WOODWARD

Installation (Set Builder) Manual

EGCP-2
Engine Generator Control Package

8406-115, 150–300 Vac PT Input, 9–32 Vdc
8406-116, 50–150 Vac PT Input, 9–32 Vdc

Manual 26076 (Revision F)

WARNING—DANGER OF DEATH OR PERSONAL INJURY

WARNING—FOLLOW INSTRUCTIONS

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.

WARNING—OUT-OF-DATE PUBLICATION

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

www.woodward.com/pubs/current.pdf

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

www.woodward.com/publications

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

WARNING—OVERSPEED PROTECTION

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

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

WARNING—PROPER USE

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

CAUTION—POSSIBLE DAMAGE TO EQUIPMENT OR PROPERTY

CAUTION—BATTERY CHARGING

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

CAUTION—ELECTROSTATIC DISCHARGE

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

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

IMPORTANT DEFINITIONS

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

Revisions—Text changes are indicated by a black line alongside the text.

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WARNING—EARTH GROUND

Protective Earth (PE) must be connected to the termination point on the back side of the unit next to the label with the ⏚ symbol (or 1 of 3 other similar 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 3.0 mm² (12 AWG).

WARNING—TRAINED PERSONNEL/HIGH VOLTAGE

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

Regulatory Compliance

European Compliance for CE Mark:

EMC Directive	Declared to 89/336/EEC COUNCIL DIRECTIVE of 03 May 1989 on the approximation of the laws of the member states relating to electromagnetic compatibility.
Low Voltage Directive	Declared to the 73/23/EEC COUNCIL DIRECTIVE of 19 February 1973 on the harmonization of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits.

North American Compliance:

UL	UL Listed for Ordinary Locations at 70 °C maximum Ambient. For use in the United States and Canada. UL File E97763
CSA	CSA Certified for Ordinary Locations at 70 °C maximum Ambient. For use in the United States and Canada. Certificate 1159277
NOTE	Wiring must be in accordance with applicable electric codes with the authority having jurisdiction.

General Installation and Operation Notes and Warnings

- The EGCP-2 is suitable for use in non-hazardous locations only.
- Wiring must be in accordance with applicable electrical codes and in accordance with the authority having jurisdiction.
- Field wiring must be suitable for at least 90 °C.
- Connect ground terminal to PE (Protective Earth).
- More than one live circuit (see wiring diagram).

Electrostatic Discharge Awareness

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

Follow these precautions when working with or near the control.

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

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

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

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

   - Do not touch any part of the PCB except the edges.
   - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
   - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

CAUTION—ELECTROSTATIC DISCHARGE

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

Chapter 1.
General Information

Introduction

This manual describes the Woodward EGCP-2 Engine Generator Control Package, models 8406-115 and 8406-116 (9–32 Vdc maximum input voltage range).

Control Electrical Ratings

nominal supply voltage range	10–29 Vdc (12 or 14 volt systems)
max. power consumption at rated voltage	20 W
max. PT input voltage range	150–300 Vac rms (8406-115) 50–150 Vac rms (8406-116)
max. CT current input range	0–6 A rms
max. generator frequency range	40–70 Hz

Chapter 2.
Control Overview

Introduction

The EGCP-2 is a microprocessor based complete generator load control and engine management package. It is designed for use with an automatic voltage regulator and Woodward speed control to automate and protect diesel or gas engine based backup generator sets.

Designed for small to medium size generator sets the EGCP-2 can be configured to operate stand-alone or utility paralleled sets. A network of EGCP-2 controls is capable of controlling up to eight un-manned generator sets for backup power, base-load, or peak shaving applications.

Engine Control

- Engine Pre-glow
- Fuel Solenoid Control
- Engine Starter Control (Cranking)
- KVA Controlled Cool-down Timer
- Oil Pressure Monitoring
- Water Temperature Monitoring
- Battery Voltage Monitoring
- Speed Monitoring with Overspeed Protection
- Idle /Rated Relay

Synchronizing

- Digital signal processing to eliminate problems induced in systems with high harmonic content causing multiple zero crossing of voltage waveforms.
- Adjustable maximum phase window, voltage window, and dwell times—windows as small as 2° phase error and 0.1% voltage matching respectively.
- Safe dead bus closing logic internal to the control.
- Multiple shot re-closing with adjustable time delays, auto-resynchronizing, and synchronizer time-outs all available.
- Manual voltage and speed adjusts for manual synchronizing (Sync-Check still active during manual parallels).
- Synchronization across generator and mains breakers.

Real (kW) Load Control

- True RMS power calculations for rapid, accurate load control even in the presence of harmonics.
- Smooth user chosen ramp rates into and out of each mode of operation.
- Isochronous load-sharing of up to 8 units based on percentage loading (allows different rated machines to proportionally balance kW loads).
- Constant base loading for optimum fuel efficiency with discrete inputs to change load levels remotely.
- Import/Export control with an external watt transducer.
- Soft Utility Transfer Function

- Externally adjustable Base Load or Process Reference Levels with independent ramp rates
- kW droop provided for manual load control.

Reactive (KVAR) Control

- VAR sharing on isolated busses based on percentage reactive load (allows different rated machines to proportionally balance KVAR loads).
- Constant Power factor or VAR base loading on units which are in kW base load control mode, or process control mode.
- Externally adjustable VAR or PF control reference levels.

Automatic Generator Sequencing

- Automatically starts additional EGCP-2 equipped generators when load exceeds a user specified percentage of the rated load of the operating machines.
- Provides controlled unloads for engines when the load is low enough that the remaining engines will not exceed a user specified percentage of the rated load.
- Engine priority sequence can be changed from any unit or from a PC to equalize run-time.

Generator Protective Features

- Over/Under Voltage
- Over/Under Frequency
- Reverse Power (Inverse time delay)
- Loss of Excitation
- Overcurrent (Inverse time delay)
- Loss of mains (utility) detection
- Speed/Frequency Mismatch
- Load Surge
- KVA Load Switch

Engine Protective Features

- High/Low Coolant Temperature
- High/Low Oil Pressure
- Overspeed
- Start Failure

Communication – PC Interface

- Easy upload and download and backup of unit configuration
- A PC can control or monitor any unit at a site by a single connection to the local operating network via RS-422 serial port using Modbus® * or ServLink protocol.

* Modbus is a registered trademark of Schneider Automation Inc.

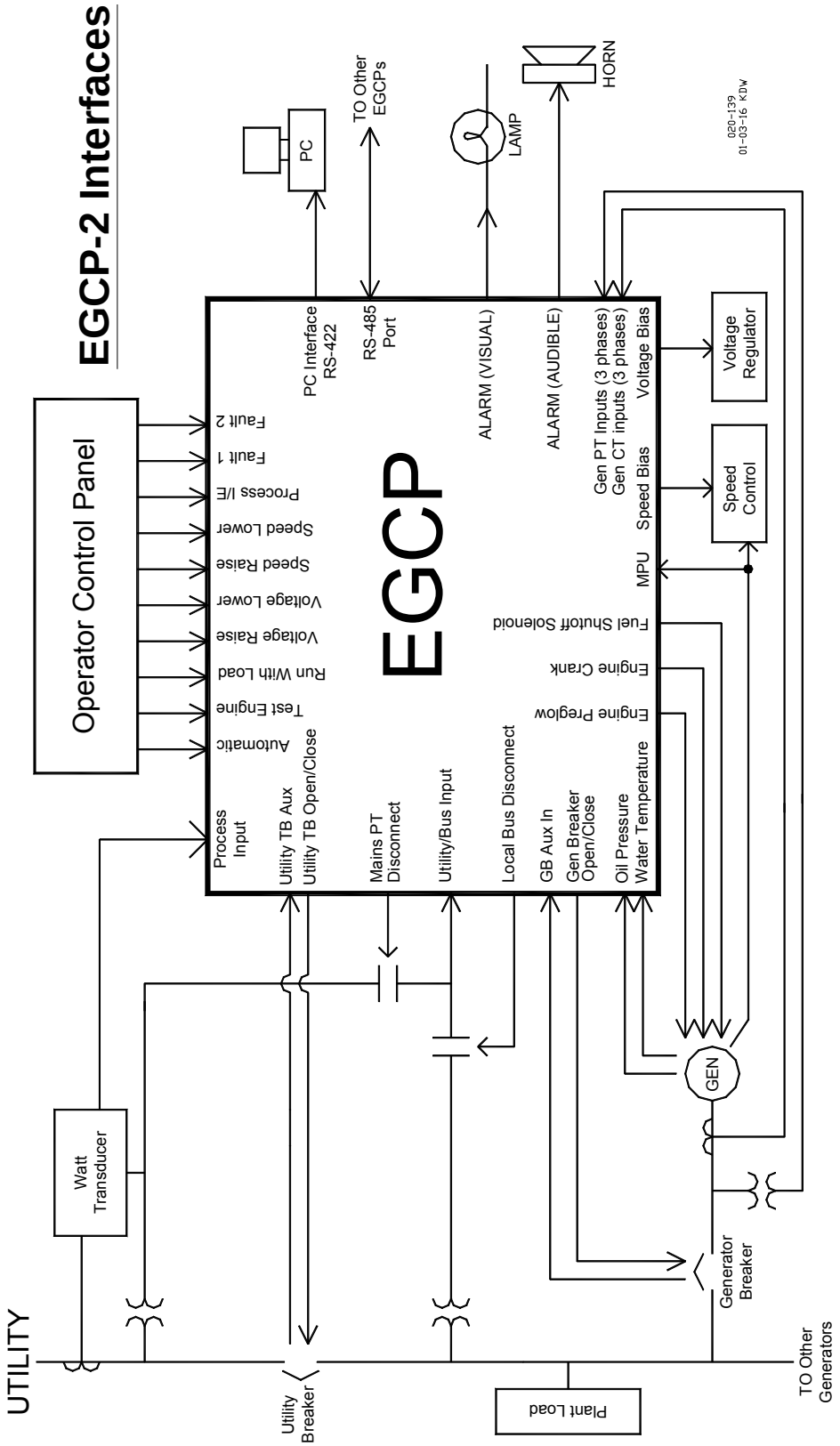


Figure 2-1. EGCP-2 Interface Connections

Operator Interface

The EGCP-2 Operator Interface is designed for simplicity and redundancy of function in all operating modes. Two backlit Liquid Crystal Display screens with contrast adjustment are used to display various operating and status information to the operator, as well as for tuning set points. The backlight on the LCD screens will stay on whenever the engine speed is above 50 rpm. When the engine is not running, the backlight will turn on whenever any key is pressed on the front panel. The backlight will turn off after 5 minutes of non-use, when the engine is not running. Additionally, in the event of a drop in supply voltage where the monitored battery voltage drops below 9.0 Vdc, the LCD back light will shut off to conserve power.

NOTE

The EGCP-2 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-2's front panel.

WARNING—TRAINED PERSONNEL

An unsafe condition could occur with improper use of these software tools. Only trained personnel should have access to these tools.

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.

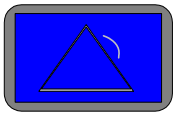
Figure 2-2. Operator Interface

A red Light Emitting Diode (LED) on the face of the control is used to indicate an alarm condition by flashing repeatedly, and to indicate a shutdown condition by staying on continuously.

There are a total of 19 keys on the keypad. Each of the keys has the following function(s):

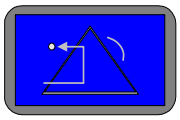
ALARM/EVENT LOG KEYS:

ALARM / EVENT



The ALARM/EVENT key is used to access the Event log. When pressed, the current alarm events will be displayed on the right hand LCD screen. When multiple alarms are logged, the up and down scroll keys will allow you to navigate within the Event log. The Event log will store up to 16 events, as more events happen the oldest alarms will be dropped off to make room for the newer events. If power is cycled to the control, the Event log will be cleared.

ALARM CLEAR



The ALARM CLEAR key is used to acknowledge and clear alarm events from the Event log. To acknowledge and clear alarm and shutdown events a Security Code of Operator Level or higher is needed. After selecting the ALARM/EVENT key:

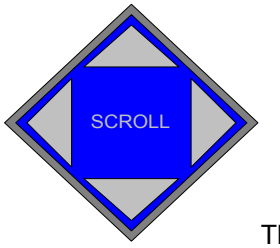
If the Alarm mode is Visual or Warning –

1. Pressing the ALARM CLEAR key will acknowledge the selected alarm, this means the cursor will move from the Alarm Name line down to the Time and Date line.
2. Pressing the Alarm Clear key a second time will remove the event from the log.

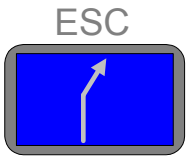
If the Alarm/Shutdown mode is Audible, Soft Shutdown, or Hard Shutdown –

1. Pressing the ALARM CLEAR key once will de-energize Discrete Output #11, Audible Alarm. This will happen without selecting the ALARM/EVENT key and without a Security Code entered.
2. With the ALARM/EVENT key pressed, so the Event log is being displayed: Pressing the ALARM CLEAR key a second time will acknowledge the selected alarm. This means the cursor will move from the Alarm Name line down to the Time and Date line.
3. Pressing the Alarm Clear key a third time will remove the event from the log.

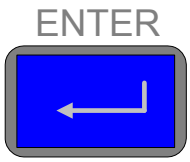
NAVIGATION and ADJUSTMENT KEYS:



The SCROLL KEY is used to move the cursor up, down , left and right. It also is used to increment and decrement values while in the configuration menus.

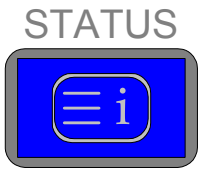


The ESCAPE KEY is used to move upwards (out of)the configuration menu levels. It also is used when tuning a value to restore the previous value, if the new value is not entered into memory (see the enter key, below).



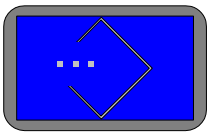
The ENTER KEY is used to move downwards (into) the configuration menu levels. It is also used to when tuning a value to enter the new value to memory. It also serves as a means to commit alarm event items to the alarm event list without removing them. This is known as logging the alarm event item. Pressing the enter key while on the selected alarm/event item will “save” that item to the event list. If the selected alarm event was an active alarm event, the action(s) associated with the alarm event will also be cleared from the control logic.

STATUS and CONFIGURATION KEYS:



The STATUS KEY, when pressed, will put both left and right LCDs into the status display mode. The status displays provide information about different items of engine and generator set operation. See the STATUS MENU buttons, below for details on the various status keys. There are no adjustment values in the status menus.

CONFIG

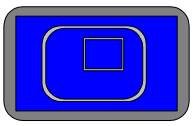


The CONFIG KEY, when pressed, will put the right hand LCD into the configuration mode. Configuration menu items will be displayed in the right hand screen. Status information will continue to be displayed in the left hand screen. Since there are various menu items and adjustments in the configuration menu, a blinking cursor is provided in the right hand display when the configure mode is active.

STATUS MENU KEYS:

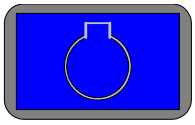
The contents of the various status menus are described in the Status Screens section in Chapter 3 of this manual.

SYSTEM



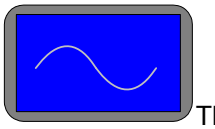
The SYSTEM STATUS key, when pressed displays the system status information. The system status display is also the default status display screen (it is always the first display shown after a power up of the control). This display shows general information about the operation of the engine generator set.

ENGINE



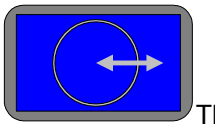
The ENGINE STATUS key , when pressed displays status information about the engine functions and operation.

GEN



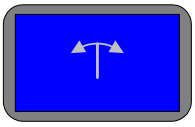
The GEN STATUS key shows three phase generator parameters when pressed.

I/O



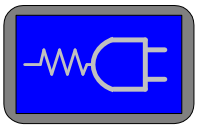
The I/O STATUS key provides the status of all the discrete inputs and outputs, as well as information on analog inputs and outputs.

SYNC



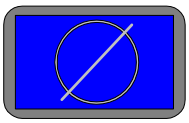
The SYNC STATUS key shows status information regarding the generator breaker and utility breaker synchronizer.

KW LOAD



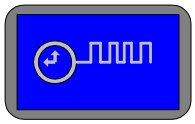
The KW LOAD STATUS key, when pressed, shows the status information for the KW load control of the EGCP-2.

PF / KVAR



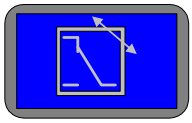
Press the PF/KVAR STATUS key to display VAR/PF Mode information, as well as three phase generator voltage and current.

SEQUENCE



The SEQUENCE STATUS key provides sequencing information for multiple unit systems. Single unit systems, and units not in the AUTO mode will not provide status information in this screen.

ATS



The ATS STATUS key, when pressed, displays the status information for the Automatic Transfer Switch functions.

Hardware

The EGCP-2 is an integrated control package. All control hardware is contained in one compact enclosure.

Figure 2-3 is a physical outline drawing with dimensions of the EGCP-2 for reference during the construction of mounting panels, etc.

To mount the EGCP-2 panel use type M5 x 12mm thread forming screws (Woodward part number 1029-529).

NOTE

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

Environmental Specification

Temperature Range around outside of EGCP-2 Chassis	–20 to +70 °C operating
Relative Humidity	95% non-condensing, at 20 to 55 °C

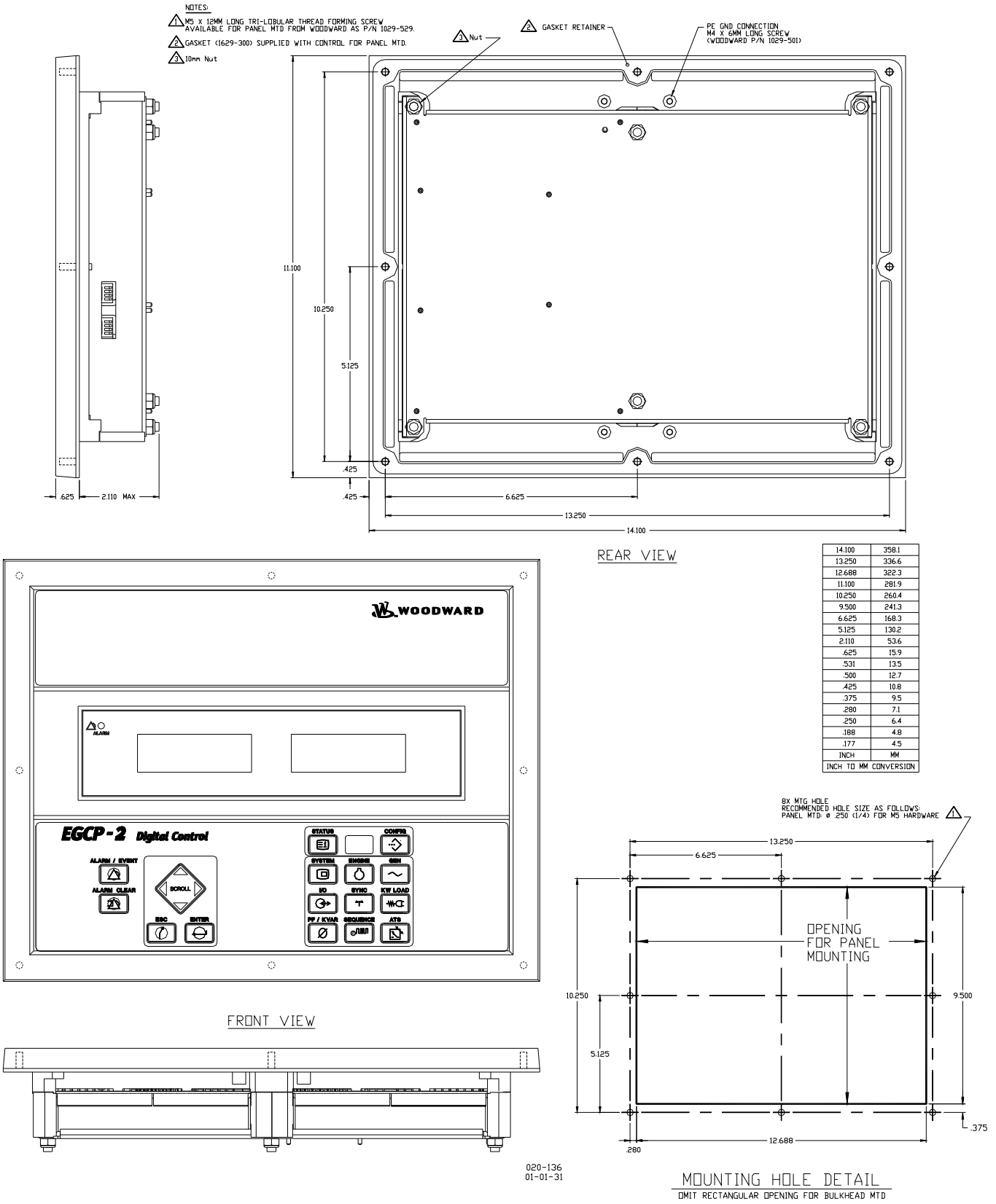
Physical Specification

Enclosure Size	282 x 358 x 69 mm 11.1 x 14.1 x 2.7 inch

Accessories

Other components you may need. These items do not ship with the 8406-115 or 8406-116 part numbers—they must be ordered separately.

- 8928-301—EGCP-2 connector kit. Contains all of the mating terminal blocks for the EGCP-2. See Appendix A for mating connector information.
- 5417-551—Communication Cable for RS422. This cable will connect your PC to the EGCP-2 RS422 port. This is a point-to-point connection. It can be used with EGCP-2 software tools.
- Download.exe—see manual 26086, Appendix B.
- EGCP-2 HMI—see manual 26099.



14.100	358.1
13.250	336.6
12.688	322.3
11.100	281.9
10.250	260.4
9.500	241.3
6.625	168.3
5.125	130.2
2.110	53.6
.625	15.9
.531	13.5
.500	12.7
.425	10.8
.375	9.5
.280	7.1
.250	6.4
.188	4.8
.177	4.5
INCH	MM
INCH TO MM CONVERSION	

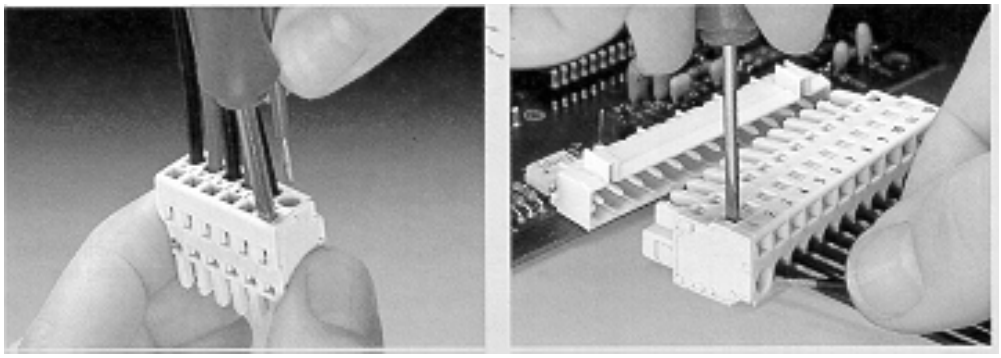
Figure 2-3. Physical Outline with Dimensions of EGCP-2

Chapter 3.
Electrical Installation and Specifications

Electrical Connections

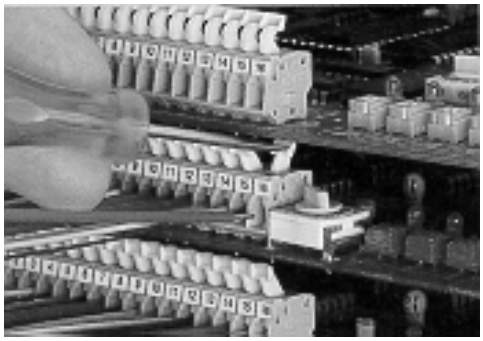
All inputs and outputs to the EGCP-2 are made through “CageClamp” terminal blocks. For noise suppression, it is recommend that all low-current wires be separated from all high-current wire.

The terminal blocks are screwless CageClamp style blocks. The spring clamp can be actuated by using a standard 3.5 mm or 1/8 inch flat bladed screwdriver (see Figure 3-1). The EGCP-2 pluggable terminal blocks accept wires from 0.08–2.5 mm² (28–12 AWG). Fixed terminal blocks accept wires from 0.08–2.5 mm² (27–12 AWG). Two 0.8 mm² (18 AWG) or three 0.5 mm² (20 AWG) wires can be easily installed in each terminal. Wires for the pluggable I/O terminals should be stripped 8–9 mm (0.3 inch) long, wires for the fixed mounted power terminals should be stripped 5–6 mm (0.2 inch) long.



Method #1
Free Hand (Holds spring open)

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



Wiring Fixed Terminal

Figure 3-1. CageClamp Termination Blocks (example photos)

Most of the EGCP-2 control’s terminal blocks are designed to be removed by hand. After EGCP-2 input power is disconnected, the terminal blocks can be removed one at a time by pulling them straight out. Care should be taken not to pull the plug out at an angle as this will fracture the end terminal.

NOTE

Do not tin (add solder to) the wires that terminate at the EGCP-2 terminal blocks. The spring-loaded CageClamp terminal blocks are designed to flatten stranded wire, and if those strands are tinned together, the connection loses surface area and is degraded.

Grounding for Protection Against Electric Shock

Protective Earth (PE) must be connected to the termination point on the back side of the unit next to the label with ⏚ symbol (or 1 of 3 other like termination points without label) to reduce the risk of electric shock. This connection will be made using a thread forming screw (M4 x 6mm). The conductor providing the connection must have a properly sized ring lug and wire larger than or equal to 3.0 mm² (12 AWG).

Recommended Grounding Practices

Providing the proper ground for the EGCP-2 is important. Improper connection of the EGCP-2 chassis to the ground plane may lead to stray currents between the reference point for the AC signal sources (current and voltage transformers), and the reference point for the sensing inputs on the EGCP-2. Differences in potential between these two points results in equalizing current flow which then produces unacceptably high common mode voltages. Common mode voltages may result in improper readings for the sensed AC inputs, or even damage to the EGCP-2 product in extreme cases. To minimize this problem, it is necessary to provide a low resistance path between the AC signal reference point, and the chassis of the EGCP-2. Typically this point is the designated ground for the generator set and related instrument transformers.

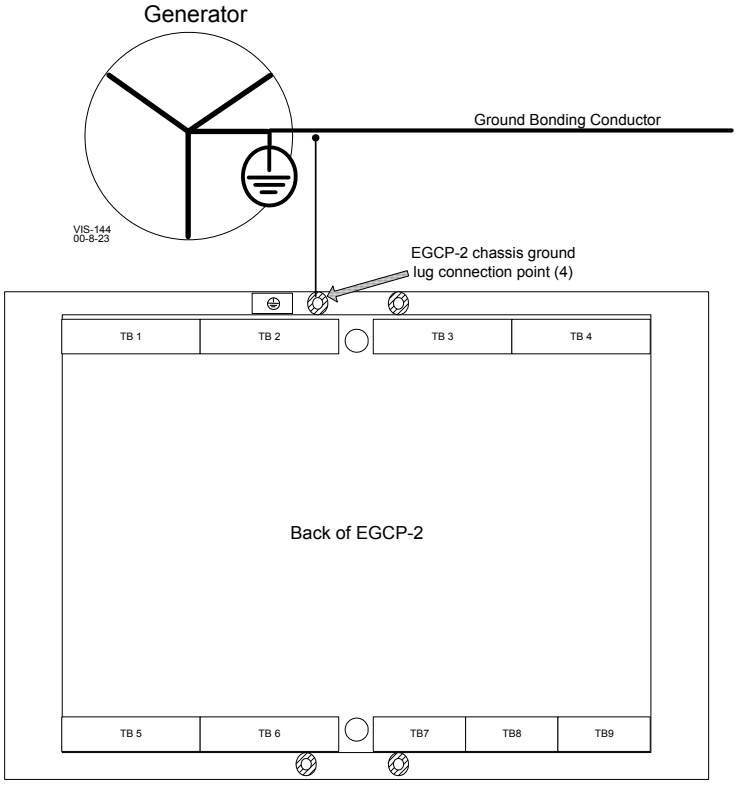


Figure 3-2. Recommended Single Point Grounding Scheme

Shields and Grounding

An individual shield termination is provided at the terminal block for each of the signals requiring shielding except for oil pressure and coolant temperature. All of these inputs should be wired using shielded, twisted-pair wiring. The exposed wire length, beyond the shield, should be limited to one inch. Relay outputs, contact inputs, and power supply wiring do not normally require shielding, but can be shielded if desired.

The EGCP-2 is designed for shield termination to earth ground at the EGCP-2. If intervening terminal blocks are used in routing a signal, the shield should be continued through the terminal block. If shield grounding is desired at the terminal block, it should be ac coupled to earth. All other shield terminations except at the EGCP-2 should be ac coupled to earth through a capacitor. A 1000 pF, 500 V capacitor is sufficient. The intent is to provide a low impedance path to earth for the shield at frequencies of 150 kHz and up. Multiple direct connections of a shield to earth risk high levels of current to flow within the shield (exception, see note on cabinet installations).

Shields can be grounded at both ends (EGCP-2 and load) if the cable length is sufficiently short (that is, within a cabinet) to prevent ground loop current in the shield.

Cabinet Installations: If the EGCP-2 is installed in a cabinet, shielded I/O can be terminated directly to the cabinet (earth ground) at the entry to the cabinet, as well as at the EGCP-2.

For noise suppression reasons, it is recommend that all low-current wires be separated from all high-current wires. Input Power ground terminal should also be wired to earth ground.

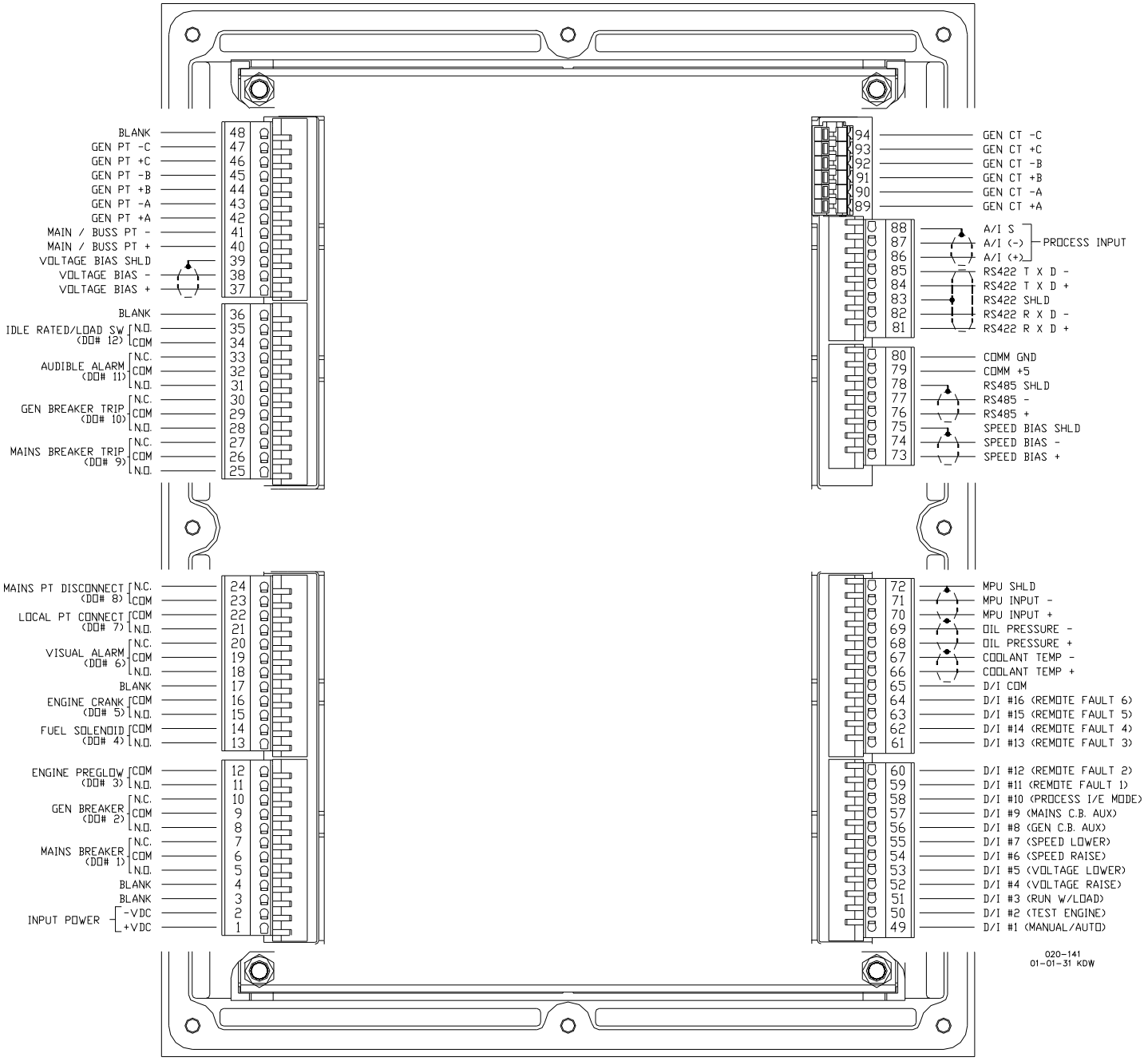


Figure 3-3. Wiring Diagram for EGCP-2

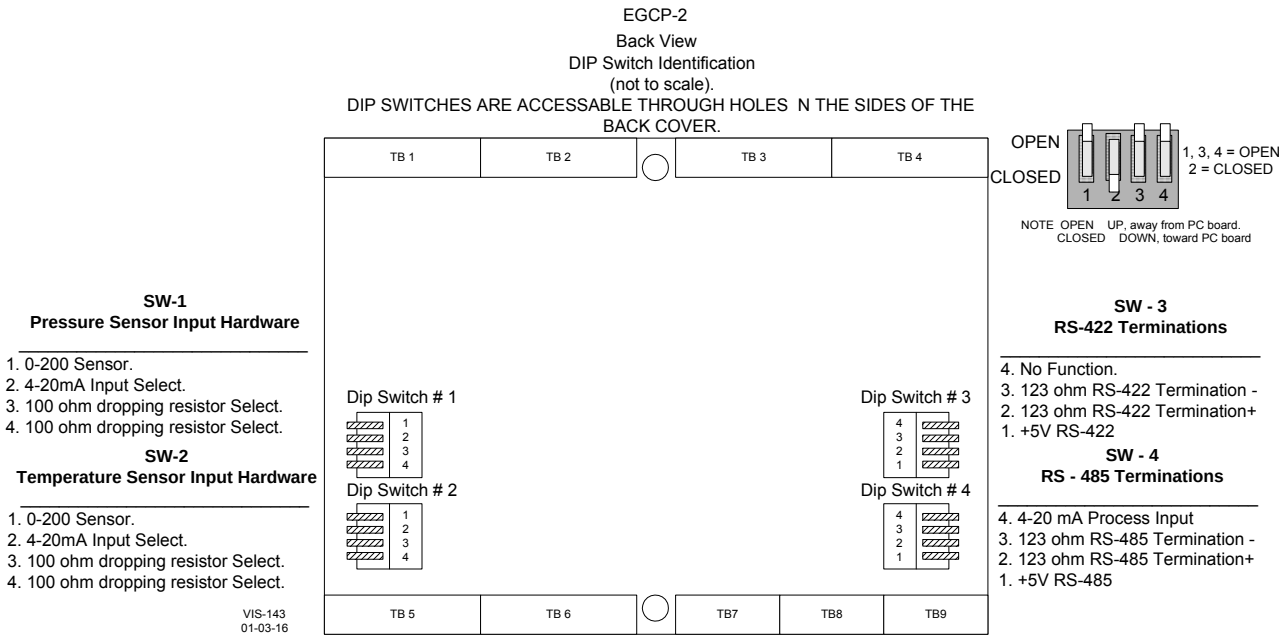


Figure 3-4. Dip Switch Location

NOTE

In the drawing above, the switches will do the mentioned functions when in the CLOSED position.

Input Power

The EGCP-2 accepts any input power source that supplies a voltage within the 9-32 Vdc voltage range. It is expected that the installation of this equipment will include overcurrent protection between the power source and the EGCP-2. This overcurrent protection may be accomplished by series connection of properly rated fuses or circuit breakers (see the Input Power Ratings below for proper sizing).

Input Power Ratings

Part Number:	8406-115 and 116
Supply Voltage Rating	
Nominal Voltage Range:	10–29 Vdc
Maximum Voltage Range:	9–32 Vdc
Maximum Power:	20 W
Typical Power:	13 W
Input Fuse Rating:	5 A (time delay with melting $I^2t \geq 100A^2sec$)
Wire Size:	Up to 12 AWG
Holdup Time:	5 milliseconds @ 24 Vdc

Significant inrush currents are possible when current is applied to the EGCP-2 control. The magnitude of the inrush current depends on the power source impedance, so Woodward cannot specify the maximum inrush current. Time-delay fuses or circuit breakers must be used to avoid nuisance trips.

Potential Transformer (PT) Inputs

Potential Transformers (PTs) are utilized with the EGCP-2 control to allow high level circuit voltages to be stepped down to a safe level for the EGCP-2 input circuitry. The EGCP-2 control senses generator output voltage through three Generator PTs, and utility and plant-bus voltages via one shared utility/plant-bus PT.

