WOODWARD

Product Manual 26195
(Revision C)
Original Instructions

EGCP-3
Engine Generator Control Package

MC (Master Control) Model

Operation Manual

General Precautions

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

Practice all plant and safety instructions and precautions.

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

Revisions

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Proper Use

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

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

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

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

⚠WARNING

Overspeed / Overtemperature / Overpressure

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

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

⚠WARNING

Personal Protective Equipment

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

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

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

⚠WARNING

Start-up

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

⚠WARNING

Automotive Applications

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

NOTICE

Battery Charging Device

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

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

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

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

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

Follow these precautions when working with or near the control.

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

Chapter 1.
General Information

Introduction

This manual describes the Woodward EGCP-3 Engine Generator Control Package, Master Control (MC) model, **part number 8406-114**. It provides description, operation, tuning, and troubleshooting information for EGCP-3 MC digital controls. The details on installation, wiring, communication, Regulatory Notes and Warnings are in the **EGCP-3 Installation Manual 26122**. The EGCP-3 MC is intended for power generator applications where multiple EGCP-3s will control generators that supply buses, which can operate in parallel with a Utility (Mains). The EGCP-3 MC can perform start/stop commands, monitor group and mains breaker status and control real and reactive load operation of any EGCP-3 LoadShare (LS) control. The EGCP-3 MC can control the operation of up to 15 gensets, which can be located on multiple bus segments and will coordinate with other MC controls for multiple utility tie bus configurations.

⚠WARNING

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. The conductor providing the connection must have a properly sized ring lug and wire larger than or equal to 4 mm² (12 AWG).

⚠WARNING

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

⚠WARNING

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.**

Application Overview

The EGCP-3 MC is a microprocessor-based control designed to supervise and control switchgear and gensets operated by EGCP-3 LS units. The MC is a field configurable control, which allows a single design to be used in many different power generation configurations and eliminates the need for extensive PLC supervisory control systems. It used menu driven software to instruct site engineers on programming the control to a specific bus/utility configuration. The MC is designed to be the interface between the utility and the local plant.

MC Features

- Display/Keypad Interface, local setup/monitoring or remote HMI
- Master/Slave sequencing relationships between 16 units
- Synchronizing of up to 2 breakers 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
- BaseLoad load control capability
- Import/export or process control
- KVAR/PF Control
- ATS control, open or closed transition
- Peak shaving/sharing control with automatic start/stop based on time of day or demand level.
- Built in diagnostics
- Bus and Mains Protective Relaying
- Bus and Mains Power & Energy Metering and Monitoring
- Multiple unit LON communication
- Modbus® * and ServLink communications for remote HMI/PLC connections

*—Modbus is a trademark of Schneider Automation Inc.

Front Panel Display

The MC is equipped with a keypad and two 4-line display panels on the front cabinet mounted chassis. The display can be used to configure and set up the control for site-specific requirements. The display is also used to monitor operation and view alarm data.

Communications

Remote monitoring equipment can be interfaced to the MC with Modbus or Woodward ServLink tools. Three serial communications ports are available on the MC. Two of these ports are dedicated for Modbus or ServLink and the third is configurable for either interface. All functions performed and parameters monitored by the front panel, as well as additional configurables, are available through the three serial ports. These ports can be configured to use with Woodward Watch Window software or an external HMI with Modbus communication, or ServLink DDE software.

Inter EGCP-3 communications are performed by LON interface. The two-wire communications channel is used to deliver sequencing; real and reactive load control and configuration messages between units for control purposes.

Power and Energy Metering

The MC digital control is equipped with industrial grade power and energy metering capability. Digital signal processing techniques are used to provide significantly improved accuracy and speed of response over conventional analog measurement techniques. Accuracy is improved using rapid sampling of the voltage and current signal waveforms and developing a true RMS measurement. Measuring true RMS power allows optimal accuracy, even in the presence of power line distortions. PT and CT inputs of both the bus and mains are used for calculation of power and energy. The algorithms used are based on IEEE 1459-2000.

For the bus and mains the following power parameters are calculated:

- Frequency (Hz)
- AC Voltage (Vac)
- Phase and Total Current (Amps)
- Phase and Total PF
- Real Power (W)
- Reactive Power (VAR)
- Apparent Power (VA)
- Current and Voltage Phase Angle
- Voltage harmonics
- Current harmonics
- Total Harmonic Distortion (Voltage and Current)
- Negative Phase Sequence Voltage (Vac)
- Negative Phase Sequence Current (Amps)

Additionally the energy at the utility PTs and CTs is calculated for:

- Import and Export kW-Hours
- Import and Export kVAR-Hours
- Import and Export kVA-Hours

Many of these parameters are also available as analog outputs to be used by other devices.

Protective Relaying

Industrial grade protective relaying functionality can be configured for both bus and mains parameters (i.e. Over Current, Under Voltage). Time delay, and separate warning and trip thresholds can be configured. Current based protections can also be coordinated with external protective equipment by adjusting the available ANSI/IEEE C37.112 Very Inverse curve used in all current protection functions. The complete list of the MC's protective relays and their functionality is provided in the Protective Relaying Chapter.

Peaking and Demand Operation

Peaking and demand operation is available through two modes of operation; time of day or plant load demand. The control can also be configured to operate in both modes of operation. For time of day operation the MC can be programmed for four different start and stop schedules. Each day of the week can then be set for one of the four schedules, and each schedule has two independent start times within a 24-hour period. An independent length of run time is set for each start time. At the scheduled time, the MC will start all of the LS units in its control and perform synchronization of these units based on the ATS status; Parallel (No ATS Mode), Open Transition or Closed Transition. When the run time has expired, the MC will perform a stop or ATS return and shutdown the LS units.

Load Demand level operation is dependant on the imported apparent power (VA) level through the mains breaker or by an analog process input. The demand level is filtered by a configurable low-pass filter and then passed to the demand logic. Two start levels and one stop level are available. If the demand becomes larger than the demand start level, the MC will initiate its demand start timer. If the demand remains above the start level when the timer expires, the MC will start one of the LS units in its control. There is also an instant demand level. If the demand becomes higher than this level, the MC will ignore the timer and immediately start the next LS unit. The LS units will run at the selected load mode and level of the MC (BaseLoad or Process). When the mains import falls below the demand stop level the MC will initiate the demand timer. If the demand is still below the stop level when the timer expires, one of the LS units will be stopped. For more information on peaking and demand operation, see Chapter 16.

Sequencing

The MC control can initiate two different start or stop commands based on the current control situation. For most control operations the MC will issue a START ALL or STOP ALL command, which will start all LS units in its control. For load demand starts, the MC will issue a START REQUEST or STOP REQUEST, which will start/stop a single LS unit. If the MC is not in control (LS units are controlling load without the mains (ATS)) or if the MC is in process control, the LS units will sequence themselves based on the Run Time Manager and their load levels. For more information on the sequencing feature of the MC, see Chapter 14.

Automatic Power Transfer Switch (ATS)

The ATS function in the MC has several different modes of operation depending on the configured type (Open Transition or Closed Transition) and the digital inputs asserted (Auto, Test and Run). By asserting the Auto and Test digital inputs (Test ATS), an open transition will simulate a Loss of Mains situation, which will open the mains breaker before starting the LS units. For a closed transition the LS units will be paralleled to the mains and will attempt to create a zero power transfer (ZPT) across the mains breaker. The mains breaker will not be opened unless ZPT is achieved. By asserting the Auto, Test and Run w/Load digital inputs a normal ATS function will be initiated (Initiate ATS). If a group breaker is configured on the system, an open transition will wait until the LS units are on the bus and stable before the mains is opened. The MC will wait for a fast transfer delay time before the group breaker will be closed. Without a group breaker the ATS will behave exactly like the Test ATS function. The closed transition will parallel all LS units to the mains and will open the mains at the end of the fast transfer delay time even if ZPT is not achieved.

The MC also has a Load Shed feature. Three load shed digital outputs can be configured to remove sections of load from the bus if under frequency and under voltage conditions occur or if ZPT does not occur. The details of ATS functionality are explained extensively in Chapter 17.

Control Overview

Synchronizer

The EGCP-3 MC control uses digital signal processing techniques to derive both true RMS voltages and the relative phase of the fundamental frequencies of the bus and mains voltage wave forms. Digital signal processing techniques offer significantly improved measurement accuracy in the presence of waveform distortions, particularly since the phase measurement does not depend on zero crossings of the waveforms.

The MC synchronizer has two modes of synchronization, Phase Matching or Slip-frequency.

Phase matching controls the bus frequency to give zero speed error and minimize phase error between the mains and bus; this provides rapid synchronizing for critical standby power applications. Slip-frequency synchronizing guarantees a fixed speed difference between bus and the mains. For both synchronizing methods, the MC control uses actual slip frequency and breaker delay values to anticipate a minimum phase difference between bus and mains at actual breaker closure.

Additionally there are four modes of operation:
1. **Run**—Actively attempts to synchronize and will send breaker closure command
2. **Check**—Actively attempts to synchronize but will not issue closure command
3. **Permissive**—Does not attempt to synchronize but will issue breaker closure command if synchronizer is within voltage, speed and phase limits
4. **Off**—No synchronization occurs

Additional synchronizer features include: deadbus closures, voltage matching, time delayed automatic multi-shot reclosing, and a synchronizer timeout alarm.

Real Load Control

The MC control real load control has three modes of operation:
1. **BaseLoad**—Real load of LS units is controlled at a configured load setpoint.
2. **Import/Export**—Real load across mains breaker is maintained at a configured import or export level
3. **Process**—Real load is controlled based on an external process input or reference setpoint

The MC control provides digital inputs to allow raising or lowering the internal BaseLoad or Process reference and a 4–20 mA (or 1–5 Vdc) analog input for remote load setpoint. Loading and unloading rates are available for smooth adjustment of both load reference and load command and these ramping rates can be set to zero any time the Ramp Pause digital input is activated.

Process Control

A process controller is provided for cogeneration, import/export control, temperature maintenance, pressure maintenance, or other applications. An adjustable bandwidth input filter, flexible controller adjustments, an adjustable deadband, and direct or indirect control action, allow the process control to be used in a wide variety of applications.

A 4–20 mA (or 1–5 Vdc) process transmitter provides the process signal to the EGCP-3 control. The control includes an internal digital process reference which may be controlled by raise and lower switch contact inputs or by an external 4–20 mA (or 1–5 Vdc) remote process reference, or by a Modbus or ServLink communication interface. The output of the process control provides a load reference to the Real Load controller.

Adjustable ramps allow smooth entry to or exit from the process control mode. When the process control mode is selected, an adjustable ramp moves the load reference in a direction to reduce the process control error. When the error is minimized, or the reference first reaches either the specified high or low load pick-up limits, the process controller is activated. When a minimum or maximum limit is reached, the control will hold the load reference at that limit until process input is returned to a level for safe operation.

When unloading from the process control, an adjustable unload ramp provides time controlled unloading to the unload trip level. When load reaches the unload trip level, the EGCP-3 control automatically issues a group breaker open command or a Stop all command to remove the LS units from the system. The ramp pause switch input allows holding of the load ramp for cool-down or warm-up purposes.

Additional functions include selectable and adjustable process high and low limit switches and alarm activation.

VAR/PF Control

The VAR/PF functions control the reactive power component exported or imported to the system mains. The reactive load mode can be configured for VAR or PF control. The controller compares the measured reactive load with an adjustable internal reference and makes corrections to the PF command sent to the LS units until the desired reactive power is obtained. The reactive power level can be maintained while also controlling real load through the mains breaker. The MC control also provides switch inputs to allow raising or lowering the reactive load reference, and provides a 4–20 mA (or 1–5 Vdc) analog input for remote VAR/PF setpoint control, if desired. The kVAR/PF reference can also be set through a Modbus or ServLink DDE communication interface.

Chapter 2.
Front Panel Operator Interface

Introduction

The EGCP-3 Operator Interface is designed for simplicity and redundancy of function in all operating modes. Two backlit LCD (Liquid Crystal Display) screens are used to display various operating and status information to the operator, as well as for configuration of setpoints. This chapter is intended to show the operation of and features available though the EGCP-3 display. The function of the configurable items shown here are described in more detail in following chapter(s).

IMPORTANT

The EGCP-3 Operator Interface can only be used for unit configuration and monitoring. Unit start/stop, sync, or mode selection commands cannot be given through the EGCP-3's front panel.

The unit's front panel screens provide eight lines of status information, with the option of displaying four lines of configuration or Alarm Log information. These screens allow the user to monitor and tune related parameters at the same time.

Figure 2-1a. EGCP-3 Front Panel & Operator Interface

Keypad

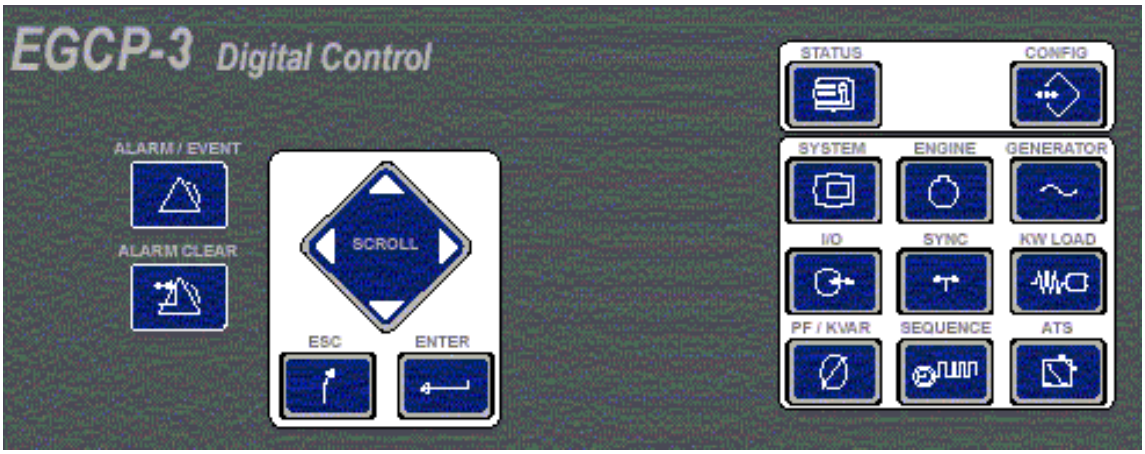


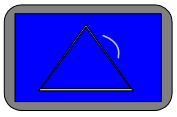
Figure 2-1b. Keypad

There are three modes of keypad/display operation: Alarm, Configure, and Status. To go into one of these modes, simply press the key named with that mode. The Alarm and Configure menus only appear on the right hand screen, the left hand screen will continue showing the Status menu for that screen. When the Status key is pressed both screens will display status menus.

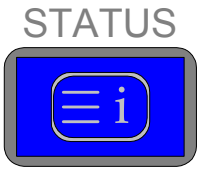
Alarm/Event, Status, and Configuration Keys:

These three keys determine the type of menus being displayed by the EGCP-3.

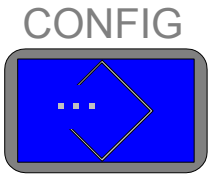
ALARM / EVENT



The ALARM/EVENT KEY is used to access the alarm and event menu in the right hand display screen. When pressed once, this key will cause the right hand LCD display to show the current active alarm(s) and the time of the alarm occurrence. Press the scroll down to view more alarms, End of List will be display after the last alarm. If pressed twice, this key will cause the right hand LCD display to show the latest alarm in the complete ALARM HISTORY log of the generator set. As confirmation, the top line of the display will indicate when the alarm history is being displayed. Press the scroll down to view previous alarms and their occurrence time and date. Press CONFIG or STATUS to exit the ALARM/EVENT mode. The ALARM CLEAR function is active while viewing the active alarm screen and the proper security code entered. The acknowledge function is available from all modes.

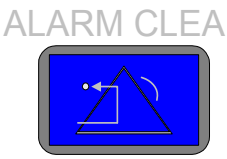


The STATUS KEY, when pressed, will put both left and right LCD into the monitor display mode. The status displays provide information about different items of MC operation. See the STATUS MENU keys, below for details on the various status keys. There are no adjustment values in the status display mode. The left screen portion of the active status screen will remain for monitoring when the Alarm or Configure mode is selected. The Scroll Up, and Scroll Down are the only navigation keys active in the Status mode,



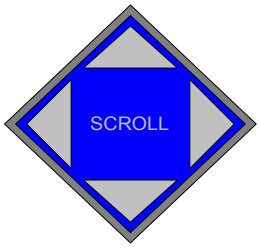
The CONFIG KEY will send the right hand LCD into the configuration mode, and if not already entered, ask a security code to be entered. After a proper code is entered, the Configuration menu items will be displayed in the right hand screen. Status information will continue to be displayed in the left hand screen. Since there are various menu items and adjustments in the configuration menu, a blinking cursor is provided in the right hand display to indicate the value may be adjusted.

Alarm/Event Keys



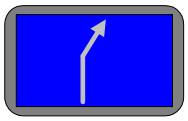
The ALARM CLEAR KEY is used to acknowledge and clear alarm events from the current event status log. Events are never cleared from the history log. When pressed, this key will silence the AUDIBLE ALARM (if present). When pressed a second time this key will clear all alarms that are no longer active. When an active alarm is cleared (Reset), the action(s) associated with the alarm event will also be cleared from the control logic.

Navigation and Adjustment Keys



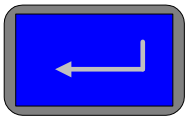
The SCROLL KEY is used to move the screen's cursor up, down, left and right by pressing the respective corner of the scroll diamond. In the Status mode and Alarm mode the Up and Down Scroll will change the screen to the next set of parameters or Alarms. This key is also used to increment and decrement values while in a Component Value Menu of the Configuration menu.

ESC



The ESCAPE KEY is used to move upwards (out of) the configuration menu levels. It also is used when tuning a value to restore the previous value, if the new value is not entered into memory (see the enter key, below). The ESCAPE KEY has no function in the Alarm mode or Status mode

ENTER

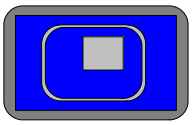


The ENTER KEY is used to move downwards (into) the configuration menu levels. It is also used when tuning a value to enter the new value to memory. The ENTER KEY has no function in the Alarm mode or Status mode.

Status Menu Keys

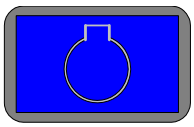
The following keys can be pressed to display the respective unit information. Many of the Status menus have more than one screen. Pressing the Scroll Up/Down key will show more parameters in the same group.

SYSTEM



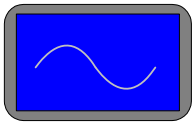
Press the SYSTEM STATUS key to display general system status information. The system status display is also the default status display screen (it is always the first display shown after a power up of the control). This display shows general information about the operation of the MC. There are two System status screens.

ENGINE



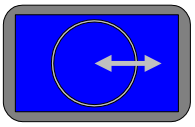
ENGINE STATUS is not available on the MC version. The screen displays no information.

GEN



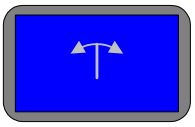
Press the GEN STATUS key to display the three phase based bus and mains parameters. There are eight status screens to monitor the bus and mains electrical parameters.

I/O



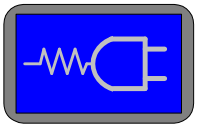
Press the I/O STATUS key to display the status of all the discrete inputs and outputs, as well as information on analog inputs and outputs and communication ports. There are three I/O status screens.

SYNC



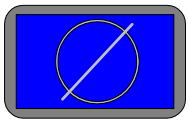
Press the SYNC STATUS key to display status information regarding the group breaker and mains breaker synchronizer. The Synchronizer status is on two screens.

KW LOAD



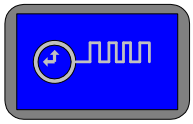
Press the KW LOAD STATUS key to display the unit's kW load control status information. There are four KW Load status screens.

PF / KVAR



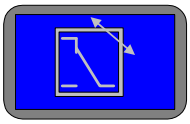
Press the PF/KVAR STATUS key to display VAR/PF Mode information, as well as related three phase generator and mains parameters. The reactive power values are contained on only one status screen.

SEQUENCE



Press the SEQUENCE key to display status information for sequencing functions. There are two status screens for Sequence functions.

ATS



Press the ATS STATUS key to display status information for the Automatic Transfer Switch functions. There are two status screens for ATS functions.

Navigation Procedure

The following drawings detail a step-by-step procedure for navigating through the EGCP-3 software. Additionally, the typical display entries seen at each step are shown. The cursor position is shown with an Underline of the first letter in the active line. Stepping through this example will give the user a quick feel for the display and keypad operation.

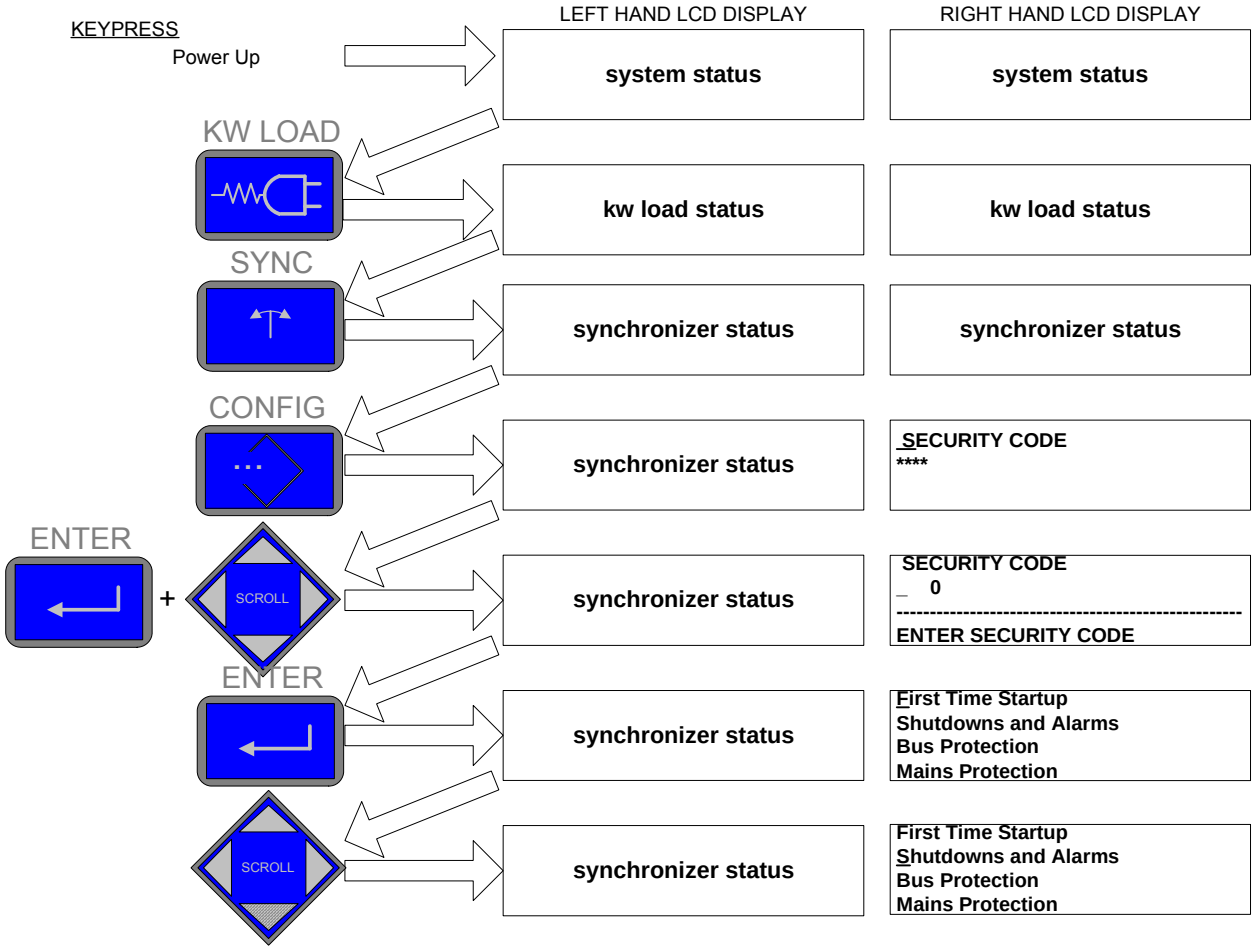


Figure 2-2a EGCP-3 Navigation (1)

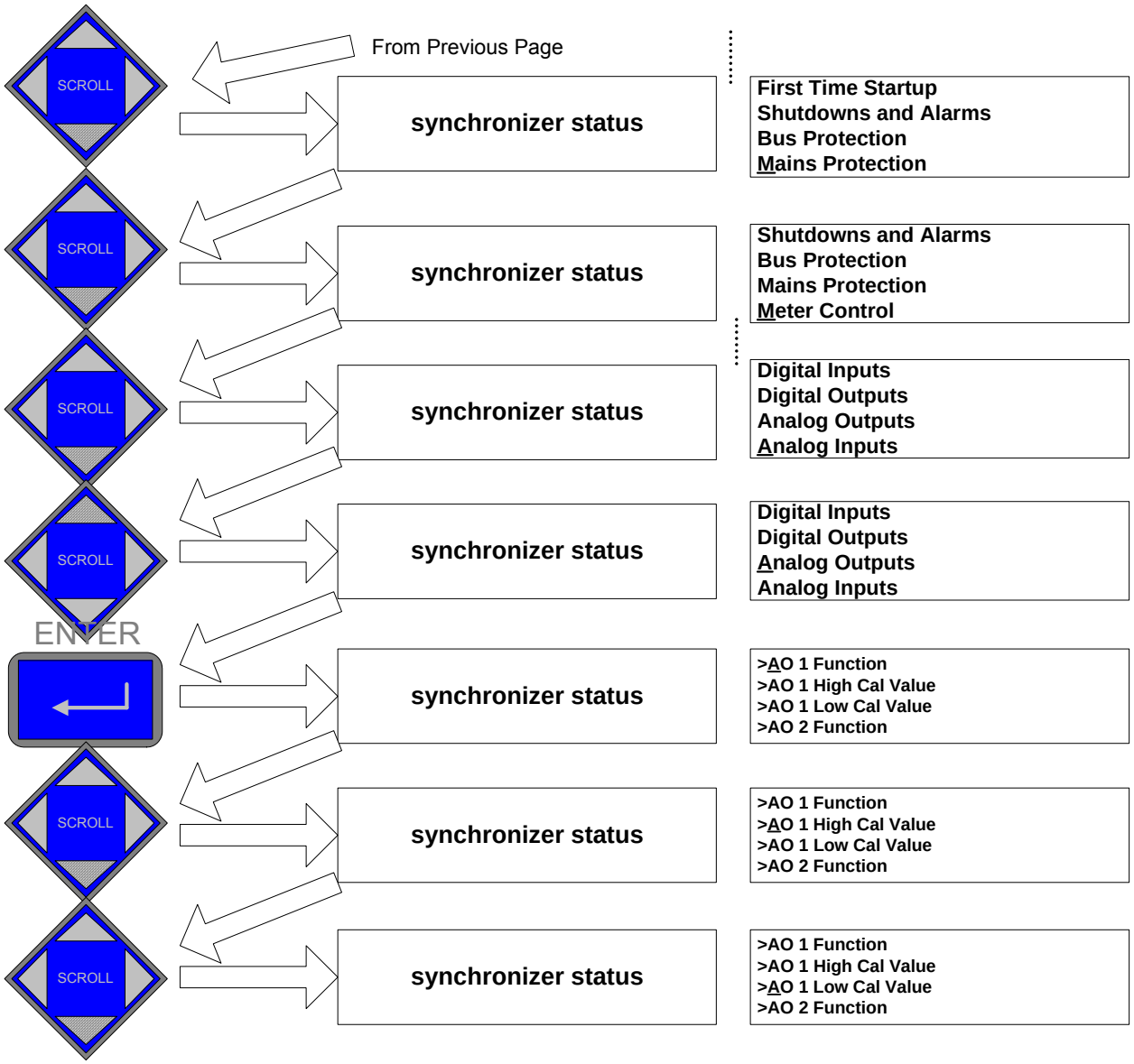


Figure 2-2b. EGCP-3 Navigation (2)

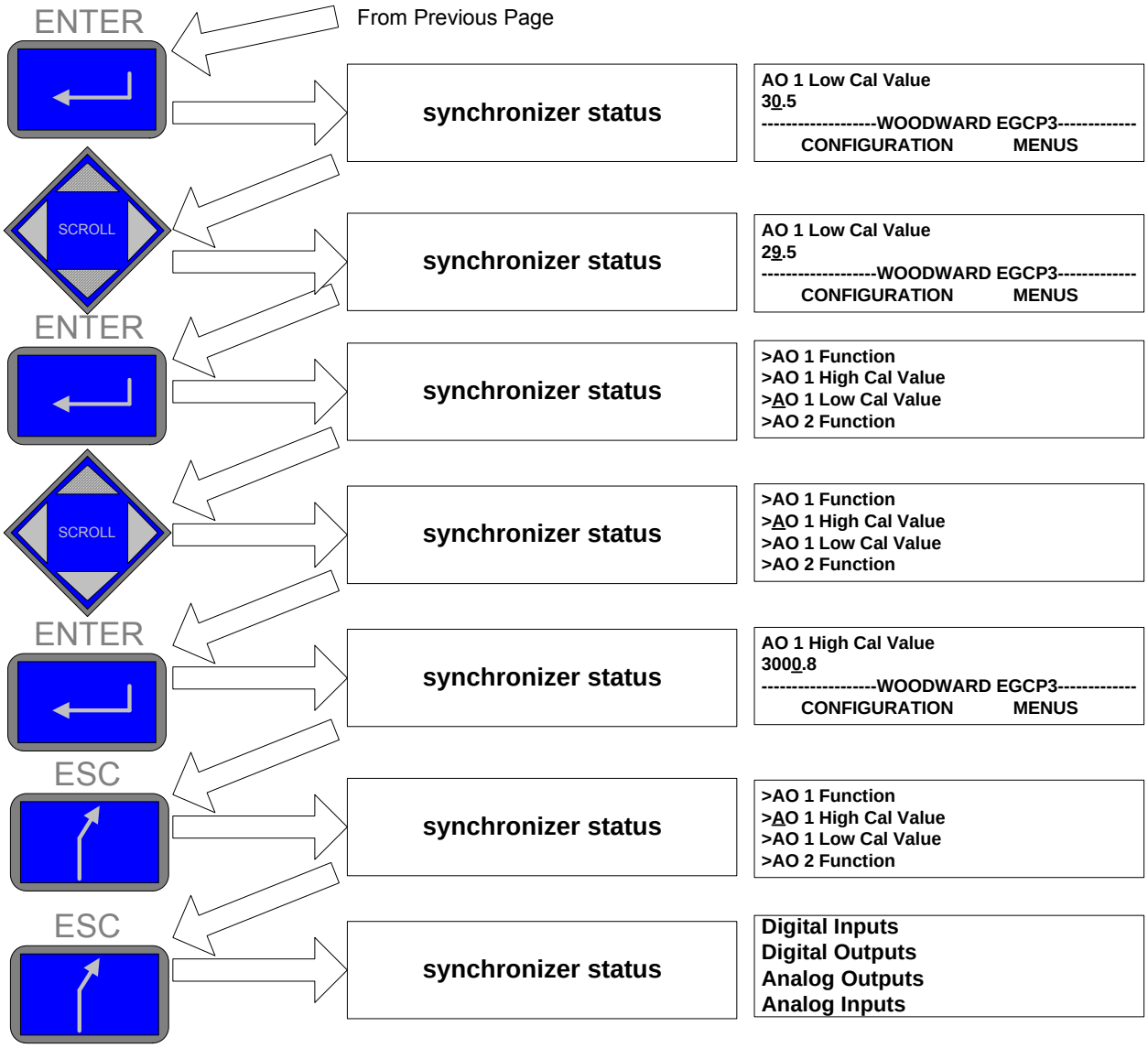


Figure 2-2c. EGCP-3 Navigation (3)

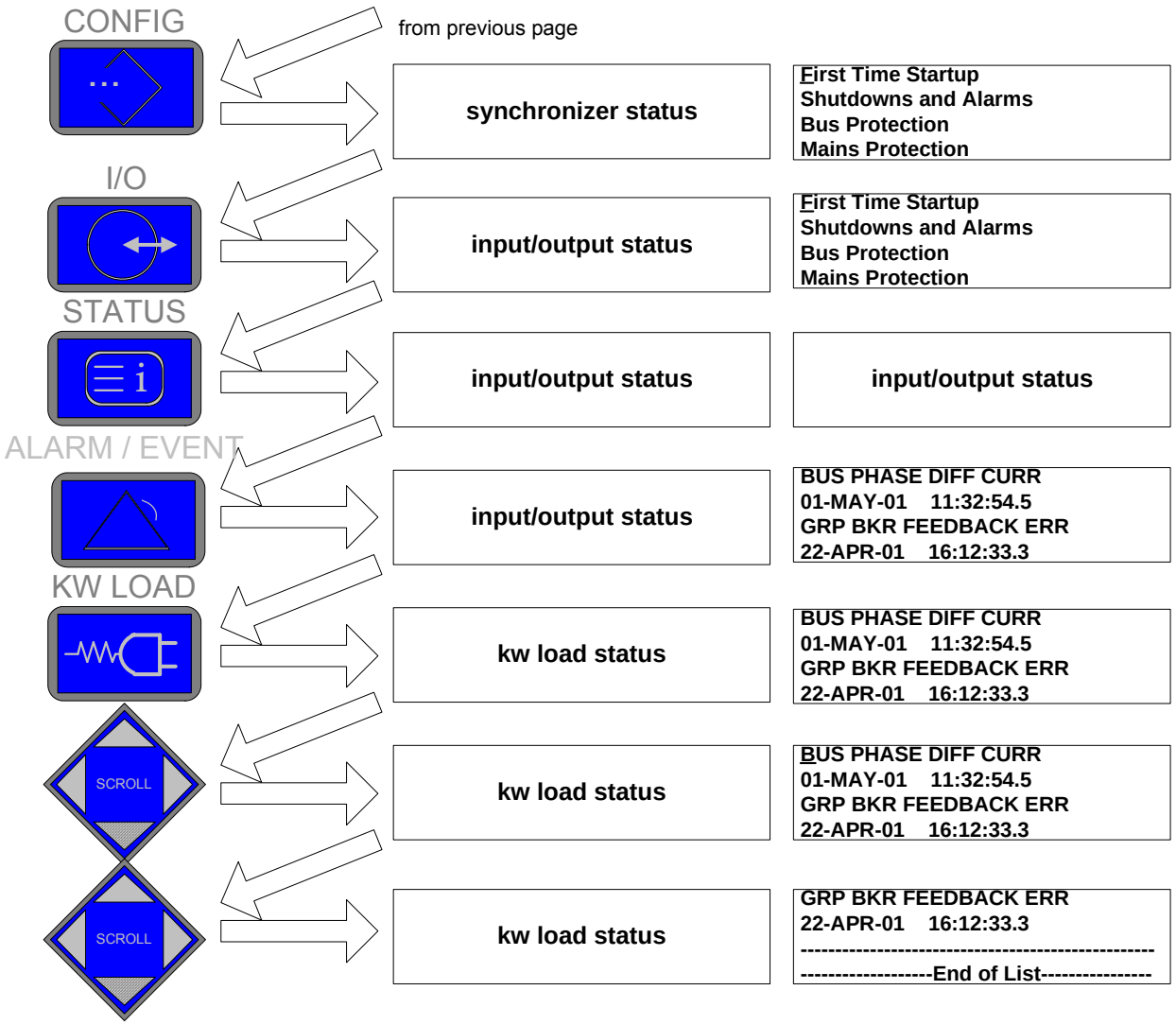


Figure 2-2d. EGCP-3 Navigation (4)

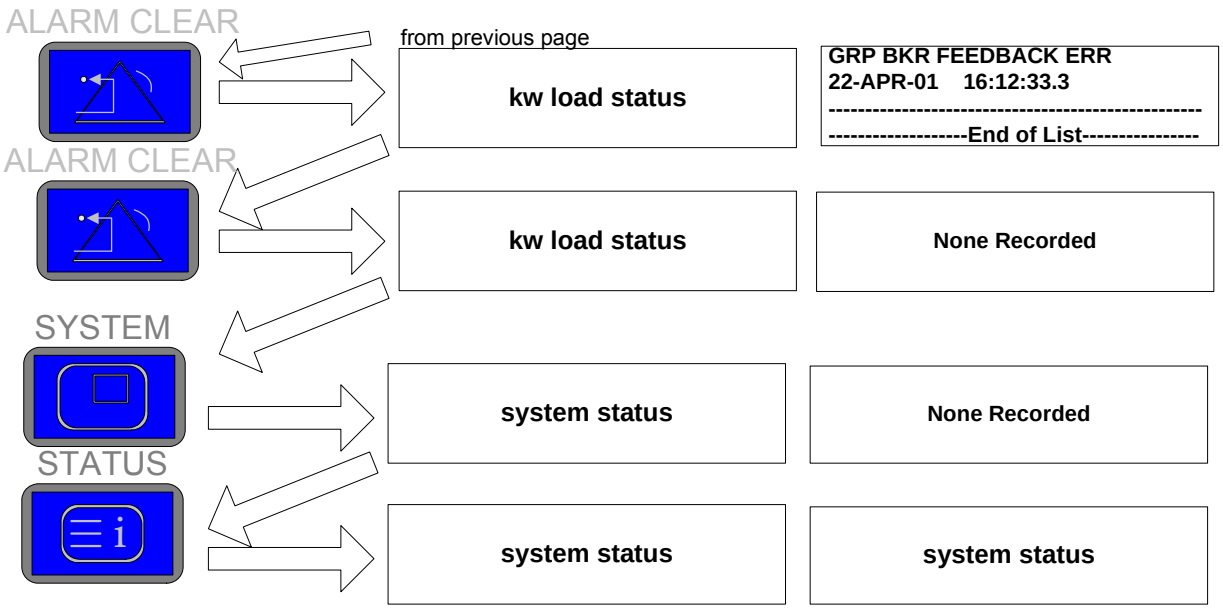


Figure 2-2e. EGCP-3 Navigation (5)

Alarms and Events

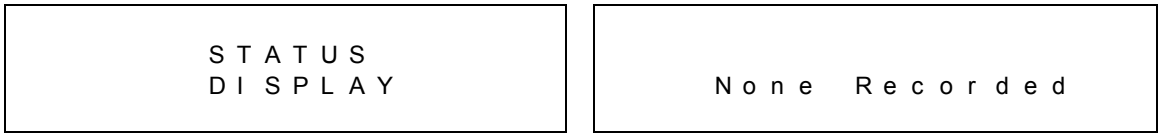
The EGCP-3 contains two separate alarm event lists, active alarms and historical alarms. The active alarm list contains all active alarms that have not been cleared with security access. The historical list contains the previous 100 alarms that have occurred in the system.

The historical alarm log is kept in non-volatile memory and will be stored if control power is lost. The active alarm list is saved only in volatile memory and will be cleared on loss control power input.

Active Alarms

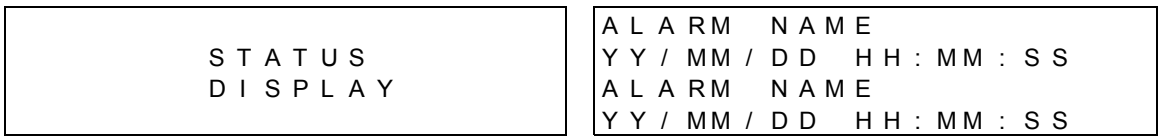
The ALARM/EVENT key provides access the MC's active alarm event log. When the ALARM/EVENT KEY is pressed once on the MC's keypad, the right hand LCD screen will switch to display the first two active alarms and the time the event occurred. Pressing the SCROLL DOWN key will page down to the next pair of events, until End of List is displayed after the final alarm. Pressing the Up Scroll key will page up to the previous pair of events. A maximum of 100 events is allowed in the active alarm list.

When no active alarms are present, pressing the ALARM/EVENT KEY will display the following:



Current Alarm/Events

If an active alarm is present the display will show the type of alarm and the date and time which it occurred.



Current Alarm/Events

ALARM NAME: The name, as defined by the particular warning, alarm, or shutdown event.

HH:MM:SS The hour, minute, seconds, of the alarm occurrence in 24 hr format.

YY/MM/DD The Year, Month and Day of the alarm occurrence. Only a 2-digit year is shown due to space limitations. The month is shown as the conventional numerical 01-12

The ALARM CLEAR KEY is used to acknowledge and reset alarm events from the current event status list. When pressed, this key will acknowledge all alarms in the Current Alarm/Event List by silencing (turning off) the AUDIBLE ALARM output (if present). When pressed a second time, the alarm will be reset. If the event was latching an associated control action(s), the latch will also be cleared from the control logic thus allowing that action to continue (if appropriate).

The alarm will not be cleared from the active list unless operator or greater security access has been entered into the control. In the event that an alarm is still active, it will not be cleared from the alarm list even with security access.

⚠WARNING

The unit may enable a start unintentionally if a fault, which caused the units to shut down, is cleared and the operating mode is enabled for Automatic Starting. Before clearing the fault, check the cause of the fault, in order to protect operating personnel located in the vicinity against injuries, and to protect gensets against unintentional damage.

⇒ If the cause of the fault is not known or is unclear, NEVER press the ALARM CLEAR KEY.

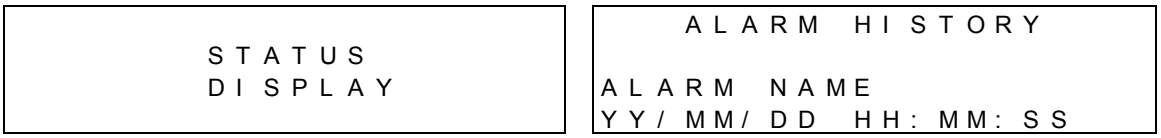
To enter a clear command, it is necessary to press the CLEAR ALARM key, wait two seconds, and then press CLEAR ALARM again. If another alarm has occurred during this two second wait period, the new alarm will be acknowledged, but no alarms(s) will be cleared. Another press of the CLEAR ALARM key is now required to clear the alarm list, and reset the alarm(s). There is no maximum wait time for the alarm clear function. Once the CLEAR ALARM key is pressed, the second ALARM CLEAR can occur any time (provided there are no new alarms), the list will be cleared, and the alarm(s) will be reset.

Historical Alarms

Pressing the ALARM/EVENT KEY twice accesses the historical alarm list. The top line of the right display will indicate ALARM HISTORY when the history log is being displayed. If the ALARM/EVENT KEY is pressed again, the display will return to showing the active alarm list.

Pressing the SCROLL DOWN key will page down to the next event and the time and date of occurrence. Pressing the SCROLL UP key will page up to the previous event.

The events displayed are arranged in a first in, last out (FILO) order. The most recent events will appear at the top of the list, followed by older events. If the total number of events exceeds 100, the oldest events will be dropped off the list. Events are never cleared from the history log until the log becomes full. The history log is saved in non-volatile memory so the equipment owner can always see past events. A sample of a historical alarm is shown below:



History Log

The ALARM CLEAR KEY has no effect when viewing the History Log.

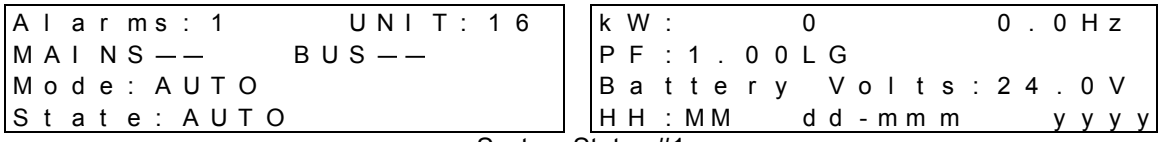
Status Menus

There are nine status menus in the EGCP-3 to be used for monitoring and troubleshooting. The status keys on the face of the EGCP-3 can be used to access these menus where information is dynamically updated about every 200 milliseconds (ms). The status menus are used to display all of the inputs and outputs of the control and the associated modes of operation for the control.

All status screens include a wrap-around feature when more than one page of data is available. Upon reaching the last page of data, pressing the scroll down arrow key again will cause the EGCP-3 to wrap-around and display the first page again. Likewise, if the first page is being displayed and the Scroll up key is pressed, the last page will then be displayed.

System Status

When the EGCP-3 is initially powered up, it will default to the System Status Screen 1. Below is an example of what the Screen may look like. The System Status Screen can be accessed while in any other status screen by pressing the SYSTEM key.



System Status #1

The screen displays the following information:

Alarms: Displays the number of active alarms on the unit.

UNIT: The LON Address of the EGCP-3 Unit.

MAINS: Graphic display of the mains condition. Two minus symbols (– –) indicates the mains are out of spec, one plus symbol indicates the mains are in spec, but not declared stable (+ –), two plus symbols (+ +) indicate the mains are in spec and stable.

BUS: A graphic display of the status of the bus. Two minus symbols (– –) indicates the bus is out of spec, one plus symbol (+ –) indicates the bus is in spec, but not declared stable; two plus symbols (+ +) indicates the bus is in spec and stable.

Mode: Mode Switch status:

Displayed State	Meaning
OFF	The Test/Run/Auto switches are all off or unit is not a master.
AUTO	The Auto switch and the MC is in automatic control
MANUAL	The Run Switch (only) was selected and no automatic breaker closures will occur

State: Shows the state of the MC unit as a whole. Display shows how/why units were started.

Displayed State	Meaning
OFF	The Test/Run/Auto switches are all off
ATS	The Test/Run/Auto switches are all asserted. An ATS function is being performed.
TEST ATS	The Test and Auto switches were asserted. A TEST ATS function is being performed.
RUN WITH LOAD	The Run switch was asserted and the engine is running. With the Auto switch the unit will automatically synchronize and close the gen breaker. Without the auto switch the engine can be manually synchronized. Once the breaker is closed, the unit will go into the appropriate Load Control Mode.
AUTO	The Auto switch (only) is asserted and the EGCP-3 is waiting for network start command. The unit is in standby and ready to start.
MAINS DEMAND	The MC has initiated a Peaking Demand startup
PEAK TIMER	The MC has initiated a Time of Day Demand startup
LOM START	The MC has detected a Loss of Mains condition and initiated a LOM startup

KW: The total kW load on the mains. Note: The display will put a blank, k, or M as the first letter so that the units appear as W, kW or MW for the displayed value.
Hz: The frequency of the mains in Hertz (Hz).
PF: The average three phase power factor of the mains set.
HH:MM: Time of Day (24 hour clock format)
dd-mmm: Date with two digits for the day and three letters for the month.
yyyy: Four digit year.
Battery Volts: Battery Voltage in Volts dc.

System Status Screen #2 contains mains import and export power meters as measured by the mains sensors.

```
MAINS IMPORT
kW-hrs          0.0000
kVAR-hrs        0.0000
kVA-hrs         0.0000
```

```
MAINS EXPORT
kW-hrs          0.0000
kVAR-hrs        0.0000
kVA-hrs         0.0000
```

System Status #2

MAINS IMPORT: This screen shows the accumulated total power that has been imported from the mains. During export, this value does not change.
MAINS EXPORT: This screen shows the accumulated total power that has been exported to the mains. During import, this value does not change.
kW-Hrs: The total accumulated kW hours measured on the mains bus.
KVA-Hrs: The total accumulated kVA hours measured on the mains bus.
KVAR-Hrs: The total accumulated kVAR-hours measured on the mains bus.

Engine Status

There is no Engine parameter information available in MC units.

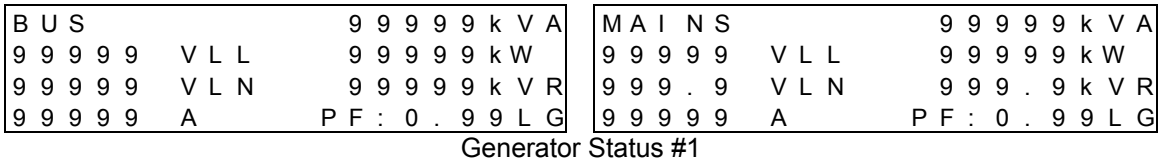
```
MASTER UNIT

NO ENGINE STATUS
```

Engine Status #1

Generator Status Screens

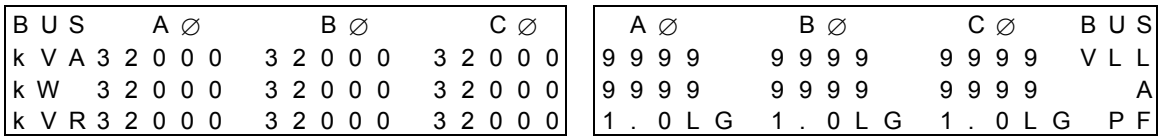
The Generator Status Screens contains summary information for the BUS and MAINS sources. It displays totals and averages as appropriate. Below is the first screen shown in the generator status section.



Generator Status #1

BUS Denotes this screen is for the bus.
MAINS: Denotes this screen is for the mains.
KVA: Total KVA reading. The display will put a blank, k, or M as the first letter so that the units appear as VA, kVA or MVA for the displayed value.
KW: Total kW readings. The display will put a blank, k, or M as the first letter so that the units appear as W, kW, or MW for the displayed value.
KVR: Total kVAR reading. The display will put a blank, k, or M as the first letter so that the units appear as VR, kVR, or MVR for the displayed value.
VLL: Average Volts L-L. The display will put a blank, k, or M as the first letter so that the units appear as V, kV, or MV for the displayed value.
VLN: Average Volts L-N. The display will put a blank, k, or M as the first letter so that the units appear as V, kV, or MV for the displayed value.
A: Average Amps. The display will put a blank, k, or M as the first letter so that the units appear as A, kA, or MA for the displayed value.
PF: Average Power Factor; with LG or LD for Lag or Lead.

Generator Screen #2 is the electric power measurements for the BUS three-phase power sensor.



Generator Status #2

BUS: Denotes this screen is for the local bus.
A∅ B∅ C∅: Three phase readings for the bus
KVA: Phase KVA reading. The display will put a blank, k, or M as the first letter so that the units appear as VA, kVA or MVA for the displayed value.
KW: Phase kW readings. The display will put a blank, k, or M as the first letter so that the units appear as W, kW, or MW for the displayed value.
KVR: Phase kVAR reading. The display will put a blank, k, or M as the first letter so that the units appear as VR, kVR, or MVR for the displayed value.
VLL: Phase Volts L-L. The display will put a blank, k, or M as the first letter so that the units appear as VLL, kVLL, or MVLL for the displayed value.

A: Phase Amps. The display will put a blank, k, or M as the first letter so that the units appear as A, kA, or MA for the displayed value.

PF: Phase Power Factor, with LG or LD for Lag or Lead.

Generator Screen #3 is the electric power measurements for the MAINS three-phase power sensor.

```
MAINS  A∅      B∅      C∅
kVA 32000  32000  32000
kW  32000  32000  32000
kVR 32000  32000  32000
```

```
A∅      B∅      C∅  MAINS
9999    9999    9999  VLL
9999    9999    9999     A
1.0LG   1.0LG   1.0LG  PF
```

Generator Status #3

MAINS: Denotes this screen is for the mains bus.
All other fields on this screen are identical in format to those on Screen #2 above.

Generator Screen #4 is the Harmonics screen for both power sources: MAINS and BUS.

IMPORTANT

The local display only shows the current harmonics, all voltage harmonics are shown in the Watch Window software, and are available through Modbus or ServLink.

```
          I-THD   V-THD
BUS       100.0   19.99
MAINS     99.99   99.99
```

```
          3RD   4TH   5TH
BUS       9.99  0.99  9.99
MAINS     9.99  0.99  9.99
CURRENT HARMONICS
```

Generator Status #4

BUS: Denotes this row is used for the local bus.
MAINS: Denotes this row is for the mains bus.
I-THD: Total Harmonic Distortion. The percentage of total current that can be attributed to harmonics as related to the fundamental.
V-THD: Total Harmonic Distortion of the Voltage in percent. Calculated the same as the current THD.
3RD: Third Harmonic in percent. It is the total current in the third harmonic, as a percentage of the total current in the fundamental. A value of 0 will denote no harmonic content, and a value of 100 will denote a third harmonic current equal to the fundamental current. All harmonic values shown are calculated by this method
4TH: Fourth Harmonic in percent.
5TH: Fifth Harmonic in percent.
CURRENT HARMONICS:
Denotes this screen shows current harmonics.

Generator Screen #5 is the second Harmonics screen for both power sources: BUS and MAINS.

```
          6TH   7TH   9TH
BUS       9.99  0.99  99.9
MAINS     9.99  0.99  99.9
CURRENT HARMONICS
```

```
          11TH  13TH
BUS       9.99  0.99
MAINS     9.99  0.99
CURRENT HARMONICS
```

Generator Status #5

6TH: Sixth Harmonic in percent
7TH: Seventh Harmonic in percent
9TH: Ninth Harmonic in percent
11TH: Eleventh Harmonic in percent
13TH: Thirteenth Harmonic in percent

Generator Status Screen #6 contains negative sequence voltage and currents. It covers both power sources: MAINS and BUS.

```
BUS                          MAINS
Neg∅  Seq: 99999  V          Neg∅  Seq: 99999  V
Neg∅  Seq: 99999  A          Neg∅  Seq: 99999  A
I-THD  999   V-THD  999      I-THD  999   V-THD  999
```

Generator Status #6

NEG∅ SEQ: Negative Phase Sequence Voltage and Negative Phase Sequence Current component value. The display will show the multiplier units as appropriate.
I-THD: Total harmonic distortion of the current in percent. Repeated from Generator Status Screen #4
V-THD: Total harmonic distortion of the voltage in percent. Repeated from Generator Status Screen #4.

Generator Status Screen #7 contains the three phase power measurements from the MAINS sensors. This is a repeat for Generator Status Screen #3 except that L-N values are used.

```
MAINS   A∅      B∅      C∅        A∅      B∅      C∅   BUS
kVA  32000   32000   32000     9999    9999    9999    VLN
kW   32000   32000   32000     9999    9999    9999      A
kVR  32000   32000   32000     1.0LG   1.0LG   1.0LG    PF
```

Generator Status #7

Generator Screen #8 is the electric power overview for the BUS three-phase power sensor. This is a repeat for Generator Status Screen #2 except that L-N values are used.

```
BUS     A∅      B∅      C∅        A∅      B∅      C∅   BUS
kVA  32000   32000   32000     9999    9999    9999    VLN
kW   32000   32000   32000     9999    9999    9999      A
kVR  32000   32000   32000     1.0LG   1.0LG   1.0LG    PF
```

Generator Status #8

I/O Status Screens

I/O Status Screen #1 contains summary information for discrete I/O. Pressing the Scroll Down key will page down to I/O Status Screen #2. Pressing the Scroll Up key will page to I/O Status Screen #3.

```
      DISCRETE I/O           PF Cmd:  0.00
123456789012345678           Load Cmd:  0.00
XXXXXXXXXXXXXXXXXX  IN       Load Ref: ———%
XXXXXXXXXXXX————  OUT       LD Mode:  OFF
```

I/O Status #1

IN: Discrete Inputs 1 through 16. X=Active, Blank=Off.
OUT: Discrete Outputs 1 through 12. X=Active, Blank=Off.
1234….56: These are the channel number 1-16 of the Discrete Inputs and 1-12 of the Discrete Outputs.

