTROL STATE	See Load Control State Def	0	6	1
30068	SYNCHRONIZER STATE	See Synchronizer State Def	0	6	1
30069	NUM UNACKNOWLEDGED ALARMS		0	99	1
30070	NOT USED				
30071	NOT USED				
30072	ENGINE STATE	See Engine State Def	0	9	1
30073	SYNCHROSCOPE	See Synchroscope Def	-180	180	1
30074	GEN POWER UNITS	See Units Def	0	2	Note E
30075	GEN AVERAGE VOLTAGE	Volts	0	32767	Note A
30076	GEN AVERAGE CURRENT	Amps	-32768	32767	Note B
30077	GEN A PHASE WATTS	KW	-32768	32767	Note E
30078	GEN B PHASE WATTS	KW	-32768	32767	Note E
30079	GEN C PHASE WATTS	KW	-32768	32767	Note E
30080	GEN NEG PHASE SEQ VOLTAGE	Volts	-32768	32767	Note A
30081	GEN NEG PHASE SEQ CURRENT	Amps	-32768	32767	Note B
30082	GEN A PHASE ANGLE	Degrees	0	3600	10
30083	GEN B PHASE ANGLE	Degrees	0	3600	10
30084	GEN C PHASE ANGLE	Degrees	0	3600	10
30085	GEN CURRENT THD	% THD	0	100	10
30086	GEN VOLTAGE THD	% THD	0	100	10
30087	GEN 2ND CURRENT HARMONIC	Percent	0	100	10
30088	GEN 3RD CURRENT HARMONIC	Percent	0	100	10
30089	GEN 4TH CURRENT HARMONIC	Percent	0	100	10
30090	GEN 5TH CURRENT HARMONIC	Percent	0	100	10
30091	GEN 6TH CURRENT HARMONIC	Percent	0	100	10
30092	GEN 7TH CURRENT HARMONIC	Percent	0	100	10
30093	GEN 9TH CURRENT HARMONIC	Percent	0	100	10
30094	GEN 11TH CURRENT HARMONIC	Percent	0	100	10
30095	GEN 13TH CURRENT HARMONIC	Percent	0	100	10
30096	GEN 2ND VOLTAGE HARMONIC	Percent	0	100	10
30097	GEN 3RD VOLTAGE HARMONIC	Percent	0	100	10
30098	GEN 4TH VOLTAGE HARMONIC	Percent	0	100	10
30099	GEN 5TH VOLTAGE HARMONIC	Percent	0	100	10
30100	GEN 6TH VOLTAGE HARMONIC	Percent	0	100	10
30101	GEN 7TH VOLTAGE HARMONIC	Percent	0	100	10

Modbus ID	Item	Semantics	Min	Max	Scale or Note
30102	GEN 9TH VOLTAGE HARMONIC	Percent	0	100	10
30103	GEN 11TH VOLTAGE HARMONIC	Percent	0	100	10
30104	GEN 13TH VOLTAGE HARMONIC	Percent	0	100	10
30105	BUS B PHASE VOLTS (L-N)	Volts	0	32767	Note C
30106	BUS C PHASE VOLTS (L-N)	Volts	0	32767	Note C
30107	BUS A PHASE VOLTS (L-L)	Volts	0	32767	Note C
30108	BUS B PHASE VOLTS (L-L)	Volts	0	32767	Note C
30109	BUS C PHASE VOLTS (L-L)	Volts	0	32767	Note C
30110	NOT USED				
30111	BUS AVERAGE VOLTAGE	Volts	0	32767	Note C
30112	NOT USED				
30113	NOT USED				
30114	NOT USED				
30115	NOT USED				
30116	NOT USED				
30117	NOT USED				
30118	NOT USED				
30119	NOT USED				
30120	NOT USED				
30121	NOT USED				
30122	NOT USED				
30123	NOT USED				
30124	NOT USED				
30125	NOT USED				
30126	NOT USED				
30127	NOT USED				
30128	NOT USED				
30129	BUS NEG PHASE SEQ VOLTS	Volts	-32768	32767	Note C
30130	BUS NEG PHASE SEQ CURRENT	Amps	-32768	32767	Note D
30131	BUS A PHASE ANGLE	Degrees	0	360	10
30132	BUS B PHASE ANGLE	Degrees	0	360	10
30133	BUS C PHASE ANGLE	Degrees	0	360	10
30134	NOT USED				
30135	BUS VOLTAGE THD	% THD	0	100	10
30136	NOT USED				
30137	NOT USED				
30138	NOT USED				
30139	NOT USED				
30140	NOT USED				
30141	NOT USED				
30142	NOT USED				
30143	NOT USED				
30144	NOT USED				
30145	NOT USED				
30146	NOT USED				
30147	NOT USED				
30148	NOT USED				
30149	NOT USED				
30150	NOT USED				
30151	NOT USED				
30152	NOT USED				