Potential Transformer Input Ratings 8406-115

Number of inputs:	4
Maximum Voltage Rating:	150–300 Vac
Burden:	0.45 VA
Input Frequency:	40–70 Hz

Potential Transformer Input Ratings 8406-116

Number of inputs:	4
Maximum Voltage Rating:	50–150 Vac
Burden:	0.25 VA
Input Frequency:	40–70 Hz

Generator PT Input Wiring

The EGCP-2 utilizes a 6 wire generator PT input configuration. This type of configuration allows the EGCP-2 to be easily wired to either Delta or Wye generators or transformers. The EGCP-2 control uses all three phases of the generator to sense both real and reactive generator power. Refer to the Figure 3-5 for Delta based wiring diagrams and Figure 3-6 for Wye based wiring diagrams. Once wired into a Delta or Wye circuit, the EGCP-2 must also be programmed to sense the correct (Delta or Wye) configuration. Refer to manual 26086, Configuration menu, item “Voltage Input.”

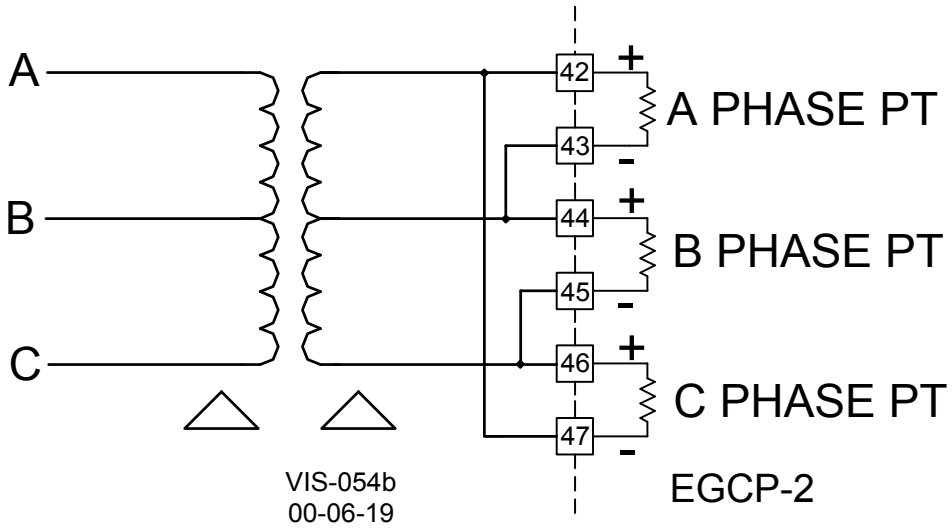


Figure 3-5. Three Wire Delta PT Connection for EGCP-2

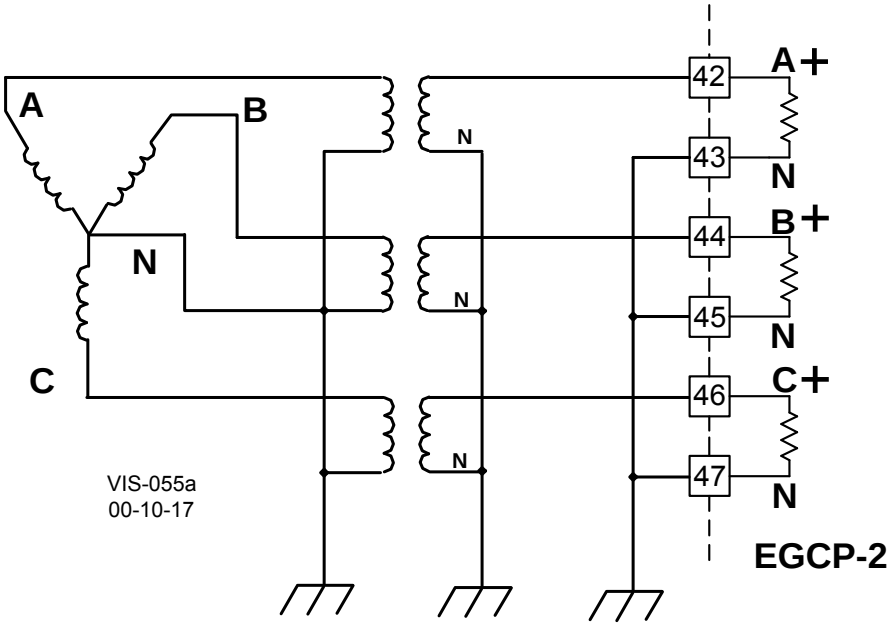


Figure 3-6. Four Wire WYE PT Connection

Utility (Mains) and Plant Bus PT Input Wiring

The EGCP-2 utilizes one PT input to sense both utility tie-line voltage and plant-bus voltage. This PT input should be the same configuration as the generator PT input. The potential transformer should be the same ratio as the generator PT input. Two Relay outputs are used by the EGCP-2 to select which voltage source to monitor, depending upon the state of the control. The EGCP-2's control logic is set up to monitor the utility tie voltage during normal operation and local bus voltage when sensing for a dead bus condition or synchronizing the generator to the local bus. Refer to figures 3-7, 3-8a and b, for required input wiring configurations. This type of configuration allows the EGCP-2 to perform a break-before-make relay action when switching between voltage sources to assure that the utility PT and Bus PT never are connected.

Sequence of Mains PT Disconnect (DO8) and Local Bus PT Connect (DO7)

The EGCP-2 will command a Mains PT disconnect (DO8) when:

1. The EGCP-2 has an "AUTO" discrete input and either
    a. A loss of Mains (LOM) is detected or
    b. A "Run with load" discrete input.
2. The Generator Stable Delay time has been met.
3. The EGCP-2 is in the "Close Gen Breaker" mode.

When the Mains PT Disconnect changes state, the EGCP-2 has to measure less than 40 Vac on the Mains/Bus PT input (terminals 40 and 41). If the EGCP-2 measures greater than 40 Vac after the Mains PT Disconnect command was given, the EGCP-2 senses this as a fault and will not synchronize.

For this reason, when only one PT signal is being connected, the external relay logic to remove the incoming Mains/Bus PT signal must still be applied (Figure 3-8a).

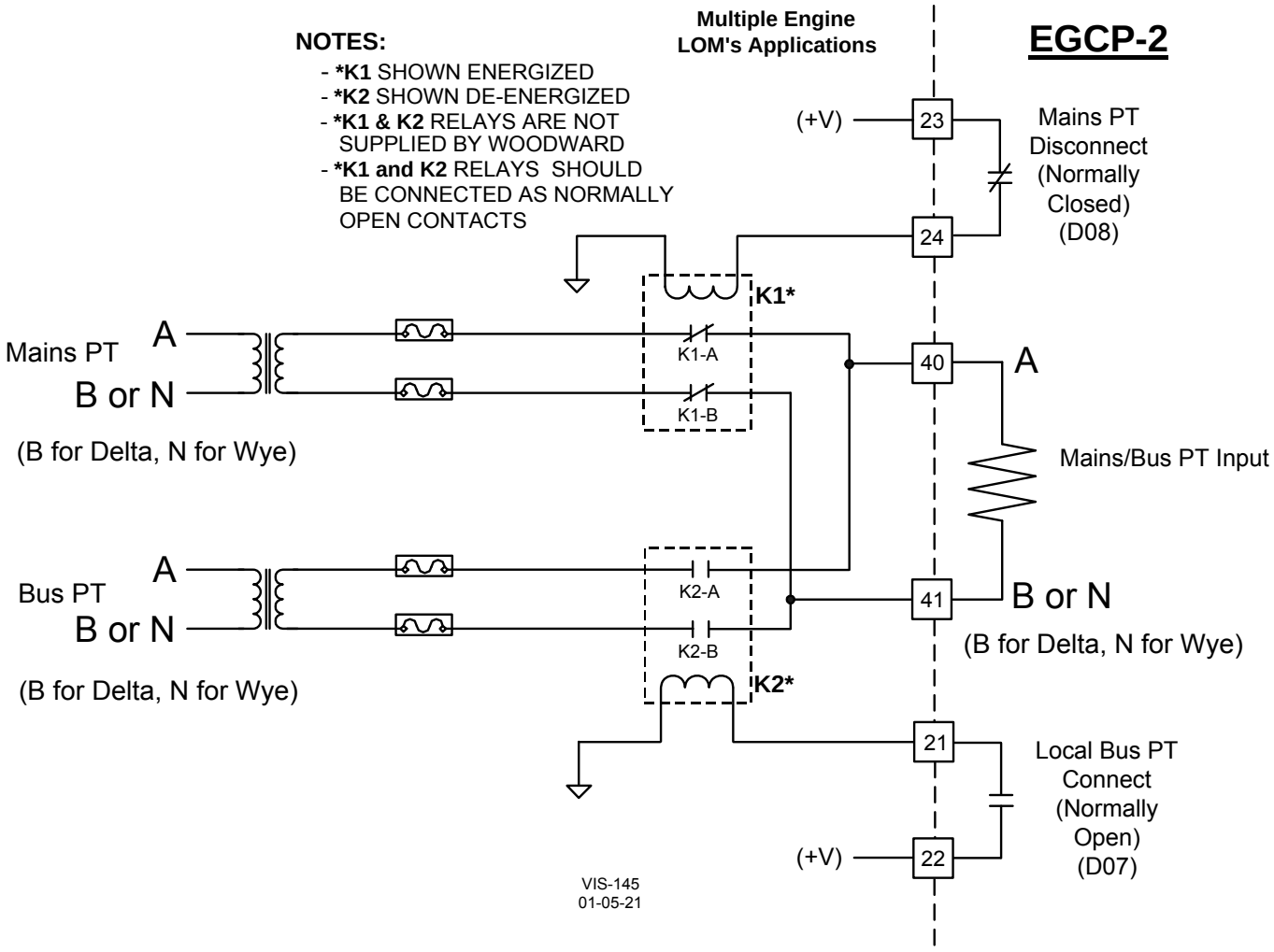


Figure 3-7. Utility / Local Bus PT Wiring for Delta and Wye Configuration

Please Note:

1. This wiring diagram must be used when sensing Loss of Mains (LOM) with multiple units.
2. K1 and K2 relays are not supplied by Woodward.
3. K1 and K2 relays should be connected as normally open contacts

NOTE

Because the same EGCP-2 input is used to sense both the utility and local bus voltages, the two PT signals must be identical in configuration (WYE or Delta), phase (A-B or A-N), and amplitude for correct input readings.

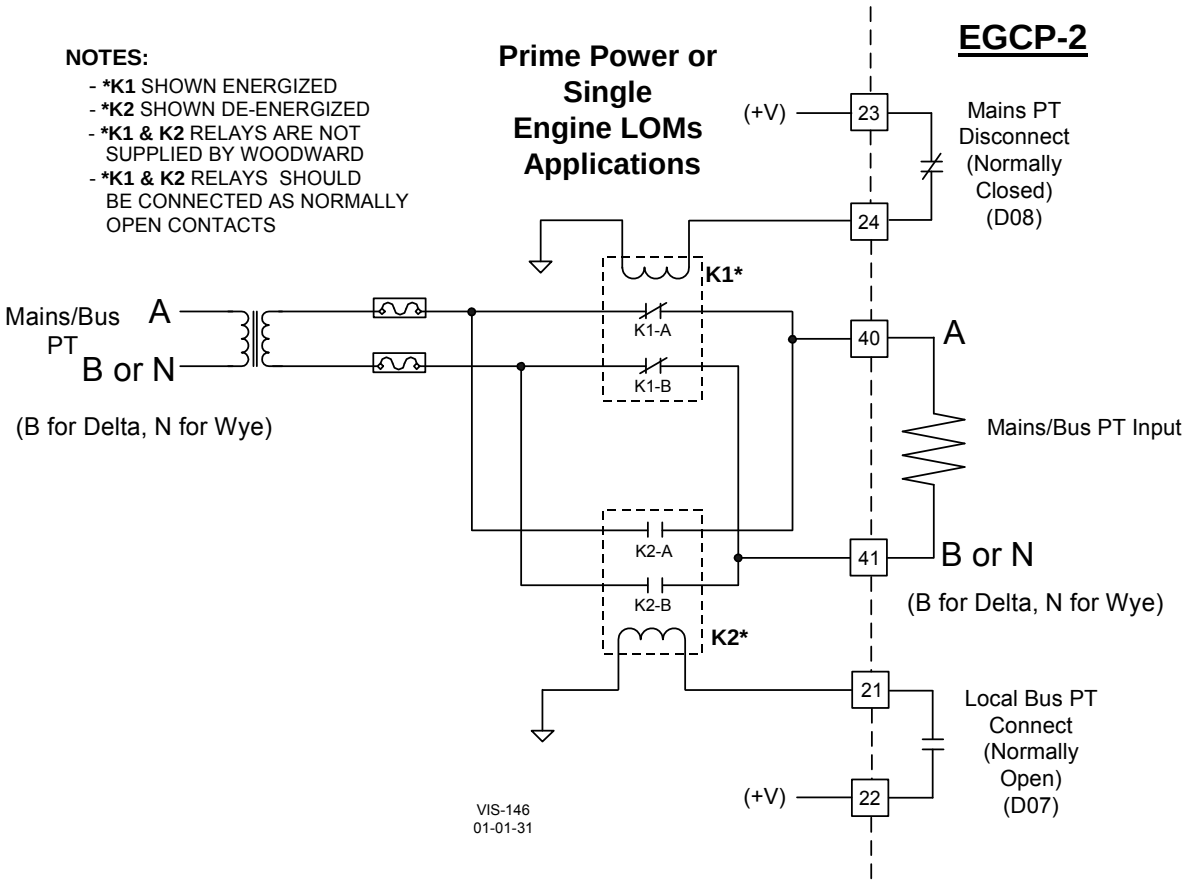


Figure 3-8a. Utility/Local Bus Single PT Wiring for Delta and WYE Configuration (two relay)

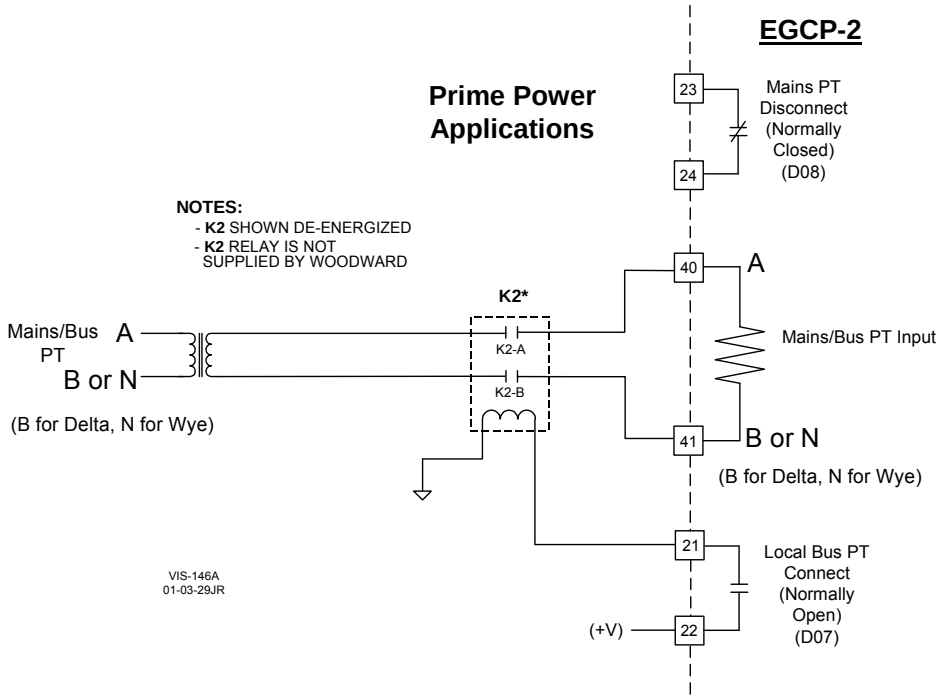


Figure 3-8b. Utility/Local Bus Single PT Wiring for Delta and WYE Configuration (single relay)

Please Note:

1. Figures 3-8a and b PT wiring can only be used in a Prime Power Application.
2. Figure 3-8a can be used for a Single Engine LOMs detection.
3. K1 and K2 relays are not supplied by Woodward.
4. K1 and K2 relays should be connected as normally open contacts

Required PT Wiring Relationships

The EGCP-2 control uses its programmed PT-Ratio setting to calculate and compare all PT input voltages. Thus, the EGCP-2 control requires the following generator, utility, and plant-bus PT relationships. Refer to Figures 3-9 and 3-10.

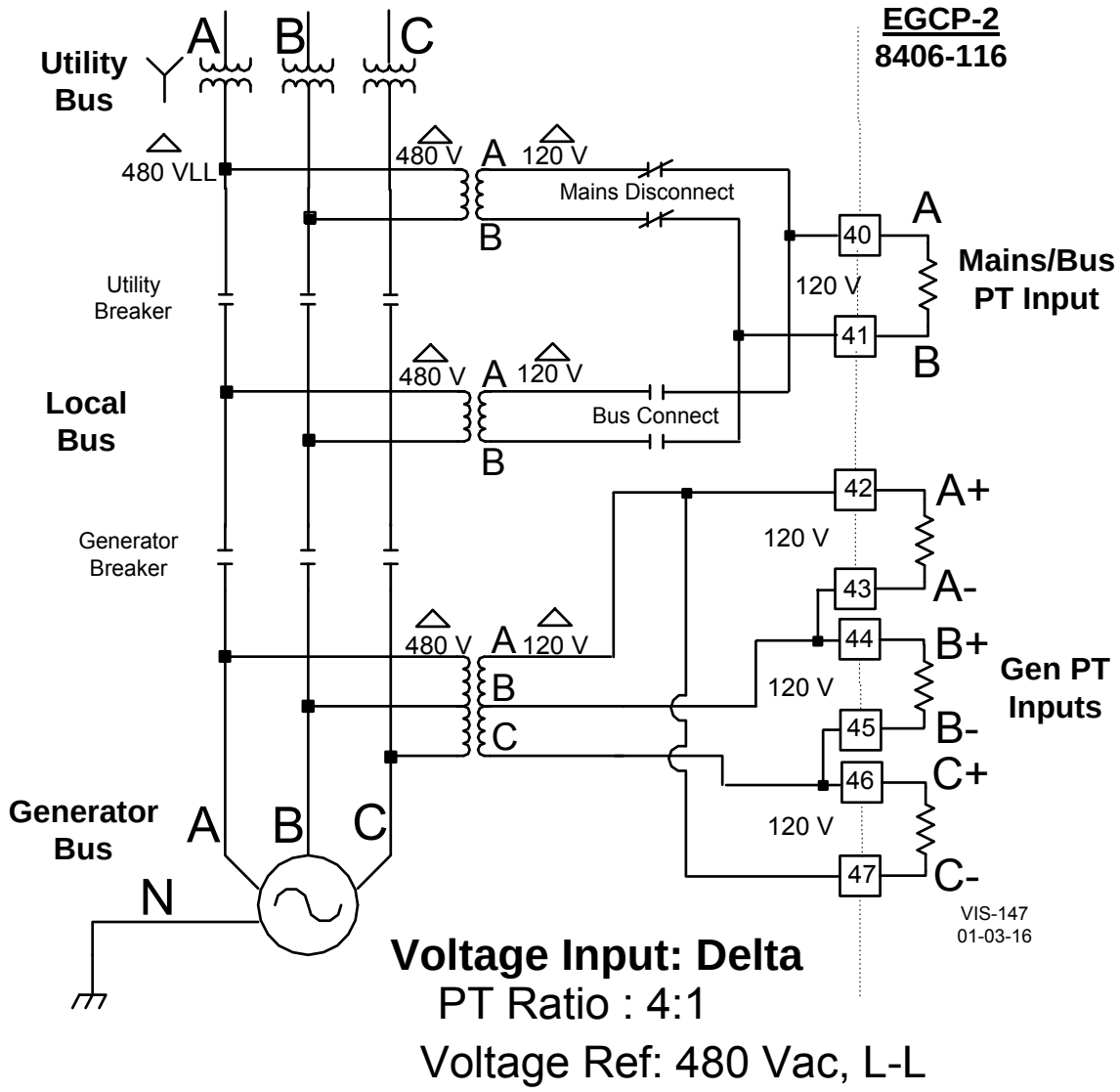


Figure 3-9a. PT Wiring Relationships for Generator, Bus, and Utility Inputs

Please Note:

1. This drawing shows EGCP-2 part number 8406-116.
2. Follow Utility/Local Bus PT wiring.

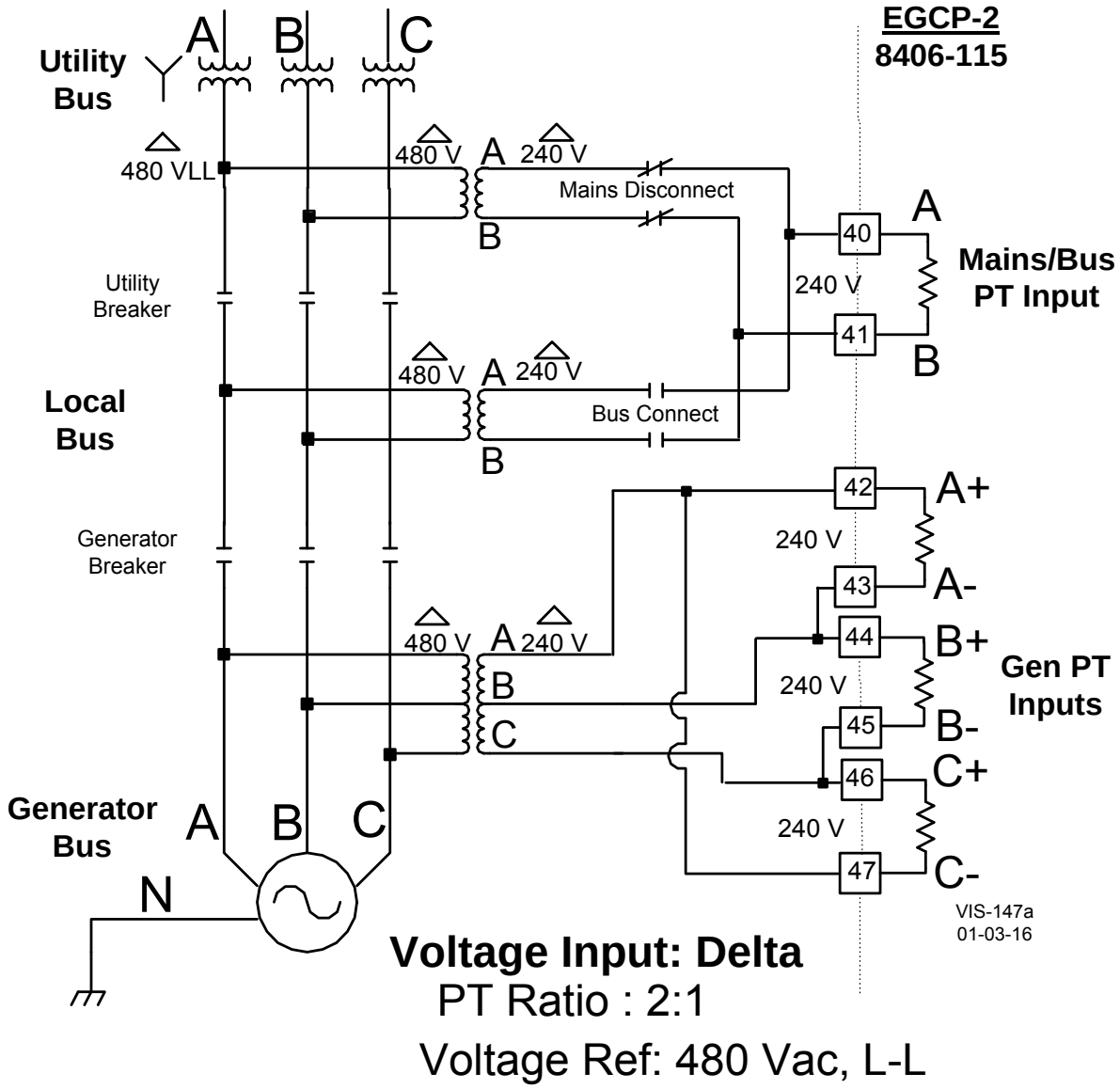


Figure 3-9b. PT Wiring Relationships for Generator, Bus, and Utility Inputs

Please Note:
1. This drawing shows EGCP-2 part number 8406-115.
2. Follow Utility/Local Bus PT wiring.

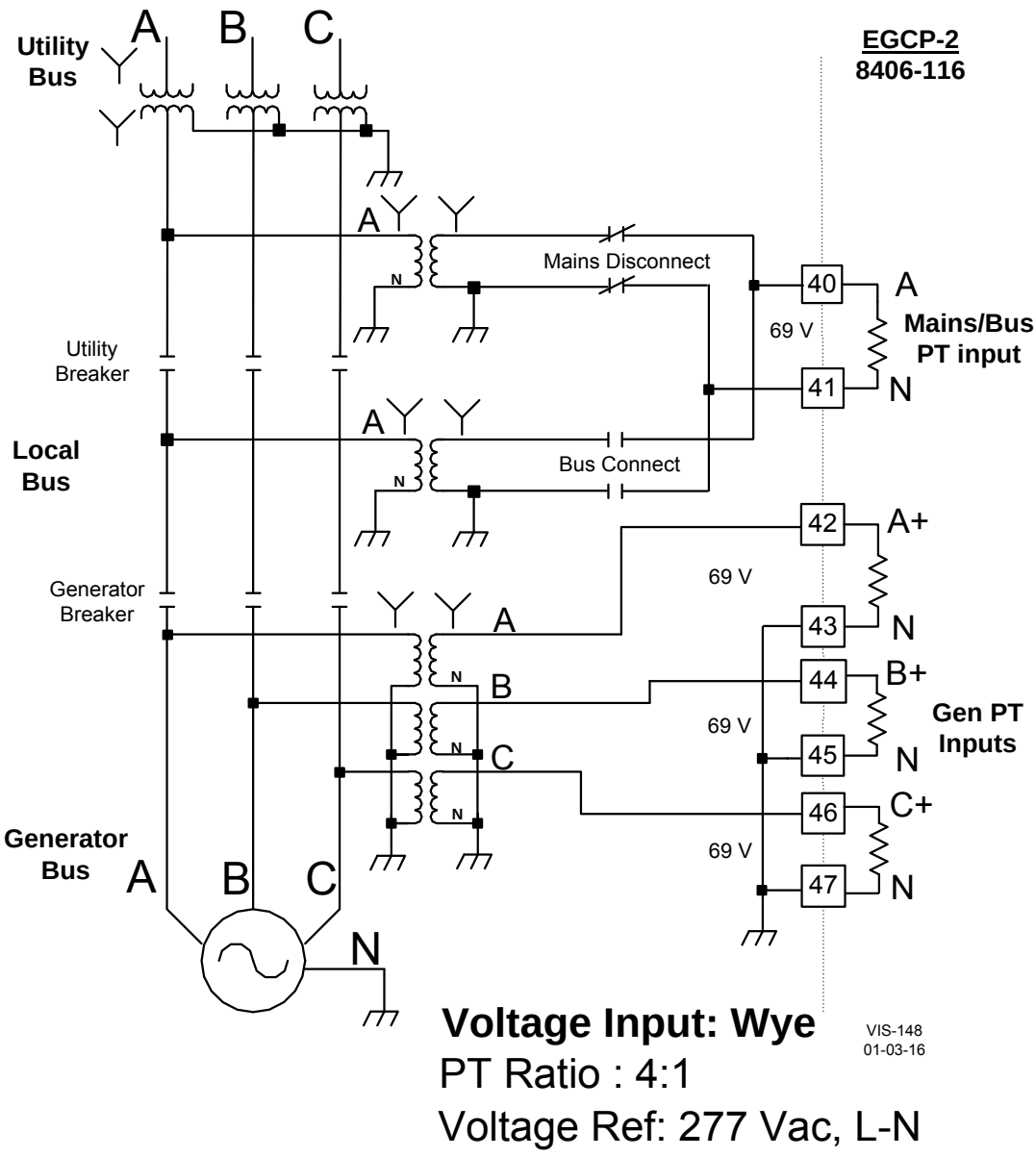


Figure 3-10a. PT Wiring Relationships for Generator, Bus, and Utility Inputs

Please Note:

1. This drawing shows EGCP-2 part number 8406-116.
2. Follow Utility/Local Bus PT wiring.

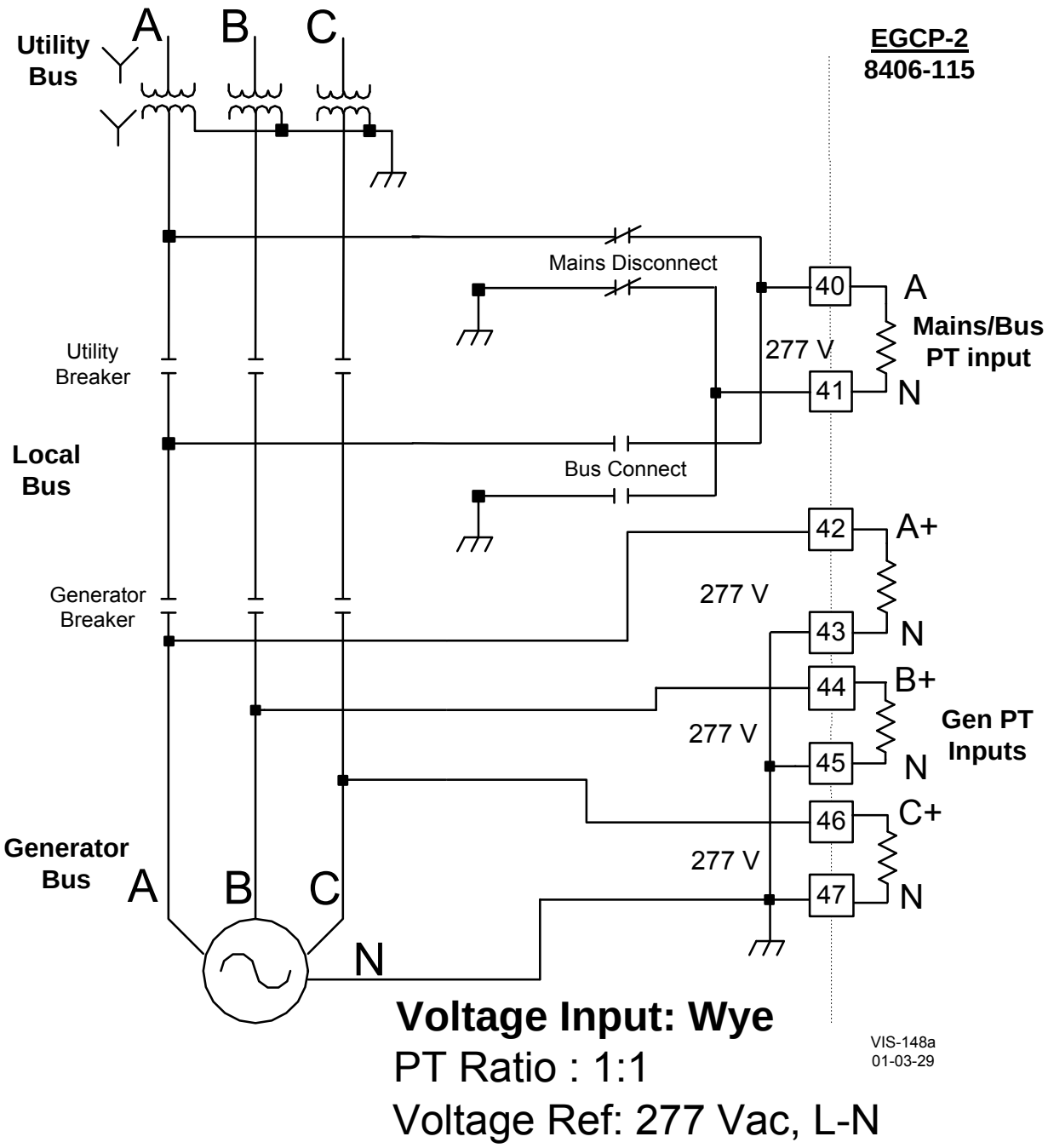


Figure 3-10b. PT Wiring Relationships for Generator, Bus, and Utility Inputs

Please Note:
1. This drawing shows EGCP-2 part number 8406-115.
2. Follow Utility/Local Bus PT wiring.

Current Transformer (CT) Inputs

Current Transformers (CTs) are utilized with the EGCP-2 control to allow high level circuit currents to be stepped down to a safe level for the EGCP-2 input circuitry. The EGCP-2 senses generator current via external current transformers. Refer to Figure 3-11 for CT input wiring schematic.

Current Transformer Input Ratings

For optimum control, the Current Transformers (CTs) should be sized at 100 to 125% of the generators rated current.

Example 1:
Generator rated for 2000 amps per phase at 100% load, rated power factor.

	CT Ratio	
100%	**2000:5**	the EGCP-2 will see 5 amps at 2000 generator amps
125%	**2500:5**	the EGCP-2 will see 4 amps at 2000 generator amps

Example 2:
Generator rated for 150 amps per phase at 100% load, rated power factor.

	CT Ratio	
100%	**150:5**	the EGCP-2 will see 5 amps at 150 generator amps
125%	**188:5**	the EGCP-2 will see 4 amps at 150 generator amps

Current Transformer Input Ratings

Number of Inputs:	3 Generator CTs
Nominal Current Ratings:	0–5 A rms
Maximum Current Rating:	7 A rms for 1 minute
Input Burden:	1.25 VA
Input Frequency Range:	40–70 Hz

CAUTION—PROTECTIVE RELAY TESTING
When conducting external Protective Relay testing, if the EGCP-2 CT inputs could measure greater than 7 A rms, *bypass the EGCP-2 CT inputs.*

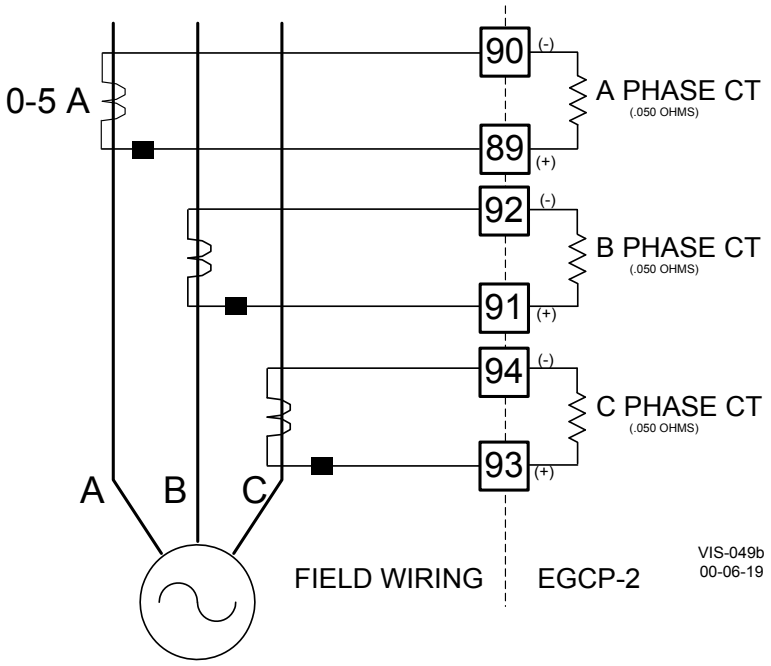


Figure 3-11. Current Transfer Wiring Diagram for EGCP-2

MPU (Speed) Input

To sense engine speed, the control accepts signals from one passive magnetic pickup unit (MPU) mounted off of a gear, which is connected or coupled to the engine's main shaft.

A passive MPU provides a frequency output signal corresponding to engine speed by sensing the movement of a gear's teeth past the MPU's pole piece. The closer the MPU's pole piece is to a gear's teeth and the faster the gear turns the higher a passive MPU's output amplitude will be. The EGCP-2 must sense an MPU voltage of 2 to 25 Vrms for proper operation.

MPU Input Ratings

Low frequency range:	100–250 Hz @ 3.5 to 25 Vrms
Normal Frequency Range:	250–15 000 Hz @ 2.0 to 25 Vrms
Input impedance:	15 000 Ω

With proper MPU, gear size, and MPU-to-gear clearance, speed measurement should be capable down to 100 Hz. Standard MPU clearance is recommended to be .010" to .040" from tooth face to pole piece. For information on selecting the correct MPU or gear size please refer to Woodward manual 82510. See Figure 3-12 for wiring schematic.