IMPORTANT

0 = Input # 10, the 1-6 to the right of 0 are 1 = Input #11, 2 = input #12, etc.

PF Cmd: PF command sent from the MC to the LON network.
Load Cmd: Load command sent from the MC to the LON network.
Load Ref: This is the load reference used by the Real Load Controller. This readout is only active when in a BASELOAD or PROCESS control mode. It will show (– – –) if not in control.
LD Mode: This is the Load Control Mode from the Real Load Status Screen. See the Real Load Status Screens section for details.

I/O Status Screen #2 contains analog I/O. The left screen indicates the actual mA value of the Analog Output 1– 4 at the I/O terminal, and Analog Input 1-4 in mA or voltage (as configured for each input) at the terminal strip. The right screen gives the scaled value for the inputs.

IMPORTANT

The right screen labels can be configured in WW to read any ASCII character so may not read ANALOG IN 1, ANALOG IN 2, etc.

```
OUT1:19.99  IN1:19.99        ANALOG IN 1    0.00
OUT2:19.99  IN2:19.99        ANALOG IN 2    0.00
OUT3:19.99  IN3:19.99        ANALOG IN 3  -15.00
OUT4:19.99  IN4:19.99        ANALOG IN 4   -1.05
```

I/O Status #2

OUT#: The current in mA being output at the indicated analog output point.
IN#: The current in mA or voltage in Vdc detected at the indicated analog input point.
Analog In 1: The scaled value for input 1 as setup in the Analog Input menu.
Analog in 2: The scaled value for input 2 as setup in the Analog Input menu.
Analog In 3: The scaled value for input 3 as setup in the Analog Input menu.
Analog in 4: The scaled value for input 4 as setup in the Analog Input menu.

I/O Status Screen #3 contains communications and network data.

```
Com Port 1: NORMAL      TIE      BUS      MAINS
Com Port 2: NORMAL      WXYZ     ABCD     OPEN
Com Port 3: NORMAL      X        X
LON Status: NORMAL      Gen Breker: OPEN
```

I/O Status #3

Com Port 1 The status of serial communication port 1. ALARM indicates a port timeout alarm, NORMAL indicates the port is active.
Com Port 2 The status of serial communication port 2. ALARM indicates a port timeout alarm, NORMAL indicates the port is active.
Com Port 3 The status of serial communication port 3. ALARM indicates a port timeout alarm, NORMAL indicates the port is active.
LON Status The status of LON communication. ALARM indicates a LON port error; NORMAL indicates the port is active.

TIE: The status of each tie breaker (W, X, Y, and Z) is indicated. 'X' means it is closed, and ' ' (blank) means it is open.

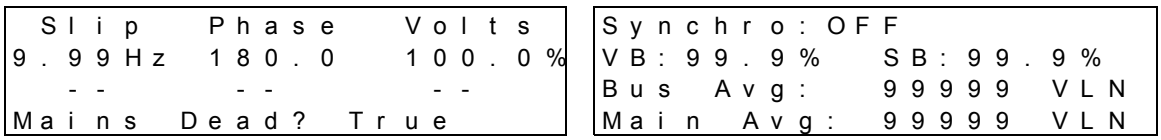
BUS: The status of each bus segment (A, B, C, and D) is indicated where 'X' means it is part of the active bus and ' ' (blank) means it is not included.

MAINS: Indicates the position of the Mains breaker.

Grp Breaker: Indicates the position of the Group breaker, OPEN or CLOSED. If a group breaker is not configured, it will show (---)

Synchronizer Status Screens

Synchronizer Status Screen #1 contains general interest synchronizing data. It is the top screen shown in the Synchronizer Status section. Pressing the Scroll Down or Up key will page to Synchronizer Status Screen #2.



Synchronizer Status #1

Slip: The slip frequency in Hz of the bus with relationship to the mains.

Phase: The phase angle difference in degrees between the bus and the mains.

Volts: The voltage differential in percent between the bus and the mains.

Line Three: Shows two minus symbols (– –) if not within programmed window. Shows one plus symbol and one minus symbol (+ –) if working to correct. Shows two plus symbols (+ +) if within window.

Mains Dead?: Indicates if the mains PT input being measured is dead.

Synchro: Displays the synchronizer's configured mode.

Displayed Mode	Meaning
OFF	Synchronizer mode is off and will not attempt to synchronize any breakers
PERMISSIVE	Synchronizer will not actively synchronize but will close breakers if within limits
CHECK	Synchronizer will actively synchronize but will inhibit any breaker closure
RUN/AUTO	Synchronizer will actively synchronize and will close breakers when within limits

VB: Voltage Bias Output from the synchronizer.

SB: Speed Bias Output from the synchronizer.

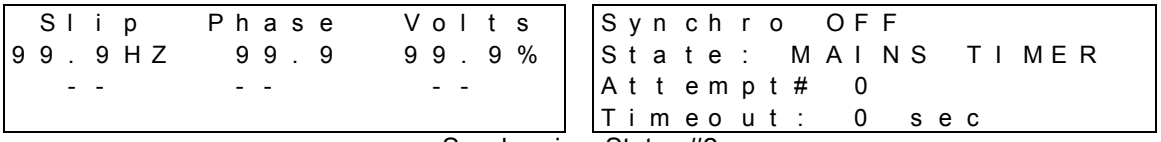
BUS AVG: Average Voltage of the bus. The display will put a blank, k, or M multiplier as the first letter, and depending on Wye or Delta configuration VLN or VLL.

MAIN AVG: Average Voltage of the mains. The display will put a blank, k, or M as the first letter, and depending on Wye or Delta configuration VLN or VLL.

IMPORTANT

The synchronizer displays ** in the place of values for Slip, Phase, and Volts when the synchronizer is inactive or off.**

Synchronizer Status Screen #2 contains timing status data on the right screen and status data repeated from Synchronizer Status #1. Pressing the Scroll Up key pages up to Synchronizer Status Screen #1. Pressing the Scroll Down also pages to the Synchronizer Status Screen #1 since there are only two screens.



Synchronizer Status #2

State: Displays the state of the synchronizer:

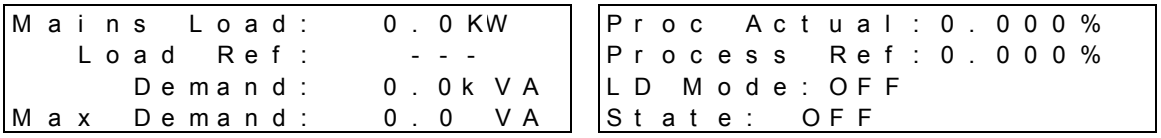
Displayed State	Meaning
OFF	The synchronizer is not actively synchronizing and is in the off mode
IN SYNC	Breaker has Closed Successfully, and held for synch timer.
SYNCING BUS	The group breaker is being actively synchronized to the bus/mains
SYNCING MAINS	The mains breaker is being actively synchronized
BUS TIMER	Bus is stable and waiting for bus stable timer
MAINS TIMER	Mains are stable and waiting for mains stable timer

Attempt#: Number of synchronization attempts (will always be less than or equal to Close Attempts set point).

Timeout: The amount of time left before synchronizer timeout in seconds. If disabled, the field will display '– – –'.

KW Load Status Screens

KW Load Status Screen #1 contains kW Load, Process Load, and Demand data.



KW Load Status #1

Mains Load: Real power sensed at the mains. The display will put a blank, k, or M as the first letter so that the units appear as W, kW, or MW for the displayed value.

Load Ref: The current load reference for the MC. The display will put a blank, k, or M as the first letter so that the units appear as W, kW, or MW for the displayed value.

Demand: Demand level in VA at mains.

Max Demand: Demand tattletale value in VA (peak value of demand, import takes precedence over export).

IMPORTANT

For all load and demand values. Export will have a positive value. Import will have a negative value.

System Load: Percent of total rated capacity of all generators on the LON network.

Proc Actual: The actual process level as seen by the EGCP-3. Units are percent of rated process.

Process Ref: The process reference for the process control. Its source is from; an internal setpoint, or an external devise, determined by the control configuration. Units are in percent of rated process.

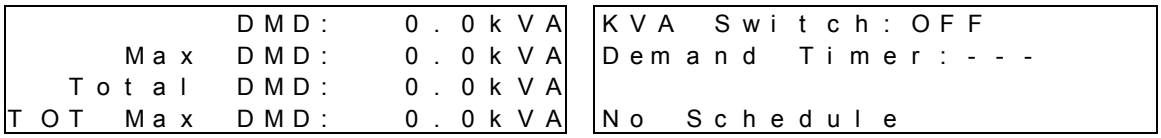
Load Mode: The current load control mode in operation.

Displayed Mode	Meaning
OFF	The load controller is off because the engine is off.
ISOCH	LS on load, but not in parallel with mains. MC not controlling load
BASELOAD	LS on load and in parallel with mains at the internal configured kW level.
IMP/EXP	Controlling the import or export of power on mains, setpoint is internal setting
PROCESS	Controlling using Temperature or Pressure Process input.
REM PROC	Controlling based on Temperature/Pressure Process input and a remote process reference.
PEAKING	System is supplying load in a peak shaving mode.
REM BASELD	Controlling in parallel with the mains to a BaseLoad reference provided by an analog input.
REM IMP/EXP	Controlling the import or export of power on mains, setpoint is provided by an analog input.
Load Share	Same as ISOCH with two or more LS's tied to the same bus

State: The state of the load controller:

Displayed State	Meaning
OFF	Not in auto
OFF/AUTO	MC in auto but not performing load control
RAMPING UP	The load is being increased, automatically or manually, at the configured ramp rate.
PAUSE	A user has manually (or through Modbus) stopped a load ramp.
RAMPING DOWN	The load is being decreased, automatically or manually, 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. It is no longer at the configured reference.

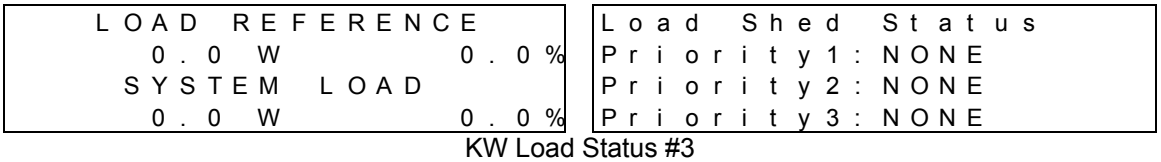
KW Load Status Screen #2 contains Demand and Peaking information.



KW Load Status #2

DMD: Current Demand level in VA at mains.
Max DMD: Demand tattletale value in VA (peak value of demand).
Total DMD: The total demand of all mains on the same active segment.
TOT Max DMD: The demand of the tattletale value of the total demand.
KVA Switch: Position of VA level switch (even if it is not mapped to an output).
Demand Timer: A countdown timer that activates when demand level is exceeded, showing time before sending start command to LS unit. It will show (---) if disabled. (integer only)
Next Demand Start: The time and day of the week that the next time scheduled start is to occur. This should indicate "No Schedule" if Time-of-Day peaking is not enabled.

KW Load Status Screen #3 contains the total load reference for all LS's online, the current system load as well as the load shed status of all three priority loadsheds.



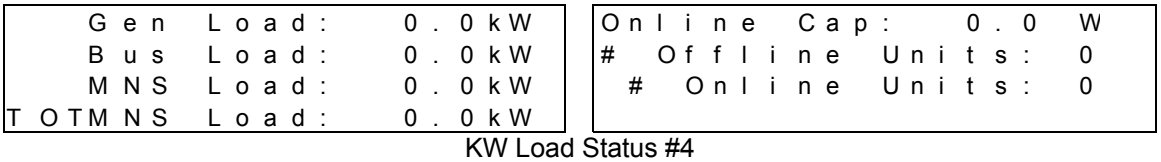
KW Load Status #3

Load Reference: The load reference for the generator(s). Both the power value and the percent load reference send to LS units on LON.

System Load: Shows both the power value and the percent load of the active bus from LON.

Priority#: There are 3 priority levels for load shed. None, some, or all may be configured. If not configured, it will show NONE. If configured, the state is either **SHED** to indicate it was Shed or **ON-LINE** to indicate it is still being served.

KW Load Status Screen #4 contains the total load of all LS units, the bus, this MC's mains and all MC's mains in real power units. The online capacity in real power units as well as the active and reserve units.



KW Load Status #4

Gen Load: Real power output sum of generator(s) on the active segment. Value from LON.

Bus Load: Measured load of bus segment connected to this MC.

MNS Load: Measured load in or out of the mains, connected to this MC.

TOT MNS Load: Instantaneous sum of all mains loads on the same active segment.

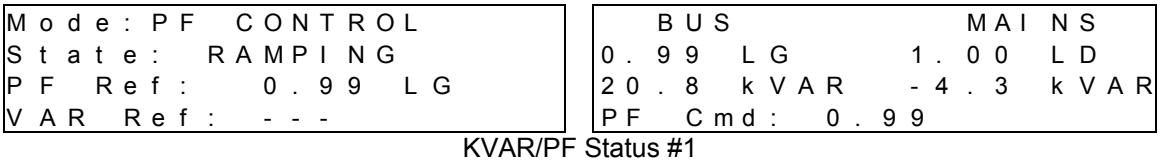
Online Capacity: The sum of the rated kW values for all LS units with breakers closed.

Offline Units: # Units ready to start (on same active bus).

Online Units: # LS units with breaker closed (on same active bus).

PF/KVAR Status Screens

PF/KVAR Status Screen #1 contains PF/KVAR data. It is the only screen in the PF/KVAR Status section.



KVAR/PF Status #1

Mode: The actual VAR/PF control mode.

Displayed Mode	Meaning
OFF	MC is not a master or is not in any VAR/PF control
PF CONTROL	At least one LS in parallel with the mains and the MC is in PF control mode.
VAR CONTROL	At least one LS in parallel with the mains and the MC is in VAR control mode.
RMT CONTROL	At least one LS in parallel with the mains and the MC is in Remote control mode using analog inputs for reference values.
MANUAL	A manual mode is selected so the user controls voltage bias using panel raise/lower switches.
IMP/EXP PF	The process controller is actively controlling import/export levels and the mode was configured for PF control.
IMP/EXP VAR	The process controller is actively controlling import/export levels and the mode was configured for VAR control.

State: The state of the load controller:

Displayed State	Meaning
RAMPING UP	Reactive load is being increased, automatically or manually, at the configured ramp rate.
PAUSE	A user has manually (or through Modbus) stopped a the ramp with a ramp pause.
RAMPING DOWN	Reactive load is being decreased, automatically or manually, at the configured ramp rate.
AT REFERENCE	The load has reached the configured level.
OFF/AUTO	MC is not a master or is not in any VAR/PF control but is in AUTO
OFF	MC is not in AUTO
MANUAL	The VAR/PF controller was placed in a manual mode and load is being controlled by external inputs.

PF REF: The PF control reference value for the control. This field will show '– – –' if the control is using VAR or Remote control modes. The display shows LAG or LEAD as appropriate.

VAR REF: The VAR control reference value for the control. This field will show '– – –' if the control is using PF or Remote control modes. The display will put a blank, k, or M as the first letter so that the units appear as VAR, kVAR, or MVAR for the displayed value.

PF: The average three phase PF of the bus or mains. The display shows LAG or LEAD depending on the power factor detected.

KVAR: The total VAR reading for the bus or mains. The display will put a blank, k, or M as the first letter so that the units appear as VAR, kVAR, or MVAR for the displayed value.

PF Cmd: PF command sent to the LON.

Sequence Status Screens

Sequence Status Screen #1 contains breaker and bus data as well as current LS sequencing data.

```
Unit: 1    State: OFF          Next On:      1
Mains Breaker: CLOSED          Next Off:     0
Group Breaker: CLOSED
BUS: A                         #Units On Load: 1
```

Sequence Status #1

Unit: Network Address (Unit number) of this unit.

State: Indicates the sequence state of the MC

Displayed State	Meaning
READY	Unit is in AUTO and ready to perform any action
ALARM	An LON alarm has been sensed.
OFF	Unit is not in AUTO

Mains Breaker: The status of the mains breaker as determined by the mains CB aux discrete input.

Group Breaker: The status of the group breaker as determined by the group CB aux discrete input.

Bus: The Active bus(es) that this unit is controlling (or joining). It may be any combination of the four letters (A, B, C, or D).

Next On: Unit Number of next unit to be sequenced onto the network. Will show ALL if all are being started. Places an asterisk (*) after the unit number when this unit is currently being sequenced (while Seq. Delay timer decrements).

Next Off: Unit Number of next unit to be sequenced off the network. Will show ALL if all are being stopped. Places an asterisk (*) after the unit number when this unit is currently being sequenced (while Seq. Delay timer decrements).

#Units On Load: Total number of units with their breakers closed.

Sequence Status Screen #2 contains data related to current LS units availability as well as bus segment information.

```
Seg Units: 1
Start Ready Units: 0
 Stop Ready Units: 0
LS Units: 0
```

```
TIE      BUS      MAINS
WXYZ     ABCD     CLOSED
X        XX
Net Units: 1
```

Sequence Status #2

Seg Units: Number of units on the active bus segment.

Start Ready Units: Number of units on the active bus ready to start.

Stop Ready Units: Number of units on the active bus ready to stop.

LS Units: Number of LS units with their load share bit true on the active bus segment.

TIE: Status Tie breakers W,X,Y,Z, ‘X’ below the breaker identification means the breaker is closed, and ‘_‘ (blank) means it is open.

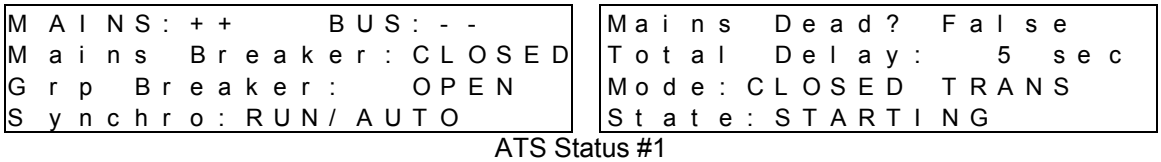
BUS: Each bus segment A,B,C,D is indicated where ‘X’ means it is part of the active bus and ‘_‘ (blank) means it is not included.

MAINS Status of the mains breaker.

Net Units: Number of units communicating on the LON network.

ATS Status Screens

ATS Status Screen #1 contains breaker and synchronization data on the left screen. On the right screen is transition timing and the current mode and state of the MC.



ATS Status #1

MAINS: A graphic display of the mains condition. Two minus symbols (--) indicates the mains are out of spec, one plus symbol (+-) indicates the mains are in spec, but not declared stable, two plus symbols (++) indicate mains are in spec and stable.

Bus: A graphic display of the bus condition. Two minus symbols (--) indicates the bus is out of spec, one plus symbol (+-) indicates the bus is in spec, but not declared stable, two plus symbols (++) indicate bus is in spec and stable.

Mains Breaker: The state of the mains breaker as determined by the mains CB aux discrete input.

Grp Breaker: The state of the group breaker as determined by the group CB aux discrete input.

Synchro: The synchronizer control mode. (See Synchronizer Status for modes)

Mains Dead: An indication of a live or dead local bus as determined by the voltage on the bus, and state of the generator and mains breaker inputs.

Total Delay: If the LS units are NOT supplying an isolated bus, then this shows the LOM Action Delay + Gen Stable Delay + Fast Transfer Delay as a countdown. If the ATS controller is OFF, it will show ---. If the EPS is now supplying the load, then this shows the Mains Stable Delay + Fast Transfer Delay as a countdown. The countdown will not be moving until the controller has decided to return the load to the mains.

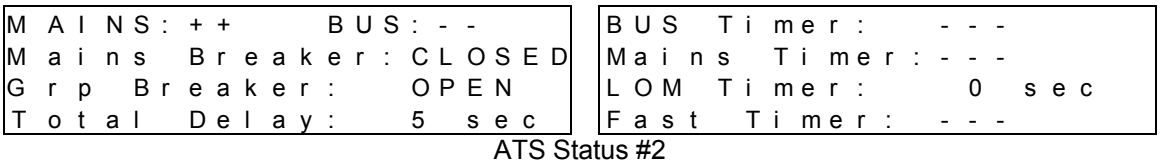
Mode: The actual ATS mode being used:

Displayed Mode	Meaning
OFF	ATS mode is selected as Off
TEST ATS	Unit is currently performing a TEST ATS (Test and Auto SW). Open or closed transition can be selected.
OPEN TRANS	No parallel ATS mode is selected.
CLOSED TRANS	Parallel ATS mode is selected

State: The actual ATS State

Displayed State	Meaning
LOM DELAY	Currently waiting for the LOM delay timer to expire
STARTING	Currently starting the ATS
BUS DELAY	Currently waiting for the Bus 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	LS units are supplying the load
STOPPING	Stopping the ATS
SYNCHRONIZING	Delay timers may be expired but synchronism is not achieved yet.
---	ATS is configured Off

ATS Status Screen #2 contains breaker and synchronization data on the left screen. On the right screen is advanced transition timing.



ATS Status #2

Bus Timer: Countdown timer from Bus Stable Delay time. Will show '---' if not active.

Mains Timer: Countdown timer from Mains Stable Delay time. Will show '---' if not active.

LOM Timer: Countdown timer from Loss of Mains Delay time. Will show '---' if not active.

Fast Timer: Countdown timer from Fast Transfer Delay time. Will show '---' if not active.

Security Access

The EGCP-3 has built-in security to protect against configuration changes and alarm log purges by unauthorized personnel. There are five levels of access to the configuration menus. They are listed in the table below. Each successive level has access to all of the levels above. A four-digit security code is required for access to the configuration menus. If a proper code is not entered within 60 seconds, the display will default to the System Status display.

For security purposes, all passwords may be changed. In order to change any password, you must log in at the Technician or Factory level. See Calibration Menu for ability to change passwords.

Security access is cleared once the escape (ESC) key is pressed while at the configuration menu screen. A password must be re-entered if accessed is again desired. While in the configuration modes, the Status menus may be selected for monitoring, then press CONFIG to return to configuration menus.

Level	Type of Access	Default Password
Monitor	View Status Screens, View current events and event history log Silence-Acknowledge alarms View and Reset (clear) current Alarm/Event	None Required
Operator	View Status Screens, View Configuration menus	9002
Supervisor	View Status Screens, Set Time/Date, Peaking mode, and Peaking schedules. View Configuration menus	9003
Technician	View Status Screens, Change Operator and Supervisor passwords, Set all Configuration points, except engine run time and MW-Hour accumulators	9004
Factory	Full access	****

Table 2-1. Security Access Codes

Entering and Changing Values

When changing component menu values in the Configuration mode, and to enter the security code use the following procedure.

To change an **analog value or integer**: Use the Left or Right Scroll key to move the cursor to the position or digit in the number that is to be changed. Then use the Up or Down scroll key to change that number. To change another digit in the number, use the Left/Right key to move to the next digit/position to change. If a value cannot be changed, it may be a its highest or lowest limit. Pressing the Up key when the digit is at 9 will roll the value to 0, and the digit to the left will increment. Pressing the Down key when a 0 is displayed will roll that digit to 9, and the digit to the left will decrement. After all digits have been changed to the desired value, press the ENTER key to save the value. To return to the last saved value, and return to the previous menu list, press the ESC key.

To change an action or function when a **function string** is shown: Press the Scroll Up/Down key until the desired action/function is displayed. These selection menus wrap-around, so all options can be seen when pressing the up or down key. When the desired action is shown, press the ENTER key to save the displayed action or function. To revert to the last saved function and to return to the previous menu list, press the ESC key.

Configuration Menus

For descriptions on the configuration menu and how it is used refer to **Chapter 3 Configuration**.

Chapter 3.
Control Configuration

Introduction

The EGCP-3 MC 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 also available by using Watch Window software through the ServLink communications serial link. The additional configuration points enable additional features but are not required for basic operation.

Configuration with the Front Panel

To enter the configure mode, press the CONFIG key, and then press ENTER. The cursor will move to the second line. After setting the proper Security Code number, press ENTER. When a valid security code has been entered, the configuration menu list will be displayed on the right side screen. If a low-level security code is entered, the configuration menu, and all component values can be observed, but only the values authorized for the entered code can be changed. The configuration list allows the user to configure, calibrate, and adjust all common items for EGCP-3 operation. Only four menu items may be viewed at a time but the complete list is shown below for simplicity. The Up and Down Scroll keys allow one to navigate to different menu items in the list. There is no wrap-around feature in this menu. The blinking cursor will indicate which menu item is currently selected. Pressing the ENTER key will display the selected menu item components, press ENTER again to see and adjust the components value or function. See the Menu Navigation section of this manual for more information on navigating through the configuration menus.

Below is the general format of the configuration menu and how to navigate once inside:

Configuration Menu List: Cursor will blink over the first letter of the menu item listed above. Press ESC to exit configuration mode. The Security code will have to be re-entered to return to the configuration menu. Press ENTER to move to the component menu.
Component Menu: There is a ‘>’ (greater than) symbol as the first character of each item to be configured. Press ESC to return to the configure menu list, press ENTER to change the value.
Component Value: The component name and its value will be shown. The third and fourth line will display the language selected, and display CONFIGURATION MENUS to flag the value-adjust screen. If the proper security code has not been entered the value can be observed, but not changed. Press ESC to return to the component menu.

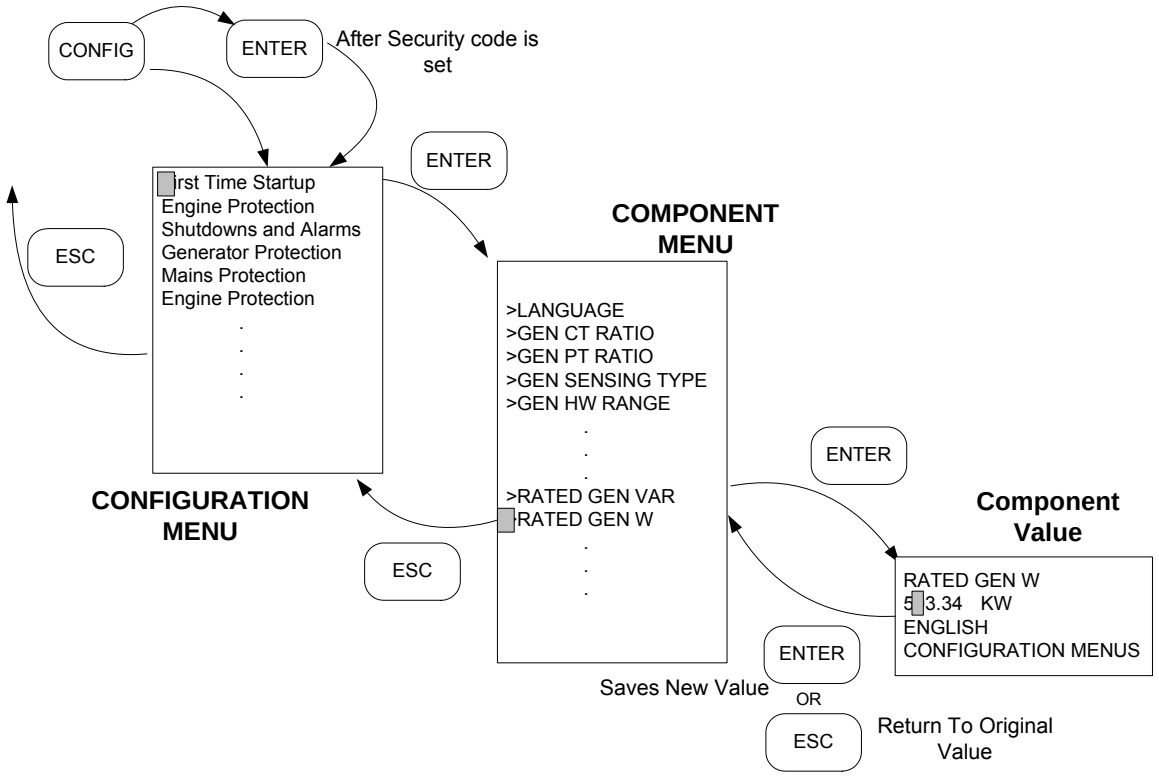


Figure 3-1. Navigation in Configure Mode

Configuration with Watch Window

If you will be performing configuration via Watch Window use the following procedure to initiate communications with the MC.

1) Connect a serial RS-232 null modem cable between COM3 of the MC and your local computer
   a. COM3 is a dedicated RS-232 ServLink communications port located on the SmartCore Board (board closest to the display)
   b. The COM port is a female serial connector
2) Turn on computer and open Woodward ServLink I/O software
3) Open a new network file by selecting NEW from the FILE menu
4) Select the proper communications port
5) Select the Mode to be Point-to-point
6) Select a Baud rate of 115200
7) Press OK

The software will begin downloading the control information from the EGCP-3 MC. This process will take several minutes. When completed the downloading screen will disappear and show an expandable control list. Save this net file for future configuration.

Once the .NET file has been saved open Watch Window. The Service and Configure sheets in Watch Window are designed to mimic the front panel display menu structure. 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.

The organization of tunable parameters is important because of the sheer number of them and due to the existence of a front panel display. The first character of most sheet names is a letter to allow control of the sheet order. Within the sheet, the parameters are numbered to control their order. This also gives a logical reference to refer to parameters, i.e. generator overvoltage trip level is set on sheet C, line 03. The numbering of the STATUSXX sheets also controls their order of placement.

Parameters are separated in Configure and Service blocks. All parameters that should not be changed while the MC is controlling LS's are placed in Configure blocks. Configure blocks require IO Lock to be set in order to allow changes in a parameter. Many of the parameters in Watch Window Configure blocks are also parameters in the First Time Startup menu on the front panel display.

Many of the Service sheets are intended to allow the user to monitor operation of the bus and mains. The sheets named STATUS01 – STATUS10 will present data that closely resembles the STATUS screens of the front panel.

There are additional configuration settings within many of the Quick Configure tabs. They are inserted in a logical order together with the front panel content. Service and Configure sheets and corresponding menu item(s) from the front panel display are listed below. Those that do not have a matching front panel menu are marked with 'XX' in the table below.

Corresponding Front Panel Menu	Configure Sheet Names	Comments / Function
First Time Startup	A# FIRST TIME CONFIG ##	System Configuration values at installation
Digital Inputs	B# DIGITAL INPUTS ##	Define Function of Configurable Discrete Inputs
Digital Outputs	C# DIGITAL OUTPUTS ##	Define Function of Configurable Relay Driver Outputs

Corresponding Front Panel Menu	Service Sheet Names	Comments / Function
System Status	01STATUS SYSTEM	Displays the System Operating Status and Values
Bus Status	02STATUS BUS	Observe the Bus Operation Values
Mains Status	03STATUS MAINS	Displays the Mains Operation Values
I/O Status	04STATUS I/O	Displays EGCP-3 Inputs and Outputs
Sync Status	05STATUS SYNCHRONIZER	Displays Synchronizer States
KW Load Status	06STATUS KW LOAD	Displays Load Control Values and Status
PF/KVAR Status	07STATUS PF / KVAR	Displays VAR/PF control Values and Status
Sequence Status	08STATUS SEQUENCE	Displays Sequencing operation States
ATS Status	09STATUS ATS	ATS function values
Alarms/Event	10STATUS ALARMS	Displays Order of Alarm Occurrence and Times
Metering Status	11STATUS METERING	Displays power-hour values
Shutdowns and	A SHUTDOWN AND ALARMS	Define Alarm Thresholds

Alarms		
Bus Protection	B BUS PROTECTION	Define Bus Trip Levels
Mains Protection	C MAINS PROTECTION	Define mains Trip Levels
Metering Control	D METER CONTROL	Setup power meter reading
Synchronizer	E SYNCHRONIZER	Define Synchronizer operating Parameters
Real Load Control	F REAL LOAD CONTROL	Set Load Control Parameters
Reactive Load Cntrl	G REACTIVE LOAD CNTRL	Set Reactive Load Control Parameters
Process Control	H PROCESS CONTROL	Define Process Control Function, Parameters
Transfer Switch	I TRANSFER SWITCH	Define ATS Mode and Timing
Peaking Control	J PEAKING	Define Peak Shaving / Demand Control
Sequencing	K SEQUENCING	Setup Auto Start/Stop Conditions
Communications	L COMMUNICATIONS	Serial Port Setup Values
Calibration	M CALIBRATION	Set Clock and Hardware Input/Output Calibration
Remote Alarm	N REMOTE ALARM INPUTS	Set Remote Discrete Alarm Functions
Analog Outputs	O ANALOG OUTPUTS	Define Function and Scaling of Analog Outputs
Analog Inputs	P ANALOG INPUTS	Define Function and Scaling of Analog Inputs
XX	Q FORCE RELAYS	Enables test and manual operation of Discrete Outputs
XX	R REMOTE CONTROL	Monitor ServLink Parameters
XX	S SEQUENCE STATES	Use to Observe the State of the EGCP-3 breaker Sequence
XX	T UNITS	Displays the Units (KW, MW) of the System
XX	U LON MESSAGING	Displays the status of LON Inputs and Outputs

XX No corresponding menu on the front panel.

Table 3-1. Front Panel Menu ↔ 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	WW	Min	Max	Default	Units
Mains Over Voltage Alarm Level	MNS VOLT HI LVL		50	30000	600	*Volts

The display name is the description used on the front panel display or in Watch Window. The names may differ because the field is limited to 20 characters on the display and 27 in Watch Window. Both interfaces use upper case for the parameter name; the parameter value (when in text form) uses upper and lower case. Numeric values may be shown as integer or real with appropriate decimals. An “WW” in the WW column indicates that the item is only available in Watch Window. “Min” and “Max” define the minimum and maximum values that may be entered. 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 bus or mains input. The appropriate units calculated by the EGCP-3 are shown on the V UNITS sheet of Watch Window, or throughout the Status screens on the display.

In Watch Window, an integer value is used to select an item in an enumerated list. Therefore, the Min and Max fields will show the valid integer value range but the Default column will show both the text and the enumeration. In Watch Window, the text related to the selected enumeration will always appear as another row directly below the parameter being configured.

Alarm Action Definition

Below is the enumerated list for configuration of alarm action. For more information on these actions refer to Chapter 9 Alarms.

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	Trip Mains Breaker	Trip Mains Breaker	Mains Breaker is opened
5	Stop All Engines	Stop All Engines	Non-critical shutdown, smooth unload, open breakers, 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, VAR, Watts
- Function selection of discrete inputs
- Function selection of analog inputs

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 until this value is corrected, and a reset/clear given.

The sanity checks are as follows:

1) Rated W must be between 70% and 100% of Rated VA
2) Rated VAR must be less than 70% of Rated VA
3) No two Analog Inputs can have the same input configuration
4) No two Digital Inputs can have the same input configuration

If there is a configuration error it can be diagnosed with Watch Window on the 01 STATUS – SYSTEM page under 13 Configuration Status and 14 Contact In Configuration Err.

MC Configuration Menu's

First Time Configure Menu

The First Time Startup Menu is included in both the front panel display and Watch Window. Items in it can be viewed but not edited unless Auto, Test and Run w/Load digital inputs are off or the control is in I/O lock.

Every item in the First Time Startup menu must ALWAYS be checked and configured upon first usage of the control.

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

Currently the only Language available is English therefore it is not suggested to change this value.

Item	Display Name	WW	Min	Max	Default	Units
Bus CT Ratio	BUS CT RATIO	Both	5.0	30000.0	1.0	Ratio

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 EGCP-3 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	WW	Min	Max	Default	Units
Bus PT Ratio	BUS PT RATIO	Both	1.0	9999.9	1.0	Ratio

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 EGCP-3 will multiply the sensed voltage at the input by this value to determine the actual voltage on the bus for the given phase. The EGCP-3 will also need to know the next two parameters to fully define the voltage.

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

This value is an enumerated list that can be either 1∅ or 3∅ with a default of 3∅. If set to 1∅, the EGCP-3 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 be a per-phase value, and not the total.

Item	Display Name	WW	Min	Max	Default	Units
Bus Hardware Range	BUS HW RANGE	Both	1	3	3=240V	

This value is an enumerated list that can be either 70, 120, or 240 Vac with a default of 240 Vac. This setting is important to the EGCP-3 for both calibration accuracy as well as ability to measure the voltage. The range limits for each selection are indicated in the table below. When the bus or mains input drops below the Dead Bus Voltage, Dead Bus operating mode to be initiated. Above this value the generator/bus is considered active.

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

Item	Display Name	WW	Min	Max	Default	Units
Mains CT Ratio	Mains CT RATIO	Both	5.0	30000.0	1.0	Ratio

This value represents a scalar for the mains 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 EGCP-3 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	WW	Min	Max	Default	Units
Mains PT Ratio	Mains PT RATIO	Both	1.0	9999.9	1.0	Ratio

This value represents a scalar for the mains 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 EGCP-3 will multiply the sensed voltage at the input by this value to determine the actual voltage on the mains for the given phase. The EGCP-3 will also need to know the next two parameters to fully define the voltage.

Item	Display Name	WW	Min	Max	Default	Units
Mains Sensing Type	MAINS SENSING TYPE	Both	False	True	True=3∅	

This value is an enumerated list that can be either 1∅ or 3∅ with a default of 3∅. If set to 1∅, the EGCP-3 will ignore any inputs on the B and C phase mains 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	WW	Min	Max	Default	Units
Mains Hardware Range	MAINS HW RANGE	Both	1	3	3=240V	NA

This value is an enumerated list that can be either 70, 120, or 240 Vac with a default of 240 Vac. This setting is important to the EGCP-3 for both calibration accuracy as well as ability to measure the voltage. The range limits for each selection are the same as those listed above for the Bus Hardware Range.

NOTICE

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	WW	Min	Max	Default	Units
Rated Bus VA	RATED BUS VA	Both	0.001	10000.0	156.0	*VA

This value is the Volt-Ampere (VA) rating for the bus. 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	WW	Min	Max	Default	Units
Rated Bus VAR	RATED BUS VAR	Both	1.0	30000.0	1000.0	*VAR

This value is the Volt-Ampere-Reactive (VAR) rating for the bus. 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	WW	Min	Max	Default	Units
Rated Bus Watts	RATED BUS W	Both	0.001	30000.0	1000.0	*Watts

This value is the Watt (W) rating for the bus. 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	WW	Min	Max	Default	Units
Rated Bus Voltage	RATED BUS VOLTAGE	Both	0.001	30000.0	220.0	*Volts

This value is the voltage of the bus where the buses 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	WW	Min	Max	Default	Units
Bus Configuration	BUS PT CONFIGURATION	Both	1	2	1=Delta(L-L)	NA

This value is an enumerated list that can be either Wye (Star, Line-to-Neutral) or Delta (Line-to-Line). If the item is set to Wye, the wiring between the bus and the EGCP-3 is configured in a L-N manner. It does NOT necessarily relate to how the bus is connected to the load. For example, the bus could be wired to the load as Wye but wired to EGCP-3 as Delta using Open Delta transformers.

Item	Display Name	WW	Min	Max	Default	Units
Mains Rated VA	RATED MAINS VA	Both	0.001	10000.0	240.0	*VA

This value is the Volt-Ampere (VA) rating of the mains tie. It should be based on the mains 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	WW	Min	Max	Default	Units
Mains Rated VAR	RATED MAINS VAR	Both	0.001	30000.0	1000.0	*VAR

This value is the Volt-Ampere-Reactive (VAR) rating of the mains tie. It should be based on the mains 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	WW	Min	Max	Default	Units
Mains Rated Watts	RATED MAINS WATTS	Both	0.001	30000.0	1000.0	*Watts

This value is the Watt (W) rating of the mains tie. It should be based on the mains 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	WW	Min	Max	Default	Units
Mains Rated Voltage	RATED MAINS VOLTAGE	Both	0.001	30000.0	220.0	*Volts

This value is the voltage of the mains bus where the mains 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	WW	Min	Max	Default	Units
Mains Configuration	MAINS PT CONFIGURATION	Both	1	2	1=Delta (L-L)	

This value is an enumerated selection that can be either Wye (Star, Line-to-Neutral) or Delta (Line-to-Line). If the item is set to Wye, the wiring between the bus and the EGCP-3 is configured in a L-N manner. It does NOT necessarily relate to the mains configuration.

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

This value is an enumerated selection that can be either 50Hz or 60Hz with a default of 60Hz. It applies to both the generator and mains inputs.

Item	Display Name	WW	Min	Max	Default	Units
System Phase Rotation	SYS PHASE ROTATION	Neither	True	True	True=CW, ABC	NA

This value is no longer adjustable. The EGCP-3 must use a CW rotation to calculate power correctly.

Item	Display Name	WW	Min	Max	Default	Units
Group Breaker Type	GROUP BREAKER TYPE	Both	1	2	1=Breaker	NA

This value is an enumerated selection that can be either Breaker or Contactor. If the item is set to breaker, the EGCP-3 operates the Group Breaker Open (Shunt Trip) and Close outputs in a manner consistent with connection to a breaker. If set to contactor, the EGCP-3 operates the Group Breaker Close output as an Open/Close output to open and close a contactor. When the contactor option is selected, the Group Shunt Trip output is not used.

Item	Display Name	WW	Min	Max	Default	Units
Mains Breaker Type	MAINS BREAKER TYPE	Both	1	2	1=Breaker	NA

This value is an enumerated selection that can be either Breaker or Contactor. If the item is set to breaker, the EGCP-3 operates the Mains Breaker Open (Shunt Trip) and Close outputs in a manner consistent with connection to a breaker. If set to contactor, the EGCP-3 operates the Mains Breaker Close output as an Open/Close output to open and close a contactor. When the contactor option is selected, the Mains Shunt Trip output is not used.

Item	Display Name	WW	Min	Max	Default	Units
ServLink Address	SERVLINK ADDRESS	Both	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	WW	Min	Max	Default	Units
Unit Number	UNIT NUMBER	Both	1	16	1	NA

This is the LON network address for his EGCP-3. It must be unique for all units communicating on the same network; two units cannot be assigned the same number. The Unit numbers in the system need not be consecutive.

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

Enter the bus segment this EGCP-3 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 MC 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	WW	Min	Max	Default	Units
Process Action	PROCESS ACTION	Both	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 the item is set FALSE, the control action is set to Indirect, an increase in process is directly proportional to a decrease in kW. For example, a co-generation unit that was being used to create steam would be a direct process. An increase in kW would give an increase in steam. An example of an indirect process would be a generator using landfill gas as fuel. As the generator increased in kW, the gas fuel pressure would decrease.

Item	Display Name	WW	Min	Max	Default	Units
Analog Input 1 Function	AN IN 1 FUNCTION	Both	1	7	1=Not Used	

This value is an enumerated list 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	Proc/ImpExp Ref	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	WW	Min	Max	Default	Units
Analog Input 2 Function	AN IN 2 FUNCTION	Both	1	7	1=Not Used	

The function of Analog Input 2 can be selected from the enumerated list detailed in the table above.

Item	Display Name	WW	Min	Max	Default	Units
Analog 3 Function	AN IN 3 FUNCTION	Both	1	7	4=Proc Ref	

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

Item	Display Name	WW	Min	Max	Default	Units
Analog 4 Function	AN IN 4 FUNCTION	Both	1	7	6=VAR Ref	

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

Digital Input Menu

The Digital Input Menu is included in both the front panel display and Watch Window. All items appear in both. In Watch Window, the Digital Input Menu is a Configure menu following the First Time Startup Menu. When using Watch Window, IO Lock must be set.

The following table lists the configurable digital inputs. All digital inputs not listed below are fixed function inputs and cannot be changed.

Item	Display Name	WW	Min	Max	Default	Units
Digital Input 1	DIGITAL INPUT 1	Both	1	24	17=reset Alarm/Fault	
Digital Input 6	DIGITAL INPUT 6	Both	1	24	2=Group breaker aux contact	
Digital Input 7	DIGITAL INPUT 7	Both	1	24	11=Remote Alarm #1	
Digital Input 8	DIGITAL INPUT 8	Both	1	24	12=Remote Alarm #2	
Digital Input 9	DIGITAL INPUT 9	Both	1	24	2=Voltage/PF/VAR Raise	
Digital Input 10	DIGITAL INPUT 10	Both	1	24	3=Voltage/PF/VAR Lower	
Digital Input 11	DIGITAL INPUT 11	Both	1	24	4=Load/Speed Raise	
Digital Input 12	DIGITAL INPUT 12	Both	1	24	5=Load/Speed Lower	
Digital Input 13	DIGITAL INPUT 13	Both	1	24	7=Load Ramp Pause	
Digital Input 14	DIGITAL INPUT 14	Both	1	24	9=Process Control Enable	
Digital Input 15	DIGITAL INPUT 15	Both	1	24	9=Meter Phase Select A	
Digital Input 16	DIGITAL INPUT 16	Both	1	24	10=Meter Phase Select B	

The configurable functions are shown in the enumerated list below. The enumerations are 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	Display	Notes
29	Demand Sequencing Enable	DMD SEQ ENABLE	Used to turn On and Off the demand sequencing function
28	Enable Bus Segment D	Bus Segment D	Puts control unit on bus D
27	Enable Bus Segment C	Bus Segment C	Puts control unit on bus C
26	Enable Bus Segment B	Bus Segment B	Puts control unit on bus B
25	Enable Bus Segment A	Bus Segment A	Puts control unit on bus A
24	Reset to Internal Load Setting	Reset Load Ref	Should be a momentary switch
23	Z Segment Breaker Aux	Z Breaker Aux Contact	Breaker Connects Bus Seg D to A
22	Y Segment Breaker Aux	Y Breaker Aux Contact	Breaker Connects Bus Seg C to D
21	X Segment Breaker Aux	X Breaker Aux Contact	Breaker Connects Bus Seg B to C
20	W Segment Breaker Aux	W Breaker Aux Contact	Breaker Connects Bus Seg A to B
19	Unload Command	Unload Command	Ramp Load to minimum
18	Enable VAR/PF Control	Enable VAR/PF Control	Reactive Load Control Enabled
17	Reset Alarm/Fault	Reset Alarm/Fault	Similar functionality to the Alarm Clear on the front panel
16	Remote Alarm Input #6	Remote Alarm #6	See also Remote Alarm Menu
15	Remote Alarm Input #5	Remote Alarm #5	See also Remote Alarm Menu
14	Remote Alarm Input#4	Remote Alarm #4	See also Remote Alarm Menu
13	Remote Alarm Input #3	Remote Alarm #3	See also Remote Alarm Menu
12	Remote Alarm Input #2	Remote Alarm #2	See also Remote Alarm Menu
11	Remote Alarm Input #1	Remote Alarm #1	See also Remote Alarm Menu
10	Meter Phase Select B	Meter Phase Select B	Must be used together with Meter Phase Select A as a multiplexed pair
9	Meter Phase Select A	Meter Phase Select A	Must be used together with Meter Phase Select B as a multiplexed pair
8	Enable Process Control	Enable Process Control	Close to enable control for Process
7	Load Ramp Pause	Load Ramp Pause	Pauses all ramping functions
6	Load / Speed Lower Command	Load / Speed Lower Command	Should always be used together with Load/Speed Raise Command as a pair
5	Load / Speed Raise Command	Load / Speed Raise Command	Should always be used together with Load/Speed Lower Command as a pair
4	Voltage/PF/VAR Lower Command	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	Voltage/PF/VAR Raise Command	Should always be used together with Voltage/PF/VAR Lower Command as a pair
2	Group Breaker Aux Contact	Group Breaker Aux Contact	Only required when MC is connected to a group.
1	Not Used	Not Used	Configures DI for no operation

The Meter Phase Select pair is a multiplexed input pair intended to be used together with analog outputs configured to indicate Power Metering values. The output of the Power Metering analog outputs will follow the Meter Select multiplexed input as indicated in the below table. There are four possible positions of the Meter Select input. A ‘0’ indicates no connection and a ‘1’ indicates the input is active.

Meter Phase Select A	Meter Phase Select B	Meter Output
1	0	Phase A
0	1	Phase B
1	1	Phase C
0	0	Average/Total

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

Selection of Digital Output functions is included in both the front panel display and Watch Window menus. Some configurable items appear only in Watch Window. Configure: “C# DIGITAL 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 EGCP-3 is in I/O Lock. Some items from this menu are also present on the front panel display in the CONFIG, Digital Outputs menu.

Output channels 3,4, and 9 are pre-configured outputs and cannot be changed. The function parameter in the Watch Window menu is an enumerated list. The enumerations are identical for all the configurable digital output functions. It is possible to configure more than one digital output for the same function, no error will result.

Item	Display Name	WW	Min	Max	Default	Units
Digital Output 1	DIGITAL OUTPUT 1	Both	1	23	2=Grp Breaker Close Command	
Digital Output 2	DIGITAL OUTPUT 2	Both	1	23	3=Grp Breaker Trip Command	
Digital Output 5	DIGITAL OUTPUT 5	Both	1	23	13=KVA Switch	
Digital Output 6	DIGITAL OUTPUT 6	Both	1	23	4=LOM	
Digital Output 7	DIGITAL OUTPUT 7	Both	1	23	5=kW-hr Pulse	
Digital Output 8	DIGITAL OUTPUT 8	Both	1	23	12=EPS Supplying Load	
Digital Output 10	DIGITAL OUTPUT 10	Both	1	23	18=Warning	
Digital Output 11	DIGITAL OUTPUT 11	Both	1	23	19=Stop All Engines Issued	
Digital Output 12	DIGITAL OUTPUT 12	Both	1	23	20=Trip Mains Breaker Issued	

Each configurable digital output can be one of the 23 functions described in the enumeration table below.

Value	Command	Display	Notes
25	Node Num Mismatch	LON Node Num Mismatch	Node numbers on LON do not match the expected node number in the sequencing menu
24	MC Loss of Power	MC Loss of Power	To configure an output for MC loss of power to the control
23	Shed highest priority load group	Load Shed Priority #3	Command to shed this load group
22	Shed medium priority load group	Load Shed Priority #2	Command to shed this load group
21	Shed Lowest Priority Load group	Load Shed Priority #1	Command to shed this load group
20	Trip Mains Breaker Shunt Trip Cmd..	Trip Mains Breaker	Open Mains Breaker command
19	Stop all engines	Stop All Engines	Active when conditions call for all engines to unload, open breakers, cooldown, shutdown
18	Warning Alarm	Warning Alarm	Active for any Warning or higher alarm. Latches closed until alarm is cleared from the alarm log.
17	Analog Pre-Alarm 4 Occurred	AI-4 Pre-Alarm	Provides discrete indication of an analog Pre-Alarm occurrence
16	Analog Pre-Alarm 3 Occurred	AI-3 Pre-Alarm	Provides discrete indication of an analog Pre-Alarm occurrence
15	Analog Pre-Alarm 2 Occurred	AI-2 Pre-Alarm	Provides discrete indication of an analog Pre-Alarm occurrence

Value	Command	Display	Notes
14	Analog Pre-Alarm 1 Occurred	AI-1 Pre-Alarm	Provides discrete indication of an analog Pre-Alarm occurrence
13	KVA Switch	KVA Switch	Indicates when generator power output exceeds a configurable level
12	EPS Supplying Load	EPS Supplying Load	Indicates when the generator(s) only providing power to the load
11	Analog Alarm 4 Occurred	AI-4 Alarm Occurred	Provides discrete indication of an analog alarm occurrence
10	Analog Alarm 3 Occurred	AI-3 Alarm Occurred	Provides discrete indication of an analog alarm occurrence
9	Analog Alarm 2 Occurred	AI-2 Alarm Occurred	Provides discrete indication of an analog alarm occurrence
8	Analog Alarm 1 Occurred	AI-1 Alarm Occurred	Provides discrete indication of an analog alarm occurrence
7	KVAR-hr pulse	KVAR - hr pulse	Pulses every 100 kVAR-hrs for 100msec duration
6	KVA-hr pulse	KVA- hr pulse	Pulses every 100 kVA-hrs for 100msec duration
5	KW-hr pulse	KW - hr pulse	Pulses every 100 kW-hrs for 100msec duration
4	Mains Failed	Loss of Mains	Used to switch external governor modes
3	Group Breaker Open Command	Group Bkr Shunt Trip	Open the breaker command
2	Group Breaker Close Command	Group Bkr Close Cmd	Close the breaker or contactor
1	Not Used	Not Used	Configures DO for no operation

The second half of the Digital Outputs menu is located in Watch Window only. It configures the action state of the relay driver.

Item	Display Name	WW	Min	Max	Default
Digital Output 1 Normal State	DIGITAL OUTPUT 1 ACTION	WW	FALSE	TRUE	FALSE=Normally Open
Digital Output 2 Normal State	DIGITAL OUTPUT 2 ACTION	WW	FALSE	TRUE	FALSE=Normally Open
Digital Output 3 Normal State	DIGITAL OUTPUT 3 ACTION	WW	FALSE	TRUE	FALSE=Normally Open
Digital Output 4 Normal State	DIGITAL OUTPUT 4 ACTION	WW	FALSE	TRUE	FALSE=Normally Open
Digital Output 5 Normal State	DIGITAL OUTPUT 5 ACTION	WW	FALSE	TRUE	FALSE=Normally Open
Digital Output 6 Normal State e	DIGITAL OUTPUT 6 ACTION	WW	FALSE	TRUE	FALSE=Normally Open
Digital Output 7 Normal State	DIGITAL OUTPUT 7 ACTION	WW	FALSE	TRUE	FALSE=Normally Open
Digital Output 8 Normal State	DIGITAL OUTPUT 8 ACTION	WW	FALSE	TRUE	FALSE=Normally Open
Digital Output 10 Normal State	DIGITAL OUTPUT 10 ACTION	WW	FALSE	TRUE	FALSE=Normally Open
Digital Output 11 Normal State	DIGITAL OUTPUT 11 ACTION	WW	FALSE	TRUE	FALSE=Normally Open
Digital Output 12 Normal State	DIGITAL OUTPUT 12 ACTION	WW	FALSE	TRUE	FALSE=Normally Open

The normal output state for discrete outputs can be Normally Open or Normally Closed. Each can be configured to close (source voltage) when active or open (float) when active. These modes mimic a Normally Open and Normally Closed relay.

MC Service Menus

Shutdowns and Alarms Menu

The Shutdowns & Alarms Menu is included in both the front panel display and Watch Window.