Modbus ID	Item	Semantics	Min	Max	Scale or Note
30153	NOT USED				
30154	IDLE OIL PRESS HIGH ALM ACTION	See Alarm Action Def	0	7	1
30155	IDLE OIL PRESS LOW ALM ACTION	See Alarm Action Def	0	7	1
30156	GEN UNDER VOLT PRE-ALM ACTION	See Alarm Action Def	0	7	1
30157	GEN OVER VOLT PRE-ALM ACTION	See Alarm Action Def	0	7	1
30158	GEN OVER FREQ PRE-ALM ACTION	See Alarm Action Def	0	7	1
30159	GEN UNDER FREQ PRE-ALM ACTION	See Alarm Action Def	0	7	1
30160	GEN REVERSE POWER PRE-ALM ACTION	See Alarm Action Def	0	7	1
30161	GEN OVER POWER ALM ACTION	See Alarm Action Def	0	7	1
30162	GEN OVER POWER PRE-ALM ACTION	See Alarm Action Def	0	7	1
30163	GEN REVERSE VAR PRE-ALM ACTION	See Alarm Action Def	0	7	1
30164	GEN OVER VAR ALM ACTION	See Alarm Action Def	0	7	1
30165	GEN OVER VAR PRE-ALM ACTION	See Alarm Action Def	0	7	1
30166	GEN PHASE OVER CURR PRE-ALM ACTION	See Alarm Action Def	0	7	1
30167	GEN PHASE CURR DIFF ALM ACTION	See Alarm Action Def	0	7	1
30168	GEN PHASE CURR DIFF PRE-ALM ACTION	See Alarm Action Def	0	7	1
30169	GEN NEG PHASE SEQ OC ALM ACTION	See Alarm Action Def	0	7	1
30170	GEN NEG PHASE SEQ OC PRE-ALM ACTION	See Alarm Action Def	0	7	1
30171	GEN NEG PHASE SEQ OV ALM ACTION	See Alarm Action Def	0	7	1
30172	GEN NEG PHASE SEQ OV PRE-ALM ACTION	See Alarm Action Def	0	7	1
30173	NOT USED				
30174	NOT USED				
30175	NOT USED				
30176	NOT USED				
30177	NOT USED				
30178	NOT USED				
30179	NOT USED				
30180	NOT USED				
30181	NOT USED				
30182	NOT USED				
30183	NOT USED				
30184	NOT USED				
30185	NOT USED				
30186	NOT USED				
30187	NOT USED				
30188	NOT USED				
30189	NOT USED				
30190	NOT USED				
30191	NOT USED				

Modbus ID	Item	Semantics	Min	Max	Scale or Note
30192	NOT USED				
30193	NOT USED				
30194	NOT USED				
30195	NOT USED				
30196	ANALOG 1 HIGH ALM ACTION	See Alarm Action Def	0	7	1
30197	NOT USED				
30198	ANALOG 1 LOW ALM ACTION	See Alarm Action Def	0	7	1
30199	NOT USED				
30200	ANALOG 2 HIGH ALM ACTION	See Alarm Action Def	0	7	1
30201	NOT USED				
30202	ANALOG 2 LOW ALM ACTION	See Alarm Action Def	0	7	1
30203	ANALOG 3 HIGH PRE-ALM ACTION	See Alarm Action Def	0	7	1
30204	ANALOG 3 HIGH ALM ACTION	See Alarm Action Def	0	7	1
30205	ANALOG 3 LOW PRE-ALM ACTION	See Alarm Action Def	0	7	1
30206	ANALOG 3 LOW ALM ACTION	See Alarm Action Def	0	7	1
30207	ANALOG 4 HIGH PRE-ALM ACTION	See Alarm Action Def	0	7	1
30208	ANALOG 4 HIGH ALM ACTION	See Alarm Action Def	0	7	1
30209	ANALOG 4 LOW PRE-ALM ACTION	See Alarm Action Def	0	7	1
30210	ANALOG 4 LOW ALM ACTION	See Alarm Action Def	0	7	1
30211	EMERGENCY STOP DI ACTION	See Alarm Action Def	0	7	1
30212	SPEED/FREQ MISMATCH ACTION	See Alarm Action Def	0	7	1
30213	NOT USED				
30214	NOT USED				
30215	LOAD REFERENCE	Rounded to integer	-32768	32767	Note E
30216	PROCESS REFERENCE	Customer units rounded to integer	-1000	1000	10
30217	ANALOG INPUT 1 LEVEL	MA or VDC depending on config	0	25	100
30218	ANALOG INPUT 2 LEVEL	MA or VDC depending on config	0	25	100
30219	ANALOG INPUT 3 LEVEL	MA or VDC depending on config	0	25	100
30220	ANALOG INPUT 4 LEVEL	MA or VDC depending on config	0	25	100
30221	REACTIVE LOAD CONTROL MODE	See Reactive Load Control Mode	0	11	1
30222	GEN VOLTAGE UNITS	See Units Def	0	2	Note A
30223	GEN CURRENT UNITS	See Units Def	0	2	Note B
30224	BUS VOLTAGE UNITS	See Units Def	0	2	Note C
30225	NOT USED				
30226	SYNCHRONIZER MODE	See Synchronizer Mode Def	0	4	1
30227	UNIT LOAD	% of rating	-168	168	10
30228	SYSTEM LOAD	% of rating	-168	168	10
30229	PF REFERENCE	-500=0.5 Lead, 500=0.5 Lag, 0=1.0	-500	500	1000
30230	VAR REFERENCE	VAR	0	32767	Note E
30231	REAL LOAD MODE	See Real Load Mode Def	0	11	1
30232	REACTIVE LOAD CONTROL STATE	See Reactive Load Control State Def	0	6	1
30233	NOT USED	See ATS State Def	0	9	1
30234	GENSET STATE	See Genset State Def	0	8	1
30235	PRODUCT PART NUMBER (FAMILY)	Application Code	0000	9999	1
30236	PRODUCT PART NUMBER (SUFFIX)	Application Code	0000	9999	1
30237	PRODUCT APPLICATION REVISION	New=0, A=1, B=2, etc	0	26	1