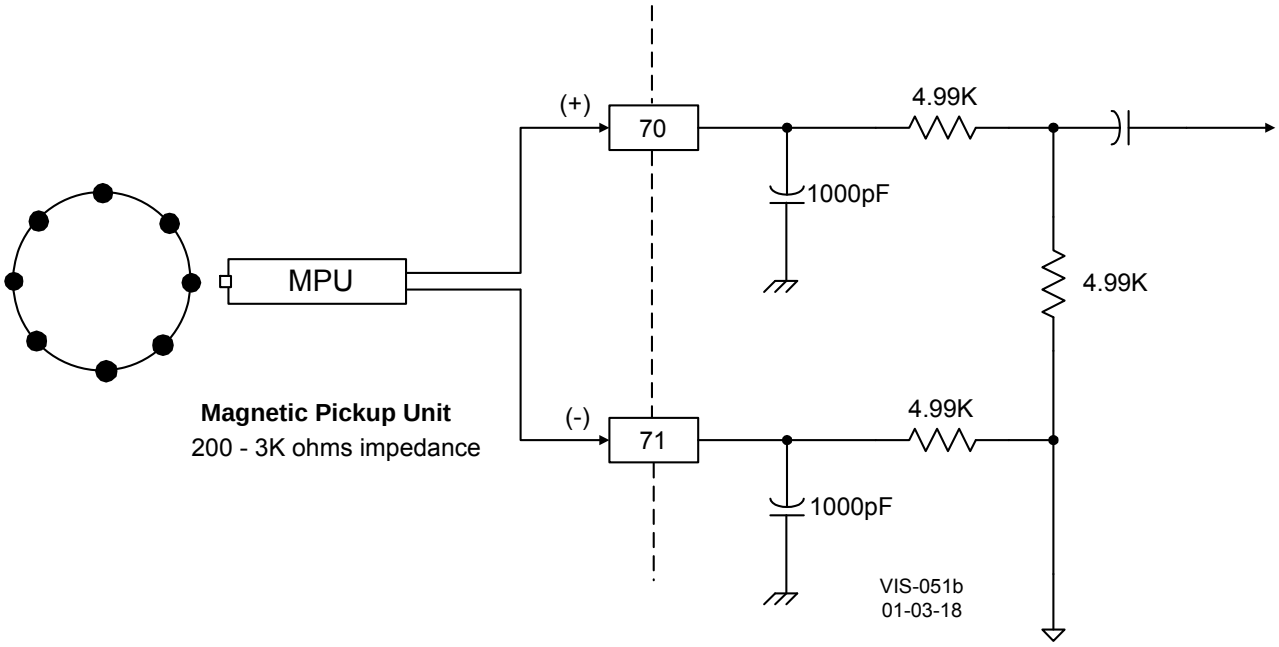


Figure 3-12. Wiring Diagram for MPU Input

Process Import/Export Input

The EGCP-2 control can be configured to control any process which is determined or affected by generator load. The Process Import/Export input is used by the EGCP-2 control to sense the process level being controlled. This input can be DIP switch configured to accept either a 4–20 mA or 1–5 dc signal. Refer to Figure 3-4 for DIP switch location.

Process Input Ratings

Loop Voltage Source: External (4–20 mA), External (1–5 Vdc)
Input Impedance: 249 Ω (4–20 mA), 30 000 Ω (1–5 Vdc)

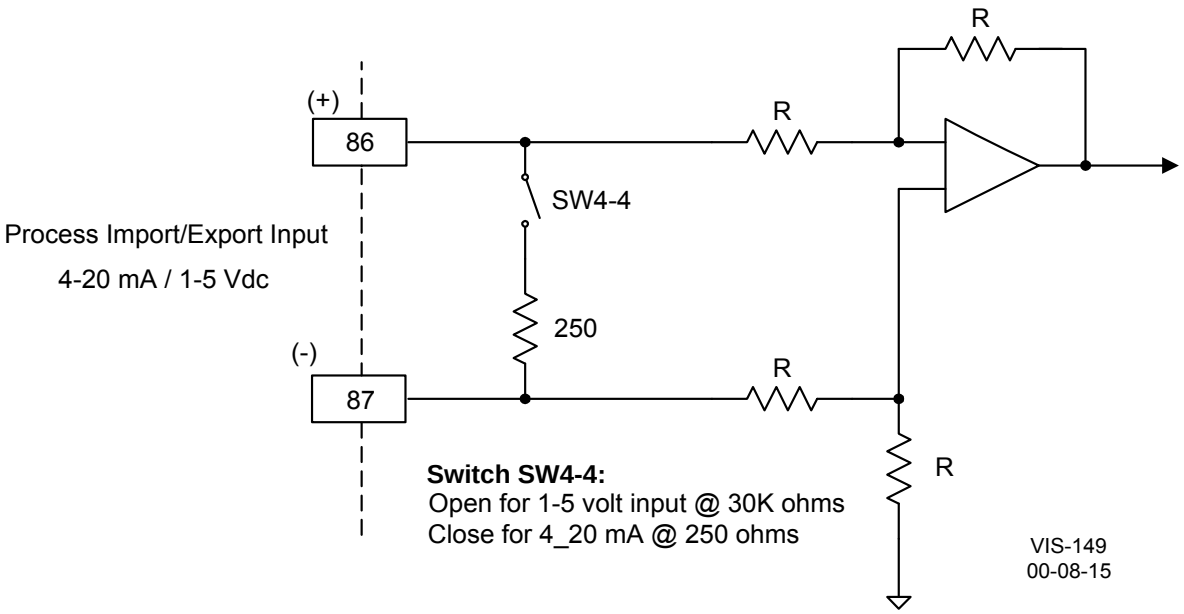


Figure 3-13a. Wiring Diagram for Process Import/Export Input

When connecting a KW transducer signal to multiple EGCP-2s, Woodward recommends converting the 4–12–20 mA signal to a 1–3–5 Vdc signal by connecting a 250 Ω resistor across the output of the KW transducer. The Vdc signal can then be paralleled to all EGCP-2 controls.

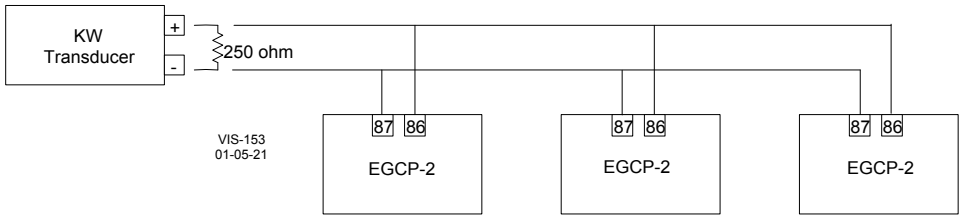


Figure 3-13b. Connecting a KW Transducer Signal to Multiple EGCP-2s (switch 4-4 is in the OPEN position)

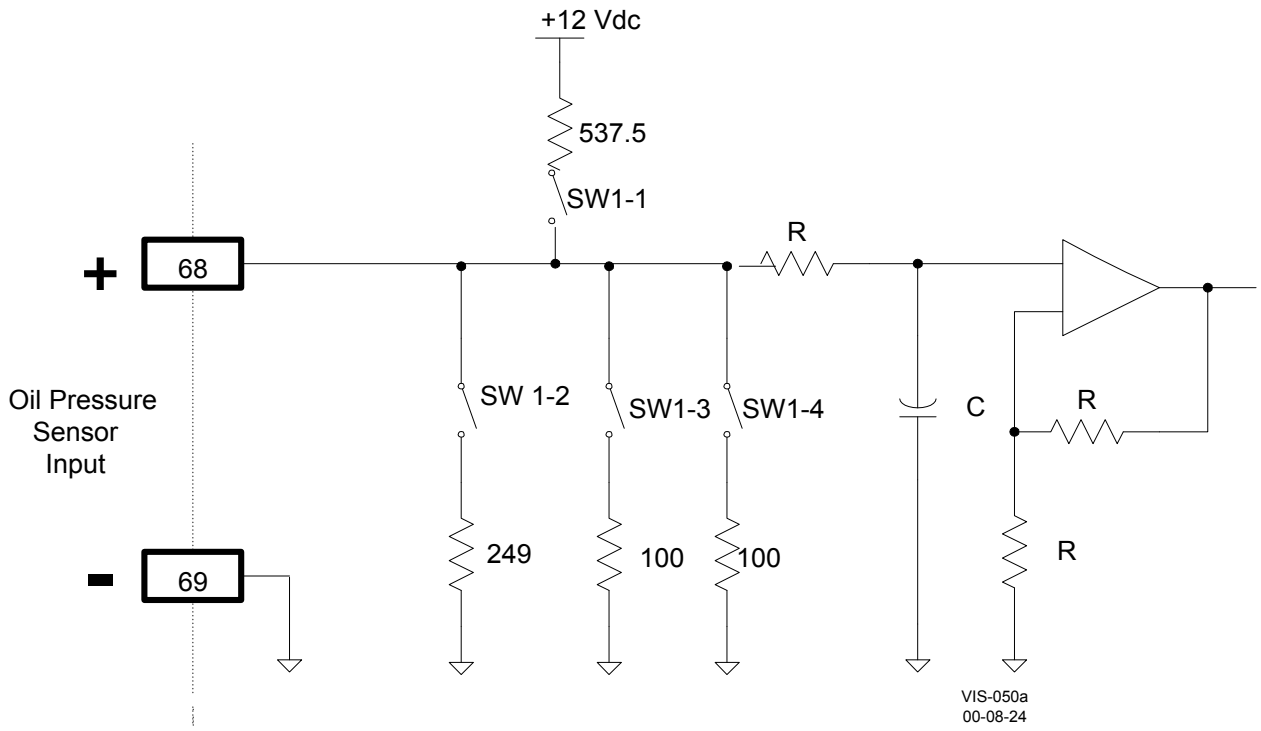
Coolant Temperature and Oil Pressure Inputs

The EGCP-2 has one analog input dedicated to sense engine coolant temperature and one analog input dedicated to sense engine oil pressure. These inputs are optional and once connected-to can be configured to protect the engine by causing a system soft shutdown, hard shutdown, or alarm. To disable these inputs set all related Shutdown/Alarm settings to their “disabled” state.

These inputs can be DIP switch configured to be compatible with 0–200 Ω sensors, 4–20 mA transducers, or 0–5 Vdc transducers. Depending on where a 0–200 Ω sensor’s linear range is, this input can also be DIP switch configured to vary sensor loading which will move the sensor output into the most linear part of its range. Refer to Figure 3-4 for DIP switch location and to Figure 3-14 for input wiring schematics.

Temperature and Pressure Input Ratings

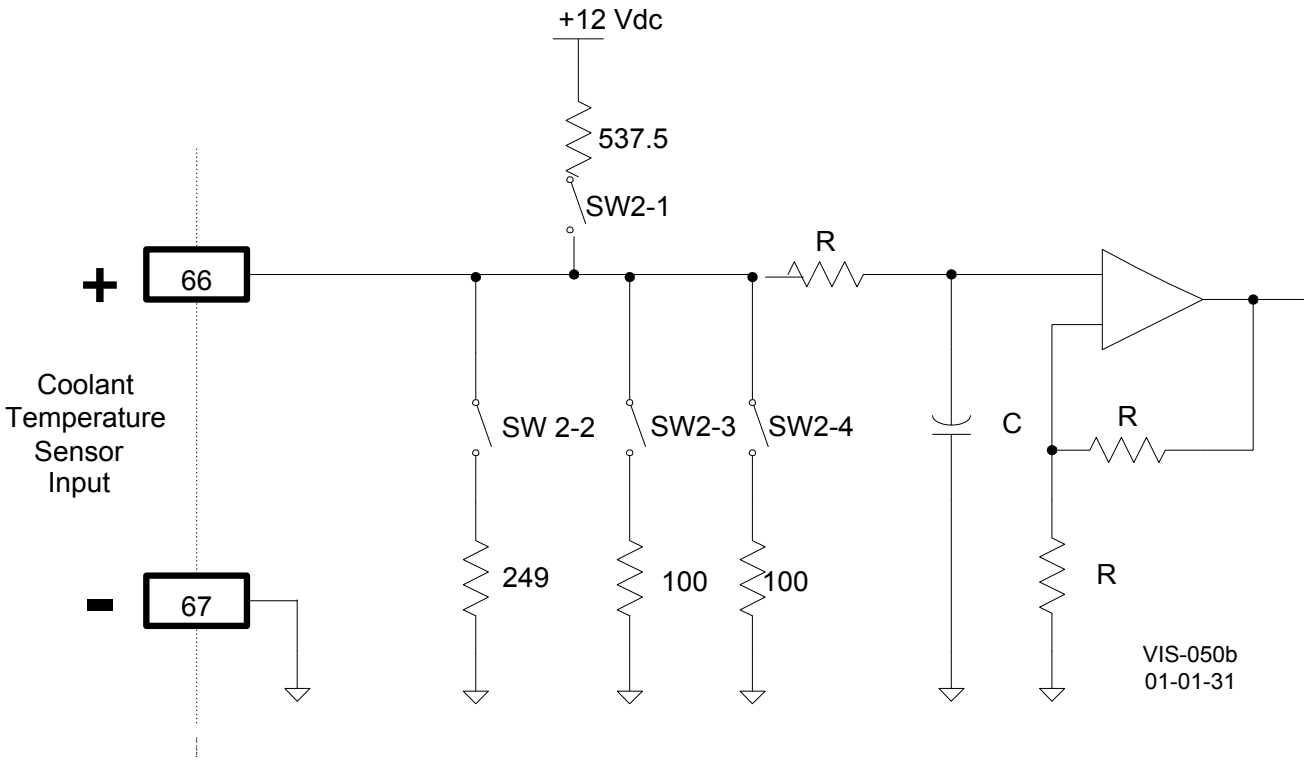
Number of Channels:	2
Loop Voltage Source:	Internal
Input Impedance:	Switch Dependant (refer to Figure 3-14)



Input	4-20mA	1-5 Volt	200 Ohm Sensor
SW1-1	Open	Open	Closed
SW1-2	Closed	Open	Open
SW1-3	Open	Open	**X**
SW1-4	Open	Open	**X**

X - May be closed to insert 100 ohm shunt resistors required to make certain 0-200 ohm transducers more linear.
DO NOT CLOSE FOR VOLTAGE OR CURRENT INPUTS.

Figure 3-14a. Wiring Diagram for Pressure Inputs



Input	4-20mA	1-5 Volt	200 Ohm Sensor
SW2-1	Open	Open	Closed
SW2-2	Closed	Open	Open
SW2-3	Open	Open	**X**
SW2-4	Open	Open	**X**

X - May be closed to insert 100 ohm shunt resistors required to make certain 0-200 ohm transducers more linear.
DO NOT CLOSE FOR VOLTAGE OR CURRENT INPUTS.

Figure 3-14b. Wiring Diagram for Temperature Inputs

Speed Bias and Voltage Bias Outputs

The EGCP-2's Speed Bias output is a dedicated analog output, which is used to bias the prime mover's speed control for unit synchronization and load control. The Speed Bias output is software configurable for outputs of ±3 Vdc, 0.5–4.5 Vdc, or 500 Hz PWM. Refer to Chapter 3, configuration menus, in manual 26086 for selection information.

±3 Vdc—Compatible with Woodward analog and digital speed Controls via the Aux Inputs or the load sharing lines on the 2301/2301A LSSC.
0.5-4.5 Vdc—Compatible with the Detroit Diesel Corp. DDEC-III and IV Control and Caterpillar's Gas Engine Control Module (GECM).
500 Hz PWM—Compatible with Caterpillar's ADEM control (diesel engine).

Refer to Appendix B of this manual for control specific speed bias connections.

The EGCP-2's Voltage Bias output is a dedicated analog output, which is used to bias the generator's automatic voltage regulator for unit synchronization and reactive load control. The Voltage Bias output is software configurable for outputs of ±1 Vdc, ±3 Vdc, or ±9 Vdc. Refer to Chapter 3, configuration menus, in manual 26086 for selection information.

The voltage bias output works with many automatic voltage regulators. Following is a list of manufacturers and types:

Basler	Caterpiller	KATO	Newage	Leroy Somer
SR4A	VR3	360	MX321	
SR8A	DVR	760	MX341	
SSE				
SSR				
DECS				

The EGCP-2 is not compatible with the Marathon 2000 DVR.

The Speed and Voltage Bias Outputs will only drive into high impedance type inputs, and are limited to inputs, which have an input impedance of 1000 ohms or more.

Speed and Voltage Bias output Ratings

Number of Channels:	2
Min Drive Impedance:	1000 Ω

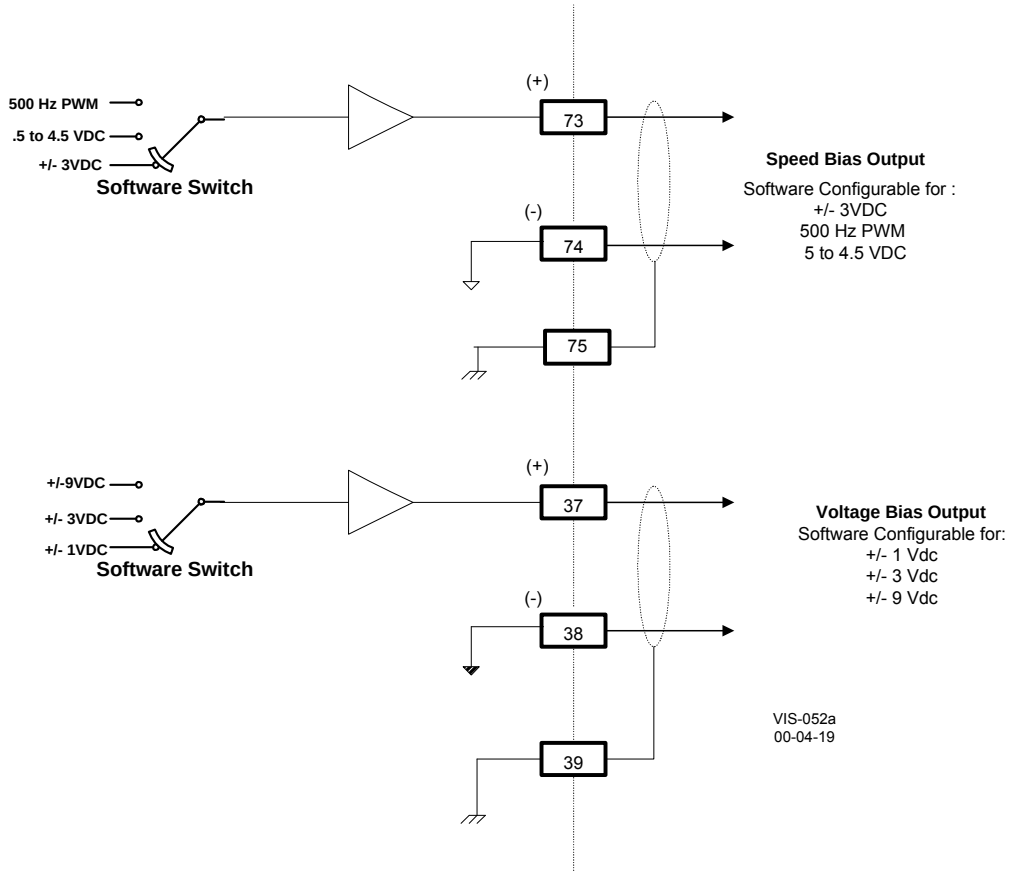


Figure 3-15. Wiring Diagram for Speed Bias and Voltage Bias Outputs

Discrete Inputs

Discrete inputs are used by the EGCP-2 control to determine breaker positions and accept external control commands. Contacts must change state for a minimum of 40 milliseconds for the control to sense and register a change in state. All discrete inputs accept dry contacts only, with contact wetting voltage provided by the EGCP-2 control. The following is a list of the available EGCP-2 Discrete Inputs:

ID #	Description
1.	Automatic Mode Select
2.	Test Engine Mode Select
3.	Run with Load Mode Select
4.	Voltage Raise
5.	Voltage Lower
6.	Speed/Load Raise
7.	Speed/Load Lower
8.	Generator Breaker Aux Contact
9.	Utility (Mains) Breaker Aux Contact
10.	Process I/E Mode Select
11–16.	Configurable Alarm or Shutdown Inputs

Discrete Input Ratings

Number of Channels:	16
Input Type:	Optically isolated
Min Closed Sense Time:	40 ms

Speed/Load Raise and Lower Inputs

The functionality of the Speed/Load Raise and Lower inputs change based on the mode that the EGCP-2 control is in. If the EGCP-2 control is in the Speed control mode (generator breaker open), these contact inputs can be used to raise and lower speed. If the EGCP-2 control is in the Baseload control mode (generator breaker closed, utility tie breaker closed), these contact inputs can be used to raise and lower unit baseload. If the EGCP-2 control is in the Process control mode (Process control enabled), these contact inputs can be used to raise and lower the process setpoint. Refer to figure 8-23 for Speed/Load raise and lower contact functionality matrix.

Voltage Raise and Lower Inputs

The functionality of the Voltage Raise and Lower inputs change based on the mode that the EGCP-2 control is in. If the EGCP-2 control is in the Speed control mode (generator breaker open), these contact inputs can be used to raise and lower unit voltage. If the EGCP-2 control is in the VAR control mode (VAR control programmed, generator breaker closed, utility tie breaker closed), these contact inputs can be used to raise and lower unit VARs. If the EGCP-2 control is in the Power Factor control mode (Power Factor control programmed, generator breaker closed, utility tie breaker closed), these contact inputs can be used to raise and lower unit Power Factor. If the EGCP-2 control is in the isochronous load sharing mode, the Voltage Raise and Lower inputs are disabled.

Gen, Tie, Alarm, and Shutdown Inputs

The Generator Breaker contact input must be wired so it is closed when the generator breaker is closed.

The Utility Tie Breaker contact input must be wired so it is closed when the utility tie breaker is closed.

The Configurable Alarm or Shutdown Inputs must be wired so they are closed when the alarm or shutdown condition is true.

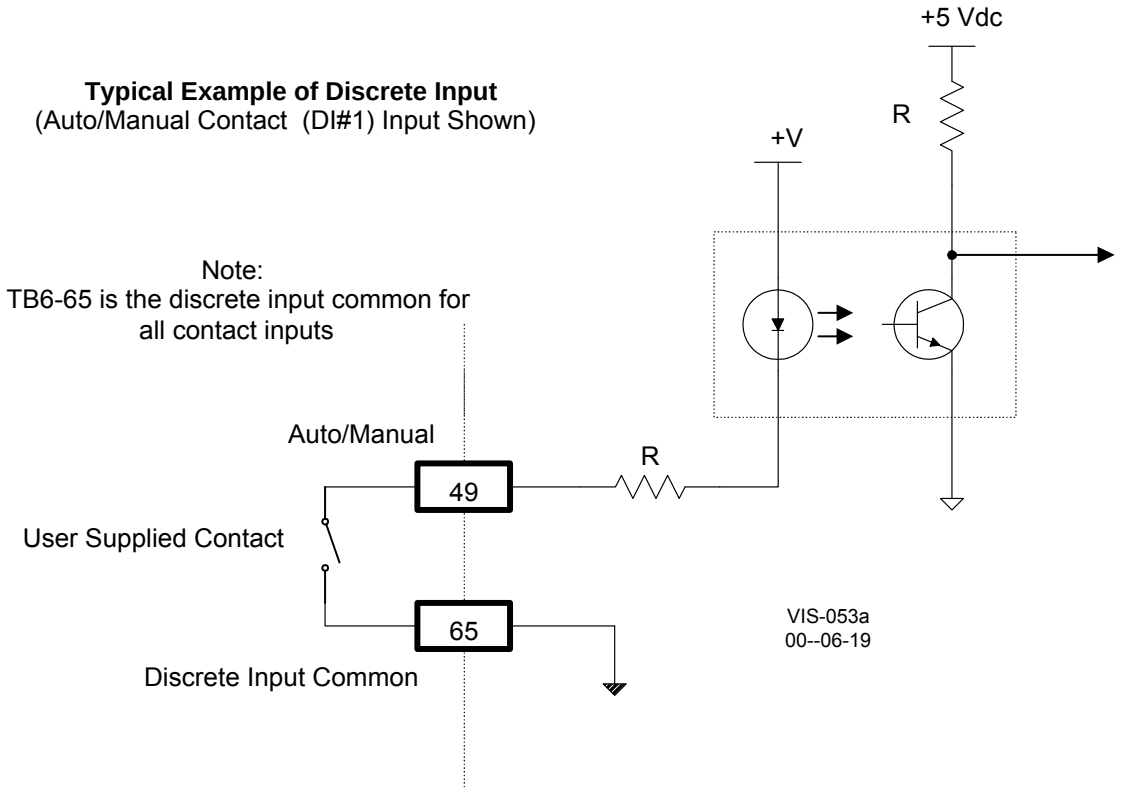


Figure 3-16. Wiring Diagram for Typical Discrete I/O Connections

Relay Outputs

Twelve (Form C type) Relay Outputs are used by the EGCP-2 control to interface with system devices. Before installation verify that the EGCP-2's relay contacts meet the power requirements of the circuit with which it is being interfaced. Interposing relays are required in cases where the interfaced circuit demands relay contacts with a higher power rating. If interposing relays are required, it is recommended that interposing relays with surge (inductive kick-back) protection be used. The following is a list of the available EGCP-2 Relay Outputs:

ID#	Description
1.	Mains (Utility) Breaker Close/Contactor Close
2.	Gen Breaker/Contactor Close
3.	Engine Preglow
4.	Fuel Solenoid
5.	Engine Crank
6.	Visual Alarm Relay
7.	Local Bus PT Connect
8.	Utility (Mains) PT Disconnect
9.	Utility (Mains) Breaker Trip (open)
10.	Gen Breaker Trip (open)
11.	Audible Alarm
12.	Idle/Rated or KVA Load Switch

Relay Output Ratings

Number of Channels:	12
Relay Type:	Sealed
Relay Response Time:	15 ms (operate and release)
Relay Life Expectancy:	≥50 000 operations @ rated load (8 A @ 250 Vac COS ≥0.7) (8 A @ 24 Vdc τ ≥0.7 ms)
Replaceability:	Relays are soldered to main board and are not field replaceable
Max. Contact Ratings:	
AC:	10 A, 250 Vac Resistive 249 W (1/3 hp), 125 Vac (7.2 A, 0.4–0.5 PF)
DC:	10 A, 30 Vdc Resistive

Relay Output Functions

Discrete Output #1—Mains Utility Breaker Close

With the relay de-energized, this output has Normally Open (NO), terminals 5 and 6, and Normally Closed (NC), terminals 6 and 7, contacts to select from.

The “Mains (utility) Breaker Close” relay output is utilized by the EGCP-2 to command the Mains (utility) Breaker to close. This output is configured for use with a BREAKER or a CONTACTOR in the Configuration menu under “CKT Breaker Control”. Every EGCP-2 that has the capability of being a MASTER unit must have this relay wired into the Mains (utility) Breaker close circuitry.

Breaker

When in the Breaker configuration, the EGCP-2 will ENERGIZE (momentary) to close the Mains (utility) Breaker. The ENERGIZE time is determined by the “CB Hold Time” in the Synchronizer menu. Discrete Output #9 is used to open the mains breaker.

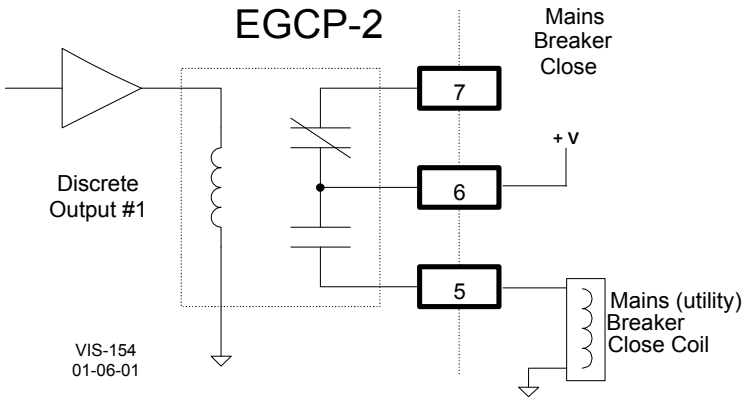


Figure 3-17. Example of the Mains Breaker NO Output Connected to Close the Mains (Utility) Breaker (ENERGIZE TO CLOSE)

Contactor

The “Mains Breaker Close” output is used to close and open the Mains Contactor. The “Mains Breaker Trip”, discrete output #10 is NOT used in the Contactor mode.

The EGCP-2 will ***DE-ENERGIZE (continuously) to close the Mains Contactor and ENERGIZE (continuously) to open the Mains Contactor***. This is reverse logic from the Generator Contactor Close, discrete output # 2. External logic will be needed to verify the contactors state when installing or replacing EGCP-2 controls and for multiple control systems.

CAUTION—REMOVING POWER
When power is removed from the EGCP-2, the "Mains Breaker Close" output will be in the De-energized state and attempt to close the Mains contactor.

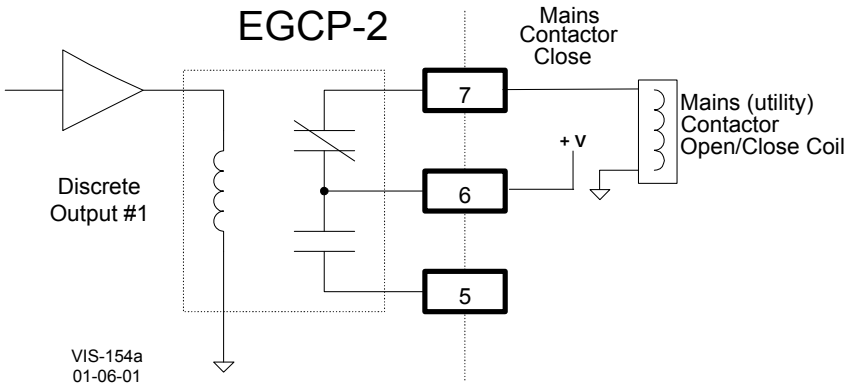


Figure 3-18. Example Using the NC Output to Control the Mains (Utility) Contactor (ENERGIZE TO OPEN)

Discrete Output #2—Generator Breaker Close
With the relay de-energized, this output has Normally Open (NO), terminals 8 and 9, and Normally Closed (NC), terminals 9 and 10, contacts to select from.

The "Generator Breaker Close" relay output is utilized by the EGCP-2 to command the Generator Circuit breaker to close. This output is configured for use with a BREAKER or a CONTACTOR in the Configuration menu under "CKT Breaker Control".

Breaker
When in the Breaker configuration, the EGCP-2 will ENERGIZE (momentary) to close the Generators Breaker. The ENERGIZE time is determined by the "CB Hold Time" in the Synchronizer menu. Discrete Output #10 is used to open the generators breaker.

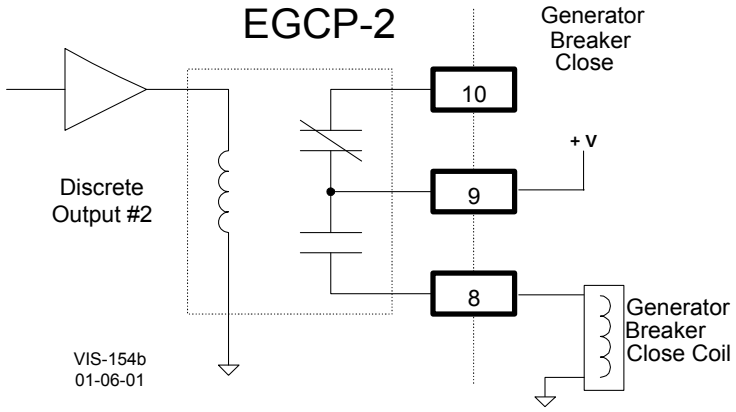


Figure 3-19. Example of the Generator Breaker Close NO Output Connected to Close the Generator Breaker (ENERGIZE TO CLOSE)

Contactor

The "Generator Breaker Close" output is used to close and open the Generators Contactor. The "Generator Breaker Trip", discrete output #10, is NOT used in the Contactor mode.

The EGCP-2 will DE-ENERGIZE (continuously) to open the Generators Contactor and ENERGIZE (continuously) to close the Generators Contactor. This is reverse logic from the Mains Contactor Close, discrete output # 1.

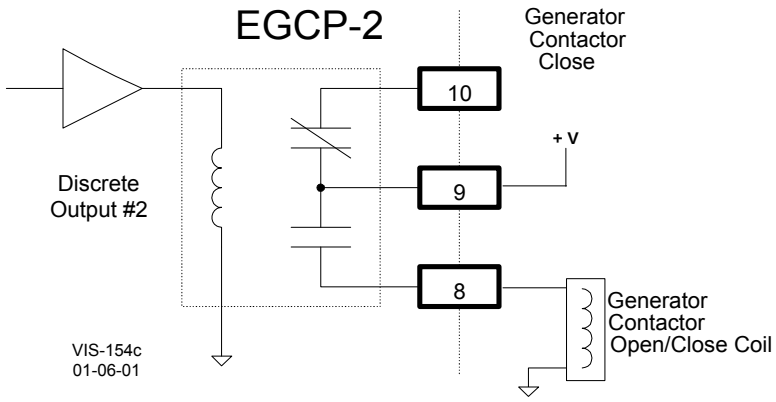


Figure 3-20. Example Using the NO Contacts to Control the Generator's Contactor (ENERGIZE TO CLOSE)

Discrete Output #3—Engine Preglow
The “Engine Preglow” relay output utilizes a set of normally open (NO) contacts on terminals 11 and 12.

The “Engine Preglow” relay output is utilized by the EGCP-2 to turn on a diesel engine’s glow plugs, if so equipped. This relay will energize for a programmed length of time, based on the “Preglow Time” setting, before an engine crank command is given.

Discrete Output #4—Fuel Solenoid
The “Fuel Solenoid” relay output utilizes a set of Normally Open (NO) contacts on terminals 13 and 14 to energize the engine’s fuel solenoid.

The Configurations menu, “Start Sequencing” setting of Enabled or Disabled, determines the EGCP-2’s start process.

Start Sequencing—Enabled
This relay ENERGIZES at the same time an Engine Crank command is initiated, and stays on until a shutdown command is received. The EGCP-2 must have a Magnetic Pickup (MPU) signal to operate in this condition.

Start Sequencing—Disabled
The EGCP-2 will ENERGIZE (continuously) the Fuel Solenoid relay when a start command is given. It will De-energize when a shutdown command is received. The fuel solenoids output will function as a Run/Stop relay.

There is no “Engine Preglow” or “Engine Crank” command in this mode. The Disabled mode allows the EGCP-2 to operate without a Magnetic Pickup (MPU) signal.

Discrete Output #5—Engine Crank
The “Engine Crank” relay output utilizes a set of Normally Open (NO) contacts on terminals 15 and 16.

The “Engine Crank” relay output is utilized by the EGCP-2 to command the engine to crank or start. This relay will energize for a programmed length of time, based on the “Crank Time” setting, or until engine speed is sensed to be above the “Crank Cutout” speed setting.

Discrete Output #6—Visual Alarm
With the relay de-energized, this output has Normally Open (NO) terminals 18 and 19 and Normally Closed (NC) terminals 19 and 20 contacts to select from.

The “Visual Alarm” relay output can be utilized as an option to remotely indicate when an alarm condition has been sensed by the EGCP-2 control. This relay energizes upon any sensed alarm condition and will remain energized until all alarm conditions have been acknowledged or committed via the unit’s Alarm Screen. Refer to manual 26086 for information on acknowledging and committing alarms.

Discrete Output #7—Local Bus PT Connect
The “Local Bus PT Connect” relay utilizes a set of Normally Open (NO) contacts on terminals 21 and 22.

The “Local Bus PT connect” relay output is utilized by the EGCP-2 to connect the Local Bus PT to the EGCP-2’s “Utility and Local Bus PT Input” on terminals 40 and 41. Due to relay load limitations, it is required that this output be configured to drive an interposing relay with which to control the Local Bus PT connection. Refer to Figures 3-7 and 3-8a and b of this chapter for detailed wiring information. This type of relay configuration allows a break-before-make action, insuring that the Utility Tie PT and the Local Bus PT are never connected.

Discrete Output #8—Utility Tie (Mains) PT Disconnect
The “Utility Tie (Mains) PT Disconnect” relay utilizes a set of Normally Open (NO) contacts on terminals 23 and 24.

The “Utility Tie (Mains) PT disconnect” relay output is utilized by the EGCP-2 to disconnect the Utility PT from the EGCP-2’s “Utility and Local Bus PT Input” on terminals 40 and 41. Due to relay load limitations, it is required that this output be configured to drive an interposing relay with which to control the Utility Tie PT connection. Refer to Figures 3-7 and 3-8a and b of this chapter for detailed wiring information. This type of relay configuration allows a break-before-make action, insuring that the Utility Tie PT and the Local Bus PT are never connected.

Discrete Output #9—Mains Breaker Trip (Open)
With the relay de-energized, this output has Normally Open (NO), terminals 25 and 26, and Normally Closed (NC), terminals 26 and 27, contacts to select from.

The “Mains Breaker Trip (open)” relay output is utilized by the EGCP-2 to command the Mains (utility) Breaker to open. This output is operational when configured for use with a BREAKER, in the Configuration menu under “CKT Breaker Control”. If configured for Contactor, see Discrete Output #1 for Mains Contactor open/close operation.

Every EGCP-2 that has the capability of being a MASTER unit must have this relay wired into the Mains (utility) Breaker open circuitry.

Breaker
When in the Breaker configuration, the EGCP-2 will ENERGIZE (momentary) to open the Mains (utility) Breaker.