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

Item	Display Name	WW	Min	Max	Default	Units
Battery Voltage High Alarm	BATT VOLT HIGH ALM	Both	1	6	4=Audible	
Battery Voltage High Alarm Level	BATT VOLT HIGH LVL	Both	24.0	45.0	28.0	Vdc

This alarm will trip if the input supply voltage exceeds this level for 1.0 second. It should be set to a value higher than the normal battery charging voltage. The action is defined by Battery Voltage High Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Battery Voltage Low Alarm	BATT VOLT LOW ALM	Both	1	6	4=Audible	
Battery Voltage Low Alarm Level	BATT VOLT LOW LVL	Both	5.0	24.0	18.0	Vdc

This alarm will trip if the input supply voltage is below this level for 1.0 second. It should be set to a value lower than the nominal battery voltage. The action is defined by Battery Voltage Low Alarm.

Item	Display Name	WW	Min	Max	Default	Units
PowerSense Board Fault Alarm	POWER MODULE FAULT	WW	1	8	5=Stop All Engines	

This alarm becomes active when the processor on the PowerSense board determines that it cannot function properly. It will trip based on internal algorithms that cannot be changed.

This alarm is continuously enabled.

Item	Display Name	WW	Min	Max	Default	Units
Phase Rotation Mismatch Alarm	PHASE ROTATION MISMATCH	WW	1	6	4=Audible Alarm	
Phase Rotation Mismatch Level	PHASE ROT MM LEVEL	WW	1	100	50	%

This alarm is used to detect a difference in rotation between the bus and the mains. The EGCP-3 uses the Negative Sequence voltage reading to detect if the incoming rotation connection is backward.

Bus Protection Menu

The Bus Protection Menu is included in both the front panel display and Watch Window. Refer to the enumerated list (Table 3-2) for configuration of alarm action.

Item	Display Name	WW	Min	Max	Default	Units
Bus Over Voltage Alarm	BUS VOLT HI ALM	Both	1	6	1=Disabled	
Bus Over Voltage Alarm Level	BUS VOLT HI ALM LVL	Both	0	30000	600	*Volts

This alarm will trip when the highest phase voltage is continuously greater than the limit setting for the time delay setting. It is continuously enabled. It should be set to a value higher than the Bus Over Voltage Pre-Alarm. The action is defined by Bus Over Voltage Alarm.

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

This alarm input is also the highest phase voltage, and is continuously enabled. It should be set to a value lower than the Bus Over Voltage Alarm. The action is defined by Bus Over Voltage Pre-Alarm.

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

The Bus Under Voltage Pre-Alarm is the lowest phase voltage and is enabled if an LS unit is on the bus or if the group breaker is configured and closed. It should be set to a value lower than Rated Bus Voltage and higher than Bus Under Voltage Alarm. The action is defined by Bus Under Voltage Pre-Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Bus Under Voltage Alarm	BUS VOLT LO ALM	Both	1	6	1=Disabled	
Bus Under Voltage Alarm Level	BUS VOLT LO ALM LVL	Both	0	30000	300	*Volts

This alarm will trip when the lowest phase voltage (or AØ when 1Ø is selected) is continuously less than the limit setting for the time delay setting. This alarm is enabled if an LS unit is on the bus or if the group breaker is configured and closed.. It should be set to a value lower than the Bus Under Voltage Pre-Alarm. The action is defined by Bus Under Voltage Alarm.

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

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

Item	Display Name	WW	Min	Max	Default	Units
Bus Voltage Alarm Delay	BUS VOLT ALM DELAY	Both	0.1	120.0	10.0	Seconds

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

Item	Display Name	WW	Min	Max	Default	Units
Bus Phase Over Current Alarm	BUS CURRENT HI ALM	Both	1	6	1=Disabled	
Bus Phase Over Current Alarm Level	BUS CURRENT HI ALM LVL	Both	0	30000	1500	*Amps

This alarm is continuously enabled. It first selects the Bus phase with the highest current. It will trip when that phase current exceeds the set limit. It should be set to a value higher than the Bus Phase Over Current Pre-Alarm. The action is defined by Bus Phase Over Current Alarm.

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

This alarm is continuously enabled. It will trip when a bus phase current exceeds the set limit. It should be set to a value lower than the Bus Phase Over Current Alarm but higher than Rated Bus Current. The action is defined by Bus Phase Over Current Pre-Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Bus Phase Over Current Curve Shift	BUS CURR CURVE SHIFT	Both	0.01	10.0	1.0	

This value acts to level shift the inverse time curve, defined by IEEE and IEC. Increasing the shift value above 1.0 will increase the time delay, below 1.0 will decrease the delay. See also Chapter 9 for a detailed description of the Inverse Time Curve.

Item	Display Name	WW	Min	Max	Default	Units
Bus Over Frequency Alarm	BUS FREQ HI ALM	Both	1	6	1=Disabled	
Bus Over Frequency Alarm Level	BUS FREQ HI ALM LVL	Both	40.0	70.0	70.0	Hertz

This alarm and is enabled if an LS unit is on the bus or if the group breaker is configured and closed.. It should be set to a value higher than the Bus Over Frequency Pre-Alarm. The action is defined by Bus Over Frequency Alarm.

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

This alarm and is enabled if an LS unit is on the bus or if the group breaker is configured and closed. It should be set to a value lower than the Bus Over Frequency Alarm but higher than the System Rated Frequency. The action is defined by Bus Over Frequency Pre-Alarm.

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

This alarm and is enabled if an LS unit is on the bus or if the group breaker is configured and closed. It should be set to a value lower than System Rated Frequency and higher than Bus Under Frequency Alarm. The action is defined by Bus Under Frequency Pre-Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Bus Under Frequency Alarm	BUS FREQ LO ALM	Both	1	6	1=Disabled	
Bus Under Frequency Alarm Level	BUS FREQ LO ALM LVL	Both	40.0	70.0	40.0	Hertz

This alarm and is enabled if an LS unit is on the bus or if the group breaker is configured and closed. It should be set to a value lower than the Bus Under Frequency Pre-Alarm. The action is defined by Bus Under Frequency Alarm.

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

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

Item	Display Name	WW	Min	Max	Default	Units
Bus Frequency Alarm Delay	BUS FREQ ALM DELAY	Both	0.1	120.0	10.0	Seconds

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

Item	Display Name	WW	Min	Max	Default	Units
Bus Over Power Alarm	BUS PWR HI ALM	Both	1	6	1=Disabled	
Bus Over Power Alarm Level	BUS PWR HI LVL	Both	-30000	30000	1500	*Watts
Bus Over Power Rated	BUS RATED HI-POWER	WW	0.001	10000	10000.0	*Watts

This alarm is continuously enabled. It should be set to a value higher than the Bus Over Power Pre-Alarm. The action is defined by Bus Over Power Alarm.

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

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

Item	Display Name	WW	Min	Max	Default	Units
Bus Reverse Power Pre-Alarm	BUS REV-PWR PRE-ALM	WW	1	6	1=Disabled	
Bus Reverse Power Pre-Alarm Level	BUS REV-PWR PRE-ALM LVL	WW	-30000	30000	-10	*Watts

This alarm is continuously enabled. It should be set to a value higher than the Bus Reverse Power Alarm but lower than Rated Bus Real Power. The action is defined by Bus Reverse Power Pre-Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Bus Reverse Power Alarm	BUS REV-PWR ALM	Both	1	6	1=Disabled	
Bus Reverse Power Alarm Level	BUS REV-PWR LVL	Both	-30000	30000	-50	*Watts
Bus Reverse Power Rated	BUS RATED REV-POWER	WW	0.001	10000	10.0	*Watts

This alarm is continuously enabled. It should be set to a value lower than the Bus Reverse Power Pre-Alarm. The action is defined by Bus Reverse Power Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Bus Directional Power Curve Shift	BUS PWR CURVE SHIFT	Both	0.01	10.0	1.0	

This value acts to level shift the inverse time curve, defined by IEEE and IEC. Increasing the shift value above 1.0 will increase the time delay, below 1.0 will decrease the delay. See also Chapter 9 for a detailed description of the Inverse Time Curve.

Item	Display Name	WW	Min	Max	Default	Units
Bus Over VAR Alarm	BUS VAR HI ALM	Both	1	6	1=Disabled	
Bus Over VAR Alarm Level	BUS VAR HI LVL	Both	-30000	30000	1500	*VAR

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

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

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

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

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

Item	Display Name	WW	Min	Max	Default	Units
Bus Reverse VAR Alarm	BUS REV-VAR ALM	Both	1	6	1=Disabled	
Bus Reverse VAR Alarm Level	BUS REV-VAR LVL	Both	-30000	30000	-50	*VAR

This alarm is continuously enabled. It should be set to a value lower than the Bus Reverse VAR Pre-Alarm. The action is defined by Bus Reverse VAR Alarm.

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

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

Item	Display Name	WW	Min	Max	Default	Units
Bus Directional VAR Alarm Delay	BUS VAR ALM DELAY	Both	0.1	120.0	10.0	Seconds

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

Item	Display Name	WW	Min	Max	Default	Units
Bus Negative Phase Sequence Over Voltage Alarm	BUS NEG SEQ-V HI ALM	Both	1	6	1=Disabled	
Bus Negative Phase Sequence Over Voltage Alarm Level	BUS NEG SEQ-V HI ALM LVL	Both	0	30000	150	*Volts

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

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

This alarm is continuously enabled. It should be set to a value lower than the Bus Negative Phase Sequence Over Voltage Alarm. The action is defined by Bus Negative Phase Sequence Over Voltage Pre-Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Bus Negative Phase Sequence Over Voltage Pre-Alarm Delay	BUS NEG SEQ-V HI PALM DLY	WW	0.1	120.0	5.0	Seconds

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

Item	Display Name	WW	Min	Max	Default	Units
Bus Negative Phase Sequence Over Voltage Alarm Delay	BUS NEG SEQ-V HI ALM DLY	Both	0.1	120.0	10.0	Seconds

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

Item	Display Name	WW	Min	Max	Default	Units
Bus Negative Phase Sequence Over Current Alarm	BUS NEG SEQ-I HI ALM	Both	1	6	1=Disabled	
Bus Negative Phase Sequence Over Current Alarm Level	BUS NEG SEQ-I HI ALM LVL	Both	0	30000	150	Amps

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

Item	Display Name	WW	Min	Max	Default	Units
Bus Negative Phase Sequence Over Current Pre-Alarm	BUS NEG SEQ-I HI PRE-ALM	WW	1	6	Disabled	
Bus Negative Phase Sequence Over Current Pre-Alarm Level	BUS NEG SEQ-I HI PALM LV	WW	0	30000	100	Amps

This alarm is continuously enabled. It should be set to a value lower than the Bus Negative Phase Sequence Over Current Alarm. The action is defined by Bus Negative Phase Sequence Over Current Pre-Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Bus Negative Phase Sequence Over Current Pre-Alarm Delay	BUS NEG SEQ-I HI PALM DL	WW	0.1	120	5	Seconds

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

Item	Display Name	WW	Min	Max	Default	Units
Bus Negative Phase Sequence Over Current Alarm Delay	BUS NEG SEQ-I HI ALM DLY	Both	0.1	120	10	Seconds

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

Item	Display Name	WW	Min	Max	Default	Units
Bus Phase Current Differential Alarm	BUS DIFF CURRENT ALM	Both	1	6	5=Stop All Engines	
Bus Phase Current Differential High Alarm Level	BUS DIFF CURRENT ALM LVL	Both	0	30000	150	*Amps

This alarm is continuously enabled. It should be set to a value higher than the Bus Phase Current Differential Pre-Alarm but lower than Rated Bus Current. The action is defined by Bus Phase Current Differential Alarm.

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

This alarm is continuously enabled. It should be set to a value lower than the Bus Phase Current Differential Alarm. The action is defined by Bus Phase Current Differential Pre-Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Bus Phase Current Differential Curve Shift	BUS DIFF CURR SHIFT	Both	0.01	10.0	1.0	

This value acts to level shift the inverse time curve, defined by IEEE and IEC. Increasing the shift value above 1.0 will increase the time delay, below 1.0 will decrease the delay. See also Chapter 9 for a detailed description of the Inverse Time Curve.

Item	Display Name	WW	Min	Max	Default	Units
Bus Voltage Restrained Phase Over Current Alarm	BUS RES CURR HI ALM	Both	1	6	1=Disabled	
Bus Voltage Restrained Phase Over Current Alarm Level	BUS RES CURR HI ALM LVL	Both	0	30000	1500	*Amps

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

Item	Display Name	WW	Min	Max	Default	Units
Bus Voltage Restrained Phase Over Current Pre-Alarm	BUS RES CURR HI PRE-ALM	WW	1	6	1=Disabled	
Bus Voltage Restrained Phase Over Current Pre-Alarm Level	BUS RES CURR HI PALM LVL	WW	0	30000	1000	*Amps

This alarm is continuously enabled. It should be set to a value lower than the Bus Voltage Restrained Phase Over Current Alarm but higher than Rated Bus Current. The action is defined by Bus Voltage Restrained Phase Over Current Pre-Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Bus Voltage Restrained Phase Over Current Curve Shift	BUS RES CURVE SHIFT	Both	0.01	10	1.0	

This value acts to level shift the inverse time curve, defined by IEEE and IEC. Increasing the shift value above 1.0 will increase the time delay, below 1.0 will decrease the delay. See also Chapter 9 for a detailed description of the Inverse Time Curve.

Item	Display Name	WW	Min	Max	Default	Units
Group Breaker Aux Feedback-Alarm	GRP FEEDBACK ERROR ALM	WW	1	6	1=Disabled	

Set the alarm action for an error of the EGCP-3 Bus breaker output not matching the auxiliary contact input.

Item	Display Name	WW	Min	Max	Default	Units
Group Breaker Opening Alarm	GRP SHUNT TRIP ERROR	WW	1	6	5=Stop All Engines	

Set the alarm action for an error of the EGCP-3 Bus breaker shunt trip output not matching the auxiliary contact input.

Mains Protection Menu

The Mains Protection Menu is included in both the front panel display and 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. Refer to Table 3-2 for the enumerated list for alarm action.

Item	Display Name	WW	Min	Max	Default	Units
Mains Over Voltage Alarm	MNS VOLT HI ALM	Both	1	8	8=LOM w/ ALARMS	
Mains Over Voltage Alarm Level	MNS VOLT HI LVL	Both	0	30000	600	*Volts

This alarm will trip when the highest phase voltage is continuously greater than the limit setting for the time delay setting. It is continuously enabled. It should be set to a value higher than the Mains Over Voltage Pre-Alarm. The action is defined by Mains Over Voltage Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Mains Over Voltage Pre-Alarm	MNS VOLT HI PRE-ALM	WW	1	8	1=Disabled	
Mains Over Voltage Pre-Alarm Level	MNS VOLT HI PRE-ALM LVL	WW	0	30000	550	*Volts

This alarm input is also the highest phase voltage, and is continuously enabled. It should be set to a value lower than the Mains Over Voltage Alarm. The action is defined by Mains Over Voltage Pre-Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Mains Under Voltage Pre-Alarm	MNS VOLT LO PRE-ALM	WW	1	8	1=Disabled	
Mains Under Voltage Pre-Alarm Level	MNS VOLT LO PRE-ALM LVL	WW	0	30000	400	*Volts

This alarm is only enabled when the Mains breaker is closed. It should be set to a value lower than Rated Mains Voltage and higher than Mains Under Voltage Alarm. The action is defined by Mains Under Voltage Pre-Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Mains Under Voltage Alarm	MNS VOLT LO ALM	Both	1	8	8=LOM w/ ALARMS	
Mains Under Voltage Alarm Level	MNS VOLT LO LVL	Both	0	30000	300	*Volts

This alarm will trip when the lowest phase voltage (or AØ when 1Ø is selected) is continuously less than the limit setting for the time delay setting. It is only enabled when the Mains breaker is closed. It should be set to a value lower than the Mains Under Voltage Pre-Alarm. The action is defined by Mains Under Voltage Alarm.

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

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

Item	Display Name	WW	Min	Max	Default	Units
Mains Voltage Alarm Delay	MNS VOLT ALM DELAY	Both	0.1	120.0	10.0	Seconds

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

Item	Display Name	WW	Min	Max	Default	Units
Mains Phase Over Current Alarm	MNS CURRENT HI ALM	Both	1	8	2=Warning	
Mains Phase Over Current Alarm Level	MNS CURRENT HI LVL	Both	0	30000	1500	*Amps

This alarm is continuously enabled. It first selects the Mains phase with the highest current. It will trip when that phase current exceeds the set limit. It should be set to a value higher than the Mains Phase Over Current Pre-Alarm. The action is defined by Mains Phase Over Current Alarm.

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

This alarm is continuously enabled. It will trip when a Mains phase current exceeds the set limit. It should be set to a value lower than the Mains Phase Over Current Alarm but higher than Rated Mains Current. The action is defined by Mains Phase Over Current Pre-Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Mains Phase Over Current Curve Shift	MNS CURR CURVE SHIFT	Both	0.01	10.0	1.0	

This value acts to level shift the inverse time curve, defined by IEEE and IEC. Increasing the shift value above 1.0 will increase the time delay, below 1.0 will decrease the delay. See also Chapter 9 for a detailed description of the Inverse Time Curve.

Item	Display Name	WW	Min	Max	Default	Units
Mains Over Frequency Alarm	MNS FREQ HI ALM	Both	1	8	8=LOM w/ ALARMS	
Mains Over Frequency Alarm Level	MNS FREQ HI LVL	Both	40.0	70.0	70.0	Hertz

This alarm is continuously enabled. It should be set to a value higher than the Mains Over Frequency Pre-Alarm. The action is defined by Mains Over Frequency Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Mains Over Frequency Pre-Alarm	MNS FREQ HI PRE-ALM	WW	1	8	1=Disabled	
Mains Over Frequency Pre-Alarm Level	MNS FREQ HI PRE-ALM LVL	WW	40.0	70.0	65.0	Hertz

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

Item	Display Name	WW	Min	Max	Default	Units
Mains Under Frequency Pre-Alarm	MNS FREQ LO PRE-ALM	WW	1	8	1=Disabled	
Mains Under Frequency Pre-Alarm Level	MNS FREQ LO PRE-ALM LVL	WW	40.0	70.0	45.0	Hertz

This alarm is only enabled only when the Mains breaker is closed. It should be set to a value lower than System Rated Frequency and higher than Mains Under Frequency Alarm. The action is defined by Mains Under Frequency Pre-Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Mains Under Frequency Alarm	MNS FREQ LO ALM	Both	1	8	8=LOM w/ ALARMS	
Mains Under Frequency Alarm Level	MNS FREQ LO LVL	Both	40.0	70.0	40.0	Hertz

This alarm is only enabled when the Mains breaker is closed. It should be set to a value lower than the Mains Under Frequency Pre-Alarm. The action is defined by Mains Under Frequency Alarm.

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

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

Item	Display Name	WW	Min	Max	Default	Units
Mains Frequency Alarm Delay	MNS FREQ ALM DELAY	Both	0.1	120.0	10.0	Seconds

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

Item	Display Name	WW	Min	Max	Default	Units
Mains Export Power Alarm	MNS EXP-PWR HI ALM	Both	1	6	6=Trip Mains Bkr	
Mains Export Power Alarm Level	MNS EXP-PWR HI ALM LVL	Both	-30000	30000	1500	*Watts
Mains Export Rated Power	MNS EXP RATED POWER	WW	0.001	10000	10.0	*Watts

This alarm is continuously enabled. It should be set to a value indicating the Mains export level is above an alarm condition. . The action is defined by Mains Export Power Alarm. Negative numbers indicate Importing power and Positive numbers indicate exporting power.

Item	Display Name	WW	Min	Max	Default	Units
Mains Export Power Pre-Alarm	MNS EXP-PWR HI PRE-ALM	WW	1	6	1=Disabled	
Mains Export Power Pre-Alarm Level	BS EX-PW PRE-ALM LVL	WW	-30000	30000	1000	*Watts

This alarm is continuously enabled. It should be set to a value indicating the Mains export level is above a warning (pre-alarm) condition. The action is defined by Mains Export Power Pre-Alarm. Negative numbers indicate Importing power and Positive numbers indicate exporting power.

Item	Display Name	WW	Min	Max	Default	Units
Mains Import Power Pre-Alarm	MNS IMP-PWR PRE-ALM	WW	1	6	1=Disabled	
Mains Import Power Pre-Alarm Level	MNS IMP-PWR PRE-ALM LVL	WW	-30000	30000	-10	*Watts

This alarm is continuously enabled. It should be set to a value indicating the Mains import level is greater (more negative) than an alarm condition. The action is defined by Mains Import Power Pre-Alarm. Negative numbers indicate Importing power and Positive numbers indicate exporting power.

Item	Display Name	WW	Min	Max	Default	Units
Mains Import Power Alarm	MNS IMP-PWR ALM	Both	1	6	2=Warning	
Mains Import Power Alarm Level	MNS IMP-PWR ALM LVL	Both	-30000	30000	-100	*Watts
Mains Import Rated Power	MNS IMP RATED POWER	WW	0.001	10000	10000.0	*Watts

This alarm is continuously enabled. It should be set to a value indicating the Mains import level is greater than a warning (pre-alarm) condition. The action is defined by Mains Import Power Alarm. Negative numbers indicate Importing power and Positive numbers indicate exporting power.

Item	Display Name	WW	Min	Max	Default	Units
Mains Directional Power Curve Shift	MNS PWR CURVE SHIFT	Both	0.01	10.0	1.0	

This value acts to level shift the inverse time curve, defined by IEEE and IEC. Increasing the shift value above 1.0 will increase the time delay, below 1.0 will decrease the delay. See also Chapter 9 for a detailed description of the Inverse Time Curve.

Item	Display Name	WW	Min	Max	Default	Units
Mains Export VAR Alarm	MNS EXP-VAR HI ALM	Both	1	6	6=Trip Mains Breaker	
Mains Export VAR Alarm Level	MNS EXP-VAR HI ALM LVL	Both	-30000	30000	1500	*VAR

This alarm is continuously enabled. It should be set to a value indicating the Mains export VAR level is greater than an alarm condition. The action is defined by Mains Export VAR Alarm. Negative numbers indicate a leading or capacitive power factor and Positive numbers indicate a lagging or inductive power factor.

Item	Display Name	WW	Min	Max	Default	Units
Mains Export VAR Pre-Alarm	MNS EXP-VAR HI PRE-ALM	WW	1	6	1=Disabled	
Mains Export VAR Pre-Alarm Level	MNS EXP-VAR HI PRE-ALM LVL	WW	-30000	30000	1000	*VAR

This alarm is continuously enabled. It should be set to a value indicating the Mains export VAR level is greater than a warning (pre-alarm) condition. The action is defined by Mains Export VAR Pre-Alarm. Negative numbers indicate a leading or capacitive power factor and Positive numbers indicate a lagging or inductive power factor.

Item	Display Name	WW	Min	Max	Default	Units
Mains Import VAR Pre-Alarm	MNS IMP-VAR PRE-ALM	WW	1	6	1=Disabled	
Mains Import VAR Pre-Alarm Level	MNS IMP-VAR PRE-ALM LVL	WW	-30000	30000	-10	*VAR

This alarm is continuously enabled. It should be set to a value indicating the Mains import VAR level is greater than a warning (pre-alarm) condition. The action is defined by Mains Import VAR Pre-Alarm. Negative numbers indicate a leading or capacitive power factor and Positive numbers indicate a lagging or inductive power factor.

Item	Display Name	WW	Min	Max	Default	Units
Mains Import VAR Alarm	MNS IMP-VAR ALM	Both	1	6	6=Trip Mains Breaker	
Mains Import VAR Alarm Level	MNS IMP-VAR ALM LVL	Both	-30000	30000	-150	*VAR

This alarm is continuously enabled. It should be set to a value indicating the Mains import VAR level is greater (more negative) than an alarm condition. The action is defined by Mains Import VAR Alarm. Negative numbers indicate a leading or capacitive power factor and Positive numbers indicate a lagging or inductive power factor.

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

This value determines the amount of time that the Mains VAR must be above the Mains Export VAR Pre-Alarm Level before declaring an alarm. This value also determines the amount of time that the Mains VAR must be below the Mains Import VAR Pre-Alarm Level before declaring an alarm.

Item	Display Name	WW	Min	Max	Default	Units
Mains Directional VAR Alarm Delay	MNS VAR ALM DELAY	Both	0.1	120.0	10.0	Seconds

This value determines the amount of time that the Mains VAR must be above the Mains Export VAR Alarm Level before declaring an alarm. This value also determines the amount of time that the Mains VAR must be below the Mains Import VAR Alarm Level before declaring an alarm.

Item	Display Name	WW	Min	Max	Default	Units
Mains Negative Phase Sequence Over Voltage Alarm	MNS NEG SQ V HI ALM	Both	1	8	1=Disabled	
Mains Negative Phase Sequence Over Voltage Alarm Level	MNS NEG SQ V HI LVL	Both	0	30000	150	*Volts

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

Item	Display Name	WW	Min	Max	Default	Units
Mains Negative Phase Sequence Over Voltage Pre-Alarm	MNS NEG SEQ-V HI PRE-ALM	WW	1	8	1=Disabled	
Mains Negative Phase Sequence Over Voltage Pre-Alarm Level	MNS NEG SEQ V HI PALM LV	WW	0	30000	100	*Volts

This alarm is continuously enabled. It should be set to a value lower than the Mains Negative Phase Sequence Over Voltage Alarm. The action is defined by Mains Negative Phase Sequence Over Voltage Pre-Alarm.

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

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

Item	Display Name	WW	Min	Max	Default	Units
Mains Negative Phase Sequence Over Voltage Alarm Delay	MNS NEG SEQ V HI ALM DLY	Both	0.1	120.0	10.0	Seconds

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

Item	Display Name	WW	Min	Max	Default	Units
Mains Negative Phase Sequence Over Current Alarm	MNS NEG SEQ I HI ALM	Both	1	8	1=Disabled	
Mains Negative Phase Sequence Over Current Alarm Level	MNS NEG SEQ I HI LVL	Both	0	30000	150	*Amps

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

Item	Display Name	WW	Min	Max	Default	Units
Mains Negative Phase Sequence Over Current Pre-Alarm	MNS NEG SEQ-I HI PRE-ALM	WW	1	8	1=Disabled	
Mains Negative Phase Sequence Over Current Pre-Alarm Level	MNS NEG SEQ-I HI PALM LV	WW	0	30000	100	*Amps

This alarm is continuously enabled. It should be set to a value lower than the Mains Negative Phase Sequence Over Current Alarm. The action is defined by Mains Negative Phase Sequence Over Current Pre-Alarm.

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

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

Item	Display Name	WW	Min	Max	Default	Units
Mains Negative Phase Sequence Over Current Alarm Delay	MNS NEG SEQ-I HI ALM DLY	Both	0.1	120.0	10.0	Seconds

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

Item	Display Name	WW	Min	Max	Default	Units
Mains Phase Current Differential Alarm	MNS DIFF CURRENT ALM	Both	1	8	2=Warning	
Mains Phase Current Differential Alarm Level	MNS DIFF CURRENT LVL	Both	0	30000	150	*Amps

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

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

This alarm is continuously enabled in 3Ø installations. It should be set to a value lower than the Mains Phase Current Differential Alarm. The action is defined by Mains Phase Current Differential Pre-Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Mains Phase Current Differential Curve Shift	MNS DIFF CURR SHIFT	Both	0.01	10.0	1.0	

This value acts to level shift the inverse time curve, defined by IEEE and IEC. Increasing the shift value above 1.0 will increase the time delay, below 1.0 will decrease the delay. See also Chapter 9 for a detailed description of the Inverse Time Curve.

Item	Display Name	WW	Min	Max	Default	Units
Mains Voltage Restrained Phase Over Current Alarm	MNS RES CURR HI ALM	Both	1	8	2=Warning	
Mains Voltage Restrained Phase Over Current Alarm Level	MNS RES CURR HI ALM LVL	Both	0	30000	1500	*Amps

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

Item	Display Name	WW	Min	Max	Default	Units
Mains Voltage Restrained Phase Over Current Pre-Alarm	MNS RES CURR HI PRE-ALM	WW	1	6	1=Disabled	
Mains Voltage Restrained Phase Over Current Pre-Alarm Level	MNS RES CURR HI PALM LVL	WW	0	30000	1000	*Amps

This alarm is continuously enabled. It should be set to a value lower than the Mains Voltage Restrained Phase Over Current Alarm but higher than Rated Mains Current. The action is defined by Mains Voltage Restrained Phase Over Current Pre-Alarm.

Item	Display Name	WW	Min	Max	Default	Units
Mains Voltage Restrained Phase Over Current Curve Shift	MNS RES CURVE SHIFT	Both	0.01	10	1.0	

This value acts to level shift the inverse time curve, defined by IEEE and IEC. Increasing the shift value above 1.0 will increase the time delay, below 1.0 will decrease the delay. See also Chapter 9 for a detailed description of the Inverse Time Curve.

Item	Display Name	WW	Min	Max	Default	Units
Mains Breaker Aux Feedback-Alarm	MNS FEEDBACK ERROR ALM	WW	1	6	4=Audible	

Set the alarm action for an error of the EGCP-3 Mains breaker output not matching the auxiliary contact input.

Item	Display Name	WW	Min	Max	Default	Units
Mains Breaker Opening Alarm	MNS SHUNT TRIP ERROR	WW	1	6	4=Audible	

Set the alarm action for an error of the EGCP-3 Mains breaker shunt trip output not matching the auxiliary contact input.

Meter Control Menu

The Meter Control Menu is included in both the front panel display and Watch Window. Items in this menu are part of a Service block
All items in the menu have the same function: To force the accumulated power-hour meter of the function to 0.0 Hours. Set the parameter TRUE and then return it to FALSE.

Item	Display Name	WW	Min	Max	Default
Clear accumulated Export VA-Hours	RESET MAINS EXPORT VA-HRS	Both	FALSE	TRUE	FALSE
Clear accumulated Export VAR-Hours	RESET MAINS EXPORT VAR-HRS	Both	FALSE	TRUE	FALSE
Clear accumulated Export W-Hours	RESET MAINS EXPORT W-HRS	Both	FALSE	TRUE	FALSE
Clear accumulated Import VA-Hours	RESET MAINS IMPORT VA-HRS	Both	FALSE	TRUE	FALSE
Clear accumulated Import VAR-Hours	RESET MAINS IMPORT VAR-HRS	Both	FALSE	TRUE	FALSE
Clear accumulated Import W-Hours	RESET MAINS IMPORT W-HRS	Both	FALSE	TRUE	FALSE

Synchronizer Menu

The Synchronizer Menu is included in both the front panel display and Watch Window. Items in this menu are part of a Service block. A detailed description of the synchronizer operation and configuration options is in Chapter 10. Refer to Table 3-2 for the enumerated list for configuration of alarm action.

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

This value is an enumerated list 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 EGCP-3 performs no synchronization functions. All breaker closures must be performed manually.
Check mode is used to confirm that the synchronizer works properly by allowing synchronizing to be performed without closing the breaker. The Synchronizer status screen can be used to observe the Slip, Phase, and voltage indication, (Displays ++ when matched).
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	WW	Min	Max	Default	Units
Synchronizer Gain	SYNC GAIN	Both	0.001	20.00	0.10	

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	WW	Min	Max	Default	Units
Synchronizer Integral Gain	SYNC INTEGRAL	Both	0.05	100.00	1.0	

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	WW	Min	Max	Default	Units
Voltage Matching	VOLTAGE MATCHING	Both	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 Mains voltages.

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

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

Item	Display Name	WW	Min	Max	Default	Units
Type of Synchronizer Action	SYNC TYPE	Both	1	2	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 Mains 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 Mains, the breaker close command will be given when phase error is within the phase window.

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

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

Item	Display Name	WW	Min	Max	Default	Units
Slip Window	SLIP WINDOW	Both	-0.30	0.30	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	WW	Min	Max	Default	Units
Slip Frequency Reference	SLIP FREQUENCY	Both	-0.30	0.30	0.1	Hertz

This value specifies the slip frequency reference. 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	WW	Min	Max	Default	Units
Close Attempts	CLOSE ATTEMPTS	Both	1	20	3	

This value is the number of attempts the synchronizer will make to close the circuit breaker. The synch reclose 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	WW	Min	Max	Default	Units
Reclose Delay	RECLOSE DELAY	Both	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 EGCP-3 will remain in the selected operating mode (run, check, or permissive) during the Reclose Delay interval.

Item	Display Name	WW	Min	Max	Default	Units
Mains Reclose Alarm	RECLOSE MAINS ALARM	Both	1	8	8=LOM w/ Alarms	
Bus Reclose Alarm	RECLOSE BUS ALARM	Both	1	5	2=Warning	

This value is an enumerated list that defines the action taken when the synchronizer has exhausted its reclose attempts without successfully closing the associated breaker.

Item	Display Name	WW	Min	Max	Default	Units
Synchronizer Timeout	SYNC TIMEOUT	Both	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 Mains 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	WW	Min	Max	Default	Units
Synchronizer Timeout Alarm for Mains Breaker	MNS BKR TIMEOUT ALM	Both	1	8	8=LOM w/ Alarms	
Synchronizer Timeout Alarm for Group Breaker	GRP BKR TIMEOUT ALM	Both	1	5	2=Warning	

This value is an enumerated list that defines the action taken when the synchronizer has exhausted the timeout without successfully closing the indicated breaker.

Item	Display Name	WW	Min	Max	Default	Units
Dead Bus Closure	DEADBUS CLOSURE	Both	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 occurs when the input voltage is less than the value given in the hardware voltage range description.

Item	Display Name	WW	Min	Max	Default	Units
Breaker Hold Time	BREAKER HOLD TIME	Both	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 Mains is out of the phase window, the Mains exceeds the slip window, or the Mains voltage exceeds the voltage window (if voltage matching is enabled).

Item	Display Name	WW	Min	Max	Default	Units
Group Breaker Close Delay Time	GRP BKR CLOSE DELAY TIME	Both	0.01	2.0	0.10	Seconds
Mains Breaker Close Delay Time	MNS BKR CLOSE DELAY TIME	Both	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 EGCP-3 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	WW	Min	Max	Default	Units
Synchronizer Gain Factor	SYNC GAIN FACTOR	Both	0.8	1.0	1.0	
Synchronizer Integral Gain Factor	SYNC INT GAIN FACTOR	Both	0.8	1.0	1.0	

These values specify the change in proportional gain and integral gain when synchronizing a multi-genset bus to the mains. The gain factors are incorporated into the gain with the following equation:

$$SyncGain(new) = SyncGain(Config) * GainFactor^{(NumberOfLoadShareUnits)}$$

The gain factor will increase stability if multiple units are attempting to synchronize at the same time. The sync gain factor is disabled if set to 1.0.

Item	Display Name	WW	Min	Max	Default	Units
Enable Sync Test	ENABLE SYNC TEST	Both	False	True	False=Disabled	

This configurable enables the synchronizer block but disables breaker closure. Typically used to measure phase and voltage differences across the breakers to check that phases are correct.

Real Load Control Menu

The Real Load Control Menu is included in both the front panel display and Watch Window. Items in this menu are part of a Service block. Refer to Table 3-2 for the enumerated list for configuration of alarm action.

Item	Display Name	WW	Min	Max	Default	Units
BaseLoad Reference	BASELOAD REFERENCE	Both	0	100	50	Percent (%)

This value is the internal default BaseLoad set point. This setting must be greater than the Unload Trip set point. It is the Load command when in the BaseLoad mode when in parallel with gensets on the bus.

The Watch Window menu has a monitor value of Generator load feedback, system load divided by the online capacity.

Item	Display Name	WW	Min	Max	Default	Units
Unload Trip Level	UNLOAD TRIP LEVEL	Both	0	100	10	Percent (%)

This value is the Load Command sent over the LON when the Unload Switch is engaged.

Item	Display Name	WW	Min	Max	Default	Units
Load Time	LOAD TIME	Both	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. It is only used when first entering the internal or remote load control mode. The Load Rate is used for changes after reaching the reference value. Ramp time in the increase load direction when switching from remote BaseLoad or process control is proportional to the load time set point.

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

This value is the time required to automatically ramp the load from the internal BaseLoad set point to zero load. It is only used when first entering the internal or remote load control mode. The Unload Rate is used for changes after reaching the reference value. Ramp time in the decrease load direction between isochronous load sharing, remote BaseLoad, and process control, or other load than that specified by the BaseLoad set point, is proportional to the unload time set point.

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

This value is the rate at which the load is increased when the raise load command input is activated. This is also the maximum rate at which load is increased when the 4–20 mA remote load setting input is changed in the increase load direction.

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

This value is the rate at which the load is decreased when the lower load command input is activated. This is also the maximum rate at which load is decreased when the 4–20 mA remote load setting input is changed in the decrease load direction.

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

The configurable defines the alarm action taken when the bus load exceeds the configured High Load Level.

Item	Display Name	WW	Min	Max	Default	Units
High Load Alarm Level	HIGH LOAD LEVEL	Both	-30000	30000	300	*VA

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

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

The configurable defines the alarm action taken when the bus load drops below the configured Low Load Level.

Item	Display Name	WW	Min	Max	Default	Units
Low Load Alarm Level	LOW LOAD LEVEL	Both	-30000	30000	5	*VA

This value is the lowest load that should be carried by the bus. It may be lower than the configured Unload Trip.

Item	Display Name	WW	Min	Max	Default	Units
KVA Switch High Level	KVA SWITCH HIGH LVL	Both	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	WW	Min	Max	Default	Units
KVA Switch Low Level	KVA SWITCH LOW LVL	Both	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	WW	Min	Max	Default	Units
VA Switch Alarm Action	KVA SWITCH ALM	Both	1	8	1=Disabled	

This value defines the action taken when the MC has activated the KVA switch. **NOTE:** 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	WW	Min	Max	Default	Units
VA Switch Direction	KVA SWITCH IMP/EXP	WW	True	False	False	

This value defines the direction of power flow for the MC KVA switch. A True value will enable the KVA Switch for Export action, false will enable Import action.

Reactive Load Control Menu

The Reactive Load Control Menu is included in both the front panel display and Watch Window. Items in this menu are part of a Service block. Refer to Table 3-2 for the configuration list of alarm action.

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

This value is a list 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 at the mains breaker. Setting the MC to manual and the LS units to PF Control, for example, will have the units control the power factor locally at their generator breakers and not at the mains. Remote control is used if external equipment will control the VAR or PF through the EGCP-3. 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	WW	Min	Max	Default	Units
VAR/PF Control Auto/Manual Enable	VAR/PF AUTO ENABLE	WW	False	True	False= Contact Enable	

This value enables the VAR/PF action automatically without using any digital inputs. True enables VAR/PF control, false disables the control. If value set to false the VAR/PF control can be still turned on by using a digital input.

Item	Display Name	WW	Min	Max	Default	Units
VAR/PF Off Level	VAR/PF OFF LEVEL	WW	-0.5	0.5	0.0	

This is the PF_CMD that is sent over the LON to the LS units when the MC is not VAR/PF Enabled. It is used to perform a “Baseload PF” of the LS units. All LS units will then run at the PF_CMD.

Item	Display Name	WW	Min	Max	Default	Units
VAR/PF Gain	VAR/PF GAIN	Both	0.01	20.00	3.00	

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	WW	Min	Max	Default	Units
Voltage Ramp Time	VOLTAGE RAMP TIME	Both	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	WW	Min	Max	Default	Units
VAR/PF Integral Gain	VAR/PF INTEGRAL GN	Both	0.00	20.00	0.30	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	WW	Min	Max	Default	Units
KVAR Reference	KVAR REFERENCE	Both	-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	WW	Min	Max	Default	Units
PF Reference	PF REFERENCE	Both	-1.0	1.0	0.0	PF

This value is the PF command sent over LON when in the PF control mode. This value is continuous over the tunable range (lead = negative) of –0.50 <-> 0.0 <-> +0.50. Where values on a Power Factor meter are discontinuous at unity (0.5 LEAD <-> 1.0 .<-> 0.5 LAG). 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	WW	Min	Max	Default	Units
PF Deadband	PF DEADBAND	Both	0.000	1.000	0.025	PF

This value specifies an error window about the measured PF input, inside of which the power factor control will not adjust the PF command. This value is not used for Import/Export Control.

Process Control Menu

The Process Control Menu is included in both the front panel display and Watch Window. Items in this menu are part of a Service block. Refer to Table 3-2 for the configuration list of alarm action.

Item	Display Name	WW	Min	Max	Default	Units
Process Control Mode	PROCESS MODE	Both	False	True	False= Import/Export	

This variable determines the source of the process control input. FALSE = Import/Export control, and the process source is the Mains Power sensing input. TRUE = Temperature/Pressure and the process source is an assigned analog input (ANIN 1-4) from a transducer measuring the parameter to be controlled.

Item	Display Name	WW	Min	Max	Default
Process Proportional Gain	PROCESS GAIN	Both	0.001	20.00	0.50

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	WW	Min	Max	Default	Units
Process Integral	PROCESS INTEGRAL	Both	0.00	20.00	0.10	Repeats/sec

This value is the integral 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. It prevents slow hunting and controls damping (overshoot or undershoot) after a disturbance. Lower the value to slow the response.

Item	Display Name	WW	Min	Max	Default
Process Derivative	PROCESS DERIVATIVE	Both	0.01	100.0	0.20

This value is the derivative gain of the process P-I-D controller. It determines the response rate of the process control for a large load error. Lower the value to slow the response.

Item	Display Name	WW	Min	Max	Default
Process Deadband	PROCESS DEADBAND	Both	-30000	30000	0

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	WW	Min	Max	Default	Units
Process Droop	PROCESS DROOP	Both	0	50	0	%

This value is the load droop (% change in process control point with load) desired based on process level. It is typically only used on a very slow moving process.

Item	Display Name	WW	Min	Max	Default	Units
Process Filter	PROCESS FILTER	Both	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	WW	Min	Max	Default
Process Control Setpoint	PROCESS REFERENCE	Both	-30000	30000	0

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

Item	Display Name	WW	Min	Max	Default	Units
High Process Level Alarm	PROC HI LVL ALM	Both	1	6	1=Disable	

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

Item	Display Name	WW	Min	Max	Default	Units
Process High Level	PROCESS HIGH LEVEL	Both	-30000	30000	10	User units

This value is the highest process that should be carried by the MC. The units are the same as configured for the assigned analog input calibration. If the monitored process exceeds this level, a High Process Limit Alarm will be issued (if configured).

Item	Display Name	WW	Min	Max	Default
Low Process Level Alarm	PROC LOW LVL ALM	Both	1	6	1=Disable

This value defines the action taken when the process drops below the configured Low Process Level.

Item	Display Name	WW	Min	Max	Default	Units
Process Low Level	PROCESS LOW LEVEL	Both	-30000	30000	-10	User units

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

Item	Display Name	WW	Min	Max	Default	Units
Import/Export Real Power Level	IMPEXP KW LVL	Both	-30000	30000	0	*Watt

This value is the reference used by Import/Export process control.

Item	Display Name	WW	Min	Max	Default	Units
Import /Export Pwr Factor Level	IMPEXP PF LVL	Both	-1.0	1.0	0.0	

This value is the Power Factor Reference when VAR/PF control mode is selected for PF control. When in Import/Export control, the MC will control the mains power factor to this value.

Item	Display Name	WW	Min	Max	Default	Units
Import/Export Reactive Power Level	IMPEXP VAR LVL	Both	-30000	30000	0	*VAR

This value is the VAR Reference when VAR/PF control mode is selected for VAR control. When in Import/Export control, the MC will control the mains VAR to this value.

Item	Display Name	WW	Min	Max	Default	Units
Process Command High Limit	PROC COMMAND HI LIMIT	WW	0	100	100	%
Process Command Low Limit	PROC COMMAND LO LIMIT	WW	0	100	100	%

These variables are used to limit the command output of the MC control to the LS. The MC control will send a load command signal over the LON network to the LS controls. This signal is in percentage and normally from 0 to 100. These high and low limits allows the user to set different operating limits for the LS controls. Note the Low Limit should never be set higher than the High Limit.

Item	Display Name	WW	Min	Max	Default	Units
Use the Analog input Process signal for Demand Sequencing	USE PROC IN FOR DMND SEQ	WW	False	True	False= Use PT /CT connections	

This variable selects whether the user wants to use the demand variable calculated by the PT and CT connections of the EGCP-3 or the demand variable that is being provided by an external transducer through a 4–20 mA input to the control.

Transfer Switch Menu

The Transfer Switch Menu is included in both the front panel display and Watch Window. Items in this menu are part of a Service block. Refer to Table 3-2 for the configuration list of alarm action.

Item	Display Name	WW	Min	Max	Default	Units
ATS Mode	ATS MODE	Both	1	3	3=Closed Trans	

This value is used to select the control mode. It may be **Off**, **Open Transition**, or **Closed Transition**. Open Transition implies the mains breaker and any LS units will never be closed simultaneously. Closed Transition implies that the local bus will never be dead unless a loss of mains occurs without any LS units running.

Item	Display Name	WW	Min	Max	Default	Units
Fast Transfer Delay	FAST XFER DELAY	Both	0.1	300.0	0.1	Seconds

This value is the amount of time to be in parallel with the mains on a closed transition transfer. It is also used as a delay time in open transition transfers to allow the local bus to completely decay before closing the group breaker. When this configurable is set to a value less than 1 second, the load controller will try to pick up the load in one step rather than in a soft ramp.

Item	Display Name	WW	Min	Max	Default	Units
Mains Stable Delay	MAINS STABLE DLY	Both	1.0	30000	15.0	Seconds

This value is the amount of time to wait upon return of the mains before transferring the load from the LS units back to the mains.

Item	Display Name	WW	Min	Max	Default	Units
Bus Stable Delay	BUS STABLE DELAY	Both	1.0	30000	5.0	Seconds

This value is the amount of time to wait after the bus reaches rated speed voltage and load capacity before starting the fast transfer timer (OT) or closing the group breaker (CT).

Item	Display Name	WW	Min	Max	Default	Units
Load Surge High Alarm	LOAD SURGE ALM	Both	1	8	8=LOM w/ Alarms	

This value is used to select the action taken when a load surge condition is detected.

Item	Display Name	WW	Min	Max	Default	Units
Load Surge High Alarm Level	LOAD SURGE LEVEL	Both	25	300	100	% load / sec

This value is the level of load change within a single second that is to be considered a surge. The alarm is only active when the mains breaker is closed so as not to provide nuisance alarms due to block load pickup from a dead bus.

Item	Display Name	WW	Min	Max	Default	Units
LOM Action Delay	LOM ACTION DELAY	Both	0.1	30.0	0.1	Seconds

This value is the amount of time to wait after detecting a loss of mains from any protective relay, analog input, or discrete input prior to taking action.

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

This value is used to select the action taken when the LS units are supplying plant load without the mains.

Item	Display Name	WW	Min	Max	Default	Units
Online Capacity required to carry load	TRANSFER CAPACITY	Both	0.001	999.9	50.0	See Below

The Online Capacity (total capacity of LS units that must be running stable at rated speed and rated voltage) must be greater than this value before continuing with transfer switch transitions. See Chapter 17 for a further description of the operation of Transfer Capacity.

Item	Display Name	WW	Min	Max	Default	Units
Units the Transfer Capacity value	XFER CAPACITY UNITS	Both	1	4	2=KILOWATTS	

This value is used to describe order of magnitude of the transfer capacity value, i.e. W, KW, MW, GW.

Item	Display Name	WW	Min	Max	Default	Units
Zero Power Transfer Deadband	ZPT Deadband	WW	0.001	500.0	5.0	Mains Powersense Units

This is the deadband width around zero power transfer. If the power flow through the mains is within this deadband the mains breaker will be opened on a closed transition start.

Item	Display Name	WW	Min	Max	Default	Units
Loss of mains action	LOM ACTION	WW	False	True	False	

Configuring this variable for FALSE will result in a LOM action that will open the mains breaker upon expiration of the LOM action delay and then start all LS units and close them onto the deadbus. Configuring this variable for TRUE will result in starting the LS units upon the expiration of the LOM action delay first and when they are stable on the bus an open transition will take place. Without a group breaker the action will always open the mains breaker upon expiration of the LOM action delay.

Peaking Menu

The Peaking Control Menu is included in both the front panel display and Watch Window. Items in this menu are part of a Service block.

Item	Display Name	WW	Min	Max	Default	Units
Peak Shaving Mode	PEAK SHAVING MODE	Both	1	4	1=Off	

This value is used to select the peaking control mode. It may be **No Demand Selected**, **Time Schedule Only**, **Load Demand Only**, or **Load Demand and Time**. When No Demand Selected, the LS unit(s) will not be started or stopped automatically due to mains load level or on a schedule. When in Time Schedule Only, the LS unit(s) are started and stopped on a clock and day schedule defined by the user. When in Load Demand Only, the LS unit(s) is started and stopped automatically based on mains demand level. If Process is asserted, the mains demand may be controlled, otherwise, the generator set will be operated at its base load setting. If Load Demand and Time is selected, either mains demand level or the Time of Day timer will cause the generator set to start or stop. The LS unit(s) will run if either demand level or clock time is in the run mode, and continue to run until both clock run time expires and demand level is reduced.

Item	Display Name	WW	Min	Max	Default	Units
Immediate Demand Start	IMMEDIATE DMD START	Both	-30000	-0.1	-1200	*VA

This value is the mains demand level at or above which the LS unit(s) will be immediately started and paralleled with the mains without waiting the Load Demand Time Delay. It will only be used if the Demand Only or Time and Demand Level mode is selected. It should be set to a value greater than the Time Delayed Demand Start but less than the Mains Rated VA.

Item	Display Name	WW	Min	Max	Default	Units
Time Delayed Demand Start	TIME DELAY DMD START	Both	-30000	-0.1	-1000	*VA

This value is the mains demand level at or above which the LS unit(s) will be started and paralleled with the mains after waiting the Load Demand Time Delay. It will only be used if the Load Only or Demand Load and Time mode is selected.

Item	Display Name	WW	Min	Max	Default	Units
Time Delayed Demand Stop	TIME DELAY DMD STOP	Both	-30000	-0.1	-500	*VA

This value is the mains demand level at or below which the LS unit(s) will be stopped after waiting the Load Demand Time Delay. It will only be used if the Load Only or Load and Time mode is selected. If the Load and Time mode is selected and the Time is currently active, this level cannot stop the generator set until the time expires.

Item	Display Name	WW	Min	Max	Default	Units
Load Demand Time Delay	LOAD DMD TIME DELAY	Both	0	1200	30	Seconds

This value is the amount of time to wait after detecting load in excess of the Time Delayed Demand Start or under the Time Delayed Demand Stop prior to starting or stopping the LS unit(s).

Item	Display Name	WW	Min	Max	Default	Units
Use Discrete Input for Demand Sequencing Enable	USE DI FOR DMD ENABLE	WW	False	True	FALSE	

If set to True, the demand sequencing function will only be enabled when the discrete input for demand sequencing is closed and the MC is in Auto Mode. If set to False, Demand Sequencing is active when the MC is in the Auto Mode.

Item	Display Name	WW	Min	Max	Default	Units
Reset Demand Input to the MC control	RESET MC DEMAND	Both	False	True	FALSE	

If set to True, the demand input average measured by the Power Sense input of this MC control will be reset to 0.0.

Item	Display Name	WW	Min	Max	Default	Units
Reset MC Max Demand	RESET MC MAX DEMAND	Both	False	True	FALSE	

If set to True, the MC Max Demand tattletale will be reset to zero.

Item	Display Name	WW	Min	Max	Default	Units
Reset Total Demand	RESET TOTAL DEMAND	Both	False	True	FALSE	

If set to True, the total demand input average measured as the sum of all the Power Sense inputs from MC controls on this active bus will be reset to 0.0.

Item	Display Name	WW	Min	Max	Default	Units
Reset MC Max Demand	RESET TOTAL MAX DEMAND	Both	False	True	FALSE	

If set to True, the total max demand tattletale will be reset to zero.

Item	Display Name	WW	Min	Max	Default	Units
Demand Coefficient	DEMAND COEFFICIENT	Both	1	1200	60	seconds

This value is the window of time (in seconds) used to average the Mains real load in order to create a Demand Level. See Chapter 16 for information on the demand coefficient

Item	Display Name	WW	Min	Max	Default	Units
Sunday Program	SUNDAY PROGRAM	Both	0	4	0	
Monday Program	MONDAY PROGRAM	Both	0	4	0	
Tuesday Program	TUESDAY PROGRAM	Both	0	4	0	
Wednesday Program	WEDNESDAY PROGRAM	Both	0	4	0	
Thursday Program	THURSDAY PROGRAM	Both	0	4	0	
Friday Program	FRIDAY PROGRAM	Both	0	4	0	
Saturday Program	SATURDAY PROGRAM	Both	0	4	0	

These values determine the program number to use each day of the week. Only 1 program may be used each day. There are 4 total programs numbered 1-4. Start and stop times for each program are configured independently below. If no programmed starts/stops are desired on a given day, configure that day for program 0.

Item	Display Name	WW	Min	Max	Default	Units
Program 1 Start 1 Hour	PROGRAM 1 START 1 HR	Both	0	24	12	Hours
Program 1 Start 1 Minute	PROGRAM 1 START 1 M	Both	0	60	0	Minutes
Program 1 Stop 1 Hour	PROGRAM 1 STOP 1 HR	Both	0	24	12	Hours
Program 1 Stop 1 Minute	PROGRAM 1 STOP 1 M	Both	0	60	0	Minutes

This group of two configurable pairs defines a single run period. The LS Unit(s) will start at the hour and minute configured by “Program 1 Start 1 Hour” and “Program 1 Start 1 Minute”. The LS’s will begin to unload, cooldown, and stop when the time has reached “Program 1 Stop 1 Hour” and “Program 1 Stop 1 Minute”. If “Program 1 Start 2” is configured to a time before “Program 1 Stop 1”, the LS’s will continue running until “Program 1 Stop 2”.

Item	Display Name	WW	Min	Max	Default	Units
Program 1 Start 2 Hour	PROGRAM 1 START 2 HR	Both	0	24	12	Hours
Program 1 Start 2 Minute	PROGRAM 1 START 2 M	Both	0	60	0	Minutes
Program 1 Stop 1 Hour	PROGRAM 1 STOP 1 HR	Both	0	24	12	Hours
Program 1 Stop 1 Minute	PROGRAM 1 STOP 1 M	Both	0	60	0	Minutes

This group of two configurable pairs defines a single run period. The LS Unit(s) will start at the hour and minute configured by “Program 1 Start 1 Hour” and “Program 1 Start 1 Minute”. The LS’s will begin to unload, cooldown, and stop when the time has reached “Program 1 Stop 1 Hour” and “Program 1 Stop 1 Minute”. “Program 1 Start 2” is intended to be programmed to follow “Program 1 Start 1”. If either Runtime 1 or 2 continues into the next day, the LS’s will continue running until the stop time is reached.

Item	Display Name	WW	Min	Max	Default	Units
Program 2 Start 1 Hour	PROGRAM 2 START 1 HR	Both	0	24	12	Hours
Program 2 Start 1 Minute	PROGRAM 2 START 1 M	Both	0	60	0	Minutes
Program 1 Stop 1 Hour	PROGRAM 1 STOP 1 HR	Both	0	24	12	Hours
Program 1 Stop 1 Minute	PROGRAM 1 STOP 1 M	Both	0	60	0	Minutes

Program 2 start 1 is set up the same as described above for program 1.