Modbus ID	Item	Semantics	Min	Max	Scale or Note
30238	LS NODES	Load share nodes on active bus	1	16	1
30239	NET NODES	Net nodes on LON	1	16	1
30240	SERVICE HOUSE REMAINING	Count down timer	-32767	32767	1
30241	NOT USED				
30242	NOT USED				
30243	GEN W-HR UNITS	See Units Def	1	4	1
30244	GEN W-HR (HUNDREDS)	000,000,000.00	1	4	1
30245	GEN W-HR (THOUSANDS)	000,000,000.00	1	4	1
30246	GEN W-HR (MILLIONS)	000,000,000.00	1	4	1
30247	NOT USED				
30248	NOT USED				
30249	NOT USED				
30250	NOT USED				
30251	OPERATION VOLTAGE	Volts	0	32767	Note A
30252	BASELOAD REFERENCE SETPOINT	KW	0	32767	Note E
30253	PROCESS REFERENCE SETPOINT	Customer units rounded to integer	-1000	1000	1
30254	PF REFERENCE SETPOINT	500=0.5 Lead, 500=0.5 Lag, 0=1.0	-500	500	1000
30255	VAR REFERENCE SETPOINT	VAR	0	32767	Note E
30256	LON BUS ONLINE DEMAND	Units based on 30257	0	32767	Note E
30257	LON BUS ONLINE DEMAND UNITS	See Units Def	1	4	1
30258	LON ONLINE CAPACITY	Units based on 30259	0	32767	Note E
30259	LON ONLINE CAPACITY UNITS	See Units Def	1	4	1
30260	LON NEXT UNIT TO START	Unit Number	1	16	1
30261	LON NEXT UNIT TO STOP	Unit Number	1	16	1
30262	LON ERROR MESSAGE NUMBER	Number of Lon error message	1	255	1
30263	ANALOG INPUT 5 VALUE	Analog Input 5 (EU)	-32767	32767	1
30264	ANALOG INPUT 6 VALUE	Analog Input 6 (EU)	-32767	32767	1
30265	ANALOG INPUT 3 VALUE	Analog Input 3 (EU)	-32767	32767	Note G
30266	ANALOG INPUT 4 VALUE	Analog Input 4 (EU)	-32767	32767	Note G
30267	ANALOG INPUT 9 VALUE	Analog Input 9 (EU)	-32767	32767	Note G
30268	ANALOG INPUT 10 VALUE	Analog Input 10 (EU)	-32767	32767	Note G
30269	NOT USED				
30270	NOT USED				
30271	NOT USED				
30272	NOT USED				
30273	ANALOG INPUT 16 VALUE	Analog Input 16 (EU)	-32767	32767	1
30274	ANALOG INPUT 17 VALUE	Analog Input 17 (EU)	-32767	32767	1
30275	ANALOG INPUT 18 VALUE	Analog Input 18 (EU)	-32767	32767	1
30276	NOT USED				
30277	SPEED REFERENCE	RPM	0	6000	1
30278	ACTUATOR OUTPUT	%	0	100	10
30279	SPEED PID OUTPUT	%	0	100	10
30280	SPEED BIAS	RPM	-300	300	10
30281	ALARM/EVENT #1	See alarm table	0	192	1
30282	ALARM/EVENT #2	See alarm table	0	192	1
30283	ALARM/EVENT #3	See alarm table	0	192	1
30284	ALARM/EVENT #4	See alarm table	0	192	1