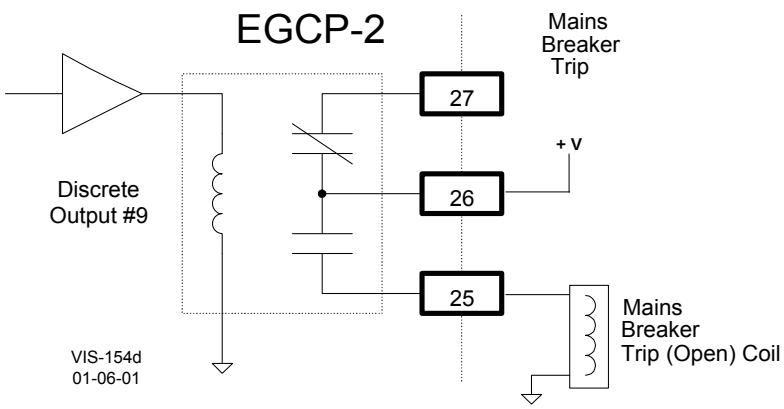


Figure 3-21. Example Using the NO Contacts to Control the Mains Breaker Trip (Open) Coil (ENERGIZE TO OPEN)

Discrete Output #10—Generator Breaker Trip (Open)
With the relay de-energized, this output has Normally Open (NO), terminals 28 and 29, and Normally Closed (NC), terminals 29 and 30, contacts to select from.

The "Generator Breaker Trip (open)" relay output is utilized by the EGCP-2 to command the Generator Breaker to open. The relay output will DE-ENERGIZE to open the Generator Breaker. This output is operational when configured for use with a BREAKER, in the Configuration menu under "CKT Breaker Control".
If configured for Contactor, see Discrete Output #2 for Generator Contactor open/close operation.

Breaker
In the Breaker configuration, the "Generator Breaker Trip (open)" relay will energize when the EGCP-2 is:
1. In the "AUTO" mode (Discrete Input #1)
2. And the Generator is stable (Generator Stable Delay time has been achieved)

The EGCP-2 will DE-ENERGIZE to open the Generators Breaker. The output will stay de-energized until the "AUTO" and Generator stable conditions are met.

When operating in the Manual mode, it is required to externally control the Generators Breaker. The EGCP-2 will continuously be providing a Generator Breaker open command. This means the EGCP-2 will have no control over opening the generators breaker once it has been closed manually. See Chapter 8 for Manual operation details.

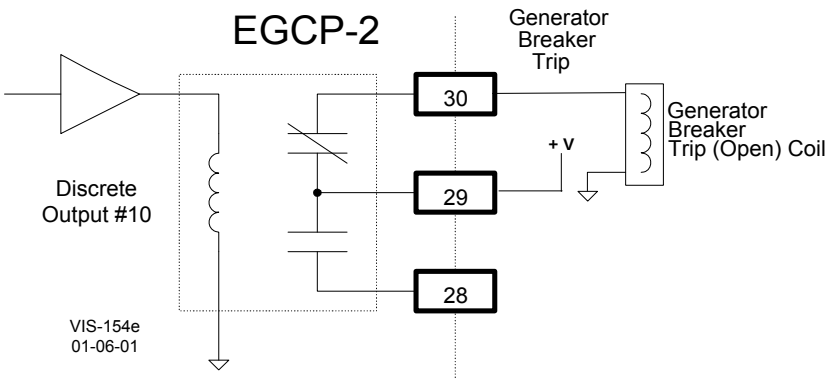


Figure 3-22. Example Using the NC Contacts to Control the Generator Breakers Open Coil (DE-ENERGIZE TO OPEN)

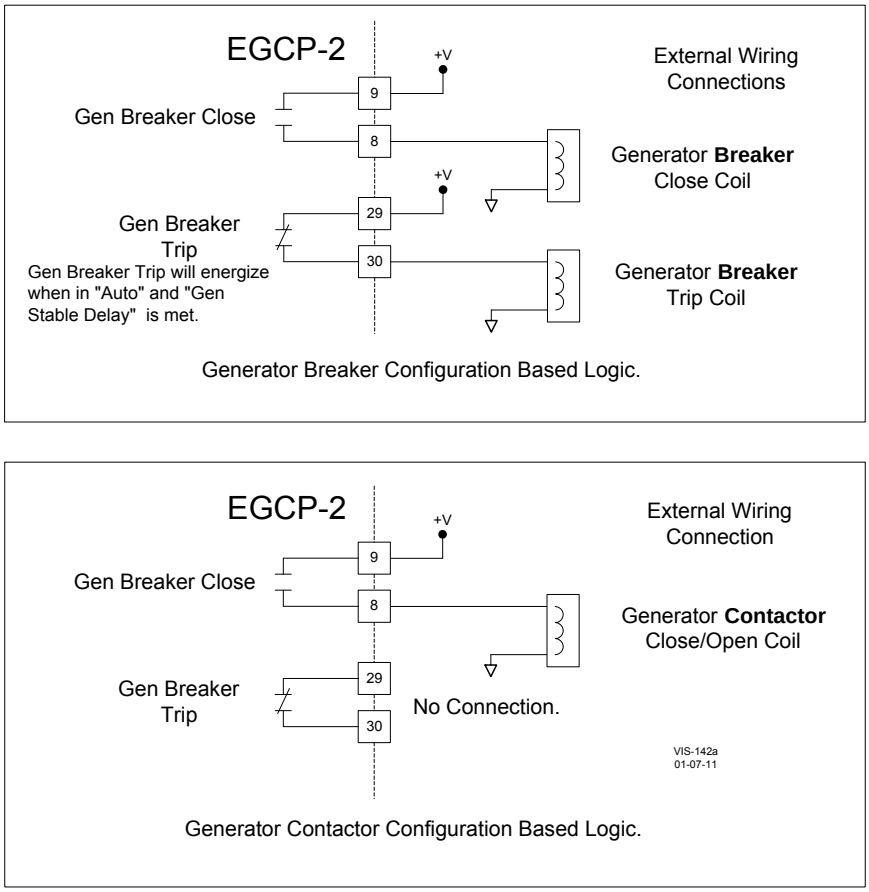


Figure 3-23. Generator Breaker and Contactor Close and Open Logic

Discrete Output #11—Audible Alarm
With the relay de-energized, this output has Normally Open (NO) terminals 31 and 32 and Normally Closed (NC) terminals 32 and 33 contacts to select from.

The “Audible Alarm” relay output can be utilized as an option to control a plant Alarm Horn to indicate when an alarm condition has been sensed by the EGCP-2 control. This relay energizes upon any sensed alarm condition and will remain energized until an acknowledged command is given. Refer to manual 26086 for information on acknowledging and committing alarms.

When an alarm setpoint is configured for Audible Alarm, the alarm condition will cause the audible and visual alarm output relays to energize and the red LED on the face of the EGCP-2 to flash. All alarm indicators will remain active until the alarm condition is acknowledged. No control actions occur as a result of an audible alarm condition.

Discrete Output #12—KVA Load or Idle/Rated Switch
This relay uses Normally Open (NO) contacts at terminal 34 and 35.

Discrete Output #12 can be configured for a “KVA Load” or an “Idle/Rated” switch. This selection is done in the Configuration menu under “Relay #12 Function”.

KVA Load Switch
This relay will energize when the controls KVA value is within the configured Low and High settings. The relay will de-energize when the KVA value is below or above the configured Low and High settings. The low and high setpoints are configured in the Real Load Control menu, under items “KVA Switch Low” and “KVA Switch High”.

Idle/Rated Switch
When selected as an Idle/Rated switch, the output must be connected to the engines speed control. This relay is de-energized to select an idle speed settings, and after reaching the set idle speed value and holding at that point for the set amount of time, the relay energizes to select the speed controls rated speed setting. The speed value and time are configured in the Engine Control menu under items “Idle Speed” and “Idle Time”.

The engines idle speed must be equal to or greater than the configured “Idle Speed” value to start the “Idle Time”. The EGCP-2 uses the magnetic pickup (MPU) signal to calculate the idle speed. If no MPU is connected, the idle speed is calculated from the Generators frequency. Remember, if the generator is NOT excited at idle speed and there is no MPU signal, the Idle/Rated switch will not energize.

When a Loss of Mains (LOM) or an overloaded system condition exists, the idle/rated function is bypassed, and rated speed is selected during the start sequencing routine.

AC Inputs

The EGCP-2 receives ac inputs from the generator, bus, mains and engine. They are as follows:

Location	Description	Signal	Burden
42	Generator PT phase A +	AC Voltage	200 kΩ
43	Generator PT phase A –	AC Voltage	A+ to A–
44	Generator PT phase B +	AC Voltage	200 kΩ
45	Generator PT phase B –	AC Voltage	B+ to B–
46	Generator PT phase C +	AC Voltage	200 kΩ
47	Generator PT phase C –	AC Voltage	C+ to C–
89	Generator CT phase A+ Current	AC Current	0.050 Ω
90	Generator CT phase A– Current	AC Current	+ to –
91	Generator CT phase B+ Current	AC Current	0.050 Ω
92	Generator CT phase B– Current	AC Current	+ to –
93	Generator CT Phase C+ Current	AC Current	0.050 Ω
94	Generator CT Phase C– Current	AC Current	+ to -
40	Mains/Bus PT Phase A	AC Voltage	200 k Ω
41	Mains/Bus PT Phase B or N	AC Voltage	+ to –
70	Magnetic Pickup +	AC Frequency	15 k Ω
71	Magnetic Pickup –	AC Frequency	+ to –
72	Magnetic Pickup Shield		

DC Inputs and Outputs

Location	Description	Signal	I/O
1	+ power supply	9–32 Vdc	Isolated
2	– power supply		Input 13 W typical, 20 W max.
86	+ Process Signal	4–20 mA	Isolated Input
87	– Process Signal	or 1–5 Vdc	249 Ω (4–20 mA)
88	Process Signal Shield		30 k Ω (1–5 Vdc)
73	+ Speed Bias	±3 Vdc,	Software Configured
74	– Speed Bias	0.5 to 4.5 Vdc,	10 mA Maximum
75	Speed Bias Shield	500 Hz PWM	Isolated Output
37	+ Voltage Bias	±1, 3, or 9 Vdc	Software Configured
38	– Voltage Bias		10mA Maximum
39	Voltage Bias Shield		Isolated Output
68	Pressure Sensor +	0–200 Ω sensor,	Internal Voltage Source
69	Pressure Sensor –	4-20 mA, or 1-5 Vdc	Internal Source Common Dip Switch Selected
66	Temp Sensor +	0–200 Ω sensor	Internal Voltage Source
67	Temp Sensor –	4–20 mA, or 1–5 Vdc	Internal Source Common Dip Switch Selected

Discrete Inputs

Loc.	Description	Signal	Input
49	Auto	Discrete Input (DI-1)	+ power supply (internal connection)
50	Test	Discrete Input (DI-2)	+ power supply (internal connection)
51	Run/Ld	Discrete Input (DI-3)	+ power supply (internal connection)
52	Volt Raise	Discrete Input (DI-4)	+ power supply (internal connection)
53	Volt Lower	Discrete Input (DI-5)	+ power supply (internal connection)
54	Speed Raise	Discrete Input (DI-6)	+ power supply (internal connection)
55	Speed Lower	Discrete Input (DI-7)	+ power supply (internal connection)
56	Gen CB Aux	Discrete Input (DI-8)	+ power supply (internal connection)
57	Mains CB Aux	Discrete Input (DI-9)	+ power supply (internal connection)
58	Process	Discrete Input (DI-10)	+ power supply (internal connection)
59	Fault 1	Discrete Input (DI-11)	+ power supply (internal connection)
60	Fault 2	Discrete Input (DI-12)	+ power supply (internal connection)
61	Fault 3	Discrete Input (DI-13)	+ power supply (internal connection)
62	Fault 4	Discrete Input (DI-14)	+ power supply (internal connection)
63	Fault 5	Discrete Input (DI-15)	+ power supply (internal connection)
64	Fault 6	Discrete Input (DI-16)	+ power supply (internal connection)
65	Switch Common	Discrete Input	– power supply (internal connection)

NOTE: Approximately 5 mA current draw across each DI when CLOSED.

Discrete Outputs

Location	Description	Signal	Output Rating
7	Mains Brkr Close	NC Discrete Output (D01)	(see Relay
6	Mains Brkr Close	C (D01)	Output Ratings)
5	Mains Brkr Close	NO Discrete Output (D01)	“
10	Gen Brkr Close	NC Discrete Output (D02)	“
9	Gen Brkr Close	C (D02)	“
8	Gen Brkr Close	NO Discrete Output (D02)	
12	Engine Preglow	C (DO3)	“
11	Engine Preglow	NO Discrete Output (DO3)	“
14	Fuel Solenoid	C (DO4)	“
13	Fuel Solenoid	NO Discrete Output (DO4)	“
16	Crank Engine	C Discrete Output (DO5)	“
15	Crank Engine	NO Discrete Output (DO5)	“
17	No Connection	Isolation Boundary	
20	Visual Alarm	NC Discrete Output (DO6)	“
19	Visual Alarm	C (DO6)	“
18	Visual Alarm	NO Discrete Output (DO6)	
22	Bus PT Connect	C (DO7)	“
21	Bus PT Connect	NO Discrete Output (DO7)	“
24	Mains PT Disconnect	NC Discrete Output (DO8)	“
23	Mains PT Disconnect	C (DO8)	“
27	Mains Brkr Trip	NC Discrete Output (DO9)	“
26	Mains Brkr Trip	C (DO9)	“
25	Mains Brkr Trip	NO Discrete Output (DO9)	
30	Gen Brkr Trip	NC Discrete Output (DO10)	“
29	Gen Brkr Trip	C (DO10)	“
28	Gen Brkr Trip	NO Discrete Output (DO10)	
33	Audible Alarm	NC Discrete Output (DO11)	“
32	Audible Alarm	C Discrete Output (DO11)	“
31	Audible Alarm	NO Discrete Output (DO11)	

Location	Description	Signal	Output Rating
35	Idle Rated/Load SW	C (DO12)	“
34	Idle Rated/Load SW	NO Discrete Output (DO12)	“
36	No Connection	Isolation Boundary	

Communication Ports: RS-485 & RS-422 (1 each)

Location	Description	Signal
77	– 485 Communication	Inter-control Communications
76	+ 485 Communication	Inter-control Communications
78	485 Shield	
80	+5 Vdc common	Internal Isolated Power Supply
79	+5 Vdc	Internal Isolated Power Supply
81	422 Communication RX+	PC interface
82	422 Communication RX–	PC interface
83	422 Shield	
84	422 Communication TX+	PC interface
85	422 Communication TX–	PC interface

Specifications

Communications:
RS-422 protocol
9600 Baud (fixed maximum)
No Parity
1 Stop Bit

Minimum Computer Requirements:
Windows 95

Hardware Connections

Once the software is installed on the computer hard drive, the hardware connection between the computer and the EGCP-2 control must be made for correct communication between the two devices. This hardware connection is completed using a direct cable connection between the computer and the EGCP-2 control(s) RS-422 network.

Modbus/ServLink Communications
The laptop or desktop computer which will be used with the EGCP-2 RS-422 port will have a 9-pin serial port. This port is configured by the computer hardware to use a serial communications protocol called RS-232. The details of this protocol are not important to know for hardware connection to the EGCP-2 control(s), other than there is a need to convert the RS-232 protocol of the computer port to RS-422 protocol used by the EGCP-2 control network. This conversion is accomplished via an external conversion module which takes the 9-pin RS-232 serial port input from the computer, and changes it to a RS-422 protocol for the EGCP-2. These converters can be found in most computer or electronics stores, and are called RS-232 to RS-422 Converters. Woodward offers a cable, 5417-551, that includes this converter. This cable is designed for point-to-point communications.

In a system with multiple (8 maximum) EGCP-2 controls, each control is interconnected to the others on the 422 network in a multidrop fashion. The computer is linked to the network at any control as if it were the next control on the network, as shown below.

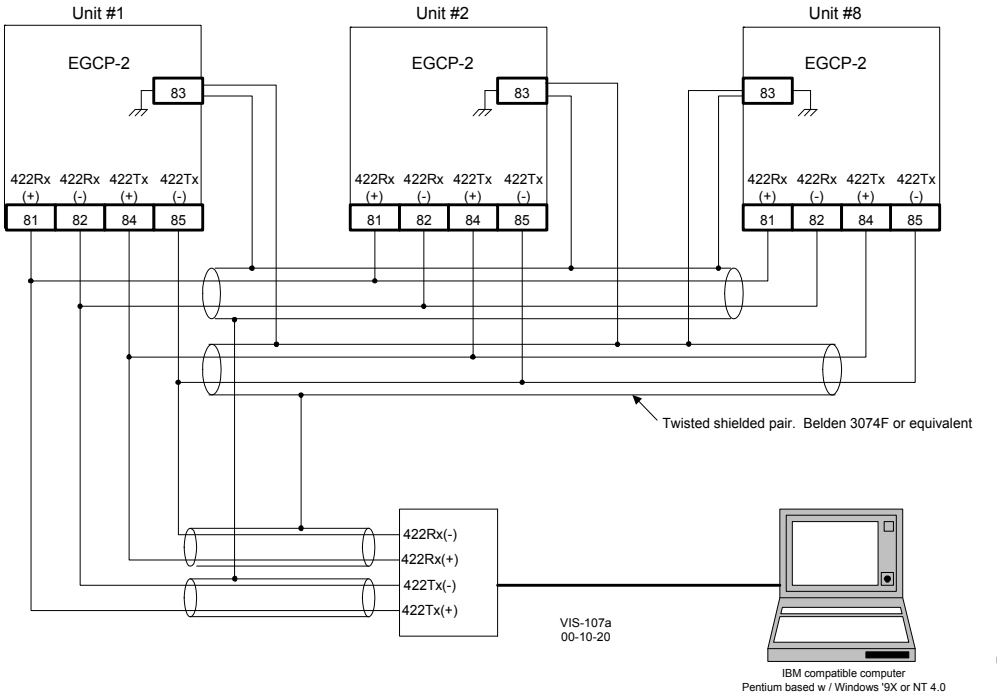


Figure 3-24. RS-422 Communications

Switch configuration for multiple units utilizing RS-422 communication.

Unit #1	Unit #2	Unit #8
SW3-1 Closed	SW3-1Open	SW3-1 Closed
SW3-2 Closed	SW3-2 Open	SW3-2 Closed
SW3-3 Closed	SW3-3 Open	SW3-3 Closed

NOTES

When the RS-422 to RS-232 converter is greater than 30 meters from unit 1, an isolating version will be required. Cable shields must also be AC coupled to earth or connected to RS-422 to RS-232 converter chassis. This chassis must be Isolated from earth and may be AC coupled to earth.

When unit 2 and/or unit 3 are more than 30 meters from unit 1, the cable shield must be ac coupled to terminal 83. The capacitor must be 0.01 µF with a working voltage of 1000 Vdc or greater.

The RS-422 Termination dip switches must be closed on the end units on the network for proper communications. See the plant wiring diagram for switch locations. Failure to terminate the network properly will cause communication drop out errors.

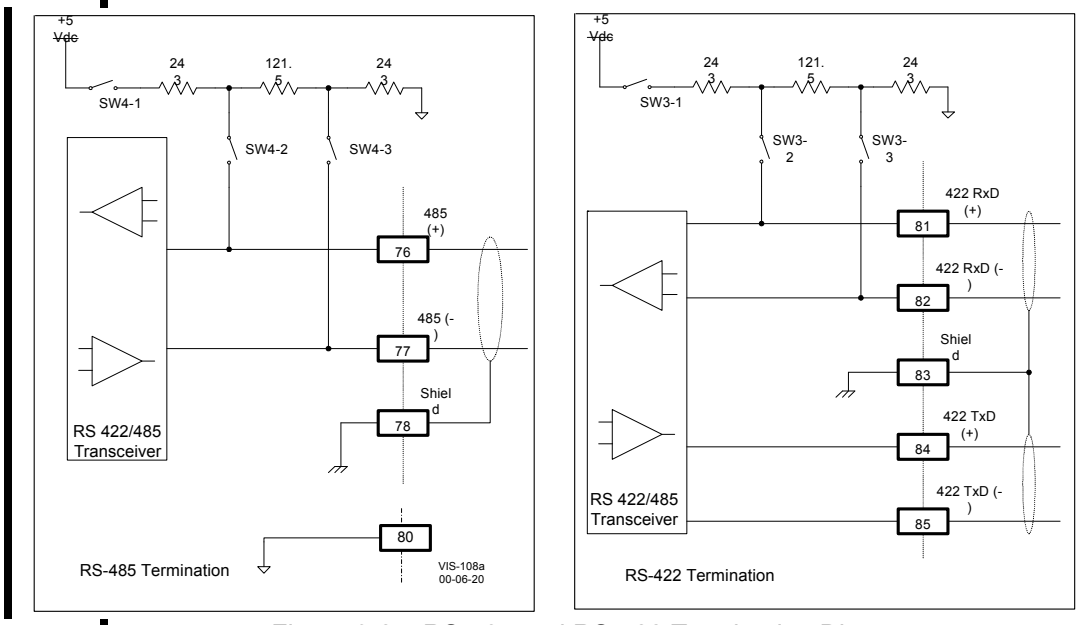


Figure 3-25. RS-485 and RS-422 Termination Diagrams

For detailed wiring diagrams pertaining to the RS-422 network of the EGCP-2 controls, please consult the plant wiring diagram in this manual.

Inter-control Communications (RS-485 Network)

The EGCP-2 uses a proprietary communication structure to share information between multiple EGCP-2 controls. This structure allows accurate load sharing, status, and command messages to be exchanged between up to 8 controls. The network uses RS-485 protocol over a standard twisted shielded pair to link the EGCP-2 controls at terminals 76(+) and 77(–) with 78 the shield.

NOTE

When EGCP-2 controls are installed with a distance of 1000 m or greater between them, additional measures should be taken to ensure solid communications. The wire gauge of the communications link should be upgraded to 0.5–0.8 mm² (18–20 AWG) where larger sizes are used for longer distances. The larger size wire will exhibit smaller voltage drop. If communications errors are observed, terminal 80 can be connected from control to control using 1.0 mm² (16 AWG) wiring. Making this connection will force all communications transceivers to the same reference.

As shown in Figure 3-25, the EGCP-2 uses Switch 4 (4-1, 4-2, and 4-3) to terminate the 485 network. Switches 4-1, 4-2, and 4-3 will be closed (pushed DOWN toward the PC board, see Figure 3-4) for proper 485 network terminations. Proper network termination will ensure robust inter-control communications.

The information on the RS-485 network is for communications between controls only and must not be interfaced in any way with external devices. There is an RS-422 port on the EGCP-2, which is used to monitor and control the units remotely.

Example:
2 EGCP-2s—Both EGCP-2s must have the 485 network terminated.
3 or more EGCP-2s—The end controls must have the 485 network terminated (see Figure 3-26).

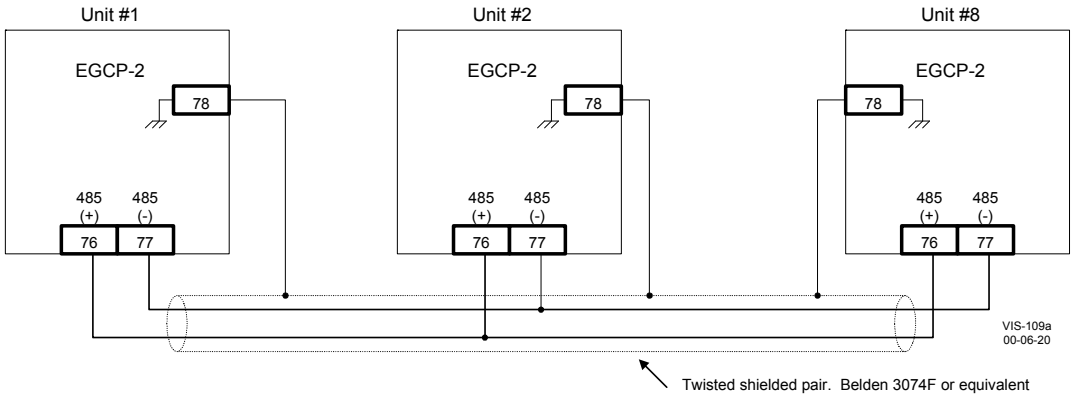


Figure 3-26. RS-485 Inter-Control Communications

Switch configuration for multiple units utilizing RS-485 communication.

Unit #1	Unit #2	Unit #8
SW4-1 Closed	SW4-1Open	SW4-1 Closed
SW4-2 Closed	SW4-2 Open	SW4-2 Closed
SW4-3 Closed	SW4-3 Open	SW4-3 Closed

NOTE
When unit 2 and/or unit 3 are more than 30 m from unit 1, the cable shield must be ac coupled to terminal 78. The capacitor must be 0.01 µF with a working voltage of 1000 Vdc or greater.

Alarms and Shutdowns

The EGCP-2 has many alarm/shutdown setpoints which can be configured for five different alarm/shutdown conditions. The five conditions are as follows:

Disabled
When an alarm setpoint is set for Disabled, the alarm condition will have no external indicators to signal the event has occurred. No control actions occur as a result of a disabled condition.

Warning
When an alarm setpoint is set for Warning, the alarm condition will cause the red LED on the face of the EGCP-2 to flash continuously until the alarm condition is acknowledged. No control actions occur as a result of a warning condition.

Visual Alarm
When an alarm setpoint is set for Visual Alarm, the alarm condition will cause the visual alarm output relay to energize, and the red LED on the face of the EGCP-2 to Flash. Both indicators will remain active until the alarm condition is acknowledged. No control actions occur as a result of a visual alarm condition.

Audible Alarm
When an alarm setpoint is set for Audible Alarm, the alarm condition will cause the audible and visual alarm output relays to energize and the red LED on the face of the EGCP-2 to flash. All alarm indicators will remain active until the alarm condition is acknowledged. No control actions occur as a result of an audible alarm condition.

Soft Shutdown
When an alarm setpoint is set for Soft Shutdown, the alarm condition will cause the generator to ramp off load, unless it is the only unit carrying the load in which case it will immediately open its gen breaker. If the unit has carried load above its cooldown limit, the unit will also cool down and then shut off. The audible, and visual alarm relays will energize at the time of the alarm condition, and the red LED on the face of the EGCP-2 will stay on continuously. Acknowledging the alarm condition will cause the alarms to reset, and make the unit operational once again.

Hard Shutdown
When an alarm setpoint is set for Hard Shutdown, the alarm condition will cause the generator to immediately open its breaker, and immediately shut off. The audible, and visual alarm relays will energize at the time of the alarm condition, and the red LED on the face of the EGCP-2 will stay on continuously. A unit which has experienced a hard shutdown condition will remove itself from any automatic sequencing displays. Acknowledging the alarm condition will cause the alarms to reset, and make the unit operational once again.

In addition to these standard shutdowns and alarms, there are five additional mains sensing parameters that can be programmed for Disabled, Warning, Loss of Mains, or Loss of Mains with Alarms. Disabled and Warning setpoints actions are identical to those described for other alarms, above.

Loss of Mains action will:
- Indicate a failed mains on the LCD Display (all modes)
- Issue a command to open the mains breaker or contactor (Auto mode only)
- Issue a command to start the engine(s) and put the generator(s) on load (Auto mode only)

Loss of Mains with Alarms action will do all of the actions assigned to the Loss of Mains condition, as well as activate the audible alarm function (audible and visual alarm outputs energize).

These parameters for loss of mains detection are as follows:

Load Surge
Senses a step kW load change (% of Rated Load Setpoint per Second) on generator. LOM indication is immediate (no delay) for this condition.

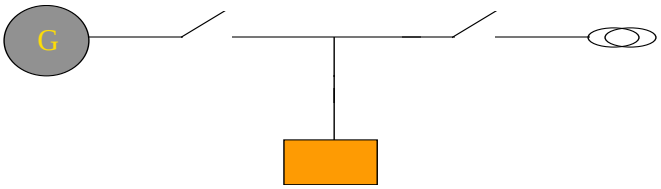
Mains Frequency Low
Detects Mains Under-frequency condition for at least as long as the LOM Action Delay setpoint (seconds).

Mains Frequency High
Detects Mains Over-frequency condition for at least as long as the LOM Action Delay setpoint (seconds).

Mains Voltage Low
Detects under-voltage on the mains for at least as long as the LOM Action Delay setpoint (seconds).

Mains Voltage High
Detects over-voltage on the mains for at least as long as the LOM Action Delay setpoint (seconds).

Chapter 4.
Operational Description:
Single No Parallel



The most basic mode of operation for the EGCP-2 is Single Unit No Parallel. In this configuration the generator will never parallel with the mains. All operations requiring the generator to be on load will take place with the mains breaker open. The operations which place the generator on load are either a Loss of Mains detection, or an Auto and Run With Load Switch Input. Since the generator will never operate in parallel with the mains, all transitions between mains and generator power to the load are done in an open transition fashion.

The key configuration points in the EGCP-2 software which need to be configured for Single Unit No Parallel operation are:

Configuration Menu:
- Number of Units: Single
- Operating Mode: No Parallel

Real Load Control Menu:
- Load Control Mode: Normal

Transfer Switch Menu:
- Check Mains Breaker: Enabled if standby; Disabled if prime power

If this is to be a standby power unit, which will close to the load on loss of mains, program the following setpoints as required by the system for reliable Loss of Mains Detection. Not all these setpoints have to be set for loss of mains detection, only those that pertain to detecting loss of mains for each particular application or system.

If this is to be a prime power unit, which operates without any mains input to the load, program either Mains Frequency Low Limit Alarm, or Mains Voltage Low Limit Alarm for Loss Of Mains. This allows the unit to start any time it is given an auto input.

Transfer Switch Menu:

Mains Under/Over Voltage Alarm: Loss of Mains
Mains Under/Over Freq. Alarm: Loss of Mains

NOTE

Loss of Mains may be substituted with Loss of Mains w/alarms if alarm indications during a loss of mains condition are desired.

Switch Input Actions: Single Unit No Parallel (Standby Unit)

Auto Switch

Enables LOM Detection.

Run with Load Switch

Starts Unit. Auto Switch must be closed for generator and mains breaker operation.

Test Switch

Starts Engine; no other action taken.

Process Switch

No effect on operation.

Auto and Run With Load

Starts Generator Set. Generator set will be put on load (open transition with mains).

Switch Input Actions: Single No Parallel Prime Power

Auto Switch

Will Start Unit and Closes Gen breaker to load.

Run With Load Switch

Starts Unit. Auto Switch must be closed for generator and mains breaker operation.

Test Switch

Starts Engine; no other action taken.

Process Switch

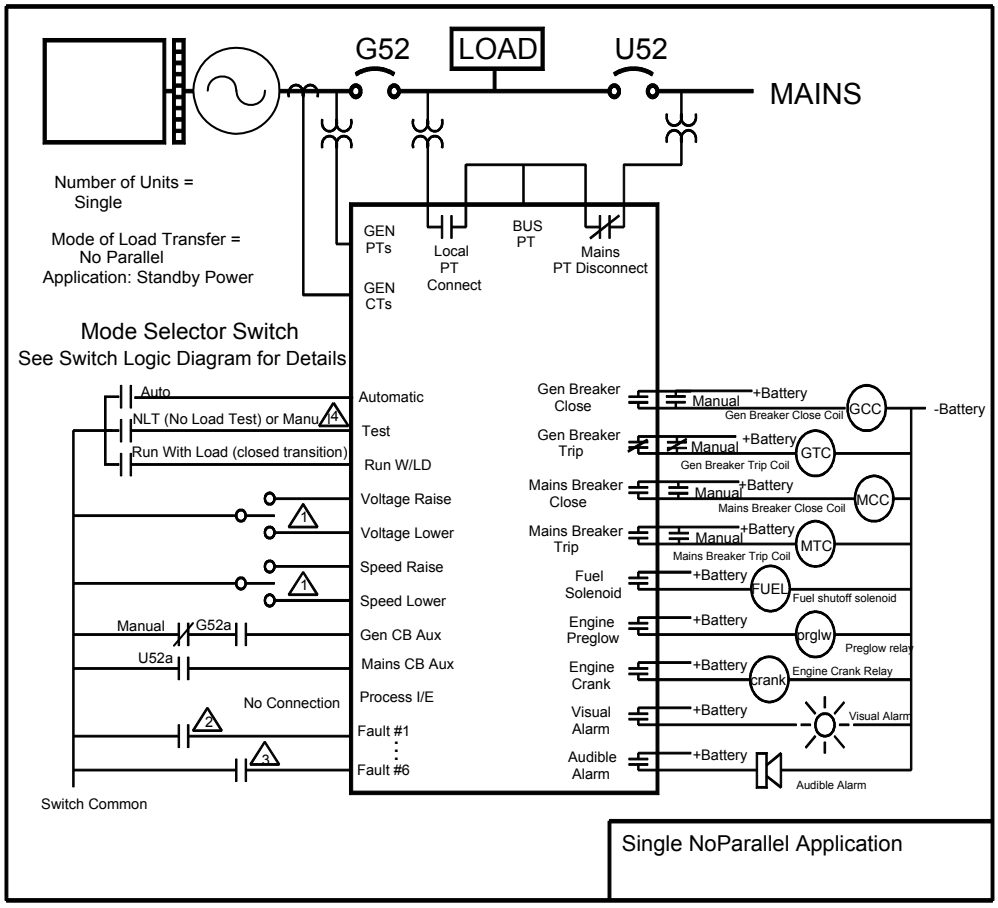
No effect in this mode.

The application overview section of the manual is intended for quick reference to basic wiring diagrams and operational concepts. Consult the Plant Wiring Diagram and Operational Description sections of the manual for more detail on the operating modes and wiring of the EGCP-2.

NOTE

These drawings show wiring for the breaker control options. See the plant wiring diagram in this manual for contactor wiring options.

These drawings are for reference only. Do not use for construction.



1. Only required if the speed and voltage need to be adjusted when Test or Manual is selected.
2. Use fault #1 or #2 input if using a seperate device to sense Low Oil Pressure or High Water Temp. These Fault Inputs have 15 second delay timers on them after the engine reaches crank cutoutt speed.
3. Faults #3 through #6 activate immediately, with programmable delays.
4. Manual mode requires manual mains and generator breaker operation. Manual mode will operate in KW and Voltage Droop.