Item	Display Name	WW	Min	Max	Default	Units
Program 2 Start 2 Hour	PROGRAM 2 START 2 HR	Both	0	24	12	Hours
Program 2 Start 2 Minute	PROGRAM 2 START 2 M	Both	0	60	0	Minutes
Program 1 Stop 1 Hour	PROGRAM 1 STOP 1 HR	Both	0	24	12	Hours
Program 1 Stop 1 Minute	PROGRAM 1 STOP 1 M	Both	0	60	0	Minutes

Program 2 start 2 is set up the same as described above for program 1.

Item	Display Name	WW	Min	Max	Default	Units
Program 3 Start 1 Hour	PROGRAM 3 START 1 HR	Both	0	24	12	Hours
Program 3 Start 1 Minute	PROGRAM 3 START 1 M	Both	0	60	0	Minutes
Program 1 Stop 1 Hour	PROGRAM 1 STOP 1 HR	Both	0	24	12	Hours
Program 1 Stop 1 Minute	PROGRAM 1 STOP 1 M	Both	0	60	0	Minutes

Program 3 start 1 is set up the same as described above for program 1.

Item	Display Name	WW	Min	Max	Default	Units
Program 3 Start 2 Hour	PROGRAM 3 START 2 HR	Both	0	24	12	Hours
Program 3 Start 2 Minute	PROGRAM 3 START 2 M	Both	0	60	0	Minutes
Program 1 Stop 1 Hour	PROGRAM 1 STOP 1 HR	Both	0	24	12	Hours
Program 1 Stop 1 Minute	PROGRAM 1 STOP 1 M	Both	0	60	0	Minutes

Program 3 start 2 is set up the same as described above for program 1.

Item	Display Name	WW	Min	Max	Default	Units
Program 4 Start 1 Hour	PROGRAM 4 START 1 HR	Both	0	24	12	Hours
Program 4 Start 1 Minute	PROGRAM 4 START 1 M	Both	0	60	0	Minutes
Program 1 Stop 1 Hour	PROGRAM 1 STOP 1 HR	Both	0	24	12	Hours
Program 1 Stop 1 Minute	PROGRAM 1 STOP 1 M	Both	0	60	0	Minutes

Program 4 start 1 is set up the same as described above for program 1.

Item	Display Name	WW	Min	Max	Default	Units
Program 4 Start 2 Hour	PROGRAM 4 START 2 HR	Both	0	24	12	Hours
Program 4 Start 2 Minute	PROGRAM 4 START 2 M	Both	0	60	0	Minutes
Program 1 Stop 1 Hour	PROGRAM 1 STOP 1 HR	Both	0	24	12	Hours
Program 1 Stop 1 Minute	PROGRAM 1 STOP 1 M	Both	0	60	0	Minutes

Program 4 start 2 is set up the same as described above for program 1.

Sequencing Menu

The Sequencing Menu is included in both the front panel display and Watch Window. Items in this menu are part of a Service block. Refer to Table 3-2 for the configuration list of alarm action.

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

This value defines the action taken when an LS fails to start when triggered from LON. See Chapter 14 for more details on this alarm.

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

This value defines the action taken when an LS fails to stop when triggered from LON. See Chapter 14 for more details on this alarm.

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

If the Net Nodes from the LON does 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. Items in this menu are part of a Service block.

Item	Display Name	WW	Min	Max	Default	Units
Serial 1 Type	SERIAL 1 TYPE	Both	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. See the EGCP-3 Installation Manual for details on each.

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

This value is 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	WW	Min	Max	Default	Units
Serial 1 Baud Rate	SERIAL PORT 1 BAUD	Both	1	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	WW	Min	Max	Default	Units
Serial 2 Type	SERIAL PORT 2 TYPE	Both	1	3	1=RS232	

This value is used to select the serial hardware interface for Serial Port 2. It may be RS232, RS422, or RS485. See the EGCP-3 Installation Manual for details on each.

Item	Display Name	WW	Min	Max	Default	Units
Serial 2 Baud Rate	SERIAL PORT 2 BAUD	Both	1	12	11=57,600	

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

Item	Display Name	WW	Min	Max	Default	Units
Serial 3 Baud Rate	SERIAL 3 PORT BAUD	Both	1	12	12=115,200	

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

Item	Display Name	WW	Min	Max	Default	Units
Serial Modbus ID	MODBUS ID	Both	1	247	1	

This value is the Modbus communication identifier or node address. This single configurable will setup the identifier to use for Modbus on Serial Port 2. It will also be used to setup the identifier to use for Modbus on Serial Port 1 if that serial port is configured as a Modbus port. The Modbus ID will always be identical on each port.

Item	Display Name	WW	Min	Max	Default	Units
Modbus Timeout	MODBUS TIMEOUT	WW	0.1	100.0	10.0	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	WW	Min	Max	Default	Units
Modbus Reset	RESET MODBUS	Both	True	False	FALSE	

This value is a momentary reset used to reset a Link Failure. The same reset is used for Serial Port 2 and Serial Port 1 if Serial Port 1 is configured as a Modbus port. If no link failure is present on a given serial port, the reset will have no effect. If a link failure was present, resetting the failure will allow the slave to communicate again.

Item	Display Name	WW	Min	Max	Default	Units
Modbus Link 1 Error Alarm Action	MBUS LINK 1 ERROR ALARM	WW	1	6	1=Disabled	

Watch Window contains a monitor value to show a Modbus Link 1 error alarm has occurred.
This value defines the action taken when the Serial Port 1 fails to communicate within the time-out period.

Item	Display Name	WW	Min	Max	Default	Units
Modbus Link 2 Error Alarm Action	MBUS LINK 2 ERROR ALARM	WW	1	6	1=Disabled	

Watch Window contains a monitor value to show a Modbus Link 2 error alarm has occurred.

This value defines the action taken when the Serial Port 2 fails to communicate within the time-out period.

Item	Display Name	WW	Min	Max	Default	Units
Modbus Mains Power Multiplier	MBUS MULT – MAINS POWER	WW	1	4	1=1XMultiplier	
Modbus Mains Volt Multiplier	MBUS MULT – MAINS VOLT	WW	1	4	1=1XMultiplier	
Modbus Mains Amps Multiplier	MBUS MULT – MAINS AMPS	WW	1	4	1=1XMultiplier	
Modbus Bus Power Multiplier	MBUS MULT – BUS POWER	WW	1	4	1=1XMultiplier	
Modbus Bus Volt Multiplier	MBUS MULT – BUS VOLT	WW	1	4	1=1XMultiplier	
Modbus Bus Amps Multiplier	MBUS MULT – BUS AMPS	WW	1	4	1=1XMultiplier	

The Modbus multipliers are used to change the decimal place of the values sent over Modbus. Because only integers can be sent over Modbus precision is lost. For example if the power through the mains is 1.75 MW the value over Modbus would be 2. Using a 1000Xmultiplier this value would now be sent over as 1750.

Calibration Menu

The Calibration Menu is included in both the front panel display and Watch Window. Items in this menu are part of a Service block.

The EGCP-3 has a battery backed real time clock that, once properly configured, will keep the date, time, and day of week even if control power is removed. Like most configurable items the clock/calendar can be set from the front panel or Watch Window, but the menu item differ depending on the tool used, so they are listed separately here.

Front Panel Clock Setup:
Use the following three menus items when setting up the control from the front panel Calibration-Configure Menu. Clock setting from Watch Window follows this front panel description.

Item	Display Name	WW	Min	Max	Default
Day of Week	DAY OF WEEK	Panel	Sunday	Saturday	Sunday

Select the current day of the week. It is part of the date and time configuration. The Day is not shown with the clock/calendar status on the panel display. When set on the panel, the day-of-week will not update until Enter is press while in the SET DATE menu.

Item	Display Name	WW	Min	Max	Default
Set Date	SET DATE	Panel	1-Jan-2000	31-Dec-2069	01-JAN-2001

This value is the exact day in a calendar year. The Day, Month, and Year are independently configurable as separate fields. Use the navigation keys to select and change each separately. When the enter key is pressed, the calendar and Day of Week will update to the entered values.

Item	Display Name	WW	Min	Max	Default
Set Time	SET TIME	Panel			00:00:00

This value is the exact time of day. The Hour, and Minute, are independently configurable as separate fields. Use the navigation keys to select and change each separately. The clock is a 24-hour clock, enter 6 pm as 18. When the Enter key is pressed the clock will be initialized to the Hour and minute and 0.0 seconds.

Watch Window Clock Calibration

The following is the Clock/Calendar configuration using Watch Window.

Item	Display Name	WW	Min	Max	Default
Current year	UPDATE YEAR TO:	WW	2000	2070	2001

Numerical value of the present year.

Item	Display Name	WW	Min	Max	Default
Current month	UPDATE MONTH TO:	WW	1	12	1=JAN

Enumerated list of the current month, This is the conventional list of January = 1, February = 2, etc.

Item	Display Name	WW	Min	Max	Default
Current date	UPDATE DATE TO:	WW	1	31	1

Numerical entry of calendar date 1-31.

Item	Display Name	WW	Min	Max	Default
Current day of Week	UPDATE CURRENT DAY TO:	WW	1	7	1=Sunday

This value is an enumerated list used to select the current day of the week (Sunday = 1, Monday = 2, etc.). It is part of the date and time configuration.

Item	Display Name	WW	Min	Max	Default
Set Calendar	UPDATE CALENDAR TRIGGER	WW	FALSE	TRUE	FALSE

The EGCP-3 calendar will initialize itself to the entered calendar when the Up Date Calendar trigger is set TRUE, then FALSE.

Item	Display Name	WW	Min	Max	Default
Current time(hour)	UPDATE HOURS TO:	WW	0	23	0

Clock hours, 24 hour clock.

Item	Display Name	WW	Min	Max	Default
Current time (minutes)	UPDATE MINUTES TO:	WW	0	59	0

Clock minutes.

Item	Display Name	WW	Min	Max	Default
Set Clock	UPDATE CLOCK TRIGGER	WW	FALSE	TRUE	FALSE

Adjust the clock parameters above to the current time. The EGCP-3 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 date and time, and day-of-week from the EGCP-3 to verify its setting.

Item	Display Name	WW	Min	Max	Default	Units
Bus A∅ Voltage Scale Factor	BUS A∅ VOLTAGE SCALE	Both	0.5	1.5	1	Per unit
Bus B∅ Voltage Scale Factor	BUS B∅ VOLTAGE SCALE	Both	0.5	1.5	1	Per unit
Bus C∅ Voltage Scale Factor	BUS C∅ VOLTAGE SCALE	Both	0.5	1.5	1	Per unit
Bus A∅ Current Scale Factor	BUS A∅ CURRENT SCALE	Both	0.5	1.5	1	Per unit
Bus B∅ Current Scale Factor	BUS B∅ CURRENT SCALE	Both	0.5	1.5	1	Per unit
Bus C∅ Current Scale Factor	BUS C∅ CURRENT SCALE	Both	0.5	1.5	1	Per unit
Mains A∅ Voltage Scale Factor	MNS A∅ VOLT SCALE	Both	0.5	1.5	1	Per Unit
Mains B∅ Voltage Scale Factor	MNS B∅ VOLT SCALE	Both	0.5	1.5	1	Per Unit
Mains C∅ Voltage Scale Factor	MNS C∅ VOLT SCALE	Both	0.5	1.5	1	Per Unit
Mains A∅ Current Scale Factor	MNS A∅ CURR SCALE	Both	0.5	1.5	1	Per Unit
Mains B∅ Current Scale Factor	MNS B∅ CURR SCALE	Both	0.5	1.5	1	Per Unit
Mains C∅ Current Scale Factor	MNS C∅ CURR SCALE	Both	0.5	1.5	1	Per Unit

The Scale setting is used to match the input value and the EGCP-3 displayed value. From Watch Window the EGCP-3 measured value is also monitored and shown here to assist with calibration. These items are discussed in the Calibration Chapter of this manual.

Item	Display Name	WW	Min	Max	Default	Units
Operator Password	OPERATOR PASSWORD	Both	0	9999	9002	

This value is the password to use when logging in at the Operator Level. It can only be changed if logged in as a Technician.

Item	Display Name	WW	Min	Max	Default	Units
Supervisor Password	SUPERVISOR PASSWORD	Both	0	9999	9003	

This value is the password to use when logging in at the Supervisor Level. It can only be changed if logged in as a Technician or Factory.

Item	Display Name	WW	Min	Max	Default	Units
Technician Password	TECHNICIAN PASSWORD	Both	0	9999	9004	

This value is the password to use when logging in at the Technician Level. It can only be changed if logged in as a Technician or Factory.

Item	Display Name	WW	Min	Max	Default	Units
Factory Password	FACTORY PASSWORD	Both	0	9999	9005	

This value is the password to use when logging in at the Factory Level. It can only be changed if logged in at the Factory Level.

Item	Display Name	WW	Min	Max	Default	Units
Disable Passwords	DISABLE PASSWORDS	Both	True	False	FALSE	

If set to False, all passwords are enabled to prevent unauthorized alteration of critical parameters from the front panel display. If set to True, a password is not required to enter Configure Menus at the Technician level. Technician level access is required to change this parameter. This value will automatically revert to False when the control power is cycled off and on.

Remote Alarm Menu

The Remote Alarm Menu is included in both the front panel display and Watch Window. Items in this menu are part of a Service block. Refer to Table 3-2 for the configuration list of alarm action.

Item	Display Name	WW	Min	Max	Default	Units
Remote Alarm 1	REMOTE ALARM 1	Both	1	8	1=Disabled	
Remote Alarm 1 Delay	REMOTE ALARM 1 DLY	Both	0.0	30.0	0.0	Seconds
Remote Alarm 1 Level	REMOTE ALARM 1 LVL	Both	False	True	True=Active High	
Remote Alarm 1 Label	REMOTE ALARM 1 LABEL	WW		~~~~	REMOTE ALARM 1	ASCII

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.

The Remote Alarm 1 value defines 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 EGCP-3 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 Active High should be used.

The Remote Alarm 1 Label is used to provide a customized name for the actual device connected to the input. It is limited to 20 characters all of which must be ASCII characters {within the range of ASCII(20) ‘space’, to ASCII(7E) ‘~’}.

Item	Display Name	WW	Min	Max	Default	Units
Remote Alarm 2	REMOTE ALARM 2	Both	1	8	1=Disabled	
Remote Alarm 2 Delay	REMOTE ALARM 2 DLY	Both	0.0	30.0	0.0	Seconds
Remote Alarm 2 Level	REMOTE ALARM 2 LVL	Both	False	True	True=Active High	
Remote Alarm 2 Label	REMOTE ALARM 2 LABEL	WW		~~~~	REMOTE ALARM 2	ASCII

See Remote Alarm 1 above for configuration description.

Item	Display Name	WW	Min	Max	Default	Units
Remote Alarm 3	REMOTE ALARM 3	Both	1	8	1=Disabled	
Remote Alarm 3 Delay	REMOTE ALARM 3 DLY	Both	0.0	30.0	0.0	Seconds
Remote Alarm 3 Level	REMOTE ALARM 3 LVL	Both	False	True	True=Active High	
Remote Alarm 3 Label	REMOTE ALARM 3 LABEL	WW		~~~~	REMOTE ALARM 3	ASCII

See Remote Alarm 1 above for configuration description.

Item	Display Name	WW	Min	Max	Default	Units
Remote Alarm 4	REMOTE ALARM 4	Both	1	8	1=Disabled	
Remote Alarm 4 Delay	REMOTE ALARM 4 DLY	Both	0.0	30.0	0.0	Seconds
Remote Alarm 4 Level	REMOTE ALARM 4 LVL	Both	False	True	True=Active High	
Remote Alarm 4 Label	REMOTE ALARM 4 LABEL	WW		~~~~	REMOTE ALARM 4	ASCII

See Remote Alarm 1 above for configuration description.

Item	Display Name	WW	Min	Max	Default	Units
Remote Alarm 5	REMOTE ALARM 5	Both	1	8	1=Disabled	
Remote Alarm 5 Delay	REMOTE ALARM 5 DLY	Both	0.0	30.0	0.0	Seconds
Remote Alarm 5 Level	REMOTE ALARM 5 LVL	Both	False	True	True=Active High	
Remote Alarm 5 Label	REMOTE ALARM 5 LABEL	WW		~~~~	REMOTE ALARM 5	ASCII

See Remote Alarm 1 above for configuration description.

Item	Display Name	WW	Min	Max	Default	Units
Remote Alarm 6	REMOTE ALARM 6	Both	1	8	1=Disabled	
Remote Alarm 6 Delay	REMOTE ALARM 6 DLY	Both	0.0	30.0	0.0	Seconds
Remote Alarm 6 Level	REMOTE ALARM 6 LVL	Both	False	True	True=Active High	
Remote Alarm 6 Label	REMOTE ALARM 6 LABEL	WW		~~~~	REMOTE ALARM 6	ASCII

See Remote Alarm 1 above for configuration description.

Analog Outputs Menu

The Analog Outputs Menu is included in both the front panel display and Watch Window. Items in this menu are part of a Service block. There are 4 configurable analog outputs that can be configured to measure several variables in the MC. The Analog Output Function defines which configurable output will be displayed by the output. The high and low calibration values are used to map the variables outputs to the 4-20mA value of the analog output. For example, if an external KW meter was needed for a remote visual reading the analog output would be configured as follows:

Analog Output 1 Function – 5
Analog Output 1 Hi Cal – 800
Analog Output 1 Lo Cal – -400

This configuration would describe a system where the Mains KW was monitored on analog output one (1). If the mains were importing 400KW the analog output would read 4mA. If the mains were exporting 800kW the analog output would read 20mA.

All analog outputs will be configured by the same mechanism.

Item	Display Name	WW	Min	Max	Default
Analog output 1 Function	ANOUT1 FUNCTION	Both	1	17	1=Not Used
Input Value for 20 mA Output	ANOUT1 HI CAL VALUE	Both	-30000	30000	
Input Value for 4 mA Output	ANOUT1 LO CAL VALUE	Both	-30000	30000	

Item	Display Name	WW	Min	Max	Default
Analog output 2 Function	ANOUT2 FUNCTION	Both	1	17	1=Not Used
Input Value for 20 mA Output	ANOUT2 HI CAL VALUE	Both	-30000	30000	
Input Value for 4 mA Output	ANOUT2 LO CAL VALUE	Both	-30000	30000	

Item	Display Name	WW	Min	Max	Default
Analog output 3 Function	ANOUT3 FUNCTION	Both	1	17	1=Not Used
Input Value for 20 mA Output	ANOUT3 HI CAL VALUE	Both	-30000	30000	
Input Value for 4 mA Output	ANOUT3 LO CAL VALUE	Both	-30000	30000	

Item	Display Name	WW	Min	Max	Default
Analog output 4 Function	ANOUT4 FUNCTION	Both	1	17	1=Not Used
Input Value for 20 mA Output	ANOUT4 HI CAL VALUE	Both	-30000	30000	
Input Value for 4 mA Output	ANOUT4 LO CAL VALUE	Both	-30000	30000	

The following is the list of configurable Analog Outputs. The configurables marked by “Phase Based” in the notes can be configured to read the phase values when used with the digital inputs “Meter Phase Select A” and “Meter Phase Select B”. See the digital inputs configuration section for more details on this feature.

Value	Command	Display	Notes
17	System Load	System Load	
16	Bus Power Factor	BUS Power Factor	Phase based
15	Bus Frequency Meter	BUS Freq Meter	
14	Bus KVAR Meter	BUS KVAR Meter	
13	Bus KVA Meter	BUS KVA Meter	
12	Bus KW Meter	BUS KW Meter	
11	Bus Current Meter	BUS Current Meter	Phase based
10	Bus Voltage Meter	Bus Voltage Meter	Phase based
9	Mains Power Factor	Mains Power Factor	Phase based
8	Mains Frequency Meter	Mains Freq Meter	
7	Mains KVAR Meter	Mains KVAR Meter	
6	Mains KVA Meter	Mains KVA Meter	
5	Mains KW Meter	Mains KW Meter	
4	Mains Current Meter	Mains Current Meter	Phase based
3	Mains Voltage Meter	Mains Voltage Meter	Phase based
2	Synchroscope	Synchroscope	
1	Not Used	Not Used	

Analog Inputs Menu

The Analog Input Menu is included in both the front panel display and Watch Window. Items in this menu are part of a Service block.

Item	Display Name	WW	Min	Max	Default	Units
Voltage or Current input Selection	ANALOG INPUT 1 TYPE	Both	1	3	1=4-20mA	
User Defined Label	ANALOG IN 1 LABEL	WW		~~~~	ANALOG IN 1	ASCII
Sensor Value at Minimum Input	ANIN1 LOW CAL VALUE	Both	-30000	30000	0.0	User
Sensor Value at Maximum Input	ANIN1 HIGH CAL VALUE	Both	-30000	30000	150.0	User
High Alarm Action	ANIN1 HIGH ALARM	Both	1	8	1=Disabled	
High Alarm Level	ANIN14 HIGH ALARM LEVEL	Both	-30000	30000	160.0	User
High Pre-alarm Action	ANIN1 HIGH PRE-ALARM	WW	1	8	1=Disabled	
High Pre-alarm Action	ANIN1 HIGH PRE-ALARM LVL	WW	-30000	30000	100.0	User
Low Pre-alarm Action	ANIN1 LOW PRE-ALARM	WW	1	8	1=Disabled	
Low Pre-alarm Level	ANIN1 LOW PRE-ALARM LVL	WW	-30000	30000	0.0	User
Low Alarm Action	ANIN1 LOW ALARM	Both	1	8	1=Disabled	
Low Alarm Level	ANIN1 LOW ALARM LEVEL	Both	-30000	30000	-10.0	User
Pre Alarm Delay Time	ANIN1 PRE-ALARM DELAY	WW	0.10	1200	5.0	Sec
Alarm Delay Time	ANIN1 ALARM DELAY	Both	0.10	1200	10.0	Sec
Analog Input 1 Out of Range Alarm	AI1 OUT OF RANGE	WW	1	6	1=Disabled	

The configurable function of inputs 1 through 4 is selected in the First Time Configuration Menu. In this menu, the user defines the calibration values for all inputs. Inputs 1 - 4 can be configured for an alarm function and the alarm action and alarm levels are set here.

Analog Input Type can be configured for 4-20mA(1), 1-5V(2), or Not Used (3). The Low calibration setpoint defines the internal number that the control will use as either 4mA or 1V. The High calibration setpoint defines the internal number that the control will use as either 20mA or 5V. All alarms are then triggered off the internal number in the control. All alarms are configurable similar the Mains and Bus Protection menus.

In order to protect the analog input port, Out of Limits alarms for the Analog inputs are also available. If the analog input is higher than 22mA or 5.5V or lower than 2mA and 0.5V the alarm will be instigated. All analog inputs can be configured by the same methods.

Item	Display Name	WW	Min	Max	Default	Units
Voltage or Current input Selection	ANALOG INPUT 2 TYPE	Both	1	3	1=4-20mA	
User Defined Label	ANALOG IN 2 LABEL	WW		~~~~	ANALOG IN 1	ASCII
Sensor Value at Minimum Input	ANIN2 LOW CAL VALUE	Both	-30000	30000	0.0	User
Sensor Value at Maximum Input	ANIN2 HIGH CAL VALUE	Both	-30000	30000	150.0	User
High Alarm Action	ANIN2 HIGH ALARM	Both	1	8	1=Disabled	
High Alarm Level	ANIN2 HIGH ALARM LEVEL	Both	-30000	30000	160.0	User
High Pre-alarm Action	ANIN2 HIGH PRE-ALARM	WW	1	8	1=Disabled	
High Pre-alarm Action	ANIN2 HIGH PRE-ALARM LVL	WW	-30000	30000	100.0	User
Low Pre-alarm Action	ANIN2 LOW PRE-ALARM	WW	1	8	1=Disabled	
Low Pre-alarm Level	ANIN2 LOW PRE-ALARM LVL	WW	-30000	30000	0.0	User
Low Alarm Action	ANIN2 LOW ALARM	Both	1	8	1=Disabled	
Low Alarm Level	ANIN2 LOW ALARM LEVEL	Both	-30000	30000	-10.0	User
Pre Alarm Delay Time	ANIN2 PRE-ALARM DELAY	WW	0.10	1200	5.0	Sec
Alarm Delay Time	ANIN2 ALARM DELAY	Both	0.10	1200	10.0	Sec
Analog Input 2 Out of Range Alarm	AI1 OUT OF RANGE	WW	1	6	1=Disabled	

The configuration of Analog input 2 has the same parameters and options as Analog Input 1 described above.

Item	Display Name	WW	Min	Max	Default	Units
Voltage or Current input Selection	ANALOG INPUT 3 TYPE	Both	1	3	1=4-20mA	
User Defined Label	ANALOG IN 3 LABEL	WW		~~~~	ANALOG IN 1	ASCII
Sensor Value at Minimum Input	ANIN3 LOW CAL VALUE	Both	-30000	30000	0.0	User
Sensor Value at Maximum Input	ANIN3 HIGH CAL VALUE	Both	-30000	30000	150.0	User
High Alarm Action	ANIN3 HIGH ALARM	Both	1	8	1=Disabled	
High Alarm Level	ANIN3 HIGH ALARM LEVEL	Both	-30000	30000	160.0	User
High Pre-alarm Action	ANIN3 HIGH PRE-ALARM	WW	1	8	1=Disabled	
High Pre-alarm Action	ANIN3 HIGH PRE-ALARM LVL	WW	-30000	30000	100.0	User
Low Pre-alarm Action	ANIN3 LOW PRE-ALARM	WW	1	8	1=Disabled	
Low Pre-alarm Level	ANIN3 LOW PRE-ALARM LVL	WW	-30000	30000	0.0	User
Low Alarm Action	ANIN3 LOW ALARM	Both	1	8	1=Disabled	
Low Alarm Level	ANIN3 LOW ALARM LEVEL	Both	-30000	30000	-10.0	User
Pre Alarm Delay Time	ANIN3 PRE-ALARM DELAY	WW	0.10	1200	5.0	Sec
Alarm Delay Time	ANIN3 ALARM DELAY	Both	0.10	1200	10.0	Sec
Analog Input 3 Out of Range Alarm	AI1 OUT OF RANGE	WW	1	6	1=Disabled	

The configuration of Analog input 3 has the same parameters and options as Analog Input 1 described above

Item	Display Name	WW	Min	Max	Default	Units
Voltage or Current input Selection	ANALOG INPUT 4 TYPE	Both	1	3	1=4-20mA	
User Defined Label	ANALOG IN 4 LABEL	WW		~~~~	ANALOG IN 1	ASCII
Sensor Value at Minimum Input	ANIN4 LOW CAL VALUE	Both	-30000	30000	0.0	User
Sensor Value at Maximum Input	ANIN4 HIGH CAL VALUE	Both	-30000	30000	150.0	User
High Alarm Action	ANIN4 HIGH ALARM	Both	1	8	1=Disabled	
High Alarm Level	ANIN4 HIGH ALARM LEVEL	Both	-30000	30000	160.0	User
High Pre-alarm Action	ANIN4 HIGH PRE-ALARM	WW	1	8	1=Disabled	
High Pre-alarm Action	ANIN4 HIGH PRE-ALARM LVL	WW	-30000	30000	100.0	User
Low Pre-alarm Action	ANIN4 LOW PRE-ALARM	WW	1	8	1=Disabled	
Low Pre-alarm Level	ANIN4 LOW PRE-ALARM LVL	WW	-30000	30000	0.0	User
Low Alarm Action	ANIN4 LOW ALARM	Both	1	8	1=Disabled	
Low Alarm Level	ANIN4 LOW ALARM LEVEL	Both	-30000	30000	-10.0	User
Pre Alarm Delay Time	ANIN4 PRE-ALARM DELAY	WW	0.10	1200	5.0	Sec
Alarm Delay Time	ANIN4 ALARM DELAY	Both	0.10	1200	10.0	Sec
Analog Input 4 Out of Range Alarm	AI1 OUT OF RANGE	WW	1	6	1=Disabled	

The configuration of Analog input 4 has the same parameters and options as Analog Input 1 described above

Force Relay Menu

The items in the Watch Window menu to test the relay/discrete outputs are shown below. Items in this menu are part of a Service Block. These configuration points are to be used for troubleshooting only. If any are set true, the corresponding digital output will be turned “on” so that wiring can be tested. The fist parameter, ENABLE RELAY FORCING, must be set to TRUE before the relays can be manually tested. To enable the test the control Mode Switch must be in the off position, and Supervisor or higher password entered. If these conditions 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. When the Enable Forcing is turned on, the output will remain in their present state.

Item	Display Name	WW	Min	Max	Default	Units
Enable Relay Forcing Test	ENABLE RELAY FORCING	WW	False	True	False	
Force DO 1	ENERGIZE RELAY 1	WW	False	True	FALSE=off	
Force DO 2	ENERGIZE RELAY 2	WW	False	True	FALSE=off	
Force DO 3	ENERGIZE RELAY 3	WW	False	True	FALSE=off	
Force DO 4	ENERGIZE RELAY 4	WW	False	True	FALSE=off	
Force DO 5	ENERGIZE RELAY 5	WW	False	True	FALSE=off	
Force DO 6	ENERGIZE RELAY 6	WW	False	True	FALSE=off	
Force DO 7	ENERGIZE RELAY 7	WW	False	True	FALSE=off	
Force DO 8	ENERGIZE RELAY 8	WW	False	True	FALSE=off	
Force DO 9	ENERGIZE RELAY 9	WW	False	True	FALSE=off	
Force DO 10	ENERGIZE RELAY 10	WW	False	True	FALSE=off	
Force DO 11	ENERGIZE RELAY 11	WW	False	True	FALSE=off	
Force DO 12	ENERGIZE RELAY 12	WW	False	True	FALSE=off	

Remote Control Menu

The Remote Control Menu acts as a remote human interface for the MC. Most of the Digital inputs are available in this menu. To use this interface the control must have its AUTO digital input on, after which all of the following commands will become active. The MC can then be controlled by ServLink and Watch Window commands. This menu works similar to setting up Modbus for remote operation. The following is a list of the available commands in WW. Items that can only be monitored are shown in the list as “Monitor”.

Item	Display Name	WW	Min	Max	Default
Acknowledge Cmd Input	ACKNOWLEDGE ALARMS	WW	False	True	False
Reset Command Input	RESET ALARMS	WW	False	True	False
Auto Mode Switch Input	AUTO COMMAND	WW	False	True	False
Test Mode Switch Input	TEST COMMAND	WW	False	True	False
Run Mode Switch Input	RUN COMMAND	WW	False	True	False
Process Mode Enable	PROCESS ENABLE COMMAND	WW	False	True	False
Reactive Load Enable	VAR\PF ENABLE COMMAND	WW	False	True	False
Reset Load	RESET LOAD COMMAND	WW	False	True	False
Unload Command Input	UNLOAD COMMAND	WW	False	True	False
Ramp Pause Input	LOAD RAMP PAUSE CMD	WW	False	True	False
Speed/Load Raise Input	SPEED RAISE COMMAND	WW	False	True	False
Speed/Load Lower Input	SPEED LOWER COMMAND	WW	False	True	False
Synchronizer Speed Bias	SYNCHRONIZER SPEED BIAS	WW			Monitor
Voltage/PF/VAR Raise In	VOLTAGE RAISE COMMAND	WW	False	True	False
Voltage/PF/VAR Lower In	VOLTAGE LOWER COMMAND	WW	False	True	False
Synchronizer Volt Bias	SYNCHRONIZER VOLT BIAS	WW			Monitor
Remote Baseload Ref	REMOTE BASELOAD REF	WW			Monitor
Read Phase A at Anout	METER PHASE A SELECT	WW	False	True	False
Read Phase B at Anout	METER PHASE B SELECT	WW	False	True	False
Reset to MC Load Ref	RESET MC DEMAND	WW	False	True	False
Reset To Total Load Ref	RESET TOTAL DEMAND	WW	False	True	False

Chapter 4.
Monitoring by Watch Window

Introduction

The following pages describe the Watch Window sheets that contain information used in monitoring the MC parameters. The status menus that have names proceeded by numbers (example: 02STATUS BUS) are menus that have parameters grouped similar to the front panel status screens. There are also status menus that are only accessible by ServLink/Watch Window.

Sequence States Menu

The EGCP-3 uses a state machine for determining its operating mode at any given time. The unit will step through these states are operating conditions or modes change. Some states the control will skip or step through too quickly to see indication change. This menu is only used for diagnostics.

Display Name	Item
ISOLATED OPERATION	Mains Breaker is open and Group Breaker is Closed or at least 1 LS has its generator breaker closed
MAINS OPERATION	Mains breaker is closed and there are no LS units on the bus or Group is open
PARALLEL OPERATION	Mains breaker is closed and Group breaker is closed or 1 LS gen breaker is closed
SYNCHRONIZE GROUP_LS	If actively synchronizing group breaker or LS units
SYNCHRONIZE UTILITY	If actively synchronizing bus to mains

Units Menu

The Units Menu is included only in Watch Window. 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
MAINS POWER	Mains Power Units	W, VA, VAR; KW, KVA, KVAR; MW, MVA, MVAR; GW, GVA, GVAR
MAINS VOLTAGE	Mains Voltage Units	Volts, Kilovolts
MAINS CURRENT	Mains Current Units	Amps, Kilamps
BUS POWER	Bus Power Units	W, VA, VAR; KW, KVA, KVAR; MW, MVA, MVAR; GW, GVA, GVAR
BUS VOLTAGE	Bus Voltage Units	Volts, Kilovolts
BUS CURRENT	Bus Current Units	Amps, Kilamps

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. On the front panel display this can be observed as the units changing to kV.

If a value of MW, MVA, MVAR is observed, the related ac quantity is scaled by 1,000 000. For example, if Bus Power Units is MW, MVA, MVAR than a value of 30.456 in Bus Rated Watts will be interpreted as 30 456 000 watts or 30.456 megawatts. On the front panel display this can be observed as the units changing to MW.

LON Status Messaging Menu

This menu is used for troubleshooting aid of the LON information only. It will help an operator diagnose problems with LON communication. Here all of the inputs into and out of the LON are compiled.

LON IN = Input from this application and sent to other LON Units

LON OUT= Output from the LON (other units) and input into this application

Display Name	Item
01 LON IN - NODE NUM	This units assigned unit/node number
02 LON IN - PF CMD	Power Factor command value for all LS nodes
03 LON IN - LOAD CMD	Load Command value for all LS nodes
04 LON IN - MON TBKR	Enables transmission of segment tie breakers to other units
05 LON IN - TIE W	W Tie Breaker Aux contact input
06 LON IN - TIE X	X Tie Breaker Aux contact input
07 LON IN - TIE Y	Y Tie Breaker Aux contact input
08 LON IN - TIE Z	Z Tie Breaker Aux contact input
09 LON IN - BKR CLOSED	Gen Breaker Closed
10 LON IN - MSTR CNTL	This control is requesting to the Master Process Controller
11 LON IN - DEADBUS	This unit sees the bus a being dead
12 LON IN - DB REQUEST	This unit would like to close onto the deadbus
13 LON IN - VOLT RAISE	Message for all other units to raise their voltage
14 LON IN - VOLT LOWER	Message for all other units to lower their voltage
15 LON IN - SEND SYNC	Enable send of the sync bias message
16 LON IN - SYNC BIAS	Value of unit synchronizer bias signal
17 LON IN - MAINS DMD	This units Demand value sent to other MC controls
18 LON IN - DMD UNITS	Indicates the units (K, M, etc) of the Mains Demand value
19 LON IN - BUS SEG A	Bus Segment A is Active
20 LON IN - BUS SEG B	Bus Segment B is Active
21 LON IN - BUS SEG C	Bus Segment C is Active
22 LON IN - BUS SEG D	Bus Segment D is Active
23 LON IN – START RQST	Request to start another genset
24 LON IN - STOP RQST	Request to stop another genset
25 LON IN – START ALL	All units on this bus segment are commanded to start and close their breakers. Start arbitration of LS units is disabled
26 LON IN - STOP ALL	All units on this bus segment are commanded to open their breakers and stop. Stop arbitration of LS units is disabled
27 LON IN – START TEST	indicates this node is requesting LS nodes to start and close their breakers onto the active bus
28 LON IN - STOP TEST	indicates this node is requesting LS nodes to open their breakers on the active bus and stop units
29 LON OUT - TIE BRKR W	W Tie Breaker is closed, two bus segments are connected
30 LON OUT - TIE BRKR X	X Tie Breaker is closed, two bus segments are connected
31 LON OUT - TIE BRKR Y	Y Tie Breaker is closed, two bus segments are connected
32 LON OUT - TIE BRKR Z	Z Tie Breaker is closed, two bus segments are connected
33 LON OUT - DB GRANT	This unit has received ok to close onto the deadbus
34 LON OUT - NET NODES	Number of LON devices on the network
35 LON OUT - SEG NODES	Number of nodes active on this bus segment
36 LON OUT - LS NODES	Indicates the number of LS units sharing load on this bus segment
37 LON OUT – BREAKER NODES	Indicates the number of LS units with their breaker closed on the active bus segment
38 LON OUT - STRT NODES	Number of Gensets ready to participate in start arbitration on the active bus
39 LON OUT - STOP NODES	Number of Gensets ready to participate in stop arbitration on the active bus
40 LON OUT - STRT READY	Number of Gensets ready to participate in a start all on the active bus
41 LON OUT - STOP READY	Number of Gensets ready to participate in a stop all on the active bus
42 LON OUT - M IN CTL	Indicates this node is the process master
43 LON OUT - SYS PF	indicates the system power factor

Display Name	Item
44 LON OUT - SYS LOAD	System Load %
45 LON OUT - SM_IN_CTL	This node is the master synchronizer controller
46 LON OUT - ONLINE DMD	Total power being generated by all the generator sets on the same active bus segment who have their breakers closed
47 LON OUT - OL_D_UNITS	Indicates the units (K, M, etc) of the active units ONLINE_DMD
48 LON OUT - ONLINE CAP	Maximum total power output capable of being generated by all the generator sets on the same active bus segment who have their breakers closed
49 LON OUT - OL_C_UNITS	Indicates the units (K, M, etc) of the active units ONLINE_CAP
50 LON OUT - TOT DEMAND	This output field indicates the sum of all 'MAIN_DMD' input field values on the active bus segment
51 LON OUT - T_D_UNITS	Indicates the units (K, M, etc) of the Total Demand value
52 LON OUT - START DONE	Start arbitration has been completed, no (more) units need to be started
53 LON OUT - STOP DONE	Stop arbitration has been completed, no (more) units need to stop
54 LON OUT - NEXT START	Displays which unit/node number will get the next start cmd
55 LON OUT - NEXT STOP	Displays which unit/node number will get the next stop cmd
56 LON OUT - SYS NUM ID	This number, when decoded, give the node numbers that are active
57 LON OUT - ERR FLAG	Indicates an error has occurred with the LON communication
58 LON OUT - ERR NUM	This is an error code indicating what error has occurred
59 LON OUT - M CTL	This field indicates whether there is a process master node on the active bus segment

The following menus will display the control's status information in groups that are similar to the front panel status screens.

01 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 NUMBER	Unit number of MC	
03 MAINS	Stable (++), Stable timing (+-), Out of Spec(--)	
04 BUS	Stable (++), Stable timing (+-), Out of Spec(--)	
05 MODE:	Indicates the position of the Control Mode Switch	
06 STATE:	Shows the state of the MC as a whole, how/why the unit started	
07 HZ	The frequency of the mains	Hz
08 KW	The total kW load on the mains	W
09 PF:	The average three phase power factor of the mains	NA
10 Mains PF Direction	Describes type of PF (LAG, LEAD)	
11 DATE / TIME	Current Date and Time of the EGCP-3 Clock	Y/M/D H:M:S
12 BATTERY	Supply voltage into this control	Volts
13 CONFIGURATION STATUS	Indicate that configuration checks are in proper range	T/F
14 CONTACT IN CONFIGURATION ERR	Indicates which discrete input are configured wrong.	Ch #

02 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 AMPS	Average Amps	A*
04 BUS VOLT-AMP	Total KVA reading.	VA*
05 BUS WATT	Total kW readings	W*
06 BUS VAR	Total kVAR reading.	VAR*
07 BUS PWR-FACTOR	Average Power Factor	
08 BUS PF DIRECTION	Describes type of PF (LAG, LEAD)	
09 BUS VA, PHS A	Phase A KVA reading	VA*
10 BUS VA, PHS B	Phase B KVA reading	VA*
11 BUS VA, PHS C	Phase C KVA reading	VA*
12 BUS WATT, PHS A	Phase A kW readings	W*
13 BUS WATT, PHS B	Phase B kW readings	W*
14 BUS WATT, PHS C	Phase C kW readings	W*
15 BUS VAR, PHS A	Phase A kVAR reading	VAR*
16 BUS VAR, PHS B	Phase B kVAR reading	VAR*
17 BUS VAR, PHS C	Phase C kVAR reading	VAR*
18 BUS VOLT, PHS A	Phase A Volts reading	Volt*
19 BUS VOLT, PHS B	Phase B Volts reading	Volt*
20 BUS VOLT, PHS C	Phase C Volts reading	Volt*
21 BUS AMP, PHS A	Phase A Amps reading	Amp*
22 BUS AMP, PHS B	Phase B Amps reading	Amp*
23 BUS AMP, PHS C	Phase C Amps reading	Amp*
24 BUS PF PHS A	Phase A Power Factor reading	-
25 BUS PF PHS A DIRECTION	Describes type of PF (LAG, LEAD)	
26 BUS PF PHS B	Phase B Power Factor reading	-
27 BUS PF PHS B DIRECTION	Describes type of PF (LAG, LEAD)	
28 BUS PF PHS C	Phase C Power Factor reading	-
29 BUS PF PHS C DIRECTION	Describes type of PF (LAG, LEAD)	
30 BUS CURR, THD	Total Harmonic Distortion of the Current	%
31 BUS CURR, 3RD HARM	Third Current Harmonic	%
32 BUS CURR, 4TH HARM	Fourth Current Harmonic	%
33 BUS CURR, 5TH HARM	Fifth Current Harmonic	%
34 BUS CURR, 6TH HARM	Sixth Current Harmonic	%
35 BUS CURR, 7TH HARM	Seventh Current Harmonic	%
36 BUS CURR, 9TH HARM	Ninth Current Harmonic	%
37 BUS CURR, 11TH HARM	Eleventh Current Harmonic	%
38 BUS CURR, 13TH HARM	Thirteenth Current Harmonic	%
39 BUS VOLT, THD	Total Harmonic Distortion of the Voltage	%
40 BUS VOLT, 3RD HARM	Third Voltage Harmonic	%
41 BUS VOLT, 4TH HARM	Fourth Voltage Harmonic	%
42 BUS VOLT, 5TH HARM	Fifth Voltage Harmonic	%
43 BUS VOLT, 6TH HARM	Sixth Voltage Harmonic	%
44 BUS VOLT, 7TH HARM	Seventh Voltage Harmonic	%
45 BUS VOLT, 9TH HARM	Ninth Voltage Harmonic	%
46 BUS VOLT, 11TH HARM	Eleventh Voltage Harmonic	%
47 BUS VOLT, 13TH HARM	Thirteenth Voltage Harmonic	%
48 BUS NEG-PHS-SEQ VOLT	Negative Phase Sequence Voltage	Amp*
49 BUS NEG-PHS-SEQ AMP	Negative Phase Sequence Current	Amp*

03 Status Mains Menu

An overview of the generator outputs.

Display Name	Item	Units
01 MAINS VOLT LINE-LINE	Average Volts L-L.	V*
02 MAINS VOLT LINE-NEUTRAL	Average Volts L-N	V*
03 MAINS AMPS	Average Amps	A*
04 MAINS VOLT-AMP	Total KVA reading.	VA*
05 MAINS WATT	Total kW readings	W*
06 MAINS VAR	Total kVAR reading.	VAR*
07 MAINS PWR-FACTOR	Average Power Factor; with +/- Lag or Lead	-
08 MAINS PF DIRECTION	Describes type of PF (LAG, LEAD)	
09 MAINS VA, PHS A	Phase A KVA reading	VA*
10 MAINS VA, PHS B	Phase B KVA reading	VA*
11 MAINS VA, PHS C	Phase C KVA reading	VA*
12 MAINS WATT, PHS A	Phase A kW readings	W*
13 MAINS WATT, PHS B	Phase B kW readings	W*
14 MAINS WATT, PHS C	Phase C kW readings	W*
15 MAINS VAR, PHS A	Phase A kVAR reading	VAR*
16 MAINS VAR, PHS B	Phase B kVAR reading	VAR*
17 MAINS VAR, PHS C	Phase C kVAR reading	VAR*
18 MAINS VOLT, PHS A	Phase A Volts reading	Volt*
19 MAINS VOLT, PHS B	Phase B Volts reading	Volt*
20 MAINS VOLT, PHS C	Phase C Volts reading	Volt*
21 MAINS AMP, PHS A	Phase A Amps reading	Amp*
22 MAINS AMP, PHS B	Phase B Amps reading	Amp*
23 MAINS AMP, PHS C	Phase C Amps reading	Amp*
24 MAINS PF PHS A	Phase A Power Factor reading	-
25 MAINS PF PHS A DIRECTION	Describes type of PF (LAG, LEAD)	
26 MAINS PF PHS B	Phase B Power Factor reading	-
27 MAINS PF PHS B DIRECTION	Describes type of PF (LAG, LEAD)	
28 MAINS PF PHS C	Phase C Power Factor reading	-
29 MAINS PF PHS C DIRECTION	Describes type of PF (LAG, LEAD)	
30 MAINS CURR, THD	Total Harmonic Distortion of the Current	%
31 MAINS CURR, 3RD HARM	Third Current Harmonic	%
32 MAINS CURR, 4TH HARM	Fourth Current Harmonic	%
33 MAINS CURR, 5TH HARM	Fifth Current Harmonic	%
34 MAINS CURR, 6TH HARM	Sixth Current Harmonic	%
35 MAINS CURR, 7TH HARM	Seventh Current Harmonic	%
36 MAINS CURR, 9TH HARM	Ninth Current Harmonic	%
37 MAINS CURR, 11TH HARM	Eleventh Current Harmonic	%
38 MAINS CURR, 13TH HARM	Thirteenth Current Harmonic	%
39 MAINS VOLT, THD	Total Harmonic Distortion of the Voltage	%
40 MAINS VOLT, 3RD HARM	Third Voltage Harmonic	%
41 MAINS VOLT, 4TH HARM	Fourth Voltage Harmonic	%
42 MAINS VOLT, 5TH HARM	Fifth Voltage Harmonic	%
43 MAINS VOLT, 6TH HARM	Sixth Voltage Harmonic	%
44 MAINS VOLT, 7TH HARM	Seventh Voltage Harmonic	%
45 MAINS VOLT, 9TH HARM	Ninth Voltage Harmonic	%
46 MAINS VOLT, 11TH HARM	Eleventh Voltage Harmonic	%
47 MAINS VOLT, 13TH HARM	Thirteenth Voltage Harmonic	%
48 MAINS NEG-PHS-SEQ VOLT	Negative Phase Sequence Voltage	Amp*
49 MAINS NEG-PHS-SEQ AMP	Negative Phase Sequence Current	Amp*

04 Status I/O Menu

The monitor menu for all inputs to the EGCP-3 and its outputs to the system.

Display Name	Item	Units
01 DI - IN 1 STATE	Input 1 Open or Closed	na
02 DI - IN 2 STATE	Input 2 Open or Closed	na
03 DI - IN 3 STATE	Input 3 Open or Closed	na
04 DI - IN 4 STATE	Input 4 Open or Closed	na
05 DI - IN 5 STATE	Input 5 Open or Closed	na
06 DI - IN 6 STATE	Input 6 Open or Closed	na
07 DI - IN 7 STATE	Input 7 Open or Closed	na
08 DI - IN 8 STATE	Input 8 Open or Closed	na
09 DI - IN 9 STATE	Input 9 Open or Closed	na
10 DI - IN 10 STATE	Input 10 Open or Closed	na
11 DI - IN 11 STATE	Input 11 Open or Closed	na
12 DI - IN 12 STATE	Input 12 Open or Closed	na
13 DI - IN 13 STATE	Input 13 Open or Closed	na
14 DI - IN 14 STATE	Input 14 Open or Closed	na
15 DI - IN 15 STATE	Input 15 Open or Closed	na
16 DI - IN 16 STATE	Input 16 Open or Closed	na
17 RELAY OUT 1 STATE	Output 1 is On or Off	na
18 RELAY OUT 2 STATE	Output 2 is On or Off	na
19 RELAY OUT 3 STATE	Output 3 is On or Off	na
20 RELAY OUT 4 STATE	Output 4 is On or Off	na
21 RELAY OUT 5 STATE	Output 5 is On or Off	na
22 RELAY OUT 6 STATE	Output 6 is On or Off	na
23 RELAY OUT 7 STATE	Output 7 is On or Off	na
24 RELAY OUT 8 STATE	Output 8 is On or Off	na
25 RELAY OUT 9 STATE	Output 9 is On or Off	na
26 RELAY OUT 10 STATE	Output 10 is On or Off	na
27 RELAY OUT 11 STATE	Output 11 is On or Off	na
28 RELAY OUT 12 STATE	Output 12 is On or Off	na
29 VOLT BIAS OUT %:	Voltage bias output of Synchronizer (no hardware out)	%
30 SPEED BIAS OUT %:	Speed bias output of Synchronizer (no hardware out).	%
31 LOAD REF:	load reference used in the Real Load Controller	W
32 LOAD MODE:	Load Control Mode of the Real Load controller	na
33 ANALOG OUT 1 MA:	Current being output at analog output 1	mA
34 ANALOG OUT 2 MA:	Current being output at analog output 2	mA
35 ANALOG OUT 3 MA:	Current being output at analog output 3	mA
36 ANALOG OUT 4 MA:	Current being output at analog output 4	mA
37 ANALOG IN 1 (V/MA)	Electrical units Input of Analog Input 1	V/mA
38 ANALOG IN 1 (EU):	Scaled units of Analog Input 1	EU
39 ANALOG IN 2(V/MA):	Electrical units Input of Analog Input 2	V/mA
40 ANALOG IN 2 (EU):	Scaled units of Analog Input 2	EU
41 ANALOG IN 3 (V/MA):	Electrical units Input of Analog Input 3	V/mA
42 ANALOG IN 3 (EU):	Scaled units of Analog Input 3	EU
43 ANALOG IN 4 (V/MA):	Electrical units Input of Analog Input 4	V/mA
44 ANALOG IN 4 (EU):	Scaled units of Analog Input 4	EU
45 COM 1 STATUS	Current status of communications port 1	
46 COM 2 STATUS	Current status of communications port 2	
47 COM 3 STATUS	Current status of communications port 3	
48 LON STATUS	Current status of LON communications	
49 GROUP BREAKER STATUS	If configured shows the status of the group breaker	
50 MAINS BREAKER STATUS	Breaker status (Closed, Open)	
51 TIE W CLOSED	Tie W Status (True=closed, False=open)	
52 TIE X CLOSED	Tie X Status (True=closed, False=open)	
53 TIE Y CLOSED	Tie Y Status (True=closed, False=open)	
54 TIE Z CLOSED	Tie Z Status (True=closed, False=open)	
55 BUS A ACTIVE	Bus A Status (True=Active, False=Not active)	
56 BUS B ACTIVE	Bus B Status (True=Active, False=Not active)	
57 BUS C ACTIVE	Bus C Status (True=Active, False=Not active)	
58 BUS D ACTIVE	Bus D Status (True=Active, False=Not active)	

05 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. This value is only correct when the EGCP-3 is actively synchronizing.	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 (--)	
07MAINS DEAD?	Indicates if the mains PT input is less than minimum	T/F
08 SYNCHRONIZER MODE	Displays the synchronizer's configured mode	
09 VOLT BIAS %:	Voltage Bias Output of the Synchronizer	%
10 SPEED BIAS %	Speed Bias Output of the Synchronizer	%
11 BUS AVG VOLTS	Average Voltage of the bus	V*
12 MAINS 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

06 Status KW Load Menu

An overview of the Real Load control.

Display Name	Item	Units
01 MAINS LOAD:	Mains real power output (1Ø or 3Ø sum)	W
02 LOAD REFERENCE ON:	True if using load reference and not in process	
03 LOAD REFERENCE:	The load reference for the MC	W
04 MAINS (MC) DEMAND:	Demand level for this MC	VA
05 MAX (MC) DEMAND	Maximum demand level on this MC	VA
06 MAX (MC) DEMAND UNITS	Units of maximum demand level on this MC	_,K,M,G
07 TIME MAX DMD OCCURRED:	Time of maximum demand on this MC	
08 TOTAL MAINS DEMAND	Total demand for all MC on active bus segment	VA
09 TOTAL MAINS MAX DEMAND	Maximum demand level read by this MC for all MCs on the active bus segment	VA
10 TOTAL MNS MAX DMD UNITS	Units of maximum total demand read by this MC	_,K,M,G
11 TIME TOT MNS MAX	Time of maximum total demand read by this MC	
12 PROCESS ACTUAL IN %:	The actual process level as seen by the EGCP-3	%
13 PROCESS REFERENCE %:	The process reference for the process control	%
14 LOAD MODE:	The current load control mode in operation	na
15 LOAD STATE:	The state of the load controller	na
16 KVA SWITCH:	Status of the KVA level switch	T/F
17 DEMAND TIMER ENABLE	True if Demand timer has started counting	
18 DEMAND TIMER (SEC):	Seconds left before a demand start occurs	Sec
19 NEXT PROGRAMMED START DAY	Day of next start	
20 NEXT PROGRAMMED START HR	Hour of next start	
21 NEXT PROGRAMMED START MIN	Minute of next start	
22 LOAD REFERENCE	Load command sent over LON	W
23 LOAD REFERENCE UNITS	Unit of load reference above	_,k,M,G
24 LOAD REFERENCE (%)	Load command sent over LON	%
25 SYSTEM LOAD	System load on LON	W

Display Name	Item	Units
26 SYSTEM LOAD UNITS	Units of system load above	_,k,M,G
27 SYSTEM LOAD (%)	System load sent over LON	
28 LOAD SHED 1 ENABLED	True if a digital input is configured for load shed 1	
29 LOAD SHED 1	True if load shed DO has been instigated	
30 LOAD SHED 2 ENABLED	True if a digital input is configured for load shed 2	
31 LOAD SHED 2	True if load shed DO has been instigated	
32 LOAD SHED 3 ENABLED	True if a digital input is configured for load shed 3	
33 LOAD SHED 3	True if load shed DO has been instigated	
34 GEN LOAD:	Actual load being supplied by LS gensets	W
35 GEN LOAD UNITS	Units of above	_,k,M,G
36 BUS LOAD:	Actual load sensed on the bus	W
37 BUS LOAD UNITS	Units of above	_,k,M,G
38 MAINS (MC) LOAD:	Actual load sensed on the mains	W
39 MAINS (MC) LOAD UNITS	Units of above	_,k,M,G
40 TOTAL MAINS LOAD:	Actual load sensed on all mains on active bus segment	VA
41 TOTAL MAINS LOAD UNITS	Units of above	_,k,M,G
42 ONLINE CAPACITY	Capacity of all LS units with their breaker closed	W
43 ONLINE CAPACITY UNITS	Units of above	_,k,M,G
44 ONLINE GEN UNITS	LS units with their breakers closed	
45 OFFLINE GEN UNITS	LS units with their breakers opened	

07 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 PF REF:	The PF control reference value. Shows --- if PF control is not used	na
04 PF REF DIRECTION:	Direction of PF (LAG, LEAD)	
05 VAR REF:	The VAR control reference value. Shows --- if VAR control is not used	VAR*
06 BUS PF:	The average three phase PF of the bus	-
07 BUS PF DIRECTION:	Direction of PF (LAG, LEAD)	-
08 MAINS PF:	The average three phase PF of the mains	-
09 MAINS PF DIRECTION:	Direction of PF (LAG, LEAD)	-
10 BUS VAR:	The total VAR reading for the bus.	VAR*
11 MAINS VAR:	The total VAR reading for the mains	VAR*
12 PF COMMAND:	Power factor command sent to LON	

08 Status Sequencing Menu

Below is the monitoring menu of the functions and operation of the MC sequencer.