Modbus ID	Item	Semantics	Min	Max	Scale or Note
30285	ALARM/EVENT #5	See alarm table	0	192	1
30286	ALARM/EVENT #6	See alarm table	0	192	1
30287	ALARM/EVENT #7	See alarm table	0	192	1
30288	ALARM/EVENT #8	See alarm table	0	192	1
30289	ALARM/EVENT #9	See alarm table	0	192	1
30290	ALARM/EVENT #10	See alarm table	0	192	1
30291	ALARM/EVENT #11	See alarm table	0	192	1
30292	ALARM/EVENT #12	See alarm table	0	192	1
30293	ALARM/EVENT #13	See alarm table	0	192	1
30294	ALARM/EVENT #14	See alarm table	0	192	1
30295	ALARM/EVENT #15	See alarm table	0	192	1

Analog Writes

Modbus ID	Item Function	Semantics	Min	Max	Scale
40001	NOT USED				
40002	PROCESS REFERENCE	% Process x 10	-1000	1000	10
40003	BASELOAD REFERENCE	In KW units	0	30,000	1
40004	NOT USED				
40005	PF REFERENCE	In PF where –500=0.5Lag, 500=0.5Lead and 1000=unity PF	-500	500	1000
40006	NOT USED				
40007	VAR REFERENCE	In KVAR units	0	30,000	10
40008	NOT USED				
40009	OPERATION VOLTAGE SETPOINT	Volts	0	32767	Note A
40010	SERVICE HOURS PRESET	Hours	-32767	32767	1

LS Modbus Table Note Explanation

Modbus Note	Type of value	Comment	Multiplier Communication Menu
Note A	Gen Voltage	Primary unit in Volts or Kilovolts X MBUS Voltage Multiplier	38 MBUS MULT - GEN VOLT
Note B	Gen Current	Primary unit in Amps or kilamps X MBUS Multiplier	40 MBUS MULT - GEN CURRENT
Note C	Bus Voltage	Primary unit in Volts or Kilovolts X MBUS Voltage Multiplier	44 MBUS MULT - BUS VOLT
Note D	Bus Current	Primary unit in Amps or kilamps X MBUS Multiplier	46 MBUS MULT - BUS CURRENT
Note E	GEN W, VAR, VA	Primary units in W, VAR, VA or KW, KVAR, KVA or MW, MVAR, MVA or GW, GVAR, GVA X MBUS Multiplier	42 MBUS MULT - GEN POWER
Note F	Bus W, VAR, VA	Primary units in W, VAR, VA or KW, KVAR, KVA or MW, MVAR, MVA or GW, GVAR, GVA X MBUS Multiplier	48 MBUS MULT - BUS POWER
Note G	4-20mA Multiplier	This is a multiplier of the Analog Inputs 3, 4, 9 and 10	50 MBUS MULT – AN COMBO

AtlasSC™ Load+Speed Control Specifications

Power Supply Rating	18–32 Vdc (SELV) Maximum input voltage range
Power Consumption	less than or equal 20 W nominal, 22 W maximum
Input Supply Voltage	24 V (nominal)
Input Supply Current	0.92 A dc
PT inputs	27–300 Vac
CT inputs	0–5 A ac-rms nominal, 7 A ac-rms maximum
Rated short-time current (1 sec)	10 X (I) rated
Generator Frequency Range	40–70 Hz
Magnetic Pickup	100–24 950 Hz
Discrete Inputs (19)	3 mA source current when CLOSED to Switch Common
Analog Inputs	4–20 mA, 1–5 Vdc, Thermocouple, RTD
Analog Outputs	4–20 mA
Voltage Bias Output	±1 Vdc, ±3 Vdc, ±9 Vdc, 4–20 mA
Discrete Outputs (12)	200 mA low-side drivers
Serial Communication Ports (3)	RS-485, RS-422, RS-232
Ambient Operating Temperature	–20 to +70 °C (–4 to +158 °F) (around outside of AtlasSC Load+Speed Control Chassis)
Storage Temperature	–40 to +85 °C (–40 to +185°F)
Humidity	95% at +20 to +55 °C (+68 to +131 °F)
Mechanical Vibration	10–2000 Hz @ 0.04 G2/Hz and 8.2Grms PSD
Mechanical Shock	US MIL-STD 810C, Method 516.2, Procedure I (basic design test), Procedure II (transit drop test, packaged), Procedure V (bench handling)
Equipment Classification	1 (grounded equipment)
Air Quality	Pollution Degree II
Installation Over Voltage	Category III
Ingress Protection	Meets IP54 per EN60529 when properly installed in an enclosure rated IP54 or greater

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