Figure 4-1. Single No Parallel Application

Switch Based Logic
(Single—No Parallel)

TEST	RUN w/ LOAD	AUTO	PROCESS	UTILITY POWER	
			X	X	OFF
1	X		X	X	STARTS ENGINE *
X	1		X	X	STARTS ENGINE *
X	1	1	X	X	OPENS TB / STARTS ENGINE / CLOSES GB / CONTROLS IN ISOCH
X	X	1	X	⌝⌞	OPENS TB / STARTS ENGINE / CLOSES GB / CONTROLS IN ISOCH
X	X	1	X	⌟⌜	OPENS GB / CLOSES TB / SHUTS DOWN ENGINE

*** = When generator breaker is closed manually, unit will operate in Droop mode.**
1 = Contact closed (Utility Power Stable)
X = Contact open or closed (Utility Power Failed or Stable)
TB = Utility Tie Breaker
GB = Generator Breaker
⌝⌞ = Transition from Utility Stable to Utility Failed
⌟⌜ = Transition from Utility Failed to Utility Stable

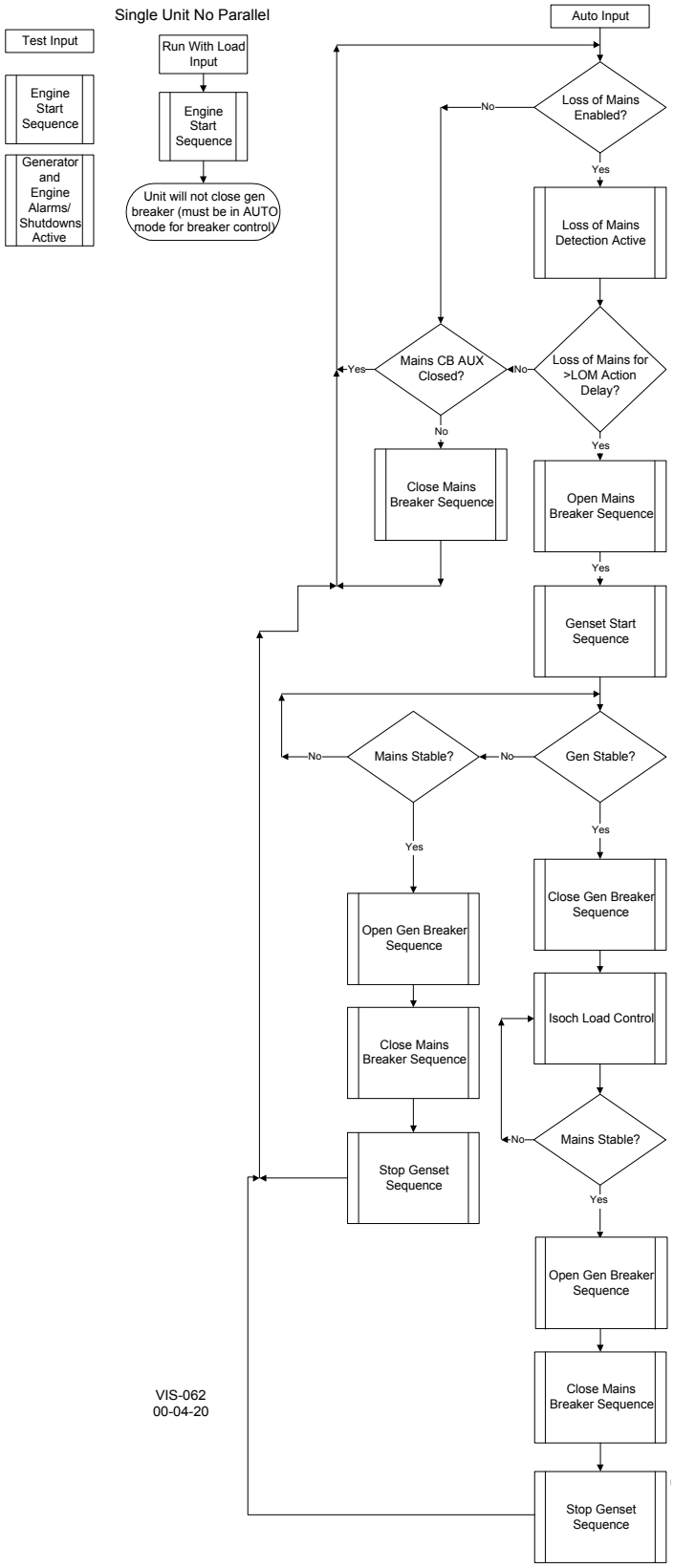


Figure 4-2a. Single No Parallel Overview Flow Diagram

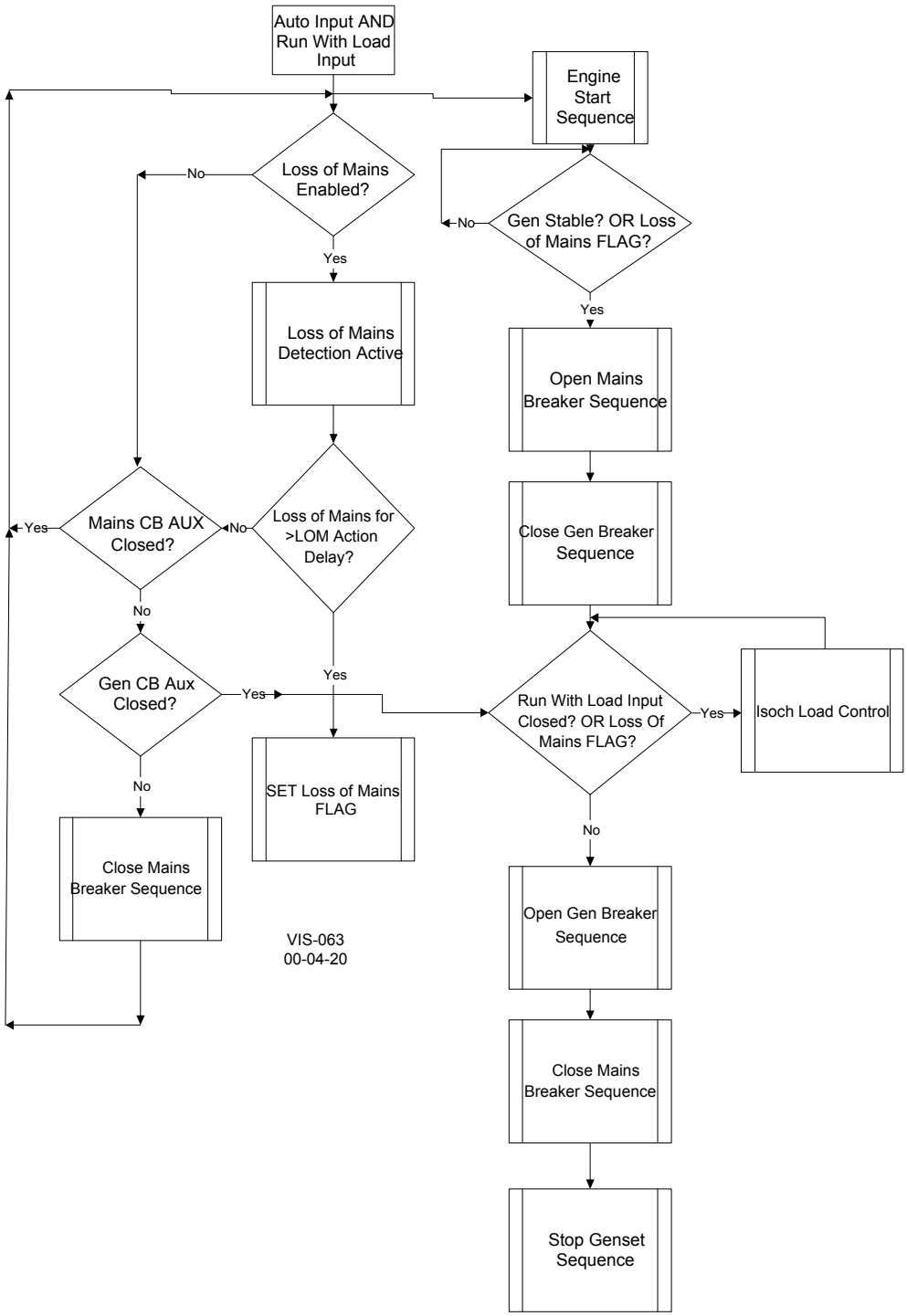
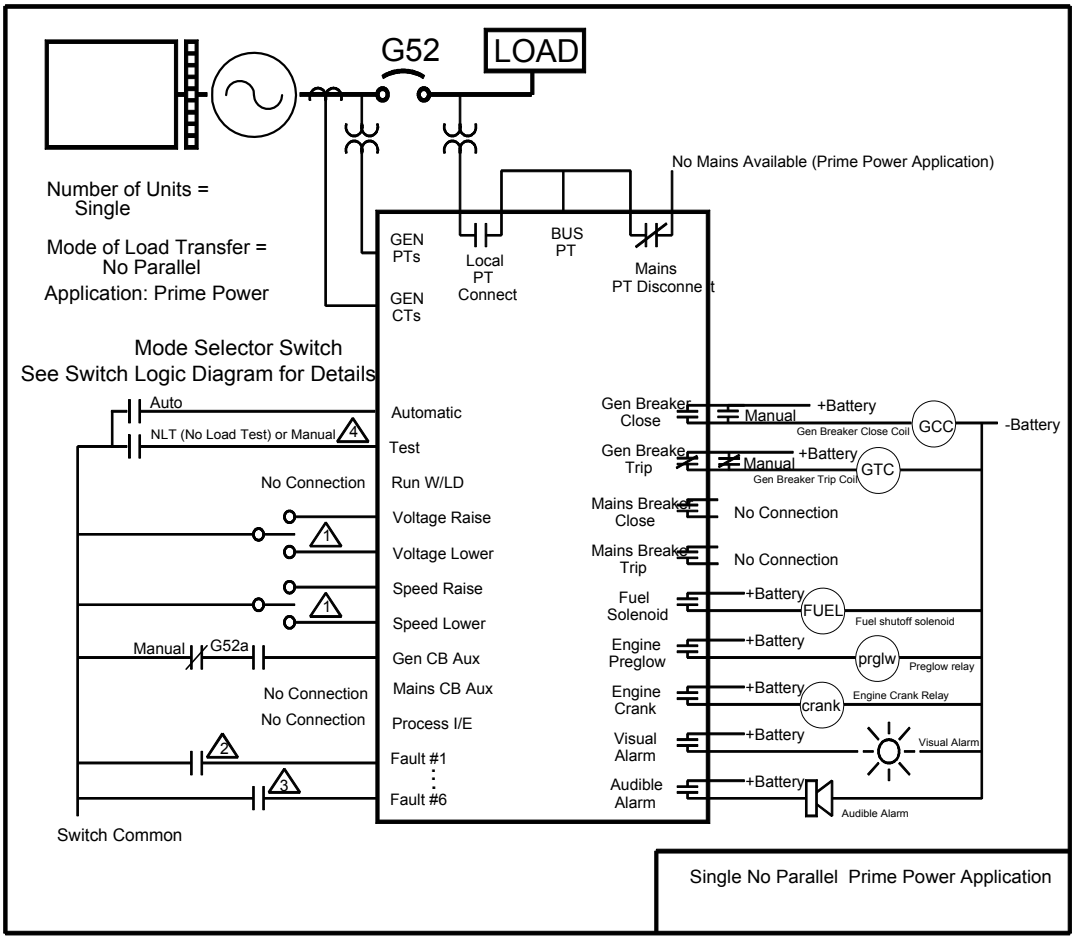


Figure 4-2b. Single No Parallel Overview Flow Diagram



1 Only required if the speed and voltage need to be adjusted when Test or Manual is selected.

2 Use fault #1 or #2 input if using a seperate device to sense Low Oil Pressure or High Water Temp. These Fault Inputs have 15 second delay timers on them after the engine reaches crank cutoutt speed.

3 Faults #3 through #6 activate immediately, with programmable delays.

4 Manual mode requires manual generator breaker operation. Manual mode will operate in KW and Voltage Droop.

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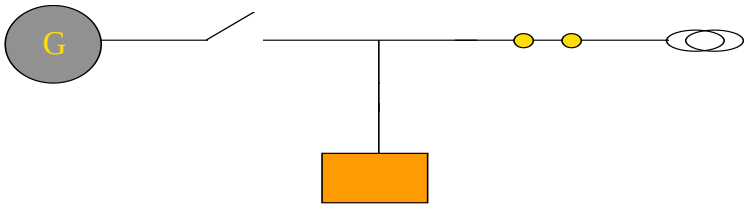
Figure 4-3. Single No Parallel Prime Power

Chapter 5.
Operational Description:
Single Unit Parallel



Single Unit Parallel operation of the EGCP-2 control enables the control's ability to synchronize and close to the mains. When paralleling to the mains, the EGCP-2 will operate in either a base load (constant generator KW), or process control modes, depending on which switch inputs are received at the control. The EGCP-2 will also operate in a Power Factor or VAR control mode while in parallel with the Mains if the VAR/PF control setpoint in the Reactive Load Control tuning menu is set for either PF control or KVAR control.

The EGCP-2 may also be configured for soft transfer operation. Soft Transfer operation is enabled in the configuration menu item labeled "Load Control Mode". Setting this item to "soft transfer" will enable the soft transfer capability of the control. Soft transfer refers to an operating mode in which the generator assumes load (either base load or process), and upon reaching a specific base load or process reference point, issues a command to open the mains breaker. This effectively transfers load from the mains to the generator in a smooth fashion.

The key configuration points in the EGCP-2 software which need to be configured for Single Unit Parallel operation are:

Configuration Menu:

Number of Units:	Single
Operating Mode:	Mains Parallel

Real Load Control Menu:

Load Control Mode:	Normal or Soft Transfer (depending on application)

Transfer Switch Menu:

Check Mains Breaker:	Enabled

If this is to be a standby power unit, which will close to the load on loss of mains, program the following setpoints as required by the system for reliable Loss of Mains Detection. Not all these setpoints have to be set for loss of mains detection, only those that pertain to detecting loss of mains for each particular application or system.

Transfer Switch Menu:

Mains Under/Over Voltage Alarm:	Loss of Mains
Mains Under/Over Freq. Alarm:	Loss of Mains
Load Surge:	Loss of Mains*

NOTE

Loss of Mains may be substituted with Loss of Mains w/alarms if alarm indications during a loss of mains condition are desired.

*Loss of Mains action is instant, and does not use the loss of mains action delay. All other Loss of Mains detection setpoints use the Loss of Mains action delay time before activating the generator set start sequence.

Loss of mains action for a single parallel unit is identical to the single no parallel application. Upon sensing a loss of mains for the loss of mains action delay period, the EGCP-2 will open the mains breaker, start the generator set, wait for the gen stable time, and close the generator onto the dead bus, providing the load with power.

Being a single unit parallel application, upon sensing return of the mains, and mains stable for the mains stable delay, the EGCP-2 will synchronize the generator set with the mains. After synchronizing to the mains, the EGCP-2 will parallel the generator with the mains, and softly unload the generator. Upon reaching the generator Unload Trip Point, the EGCP-2 will issue a generator breaker open command. This sequence softly transfers load from the generator back to the Mains. After the generator is unloaded, and its breaker is opened, it will shut down. There may be a cooldown period prior to shut down if the generator set has run at loads which exceed the Cooldown Limit KVA value.

Switch Input Actions: Single Unit Parallel

Auto Switch

Enables LOM Detection.

Run With Load Switch

Starts Unit. Auto Switch must be closed for breaker operation.

Test Switch

When individually selected
Starts Engine; no other action.

Process Switch

When individually selected
No action.

Auto and Run/Ld

Synchronizes and Base Loads Unit with LOM detection enabled.

Auto and Run/Ld and Process

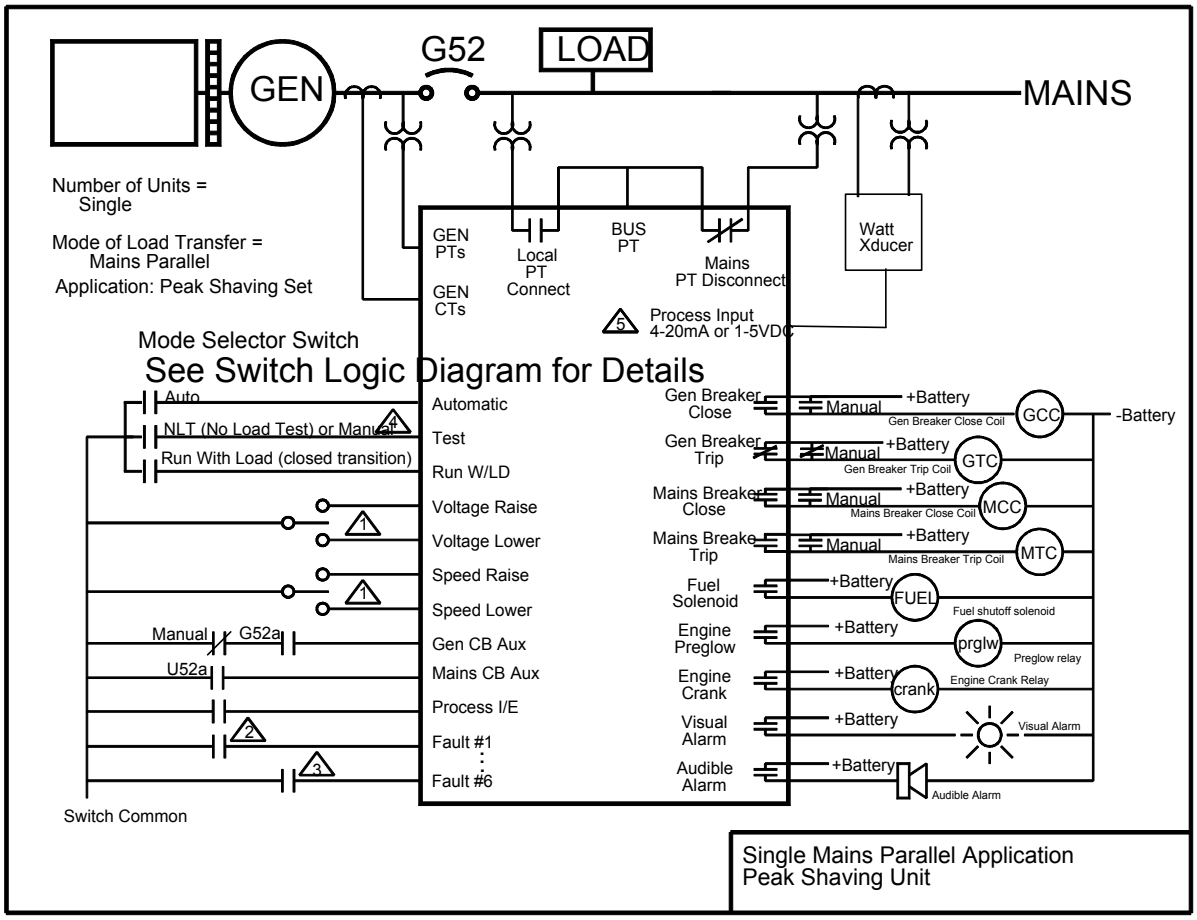
Synchronizes and Ramps to Process Control with LOM detection enabled.

Auto and Run with Load and Test

Synchronizes and Ramps to Base Load.
If "Load Control Mode" is set for Soft Transfer in configuration menu, unit will open mains breaker when base load reference is reached.

Auto and Run/Ld and Process and Test

Synchronizes and Ramps to Process Control.
Will open mains upon reaching Process Reference if software "Load Control Mode" in configuration menu is set for Soft Transfer.



1 Only required if the speed and voltage need to be adjusted when Test or Manual is selected.

2 Use fault #1 or #2 input if using a seperate device to sense Low Oil Pressure or High Water Temp. These Fault Inputs have 15 second delay timers on them after the engine reaches crank cutoutt speed.

3 Faults #3 through #6 activate immediately, with programmable delays.

4 Manual mode requires manual mains and generator breaker operation. Manual mode will operate in KW and Voltage Droop.

5 Transducer input not required if Process Control Mode is Not used.

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Figure 5-1. Single Unit Parallel Application

Switch Based Logic
(Single—Parallel)

TEST	RUN /w LOAD	AUTO	PROCESS	UTILITY POWER	
			X	X	OFF
1	X		X	X	STARTS ENGINE *
X	1		X	X	STARTS ENGINE *
		1	X	1	READY TO START ENGINE UPON LOSS OF UTILITY POWER
X	1	1		1	STARTS ENGINE / SYNCHRONIZES TO UTILITY / CONTROLS IN BASELOAD
X	1	1	1	1	STARTS ENGINE / SYNCHRONIZES TO UTILITY / CONTROLS IN PROCESS
1	1	1		1	STARTS ENGINE / SYNCHS TO UTILITY / RAMPS TO BASELOAD / OPENS TB #
1	1	1	1	1	STARTS ENGINE / SYNCHS TO UTILITY / RAMPS TO PROCESS / OPENS TB #
		1	X	⌜	OPENS TB / STARTS ENGINE / CLOSES GB / CONTROLS IN ISOCH
		1	X	⌟	SYNCS TO UTILITY / OPENS GB / SHUTS DOWN ENGINE

*** = When generator breaker is closed manually, unit will operate in Droop mode.**
 # = Soft Transfer Setting must be "Enabled"
1 = Contact closed (Utility Power Stable)
X = Contact open or closed (Utility Power Failed or Stable)
TB = Utility Tie Breaker
GB = Generator Breaker
⌜ = Transition from Utility Stable to Utility Failed
⌟ = Transition from Utility Failed to Utility Stable

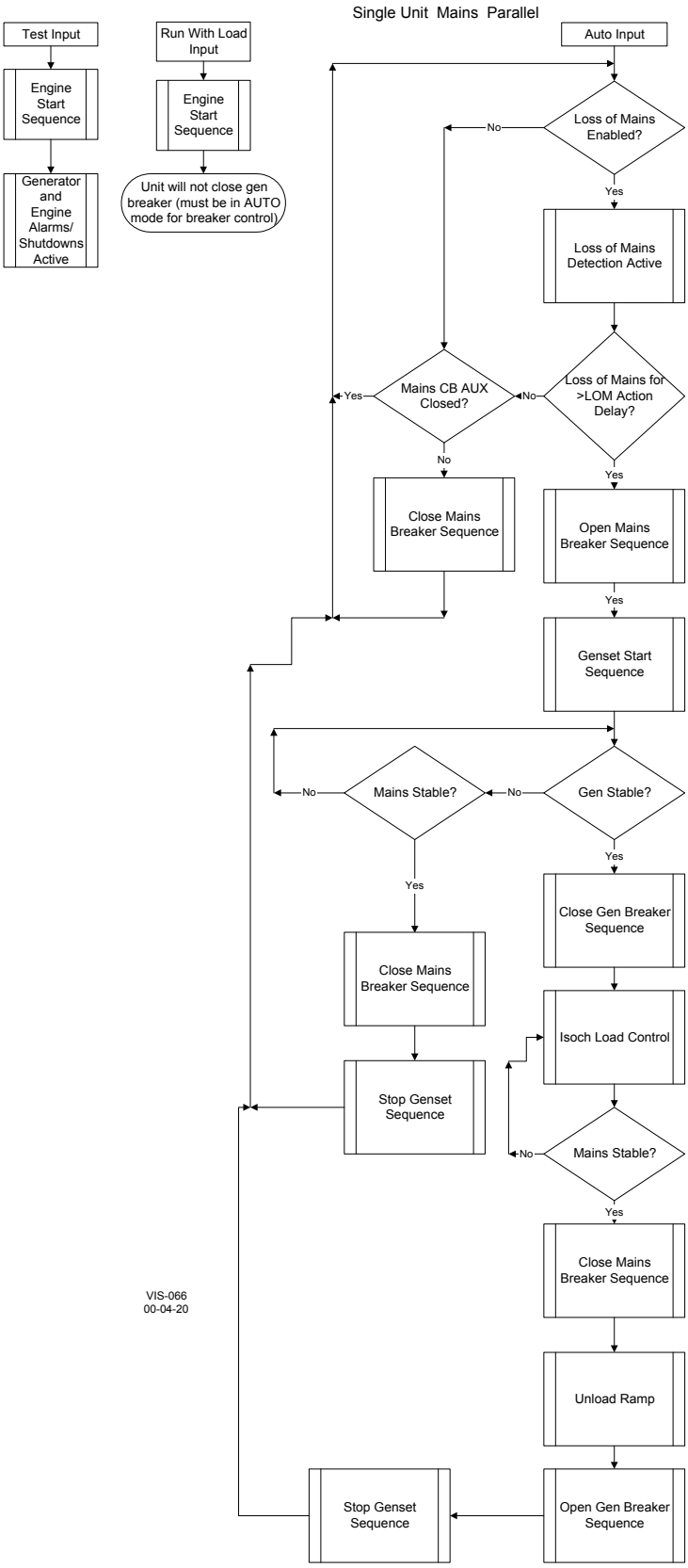


Figure 5-2a. Single Unit Parallel Overview Flow Diagram

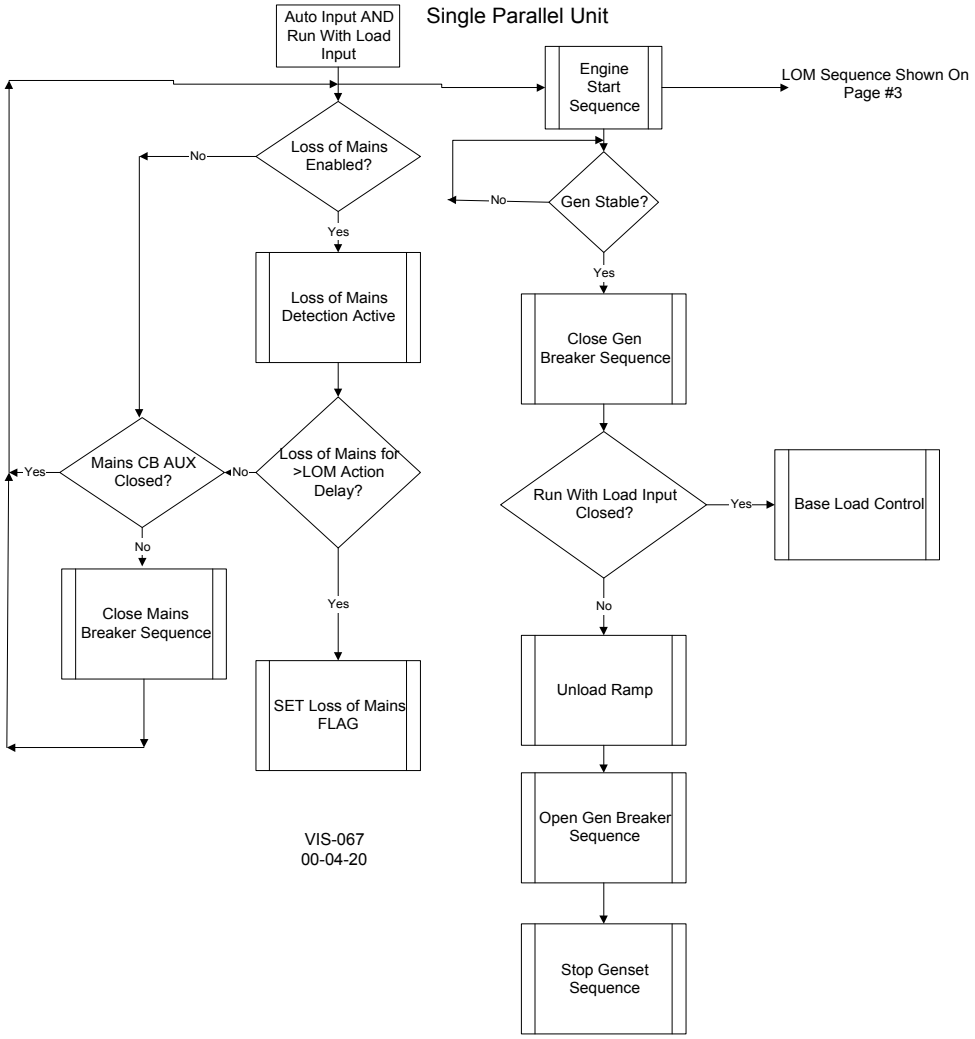


Figure 5-2b. Single Unit Parallel Overview Flow Diagram

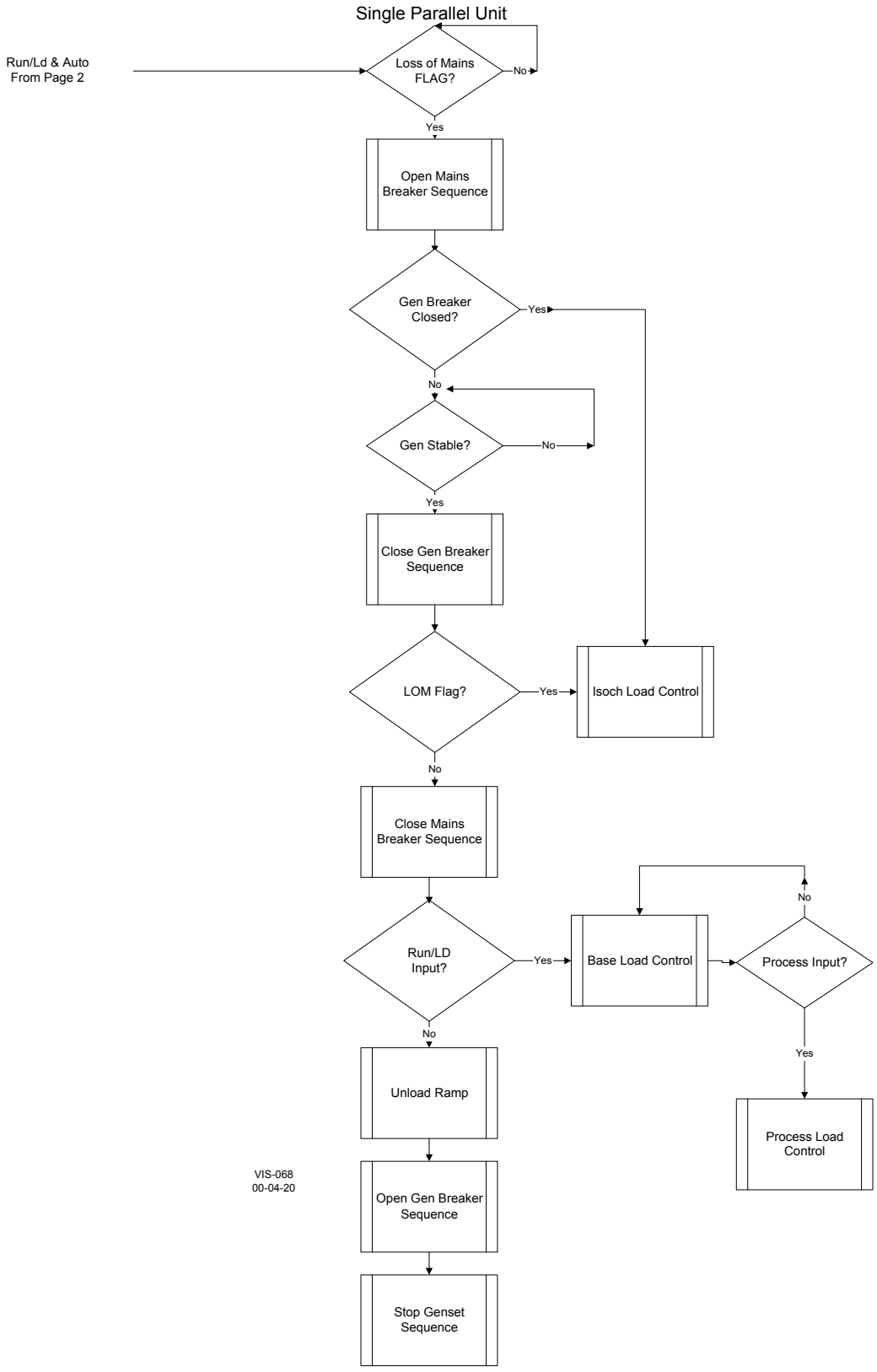
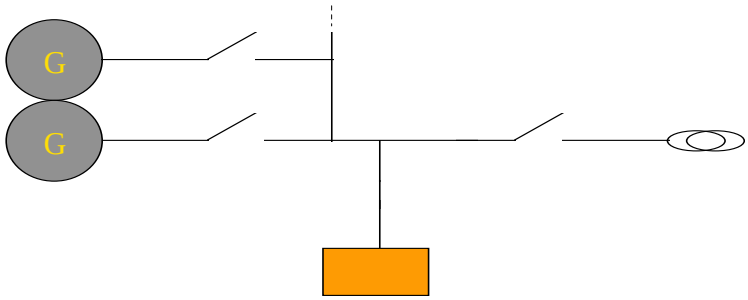


Figure 5-2c. Single Unit Parallel Overview Flow Diagram

Chapter 6.
Operating Mode:
Multiple No Parallel



Multiple no parallel operation combines the generating capacity of multiple units to supply an isolated load. All operations of the generators on load in a multiple no parallel system are accomplished isolated from the mains.

In a multiple unit system the EGCP-2 control operates in a Master/Slave type configuration. The master role is determined over the inter-control RS-485 network by the unit in Auto mode with the highest network priority (lowest numerical value). All other units on the same network, and in Auto mode are considered slave units, and follow the master commands for starting, and stopping.

The Sequencing Status Screen can be viewed on any unit in auto to determine the master control on the network.

The key configuration points in the EGCP-2 software which need to be configured for Multiple Unit No Parallel operation are:

Configuration Menu:

Number of Units:	Multiple
Operating Mode:	No Parallel

Real Load Control Menu:

Load Control Mode:	Normal

Transfer Switch Menu:
Check Mains Breaker:

Enabled at units receiving Mains Breaker Aux. hard wired input in standby.
Disabled if prime power application (there is no mains breaker to monitor).

IMPORTANT

When operating as standby units there must be at least one unit on the network and in Auto with the mains breaker aux input wired, and the Check Mains Breaker setpoint Enabled at any given time.

If these are to be standby power units, which will close to the load on loss of mains, program the following setpoints as required by the system for reliable Loss of Mains Detection. Not all these setpoints have to be set for loss of mains detection, only those that pertain to detecting loss of mains for each particular application or system.

If these are to be a prime power units, which operate without any mains input to the load, program all units in the system for either Mains Frequency Low Limit Alarm, or Mains Voltage Low Limit Alarm for Loss Of Mains. This allows each unit to start any time it is given an auto input.

In a multiple no parallel system automatic sequencing will be effective between all units in the auto mode with the "Automatic Sequencing" setpoint in the configuration menu set for "enabled". If this setpoint is set for disabled, that unit will not be a part of the auto sequencing scheme.

Transfer Switch Menu:

Mains Under/Over Voltage Alarm: Loss of Mains
Mains Under/Over Freq. Alarm: Loss of Mains

NOTE

Loss of Mains may be substituted with Loss of Mains w/alarms if alarm indications during a loss of mains condition are desired.

Switch Input Actions: Multiple No Parallel

Auto Switch

Enables LOM detection.
Enables Automatic Sequencing.
Enables Dead Bus Closing.

Run with Load Switch

Starts Unit, but without Auto switch unit cannot close to dead bus.

Process Switch

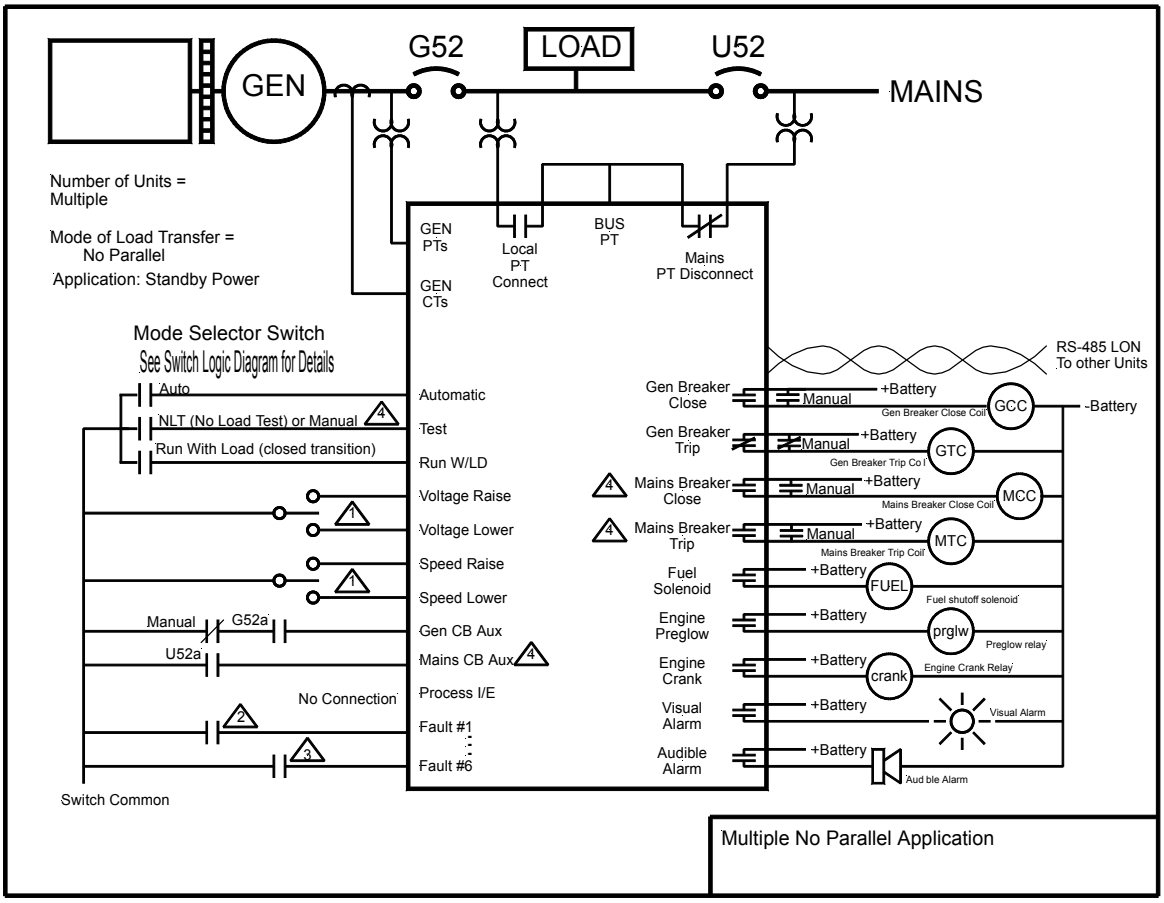
When individually selected
No effect in this mode.

Test Switch

When individually selected
Starts Engine; no further action.

Auto and Run with Load

Isolates Mains.
Loads Generators which are operating in Auto Mode (Enables Dead Bus Closing).
Removal of Run with Load input causes open transition back to mains (so long as mains are in spec).



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1. Only required if the speed and voltage need to be adjusted when Test or Manual is selected.
2. Use fault #1 or #2 input if using a seperate device to sense Low Oil Pressure or High Water Temp. These Fault Inputs have 15 second delay timers on them after the engine reaches crank cutoutt speed.
3. Faults #3 through #6 activate immediately, with programmable delays.
4. Manual mode requires manual mains and generator breaker operation. Manual mode will operate in KW and Voltage Droop.
4. Only required if "Check Mains Breaker" setpoint is Enabled. Any unit which may operate as the master must have these inputs.