Display Name	Item
01 UNIT NUMBER	Network Address of this unit
02 SEQUENCE STATE	Indicates the availability of the genset: Ready, LON Alarm, Off
03 MAINS BREAKER STATUS	The status of the mains breaker as determined by the mains CB aux discrete input.
04 GROUP BREAKER STATUS	The status of the group breaker as determined by the group CB aux discrete input.
05 BUS "A" ACTIVE	True if Bus A is part of the active bus
06 BUS "B" ACTIVE	True if Bus B is part of the active bus
07 BUS "C" ACTIVE	True if Bus C is part of the active bus
08 BUS "D" ACTIVE	True if Bus D is part of the active bus
09 NEXT ON ALL	True if the MC is sending an ALL START to the LON
10 NEXT ON	Unit Number of next unit to be sequenced onto the network
11 NEXT OFF ALL	True if the MC is sending an ALL STOP to the LON
12 NEXT OFF	Unit Number of next unit to be sequenced off the network
13 UNITS ON LOAD	Total number of units with their breakers closed
14 SEGMENT UNITS	Number of units on the active bus segment
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 LOADSHARE UNITS	Number of load share units on the active bus.
18 NET UNITS	Number of units communicating on the LON network

09 Status ATS Menu

Below is the monitoring menu of the functions and operation of the MC ATS.

Display Name	Item
01 MAINS	Visual description of mains stability
02 BUS	Visual description of bus stability
03 MAINS BREAKER:	Status of mains breaker
04 GROUP BREAKER	Status of group breaker
05 SYNCHRONIZER:	Mode of synchronizer
06 MAINS DEAD:	True if mains is currently a deadbus
07 TOTAL DELAY:	Total delay before and system is to be supplied by mains or isolated bus
08 ATS MODE:	Mode of ATS
09 ATS STATE:	State of ATS
10 GROUP TIMER:	Time after bus is stable that group will be closed
11 MAINS TIMER:	Time after mains is stable that mains will be closed
12 LOM TIMER:	Time after LOM is sensed that action will occur
13 FAST TIMER:	Time in the transition state of the ATS
14 TRANSFER CAPACITY	Amount of capacity needed on the bus before a transition will occur
15 ONLINE CAPACITY	Capacity of units on the active bus segment with their breaker closed

10 Status Alarms Menu

A monitor of the alarm condition of the MC Control.

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 AUDIBLE ALARM ACTIVE	Active or un-cleared Audible alarm(s) exist	-
04 STOP ALL ENGINES ACTIVE	True if there is an active Stop All Engines alarm	-
05 TRIP MAINS BREAKER ACTIVE	True if there is an active Trip Mains Breaker alarm	-
06 ALARM EVENT _#1	Description of the alarm that occurred first	-
07 TIME OF EVENT #1	Date and Time of the first alarm	Y/M/D H:M:S
08 ALARM EVENT _#2	Description of the alarm that occurred second	-
09 TIME OF EVENT #2	Date and Time of the second alarm	Y/M/D H:M:S
10 ALARM EVENT _#3	Description of the alarm that occurred third	-
11 TIME OF EVENT #3	Date and Time of the third alarm	Y/M/D H:M:S
12 ALARM EVENT _#4	Description of the alarm that occurred fourth	-
13 TIME OF EVENT #4	Date and Time of the fourth alarm	Y/M/D H:M:S
14 ALARM EVENT _#5	Description of the alarm that occurred fifth	-
15 TIME OF EVENT #5	Date and Time of the fifth alarm	Y/M/D H:M:S

11 Status Metering Menu

A monitor of the Mains Power Meter outputs.

Display Name	Item	Units
01 MAINS IMPORT W-HRS	Total Watt-Hours Meter of Mains Import	
02 MAINS IMPORT W_UNITS	Units (KW, MW, GW) of the total W-Hr number above	
03 MAINS IMPORT W_H	000 000 000 **000.00** Hundred portion of the W-Hr	
04 MAINS IMPORT W_K	000 000 **000** 000.00 Thousands portion of the W-Hr	
05 MAINS IMPORT W_M	000 **000**,000,000.00 Mega portion of the W-Hr	
06 MAINS IMPORT W_G	**000,**000,000,000.00 Giga portion of the W-hr	
07 MAINS EXPORT W_HRS	Total Watt-Hours Meter of Mains Export	
08 MAINS EXPORT W_UNITS	Units (KW, MW, GW) of the total W-Hr number above	
09 MAINS EXPORT W_H	000 000 000 **000.00** Hundred portion of the W-Hr	
10 MAINS EXPORT W_K	000 000 **000** 000.00 Thousands portion of the W-Hr	
11 MAINS EXPORT W_M	000 **000**,000,000.00 Mega portion of the W-Hr	
12 MAINS EXPORT W_G	**000,**000,000,000.00 Giga portion of the W-hr	
13 MAINS IMPORT VA_HRS	Total VA Hours Meter of Mains Import	
14 MAINS IMPORT VA_UNITS	Units (KVA, MVA, GVA) of the total VA-Hr number above	
15 MAINS IMPORT VA_H	000 000 000 **000.00** Hundred portion of the VA-Hr	
16 MAINS IMPORT VA_K	000 000 **000** 000.00 Thousands portion of the VA-Hr	
17 MAINS IMPORT VA_M	000 **000**,000,000.00 Mega portion of the VA-Hr	
18 MAINS IMPORT VA_G	**000,**000,000,000.00 Giga portion of the VA-hr	
19 MAINS EXPORT VA_HRS	Total VA Hours Meter of Mains Export	
20 MAINS EXPORT VA_UNITS	Units (KVA, MVA, GVA) of the total VA-Hr number above	
21 MAINS EXPORT VA_H	000 000 000 **000.00** Hundred portion of the VA-Hr	
22 MAINS EXPORT VA_K	000 000 **000** 000.00 Thousands portion of the VA-Hr	
23 MAINS EXPORT VA_M	000 **000**,000,000.00 Mega portion of the VA hr	
24 MAINS EXPORT VA_G	**000,**000,000,000.00 Giga portion of the VA-hr	
25 MAINS IMPORT VAR_HRS	Total VAR Hours Meter of Mains Import	
26 MAINS IMPORT VAR_UNITS	Units (KVAR, MVAR, GVAR) of the total VAR-Hr number above	

Display Name	Item	Units
27 MAINS IMPORT VAR_H	000 000 000 **000.00** Hundred portion of the VAR-Hr	
28 MAINS IMPORT VAR_K	000 000 **000** 000.00 Thousands portion of the VAR-Hr	
29 MAINS IMPORT VAR_M	000 **000**,000,000.00 Mega portion of the VAR-Hr	
30 MAINS IMPORT VAR_G	**000,**000,000,000.00 Giga portion of the VAR-hr	
31 MAINS EXPORT VAR_HRS	Total VAR Hours Meter of Mains Export	
32 MAINS EXPORT VAR_UNITS	Units (KVAR, MVAR, GVAR) of the total VAR-Hr number above	
33 MAINS EXPORT VAR_H	000 000 000 **000.00** Hundred portion of the VAR-Hr	
34 MAINS EXPORT VAR_K	000 000 **000** 000.00 Thousands portion of the VAR-Hr	
35 MAINS EXPORT VAR_M	000 **000**,000,000.00 Mega portion of the VAR-Hr	
36 MAINS EXPORT VAR_G	**000,**000,000,000.00 Giga portion of the VAR-hr	

Chapter 5.
Startup Checkout Procedures

Before Starting

Before initiating MC control of one or several LS units, configuration of the control for values that best match the operating and performance characteristics is required. Double-check these values prior to starting the unit and verify mechanical connections to the MC. The list below details several inputs that should be verified before operation:

Refer to the Installation Manual #26122 for wire terminal location and terminal numbers.

1. Check for correct wiring. Take note of polarity, signal type, terminal connection, grounding, and shielding as shown in the Installation Manual.
    1. Power Supply Input
    2. Mains PT Inputs
    3. Mains CT Inputs
    4. Bus PT Inputs
    5. Bus CT Inputs
    6. Control Switch Inputs (Run, Test, Auto)
2. Check for broken terminals and loose terminal screws.
3. Check for shield faults by measuring the resistance from control terminals to chassis. If a resistance less than infinite is obtained, remove the connections from each terminal one at a time until the resistance is infinite. Check the line that was last removed to locate the fault.

Once these items have been checked, check the power supply voltage for proper amplitude. When this is confirmed, apply the power supply to the EGCP-3.

When the EGCP-3 is given power, it will go through RAM test and self-test. After a self-check period, the System Status Menu will be displayed. If the EGCP-3 fails to power up properly, remove the power supply input and double check the polarity and amplitude of the voltage feeding the EGCP-3.

⚠WARNING

When operating the discrete inputs certain outputs may be activated. Make sure that the various breakers are locked out and that the LON communication disconnected to prevent an inadvertent start or breaker close.

Verify that the transducer and other analog input signal levels are at the proper levels with respect to a measured or known input. The I/O Status screen #2 displays the analog inputs in volt or mA and in the configured parameter units.

⚠WARNING

The start procedures and tests listed here are only a general guide. ALL site safety procedures take precedent over the steps given here.

Configuration Menu

Enter the First Time Configuration menu as described in Chapter 3. Enter the following set points to their appropriate value for the Bus and the Mains.

1. Potential Transformer Ratio
2. Current Transformer Ratio
3. Sensing Type
4. Hardware Range
5. Rated Voltage
6. PT Configuration
7. Breaker Type (If there is no group breaker, leave at default)

Additionally input the following system parameters:

1. System Frequency
2. System Phase Rotation
3. Network Address
4. Bus Segment

Enter the Digital Inputs and Digital Outputs menus and configure the MC to your preferences of digital inputs/outputs for your system configuration.

Once the set points are entered, the MC must be reset.
To reset via Watch Window go to the CONTROL menu and select RESET.

To reset via the front panel exit the configuration menu by pressing status. The right LCD screen will now read:

CAUTION! CHANGES ARE
APPLIED UPON REQUEST
<ENTER> = RESET
<ESC> = CONTINUE

Press ENTER and the control will reset and enter the configurables into memory.

Refer to “I/O Status Screens” section of Chapter 2. With the EGCP-3 powered, go to the I/O Status screen #1 in the Status menus. This display shows the state of the discrete inputs and outputs of the control. Monitor this screen and close each discrete input to the EGCP-3 that is being used in this particular application. Verify that the EGCP-3 recognizes these inputs in the I/O Status screen.

Once the First Time Configuration menu has been set up, the values saved to memory the remaining configuration menus can be set up.

LON Status

Verify all DIGITAL INPUTS are NOT asserted and connect the LON communication into terminals 45,46 and 47 on the PowerSense board. Enter the I/O status screen by the front panel and go to screen 3 or simply go to the I/O service menu in WW. Verify that the LON Status is NORMAL.

If the display gives an ALARM at least one problem exists. Possibilities are (1) Two units have the same UNIT NUMBER; (2) Two LS units have different Start/Stop Arbitration Algorithms (Run Time Manager). The problems can be diagnosed by using WW.

WARNING

The LON Status alarm will only diagnose problems with other EGCP-3s. If the MC and another unit have the same unit number, the MC will not be able to interpret an alarm condition. This is solved by looking at several units to verify that no units have the LON status alarm.

To diagnose a LON Status Alarm use the following procedure:

1. Open a Watch Window
2. Enter the SERVICE menus and open U LON MESSAGING
3. Bring the following variables to the current Inspector
   - 56 LON OUT – ERR FLAG
   - 57 LON OUT – ERR NUM

The ERR FLAG shows that there is an alarm on the LON network. The ERR NUM diagnoses the problem seen by this MC.

If the ERR NUM equals 1-16 then there are two units on the network with that unit number on the LON network. Find the two units and change one of the unit numbers

If the ERR NUM equals 261 then two LS's have different Run Time Manager configurations. All of these algorithms must match.

Once the LON STATUS shows NORMAL on all EGCP-3's, move on to the next section.

Mains Parallel Setup

Follow these steps to configure the MC for Mains Parallel operation.

1. With all Digital Inputs OFF verify the mains voltage. If calibration is needed use the method diagramed in Chapter 6-AC Voltage Inputs.
2. Manually close Mains breaker.
3. If you have a group breaker manually close it as well
4. Verify bus readings for voltage. If needed use calibration as in step one
5. Verify phase rotation by removing B and C phase fuses and check to see that the mains and bus PTs are reading the same voltage on phase A. Repeat procedure with B and C PTs.
6. Open mains breaker
7. Enter the Synchronizer configuration menu
8. Set Synchronizer Mode to Check.
9. On the Sync screen, verify the Mains Input shows a ++ reading indicating the voltage and frequency are within specification.

WARNING

Before proceeding to the next step, verify proper isolated operation with a single or multiple LS units. All LS units should be configured before configuring the MC.

10. Start an LS unit by asserting both AUTO and RUN w/LOAD digital inputs.
    - Unit will start and synchronize to the bus.
    - If you have a group breaker and it is not already closed close it now manually.

11. Put the MC into run with load by asserting the AUTO and RUN w/LOAD digital inputs. The MC should not attempt to synchronize the mains breaker but will not close it.
12. Adjust Synchronizer proportional Gain and Integral Gain for best control (monitor sync status menu and synchroscope to see phase and slip errors).
13. Use voltmeter to check voltage across mains breaker to assure proper voltage matching.
14. Use phase rotation meter on mains and bus inputs to verify correct wiring.
15. Set Load/Unload Ramp Times to at least 60 seconds in the Real Load Control menu.
16. Set BaseLoad Reference to 30% in the Real Load Control menu.
17. Set Synchronizer Mode to Run.
18. Monitor synchroscope status menu. Verify action of synchronizer.
19. After main breaker closes to the bus, monitor KW LOAD Status menu 3 and 4:
    - Monitor Load Reference and System Load.
        a. System load should be attempting to match load reference
    - Monitor Gen Load, Bus Load and Mains Load
        a. Note: If Bus or Mains is not configured for 3-phase sensing then the above values will not match
        b. If no plant load is available all of the above loads will match
20. Adjust the load on the LS unit by using the Load Raise and Load Lower inputs. Set Load Raise/Lower rates if needed.

IMPORTANT **If using a Process input, Set Process Reference to logical level. If using Import/Export control set Import/Export KW, PF and VAR to logical levels.**

21. Once satisfied with load control operation, switch to process control (if applicable) by closing the Process Enable input.
22. Confirm ramp to process reference level. Adjust Process Gain, Integral, Derivative, and Deadband for best response.
23. Return to BaseLoad control, by opening the Process input.
24. Set VAR/PF mode to VAR or PF control.
25. Set VAR or PF reference to a logical value that will not overload the LS unit (i.e. 10kVAR, 0.95LAG).
26. Switch to VAR/PF control by asserting the digital input or using the automatic feature.
27. Monitor the VAR/PF screen adjust VAR/PF Gain and Integral for stable reactive load control.
28. Remove RUN w/LOAD input to LS unit.
29. Remove RUN w/LOAD input to MC unit
    - Verify unload ramping.
    - Verify LS's breaker opens.
    - Verify MC opens group breaker (if applicable)
30. Set BaseLoad Reference, Process Reference, Load Ramp Times, and Load Control Mode as required for proper operation.
31. Configure next MC unit (if applicable).
32. Move to Application Overview for system operation

Chapter 6.
Calibration Procedures

Factory Calibrations

All analog I/O is factory calibrated to accuracy levels described in the EGCP-3 Installation Manual. This calibration is not accessible to a user and should never need to be changed.

AC Voltage Inputs

AC Voltage inputs are calibrated based on the selected hardware PT input level (70, 120, 240). Therefore, for accurate readings, it is important to select the correct hardware input level.

When a potential transformer is used between the EGCP-3 and the generator or mains bus, the transformer will certainly be less accurate than the EGCP-3. The most common inaccuracy in a properly sized transformer is a turns ratio error. When multiple transformers are used, such as one per phase, the turns ratio error is often not the same for each transformer even when purchased from the same company.

The EGCP-3 allows the user to correct for this error on each phase independently. The correction factors may be found in the CALIBRATION menu as VOLTAGE SCALE Factors. If a phase is reading low, increase the correction to compensate for a low voltage reading. If a phase is reading high, decrease the correction. Using Watch Window and an accurate probe the phase voltages can be tuned so that precise values are seen. It is important that the equipment used to compare readings with the EGCP-3 be at least as accurate as the EGCP-3 itself. A Fluke 87 type meter is generally NOT as accurate and hence does not make for a very good comparison.

AC Current Inputs

AC Current inputs are calibrated at 5 A. Therefore, for accurate readings, CTs should be sized to provide nearly 5 A at full load. 1A CTs are not recommended for use with the EGCP-3.

The current transformers will certainly be less accurate than the EGCP-3 across the full range. The most common inaccuracy in a properly sized transformer is a turns ratio error. The EGCP-3 allows the user to correct for this error on each phase independently. The correction factors may be found in the CALIBRATION menu as CURRENT SCALE Factors. If the EGCP-3 is reading a low current value, increase the correction to compensate for a low current reading. If the EGCP-3 is reading a high current value, decrease the correction. Using Watch Window and an accurate probe the phase currents can be tuned so that precise values are seen. It is important that the equipment used to compare readings with the EGCP-3 be at least as accurate as the EGCP-3 itself. A Fluke 87 type meter with a clamp on current probe is generally NOT as accurate and hence does not make for a very good comparison.

Analog Inputs

The four analog inputs are factory calibrated in both the 4–20 mA current mode and the 1–5 Vdc voltage mode. For this reason, it is very important to select the appropriate mode when configuring the inputs.

Although the inputs are accurate, they must be scaled to the device being connected to the input. This scaling is referred to as calibration in this manual. The configuration settings are found in the ANALOG INPUT Menu and are called a Low Calibration Value and a High Calibration Value.

The Low Calibration value should be configured to a number represented by 4 mA or 1Vdc depending on the type of input used. As an example, for a temperature sensor input, if the output of the transducer is 4 mA when the temperature measured is 0°C, then the Low Calibration value should be configured for 0.

The High Calibration value should be configured to a number represented by 20 mA or 5 Vdc depending on the type of input used. As an example, for a temperature sensor input, if the output of the transducer is 20 mA when the temperature measured is 200°C, then the High Calibration value should be configured for 200.

The EGCP-3 will interpolate the analog input using a linear interpolation between and beyond the two calibration points.

Analog Outputs

The four analog outputs are factory calibrated at 4 mA and 20 mA. Although the outputs are accurate, they must be scaled to the device being connected to the output. This scaling is referred to as calibration in this manual. The configuration settings are found in the ANALOG OUTPUT Menu and are called a Low Calibration Value and a High Calibration Value.

The Low Calibration value should be configured to a number represented by 4 mA. As an example, consider the case of a kW panel meter connected to Analog Output #1. If the meter expects 4 mA when the kW should indicate 0 kW, then the Low Calibration value should be configured for 0.
The High Calibration value should be configured to a number represented by 20 mA. Continuing with the example above, If the meter expects 20 mA when the kW should indicate 1500 kW, then the High Calibration value should be configured for 1500.

The EGCP-3 will interpolate the mA level to provide using a linear interpolation between and beyond the two calibration points.

Chapter 7.
Mode Control Switch

Introduction

The mode control switch is defined as the three (3) switch inputs labeled, Test, Run w/ Load, and Auto. The Process Enable and VAR/PF enable switch input also affect the final mode but does not affect starting conditions. As long as the physical Auto switch is closed (asserted), the mode switch "inputs" can also be received via a communication link such as MODBUS or ServLink/WW. In the case of communication link usage, all three switch "Enable" and switch "Disable" positions should be sent together as a precaution.

In the tables below, the following key applies:

1—denotes connection made, On (+V applied to input)

0—denotes input point floating, Off

Test	Run	Auto	Control
0	0	0	Off, no control action will be performed
1	0	0	Off, no control action will be performed
0	1	0	Off, no control action will be performed
1	0	1	Test ATS condition. See Chapter 16 for detailed information
0	1	1	All units will be started and MC will perform BaseLoad or Process. See Chapter 11 for baseload operation and Chapter 13 for process operation
0	0	1	Auto- LOM and all alarms will be active
1	1	0	Off - Not Valid
1	1	1	Initiate ATS condition. See Chapter 17 for detailed information

Auto Mode

If the Auto Input is asserted, then a different mode will be selected depending on the state of the Test Input, Run Input, Process Enable Input, or bus/mains condition. In all cases, the Auto Input must be asserted for automatic breaker operation to be engaged. If neither the Test or Run inputs are asserted, the control will assume any mode command provided from MODBUS or ServLink communication links.

Process Mode

If the Process Enable digital input is asserted with the Auto and Run w/ Load input the MC will control all LS's on the active bus segment that are in parallel with the mains at its process setpoints. For detailed information about the process mode, see Chapter 13.

VAR/PF Mode

If the VAR/PF Enable digital input is asserted or the VAR/PF automatic enable is on (See Reactive Load control menu) together with the Auto and Run w/ Load input the MC will control all LS's on the active bus segment that are in parallel with the mains at its VAR/PF setpoints. For detailed information about the VAR/PF mode, see Chapter 12.

Chapter 8.
Application Overview

In this chapter, block diagrams of the control functions are shown to give the basic signal flow and control methods.

Alarm Logic

The alarm and event logic within the EGCP-3 can be simplified to the below flowchart. The flowchart also indicates how events can be reset and cleared.

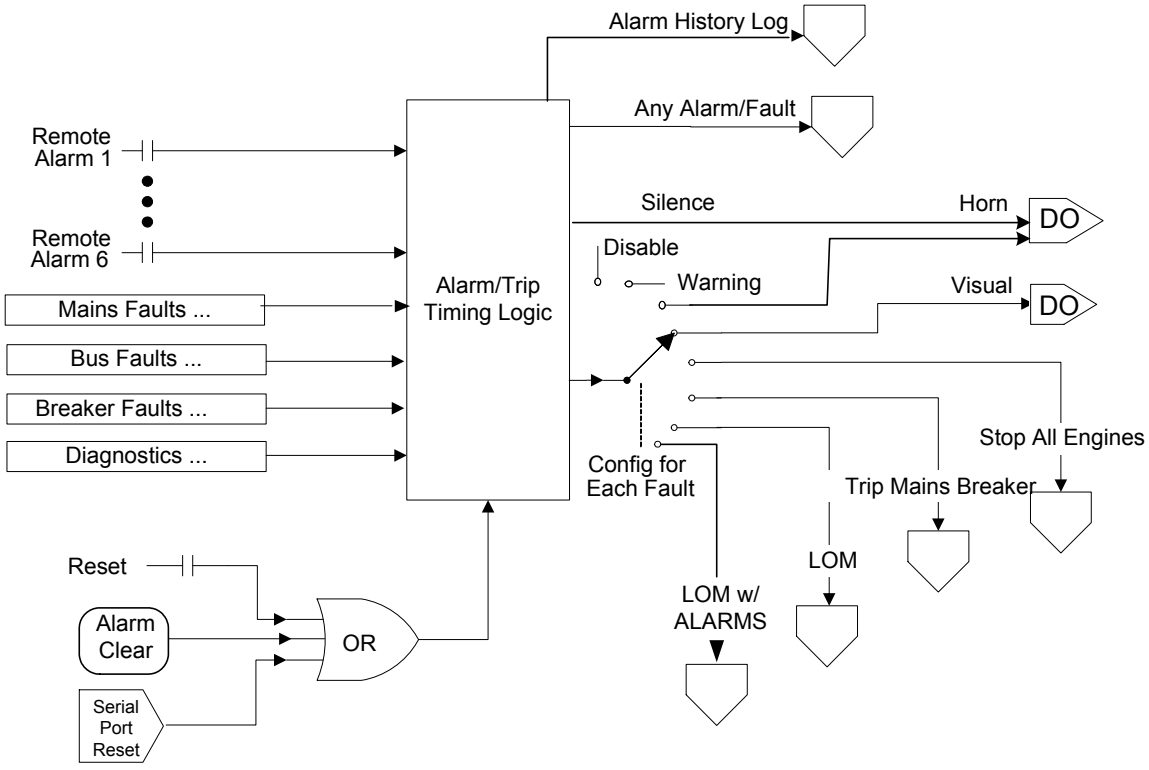


Figure 8-1. Alarm Logic Block Diagram

Synchronizer

The synchronizer controls the Send Sync, Voltage Raise/Lower and the Speed Bias to the LON network. It is only active when attempting to synchronize a breaker.

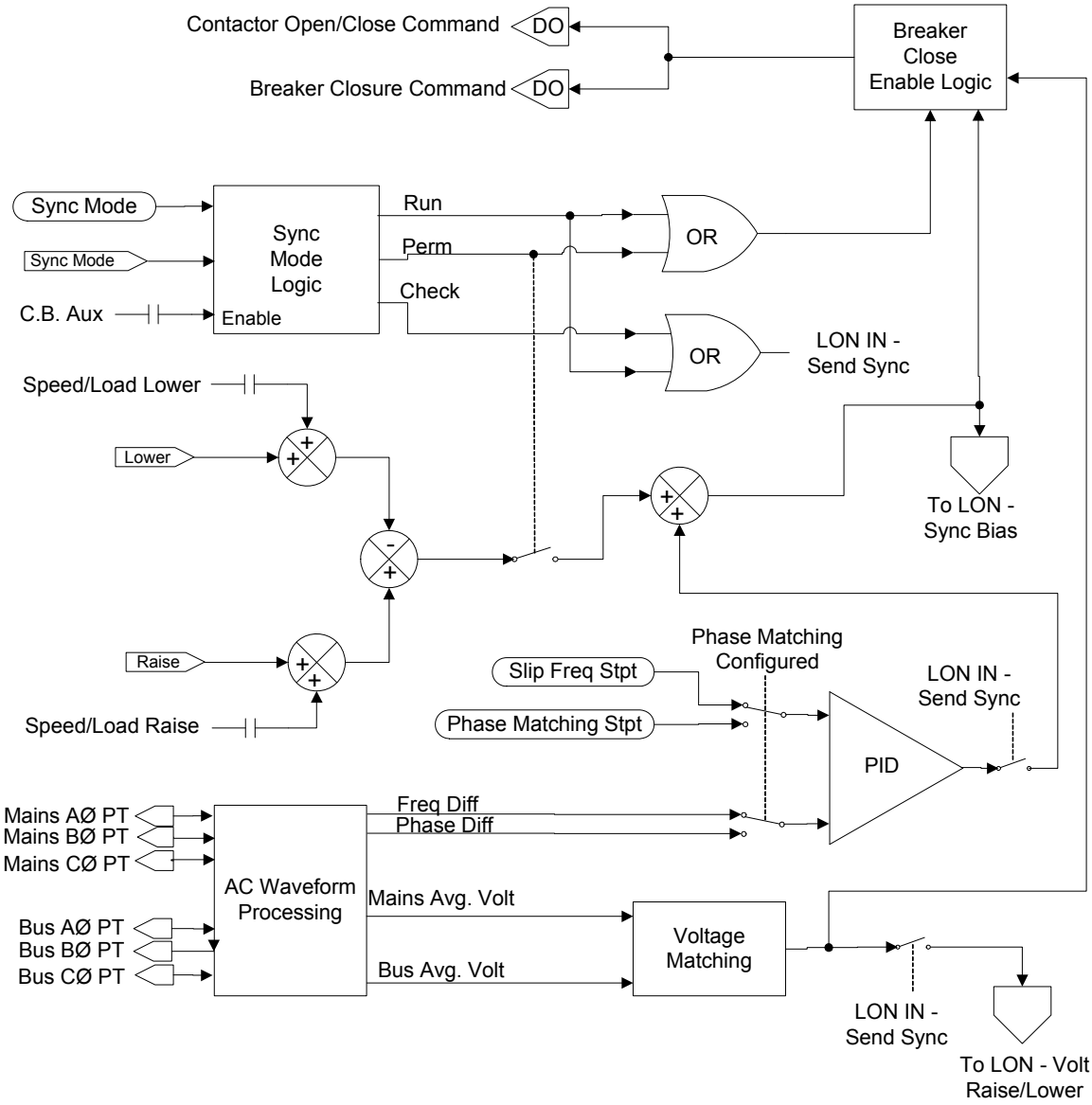


Figure 8-2. Synchronizer Block Diagram

Real Load Controller

The load controller controls the Load Command sent to all LS units over the LON network. No synchronizing functionality is performed by the Load Command, that function is left to the Sync Bias into the LON. The controller is only actively controlling the load if the MC is the Master in Control of the active bus segment. If the MC is not currently in control then this ramp will track the load on the LS units, which creates smooth transitions from isolated to parallel operation.

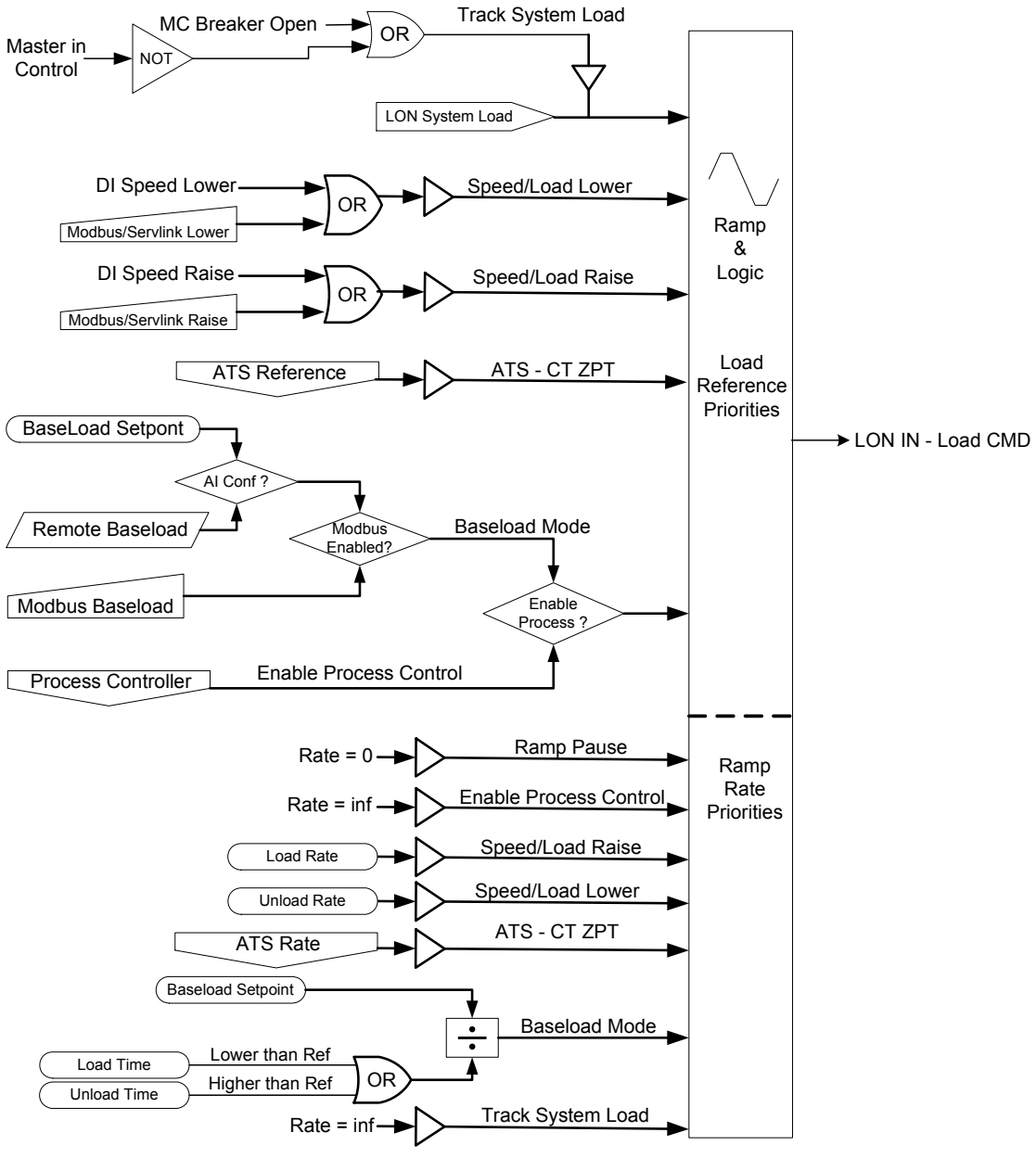


Figure 8-3. Load Control Block Diagram

Reactive Load Controller

The reactive load controller controls the voltage bias output and therefore, it controls reactive load only. The synchronizer works through the reactive load controller in order to get to the voltage bias output so that they do not fight over control of the output.

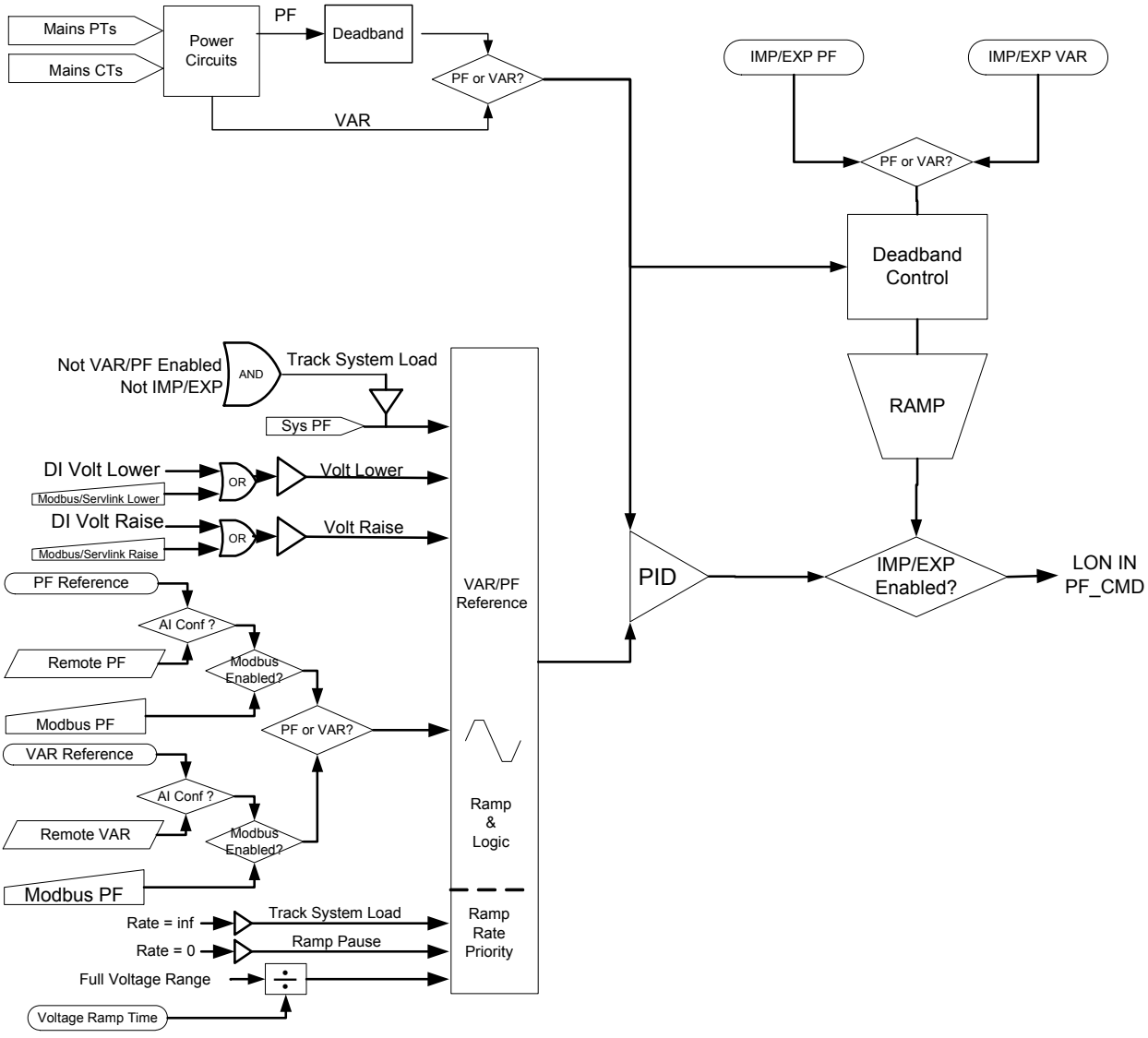


Figure 8-4. VAR / Power Factor Control Block Diagram

Process Controller

The process controller controls the real and reactive loads using the Real and Reactive Load Controllers. The output of the process controller is an input to the load controllers.

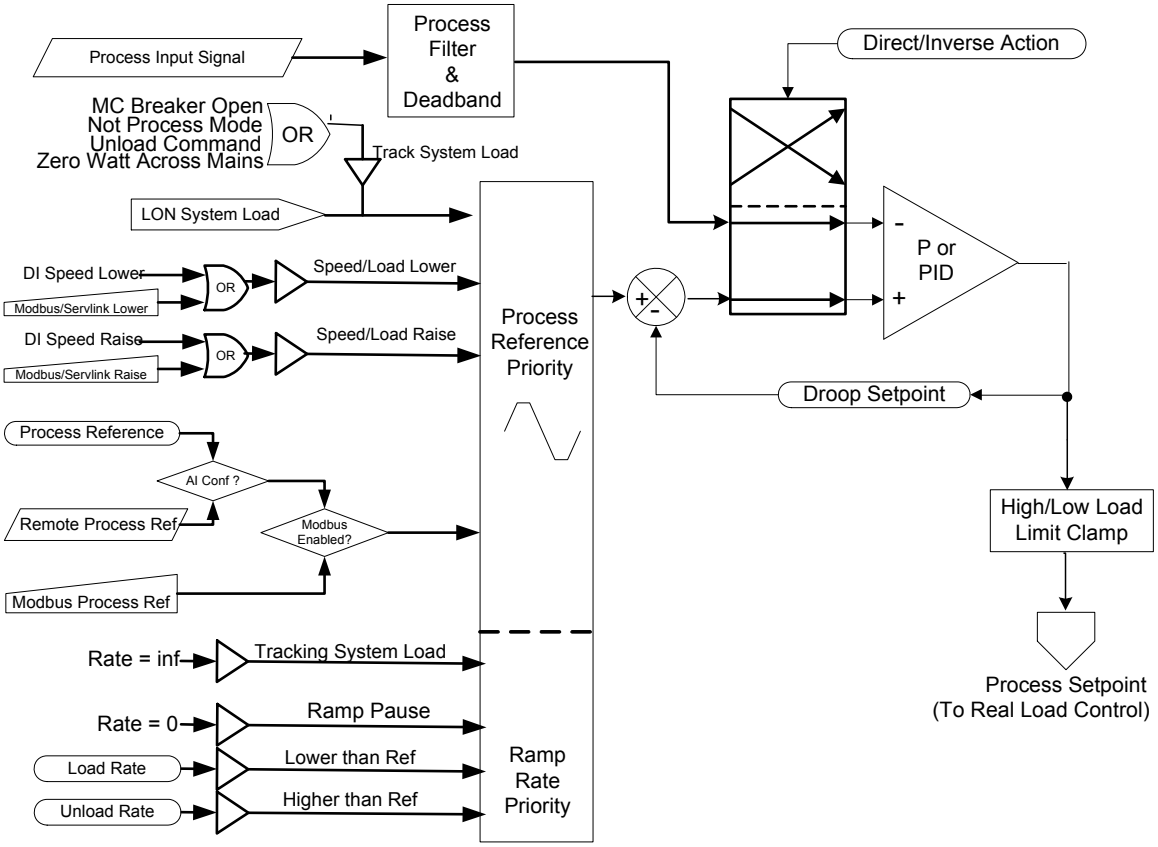


Figure 8-5. Process Control Block Diagram

Chapter 9.
Alarms, Protective Relay, and Diagnostic Summary

Introduction

All Alarms can be configured to perform a specific action when detected. The complete lists 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 EGCP-3 will not look for the alarm condition. No alarm will be logged, sent over a communication link, or shown on the display.

Warning
When the EGCP-3 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 EGCP-3 detects the event/alarm condition, the alarm will be added to the current event list and the alarm history log. 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 EGCP-3 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. Pressing the Alarm Clear Key once will turn off the Alarm Horn output. Alternatively, momentarily asserting the Reset Alarm/Fault discrete input (if configured) will also 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.

Stop All Engines
When the EGCP-3 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 Stop All Engines alarm condition, the output will be asserted. The communication links will indicate a Stop All Engines alarm condition exists. All LS unit(s) that are stop ready will be told to unload, open the generator breaker, cool down (if conditions met) and stop. They will remain stopped and not restart unless all configured shutdown alarms are cleared.

Trip Mains Breaker
When the EGCP-3 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 Trip Mains Breaker alarm condition, the output will be asserted. The communication links will indicate a Trip Mains Breaker alarm condition exists. The Mains Shunt Trip will immediately open the Mains Breaker and isolated operation will be asserted to the LS units. Units will start or change Load control mode depending on the Mode Switch status, and unit configuration. If genset starting occurs, the operation mode would be isolated operation. It will remain in this mode and not allow mains paralleling until all configured trip mains breaker alarms are cleared.

Loss of Mains (LOM)
When the EGCP-3 detects the event/alarm condition a discrete output is configured to indicate a LOM condition, the output will be asserted. The Modbus and LON communication links will indicate a loss of mains condition exists. The EGCP-3 will immediately open the mains breaker (if not already open), a start command for the genset(s) will be issued, and depending on the configured conditions and priorities the engine will start and assume the load. When the mains condition is determined to be stable the MC control will perform the selected ATS function and the LS controls and gensets will assume their configured operation, parallel operation mode, or shutdown. This alarm action would be selected in application where a loss of mains is not an alarm condition and does not need to be added to the alarm log, or reset to clear an alarm indication.

Loss of Mains w/ Alarm
When the EGCP-3 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 LOM condition, the output will be asserted. The Modbus and LON communication links will indicate a loss of mains condition exists. The EGCP-3 will immediately open the mains breaker (if not already open), a start command for the genset(s) will be issued, and depending on the configured conditions and priorities the engine will start and assume the load. When the mains condition is determined to be stable the MC control will perform the selected ATS function and the LS controls and gensets will assume their configured operation, parallel operation mode, or shutdown.

Alarm List

The following table is a list of all alarms generated by the EGCP-3 MC. The Modbus ID is the Boolean Read address where the status of the named alarm can be determined via Modbus. Missing alarm numbers are not available in this control.

Alm #	Event Name	Display Name	Modbus ID
1	Battery Volt High Alarm	BATTERY VOLTAGE HIGH	10048
2	Battery Volt Low Alarm	BATTERY VOLTAGE LOW	10047
9	EPS Supplying Load	EPS SUPPLYING LOAD	10079
13	Group Breaker Feedback Error	GRP BKR FEEDBACK ERR	10157
14	Group Breaker Shunt Trip Error	GRP BKR SHUNT TRIP ERR	10155
15	Bus Neg. Phase Sequence Over Current Alarm	BUS NEG PHS OVR CURR	10095
16	Bus Neg. Phase Sequence Over Current Pre-Alarm	PRE BUS NPHS OVR CUR	10096
17	Bus Neg. Phase Sequence Over Voltage Alarm	BUS NEG PHS OVR VOLT	10097
18	Bus Neg. Phase Sequence Over Voltage Pre-Alarm	PRE BUS NPHS OVR VLT	10098
19	Bus Over Freq Alarm	BUS OVER FREQUENCY	10051
20	Bus Over Freq Pre-Alarm	PRE BUS OVER FREQ	10084
21	Bus Under Freq Alarm	BUS UNDER FREQUENCY	10052
22	Bus Under Freq Pre-Alarm	PRE BUS UNDER FREQ	10085
23	Bus Over Volt Alarm	BUS OVER VOLTAGE	10050
24	Bus Over Volt Pre-Alarm	PRE BUS OVER VOLTAGE	10083
25	Bus Under Volt Alarm	BUS UNDER VOLTAGE	10049
26	Bus Under Volt Pre-Alarm	PRE BUS UNDER VOLT	10082
27	Bus Over Power Alarm	BUS OVER POWER	10087
28	Bus Over Power Pre-Alarm	PRE BUS OVER POWER	10088
29	Bus Reverse Power Alarm	BUS REVERSE POWER	10040
30	Bus Reverse Power Pre-Alarm	PRE BUS REVERSE POWR	10086
31	Bus Over VAR Alarm	BUS OVER VARs	10090
32	Bus Over VAR Pre-Alarm	PRE BUS OVER VARs	10091
33	Bus Reverse VAR Alarm	BUS REVERSE VARs	10041
34	Bus Reverse VAR Pre-Alarm	PRE BUS REVERSE VARs	10089
35	Bus Phase Current Differential Alarm	BUS PHASE DIFF CURR	10093
36	Bus Phase Current Differential Pre-Alarm	PRE BUS PHS DIFF CUR	10094
37	Bus Phase Over Current Alarm	BUS PHASE OVER CURR	10039
38	Bus Phase Over Current Pre-Alarm	PRE BUS PHS DIF CURR	10092
40	KVA Switch	KVA SWITCH	10163
41	Load High Limit	LOAD HIGH LIMIT	10053
42	Load Low Limit	LOAD LOW LIMIT	10054
43	Load Surge Alarm	LOAD SURGE	10063
44	Loss of Mains Alarm	LOSS OF MAINS	10005
47	Mains Breaker Feedback Alarm	MAINS BKR FDBCK ERR	10158
48	Mains Breaker Open Failure Alarm	MAINS BKR SHUNT ERR	10156
49	Mains Export Power Alarm	MAINS EXPORT POWER	10105
50	Mains Export Power Pre-Alarm	PRE MAINS EXPORT PWR	10106
51	Mains Import Power Alarm	MAINS IMPORT POWER	10103
52	Mains Import Power Pre-Alarm	PRE MAINS IMPORT PWR	10104
53	Mains Export VAR Alarm	MAINS EXPORT VARs	10109
54	Mains Export VAR Pre-Alarm	PRE MAINS EXPORT VAR	10110
55	Mains Import VAR Alarm	MAINS IMPORT VARs	10107
56	Mains Import VAR Pre-Alarm	PRE MAINS IMPORT VAR	10108
57	Mains Neg. Phase Sequence Over Current Alarm	MAINS N-PHS-OVER CURR	10115
58	Mains Neg. Phase Sequence Over Current Pre-Alarm	PRE MAINS N-PHS OVR CUR	10116
59	Mains Neg. Phase Sequence Over Voltage Alarm	MAINS N-PHS-OVER VOLT	10117
60	Mains Neg. Phase Sequence Over Voltage Pre-Alarm	PRE MAINS N-PHS OVR VLT	10118
61	Mains Over Freq Alarm	MAINS OVER FREQ	10066
62	Mains Over Freq Pre-Alarm	PRE MAINS OVER FREQ	10101
63	Mains Under Freq Alarm	MAINS UNDER FREQ	10067

Alm #	Event Name	Display Name	Modbus ID
64	Mains Under Freq Pre-Alarm	PRE MAINS UNDER FREQ	10102
65	Mains Over Volt Alarm	MAINS OVER VOLTAGE	10065
66	Mains Over Volt Pre-Alarm	PRE MAINS OVER VOLT	10100
67	Mains Under Volt Alarm	MAINS UNDER VOLTAGE	10064
68	Mains Under Volt Pre-Alarm	PRE MAINS UNDER VOLT	10099
69	Mains Phase Current Differential Alarm	MAINS PHASE DIFF CUR	10113
70	Mains Phase Current Differential Pre-Alarm	PRE MAINS PHS DIF CUR	10114
71	Mains Phase Over Current Alarm	MAINS PHASE OVER CUR	10111
72	Mains Phase Over Current Pre-Alarm	PRE MAINS PHS OVER CUR	10112
73	Mains Volt Restrained Phase Over Current Alarm	MAINS VLT R-PH OVR CUR	10119
74	Mains Volt Restrained Phase Over Current Pre-Alarm	P-MAINS V R-PH OVR CUR	10120
76	Phase Rotation Mismatch	PHASE ROTATN MISMTCH	10161
77	Process High Limit	PROCESS HIGH LIMIT	10055
78	Process Low Limit	PROCESS LOW LIMIT	10056
84	Remote Fault1	REMOTE FAULT 1	10057
85	Remote Fault2	REMOTE FAULT 2	10058
86	Remote Fault3	REMOTE FAULT 3	10059
87	Remote Fault4	REMOTE FAULT 4	10060
88	Remote Fault5	REMOTE FAULT 5	10061
89	Remote Fault6	REMOTE FAULT 6	10062
90	Program Configuration Check Error	PROG CONFIG ERROR	10162
91	Analog Input 1, High Alarm	ANALOG IN 1 HIGH	10122
92	Analog Input 1, High Pre-Alarm	PRE ANALOG IN 1 HIGH	10121
93	Analog Input 1, Low Alarm	ANALOG IN 1 LOW	10124
94	Analog Input 1, Low Pre-Alarm	PRE ANALOG IN 1 LOW	10123
95	Analog Input 2, High Alarm	ANALOG IN 2 HIGH	10126
96	Analog Input 2, High Pre-Alarm	PRE ANALOG IN 2 HIGH	10125
97	Analog Input 2, Low Alarm	ANALOG IN 2 LOW	10128
98	Analog Input 2, Low Pre-Alarm	PRE ANALOG IN 2 LOW	10127
99	Analog Input 3 High Alarm	ANALOG IN 3 HIGH	10130
100	Analog Input 3 High Pre-Alarm	PRE ANALOG IN 3 HIGH	10129
101	Analog Input 3 Low Alarm	ANALOG IN 3 LOW	10132
102	Analog Input 3 Low Pre-Alarm	PRE ANALOG IN 3 LOW	10131
103	Analog Input 4 High Alarm	ANALOG IN 4 HIGH	10134
104	Analog Input 4 High Pre-Alarm	PRE ANALOG IN 4 HIGH	10133
105	Analog Input 4 Low Alarm	ANALOG IN 4 LOW	10136
106	Analog Input 4 Low Pre-Alarm	PRE ANALOG IN 4 LOW	10135
107	Group Breaker Sync Timeout	GRP BKR SYNC TIMEOUT	10034
108	Mains Breaker Sync Timeout	MAINS BKR SYNC TMOUT	10199
109	Group Breaker Sync Reclose Alarm	GROUP SYNC RECLOSE	10035
110	Mains Breaker Sync Reclose Alarm	MAINS SYNC RECLOSE	10200
117	Modbus Port 1 Failed	MODBUS PORT 1 FAILED	10167
118	Modbus Port 2 Failed	MODBUS PORT 2 FAILED	10168
119	Analog In 1 Failed	Analog Input 1 Failed	10171
120	Analog In 2 Failed	Analog Input 2 Failed	10172
121	Analog In 3 Failed	Analog Input 3 Failed	10173
122	Analog In 4 Failed	Analog Input 4 Failed	10174
123	Atlas PowerSense Module Fault	Power Module Fault	10175
124	Genset failed to start after LON start command	LON Auto Start Seq Fault	10195
125	Genset failed to stop after LON stop command	LON Auto Stop Seq Fault	10196
127	Bus Volt Restrained Phase Over Current Alarm	BUS VLT R-PH OVR CUR	10201
128	Bus Volt Restrained Phase Over Current Pre-Alarm	P-BUS V R-PH OVR CUR	10202

Protective Relaying—Definite Time

The table below gives some summary information about each type of definite time protective relay function available in the MC. Details for each follow the table. Note that the Alarm and Pre-Alarm Time Delays are used for both high and low conditions. (ANSI numbers are in parenthesis)

Name	Functionality	Type
Mains Under/Over Voltage (27,59)	Alarm and Pre-Alarm capability	Definite Time
Bus Under/Over Voltage (27,59)	Alarm and Pre-Alarm capability	Definite Time
Mains Over/Under Frequency (81O, 81U)	Alarm and Pre-Alarm capability	Definite Time
Bus Over/Under Frequency (81O, 81U)	Alarm and Pre-Alarm capability	Definite Time
Mains Negative Phase Sequence Over Current (46)	Alarm and Pre-Alarm capability	Definite Time
Bus Negative Phase Sequence Over Current (46)	Alarm and Pre-Alarm capability	Definite Time
Mains Negative Phase Sequence Over Voltage (47)	Alarm and Pre-Alarm capability	Definite Time
Bus Negative Phase Sequence Over Voltage (47)	Alarm and Pre-Alarm capability	Definite Time
Mains Directional VAR Relay	Alarm and Pre-Alarm capability	Definite Time
Bus Directional VAR relay	Alarm and Pre-Alarm capability	Definite Time
Sync Check (25)	True / False (no alarm)	Definite Time
Battery Voltage	Alarm only	Definite Time
Load Surge Alarm	Alarm only	Definite Time
Remote Alarm 1	Alarm only	Definite Time
Remote Alarm 2	Alarm only	Definite Time
Remote Alarm 3	Alarm only	Definite Time
Remote Alarm 4	Alarm only	Definite Time
Remote Alarm 5	Alarm only	Definite Time
Remote Alarm 6	Alarm only	Definite Time
Analog Alarm 1	Alarm and Pre-Alarm	Definite Time
Analog Alarm 2	Alarm and Pre-Alarm	Definite Time
Analog Alarm 3	Alarm and Pre-Alarm	Definite Time
Analog Alarm 4	Alarm and Pre-Alarm	Definite Time

Over and Under Voltage

The Over and Under Voltage protective relay is definite time delay relay. 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 EGCP-3 is reset. The Bus Under Voltage relay is automatically disabled anytime the group breaker is configured and open or if there is no group breaker and there are no LS units on the bus. The Mains Under Voltage relay, Mains and Bus Over Voltage relays are 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 but Mains and Bus are independently configured.

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.

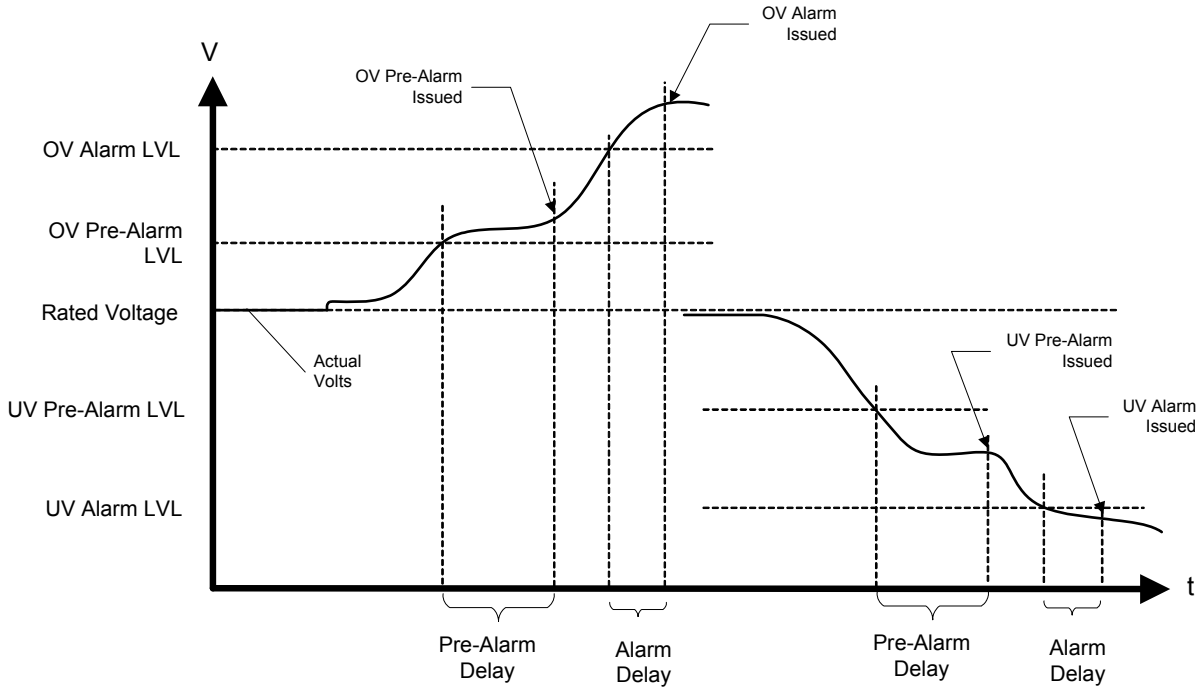


Figure 9-1. Over Voltage/Under Voltage Alarm

Over and Under Frequency

The Over and Under Frequency protective relay is definite time delay relay. 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 EGCP-3 is reset. The Bus Under Frequency relay is automatically disabled anytime the group breaker is configured and open or if there is no group breaker and there are no LS units on the bus. The Bus Over Frequency relay, Mains Over and Under Frequency relays are 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 Alarm. The delay times for Over Frequency and Under Frequency are identical but Mains and Bus are independently configured.

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.

Negative Phase Sequence Over Current

This Negative Phase Sequence Over Current protective relay is a definite time delay relay. As the name implies, it trips when levels are ABOVE a configured setting. It operates by comparing the actual Negative Phase Sequence Current with the level set point for this relay. Once an alarm is issued, it is latched until the EGCP-3 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.

Negative Phase Sequence Over Voltage

This Negative Phase Sequence Over Voltage protective relay is a definite time delay relay. As the name implies, it trips when levels are 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 EGCP-3 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.

Directional VAR

The Over and Reverse VAR (Export and Import VAR) protective relay is definite time delay relay. 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. For purpose of this alarm, Over VAR for the Bus is defined as a positive value on the display or Watch Window, and is representative of lagging power factor. CT orientation will determine if the reading is positive or negative. Physical location of the PTs and CTs in the system bus layout determines if the power is ‘into’ or ‘out-of’ the bus. Reverse VAR for the Bus is read as negative VAR values, and is representative of leading power factor.

Over VAR for the mains is defined as reactive power flowing out of the plant into the mains. This will be referred to as Export VAR, and is displayed as a positive value. It is representative of lagging power factor. Reverse VAR for the mains will be referred to as Import VAR, represented as a negative value and leading power factor.

Once an alarm is issued, it is latched until the EGCP-3 is reset. The Directional VAR relays are continuously enabled.

The actions to be taken for all Directional VAR Alarms are all independently configurable. There are separate Delay times for Pre-Alarm and Alarm. The delay times for Over and Reverse VAR (Export and Import VAR) are identical but mains and Bus are independently configured.

The Alarm and Pre-Alarm trigger levels for all Directional VAR Alarms 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.

The diagram in Over and Under Voltage above shows how the Pre-Alarm and Alarm events are envisioned to operate. The Directional VAR protective relay function operates in the same manner as the Over and Under Voltage protective relay function.

Sync Check

The EGCP-3 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 which mimics a typical ANSI 25 device by closing the output when the two sources are in sync.

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. Since an MC control is not powered from the same supply that would normally be used to power a starter motor, this alarm is continuously 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 does not cause erroneous alarms. How the alarms react is independently configurable.

Load Surge Alarm

The load surge alarm compares the real power (watts) on the mains to the same value sampled at a fixed time in the past. If this value is larger than the alarm level and there is at least one LS parallel with the mains the alarm is triggered. The load surge alarm will only sense a load surge flowing out to the mains, which usually occurs if the mains suddenly becomes unstable. For this reason the alarm is configured for a LOM condition, but can be configured for any alarm event.

Remote Alarms

There are six (6) configurable alarms based on discrete inputs. Each alarm is a definite time function with an independent configurable delay time. The action taken by each alarm is configurable for Disabled, Warning, Audible, Visual, Stop All Engines, Trip Mains Breaker, LOM, and LOM with alarm. Each input may be configured to consider the active condition as one with +24 Vdc 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.

Analog Alarms

There are four (4) configurable alarms based on the analog inputs. Each has High Alarm and High Pre-Alarm level set points and Low Alarm and Low Pre-Alarm level set points. The Analog Alarms are all definite time alarms with independent configurable timeouts. The action taken by the Alarms and Pre-Alarms are all configurable for Disabled, Warning, Audible, Visual, Stop All Engines, Trip Mains Breaker, LOM, and LOM with alarm.

Protective Relaying—Inverse Time

Name	Functionality	Type
Mains Directional Power Relay (32)	Alarm and Pre-Alarm capability	Inverse Time
Bus Directional Power Relay (32)	Alarm and Pre-Alarm capability	Inverse Time
Mains Phase Over Current (51)	Alarm and Pre-Alarm capability	Inverse Time
Bus Phase Over Current (51)	Alarm and Pre-Alarm capability	Inverse Time
Mains Voltage Restrained Phase Over Current (51V)	Alarm and Pre-Alarm capability	Inverse Time
Bus Voltage Restrained Phase Over Current (51V)	Alarm and Pre-Alarm capability	Inverse Time
Mains Phase Current Imbalance relay (46)	Alarm and Pre-Alarm capability	Inverse Time
Bus Phase Current Imbalance relay (46)	Alarm and Pre-Alarm capability	Inverse Time

Directional Power

The Bus Over and Reverse Power protective relays, and Mains Import and Export Power protective relays are inverse time delay relays. 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.

Import power for the Mains is power flowing in from the Mains (produced by the Utility). The Mains KW reading on the front panel or Watch Window will be a negative value when importing power, and read positive value when exporting.

Likewise, power readings for the bus will read positive or negative. For purpose of this alarm, CT orientation will determine if the power reading is positive or negative. Physical location of the PTs and CTs in the system bus layout determines if the power is ‘into’ or ‘out-of’ the bus. Reverse Power for the Bus is denoted as negative Power values.

A configurable time delay setting is provided to shift the inverse time curve along the time axis. This movement allows adjustment of the 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. There are also configurable rated mains import, mains export, bus over and bus reverse power levels that need to be adjusted. Using these rated values the inverse time curve can be adjusted to protect the system at all values.

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 always being recalculated for the present power input value. Once an alarm is issued, it is latched until the EGCP-3 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.

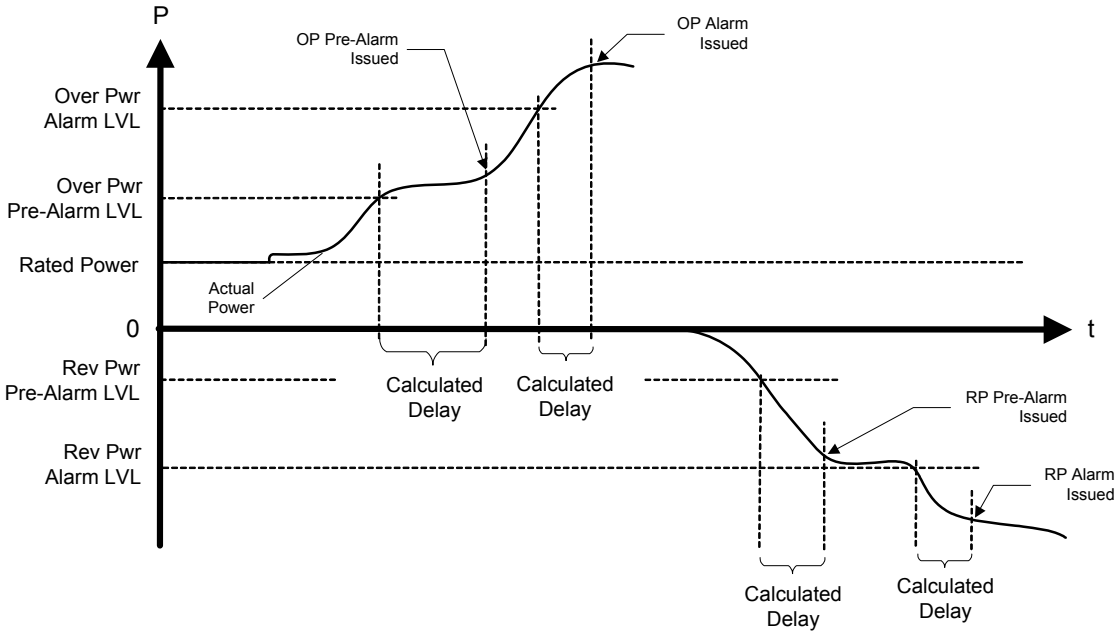


Figure 9-2. Over Power/Reverse Power

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 Bus Over and Bus Reverse Power. Likewise, for the Mains, the same curve shift would apply to both Import and Export Power.

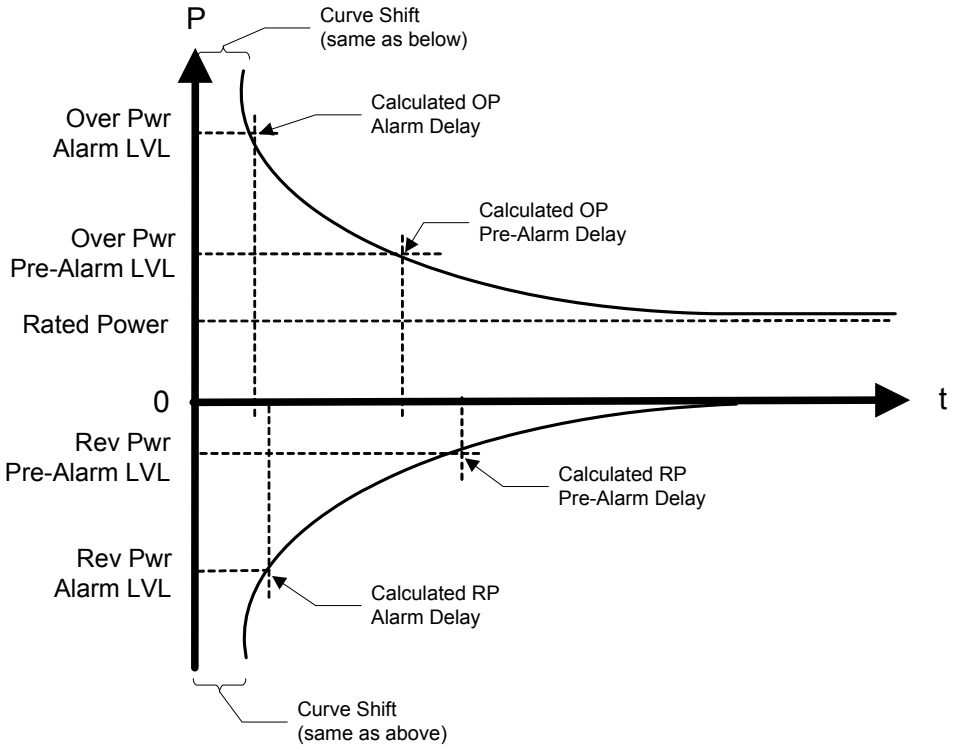


Figure 9-3. Over Power/Reverse Power Time Delay

Phase Over Current

The Phase Over Current protective relay is an inverse time delay 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 input. Once an alarm is issued, it is latched until the EGCP-3 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 delay. It operates by comparing the highest current of the 3 phase inputs to the level set point for this relay. Total current is not evaluated. The average voltage is used to determine the amount of restraint or bias to the over current trip level.

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 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 bus 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 input. Once an alarm is issued, it is latched until the EGCP-3 is reset. The Voltage Restrained Phase Over Current protective relay is continuously enabled.

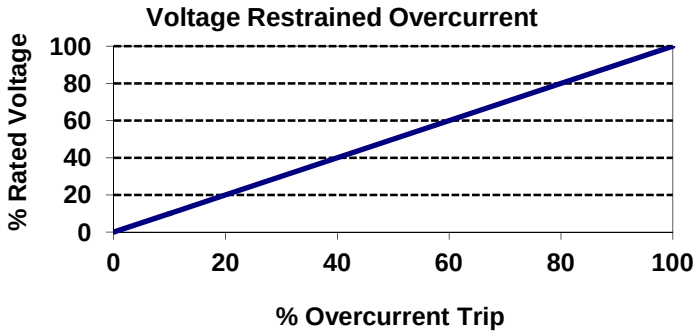


Figure 9-4. Voltage Restrained Over Current

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.

Phase Current Imbalance

The Phase-balance Current protective relay is an inverse time delay 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 EGCP-3 is reset. The Phase Current Differential protective relay is continuously enabled.

The below graph 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 EGCP-3 will automatically add Rated Current to the configured value.

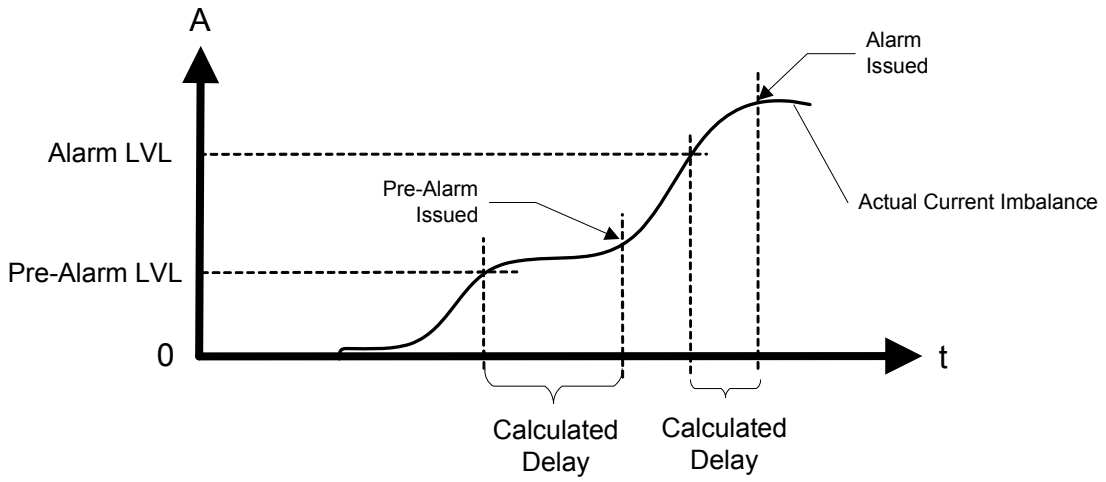


Figure 9-5. Phase Current Imbalance

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.

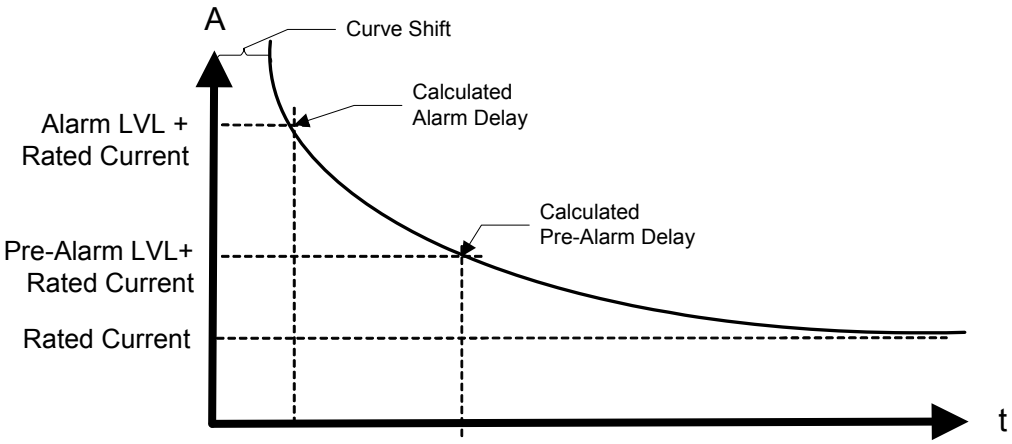


Figure 9-6. Phase-Balance Current, Inverse Time Delay

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 EGCP-3 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 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 EGCP-3 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 EGCP-3 extend above 25 second delay between 1.0 and 1.35, and also extend to the right beyond the ratio of 5.0.

IMPORTANT

The below figures have reversed axes from previous figures in this chapter in order to simplify the above descriptions. All figures show the same method of applying the inverse time curve.

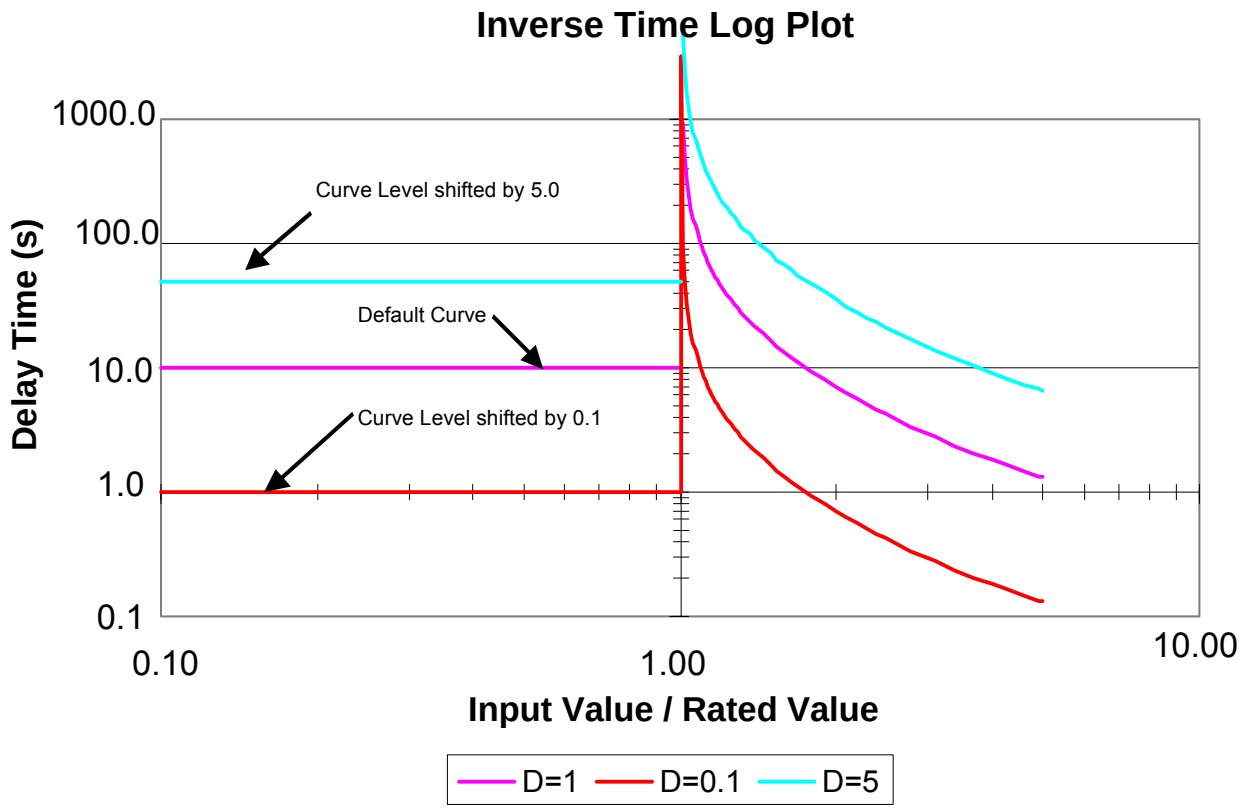


Figure 9-7. Inverse Curve Time Delay, Level Shift

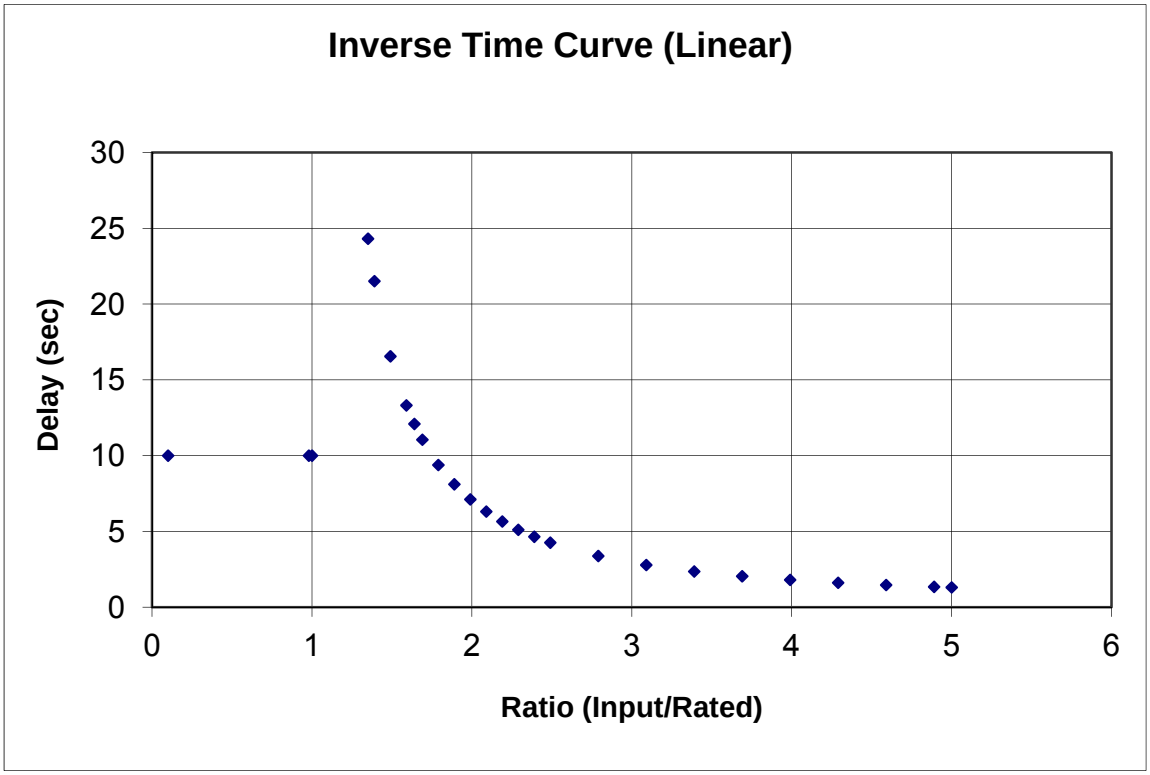


Figure 9-8. Inverse Curve Time Delay, Linear Graph

Example: If an alarm set point is 150% of the rated (1.5 ratio), and the input is at this 150% 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 = (700/500) = 1.4

$$\left(\frac{19.61}{1.4^2-1}+0.491\right)*1.0=20.9$$

Normalized Delay = 20.9 sec.

Then: 5.0 sec / 20.9 sec = 0.24

The curve shift value of 0.24 is required to meet the desired level and delay requirement.

Diagnostics

The following table is a concise list of all diagnostic alarms generated by the EGCP-3. The Modbus ID is the Boolean Read address where the status of the named diagnostic can be determined via Modbus. Some diagnostic actions are not configurable but force a specific action to be taken.

Event	Display Name	MODBUS ID
Analog IN 1 Out of Range	AI 1 OUT OF RANGE (Analog Input 1 Failed)	10171
Analog IN 2 Out of Range	AI 2 OUT OF RANGE (Analog Input 2 Failed)	10172
Analog IN 3 Out of Range	AI 3 OUT OF RANGE (Analog Input 3 Failed)	10173
Analog IN 4 Out of Range	AI 4 OUT OF RANGE (Analog Input 4 Failed)	10174
Group Breaker Sync Timeout	GRP BKR SYNC TIMEOUT	10034
Mains Breaker Sync Timeout	MAINS BKR SYNC TMOUT	10199
Group Breaker Sync Reclose Alarm	GROUP SYNC RECLOSE	10035
Mains Breaker Sync Reclose Alarm	MAINS SYNC RECLOSE	10200
Group Breaker Feedback Error	GRP BKR FEEDBACK ERR	10157
Group Breaker Shunt Trip Error	GRP BKR SHNT TRP ERR	10155
Mains Breaker Feedback Error	MAINS BKR FDBCK ERR	10158
Mains Breaker Shunt Trip Error	MAINS BKR SHUNT ERR	10156
Modbus Link 1 Error	MODBUS LINK 1 ERR	10167
Modbus Link 2 Error	MODBUS LINK 2 ERR	10168
Phase Rotation Mismatch	PHASE ROTATN MISMTCH	10161
PowerSense Board Fault	POWER MODULE FAULT	10175

Analog Input Out of Range

The Out of Range Diagnostic function applies to all four analog inputs. A separate alarm is issued for each input. The default alarm action for Out of Range alarms is Disabled, The Alarm Action can be configured from the Watch Window Service Analog Input menu for: Disabled, Warning, Visual Alarm, Audible Alarm, Stop All Engines, and Trip Mains Breaker.

If an analog input measures a value less than 2 mA or greater than 22 mA, this diagnostic becomes true. When the input is configured as a voltage input, the equivalent range is 0.5 V at the low end and 5.5 volts at the high end. This diagnostic is always enabled.

Breaker Sync Timeout Alarm

The breaker sync timeout Diagnostic will occur if the EGCP-3 was not able to bring the mains and bus into synchronization long enough to close the breaker prior to the Synchronizer Timeout expiring. If the EGCP-3 attempts to close the breaker but cannot due to other reasons, this diagnostic would be disabled. The Alarm Action can be Configured from the Synchronizer menu. The Alarm Action is defaulted for Warning, it can be configured for: Disabled, Warning, Visual Alarm, Audible Alarm, Stop All Engines. When this diagnostic occurs, the configured action is taken.

Breaker Sync Reclose Alarm

This diagnostic results when a breaker close output is operated more than the configured reclose attempts without the breaker auxiliary contact reporting that the breaker has closed. When this diagnostic occurs, by the default action, it is logged in the event list as a warning and the warning output is engaged. From the Front panel or Watch Window it can be configured for: Disabled, Warning, Visual Alarm, Audible Alarm, Stop All Engines or Trip Mains Breaker.

Breaker Feedback Error

The Breaker Feedback Error Diagnostic results when the breaker auxiliary contact reports that the breaker is open but current is observed flowing through the breaker. This indicates that the breaker auxiliary contact circuit is open or failed. When this condition occurs, the EGCP-3 automatically begins performing the actions associated with the relevant breaker closure as if the auxiliary contact indicated the breaker was closed.

The default action is Warning, so when this diagnostic occurs, by, it is logged in the event list as a warning and the warning output is engaged. From the Front panel or Watch Window it can be configured for: Disabled, Warning, Visual Alarm, Audible Alarm, Stop All Engines or Trip Mains Breaker.

Breaker Shunt Trip Error

The Breaker Shunt Trip Error Diagnostic results when a breaker shunt trip output is operated without the breaker auxiliary contact reporting that the breaker has opened. It may be that the auxiliary contact is failed closed but typically will indicate that the shunt trip wiring is open or the shunt trip coil in the breaker is failed. From Watch Window Engine Protection menu, it can be configured for: Disabled, Warning, Visual Alarm, Audible Alarm, Stop All Engines or Trip Mains Breaker. The default action is to initiate a Stop All Engines.

Modbus Link Error

There is a Link Error for each of the 2 possible Modbus connections. The Link Error is flagged when a Modbus Timeout is detected. The timeout period is configurable in the Communications Menu. The default action is Warning, so when this diagnostic occurs, by, it is logged in the event list as a warning and the warning output is engaged

Phase Rotation Mismatch

The Phase Rotation Mismatch Diagnostic indicates that the configuration for phase rotation on the bus or mains does not match the observed phase rotation. This diagnostic relies on Negative Phase Sequence Voltage to determine the mismatch. If either bus is configured to use single phase sensing, the phase rotation mismatch check will not operate. When this diagnostic occurs, it is logged in the event list as and an audible alarm output is engaged. It will also prevent breaker closure.

Power Module Board Fault

The Power Module Board Fault Diagnostic occurs when an error is detected with the PowerSense board in EGCP-3. The PowerSense board is the board that monitors ac inputs and calculates the control values based on the inputs. This board is located in the middle of the stack. If this diagnostic occurs, the EGCP-3 will automatically perform an I/O Lock which will disable all digital outputs and LON communication.

There is a LED on the top of the board closest to the display, labeled CPU. Check the LED to see if it is blinking, solid on, or off. If it is blinking, make a note of how many times it blinks before it starts the sequence over. There will be a long pause when the sequence is starting over. The LED may blink up to 24 times in a sequence. Making a note of the LED status will help Woodward applications staff determine the nature of the problem.

Before calling Woodward, cycle power to the EGCP-3. The board fault may clear by itself and allow normal operation again. If, after cycling power to the EGCP-3, the board fault remains, call Woodward for assistance in troubleshooting.

From Watch Window Shutdown and Alarms menu, it can be configured for: Disabled, Warning, Visual Alarm, Audible Alarm, Stop All Engines or Trip Mains Breaker. The default action is to initiate a Stop All Engines.

Configuration Check

The EGCP-3 performs some configuration checks to determine if the control is configured in a manner that is inconsistent, dangerous, or non-functional. An error message is issued if the EGCP-3 finds a configuration error.
This check covers:

- The same feature should not be assigned to more than one discrete input.
- The same feature should not be assigned to more than one analog input.
- Value entered for Rated Watts must be between 70% to 100% of entered Rated VA.
- Entered Rated VAR should be between 0.0 and 70% of Rated VA.

Status Indicators

Both the SmartCore board and the PowerSense board have red status LEDs which indicate internal CPU detected errors. These indicators are useful for troubleshooting problems. The status LEDs on the PowerSense board are located on the bottom edge(when panel mounted) of the board between terminals 36 and 45 (terminals 37-45 are not used). The status LED on the SmartCore board is next to terminal 82.

Check the LED to see if it is blinking, solid on, or off. It is normal for both board's status LEDs to be on for approximately 60 sec during power-up tests, then turn off. If an LED is blinking, make a note of how many times it blinks before it starts the sequence over. There will be a long pause when the sequence is starting over. The PowerSense board LED may blink up to 24 times in a sequence. The SmartCore board LED may blink up to 14 times in a sequence.
Interpretation of the LED flash codes is not provided here since it will not help the user to correct the problem. However, the flash codes will help Woodward personnel in troubleshooting the problem.

The PowerSense board also has LEDs for the LON status, these are located next to the CPU status LED. The center LON Status LED will flash green to indicate the LON communication is operational. The rate of flashing indicates the amount of "traffic" on the LON network. The LON Service LED will be off during normal operation. The Service LED may turn on during power-up tests, but will turn off when the application is running. If this LED is flashing, the rate of flashes will indicate the possible LON network problem.

Chapter 10.
Synchronizer Description

Introduction

Synchronization is the matching of the output voltage waveform of one synchronous alternating current electrical generator with the voltage waveform of another alternating current electrical system. For the two systems to be synchronized and connected in parallel, five conditions must be considered:

- Number of phases in each system
- Direction of rotation of the phases
- Voltage amplitudes of the two systems
- Frequencies of the two systems
- Phase angle of the voltage of the two systems

The first two conditions are determined when the equipment is specified, installed, and wired. The synchronizer matches the remaining conditions (voltage, frequency, and phase) before the paralleling breaker is closed.

Functional Description

The Synchronizer is the functional section in software and hardware of the EGCP-3 that synchronizes the mains to the bus and closes breakers. To accomplish this the synchronizer has four outputs, a speed bias output, a voltage raise/lower output, and a breaker/contactor command. Working with the outputs are the four “modes” of operation. These modes may be configured from the front panel or any of the communications links (ServLink Watch Window, Modbus). The last command given from any of these sources dictates the synchronizer mode.

The synchronizer may be configured for either Phase Matching or Slip Frequency Synchronizing. If the system does not require synchronizing functions, the sync type may be configured to Off. Phase Matching provides rapid synchronizing for critical standby power applications. Slip Frequency Synchronizing is used for larger generators and guarantees minimum transients at breaker closing and that initial power flow is out of the machine. In the slip mode a synchroscope will continuously rotate slowly clockwise, in the phase mode a synchroscope will hold at the 12:00 position.

Additional synchronizer features include voltage matching, time delayed automatic multi-shot re-closing, breaker / contactor control configuration, phase rotation mismatch alarm, breaker sync timeout alarm, and breaker sync reclose alarm. Each of these features may be enabled or disabled according to the needs of the application.

The EGCP-3 MC can synchronize and open/close up to two breakers in a system. It is important to note that if multiple MCs are available in the system only one “Group Breaker” can be configured. A group breaker is used to be an intermediary between the load bus and generator bus in order to synchronize all generators to a single bus before plant load is introduced to them. Group breakers are used extensively for ATS situations where multiple gensets are needed take load from the utility without overloading a single unit. For more information about system configuration and group breakers see Chapter 17 further on in the application section.

Operating Modes

Mode	Speed Bias Output	Voltage Raise/Lower CMDs	Breaker control
Off	Disabled	Disabled	Disabled
Check	Active	Active ◊	Disabled
Permissive	Disabled	Disabled	Active
Run	Active	Active ◊	Active

◊ If the synchronizer is configured without voltage matching, this output is always disabled.

The operation of the synchronizer is determined by the mode configuration. When in the **Off Mode**, the synchronizer is out of operation. This mode is entered when the Mode Switch is not in the Auto position, the Synchronizer mode is configured as “Off”, or the breaker closes successfully. In the Off mode the user has the ability to manually bias the speed of the LS units via the sync speed bias input into the LON with the Raise/Lower Speed panel switches. The user also has the ability to manually bias the voltage of the LS units via the voltage raise/lower inputs into the LON with the Raise/Lower Voltage panel switches.

Run mode allows normal automatic synchronizer operation and breaker closure signals. It will only occur if the Mode Switch input is in Auto. The Raise/Lower Speed and Voltage panel switches are ignored. The sync speed bias signal (explained below) is maintained throughout the breaker closure signal. The voltage raise/lower signal is also maintained throughout the breaker closure signal if voltage matching is enabled. When the specified closure signal time has elapsed or the CB (circuit breaker) aux contact closure signal is received, the synchronizer is automatically turned off.

The **Check mode** allows normal synchronizing and voltage matching, but does not issue a breaker closure signal. It will only occur if the Auto Mode Switch input is asserted. The Raise/Lower Speed and Voltage panel switches are ignored. It is used during commissioning or if the user wishes only to close a breaker manually. The mode applies to closure of both the group and mains breakers.

Permissive mode enables the synch-check function for proper synchronization, but synchronizer operation does not affect the LS units speed or voltage. If phase, frequency, and voltage are within proper limits, the synchronizer issues the breaker closure command. It will only occur if the Auto switch input is asserted. The user also has the ability to manually bias the voltage raise/lower via LON communication with the Raise/Lower Voltage panel switches and the sync speed bias via LON communication with the Raise/Lower Speed panel switches. This mode is typically used with breaker closure wiring in series with a manual closure command such that the EGCP-3 is not actually closing the breaker but allowing it to close.

Dead Bus

The dead bus closing function may be enabled or disabled during configuration. The dead bus detection level depends on the three hardware range selections for the PT inputs. A dead bus will be indicated when the voltage is less than 27,40, or 80 Vac L-N respectively. On a deadbus, realization the MC will send a deadbus acknowledgement over the LON. In order for the MC to gain permission to close the breaker, all units must acknowledge the deadbus and deliver a deadbus token to the MC. The synchronizer will allow breaker closure only if the bus breaker aux contact indicates the breaker is open AND the configuration for dead bus is enabled AND the bus or mains voltage is below the threshold AND the deadbus token is received from the rest of the units communicating on the LON.

Dynamic Control Adjustments – PI Control

The Synchronizer has a PI controller to determine the dynamic response during synchronizing. The proportional gain 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.

Integral gain determines how quickly the synchronizer responds to a large error in phase or frequency. It 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.

Slip Frequency

In larger systems, it is often desirable for the oncoming generator(s) speed to be slightly higher than the mains when the group breaker is closed. This assures that power immediately flows out of the generator(s) and into the system. The slip frequency synchronizing function is enabled when the Sync Type configuration setting indicates Slip Frequency. A Slip Window and a Slip Frequency may be configured. The Slip Frequency is the exact frequency difference desired between the mains and bus. The Slip Window is the amount of error around the slip frequency that is allowed. The phase error must be within the Phase Match Window before a breaker close command output will be issued.

The synchronizer automatically controls the sync speed bias at the specified slip frequency. Gain and Stability adjustments to the slip frequency PI controller are provided to allow stable operation of the automatic synchronizer function over a wide range of system dynamics.

During Phase Matching synchronizing, the Slip Frequency represents the maximum speed difference allowed before the breaker close command is active. This is proportional to the time the phase match must be within the phase window.

Phase Match

The phase matching synchronizing mode corrects the frequency and phase of the LS unit(s) to lock it to the mains frequency and phase. Phase matching synchronizing is exclusive of the slip frequency method. The EGCP-3 uses signal processing techniques to derive the difference in phase of the mains A and bus A phase voltage signals. When there is a difference, the synchronizer sends a correction signal to the sync speed bias. The correction signal from the sync speed bias output to LS units tells the LS's to increase or decrease engine speed depending on whether the slip is faster or slower than the mains. Corrections will occur when the phase is not within the configured phase match window. Slip Window is not used in Phase Match mode.

A PI (proportional, integral) controller provides the correction signal. Proportional Gain and Integral Gain adjustments to the PI controller are provided to allow stable operation of the automatic synchronizer function over a wide range of system dynamics.

Voltage Match

The voltage of a bus containing several parallel generators must be matched to the mains within a small percentage to minimize the reactive power flow upon breaker closure and to maximize breaker contact life. If a synchronous generator is paralleled to a larger system such as a utility, a difference in voltages before paralleling will not change the voltage of the mains. If the generator voltage is lower than the mains voltage, reactive power will be drawn from the mains and used to excite the generator to the higher mains voltage. In the case where the generator voltage is low enough, the reactive power flow could motorize the generator with potential damage to the generator windings.

The voltage matching function of the EGCP-3 uses bus A phase and mains A phase signals. True RMS measurements are compared and matched. The processor issues appropriate raise or lower commands to the LON communications to bring the voltage of the generators controlled by LS units within the specified window of the mains voltage. Once the difference between bus and mains is within the configured voltage match window, the voltage raise/lower commands will not be moved. If the voltage match falls out of the window, the voltage raise/lower will again affect a change to bring the bus voltage back into compliance.

The automatic voltage matching function may be enabled or disabled in the Synchronizer menu. When enabled, voltage matching will occur in both the Check and Run modes and is verified only by the sync-check function in Permissive mode.

Synch-check

The synch-check function is enabled when the Permissive mode is selected as described earlier. The synch-check function determines when all conditions for proper synchronization are satisfied and energizes the breaker closure relay. The mains and bus voltage comparison is made if the voltage matching function is enabled. The bus voltage must be within the specified voltage window before the breaker closure command may be given.

To minimize transients, the breaker must be closed when the phase difference between the mains and bus is near zero. Due to delays in any interposing relays and to the delay in closing the circuit breaker, the synchronizer may initiate the breaker closing ahead of the zero phase point. The control uses slip frequency and the specified breaker delay to predict breaker closure. The phase window and slip frequency (and slip window) provide maximum and minimum conditions on the prediction. When all conditions of voltage and phase are met, then the breaker closure command is given.

Multiple Shot Reclosing

The multiple shot reclosing function allows multiple closing attempts. The EGCP-3 provides a configuration for the number of close attempts and the reclose delay timing. Failure to get closure after the specified number of attempts locks out the synchronizer by setting it to the auto-off mode and; if the reclose alarm is enabled, issuing an alarm. The synchronizer must then be reset by cycling the auto mode switch to off and back to auto and/or by clearing the reclose alarm. Setting the number of close attempts to one disables the multiple shot closing function.

When the Permissive or Check modes are selected, the number of close attempts is considered infinite.

Synchronizer Time Out

When in the Run mode, the synchronizer will attempt to synchronize and close the breaker in the minimum time, as soon as all conditions are met. If the synchronization process has not successfully closed the breaker within a time equal to the Synchronizer Timeout value, the synchronizer will be latched into the auto-off mode and; if the timeout alarm is enabled, issuing an alarm. The synchronizer must then be reset by cycling the auto mode switch to off and back to auto and/or by clearing the timeout alarm.

If the Synchronizer Timeout value is configured as zero, this timeout is disabled and the synchronizer will continue to attempt synchronization indefinitely until turned off. When the Permissive or Check modes are selected, the synchronizer timeout is considered infinite. If a Synchronizer Time Out occurs, the EGCP-3 will initiate a Synchronizer Time Out Alarm based on the Synchronizer Time Out Alarm Action.

Phase Rotation Check

The EGCP-3 will automatically check for proper phase rotation between the mains and bus inputs. If the phase rotation does not match, synchronization will be halted and set to Auto-Off. A manual double-check of phase rotation may be performed by observing the Negative Phase Sequence Voltage reported by the EGCP-3. If the Negative Phase Sequence Voltage for the Mains and Bus are both below 50% of rated voltage, the phase rotation check is considered passing.

Note that if either sensed bus is set to use single phase sensing, the phase rotation check is not available.

Synchronizer Time Line

The time line diagrams below illustrate a couple of timing sequences the synchronizer function uses when operating. First is a successful closure on the first attempt. Second is an unsuccessful closure where timeouts where configured such that the second attempt would not complete before total synchronizer timeout occurs.

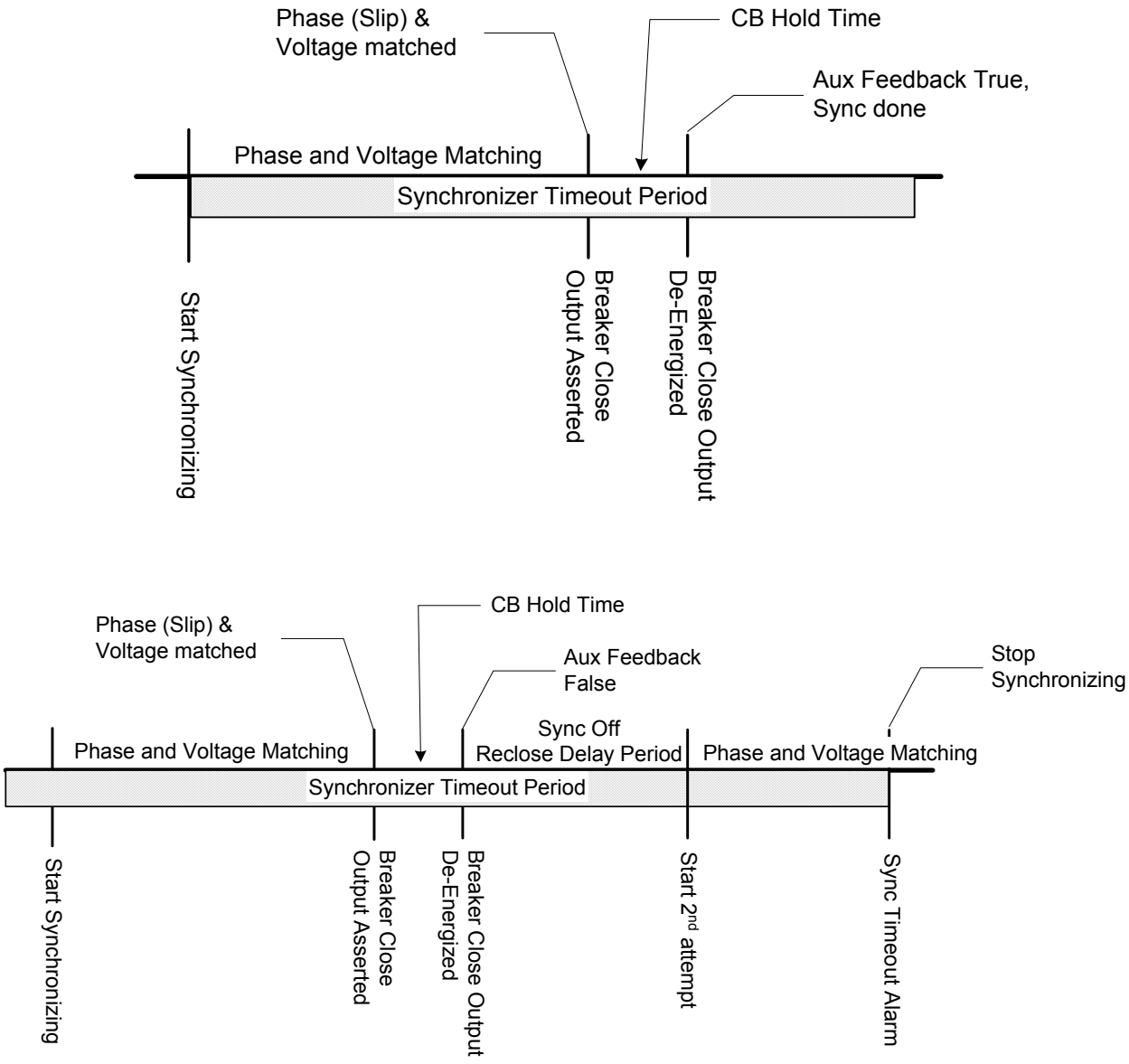


Figure 10-1. Synchronizer Action Time-Line

Breaker/Contactor Control

The mains and group breaker outputs are configured independently of each other. Either one or both may be configured as breakers or contactors. Open and Close logic for each type is indicated below.

In Breaker operation the EGCP-3 control has a pulsed output to the breaker closing circuit, and a separate pulsed output to give an open command the breaker shunt trip circuit. For Contactor type operation, a constant level close command holds the contactor closed, this command is removed to open the contactor.

Shunt Trip

When Breaker type logic is selected, two digital outputs will be used for breaker operation. The shunt trip output is used to open the breaker. Mains shunt trip is digital output 4 and can be configured for normally closed or normally open operation. Group breaker shunt trip can be configured as any configurable digital output, and set for normally closed or normally open operation.

When the EGCP-3 wishes to open a breaker (shunt trip), it will de-energize or energize the output to the breaker shunt trip discrete output depending on Normally Open or Normally Closed configuration.

Breaker/Contactor Closure

If the breaker closure conditions are met, the synchronizer will give a breaker closure command for a time equal to the Breaker Hold Time configuration setting. If breaker closure feedback (breaker auxiliary contact) is not received within the Breaker Hold Time configuration setting, a failed close attempt condition exists. The synchronizer will not attempt to close the breaker again for a time equal to the Reclose Delay configuration. If the breaker closure feedback signal is received, and then lost before the Reclose Delay time, this is also a failed close attempt. If the number of failed close attempts is equal to the Close Attempts configuration, the synchronizer is latched into the Auto-Off mode. A Reclose Attempts Alarm will be issued according to the Reclose Attempts Alarm Configuration. Also, if the total time to synchronize, including reclose attempts and delays, exceeds the Synchronizer Time-Out Alarm configuration prior to the reclose attempts expiring, the synchronizer will be latched into the Auto-Off mode.

The user also has the ability to configure breaker or contactor logic for breaker closure. This configuration may be set for each breaker (mains and group) independently. When configured as a breaker the output is held on until an auxiliary contact feedback is received or for the Breaker Hold Time configuration—whichever is shorter. When configured as a contactor, the output will be held on, as long as the auxiliary contact feedback is first sensed within the Breaker Hold Time configuration. The output will also follow the auxiliary contact input if the input indicates the contactor has opened.

Chapter 11.
Real Load Control Description

Introduction

The Real Load Controller is the section of the MC that controls the real power management of the system whenever any LS loadshare unit is parallel with the mains. The MC controls the LS units by sending a load command (Lon In - LOAD_CMD) to the LS units through the LON. The load command is a value between 0 and 100 and is interpreted by the LS units as the percentage of their rated load that they are to operate.

For example, if an MC sends a load command of 25 to two units on its active bus segment that are rated at 100 kW (Unit 1) and 400kW (Unit 2) respectively. The load command of 25 will be interpreted by unit 1 as a command to generate 25kW. Unit 2 will interpret the command as 100 kW.

The load command will be adjusted depending on the current operating conditions and configurations, and because it has no interaction with synchronizing functionality, will not be affected by any synchronizing efforts.

Functional Description

The MC's load controller is a load command broadcaster and therefore does not have any direct PID functionality. In order to control changes in the load command the unit transitions to different set points by setting a target and then using a configured ramp rate to increase or decrease to the that value. This method insures bumpless transitions between load control modes.

The EGCP-3 MC has five modes of controlling the real power:

- Internal BaseLoad
- Manual
- Remote Operation (Baseload, Process)
- Process
- Import/Export

Manual, BaseLoad and Remote Baseload operation will be discussed in this chapter.

IMPORTANT

All process methods will be discussed in Chapter 13. It should be noted that when the load controller is in Process mode the ramping characteristics of the load control are dictated by the process PID or the import/export deadband controller and not by the load control ramp rates. Separate process ramp rates are available for these modes of operation.

Load and Unload Rates

The rates used by the load controller described in the next sections are different depending on which method of control is being employed. In the Real Load Control menu, there are four configuration set points used to develop the rates:

- Load Time
- Unload Time
- Load Rate
- Unload Rate

When the digital inputs Load Raise/Lower are asserted, the LOAD_CMD is changed at a rate dictated by the load and unload rates. These rates are configured as percent per second (%/sec) and will raise or lower the LOAD_CMD towards 100 or 0, respectively, at these rates.

For all other changes to the LOAD_CMD the load and unload times are used. The rate at which the LOAD_CMD is changed is dictated by the following equations in %/sec:

$$LoadRate = \frac{InternalBaseLoad\_SetPoint}{LoadTime}$$

$$UnloadRate = \frac{InternalBaseLoad\_SetPoint}{UnloadTime}$$

Internal BaseLoad

BaseLoad operation is performed any time at least one LS unit is operating in parallel with the mains and the Enable Process digital input is not asserted. BaseLoad for the MC is a fixed load command (LOAD_CMD) sent over the LON to all of the LS units. When Internal BaseLoad is active, the MC load control will ramp the LOAD_CMD to the BaseLoad configuration setting using the Load or Unload Time, whichever applies. In addition, the user also has the ability to stop the ramp with the activation of the Load Raise/Lower switches or the Ramp Pause switch. If the Load Raise/Lower switches are activated during a ramp, the LOAD_CMD assumes the current load. If the Ramp Pause is removed, the ramp will continue to the BaseLoad set point.

Once the load has reached the BaseLoad configuration setting, the user has the ability to change the load reference using the Load Raise/Lower switches. When these switches are activated, the load is ramped at the Load or Unload Rate, whichever applies. When switching from any other mode to BaseLoad, the BaseLoad configuration setting becomes the current load reference in order to provide for a bumpless mode transfer.

Configuration Example (WW Commands)

An operator wants the baseload set point in the plant to be 60.

- Configure Internal BaseLoad Reference
  (F Real Load Control – 01 Baseload Reference = 60)

During operation the Load Raise/Lower switches have been used and the operator wants to return to the internal baseload reference.

- Assert the Reset Load digital input (or via MODBUS)
- LOAD_CMD should return to 60

Manual

Manual operation can always be assumed by using the Load Raise/Lower switches. When these switches are activated, the LOAD_CMD is ramped at the Load or Unload Rate, whichever applies.

Remote BaseLoad

A Remote BaseLoad mode is a mode where the LOAD_CMD is determined by an analog input. If an analog input is configured for BaseLoad Reference (First Time Configuration menu), the analog input reference will automatically be used in place of the internal BaseLoad setting. When switching from any other mode to Remote BaseLoad Control mode, or if changes are made in Remote BaseLoad Control, the LOAD_CMD is ramped to match the Remote BaseLoad Reference (the analog input) using the Load or Unload Time, whichever applies. In the Remote BaseLoad mode, the Speed/Load Raise/Lower panel switches will also be available to raise or lower the reference. When these switches are activated, the LOAD_CMD is ramped at the Load or Unload Rate, whichever applies. In addition, the user also has the ability to stop the ramp with the activation of the Ramp Pause switch.

IMPORTANT

Remote Baseload is limited to high and low analog input calibration values of 0 and 100. The operator can configure the analog input for larger or smaller values but the MC will limit the range. If the operator configures the analog input for larger values the resolution will not be as accurate.

Configuration Example (WW Commands)

Using a 4-20mA analog input an operator wants to configure the MC to regulate the BaseLoad set point between 50 and 80 depending on plant conditions. In order to prevent damage to the generators controlled by the LS units a loading ramp rate of 0.5%/second and an unloading ramp rate of 1.0%/second is desired.

Set up analog input:

- Configure Analog Input 1 for BaseLoad Reference (A# First Time Config ## - 41 Analog Input 1 Function = 1)
- Configure Analog Input 1 for 4-20mA (Q Analog Inputs - 01 AI1 Type = 1)
- Configure Low Calibration Value (Q Analog Inputs - 04 AI1 Low Cal Value = 50)
- Configure High Calibration Value (Q Analog Inputs - 05 AI1 High Cal Value = 80)
- Optional:
    - Configure Label, High and Low Alarms and Pre Alarms

Set up ramp rates based on Internal reference and load times

- Configure Internal BaseLoad Reference (F Real Load Control – 01 Baseload Reference = 50)
- Configure Load Time (F Real Load Control – 04 Load Time = 100)
- Configure Unload Time (F Real Load Control – 05 Unload Time = 50)

Optional Load Functions

The functions described below are available when a discrete input is configured for the function or a MODBUS command is given to affect the function. These functions are operated in common with the reactive load functions by the same name. The discrete inputs operate both simultaneously.