Figure 6-1. Multiple Unit No Parallel Application

Switch Based Logic
(Multiple—No Parallel, Master Control's Action)

TEST	RUN /w LOAD	AUTO	PROCESS	UTILITY POWER	
			X	X	OFF
1	X		X	X	STARTS MASTER ENGINE *
X	1		X	X	STARTS MASTER ENGINE *
		1	X	1	READY TO START ALL ENGINES UPON LOSS OF UTILITY POWER
X	1	1	X	1	OPENS TB / STARTS ALL ENGINES / CLOSES GB / CONTROLS IN ISOCH #
		1	X	⌜	OPENS TB / STARTS ALL ENGINES / CLOSES GB / CONTROLS IN ISOCH #
		1	X	⌟	OPENS ALL UNIT GBs / CLOSES TB / SHUTS DOWN ALL UNITS

*** = When generator breaker is closed manually, unit will operate in Droop mode.**
 # = Depending on plant load, slave units will be sequenced on or off the plant bus.
1 = Contact closed (Utility Power OK)
X = Contact open or closed (Utility Power Failed or OK)
TB = Utility Tie Breaker
GB = Generator Breaker
⌜ = Transition from Utility Stable to Utility Failed
⌟ = Transition from Utility Failed to Utility Stable

Switch Based Logic
(Multiple—No Parallel, Slave Control's Action)

TEST	RUN /w LOAD	AUTO	PROCESS	
			X	OFF
1	X		X	STARTS ENGINE *
X	1		X	STARTS ENGINE *
		1	X	FOLLOWS ALL MASTER'S COMMANDS

*** = When generator breaker is closed manually, unit will operate in Droop mode**
1 = Contact closed
X = Contact open or closed

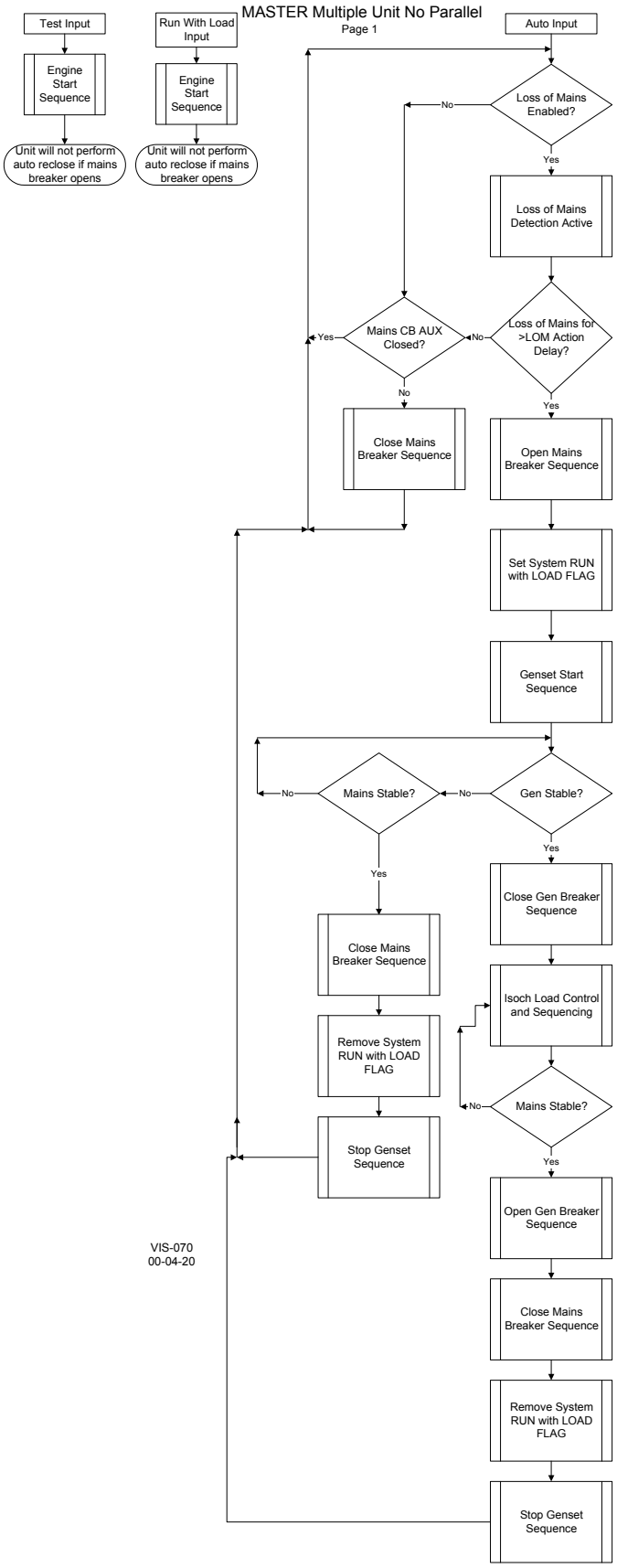


Figure 6-2a. Master Multiple Unit No Parallel Overview Flow Diagram

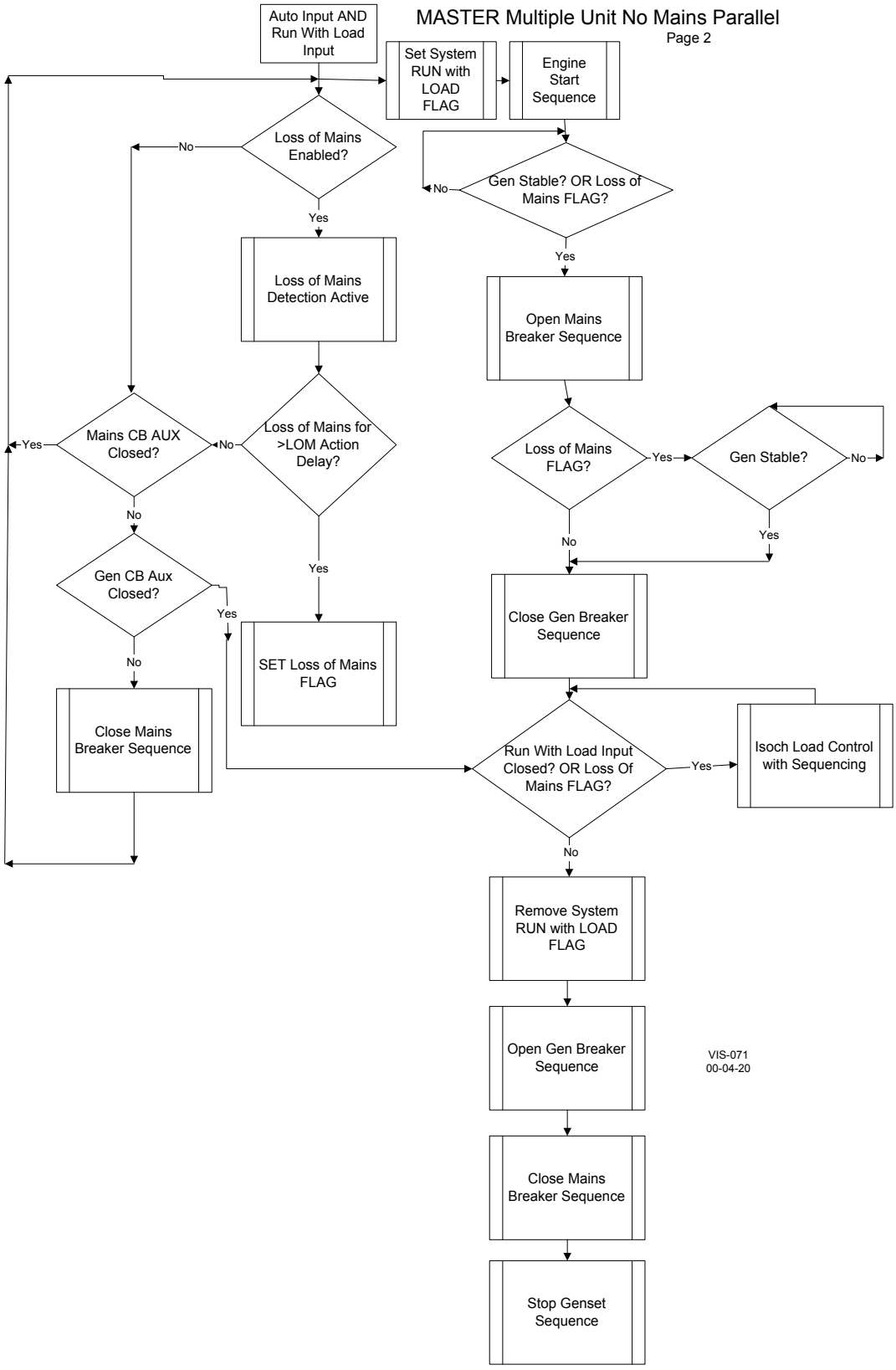


Figure 6-2b. Master Multiple Unit No Parallel Overview Flow Diagram

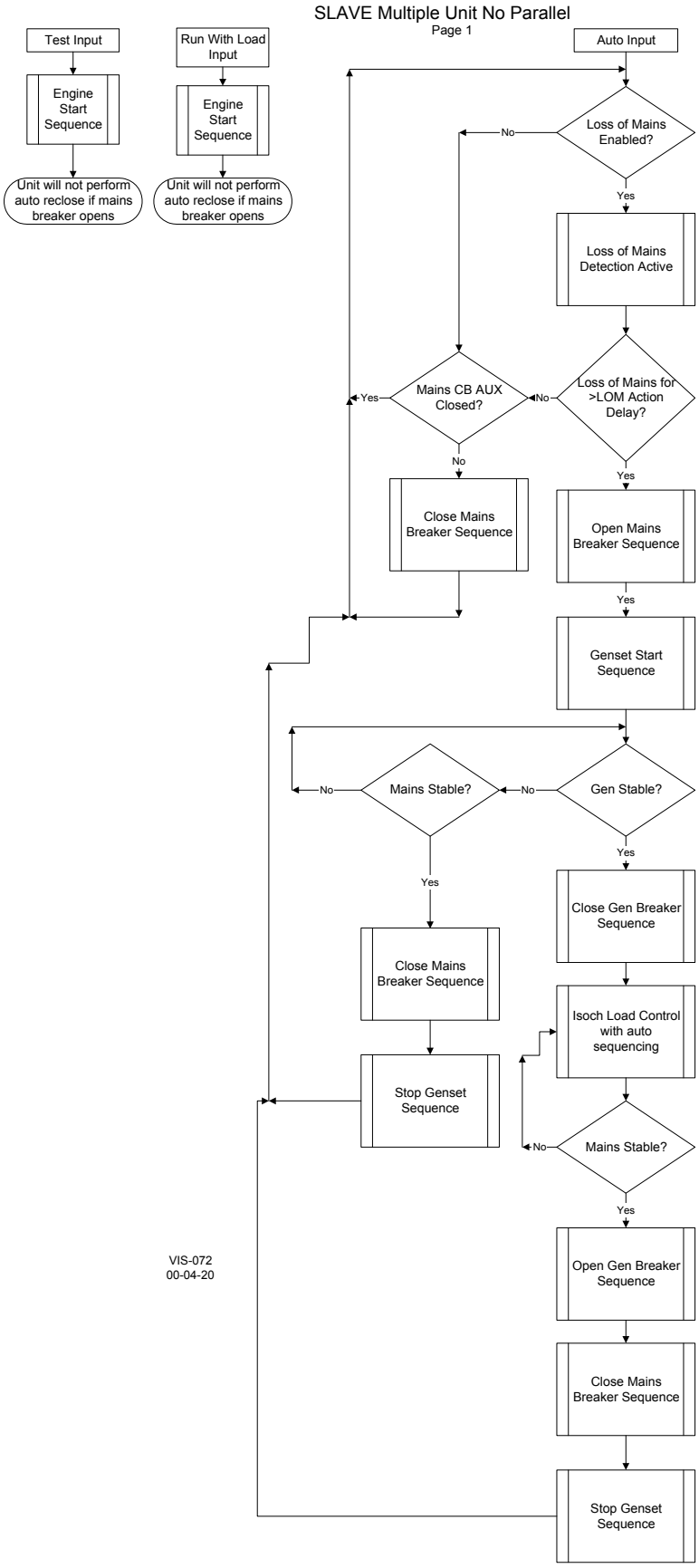


Figure 6-3a. Slave Multiple Unit No Parallel Overview Flow Diagram

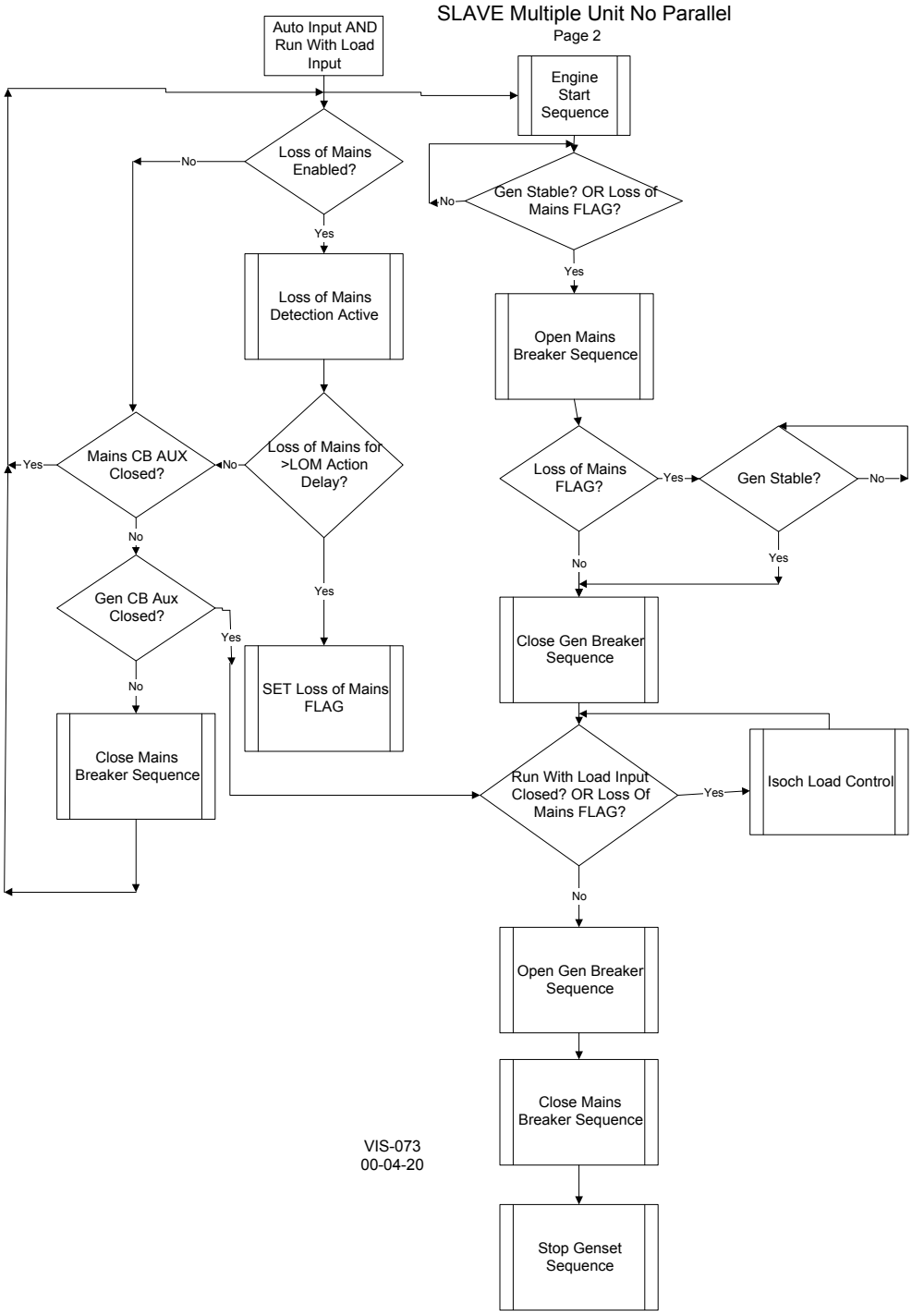


Figure 6-3b. Slave Multiple Unit No Parallel Overview Flow Diagram

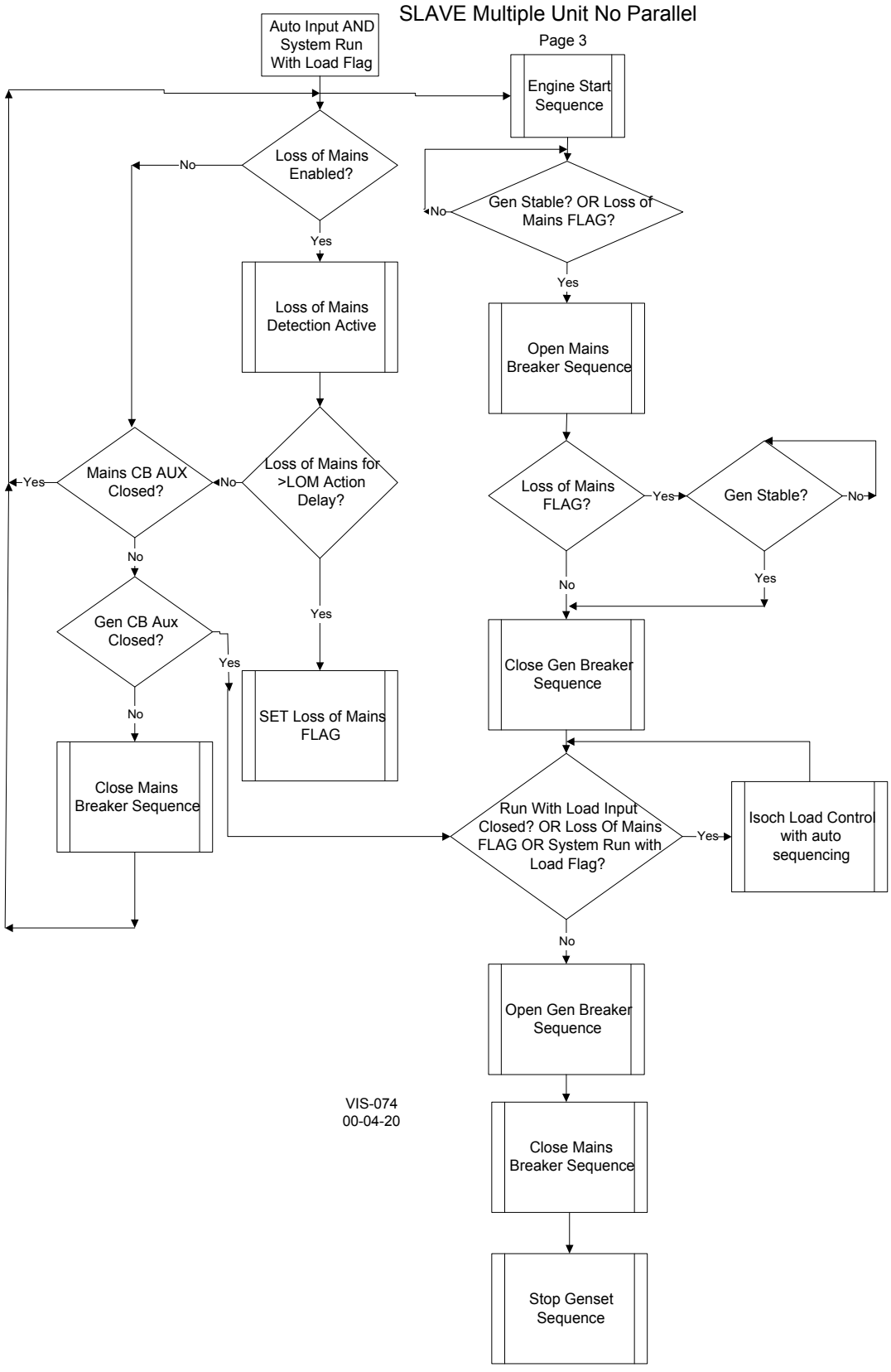
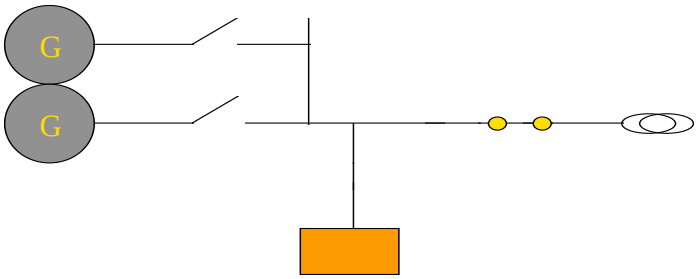


Figure 6-3c. Slave Multiple Unit No Parallel Overview Flow Diagram

Chapter 7.
Operating Mode:
Multiple Parallel



The Multiple Parallel operating mode of the EGCP-2 is the most complex. In this mode, multiple generator sets have the capability to operate as: Standby Units upon loss of mains detection; Peak Shaving Units; Load Demand Reduction Units, and Soft Transfer Units. Since the operating mode implies mains parallel, the generators are allowed to synchronize with the mains under various operating conditions such as: Loss of Mains re-transfer to the mains, Base Load Control, Process Control, Soft Transfer return to Mains (softly unloads generators and restores mains power feed to the load), Soft Transfer from the Mains to the generators (softly loads the generators against the mains before opening the mains breaker).

In a multiple parallel system, automatic sequencing will be effective between all units in the auto mode with the “Automatic Sequencing” setpoint in the configuration menu set for “enabled”. If this setpoint is set for disabled, that unit will not be a part of the auto sequencing scheme.

The key configuration points in the EGCP-2 software which need to be configured Multiple Unit Parallel operation are:

Configuration Menu:

Number of Units:	Multiple
Operating Mode:	Parallel

Real Load Control Menu:

Load Control Mode:	Normal or Soft Transfer (depending on application)

Transfer Switch Menu:
Check Mains Breaker:

Enabled at units receiving the Mains Breaker Aux . hard wired input.
Disabled in units not receiving the Mains Breaker Aux. hard wire input.

IMPORTANT

There must be at least one unit on the network and in Auto with the mains breaker aux hard wired input, and configured for "Check Mains Breaker" setpoint "enabled" at any given time.

If these are to be standby power units, which will close to the load on loss of mains, program the following setpoints as required by the system for reliable Loss of Mains Detection. Not all these setpoints have to be set for loss of mains detection, only those that pertain to detecting loss of mains for each particular application or system.

Transfer Switch Menu:

Mains Under/Over Voltage Alarm: Loss of Mains
Mains Under/Over Freq. Alarm: Loss of Mains

NOTE

Loss of Mains may be substituted with Loss of Mains w/alarms if alarm indications during a loss of mains condition are desired.

Switch Input Actions: Multiple Parallel

Auto
Enables LOM Detection and Dead Bus Closing.
Enables Auto Sequencing.

Run With Load

StartsUnit. Auto Switch must be closed for breaker operation.

Process

When individually selected
No action as a single input.

Test

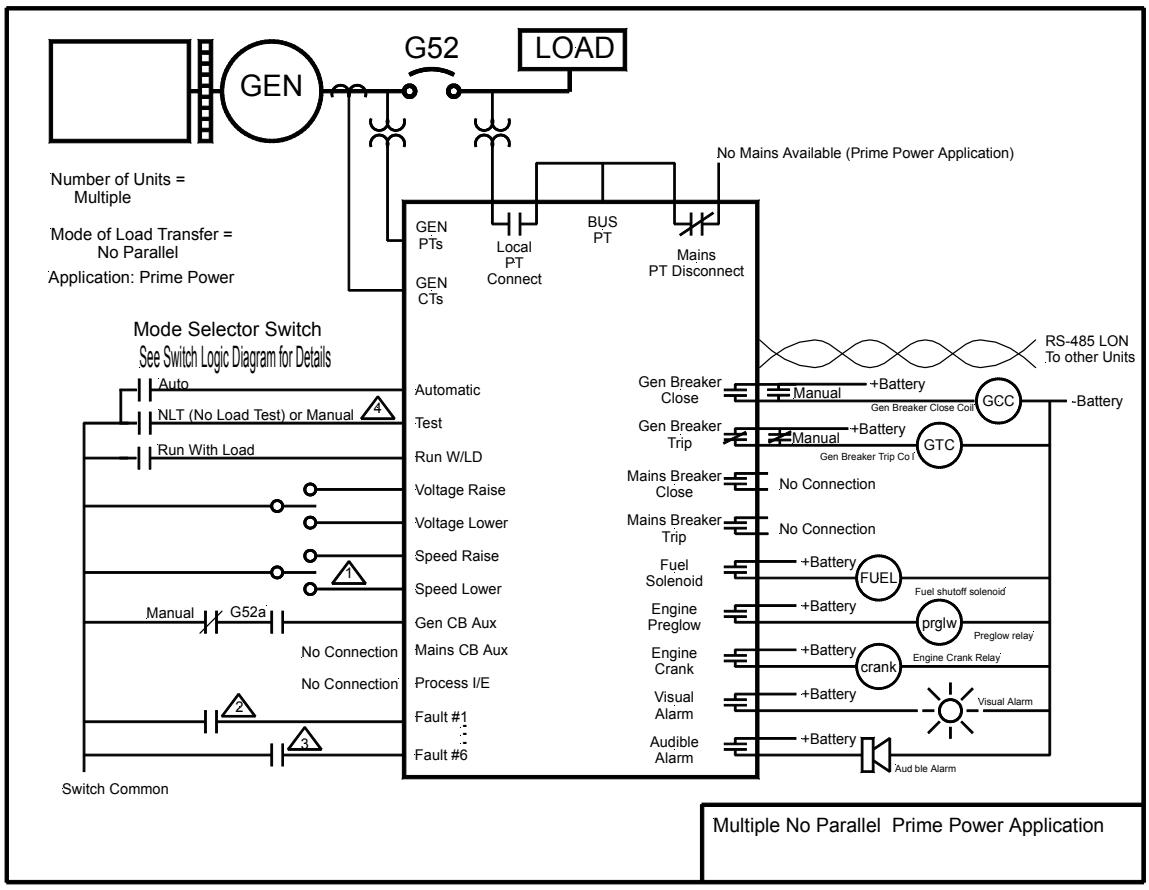
When individually selected
Starts Engine.

Auto and Run With Load and Test (Base load Soft Transfer Mode Selected)

Starts all Units in Auto Mode.
Units synchronize and parallel with Mains.
Units Ramp to Base Load control Reference.
Upon reaching Base Load Reference, Master opens Mains Breaker.
Removing Run with Load input softly transfers load back to mains.

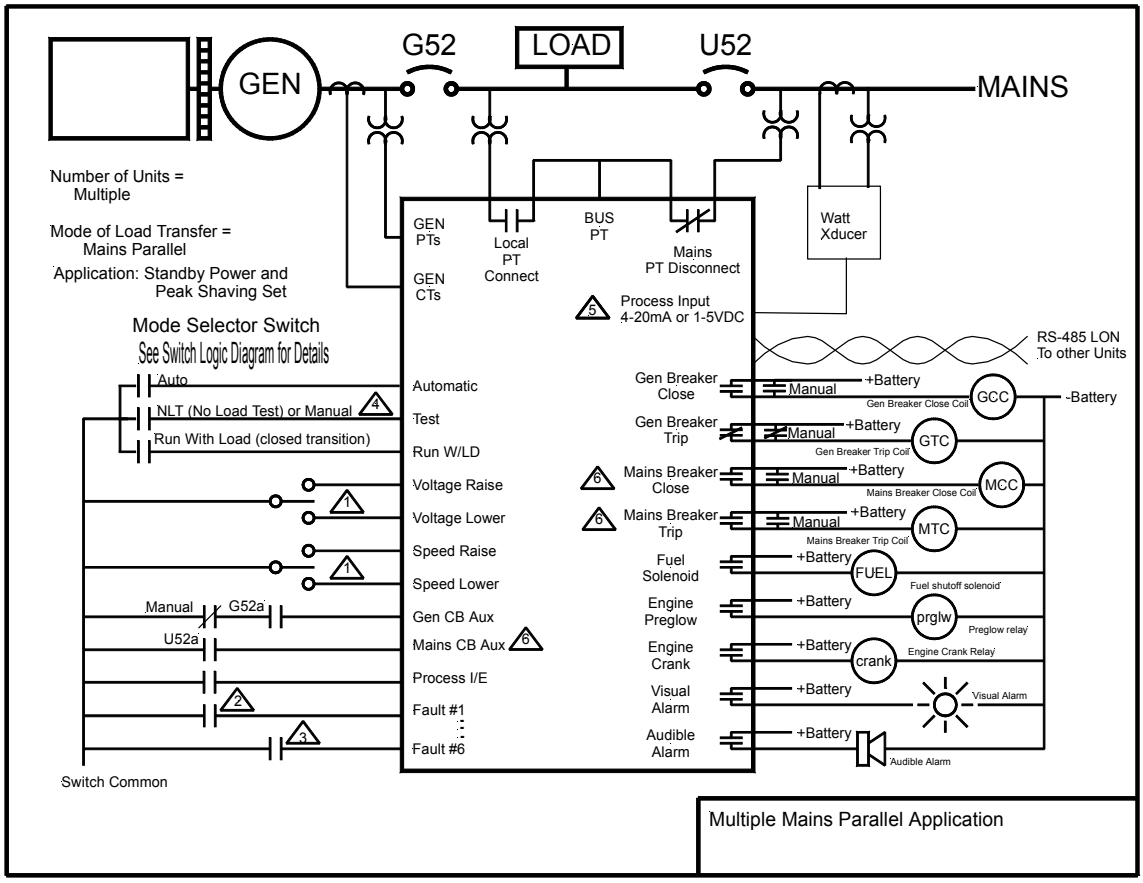
Auto and Run With Load and Process and Test (Process Soft Transfer Mode Selected)

Starts all Units in Auto Mode.
Units synchronize and parallel with Mains.
Units Ramp to Process control Reference.
Upon reaching Process Reference, Master opens Mains Breaker.
Removing Run with Load input softly transfers load back to mains.



1. Only required if the speed and voltage need to be adjusted when Test or Manual is selected.
2. Use fault #1 or #2 input if using a seperate device to sense Low Oil Pressure or High Water Temp. These Fault Inputs have 15 second delay timers on them after the engine reaches crank cutoutt speed.
3. Faults #3 through #6 activate immediately, with programmable delays.
4. Manual mode requires manual generator breaker operation. Manual mode will operate in KW and Voltage Droop.

Figure 7-1. Multiple Unit No Parallel Prime Power Application



1. Only required if the speed and voltage need to be adjusted when Test or Manual is selected.
2. Use fault #1 or #2 input if using a seperate device to sense Low Oil Pressure or High Water Temp. These Fault Inputs have 15 second delay timers on them after the engine reaches crank cutoutt speed.
3. Faults #3 through #6 activate immediately, with programmable delays.
4. Manual mode requires manual mains and generator breaker operation. Manual mode will operate in KW and Voltage Droop.
5. Transducer input not required if Process Control Mode is Not used.
6. Only required if "Check Mains Breaker" setpoint is Enabled. Any unit which may operate as the master must have these inputs.

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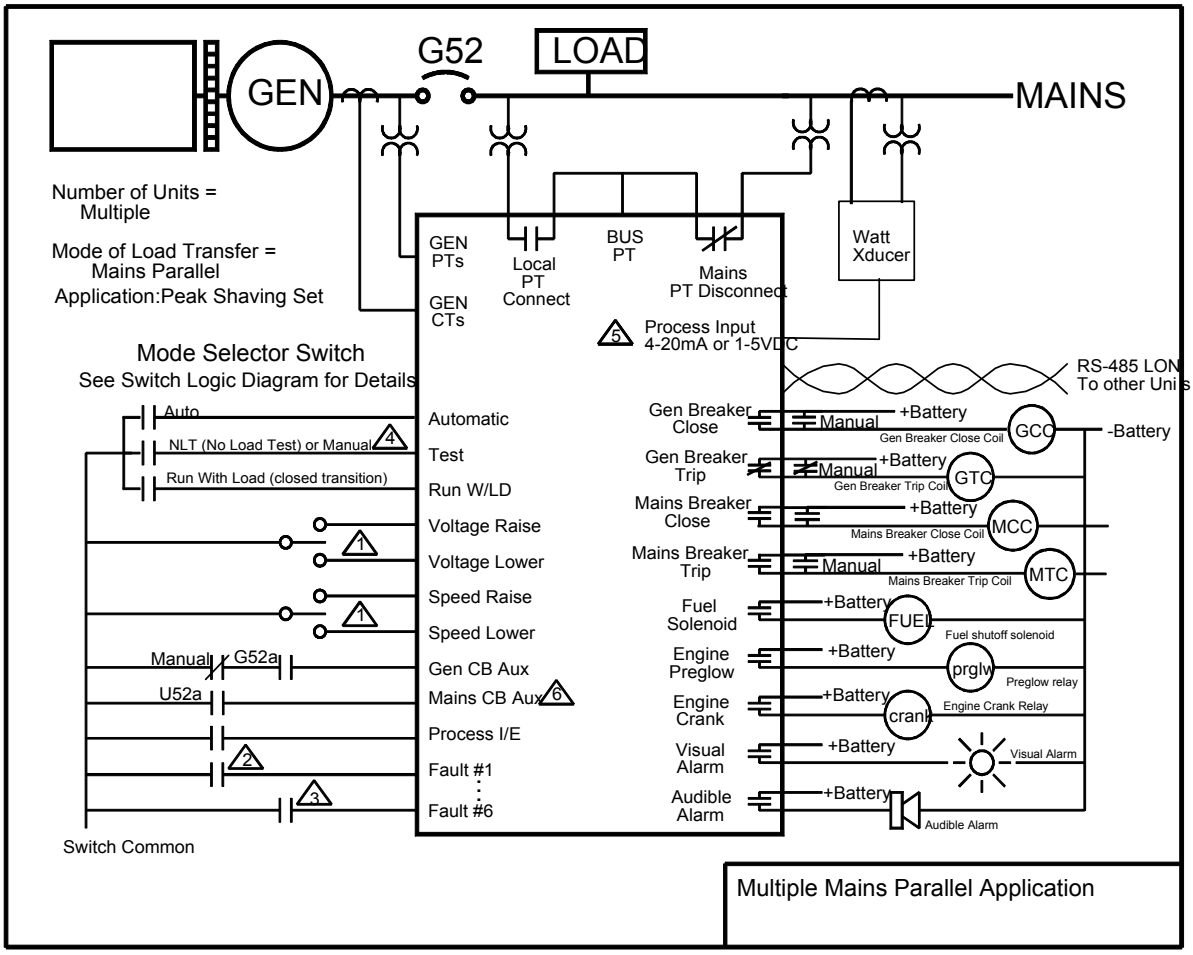
Figure 7-2. Multiple Unit Parallel Standby Power Application



1 Only required if the speed and voltage need to be adjusted when Test or Manual is selected.

2 Use fault #1 or #2 input if using a seperate device to sense Low Oil Pressure or High Water Temp. These Fault Inputs have 15 second delay timers on them after he engine reaches crank cutoutt speed.

3 Faults #3 through #6 activate immediately, with programmable delays.

4 Manual mode requires manual mains and generator breaker operation. Manual mode will operate in KW and Voltage Droop.

5 Transducer input not required if Process Control Mode is Not used.

6 Only required if "Check Mains Breaker" setpoint is Enabled. Any unit which may operate as the master must have these inputs.