Reset Load

The Reset Load mode switch is used to reset the BaseLoad set point. When the Reset Load mode switch is activated by DI, Modbus or ServLink/WW, and then deactivated and the load control is in Internal BaseLoad control mode, the load control will ramp the LOAD_CMD to the current internal reference (configuration setting) using the Load or Unload Time. In addition, the user also has the ability to stop the ramp with the activation of the Load Raise/Lower switches. If the Load Raise/Lower switches are activated during a ramp the current load becomes the load reference.

Ramp Pause

When the Ramp Pause mode switch is activated, by DI, Modbus or ServLink/WW, the LOAD_CMD ramp will pause and hold the current load. When the switch is opened again, the load ramp will continue to the present set point. The Ramp Pause mode switch will not stop the LOAD_CMD from ramping if a shutdown (Stop All Engines) is present.

Unload

If the Unload mode switch is activated, by DI, Modbus or ServLink/WW, while the MC is in control of the LOAD_CMD, the LOAD_CMD will ramp to the Unload Level configuration setting and remain there until the Unload mode switch is deactivated.

Chapter 12.
Reactive Load Control Description

Introduction

The VAR/PF (Volt Amp Reactive or Power Factor) controller adjusts the reactive power component of the generators controlled by LS units in systems that are in parallel with the mains. The controller compares either the reactive power on the mains with a reactive power setpoint, or the PF on the mains with a PF set point, and makes corrections to the PF command (PF_CMD) sent to the LON until the desired reactive power is obtained. The VAR/PF mode is activated by closing a digital input configured for Enable VAR/PF Control or by using the VAR/PF AUTO ENABLE found in the Reactive Load Control configuration menu.

Functional Description

The VAR/PF controller is determined by the VAR/PF Mode selection in the Reactive Load menu. Two methods of control are employed depending on the mode of operation of the MC. All modes that do not involve Import/Export control apply PI control action to the control of reactive power (derivative action is not available in reactive power control). Import/Export control applies a deadband controller because of the possibility of zero real power transfer across the mains, which causes oscillatory PI control action because of the rapid change in actual VAR/PF across the mains.

The EGCP-3 MC has six modes of controlling the reactive power:

- Manual
- VAR Control
- PF Control
- Remote Control (VAR, PF)
- Import/Export (VAR, PF)
- Modbus (VAR, PF)

VAR/PF control by the master is always in Manual control unless the mode is activated by closing a digital input configured for Enable VAR/PF Control or by using the VAR/PF AUTO ENABLE. Another control stipulation is that the LS units that the MC is controlling must have the VAR/PF enabled as well. When the PI or deadband controllers generate a control action, this MC sends a PF_CMD over the LON to the LS units. The LS units then take the value and adjust the voltage bias sent to their individual voltage regulators.

IMPORTANT **The LS units will only listen to the MC commands if their VAR/PF is enabled, otherwise they will take no action.**

⚠WARNING **If the MC has VAR/PF control enabled and the LS units that it is controlling are not VAR/PF enabled, the PID may wind-up. If the LS units are then VAR/PF control enabled, the voltage may become oscillatory.**

Manual

To adjust the VAR/PF on the system in Manual mode the Voltage Raise/Lower switches are used to change the PF_CMD sent over the LON. This mode will work if the VAR/PF is enabled or disabled but will only adjust the PF reference and not the VAR reference as shown on the PF/VAR status screen.

VAR Control

The VAR control adjusts the PF_CMD to maintain a set reactive power (VAR) load on the mains throughout the kW operating range. A configuration setting is provided to set the desired VARs. The VAR control function only will work when VAR/PF control is enabled.

The VAR/PF control is in VAR Control when the load control mode is in BaseLoad or Process (but not Import/Export), and the VAR control mode is selected and enabled. When switching to this mode, the VAR control will ramp the VAR reference to match the VAR configuration setting at a rate determined by the Voltage Ramp Rate. The user has the ability to stop the ramp with the activation of the Voltage Raise/Lower switches or the Ramp Pause switch. Once the VAR load has reached the VAR configuration setting, the user has the ability to change the VAR load reference using the Voltage Raise/Lower switches. When these switches are activated, the VAR load reference is ramped at a rate determined by the Voltage Ramp Rate.

The reference value is sent to the PI controller where it is compared to the actual VAR load on the mains. Two configurables are available to control the response, proportional gain and integral gain and can be adjusted to tune the performance of the control. The PI controller will then send a PF_CMD between ±0.5 over the LON to the LS units.

Configuration Example (WW Commands)

An operator wants to control his plant in baseload. The plant has a high motor load so reactive power consumption is usually a problem. In order to avoid utility penalties for reactive power consumption the operator would like to export 10 kVAR to the utility.

- Configure the MC for VAR Control (G Reactive Load Control – 01 VAR/PF Mode = 1)
- Configure Internal VAR Reference (G Reactive Load Control – 08 KVAR Reference = 10)
- Enable the VAR/PF Control
    - Configure a Digital input for VAR/PF Enable and assert the DI
    - **OR** Configure auto enable (G Reactive Load Control – 03 VAR/PF Auto Enable = TRUE)
- Additional adjustments that can improve performance
    - VAR/PF Gain
    - VAR/PF Integral Gain
    - Voltage Ramp Time

PF Control

The power factor (PF) control adjusts the PF_CMD to maintain a set PF on the mains throughout the kW operating range. A configuration setting is provided to set the desired PF. The PF control function only will work when VAR/PF control is enabled.

The VAR/PF control is in PF Control when the load control mode is in BaseLoad or Process (Import/Export PF and VAR control is found in a later section), and the PF control mode is selected and enabled. When switching to this mode, the PF control will ramp the PF reference to the Power Factor configuration setting at a rate determined by the Voltage Ramp Time. The user has the ability to stop the ramp with the activation of the Voltage Raise/Lower switches or the Ramp Pause switch. Once the Power Factor has reached the Power Factor configuration setting, the user has the ability to change the Power Factor reference using the Voltage Raise/Lower switches. When these switches are activated, the PF load reference is ramped at a rate determined by the Voltage Ramp Rate. The reference value is sent to the PI controller where it is compared to the actual PF on the mains. The actual PF has a deadband to prevent excessive control. The three configurables that are available to control the response; proportional gain, integral gain and deadband can be adjusted to tune the performance of the control. The PI controller will then send a PF_CMD between ±0.5 over the LON to the LS units.

Configuration Example (WW Commands)

An operator wants to control his plant in process. The plant has a high motor load so reactive power consumption is usually a problem. In order to avoid utility penalties for reactive power consumption the operator would like to keep the PF on the mains at 0.95 leading which means that the utility is still supplying reactive power to the plant but the operator is in control of the consumption from the utility.

- Configure the MC for PF Control (G Reactive Load Control – 01 VAR/PF Mode = 3)
- Configure Internal PF Reference to 0.95 LEAD (G Reactive Load Control – 10 PF Reference = -0.05)
- Configure PF Deadband (G Reactive Load Control – 13 PF Deadband = 0.02)
- Enable the VAR/PF Control
    - Configure a Digital input for VAR/PF Enable and assert the DI
    - **OR** Configure auto enable (G Reactive Load Control – 03 VAR/PF Auto Enable = TRUE)
- Additional adjustments that can improve performance
    - VAR/PF Gain
    - VAR/PF Integral Gain
    - Voltage Ramp Time

Remote Control

When the remote control mode is selected, the PF or VAR reference level is determined by an analog input. Remote Control with analog inputs works the same way as the above control methods. The analog input becomes the reference value; the Voltage Ramp Rate is used for all raise and lower adjustments; and the reference value and actual value are used by the PI control to develop a PF_CMD that is sent to the LON.

To use a Remote VAR/PF reference an Analog Input must be set to either VAR reference or PF reference. The VAR/PF mode must also be set to Remote control. The analog input high and low calibration values must also be set up but will have different values depending on which configuration is used.

For PF control the MC limits the input into the reference to ± 50. This value would correspond to a reference of 0.5 LEAD to 0.5 LAG. For example, if the operator would like to set up the analog input to control PF on the mains between 0.9LEAD (4mA) to 0.9LAG (20mA) the high and low calibration would become ± 10.

For VAR control the MC limits the input to ± Rated Mains VAR. The input should be calibrated to the VAR values that are desired. The MC will then use this number to create a percentage of rated VAR that is then sent to the PI control. For example, if the operator would like to set up the analog input to control VAR on the mains between –100 and 500kVAR, where the rated mains VAR level was 1000kVAR, the high and low calibration would become –100 and 500.

Configuration Example
(WW Commands)

Set up an analog input that will regulate the VARs at the mains to between –2000 to 1000kVAR. The rated mains VAR is 2500kVAR.

- Configure the MC for Remote Control (G Reactive Load Control – 01 VAR/PF Mode = 4)
- Enable the VAR/PF Control
    - Configure a Digital input for VAR/PF Enable and assert the DI
    - **OR** Configure auto enable (G Reactive Load Control – 03 VAR/PF Auto Enable = TRUE)
- Configure Rated Mains VAR (A# First Time Config ## - 22 Rated Mains VAR = 2500)
- Configure Analog Input 1 to VAR Reference (A# First Time Config ## - 41 Analog Input 1 Function = 6)
- Configure Analog Input 1 for 4-20mA (Q Analog Inputs - 01 AI1 Type = 1)
- Configure Low Calibration Value (Q Analog Inputs - 04 AI1 Low Cal Value = -2000)
- Configure High Calibration Value (Q Analog Inputs - 05 AI1 High Cal Value = 1000)
- Optional:
    - Configure Label, High and Low Alarms and Pre Alarms

Set up an analog input that will regulate the PF at the mains to between 0.95LEAD to 0.80LAG.

- Configure the MC for Remote Control (G Reactive Load Control – 01 VAR/PF Mode = 4)
- Enable the VAR/PF Control
    - Configure a Digital input for VAR/PF Enable and assert the DI
    - **OR** Configure auto enable (G Reactive Load Control – 03 VAR/PF Auto Enable = TRUE)
- Configure Analog Input 1 to PF Reference (A# First Time Config ## - 41 Analog Input 1 Function = 5)
- Configure Analog Input 1 for 4-20mA (Q Analog Inputs - 01 AI1 Type = 1)
- Configure Low Calibration Value (Q Analog Inputs - 04 AI1 Low Cal Value = - 5)
- Configure High Calibration Value (Q Analog Inputs - 05 AI1 High Cal Value = 20)

- Optional:
    - Configure Label, High and Low Alarms and Pre Alarms

Import/Export VAR/PF Control

Import/Export VAR/PF control acts differently then all of the above modes because of the probability of having zero real power transfer across the mains breaker causing the sensed PF to swing leading and lagging in very short periods of time. In order to prevent these oscillatory effects a deadband controller is in place that controls the PF_CMD accurately. The deadband controller compares the reference and the actual VAR/PF. If the actual value is higher than the reference plus the deadband the control will lower the PF_CMD. If the actual value is lower than the reference plus the deadband the control will raise the PF_CMD. By instituting the deadband inadvertent, unnecessary control is eliminated. Import/Export Control is configured in the Process control section of the MC but is added here because it also can adjust the VAR/PF of the system

Configuration Example
(WW Commands)

An operator wants to control his plant in Import/Export. He only wants to purchase power from the utility in an emergency but wants to remain in parallel in case one of the generators fails. The operator also wants to export VAR to stabilize the voltage on the distribution line but wants to keep this in the range of 0.95LAG.

- Configure the MC for Import\Export (H Process Control – 01 Process Mode = FALSE)
- Enable Process Control
    - Configure a Digital input for VAR/PF Enable and assert the DI
- Configure Import/Export KW Reference to 0.0 (H Process Control – 16 IMPEXP KW LVL = 0.0)
- Configure Import/Export PF Reference to 0.95 LAG (H Process Control – 17 IMPEXP PF LVL = 0.05)
- Enable the VAR/PF Control
    - Configure a Digital input for VAR/PF Enable and assert the DI
    - **OR** Configure auto enable (G Reactive Load Control – 03 VAR/PF Auto Enable = TRUE)
- Additional adjustments that can improve performance
    - Voltage Ramp Time

Modbus (VAR, PF)

VAR/PF control can also be accomplished via MODBUS. The configuration of the MODBUS is similar to the Remote Control setup except for a few slight configuration changes. Instead of using Remote Control Mode the normal VAR/PF mode is needed. Via MODBUS the PF reference can have a value between –500 and 500, which corresponds to –0.5LEAD to 0.5LAG. The VAR reference however works by the same method described in the Remote Control section. One difference between MODBUS and Remote Control is the need for MODBUS-BW – 15 to be True. This BW works similarly to the Enable VAR/PF digital input bus is for MODBUS. See the following example for a configuration setup.

Configuration Example
(WW Commands)
Set up MODBUS to regulate the PF at the mains to between 0.95LEAD to 0.80LAG.

- Configure the MC for PF Control (G Reactive Load Control – 01 VAR/PF Mode = 3)
- Enable the VAR/PF Control
    - Configure a Digital input for VAR/PF Enable and assert the DI
    - **OR** Configure auto enable (G Reactive Load Control – 03 VAR/PF Auto Enable = TRUE)
- Enable the VAR/PF Control of MODBUS
    - MODBUS BW – 15 = TRUE (1)
- Set up MODBUS AW to values between –50 and 200.

Optional Reactive Load Functions

The functions described below are available when a discrete input is configured for the function or a MODBUS command is given to affect the function. These functions are operated in common with the real load functions by the same name. The discrete inputs operate both simultaneously.

Ramp Pause

When the Ramp Pause mode switch is activated, by DI, Modbus or ServLink/WW, the LOAD_CMD ramp will pause and hold the current load. When the switch is opened again, the load ramp will continue to the present set point. The Ramp Pause mode switch will not stop the LOAD_CMD from ramping if a shutdown (Stop All Engines) is present.

Reset VAR/PF Reference

The Reset VAR/PF reference is only available in MODBUS – BW 15. This variable will enable or reset(if cycled) the configured VAR/PF set point to the MODBUS value. In order to reset by the front panel or by Watch Window, the Enable VAR/PF DI or the AUTO ENABLE configurable must be cycled. The MC will then resume control and ramp to the new internal setpoint value. This will hold true for Import/Export and all other PI controlled VAR/PF set points.

Chapter 13.
Process Control Description

Introduction

Process control is a method by which the EGCP-3 MC will vary the LOAD_CMD and/or PF_CMD sent to the LS units in order to increase or decrease a measured parameter (temperature, pressure, kW, etc) that is being analyzed by the MC. The two methods of performing this operation are by Process or Import/Export. Process control is typically a method of controlling temperature or pressure in a thermodynamic process, but is not limited to these two variables. Import/Export control is a method of controlling the real and reactive power being consumed by a plant through the mains breaker.

Functional Description

Process control is enabled when the Enable Process Control digital input is asserted. The mode of control is configured in the Process control menu as Temperature/Pressure or Import/Export. When the process control is enabled, the error signal between the process reference and process signal is input to a PID controller. The output of the process controller is a load reference to the Real Load Controller, which then generates a LOAD_CMD to the LS units. This signal is sent in percentage of Rated Load. The default operation is 0 to 100%, but these limits can be set higher or lower using the Process Command High and Low Limits in the Process menu.

The Temperature/Pressure process control function is flexible enough to control any process where the controlled parameter can be monitored as an analog input signal. It can be configured as direct or indirect acting, depending on the process input increasing value with a power increase (direct), or increasing value with a power decrease (indirect); the process reference may be either an internal reference or the analog remote process reference input.

For the Import/Export process control function the controlled parameter is the Mains Watt, PF or VAR levels. The MC applies configured or remote reference values and the actual power on the mains to the PID controller, which then generates a reference for the Real Load Controller.

When the process control is enabled, the process controller will ramp the process reference until the Process Input matches Process Reference at the Load or Unload Rate, whichever applies. When the process reference is the internal configured value, the user has the ability to change the set point using the Load Raise/Lower switches. When these switches are activated, the process reference is ramped at the Load or Unload Rate, whichever applies. If a remote reference or Modbus reference is used, the Raise/Lower load switches will also be available. When switching from any other load control mode to Process Control, the current load becomes the new process reference, and the reference begins ramping from that point. This provides for a bumpless mode transfer.

Temperature/Pressure

Temperature/Pressure process control derives its feedback signal (process input) from an analog input. The analog input limits for this operation can be configured for any values because the MC will normalize these values before using the input in the PID. The reference value for the PID can be derived from two locations; the internal configurable or an analog input reference. Before these values are sent to the PID, they are scaled by the high and low limits of the feedback signal (process input). Care must be taken to select a reference value that will be within the calibrated limits of the process input or the PID will ramp to its limits and not control correctly.

If the process input signal happens to fail, the EGCP-3 will automatically switch load modes to the Internal Baseload Mode.

The process action (First Time Config menu) can also be selected for Direct or Indirect control. If the control is configured for Direct control a positive error between the reference and the input will increase the PID output and therefore increase the LOAD_CMD sent to the LS units. If configured for indirect action a positive error will decrease the PID output and the LOAD_CMD sent to the LS units. Another method of visualizing the control action is illustrated in the following figure:

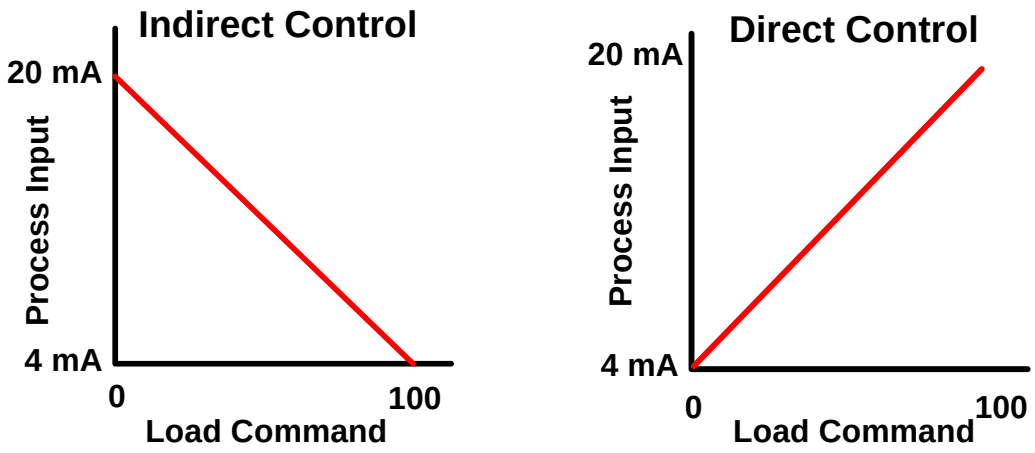


Figure 13-1. Indirect and direct process control action

For indirect action, an increase in load command will decrease the process input. For direct action, an increase in load command will increase the process input. A configuration example for each type of control action is shown below.

Configuration Example – Configure the MC for Direct Action (WW Commands)

A plant has a thermodynamic process where temperature control is very important. If the temperature drops below the rated temperature the generated power in the plant needs to be increased. The temperature can range from 180 and 200 °C and needs to be controlled at 190. The MC receives a 4-20mA input from a temperature sensor. Configure the MC for this action.

- Configure the MC for Direct Action (A# First Time Config ## - 39 Process Action = True)
- Enable Process Control – Assert the process control digital input
- Configure Analog Input 1 for Process Control Input (A# First Time Config ## - 41 Analog Input 1 Function = 3)
- Configure the MC for Process (Temperature/Pressure) (H Process Control – 01 Process Mode = True)
- Configure Analog Input 1 for 4-20mA (Q Analog Inputs - 01 AI1 Type = 1)
- Configure Low Calibration Value (Q Analog Inputs - 04 AI1 Low Cal Value = 180)
- Configure High Calibration Value (Q Analog Inputs - 05 AI1 High Cal Value = 200)
- Configure Process Reference (H Process Control – 09 Process Reference = 190)
- Optional:
    - Configure Label, High and Low Alarms and Pre Alarms for Analog Input 1
    - Configure Process High and Low Level Alarms
    - Configure Droop, Filter and Deadband for Process Control

Configuration Example – Configure the MC for Indirect Action (WW Commands)

A plant has a thermodynamic process where pressure control is very important. If the pressure is too high, the generated power in the plant needs to be decreased. The pressure can range from 100 to 200 psi, and needs to be controlled at different pressures depending on an external reference ranging from 120 to 170 psi. The MC receives a 1-5V input from a pressure sensor and a 4-20mA input from the reference sensor. Configure the MC for this action.

- Configure the MC for Indirect Action (A# First Time Config ## - 39 Process Action = False)
- Enable Process Control – Assert the process control digital input
- Configure Analog Input 1 for Process Control Input (A# First Time Config ## - 41 Analog Input 1 Function = 3)
- Configure Analog Input 2 for Process Reference (A# First Time Config ## - 43 Analog Input 2 Function = 4)
- Configure the MC for Process (Temperature/Pressure) (H Process Control – 01 Process Mode = True)
- Configure Analog Input 1 for 1-5 V (Q Analog Inputs - 01 AI1 Type = 2)
- Configure Analog Input 1 Low Calibration Value (Q Analog Inputs - 04 AI1 Low Cal Value = 100)
- Configure Analog Input 1 High Calibration Value (Q Analog Inputs - 05 AI1 High Cal Value = 200)
- Configure Analog Input 2 for 4-20 mA (Q Analog Inputs - 20 AI2 Type = 1)
- Configure Analog Input 1 Low Calibration Value (Q Analog Inputs - 23 AI2 Low Cal Value = 120)
- Configure Analog Input 1 High Calibration Value (Q Analog Inputs - 24 AI2 High Cal Value = 170)
- Optional:
    - Configure Label, High and Low Alarms and Pre Alarms for Analog Input 1
    - Configure Label, High and Low Alarms and Pre Alarms for Analog Input 2
    - Configure Process High and Low Level Alarms
    - Configure Droop, Filter and Deadband for Process Control

Import/Export

Import/Export is a special case of process control. Instead of using analog inputs for the process control input, the MC uses the power sensed through the mains breaker. The objective of Import/Export is to control the real and reactive load being consumed by a plant from the utility. This section will describe the operation of Import/Export control for real power. Reactive Import/ Export control descriptions are detailed in the Reactive Load Control Description, Chapter 12.

For Import/Export control the MC uses a configured or remote kW reference and the actual real power at the mains as inputs into the process control PID. If the plant load increases the internal generation is increased in order to maintain a constant power import or export from/to the utility. The following example will detail configuration setup.

Configuration Example
(WW Commands)
A plant wants to minimize utility bills but still wants to remain parallel with the mains for reliability reasons. A contract with the utility is made which stays that the plant can parallel with the utility as long as the plant maintains 500kW consumption. The daily plant load is usually 2MW and the remaining 1.5MW can be serviced by the three 600kW generators in the plant. Set the MC up for Import/Export control.

- Configure the MC for Direct Action (A# First Time Config ## - 39 Process Action = True)
- Enable Process Control – Assert the process control digital input
- Configure the MC for Import/Export (H Process Control – 01 Process Mode = False)
- Configure Import/Export Reference (H Process Control – 16 IMPEXP KW Level = 1.5)

IMPORTANT **Import/Export control should not be set up as an indirect process, direct action is the standard method of configuring this type of control.**

Modbus

Process control can also be accomplished via Modbus. Over Modbus the Process or Import/Export references can be configured. The operation is the same as the above two configurations only the Modbus reference will be used.

Optional Process Functions

The functions described below are available when the process mode is active. They are optional because a discrete input must be configured for the function or a MODBUS or ServLink/WW command must be given to affect the function.

Reset Load

When the Reset Load mode switch is closed and then opened, the process control will ramp the process reference to the original internal reference (configuration setting) at the Load or Unload Rate. This function will not work with a Remote reference. In addition, the user also has the ability to stop the ramp with the activation of the Load Raise/Lower switches. If the Load Raise/Lower switches are activated during a ramp, the current level becomes the process reference.

Ramp Pause

The Ramp Pause Load mode switch is used to pause an internal process control ramp. When the Ramp Pause mode switch is closed the process reference ramp will pause and hold the current process level until the switch is opened again. When the switch is opened again, the process ramp will continue where it left off. The Ramp Pause mode switch will not stop the process reference from ramping if a shutdown is present.

In addition, the user also has the ability to stop the ramp with the activation of the Load Raise/Lower switches. If the Load Raise/Lower switches are activated during a ramp the current load becomes the load reference, and the reference will ramp in up or down respectively. This is used to manually assume a new reference, where the pause would be used to hold a load to allow system stabilization, then move to the configured reference.

Unload
If the Unload mode switch is activated, by DI, Modbus or ServLink/WW, while the MC is in control of the LOAD_CMD, the LOAD_CMD will ramp to the Unload Level configuration setting and remain there until the Unload mode switch is deactivated.

The Unload configuration setting can be automatically overridden. The Unload configuration setting is considered the larger of the Process Low Limit and the Unload Trip configuration settings when evaluated from the perspective of the load controller.

Droop Control

Process Droop can be added to any process mode. The droop amount is configurable in percent of the process range up to 50%. The process reference will be decreased proportional to the generator load. This is typically only used in temperature/pressure control but there are no restrictions on its use. It is added to the otherwise isochronous control already in place. The Droop will add an element of stability to the process control loop by limiting large load variations for small process variations.

Filter

The process being controlled will react to load changes quickly or slowly. The process controller includes an adjustable filter to adjust the process control rate of response. The filter is a low pass filter where the frequency is adjustable. Higher frequency settings result in faster control response, but also more response to process noise. In systems experiencing rapid fluctuations in the process input signal (such as digester gas fuel pressure maintenance), reducing the Process Control Filter setpoint and increasing the Process Deadband will reduce control sensitivity to the fluctuations. This allows for slower, but more stable, performance. When the input reacts very slowly to load change a lower frequency setpoint is needed so as not to over-compensate.

Deadband

The process controller includes an adjustable deadband above and below the input signal. The deadband is useful in both noisy applications as well as for very slow processes. When the process input is within a deadband amount of the previous measurement (one rate group ago), no active adjustment will be made. For example, if Temperature/Pressure process is enabled with a deadband of 10°C, the process sensor input is 200°C, and the temperature sensed moves to 207°C, no adjustment will be made because the level sensed is within the deadband, the controller will continue to base its output on 200° input. If the next sample measures 212° the process will react and use 212° as a comparison to the reference.

Process Action

The process control function is configurable for direct and inverse action. Direct process control is where the sensed input signal increases as the load increases (such as where the sensed input is exhaust pressure or export power). An inverse action control is where the sensed input signal decreases as the load increases (such as when controlling import power where the import power will decrease as the generating system picks up more of the local load).

Chapter 14. Sequencing

Introduction

MC sequencing is very different then that found in the LS. There is no selection of Run Time manager available in the MC. The MC has two methods of starting/stopping LS units: Start/Stop All or Start/Stop Request. When a single unit Start/Stop request is made by the MC, the LS units determines whose turn it is to start or stop.

Functional Description

Start/Stop All is a command sent to the LON to all LS units that are START/STOP READY, which means that the LS units have their LON IN – Start/Stop Ready bit TRUE. The LS units will have their Auto only input closed and will not have any active shutdowns. When this command is issued, all units will be told to start and synchronize to the bus.

Start/Stop Request is a command sent to the LON to all LS units that are START/STOP NODES, which means that the LS units have their LON IN – Start/Stop Ready bit TRUE and their Run Time Manager (LON IN – SS_ARB_ALG) is not disabled (greater than zero). When this command is issued, the LS units on the bus will arbitrate between themselves and start/stop only the next unit to be started/stopped.

Start/Stop All commands are issued for a Loss Of Mains start event, a discrete input commanded start for paralleling, an ATS start, or a Time of Day start. The single units Start/Stop commands come from the MC demand control. For a Load demand Start/Stop, the Start/Stop Request will be used, which only starts a single unit at a time. The following list will explain the terms used in sequencing:

Start Nodes: LS nodes that have their Start Ready bit TRUE and their SS_ARB_ALG is greater than zero.

Start Ready: LS nodes that have their Start Ready bit TRUE.

Stop Nodes: LS nodes that have their Stop Ready bit TRUE and their SS_ARB_ALG is greater than zero.

Stop Ready: LS nodes that have their Stop Ready bit TRUE.

Start All: Command issued by the MC to start all LS units that are START READY. This command will start all LS units even if Lon Sequencing is disabled or the Run Time Manager is disabled.

Stop All: Command issued by the MC to stop all LS units that are STOP READY. This command will stop all LS units even if Lon Sequencing is disabled or the Run Time Manager is disabled.

Start Request: Command issued by the MC to start one of the LS units that is a START NODE. This command will not start an LS unit if Lon Sequencing is disabled or if the Run Time Manager is disabled.

Stop Request: Command issued by the MC to stop one of the LS units that is a STOP NODE. This command will not stop an LS unit if Lon Sequencing is disabled or if the Run Time Manager is disabled.

Chapter 15.
LON (Local Network) Description

Introduction

This section describes the messaging between LS and MC units over the Echelon Network (LON). The LON will allow multiple units to share load, control processes and sequence the starting and stopping of units.

Functional Description

The EGCP-3 LON is capable of working with multiple bus segments all connected on the same LON link. In the EGCP-3 implementation, the LON segments are always joined and the messaging indicates which genset is in which segment and which tie breakers are closed. Up to four separate buses are supported. The four buses may be isolated buses, mains feeds, or a combination of the two. Although many networks can be created, the below diagram is a single representation used to facilitate explanation. A network may contain up to 16 nodes (MC and LS together) and up to 4 bus segments. In the below diagram, the bus segments are identified with a capital letter A-D. The gensets (LS units) are identified with a number 1-8 which would also represent the node number on LON for this example. The bus segment tiebreakers are identified with a letter w-z simply to set them apart from the gensets.

The LON block has inputs from the application that inform it as to which segment it resides on and which other segments are currently tied to the same segment by closed tie-breakers. The tie-breaker status information is indicated by a discrete input on any LS or MC configured to indicate a specific tie-breaker position.

The application determines the active bus segment by observing which tie-breakers are closed, considering if it is an LS at generator or an MC at the mains, and considering its own configured bus segment location. The application asserts each of the four discrete inputs to the LON block related to the active bus. For example, if the active bus is segments A, B, and D, those three inputs to the LON block will be asserted but the C input will not be asserted.

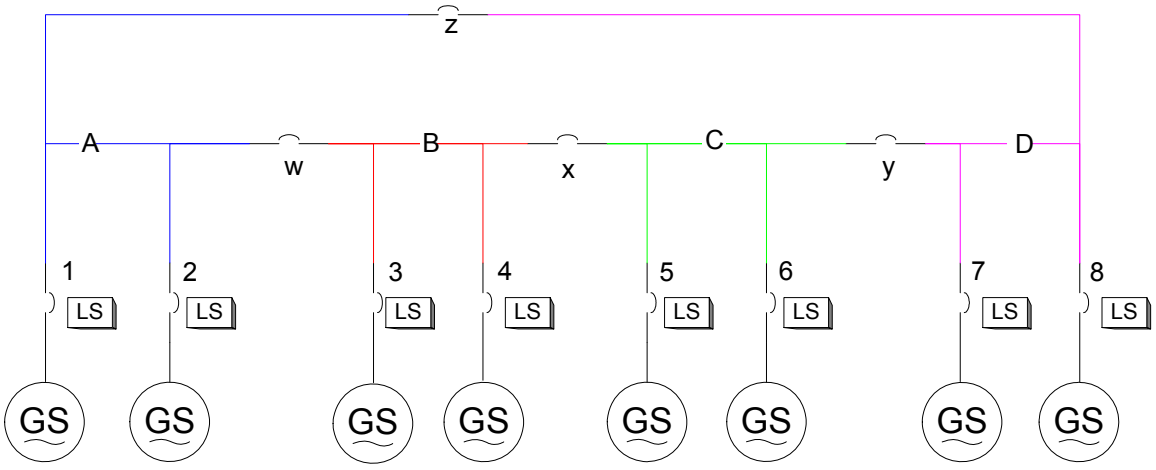


Figure 15-1. LON Bus Configuration

If the system also has mains connections, it may be modified as below. The diagram shows only 2 mains connections but it is technically feasible to have one on each segment for a total of 4. The initial release of the EGCP-3 MC will only be able to support two mains connections. The MC units on the LON still have a node number within the range of 1-16.

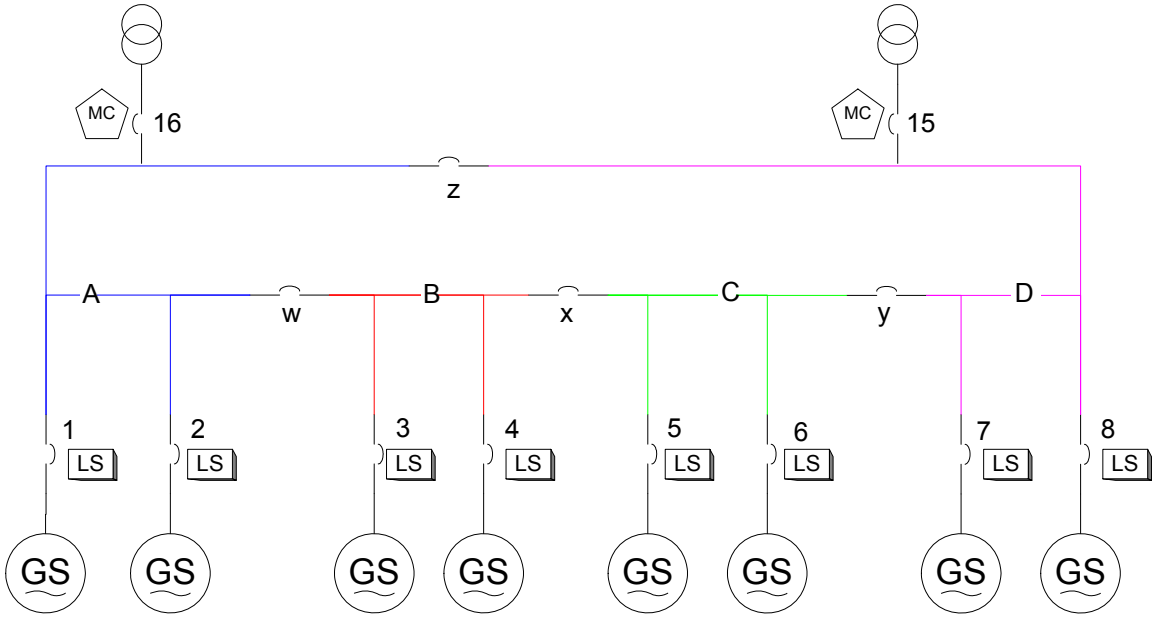


Figure 15-2. LON Bus Configuration, with Mains Tie(s)

Dead Bus Closing

Using the bus segment information and tie-breaker status to define the active bus segment, the LON block will perform dead bus arbitration with all other nodes that identify themselves on LON as participating in that active bus segment.

The algorithm uses a special LON message where each node that sees a deadbus and wishes to close to that bus requests permission to close. All units designated as on a common segment must declare the segment to be a deadbus before any unit will be allowed to close it's breaker onto the deadbus. The units on the active bus segment will then decide which unit will be granted permission to close onto the deadbus. Once a single node has been granted permission to close, it will attempt to close by signaling its application that it is OK to close. If the unit is not able to close the breaker/contactor because of a timeout or reclose alarm, the unit will release its request to close to the deadbus. All units that are still requesting to close to the deadbus will then arbitrate the permissions again.

This function is performed between units on the active bus segment only. The active segment will depend on which tiebreakers are closed. The active bus is at least the single segment on which a unit resides, but may be more than one segment if tiebreakers are closed to other segments.

Real Load Sharing

This function is performed between LS controls on the same active bus segment only. The block uses the same four discrete inputs described in the above section to determine which segments to share load with. The LON block will determine which nodes are part of the active bus segment and perform all calculations necessary to provide the application with the average load value. The application is responsible for using the average load information and its actual load to bias the speed output thus changing the power output.

The LON block will be informed, via the application, if it is to participate in the load sharing. There are times when an LS unit will desire not to participate in load sharing. In this instance, the LS unit will remove its Loadshare bit and will run at its internal setting, an example of this is if the unit has its BaseLoad digital input asserted. There are also times when a master may indicate that it is in control of the slave node. In this case, the LON block is to inform the application that it is now under the control of a master. LON will pass the master's requested load to the application for use in biasing the LS units speed output.

A Speed Trim feature is activated with the Load Sharing mode. The error between generator frequency and system frequency will be added to the speed bias. The application is responsible for performing the speed trim and does not need the assistance of the LON block.

Power Factor sharing

This function is performed between slaves on the same active bus segment only. The block uses the same four discrete inputs described in the above section to determine which segments to PF share. The LON block will determine which nodes are part of the active bus segment and perform all calculations necessary to provide the application with the average PF value. The application is responsible for using the average PF information and its actual PF to bias the voltage output thus changing the power factor.

The LON block will be informed, via the application, if it is to participate in the PF sharing. There are times when the application will wish the LON block not to participate in PF sharing so that it may use another method (like BaseLoad mode or when the mains are connected). There are also times when a master may indicate that it is in control of the slave node. In this case, the LON block is to inform the application that it is now under the control of a master. It will pass the master's requested PF to the application for use in biasing the voltage output.

Master Load / Process / PF Control

This function is performed between a master and its slaves on the same active bus segment only. The block uses the same four discrete inputs described in the above section to determine which master is in control. The master tells the LON block what load level and PF level it is requesting and asserts the Master in Control bit to indicate that it wishes to control the slaves. The slave LON block will simply report the percent load and PF values requested to the LS units. The LS units will then use the values to adjust their speed and voltage bias.

Run Time Manager

This function is only available in the LS units and is detailed in the LS manual.

Networked Start/Stop

The EGCP-3 MC can determine when there is a need to start and stop LS units on a bus and communicates this over the LON network. The decision to start/stop units will be due to mains demand, time of day, mains failure, automatic or manual request. This feature is detailed in Chapter 14, Sequencing.

Chapter 16.
Demand Control Description

Introduction

Many plants do not have a constant load profile. The load in the plant varies depending on time of day, time of year and even type of process or equipment being used. Sometimes it is cheaper for a plant to generate internal power during times of high demand. To do this an operator would need to initiate a start of the units in the plant based on time of day or local demand. In order to automate this operation the MC has a peaking and demand feature. The demand operation can operate based on demand level of the plant through the mains or at specific configurable times of day.

Functional Description

Peaking and Demand control is configured in the Peaking Menu of the MC.

The demand feature of the MC has four modes of operation based on time of day or imported demand level:
1. Off
2. Time of Day
3. Load Demand Level
4. Time and Load Demand

The type of start/stop that the MC will initiate will depend on the type of control configured. Time of Day starts issue a Start All command; Load Demand starts issue a Start Request (Start One) command.

The current demand level is derived using the mains demand (in VA) of all MCs on the active bus segment or by using one of the configured analog inputs. The setting USE PROC IN FOR DMND SEQ in the Process menu determines which demand signal will be used. The total demand is then filtered with the Demand Coefficient. Filtering is used to remove inadvertent load spikes that could cause unwanted starts. The low pass filter is shown below:

$$Demand = \frac{1}{1+s(\tau)} * Total\_Mains\_Load(VA)$$

A better visual tool is to look at a bode diagram of the filter and its cutoff frequency. Figure 16-1 shows the bode diagram of the filter with varying time coefficients. By varying the time coefficient the response of the demand will become slower. Figure 16-2 illustrates the effect of the filter on the demand. If the demand coefficient is small then the demand almost matches the actual load profile. By increasing the filter time coefficient more frequencies are filtered and the slower the response to a change in load.

The demand feature also remembers the maximum demand value of the mains for the MC and for all mains on the active bus segment. The MC demand monitored is the demand value for the mains connection to this MC. The Total Demand is the demand monitored by all of the MCs on the active bus segment added together. Only the highest demand level is remembered. The Time and Date at which the maximum event occurred will also be retained. This feature is always active as long as the Peak Shaving Mode is configured for a mode other than OFF.

Both the MC and the Total Demand Maximum value can be reset (to zero) by using the front panel display and selecting the Reset Demand options. The reset can also be performed through Watch Window. When resetting from the front panel display, a technician level password is required.

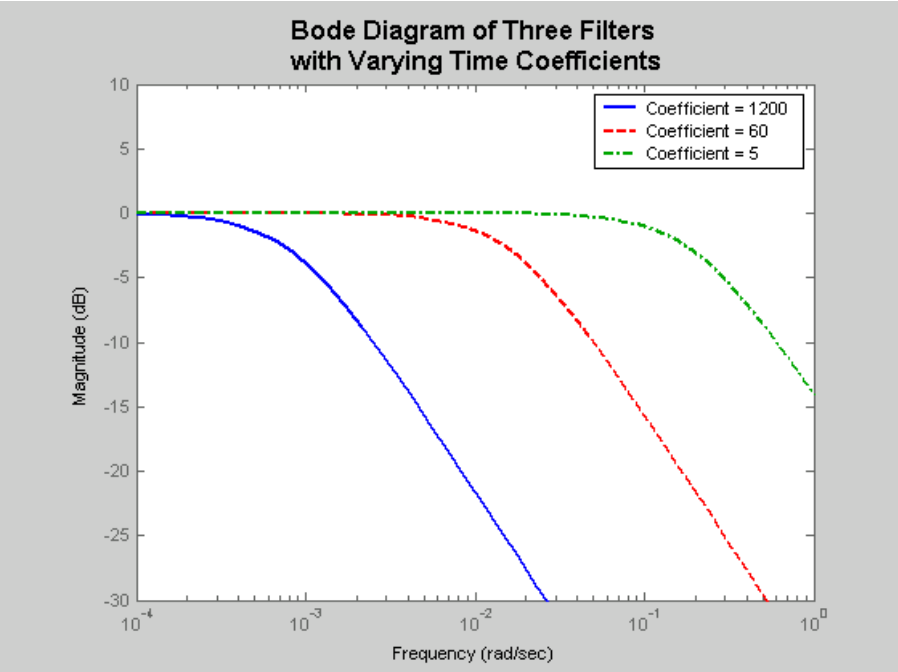


Figure 16-1. Bode Diagram of Three Filters

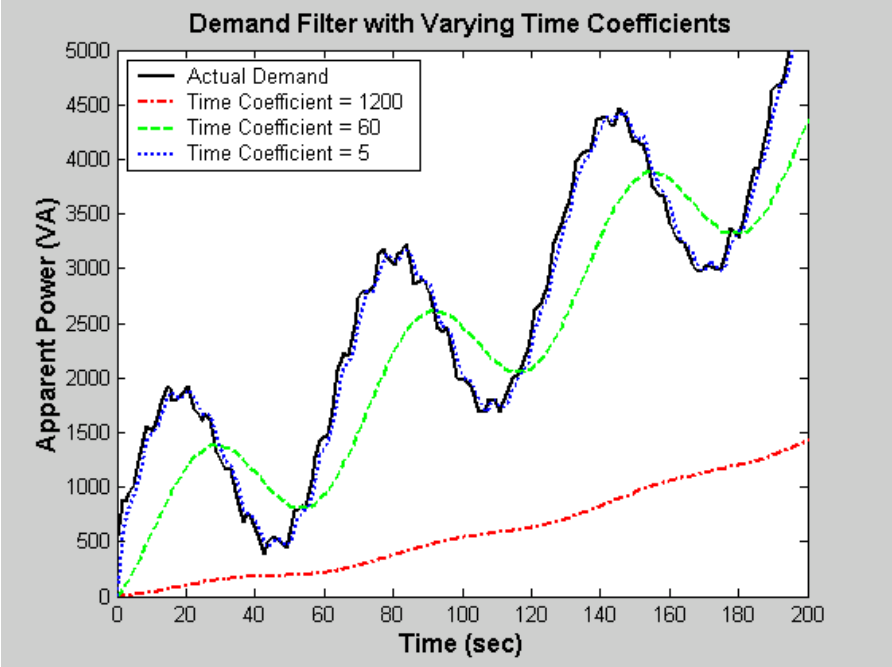


Figure 16-2. Demand Filter with Different Time Coefficients

Off

MC will not perform any peaking or time of day operation.

Time of Day

Time of Day mode starts and loads the LS unit(s) using the Time of Day controller. There is no delay on starting or stopping the genset – the programmed times are used as is. The method of control is dictated by how the unit is configured for ATS. If ATS is Off the LS units will be paralleled to the mains and the load will be controlled by either Process or BaseLoad control depending on the mode that is configured. If ATS is configured for Open Transition, the MC will initiate an Initiate ATS OT start. If ATS is configured for Closed Transition, the MC will initiate an Initiate ATS CT start. These modes of operation are detailed in Chapter 17.

The Time of Day controller contains four separate programs with two start and duration times for each program. Only one program can be configured per day of the week. A simple program is shown below:

Configuration Example
(WW Commands)
A rolling mill has a high demand on Tuesday and Thursday when additional motors are used to satisfy the rolling process. During this time, it is cheaper for the plant to supply some of the additional load with its available gensets at the plant. The operator wants to automate these starts and uses the MC to do so. On Tuesday, the demand begins at 09:30 and runs for 3.5 hours. On Thursday, the demand has two different peaks, one at 08:00 for 1.25 hours and another at 14:15 and both run for 4 hours. The operator would like to run all units at 90% load during these times. Configure the MC to perform this function.

- Configure the MC for Time of Day Operation
  (J Peaking – 01 Peak Shaving Mode = 2 = Time of Day)
- Configure the MC for ATS Off
  (I Transfer Switch – 01 ATS Mode = 1 = Off)
- Configure the BaseLoad Setpoint
  (F Real Load Control – 01 BaseLoad Reference = 90)
- Set Program 1 for Tuesday
  (J Peaking – 14 Tuesday Program = 1)
- Set Program 2 for Thursday
  (J Peaking – 16 Thursday Program = 2)
- Configure the two programs

Configurable	Set Value
Program 1 Start 1 Hour	9
Program 1 Start 1 Minute	30
Program 1 Stop 1 Hour	13
Program 1 Stop 1 Minute	0
Program 1 Start 2 Hour	12 *Default Value
Program 1 Start 2 Minute	0 *Default Value
Program 1 Stop 2 Hour	12 *Default Value (Will Not Start Units)
Program 1 Stop 2 Minute	0 *Default Value (Will Not Start Units)
Program 2 Start 1 Hour	8
Program 2 Start 1 Minute	0
Program 2 Stop 1 Hour	9
Program 2 Stop 1 Minute	15
Program 2 Start 2 Hour	14
Program 2 Start 2 Minute	15
Program 2 Stop 2 Hour	18
Program 2 Stop 2 Minute	15

Load Demand

In the Load Demand Only mode, the Demand Dispatcher will start and load the genset according to the demand level settings. The dispatcher watches the mains demand level of all MCs on the active bus segment and compares it against the Time Delayed Demand Start Level and Immediate Demand Level set points. If the demand level exceeds the Time Delayed Demand Start Level but not the Instantaneous Demand Level set point, the dispatcher will wait the Load Demand Time Delay set point prior to starting, synchronizing, and loading the next LS unit. If the Demand Level drops below the Time Delayed Demand Start Level before the Load Demand Time Delay, the timer will be reset. However, if the demand level exceeds the Instantaneous Demand Level set point, the dispatcher will immediately start, synchronize, and load the next LS unit. The instantaneous demand condition is considered latched until the LS unit is on-line. The LS units will be controlled in BaseLoad (recommended use) or Process (**see below note **), whichever mode is configured.

When the demand level drops below the Time Delayed Demand Stop Level set point, the dispatcher will wait the Load Demand Time Delay set point and then unload and stop the next LS unit.

For certain applications, it may be necessary to have the Demand sequencing active at certain times and not active at other times. In software revision F, a new discrete input was added to enable the demand sequencing. The setpoint 07 USE DI FOR DMD ENABLE, in the Peaking menu determines if the demand sequencing will always be active or if it will only be active when the input is closed. This input can be assigned to any of the programmable inputs.

An example of how the load demand feature works is illustrated in Figure 16-2.

IMPORTANT

It is not recommended to use the Process load control mode with the Load Demand mode. In process control a fixed load is maintained through the mains breaker, so the process is fixing the demand level in place. If this load level is above the Demand Stop level, the unit will run continuously. If set below the Demand Stop level the Demand Stop will become active and the unit may be cycled on and off the bus without any change in the plant load.

Figure 16-3 illustrates an example of a demand curve with configured Start and Stop levels. At time T1 the demand has crossed the time delayed start level but no control is currently taking place. At T2 the demand becomes larger than the time delayed start level and the Load Demand Time Delay begins to count down. When the time delay expires the next available LS units is started. The demand continues to increase even after the LS is online so the time delay begins again. Before the delay expires, the demand reaches the Immediate demand level (T3). The next LS unit is started immediately. When the second unit comes online, the demand timer starts again, but before it expires, the level falls below the time delayed start level. At this time, the timer shuts off. At T4 the demand increases above the time delayed start level and the timer is started. The delay expires and a third LS is told to start and come online. Now that three units are online the demand level begins to decline. Plant load also decreases at this time so that the demand falls below the time delayed stop time and the time delay is initiated (T5). The next available LS unit is stopped when the timer expires. Eventually all LS units are stopped because of insufficient demand. A typical configuration example is shown below.

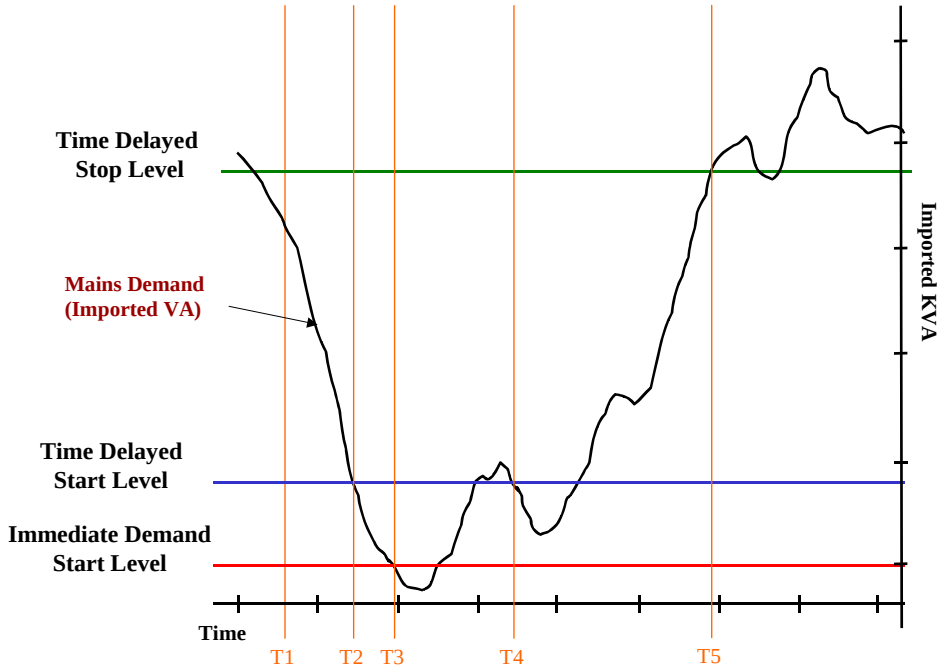


Figure 16-3. Demand Profile with Start and Stop Levels

Configuration Example
(WW Commands)
An industrial manufacturer has a cyclic demand depending on the type of process operating at certain times of day. The plant operator wishes to use the MC to perform peaking operation when the plant is at certain demand levels. The plant load can vary tremendously and in order to save maintenance costs on the gensets only a large prolonged demand should call for a demand start. To accomplish this a decision is made to place the demand coefficient for the filter at 120. The stop level will be set at 1.5MW and the start and immediate start levels are to be placed at 5MW and 6MW respectfully. The start and stop time delay is 3 minutes. Configure the MC to perform this function.

- Configure the MC for Load Demand Operation (J Peaking – 01 Peak Shaving Mode = 3 = Load Demand Only)
- Configure the Load Demand Time Delay (J Peaking – 06 Load Dmd Time Delay = 180)
- Configure the Demand Coefficient (J Peaking – 11 Demand Coefficient = 120)
- Configure the Time Delayed Stop Level (J Peaking – 05 Time Delayed Dmd Stop = 1.5)
- Configure the Time Delayed Start Level (J Peaking – 04 Time Delayed Dmd Start = 5.0)
- Configure the Immediate Start Level (J Peaking – 03 Immediate Dmd Start = 6.0)

Load Demand and Time

In the Load Demand and Time mode, the Demand Dispatcher will start and load the LS units according to the Time/Day of Week control with a Demand override. All functions of the Demand Mode (described above) still apply simultaneous with all functions of the Time Mode. Either one may start the LS units. In order to stop the LS units, however, both must agree. In other words, the time schedule must indicate the LS's should be off AND the demand level must be below the Time Delayed Demand Stop Level set point in order to stop a LS unit.

Chapter 17.
Automatic Transfer Switch Description

Introduction

The Automatic Transfer Switch functions in the EGCP-3 MC are intended to operate similarly to a traditional ATS but also have several different modes of operation. Some applications use a mechanically locked ATS rather than breakers; the EGCP-3 will also be capable of controlling this typical transfer switch rather than a pair of breakers. The physical signals from the EGCP-3 are identical in either case.

The MC can be configured to automatically detect when Mains voltage becomes unstable or disappears and an Open transition ATS will be initiated. When returning from a LOM the configured ATS return mode will occur.

Timers will be provided to allow the EGCP-3 to ignore momentary disturbances. A delay timer is provided for open transition mode to control the open time. All features of the synchronizer will be utilized for closed transition applications. The protective relay alarms for the mains input are the normal means of declaring a loss of mains but discrete inputs may also be used.

Functional Description

The ATS controller may be configured for Off, Open or Closed transition. When open transition is selected, the ATS controller will never close the mains breaker and generator simultaneously. However, it should be noted that this configuration setting only affects the ATS controller and will not inhibit a mains parallel action by other means. It is up to the user to configure the entire EGCP-3 MC properly if mains parallel is not desired at any time.

Loss of Mains Definition

A Loss of Mains may be declared for a number of reasons as listed below.

- A user defined spare fault input that is configured for Loss of Mains action is asserted.
- Mains Under Frequency condition (this requires a Mains Under Frequency alarm and/or pre-alarm to be configured for LOM action).
- Mains Under Voltage condition (this requires a Mains Under Voltage alarm and/or pre-alarm to be configured for LOM action).
- Mains Negative Phase Sequence Over Voltage condition (this requires a Mains Negative Phase Sequence Over Voltage alarm and/or pre-alarm to be configured for LOM action).
- Mains Negative Phase Sequence Over Current condition (this requires a Mains Negative Phase Sequence Over Current alarm and/or pre-alarm to be configured for LOM action).
- Load Surge condition (this requires a Load Surge alarm and/or pre-alarm to be configured for LOM action).

Any function that can be configured for loss of mains action can be configured for either LOM or LOM with Alarms. When selecting LOM w/ Alarms, an audible alarm will be instigated and the alarm is posted in the alarm logs.

Once the LOM condition is detected and declared by the protective relay function, discrete input, or load surge condition, a LOM action delay timer is started. Once this timer has expired, if the condition still exists, the configured LOM action will be performed. LOM has two methods of initiation, Open Mains First or Start Genset First. This option is configurable in the Transfer Switch menu in Watch Window.

If the control is configured for Open Mains First, or no group breaker is configured, the mains breaker will be opened upon the expiration of the LOM action delay timer. Once the mains has been opened the MC will send a signal to the LS units to start and close onto the dead bus. The action is exactly as the OT Test ATS described below.

If the control is configured for Start Genset First and there is a group breaker configured the LS units will be started first upon the expiration of the LOM action delay timer. The LOM will then transition through an OT ATS Start as described below.

The return from a loss of mains will follow whichever transition is configured. If ATS is configured for OFF or CT the transition will parallel the gensets to the mains and then unload and shutdown the units. If the ATS is configured for OT, an OT return will be followed.

ATS Initialization

The ATS function in the EGCP-3 MC can be initiated by several methods. Besides the open transition and closed transition, a number of other configurables and variables can affect the operation of the transfer. The modes of operation of the ATS in the EGCP-3 MC are detailed below.

There are three methods of entering an ATS mode in the MC.

Test ATS: Enabled by asserting the Auto and Test contacts or by similar action over Modbus or ServLink

Initiate ATS: Enabled by asserting the Auto, Test and Run contacts or by similar action over Modbus or ServLink

Run w/Load to ATS: Enabled by asserting the Test contact while in Run w/Load mode or similar action over Modbus or ServLink

ATS Configurables and Variables

There are also several configurables and variables that can effect the operation of ATS.

Load Shed DO: Enable the loadshed algorithm.

Start Nodes: LS nodes that have their Start Ready bit TRUE and their SS_ARB_ALG is greater than zero.

Start Ready: LS nodes that have their Start Ready bit TRUE.

Stop Nodes: LS nodes that have their Stop Ready bit TRUE and their SS_ARB_ALG is greater than zero.

Stop Ready: LS nodes that have their Stop Ready bit TRUE.

Start All: Command issued by the MC to start all LS units that are START READY. This command will start all LS units even if Lon Sequencing is disabled or the Run Time Manager is disabled.

Stop All: Command issued by the MC to stop all LS units that are STOP READY. This command will stop all LS units even if Lon Sequencing is disabled or the Run Time Manager is disabled.

Transfer Capacity: Makes sure that the capacity of the system will match the load on the bus. If RWL-ATS is initiated the transfer time cannot be guaranteed. If no group breaker is configured then the transfer capacity is automatically set to zero.

WARNING

If no group breaker is configured for the system, it is recommended that the Transfer Capacity and Transfer Capacity Units be set at their minimum values.

Online Capacity: Total Capacity of units on the active bus segment with their breaker closed.

Fast Transfer Time: Dictates the time for a transition to occur. Transfer will not occur before this delay has occurred. If the fast transfer time is less than 5 seconds the ATS will not wait for zero power transfer across the breaker.

Zero Power Xfer: Zero power transfer (ZPT) window is only configurable in debug and is set at 5. If the units of the PTCT_ATL block are in KW then the zero power transfer will be set true when the mains breaker sees less than 5KW across its breaker. This test is an absolute so that plus or minus 5KW will be ZPT.

Zero Power Xfer Deadband: This is the deadband around the zero power xfer where the breaker will be opened. It is in mains power units. If the mains is in kW and the deadband is configured for 5 then ZPT will be assumed if less than 5kW is flowing through the mains.

Group Breaker: Configuring a group breaker in the system is the only way to guarantee transfer times. Without a group breaker, the ATS cannot guarantee fast transfer times because of LS synchronization times.

LoadShare (LS): EGCP-3 Load Share Unit

CT Load Rate: Closed Transition load rate. This rate is calculated by taking a sample of the load needed to create ZPT when ATS is initiated. This load is then divided by the Fast Transfer Delay Time to create a ramp rate. During a closed transition the load ramp has a calculated setpoint and the ramp rate. If the ramp reaches the setpoint or ZPT occurs the ramp is turned off.

CT Unload Rate: Closed Transition unload rate. This rate is calculated by taking a sample of the system load when the mains breaker is closed. This load is then divided by the Fast Transfer Delay Time to create a ramp rate. During the closed transition return the load ramp has a setpoint of 0 and the ramp rate dictates the speed that the ramp is decreasing. If the ramp reaches 0 the ramp is turned off.

Open Transition

Test ATS with Group Breaker:
The open transition Test ATS function behaves similarly to a Loss of Mains (LOM) action. When Auto and Test are instigated, the MC recognizes a Test ATS condition and opens the **Mains Breaker**. Once there is confirmation from the mains breaker aux of the mains being opened the MC will initiate a **Start All** Engines signal. The LS units that are **Start Ready** will then start and synchronize onto the bus. Based on the **Transfer capacity** and the **Online capacity** the MC will make a decision on group breaker closure.

Breaker Options:

1. If the **Online capacity** is greater than the **Transfer capacity,** the group breaker will be closed onto the load.
2. If the **Online capacity** is less than the **Transfer capacity**, the control will then look to see if there are any **Start Ready** nodes on the network. If the **Start Ready** nodes are greater than zero and the **Start All** command has been issued for longer than 240 seconds (configurable in debug – LON_ALLST.ALLST_DLY.DLY_TIME) and no **Load shed DO's** have been configured the MC will issue a **Auto Start Sequence** alarm.
3. If the **Online capacity** is less than the **Transfer capacity**, and the control has a configured **Load shed DO** the MC will wait for 100 seconds (configurable in debug – XFER_CAP.LS_DELAY.DLY_TIME) and then close the group breaker. If the generation capacity is unable to support the online load a **Load shed DO** will be triggered. If all loads have been shed the MC will wait an additional load shed delay time and then issue an **Auto Start Sequence Alarm.** Simultaneously the MC will exit the ATS mode by opening the **Group Breaker** and issuing a **Stop All** to the LS's which are **Stop Ready.** Once the group breaker has been opened, the **Fast Transfer Delay Time** will be initiated. At the end of the delay time, the mains will be closed onto the deadbus.

Test ATS without Group Breaker:
The open transition Test ATS without a group breaker function behaves similarly to a Loss of Mains (LOM) action. When Auto and Test are instigated, the MC recognizes a Test ATS condition and opens the **Mains Breaker**. Once there is confirmation of the mains being opened, the MC will initiate a **Start All** Engines signal. All LS units that are **Start Ready** will start and synchronize to the bus.

Breaker Options:

1. If the LS's are able to support the load that is on the bus no action will be taken.
2. If the **Start Ready** nodes are greater than zero and the **Start All** command has been issued for longer than 240 seconds (configurable in debug – LON_ALLST.ALLST_DLY.DLY_TIME) and no **Load shed DO's** have been configured the MC will issue a **Auto Start Sequence** alarm.
3. If **Load Shed DO's** are configured and the above option occurs then the **Auto Start Sequence** alarm will not be issued unless all **Load Shed DO's** have been used. If this occurs an **Auto Start Sequence** alarm will be issued and the MC will exit the ATS mode by issuing a **Stop All** to the LS's which are **Stop Ready.** Once the MC receives confirmation that no LS's are still on the bus the **Fast Transfer Delay Time** will be initiated. At the end of the delay time, the mains will be closed onto the deadbus.

Initiate ATS with Group Breaker:
Initiate ATS open transition will behave in a normal ATS manner. When Auto, Test and Run are instigated, the MC recognizes an Initiate ATS condition and sends a **Start All** command to the LS's. All LS units that are **Start Ready** will start and synchronize to the bus. The breaker options are as follows:

Breaker Options:

1. If the **Online capacity** is greater than the **Transfer capacity** the MC will open the **Mains Breaker**, and begin the **Fast Transfer Delay Time**. When the **Fast Transfer Delay Time** has expired the **Group Breaker** will be closed.
2. If the **Online capacity** is less than the **Transfer capacity** the and a **Load shed DO** is configured the MC will wait for 100 seconds (configurable in debug – XFER_CAP.LS_DELAY.DLY_TIME) and then open the **Mains Breaker.** When confirmation of the mains breaker being opened has occurred the **Fast Transfer Delay Time** is initiated. When the delay has expired, the **Group Breaker** will be closed. If the generators cannot support the load, the loadshed algorithm will be initiated. If all loads have been shed the MC will wait an additional load shed delay time and then issue a **Auto Start Sequence Alarm** and exit the ATS mode by opening the **Group Breaker** and issuing a **Stop All** command to the LS's which are **Stop Ready.**
3. If the **Online capacity** is less than the **Transfer capacity** and no **Load Shed DO's** are configured, the control will then look to see if there are any **Start Ready** nodes on the network. If the **Start Ready** nodes are greater than zero and the **Start All** command has been issued for longer than 240 seconds (configurable in debug – LON_ALLST.ALLST_DLY.DLY_TIME) the MC will issue an **Auto Start Sequence** alarm.

Initiate ATS without Group Breaker:
Open Transition Initiate ATS without a group breaker will behave exactly like Open transition Test ATS.

Closed Transition

Test ATS with Group Breaker
The closed transition Test ATS function in the MC will attempt to create a zero power transfer across the mains breaker. When Auto and Test are instigated, the MC recognizes a Test ATS condition and initiates a **Start All** command. All LS units that are **Start Ready** will start and synchronize to the bus. The breaker options are as follows.

Breaker Options:

1. If the **Online capacity** is greater than the **Transfer capacity** the MC will close the **Group Breaker**, and begin the **Fast Transfer Delay Time**.

    i. If the **Fast Transfer Delay Time** expires and **ZPT** has been reached, the **Mains Breaker** will be opened.
    ii. If the **Fast Transfer Delay Time** is configured for less than 5 seconds, and expires, the **Mains Breaker** will be opened even if **ZPT** has not been reached.
    iii. If the **Fast Transfer Delay Time** is configured for more than 5 seconds and has expired and there are no **Load Shed DO's** configured the **Mains Breaker** will remain closed until **ZPT** has been reached. If **ZPT** is never reached then the LS's will remain in parallel with the mains.
    iv. If the **Fast Transfer Delay Time** is configured for more than 5 seconds and has expired and there are **Load Shed DO's** configured and **ZPT** has not been reached the MC will initiate the load shed. If **ZPT** is never reached and all loads have been shed a **High Load Limit** alarm will be issued and the MC will exit the ATS mode by opening the **Group Breaker** and issuing a **Stop All** command to the LS's.

2. If the **Online capacity** is less than the **Transfer capacity**, and the control has a configured **Load shed DO** the MC will wait for 100 seconds (configurable in debug – XFER_CAP.LS_DELAY.DLY_TIME) and then close the **Group Breaker** and begin the **Fast Transfer Delay Time.**

    i. If the **Fast Transfer Delay Time** expires and **ZPT** has been reached, the **Mains Breaker** will be opened.
    ii. If the **Fast Transfer Delay Time** is configured for less than 5 seconds, and has expired, the **Mains Breaker** will be opened even if **ZPT** has not been reached.
    iii. If the **Fast Transfer Delay Time** is configured for more than 5 seconds, and has expired, the MC will initiate the load shed. The **Mains Breaker** will remain closed until **ZPT** has been reached. If **ZPT** is never reached and all loads have been shed a **High Load Limit** alarm will be issued and the MC will exit the ATS mode by opening the **Group Breaker** and issuing a **Stop All** command to the LS's.

3. If the **Online capacity** is less than the **Transfer capacity** and no **Load Shed DO's** are configured, the control will then look to see if there are any **Start Ready** nodes on the network. If the **Start Ready** nodes are greater than zero and the **Start All** command has been issued for longer than 240 seconds (configurable in debug – LON_ALLST.ALLST_DLY.DLY_TIME) the MC will issue an **Auto Start Sequence** alarm. The **Group Breaker** will not be closed and no transition will take place.

Test ATS without Group Breaker

The closed transition Test ATS without a group breaker function in the MC will attempt to create a zero power transfer across the mains breaker. Without a group breaker the transfer capacity is automatically set to zero. When Auto and Test are instigated, the MC recognizes a Test ATS condition and initiates a **Start All** command. After one LS unit has started and has synchronized to the bus, the MC has several options depending on configuration.

Breaker Options:

1. When an LS unit has closed onto the bus, the MC will begin the **Fast Transfer Delay Time.**
    i. If the **Fast Transfer Delay Time** expires and **ZPT** has been reached, the **Mains Breaker** will be opened.
    ii. If the **Fast Transfer Delay Time** is configured for less than 5 seconds, and has expired, the **Mains Breaker** will be opened even if **ZPT** has not been reached.
    iii. If the **Fast Transfer Delay Time** is configured for more than 5 seconds, and has expired, the **Mains Breaker** will remain closed until **ZPT** has been reached. If **ZPT** is never reached then the LS's will remain in parallel with the mains.
    iv. If the **Fast Transfer Delay Time** is configured for more than 5 seconds and has expired and there are configured **Load shed DO's** the MC will initiate the load shed algorithm.
        1. If a load is shed and **ZPT** is reached then the **Mains Breaker** will be opened
        2. If all loads have been shed the MC will wait an additional load shed delay time then issue a **High Load Limit Alarm**. If **ZPT** is not reached when the delay time has expired, the **Mains Breaker** will remain closed and the MC will exit the ATS mode by issuing a **Stop All** command to the LS's which are **Stop Ready.**

Initiate ATS with Group Breaker

Initiate ATS closed transition will behave in a normal ATS manner. When Auto, Test and Run are instigated, the MC recognizes an Initiate ATS condition and sends a **Start All** command to the LS's. All LS's that are **Start Ready** will start and synchronize to the bus. The breaker options are as follows:

Breaker Options:

1. If the **Online capacity** is greater than the **Transfer capacity** the MC will close the **Group Breaker**, and begin the **Fast Transfer Delay Time**.

    i. If the **Fast Transfer Delay Time** expires and **ZPT** has been reached, the **Mains Breaker** will be opened.
    ii. If the **Fast Transfer Delay Time** is configured for less than 5 seconds, and expires, the **Mains Breaker** will be opened even if **ZPT** has not been reached.
    iii. If the **Fast Transfer Delay Time** is configured for more than 5 seconds and has expired and there are no configured **Load shed DO's** the **Mains Breaker** will be opened even if **ZPT** has not been reached
    iv. If the **Fast Transfer Delay Time** is configured for more than 5 seconds and has expired and there are configured **Load shed DO's** the MC will initiate the load shed algorithm.
        a. If a load is shed and **ZPT** is reached then the **Mains Breaker** will be opened
        b. If all loads have been shed the MC will wait an additional load shed delay time then issue a **High Load Limit Alarm**. If **ZPT** is not reached when the delay time has expired the **Mains Breaker** will remain closed and the MC will exit the ATS mode by opening the **Group Breaker** and issuing a **Stop All** command to the LS's which are **Stop Ready.**

2. If the **Online capacity** is less than the **Transfer capacity** and a **Load shed DO** is configured and a 100 second (configurable in debug – XFER_CAP.LS_DELAY.DLY_TIME) delay has expired the MC will close the **Group Breaker** and begin the **Fast Transfer Delay Time.**

    i. If the **Fast Transfer Delay Time** expires and **ZPT** has been reached, the **Mains Breaker** will be opened.
    ii. If the **Fast Transfer Delay Time** is configured for less than 5 seconds, and has expired, the **Mains Breaker** will be opened even if **ZPT** has not been reached.
    iii. If the **Fast Transfer Delay Time** is configured for more than 5 seconds, and has expired, the MC will initiate the loadshed algorithm.
        a. If a load is shed and **ZPT** is reached then the **Mains Breaker** will be opened

b. If all loads have been shed the MC will wait an additional load shed delay time then issue a **High Load Limit Alarm**. If **ZPT** is not reached when the delay time has expired the **Mains Breaker** will remain closed and the MC will exit the ATS mode by opening the **Group Breaker** and issuing a **Stop All** command to the LS's which are **Stop Ready.**

3. If the **Online capacity** is less than the **Transfer capacity** and no **Load Shed DO's** are configured, the control will then look to see if there are any **Start Ready** nodes on the network. If the **Start Ready** nodes are greater than zero and the **Start All** command has been issued for longer than 240 seconds (configurable in debug – LON_ALLST.ALLST_DLY.DLY_TIME) the MC will issue a **Auto Start Sequence** alarm. The **Group Breaker** will not be closed and no transition will take place.

Initiate ATS without Group Breaker

Initiate ATS closed transition will behave in a normal ATS manner. Without a group breaker the transfer capacity is automatically set to zero. When Auto, Test and Run are instigated, the MC recognizes an Initiate ATS condition and sends a **Start All** command to the LS's. All LS's that are **Start Ready** will start. When the first LS unit synchronizes to the bus the MC has several options depending on configuration.

Breaker Options:

1. When an LS unit has closed onto the bus, the MC will begin the **Fast Transfer Delay Time.**
   a. If the **Fast Transfer Delay Time** expires and **ZPT** has been reached, the **Mains Breaker** will be opened.
   b. If the **Fast Transfer Delay Time** is configured for less than 5 seconds, and has expired, the **Mains Breaker** will be opened even if **ZPT** has not been reached.
   c. If the **Fast Transfer Delay Time** is configured for more than 5 seconds and has expired and there are no configured **Load shed DO's** the **Mains Breaker** will be opened even if **ZPT** has not been reached
   d. If the **Fast Transfer Delay Time** is configured for more than 5 seconds and has expired and there are configured **Load shed DO's** the MC will initiate the load shed algorithm.
      i. If a load is shed and **ZPT** is reached then the **Mains Breaker** will be opened
      ii. If all loads have been shed the MC will wait an additional load shed delay time then issue a **High Load Limit Alarm**. If **ZPT** is not reached when the delay time has expired, the **Mains Breaker** will remain closed and the MC will exit the ATS mode by issuing a **Stop All** command to the LS's which are **Stop Ready.**

Run w/Load to ATS with Group Breaker
Run w/ Load to ATS is started by initially being parallel with the mains and asserting Test. This situation creates an Initiate ATS mode in the MC. Since a **Start All** command is always occurring during Run w/ Load, the command will not be reissued, but all alarms associated with Initiate ATS will now become active. The breaker options are as follows depending on configuration.

Breaker Options:

1. If the **Online capacity** is greater than the **Transfer capacity** the MC will begin the **Fast Transfer Delay Time**.
    i. If the **Fast Transfer Delay Time** expires and **ZPT** has been reached the **Mains Breaker** will be opened.
    ii. If the **Fast Transfer Delay Time** is configured for less than 5 seconds the **Mains Breaker** will be opened even if **ZPT** has not been reached.
    iii. If the **Fast Transfer Delay Time** is configured for more than 5 seconds and has expired and there are no configured **Load shed DO's** the **Mains Breaker** will be opened even if **ZPT** has not been reached
    iv. If the **Fast Transfer Delay Time** is configured for more than 5 seconds and has expired and there are configured **Load shed DO's** the MC will initiate the load shed algorithm.
        a. If a load is shed and **ZPT** is reached then the **Mains Breaker** will be opened
        b. If all loads have been shed the MC will wait an additional load shed delay time then issue a **High Load Limit Alarm**. If **ZPT** is not reached when the delay time has expired the **Mains Breaker** will remain closed and the MC will exit the ATS mode by opening the **Group Breaker** and issuing a **Stop All** command to the LS's which are **Stop Ready.**

2. If the **Online capacity** is less than the **Transfer capacity** and a **Load shed DO** is configured and a 100 second (configurable in debug – XFER_CAP.LS_DELAY.DLY_TIME) delay has expired the MC will begin the **Fast Transfer Delay Time.**
    i. If the **Fast Transfer Delay Time** expires and **ZPT** has been reached the **Mains Breaker** will be opened.
    ii. If the **Fast Transfer Delay Time** is configured for less than 5 seconds the **Mains Breaker** will be opened even if **ZPT** has not been reached.
    iii. If the **Fast Transfer Delay Time** is configured for more than 5 seconds and has expired the MC will initiate the loadshed algorithm.
        a. If a load is shed and **ZPT** is reached then the **Mains Breaker** will be opened

b. If all loads have been shed the MC will wait an additional load shed delay time then issue a **High Load Limit Alarm**. If **ZPT** is not reached when the delay time has expired the **Mains Breaker** will remain closed and the MC will exit the ATS mode by opening the **Group Breaker** and issuing a **Stop All** command to the LS's which are **Stop Ready.**

3. If the **Online capacity** is less than the **Transfer capacity** and no **Load Shed DO's** are configured, the control will then look to see if there are any **Start Ready** nodes on the network. If the **Start Ready** nodes are greater than zero and the **Start All** command has been issued for longer than 240 seconds (configurable in debug – LON_ALLST.ALLST_DLY.DLY_TIME) the MC will issue a **Auto Start Sequence** alarm. The LS's will remain in parallel with the mains unless the alarm is configured for **Stop All Engines.**

Run w/Load to ATS without Group Breaker

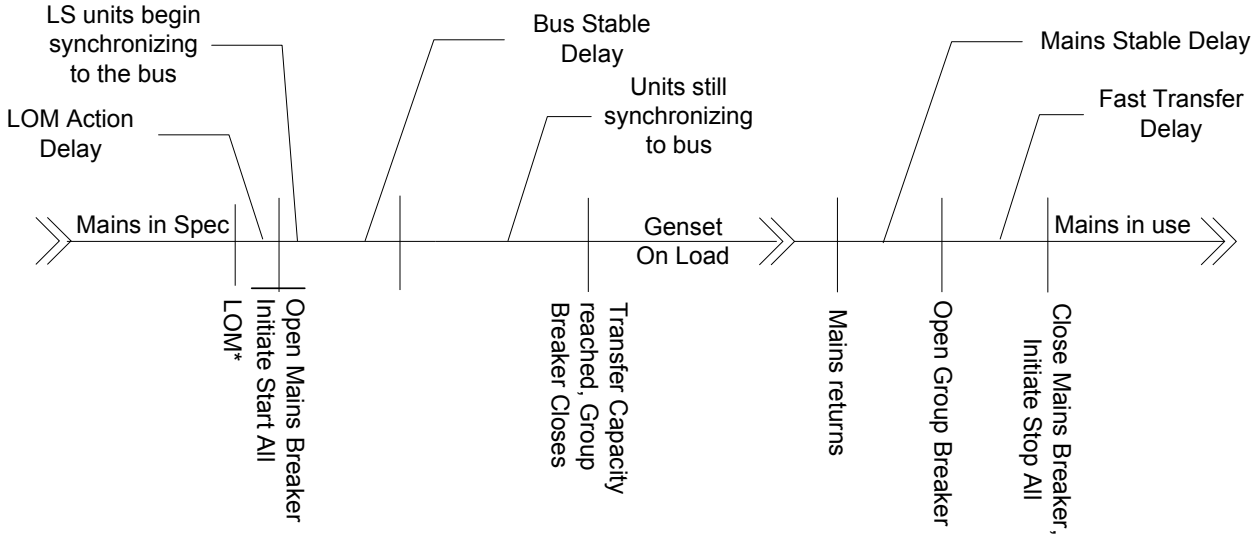
Run w/ Load to ATS without a Group Breaker is started by initially being parallel with the mains and asserting Test. This situation creates an Initiate ATS mode in the MC. Without a group breaker the transfer capacity is automatically set to zero. Since a **Start All** command is always occurring during Run w/ Load, the command will not be reissued, but all alarms associated with Initiate ATS will now become active. The breaker options are as follows depending on configuration.

Breaker Options:

1. The MC will begin the **Fast Transfer Delay Time.**
   a. If the **Fast Transfer Delay Time** expires and **ZPT** has been reached the **Mains Breaker** will be opened.
   b. If the **Fast Transfer Delay Time** is configured for less than 5 seconds the **Mains Breaker** will be opened even if **ZPT** has not been reached.
   c. If the **Fast Transfer Delay Time** is configured for more than 5 seconds and has expired and there are no configured **Load shed DO's** the **Mains Breaker** will be opened even if **ZPT** has not been reached
   d. If the **Fast Transfer Delay Time** is configured for more than 5 seconds and has expired and there are configured **Load shed DO's** the MC will initiate the load shed algorithm.
      i. If a load is shed and **ZPT** is reached then the **Mains Breaker** will be opened
      ii. If all loads have been shed the MC will wait an additional load shed delay time then issue a **High Load Limit Alarm**. If **ZPT** is not reached when the delay time has expired the **Mains Breaker** will remain closed and the MC will exit the ATS mode by issuing a **Stop All** command to the LS's which are **Stop Ready.**

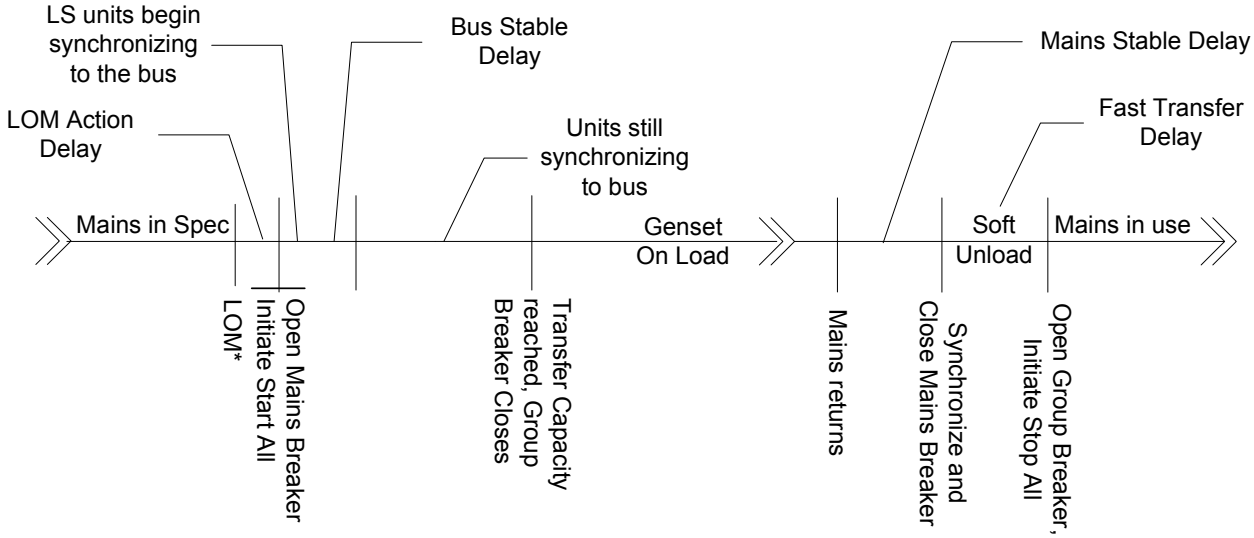
Graphical Representations

Open Transition Loss of Mains Start and Return



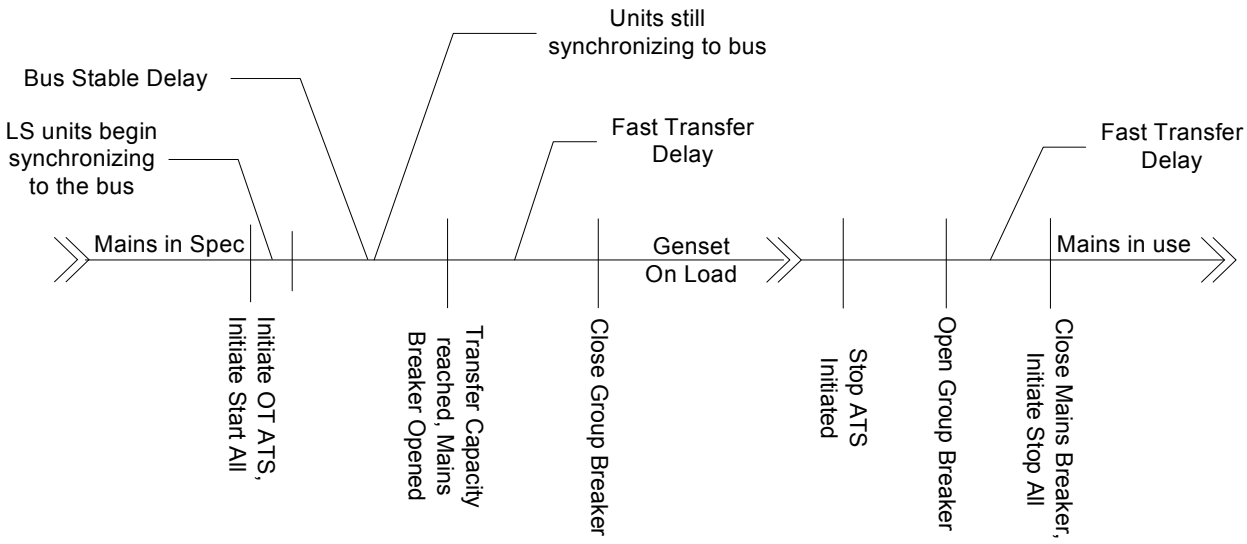
*Any alarm condition configured for LOM or LOM w/ Alarms

Closed Transition Loss of Mains Start and Return

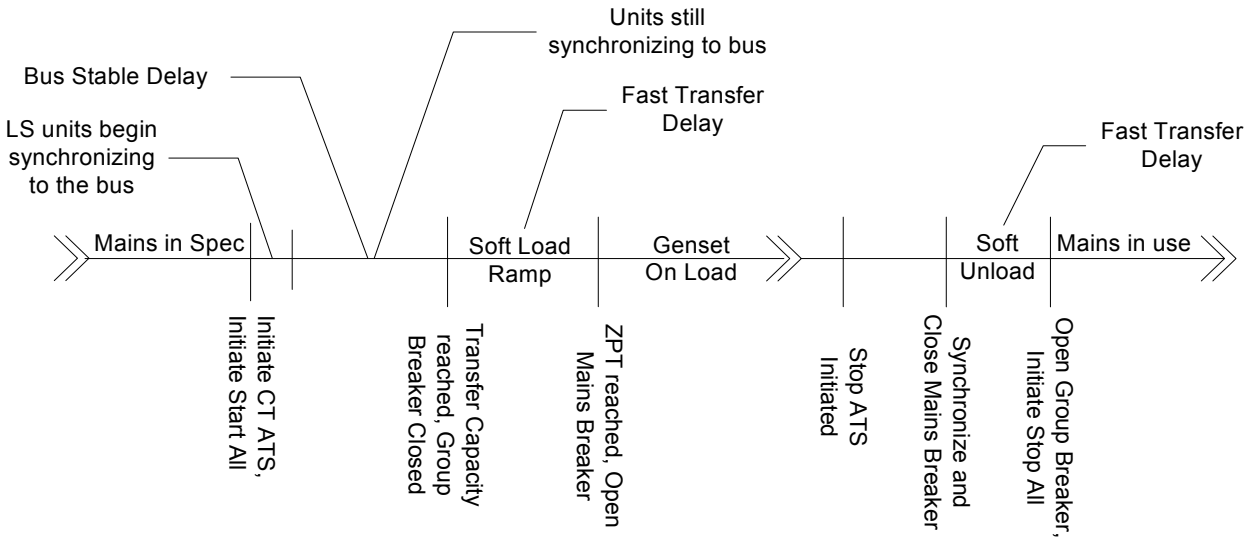


*Any alarm condition configured for LOM or LOM w/ Alarms

Open Transition Start and Return (Initiate ATS)



Closed Transition Start and Return (Initiate ATS)



Load Shed Operation

Load shed operation will take effect in two modes; ATS and Isolated operation and these modes will operate differently. Isolated operation load shed will operate on low frequency and low voltage pre-alarms, ATS operation load shed will operate if zero power transfer does not occur. The following sections will describe operation and configuration.

IMPORTANT **The load shed digital outputs are not latched outputs. When the conditions for a load shed are no longer present the digital outputs will deactivate.**

Isolated Operation

Load shed in isolated operation can occur if the system has just completed an open transition, a loss of mains, or any time that the LS units are isolated from the mains and the load on the bus cannot be supported by the LS units gensets. The load shed algorithm is initiated by configuring a digital output for load shed. The triggers for load shedding are the Bus Under Frequency Pre-Alarm and the Bus Under Voltage Pre-Alarm. Other factors that affect operation are the Under Frequency Pre-Alarm Delay, the Mains Breaker Status and the Group Breaker or LS unit status.

To configure a load shed in isolated operation the Pre-Alarms must be set for either Audible or Visual alarm status. In software Revision F, this was changed so that the alarms must be Audible or Visual class. For earlier versions, the load shed function used the Warning and Visual classes. To trigger the load shed, the mains breaker must be open, there must be at least one LS unit online, and the group breaker (if configured) must be closed.

Three load sheds are available and are triggered as follows:

Load Shed 1: Either pre-alarm becomes active (Under Voltage or Under Frequency)

Load Shed 2: Load Shed 1 has been triggered and both pre-alarms are active. This triggers the under frequency pre-alarm delay. When the delay expires load shed 2 is triggered.

Load Shed 3: Load shed 2 has been triggered. This triggers another under frequency pre-alarm delay. When the delay expires load shed 3 is triggered.

Configuration Example (WW Commands)

An operator wants to shed load if the generators in his system cannot support load during a loss of mains situation. Speed is necessary for power quality reasons so the non-essential loads will be shed if voltage becomes 460V or frequency becomes 58.5 Hz. Three load sheds will be configured to act every 0.5 seconds if the conditions persist.

- Configure the MC for the three load sheds (C# Digital Outputs ## – 15 Digital Output 10 = 21)
  (C# Digital Outputs ## – 17 Digital Output 11 = 22)
  (C# Digital Outputs ## – 19 Digital Output 12 = 23)
- Configure the Under Voltage Pre-Alarm for Audible (B Bus Protection – 07 Bus Volt Lo Pre-Alm= 4)
- Configure the Under Frequency Pre-Alarm for Audible (B Bus Protection – 28 Bus Freq Lo Pre-Alm= 4)
- Configure the Under Voltage Pre-Alarm Level (B Bus Protection – 09 Bus Volt Lo Pre-Alm Lvl= 460)
- Configure the Under Frequency Pre-Alarm Level (B Bus Protection – 30 Bus Freq Lo Pre-Alm Lvl= 58.5)
- Configure the Under Frequency Pre-Alarm Delay (B Bus Protection – 34 Bus Freq Lo Pre-Alm Dly= 0.5)

ATS Operation

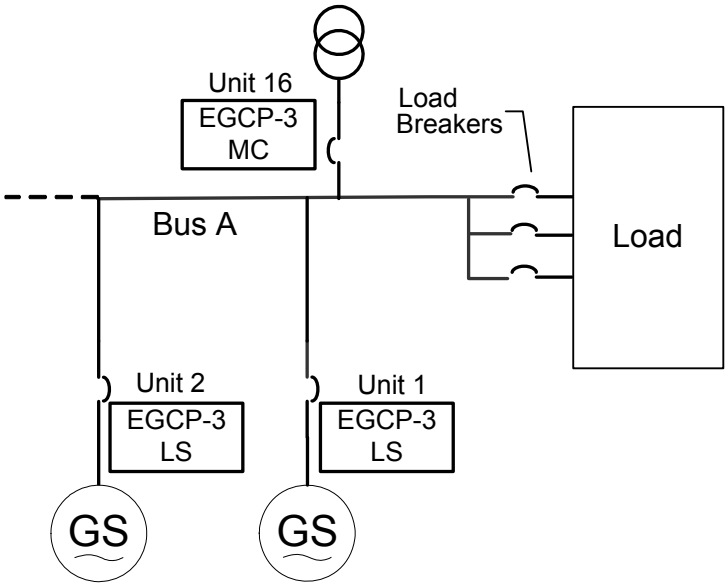
Load shed in ATS operation can be triggered by only configuring a digital output for load shed operation. Most of the load shed logic is found in the previous sections in this chapter but the triggers are as follows:

Load Shed 1: The ATS logic triggers load shed action

Load Shed 2: Load Shed 1 has been triggered and the ATS load shed logic is still active. This triggers the under frequency pre-alarm delay. When the delay expires load shed 2 is triggered.

Load Shed 3: Load shed 2 has been triggered. This triggers another under frequency pre-alarm delay. When the delay expires load shed 3 is triggered.

Chapter 18.
LS-MC Mains Parallel Application



In a Multiple Unit Mains Parallel Application, a EGCP-3 MC is will sequence gensets, synchronize the Mains (breaker 16) to the local bus (A) and control import/export of power with the mains by controlling genset/bus power through the LS units.

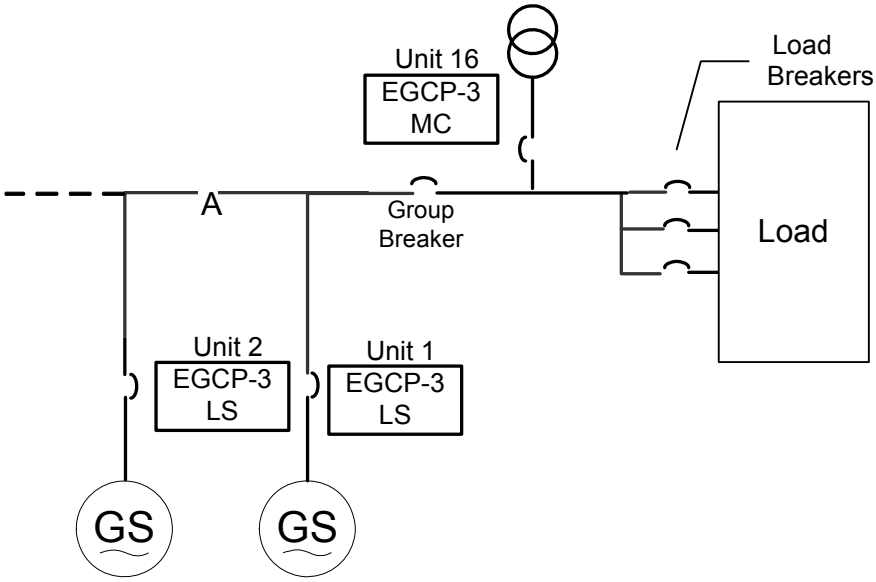
The MASTER EGCP-3 control shall be capable of:

- Control Auto Start Sequencing of LS units based upon system load levels and accumulated unit run times.
- Synchronize Bus generators to the Utility, and close the utility breaker.
- Soft Load Bus generators to and from the utility
- Open the utility breaker in the event of a loss of utility, or during an open transition return to utility power.
- Control the Bus Generators in BaseLoad Control Mode
- Control the Bus Generators in Process Control Mode
- Control the Bus Generators in Import Export Control Mode
- Control the bus Generators in PF or KVAR control mode (relative to the utility feed)
- Control the bus generators in a Fixed PF control mode (PF BaseLoad)
- The local display and HMI will:
  - Provide V, A, W, KVA, KVAR, PF information for single or three Mains phase configuration.
  - Provide Mains Total VA, VAR, and W information
  - Provide Bus and Breaker Status Information, i.e. Stopped, Isoch, BaseLoad, etc.
  - Provide dynamic adjustment of relative control loops (load, synch, PF/VAR)
  - Provide calibration of analog I/O
  - Provide LON network information
  - Number of units on the network
  - Number of units on load
  - Next unit start sequence
  - Next unit stop sequence

The EGCP-3 LS slave control shall perform the following functions:

- Start the genset(s), and placing the generator on load (dead bus closing or active synchronization) upon receipt of the appropriate input commands.
- Operate in Isochronous Loadsharing Control (A, B, C, D Bus, or Combined, depending upon configuration and status of the Mains tie breaker).
- Genset Cooldown when a set KVA load level is exceeded.
- Ramp to master controlled load upon closure of the tie breaker.
- Operate in BaseLoad Control
- Operate in Process Load Control
- Operate in PF sharing control (load sharing mode only)
- Operate in PF Control (BaseLoad or process mode only)
- Operate in KVAR Control (BaseLoad or process mode only)
- Voltage Trim (isoch operation only)
- Frequency Trim (isoch operation only)
- Remove the generator from load (open gen breaker) upon shutdown signal i.e., either from discrete input or internally generated shutdown condition.
- Engine stop
- The local display and HMI will:
  - Provide V, A, W, KVA, KVAR, PF information for single or three phase configuration.
  - Provide Engine Speed, Oil Pressure, Coolant Temp, Battery (supply) voltage, kW-hours, accumulated engine run time (hours), and Service hours information.
  - Provide Engine and Generator Status Information, i.e. Running, Stopped, Isoch, BaseLoad, etc.
  - Provide dynamic adjustment of relative control loops (load, synch, PF/VAR)
  - Provide calibration of analog I/O
  - Provide LON network information
  - Number of units on the network
  - Number of units on load
  - Next unit start sequence
  - Next unit stop sequence

Chapter 19.
LS-MC Mains Parallel ATS Application



In a Multiple Unit Mains Parallel Application, a EGCP-3 MC is required to sequence, synchronize and control import/export of power with the mains (breaker 16). With the addition of the bus tie breaker (w) the MC control is capable of ATS operation.

The MASTER EGCP-3 control shall be capable of:

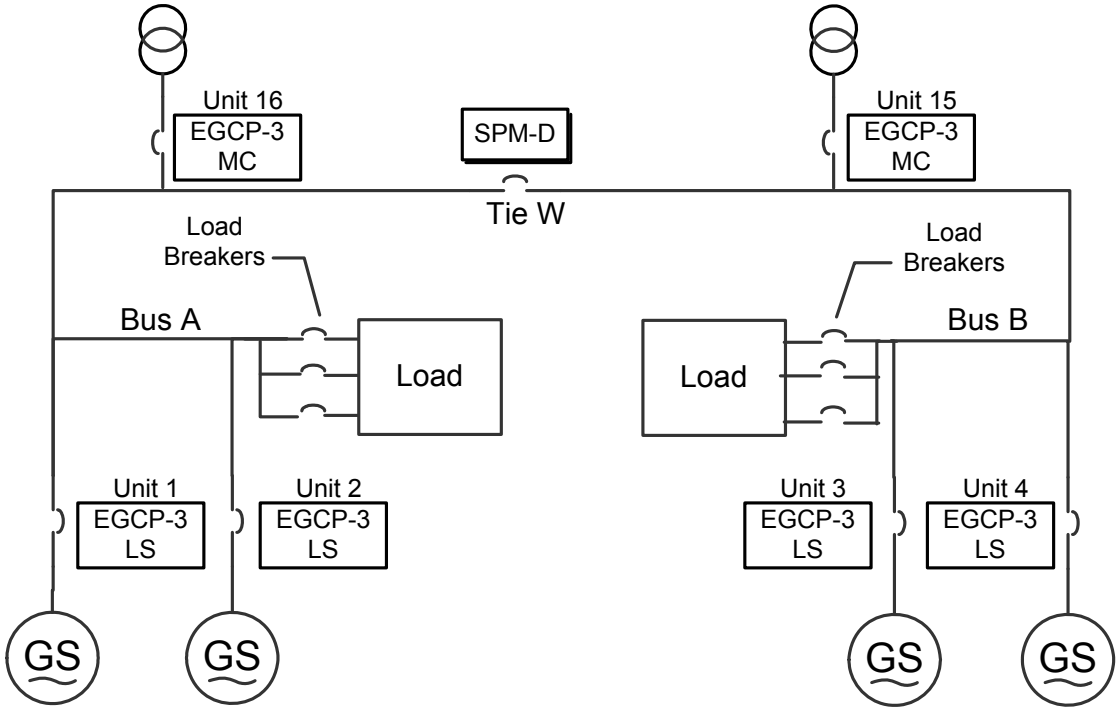
- Perform Open and Closed Transition ATS functions with 100msec overlap capability
- Synchronize Bus generators to the Utility, and close the utility breaker.
- Soft Load Bus generators to and from the utility
- Open the utility breaker in the event of a loss of utility, or during an open transition return to utility power.
- Monitor the capacity of engines on load to close group breaker (w) for isolated load.
- Control the Bus Generators in BaseLoad Control Mode
- Control the Bus Generators in Process Control Mode
- Control the Bus Generators in Import Export Control Mode
- Control the bus Generators in PF or KVAR control mode (relative to the utility feed)
- Control the bus generators in a Fixed PF control mode (PF BaseLoad)
- The local display and HMI will:
    - Provide V, A, W, KVA, KVAR, PF information for single or three phase configuration.
    - Provide Total VA, VAR, and W information
    - Provide system load and system PF averages
    - Provide Engine Speed, Oil Pressure, Coolant Temp, Battery (supply) voltage, kW-hours, accumulated engine run time (hours), and Service hours information.
    - Provide Bus and Breaker Status Information, i.e. Stopped, Isoch, BaseLoad, etc.

Provide dynamic adjustment of relative control loops (load, synch, PF/VAR)
Provide calibration of analog I/O
Provide LON network information
Number of units on the network
Number of units on load
Next unit start sequence
Next unit stop sequence

The EGCP-3 slave control shall be capable of:

- Start the genset(s), and placing the generator on load (dead bus closing or active synchronization) upon receipt of the appropriate input commands.
- Operate in Isochronous Loadsharing Control (A, B, C, D Bus, or Combined, depending upon configuration and status of the group and Mains Tie breaker).
- Genset Cooldown when a set KVA load level is exceeded.
- Ramp to master controlled load upon closure of the tie breaker.
- Operate in BaseLoad Control
- Operate in Process Load Control
- Operate in PF sharing control (load sharing mode only)
- Operate in PF Control (BaseLoad or process mode only)
- Operate in KVAR Control (BaseLoad or process mode only)
- Voltage Trim (isoch operation only)
- Frequency Trim (isoch operation only)
- Provide Auto Sequencing based upon system load levels and accumulated unit run times.
- Remove the generator from load (open gen breaker) upon shutdown signal i.e., either from discrete input or internally generated shutdown condition.
- Engine stop
- The local display and HMI will:
  - Provide V, A, W, KVA, KVAR, PF information for single or three phase configuration.
  - Provide Engine Speed, Oil Pressure, Coolant Temp, Battery (supply) voltage, kW-hours, accumulated engine run time (hours), and Service hours information.
  - Provide Engine and Generator Status Information, i.e. Running, Stopped, Isoch, BaseLoad, etc.
  - Provide dynamic adjustment of relative control loops (load, synch, PF/VAR)
  - Provide calibration of analog I/O
  - Provide LON network information
  - Number of units on the network
  - Number of units on load
  - Next unit start sequence
  - Next unit stop sequence

Chapter 20.
LS-MC Mains Parallel, Split Bus Application



A Multiple Unit, Mains Parallel, Split bus Application would use EGCP-3 LS, and MC control with an SPM-D synchronizer. Each bus is capable of isolated or mains parallel operation. Both local bus' can also be tied together.

The MASTER EGCP-3 control shall be capable of:

- Perform Open and Closed Transition ATS functions with 100msec overlap capability
- Synchronize Bus generators to the Utility, and close the utility breaker.
- Soft Load Bus generators to and from the utility
- Open the utility breaker in the event of a loss of utility, or during an open transition return to utility power.
- Control the Bus Generators in BaseLoad Control Mode
- Control the Bus Generators in Process Control Mode
- Control the Bus Generators in Import Export Control Mode
- Control the bus Generators in PF or KVAR control mode (relative to the utility feed)
- Control the bus generators in a Fixed PF control mode (PF BaseLoad)
- Provide Auto Sequencing based upon system load levels and accumulated unit run times.
- The local display and HMI will:
  - Provide V, A, W, KVA, KVAR, PF information for single or three phase configuration.
  - Provide Total VA, VAR, and W information

Provide bus and breaker Status Information, i.e. Running, Stopped, Isoch, BaseLoad, etc.
Provide Unit Sequencing Status Information
Provide system load and system PF averages
Provide dynamic adjustment of relative control loops (load, synch, PF/VAR)
Provide calibration of analog I/O
Provide LON network information
Number of units on the network
Number of units on load
Next unit start sequence
Next unit stop sequence

The EGCP-3 slave control shall be capable of:

- Start the genset(s), and placing the generator on load (dead bus closing or active synchronization) upon receipt of the appropriate input commands.
- Operate in Isochronous Loadsharing Control (A, B, C, D Bus, or Combined, depending upon configuration and status of the tie breaker).
- Genset Cooldown when a set KVA load level is exceeded.
- Ramp to master controlled load upon closure of the tie breaker.
- Operate in BaseLoad Control
- Operate in Process Load Control
- Operate in PF sharing control (load sharing mode only)
- Operate in PF Control (BaseLoad or process mode only)
- Operate in KVAR Control (BaseLoad or process mode only)
- Voltage Trim (isoch operation only)
- Frequency Trim (isoch operation only)
- Remove the generator from load (open gen breaker) upon shutdown signal i.e., either from discrete input or internally generated shutdown condition.
- Engine stop
- The local display and HMI will:
  - Provide V, A, W, KVA, KVAR, PF information for single or three phase configuration.
  - Provide Engine Speed, Oil Pressure, Coolant Temp, Battery (supply) voltage, kW-hours, accumulated engine run time (hours), and Service hours information.
  - Provide Engine and Generator Status Information, i.e. Running, Stopped, Isoch, BaseLoad, etc.
  - Provide dynamic adjustment of relative control loops (load, synch, PF/VAR)
  - Provide calibration of analog I/O
  - Provide LON network information
  - Number of units on the network
  - Number of units on load
  - Next unit start sequence
  - Next unit stop sequence

The SPM-D shall can perform the following functions:

- Synchronize Bus “A” to Bus “B”, or vice Versa
- Dead bus closing to Bus “A” or Bus “B”

Chapter 21.
Acronyms

Abbreviation	Definition
A/D	Analog to Digital Converter
AI	Analog Input
AO	Analog Output
Atlas	Woodward turbine control platform
AVR	Automatic Voltage Regulator
CAN	Controller Area Network
Coder	The Code generator, used to convert GAP output files into executable code.
Control	EGCP-3 Control System
CPU	Central Processing Unit.
DG	Distributed Generation (Connected to mains and operated by utility)
DI	Discrete Input (Contact Input)
DO	Discrete Output (Relay Driver Output)
DR	Distributed Resource EGCP-3 (May be connected to mains)
DSLC™	Digital Synchronizer and Load Controller
DSP	Digital Signal Processing
EGCP	Engine Generator Control Panel
EPS	Emergency Power System
EU	Engineering Unit (psi, KW, ºC, etc.)
FFT	Fast Fourier Transform
FW	Firmware (embedded software)
GAP	Graphical Applications Programmer used to create application programs.
HW	Hardware
I/O	Input/Output, typically the interface to field devices such as switches, transducers, meters, controls, or actuators.
Interrupt Latency	The time delay from when an interrupt is generated in hardware until the processor has started the user interrupt service code.
ISLU	Isochronous Load Sharing Unit
LON	Echelon Network (Load Sharing, Sequence Communication
LS	Load Sharing EGCP-3 (Multiple Unit parallel)
MC	Master Control EGCP-3 (Sequence and monitoring)
MOP	Motor Operated Potentiometer
MSLC	Master Synchronizer and Load Controller
PI	Proportional, Integral controller
PID	Proportional, Integral, Derivative controller
Rate Group	Recursion rate assigned to each GAP Block.
RTD	Resistive Temperature Device.
SPM-D	Woodward Digital Synchronizer
SUMP	Single Unit Mains Parallel
SW	Software
TC	Thermocouple
THD	Total Harmonic Distortion

Chapter 22.
Service Options

Product Service Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact the manufacturer or packager of your system.
- Contact the Woodward Full Service Distributor serving your area.
- Contact Woodward technical assistance (see "How to Contact Woodward" later in this chapter) and discuss your problem. In many cases, your problem can be resolved over the phone. If not, you can select which course of action to pursue based on the available services listed in this chapter.

OEM and Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.
- A **Recognized Engine Retrofitter (RER)** is an independent company that does retrofits and upgrades on reciprocating gas engines and dual-fuel conversions, and can provide the full line of Woodward systems and components for the retrofits and overhauls, emission compliance upgrades, long term service contracts, emergency repairs, etc.
- A **Recognized Turbine Retrofitter (RTR)** is an independent company that does both steam and gas turbine control retrofits and upgrades globally, and can provide the full line of Woodward systems and components for the retrofits and overhauls, long term service contracts, emergency repairs, etc.

You can locate your nearest Woodward distributor, AISF, RER, or RTR on our website at:

www.woodward.com/directory

Woodward Factory Servicing Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is originally shipped from Woodward or a service is performed:

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is a flat-rate program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned within 60 days, a credit for the core charge will be issued.

Flat Rate Repair: Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward Product and Service Warranty 5-01-1205) on replaced parts and labor.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in “like-new” condition and carry with it the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205). This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:

- return authorization number;
- name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part number(s) and serial number(s);
- description of the problem;
- instructions describing the desired type of repair.

Packing a Control

Use the following materials when returning a complete control:
- protective caps on any connectors;
- antistatic protective bags on all electronic modules;
- packing materials that will not damage the surface of the unit;
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
- a packing carton with double walls;
- a strong tape around the outside of the carton for increased strength.

NOTICE

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

Replacement Parts

When ordering replacement parts for controls, include the following information:
- the part number(s) (XXXX-XXXX) that is on the enclosure nameplate;
- the unit serial number, which is also on the nameplate.

Engineering Services

Woodward offers various Engineering Services for our products. For these services, you can contact us by telephone, by email, or through the Woodward website.
- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact. Emergency assistance is also available during non-business hours by phoning Woodward and stating the urgency of your problem.

Product Training is available as standard classes at many of our worldwide locations. We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from many of our worldwide locations or from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact us via telephone, email us, or use our website: **www.woodward.com**.

How to Contact Woodward

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

Electrical Power Systems

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

Engine Systems

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

Turbine Systems

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

You can also locate your nearest Woodward distributor or service facility on our website at:

www.woodward.com/directory

Technical Assistance

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

Your Name	
Site Location	
Phone Number	
Fax Number	
Engine/Turbine Model Number	
Manufacturer	
Number of Cylinders (if applicable)	
Type of Fuel (gas, gaseous, steam, etc)	
Rating	
Application	
Control/Governor #1	
Woodward Part Number & Rev. Letter	
Control Description or Governor Type	
Serial Number	
Control/Governor #2	
Woodward Part Number & Rev. Letter	
Control Description or Governor Type	
Serial Number	
Control/Governor #3	
Woodward Part Number & Rev. Letter	
Control Description or Governor Type	
Serial Number	

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

EGCP-3 MC Control Specifications

Please refer to the EGCP-3 Installation Manual 26122 for all control specifications.

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 26195C.

WOODWARD

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Email and Website—www.woodward.com

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as well as authorized distributors and other authorized service and sales facilities throughout the world.**

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

2012/12/Colorado