VIS-077
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Figure 7-3. Multiple Unit Parallel Peak Shaving Application

Switch Based Logic
(Multiple—Parallel, Master Control's Action)

TEST ⌐	RUN /w LOAD	AUTO	PROCESS	UTILITY POWER	
			X	X	OFF
1	X		X	X	STARTS ALL ENGINES *
X	1		X	X	STARTS ALL ENGINES *
		1	X	1	READY TO START ALL ENGINES UPON LOSS OF UTILITY POWER
X	1	1		1	STARTS ALL ENGINES / ALL UNITS SYNC TO UTILITY / CONTROL IN BASELOAD
X	1	1	1	1	STARTS ALL ENGINES / ALL UNITS SYNC TO UTILITY / CONTROL IN PROCESS #
1	1	1		1	STARTS ALL ENGINES / UNITS SYNC TO UTILITY / RAMP TO BASELOAD / OPENS TB **
1	1	1	1	1	STARTS ALL ENGINES / UNITS SYNC TO UTILITY / RAMPS TO PROCESS / OPENS TB **
		1	X	⌐	OPENS TB / STARTS ENGINES / UNITS CLOSE GBs TO BUS / CONTROLS IN ISOCH #
		1	X	⌐	SYNCS BUS TO UTILITY / UNLOADS ALL ENGINES / SHUTS DOWN ALL ENGINES

*** = When generator breaker is closed manually, unit will operate in Droop mode.**
**** = Soft Transfer Setting must be "Enabled"**
 # = Depending on process demand, slave units will be sequenced on or off the plant bus.
1 = Contact closed (Utility Power OK)
X = Contact open or closed (Utility Power Failed or OK)
TB = Utility Tie Breaker
GB = Generator Breaker
⌐ = Transition from Utility Stable to Utility Failed
⌐ = Transition from Utility Failed to Utility Stable

Switch Based Logic
(Multiple—Parallel, Slave Control's Action)

TEST ⌐	RUN /w LOAD	AUTO	PROCESS	
			X	OFF
1	X		X	STARTS ENGINE *
X	1		X	STARTS ENGINE *
		1	X	FOLLOWS ALL MASTER'S COMMANDS

*** = When generator breaker is closed manually, unit will operate in Droop mode**
1 = Contact closed
X = Contact open or closed

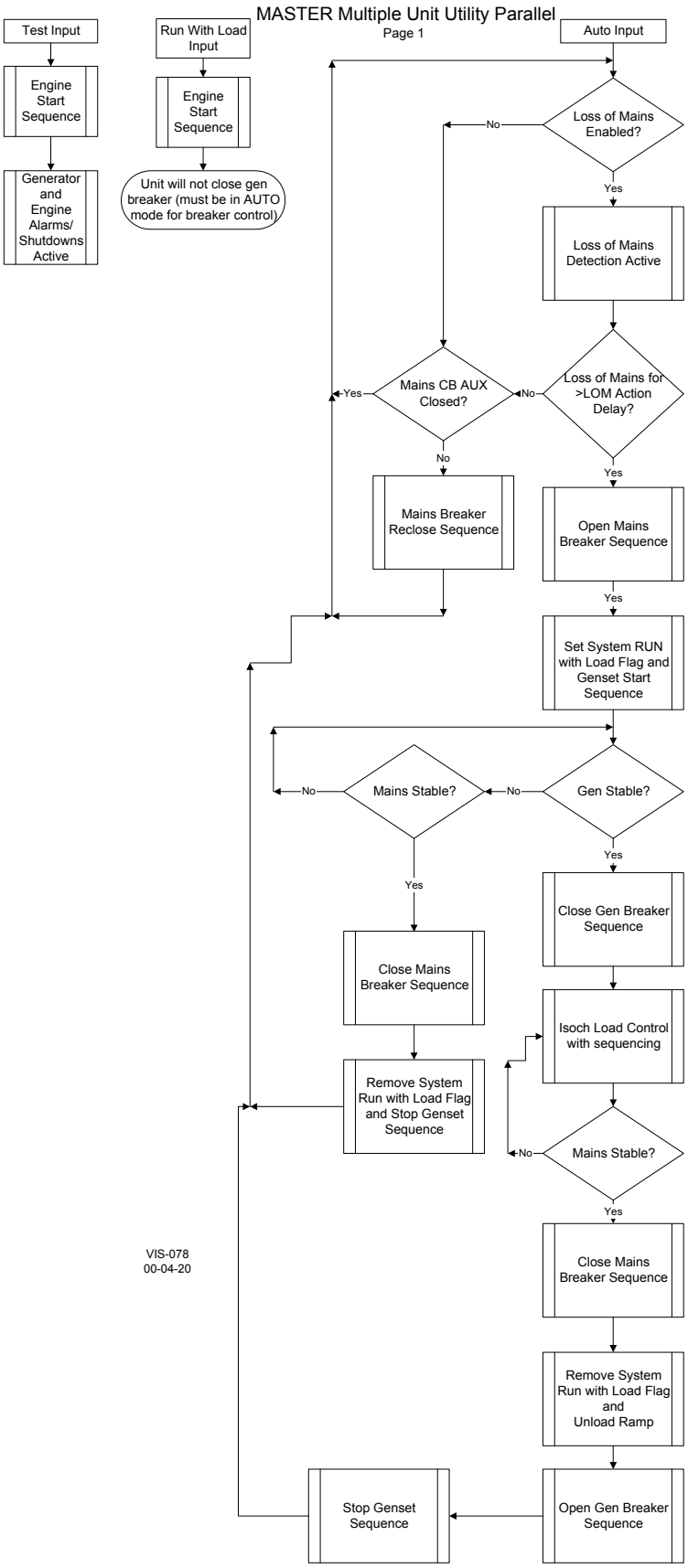


Figure 7-4a. Master Multiple Parallel Process Control Flow Diagram

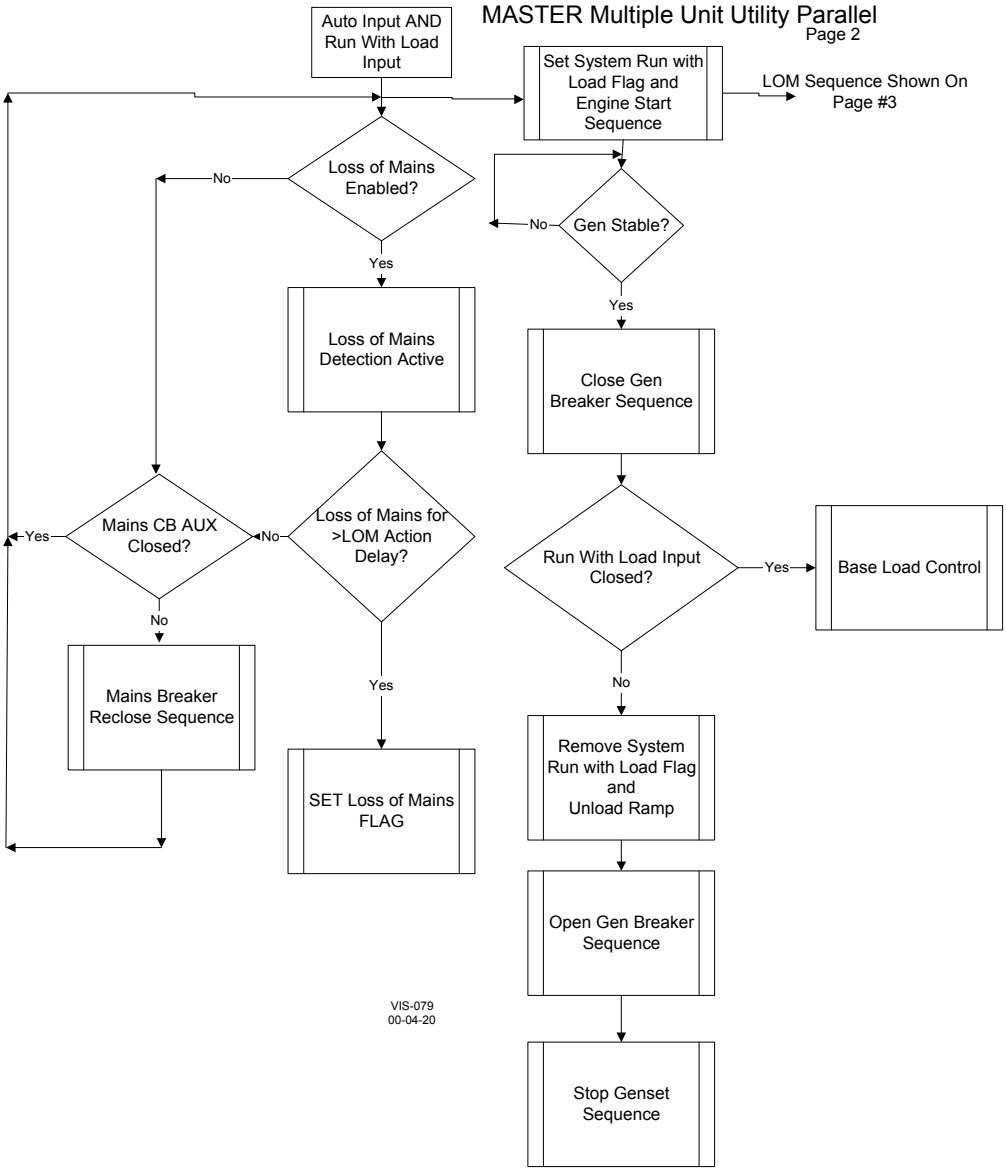


Figure 7-4b. Master Multiple Parallel Process Control Flow Diagram

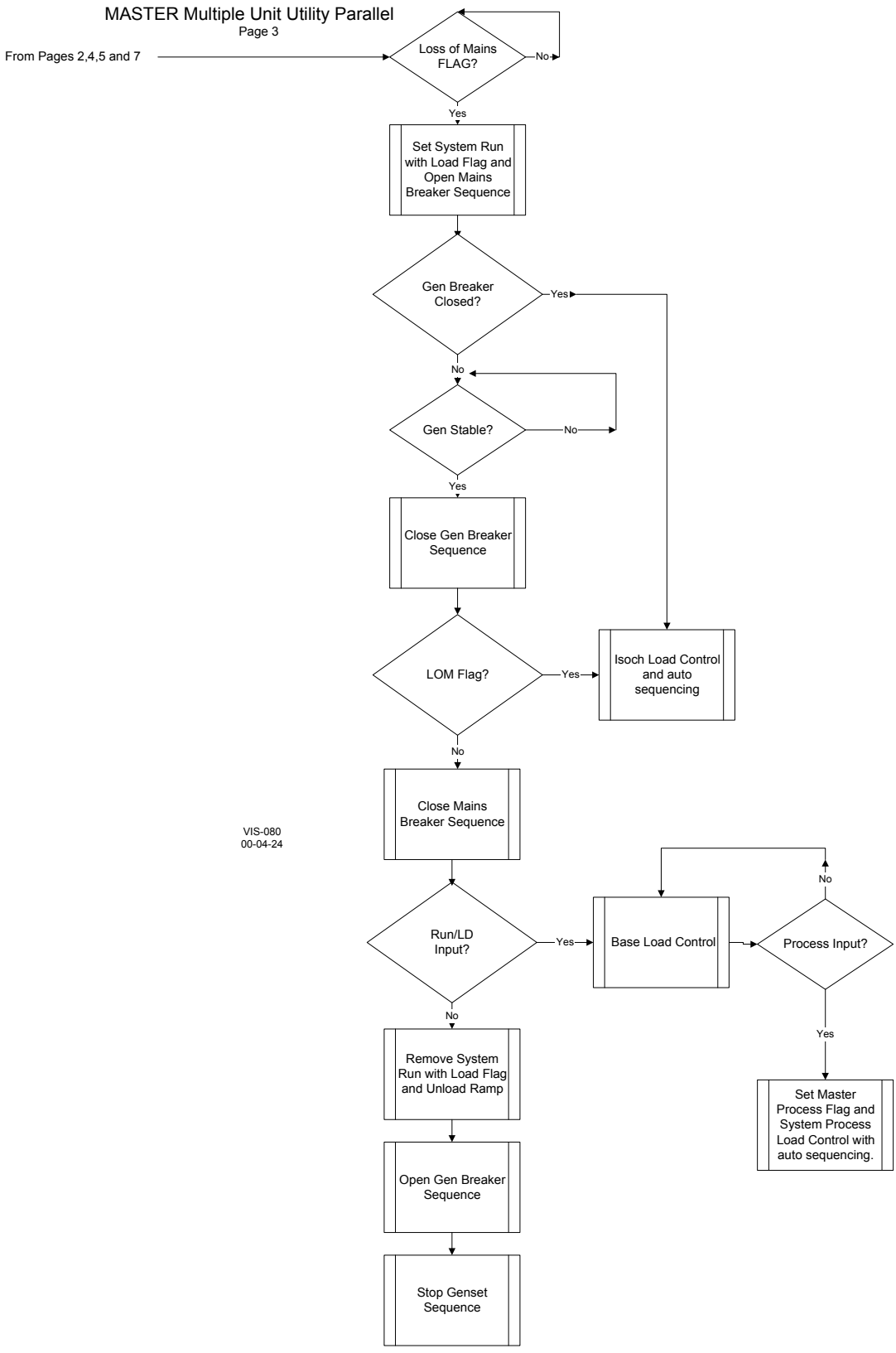


Figure 7-4c. Master Multiple Parallel Process Control Flow Diagram

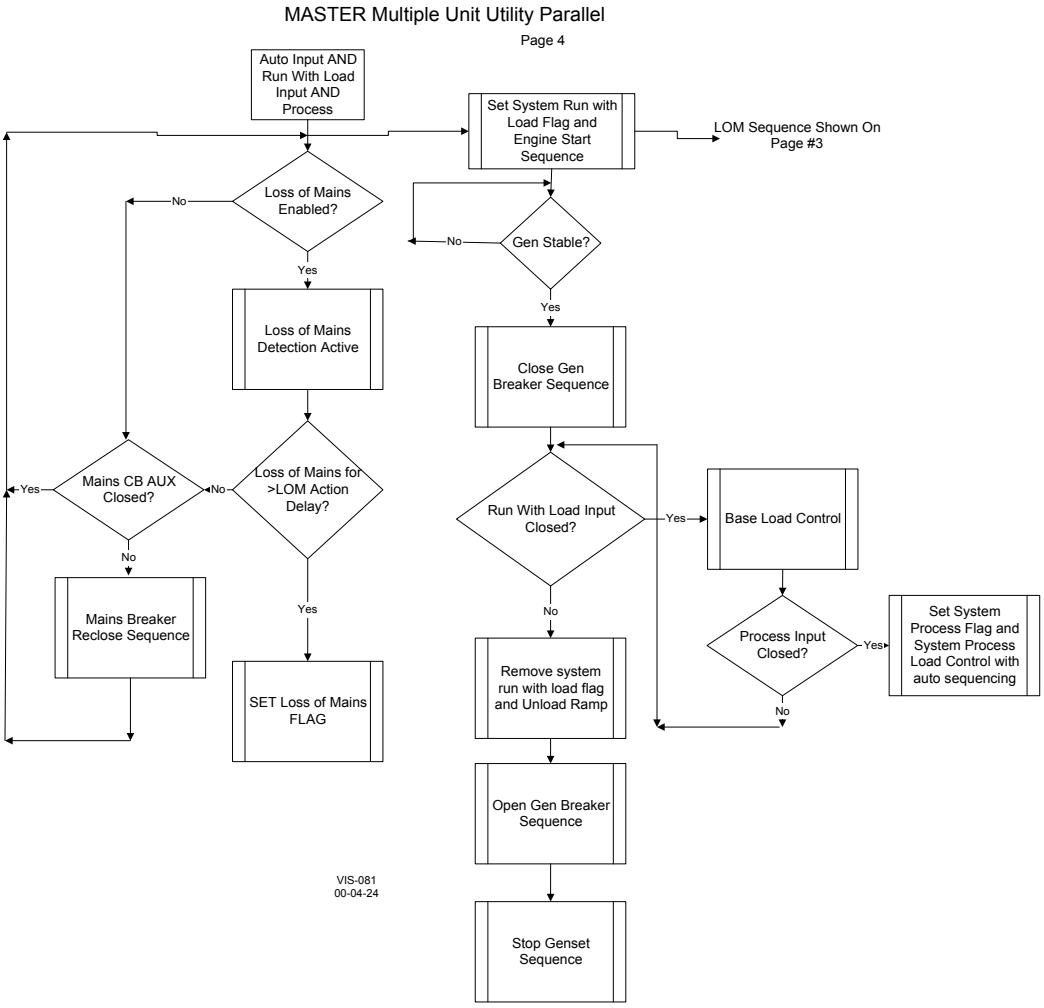


Figure 7-4d. Master Multiple Parallel Process Control Flow Diagram

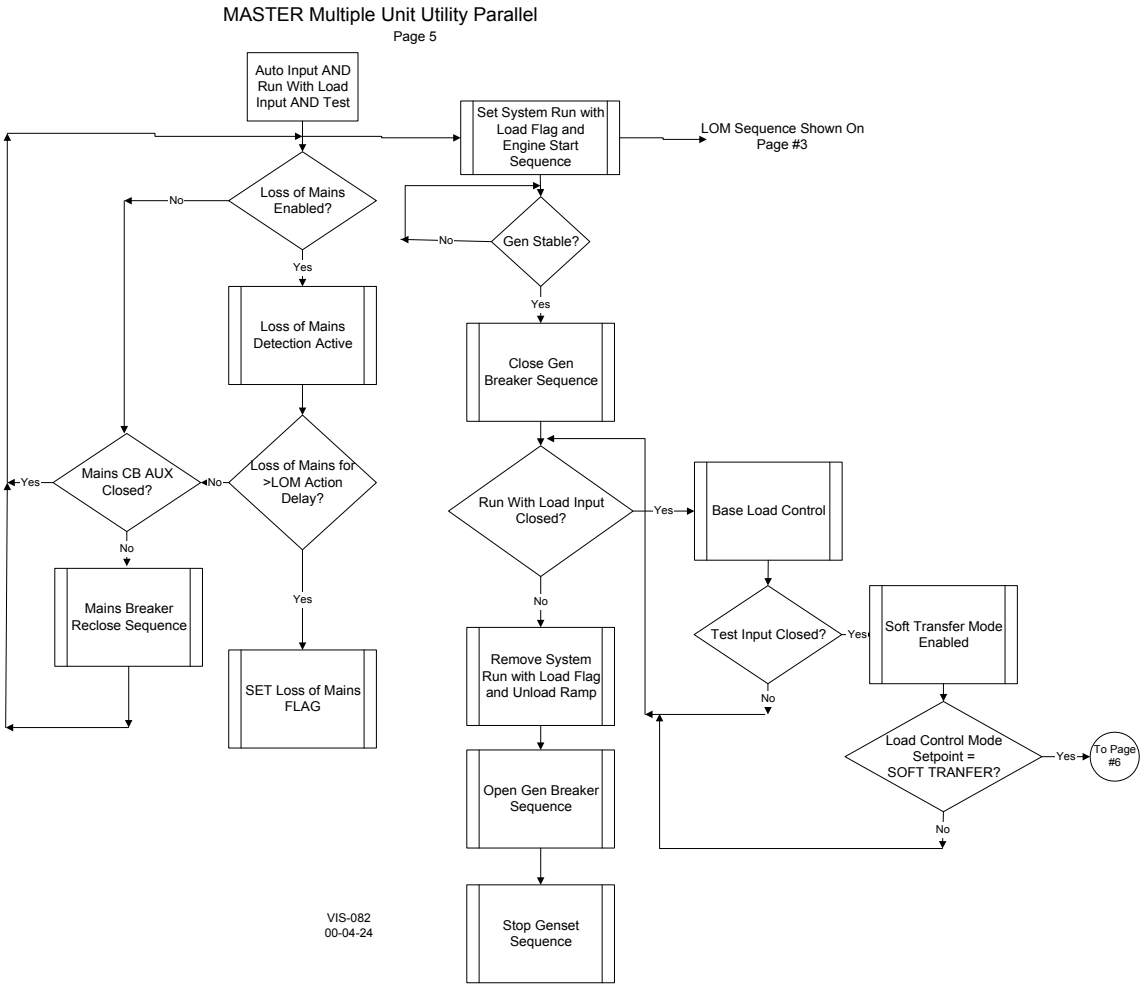


Figure 7-4e. Master Multiple Parallel Process Control Flow Diagram

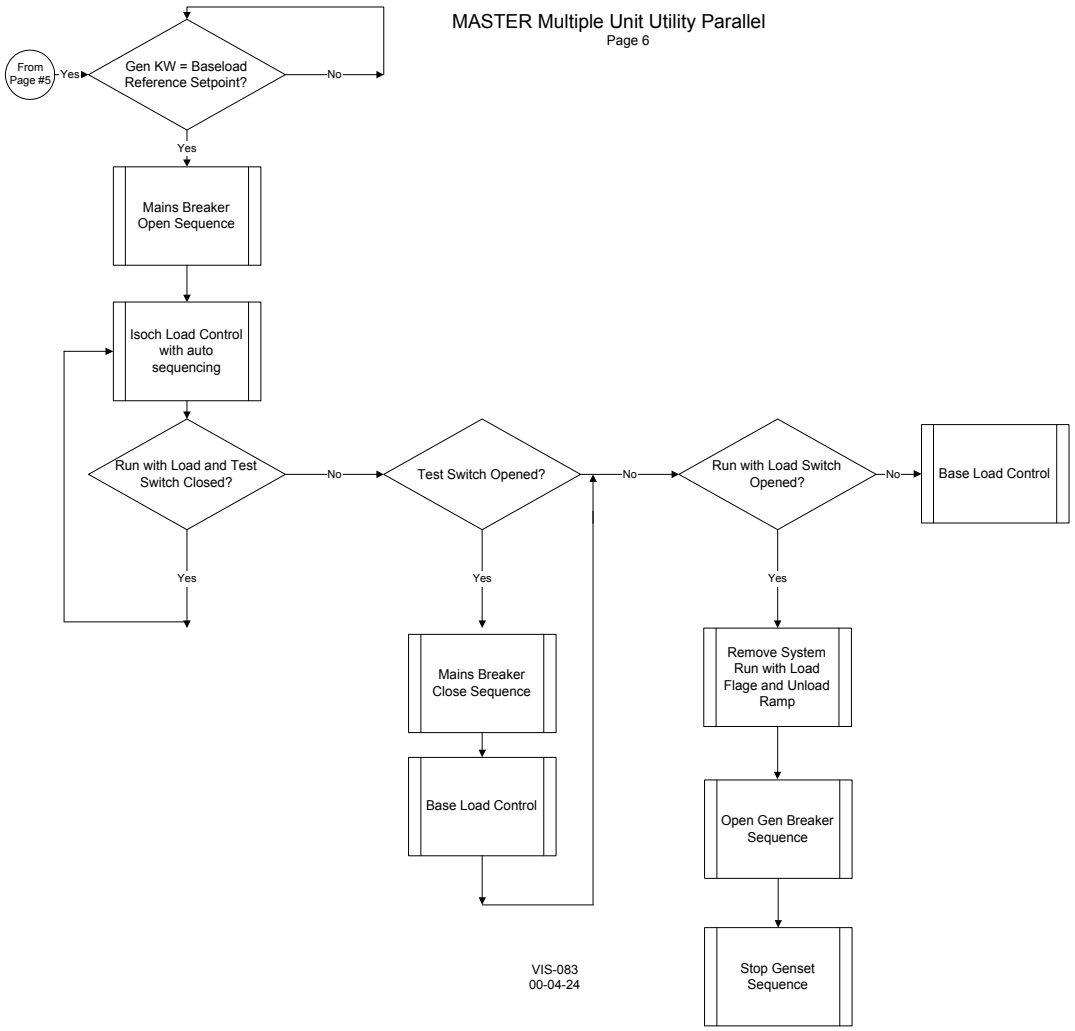


Figure 7-4f. Master Multiple Parallel Process Control Flow Diagram

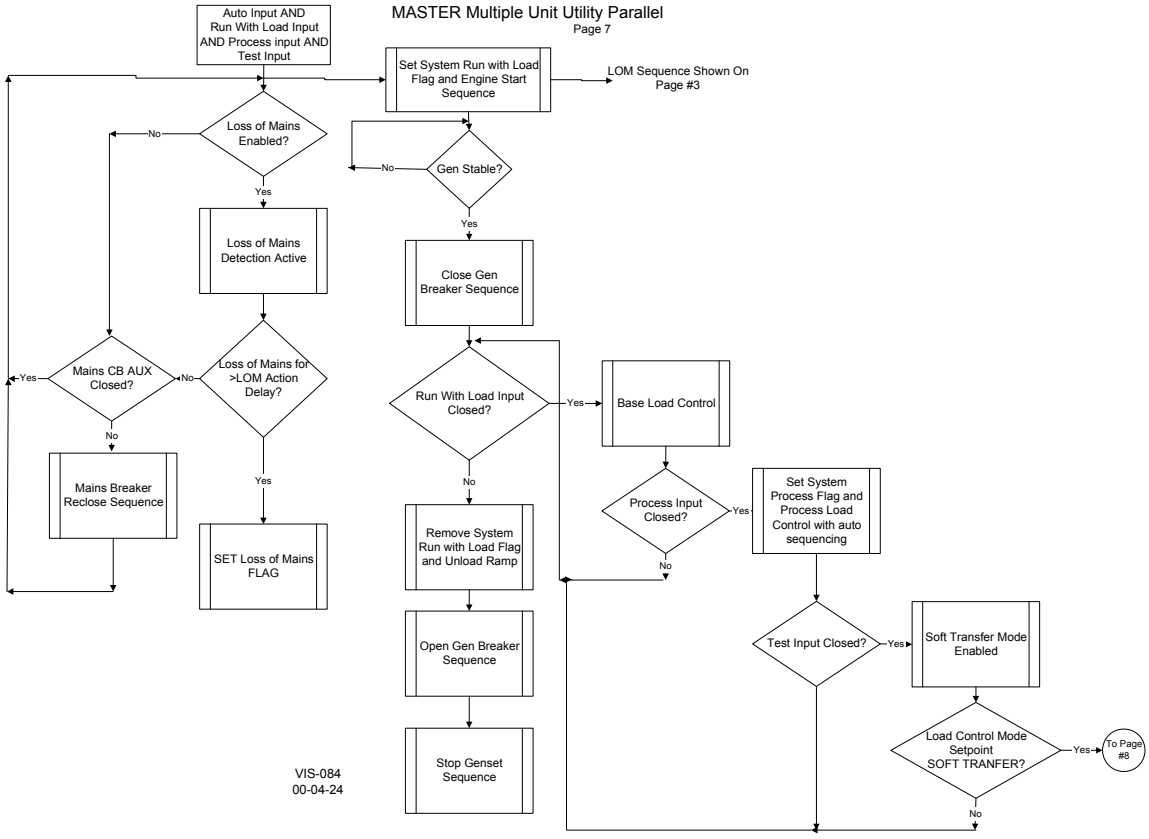


Figure 7-4g. Master Multiple Parallel Process Control Flow Diagram

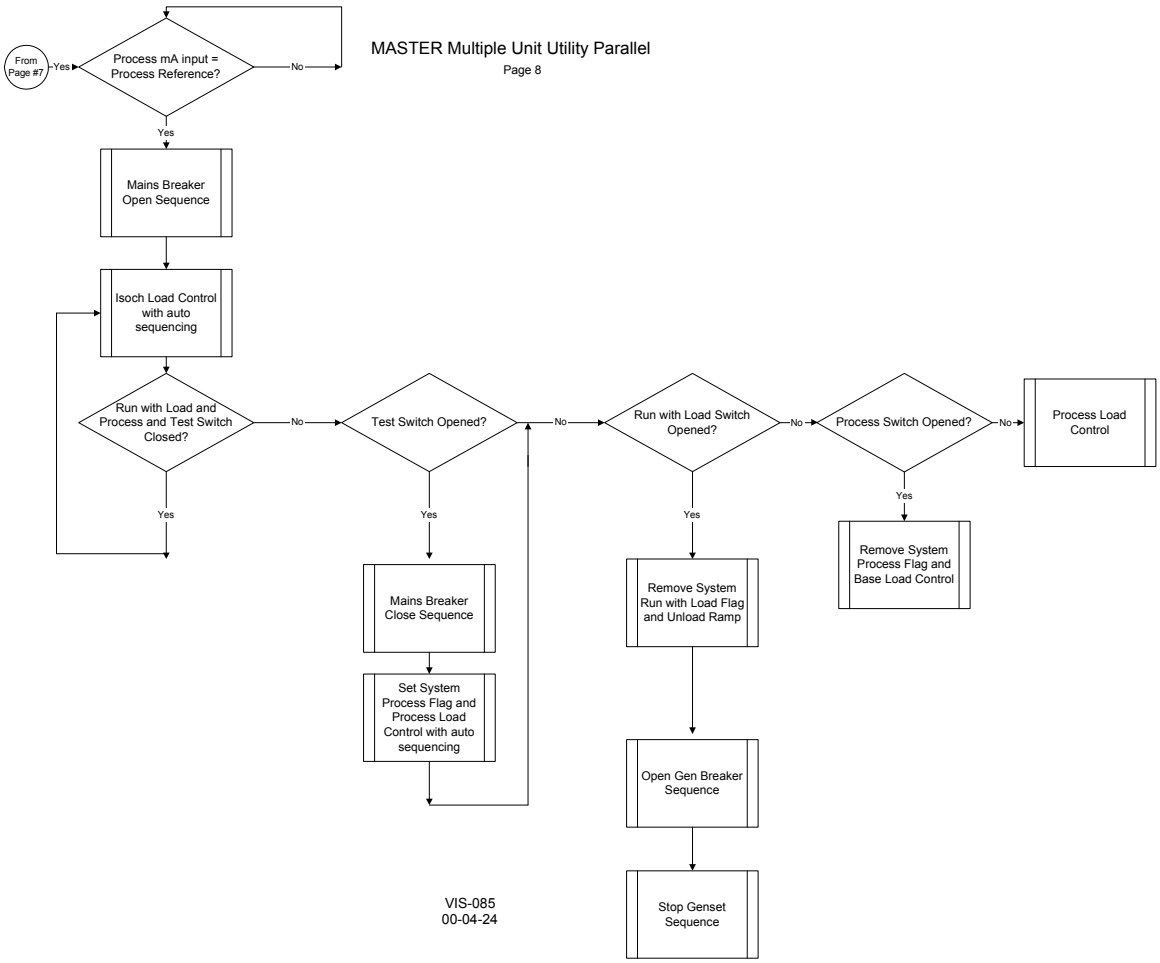


Figure 7-4h. Master Multiple Parallel Process Control Flow Diagram

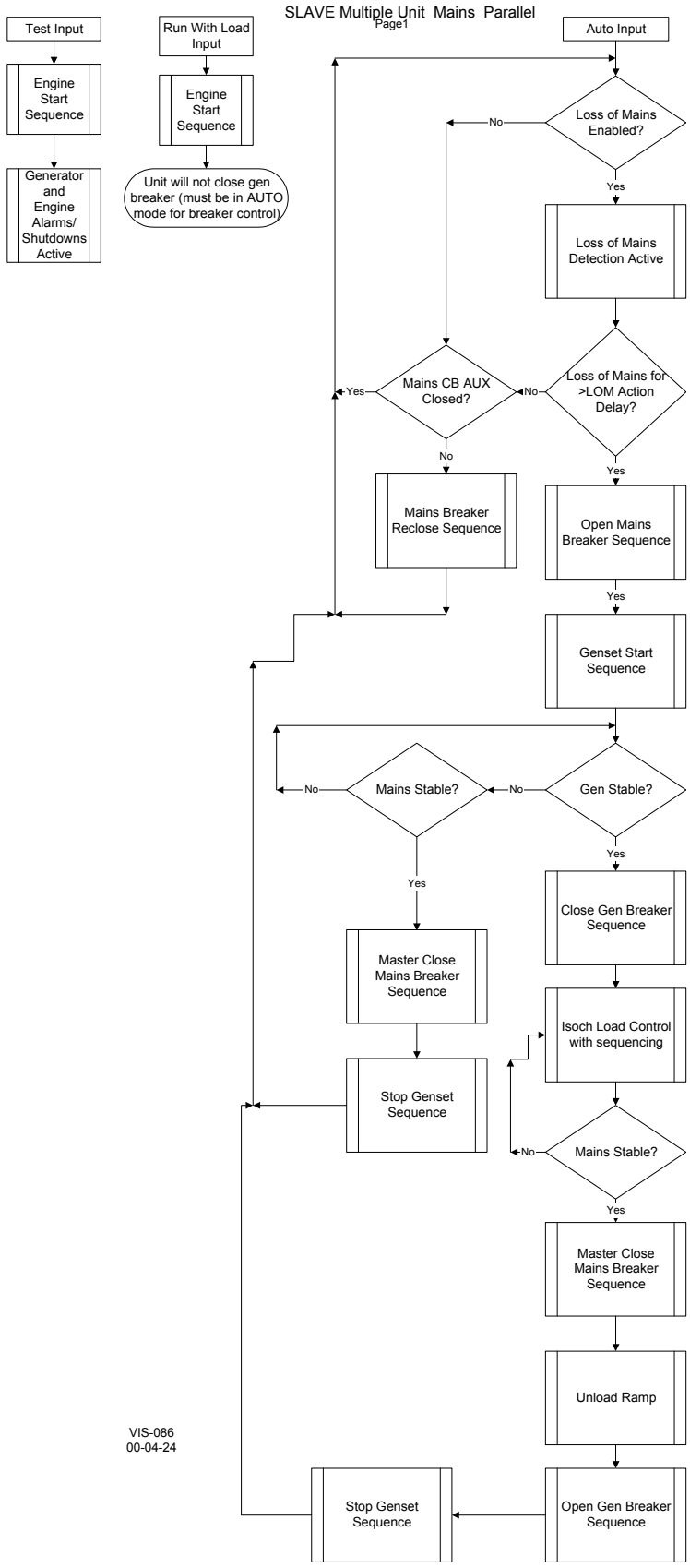


Figure 7-5a. Slave Multiple Parallel Process Control Flow Diagram

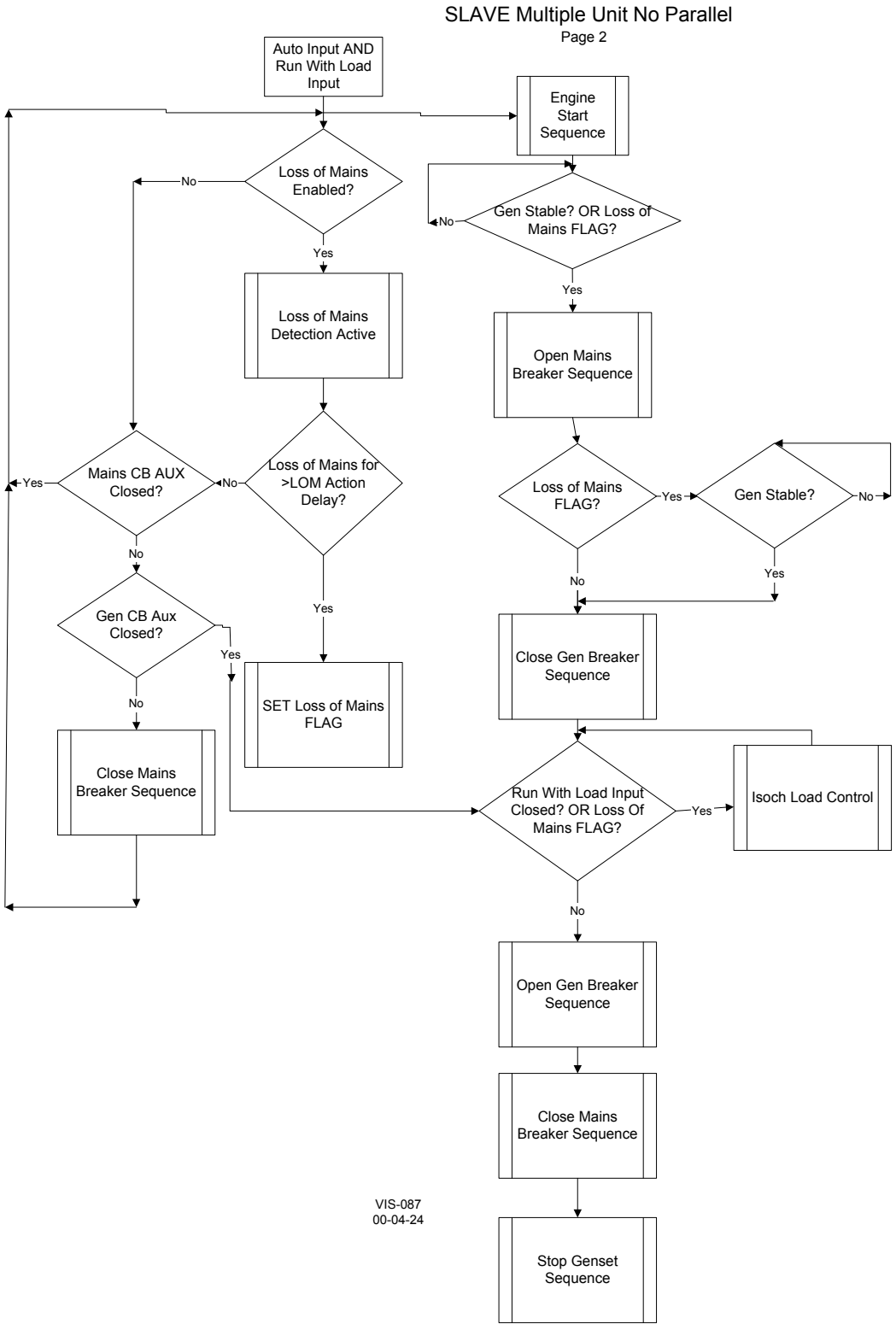


Figure 7-5b. Slave Multiple Parallel Process Control Flow Diagram

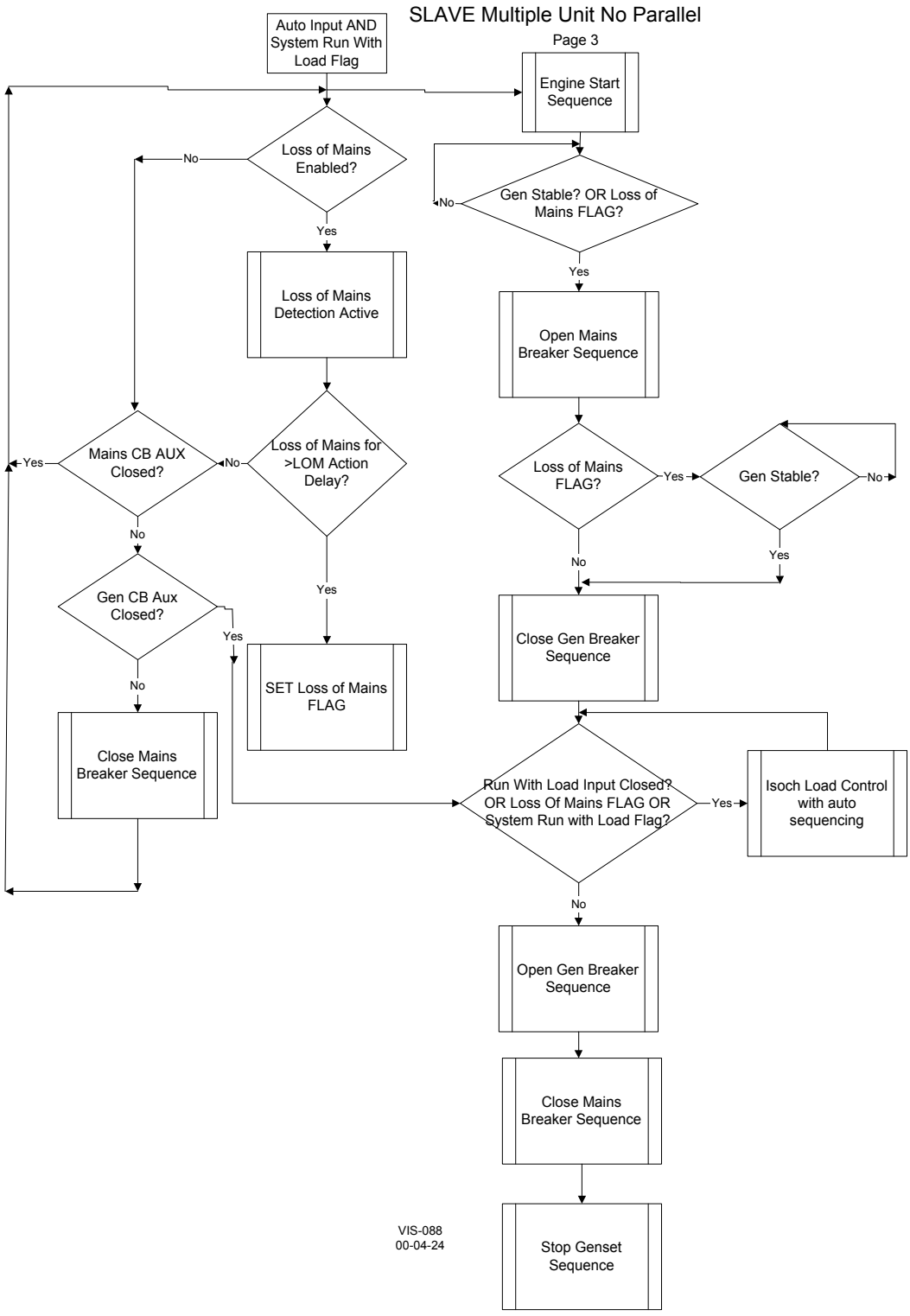


Figure 7-5c. Slave Multiple Parallel Process Control Flow Diagram

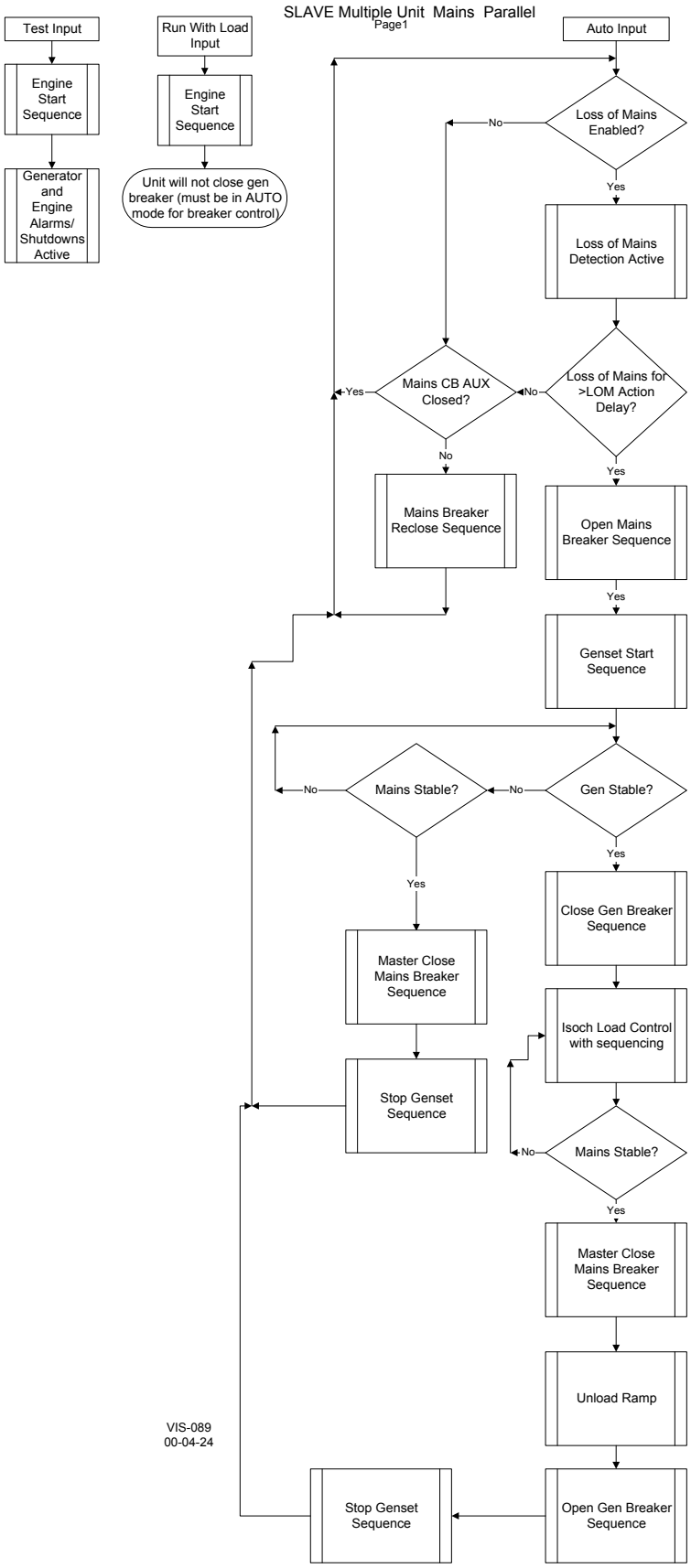


Figure 7-5d. Slave Multiple Parallel Process Control Flow Diagram

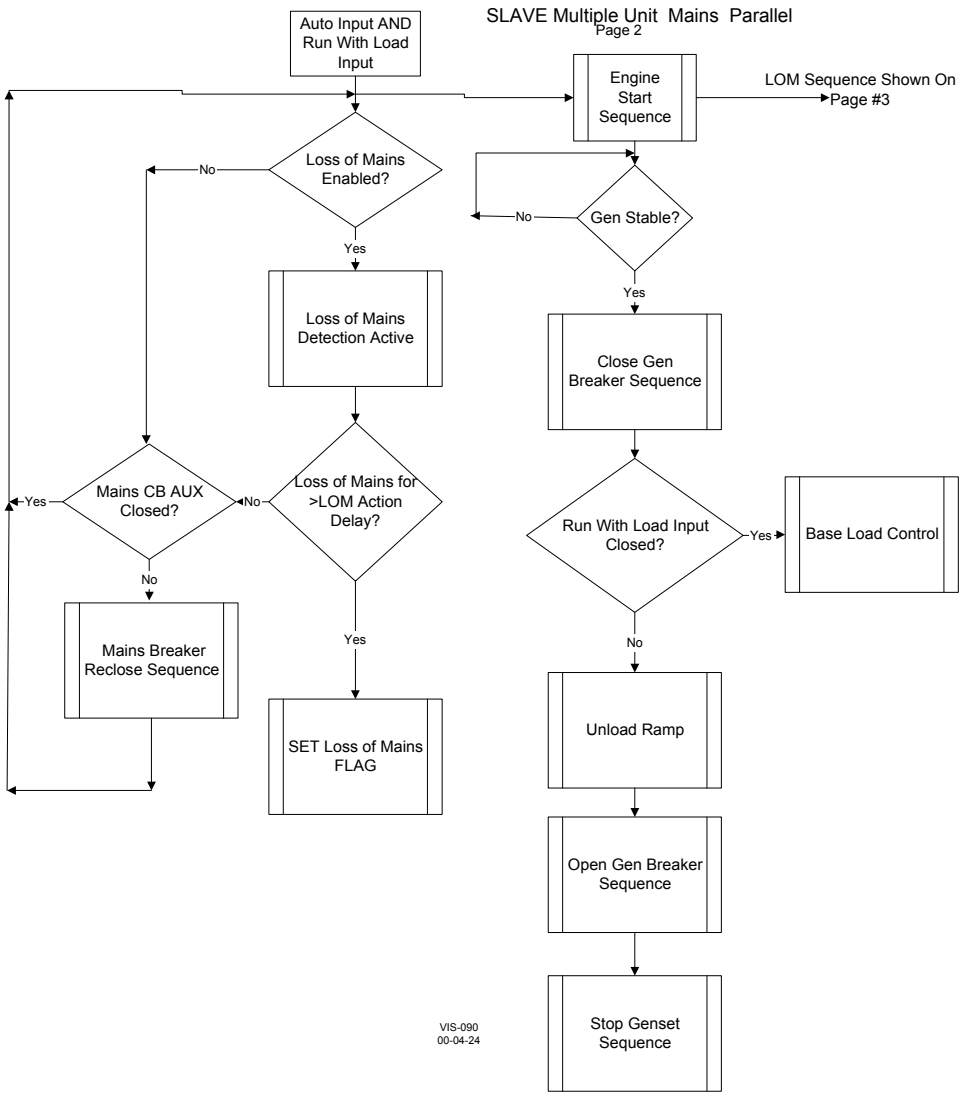


Figure 7-5e. Slave Multiple Parallel Process Control Flow Diagram

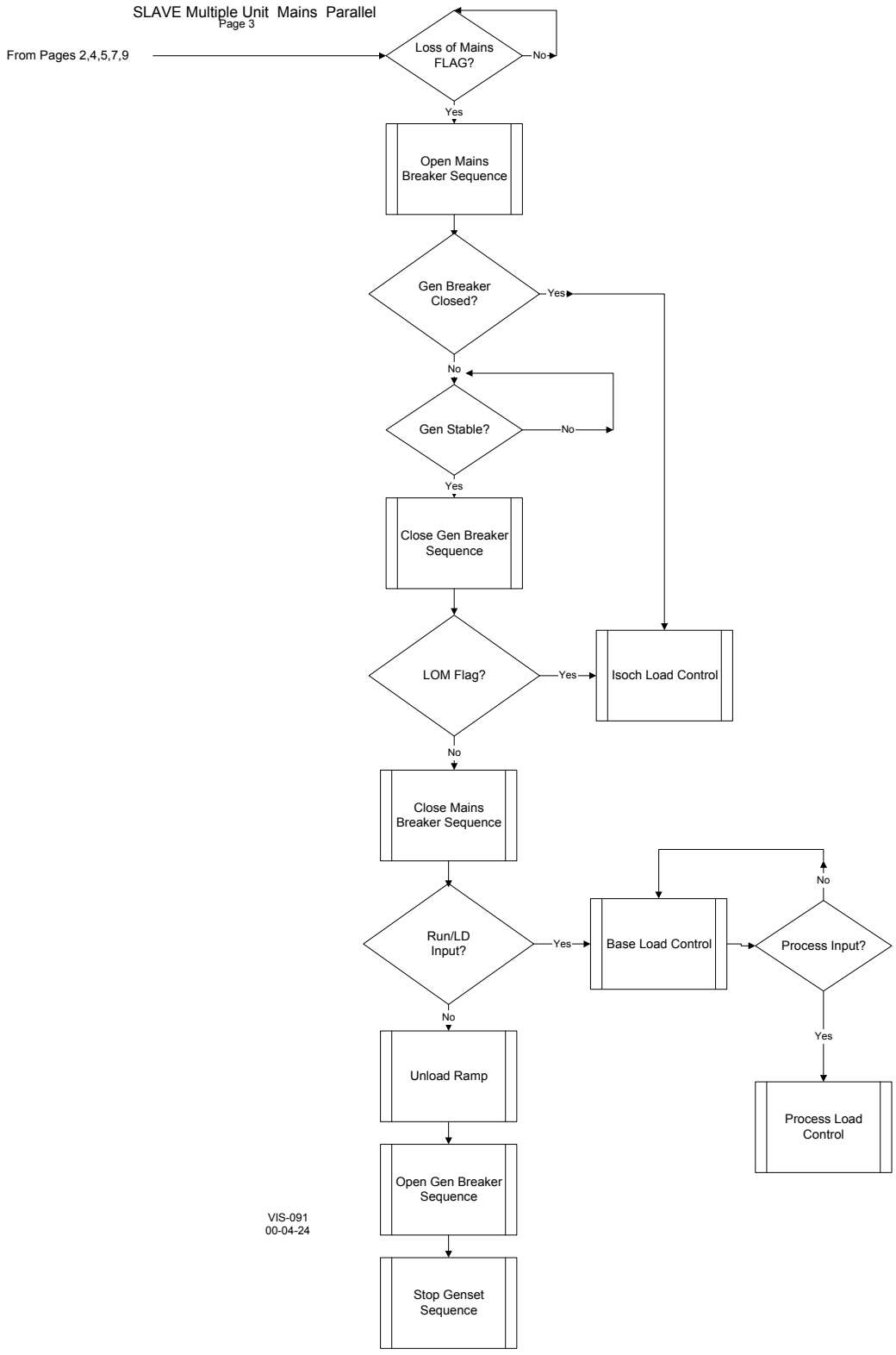


Figure 7-5f. Slave Multiple Parallel Process Control Flow Diagram

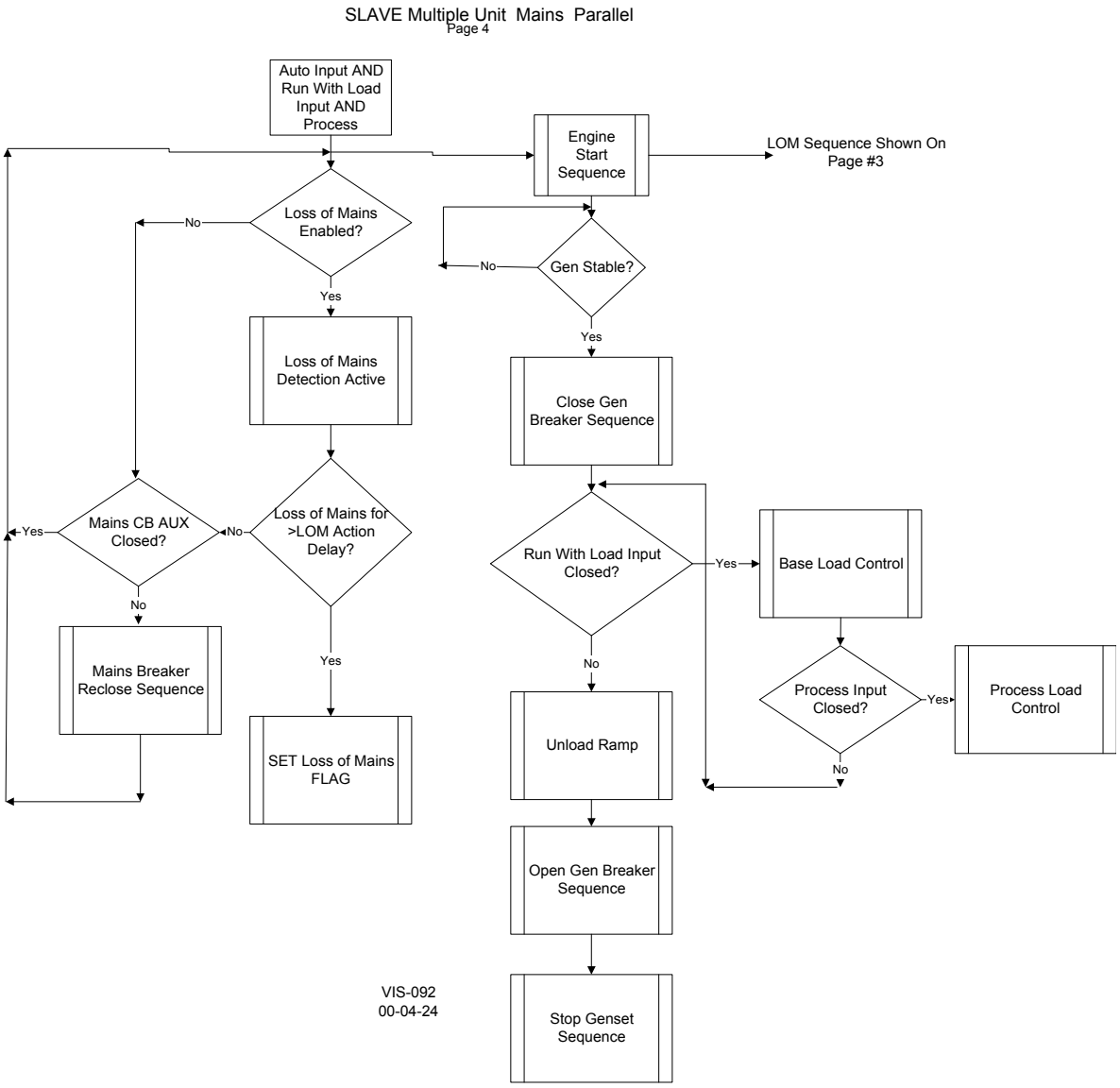


Figure 7-5g. Slave Multiple Parallel Process Control Flow Diagram

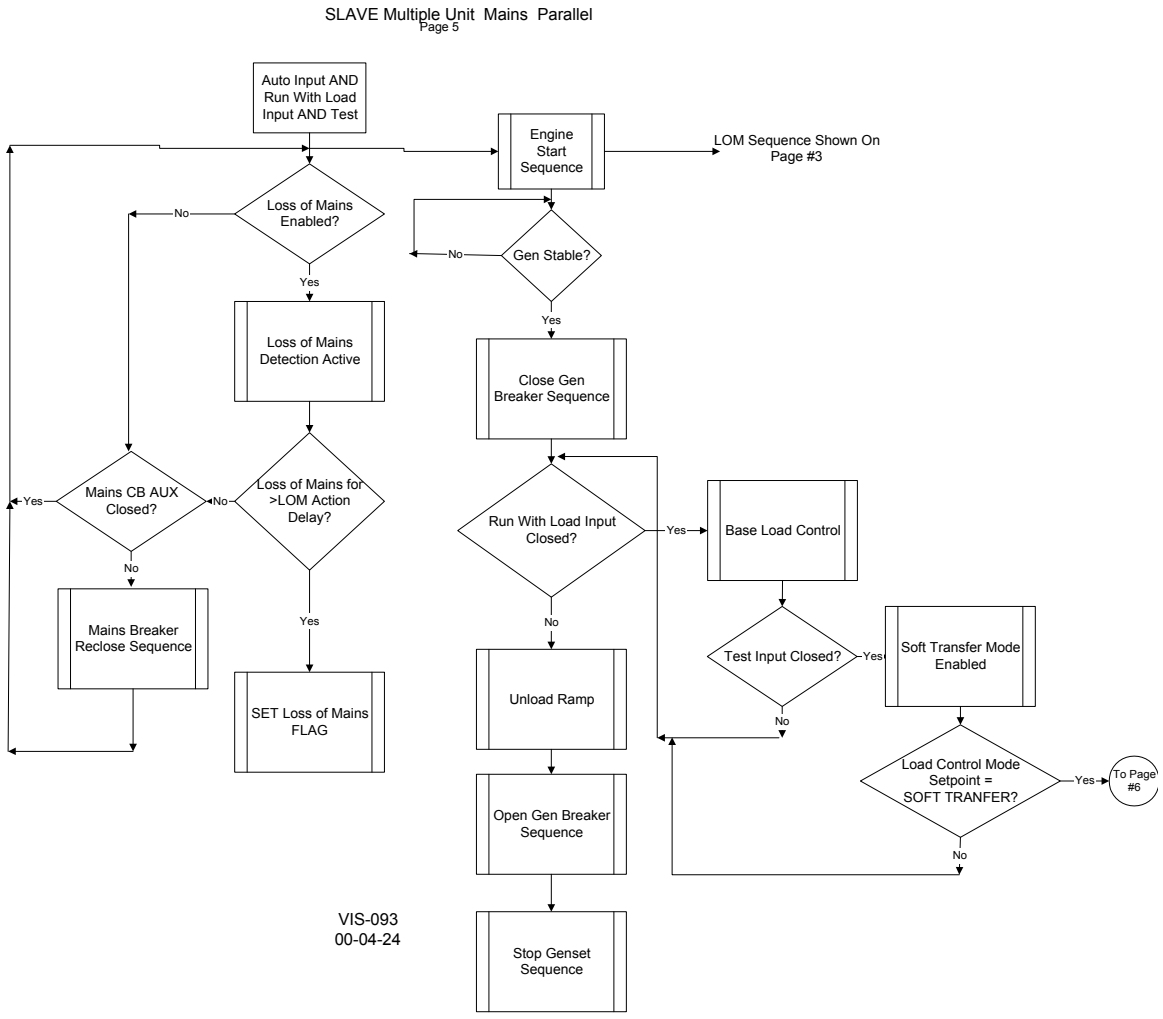


Figure 7-5h. Slave Multiple Parallel Process Control Flow Diagram

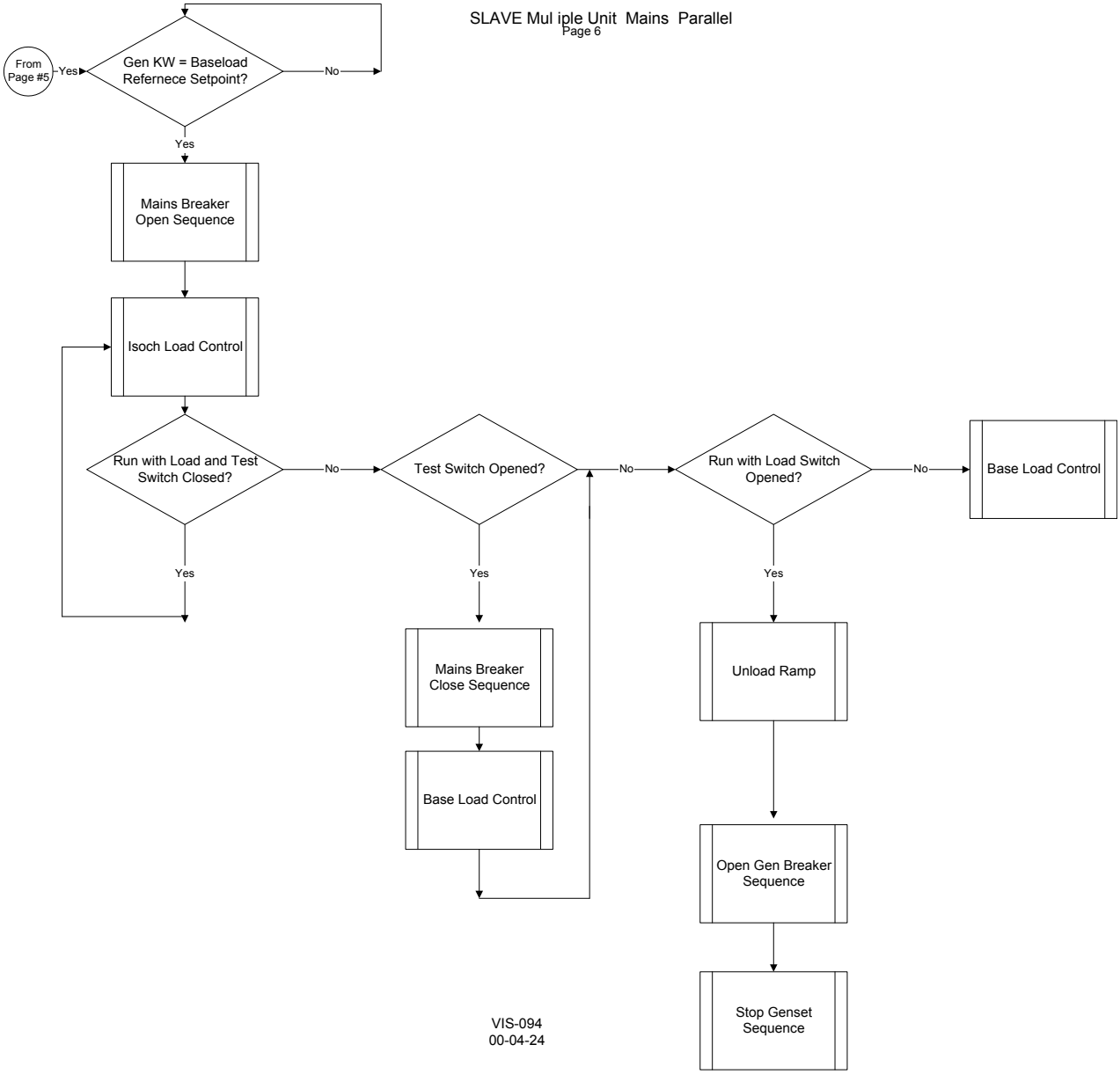


Figure 7-5j. Slave Multiple Parallel Process Control Flow Diagram

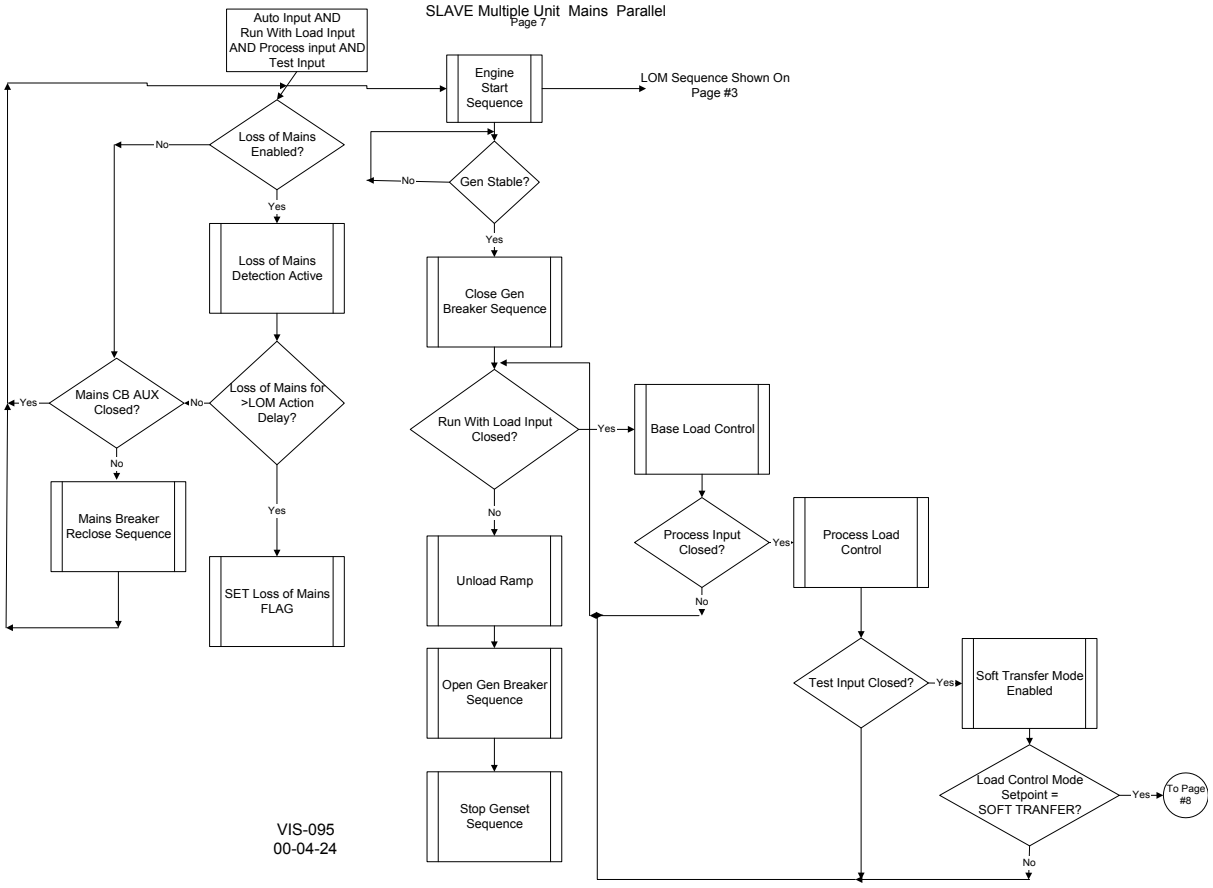


Figure 7-5k. Slave Multiple Parallel Process Control Flow Diagram

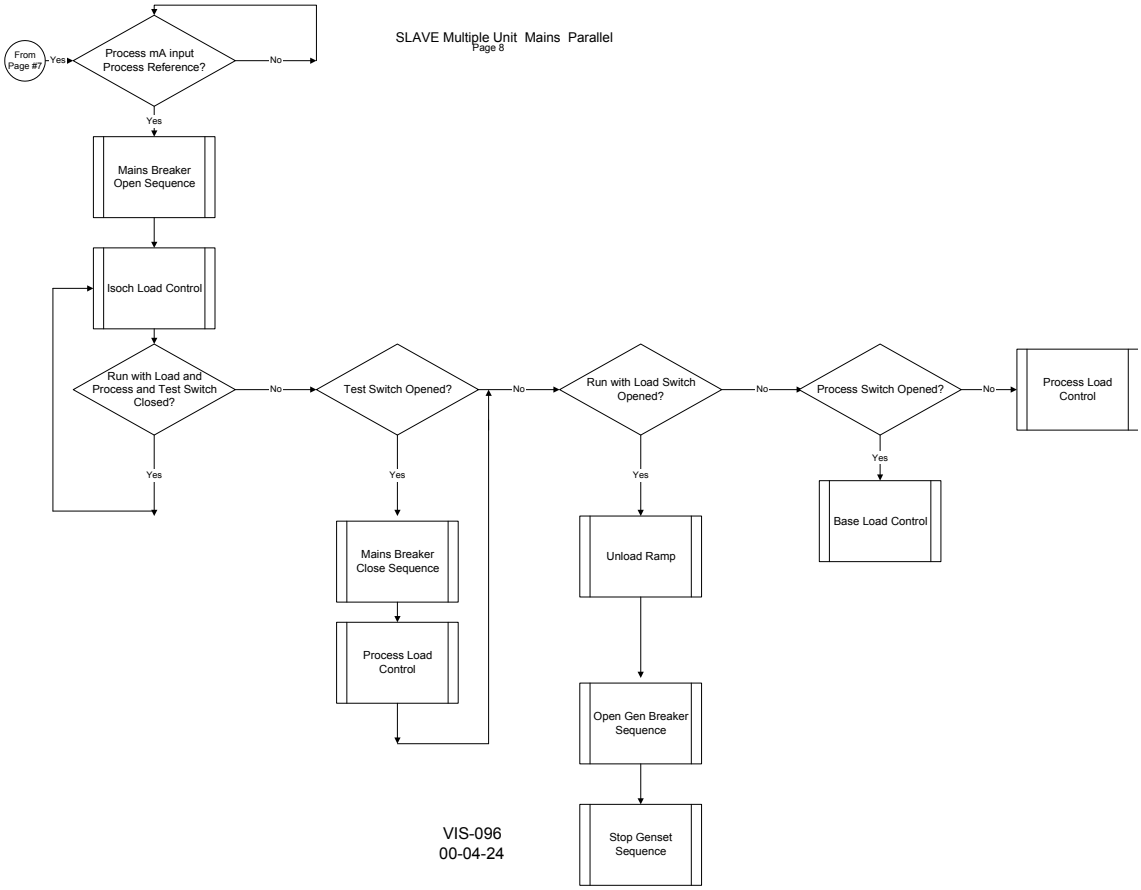


Figure 7-5l. Slave Multiple Parallel Process Control Flow Diagram

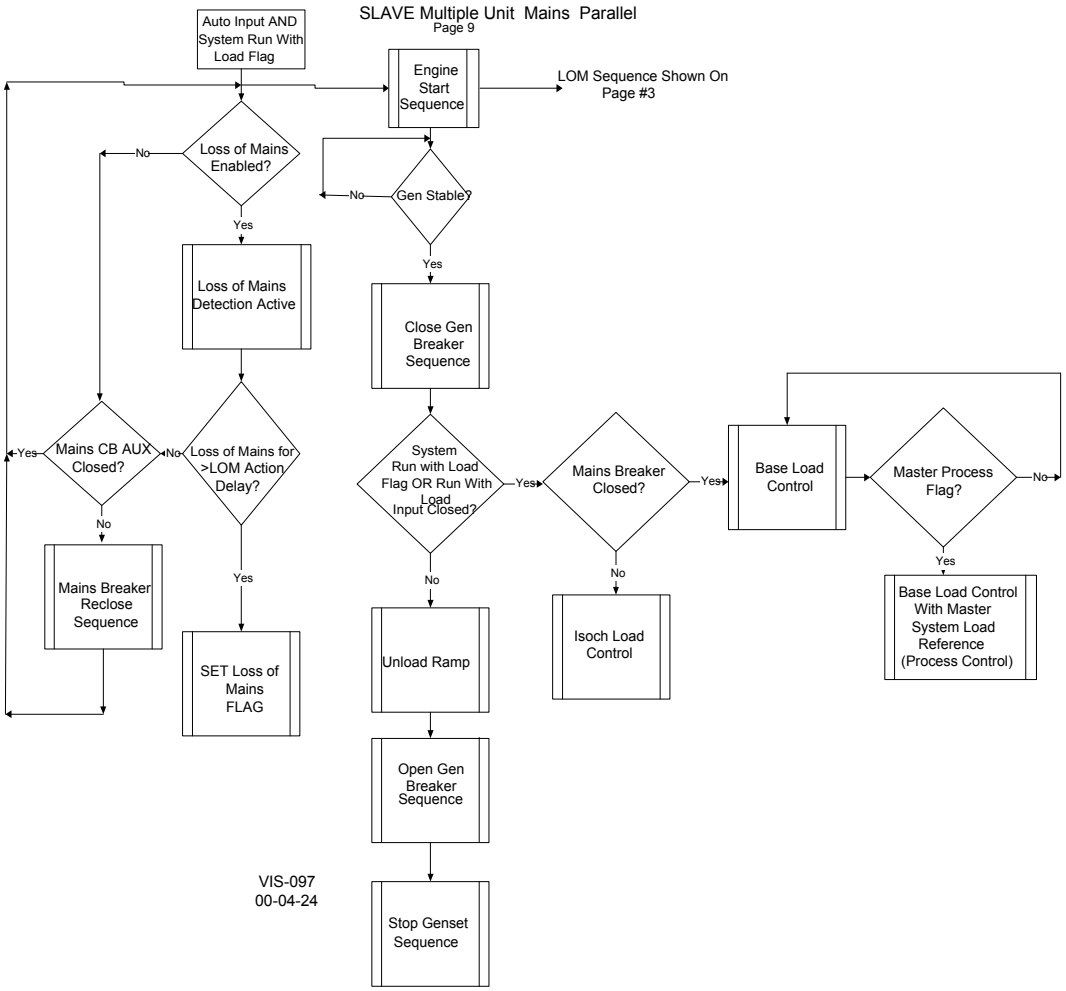


Figure 7-5m. Slave Multiple Parallel Process Control Flow Diagram

The following flow diagrams are specific sequences referred to in the preceding overview flow diagrams:

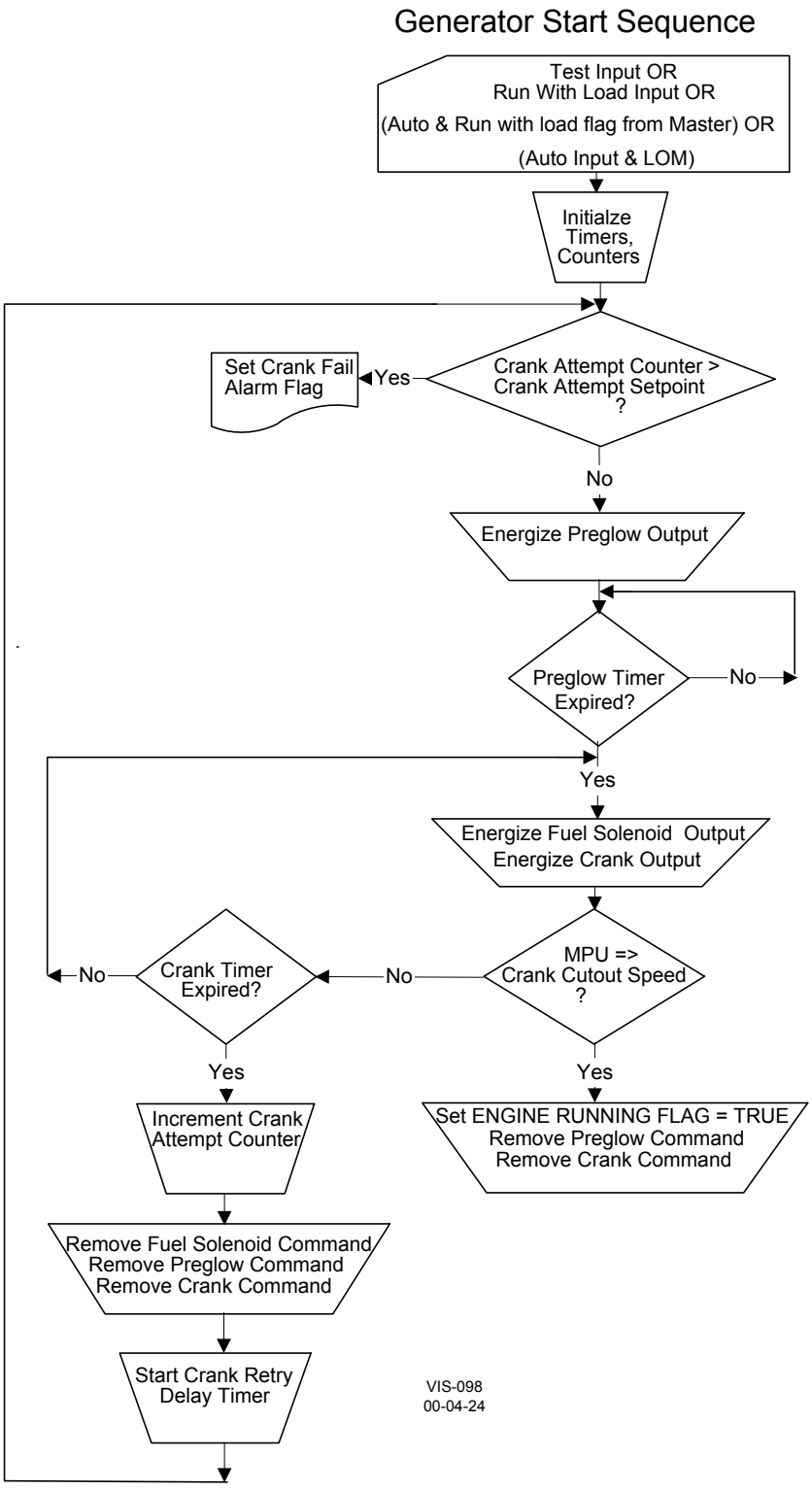


Figure 7-6. Generator Start Sequence

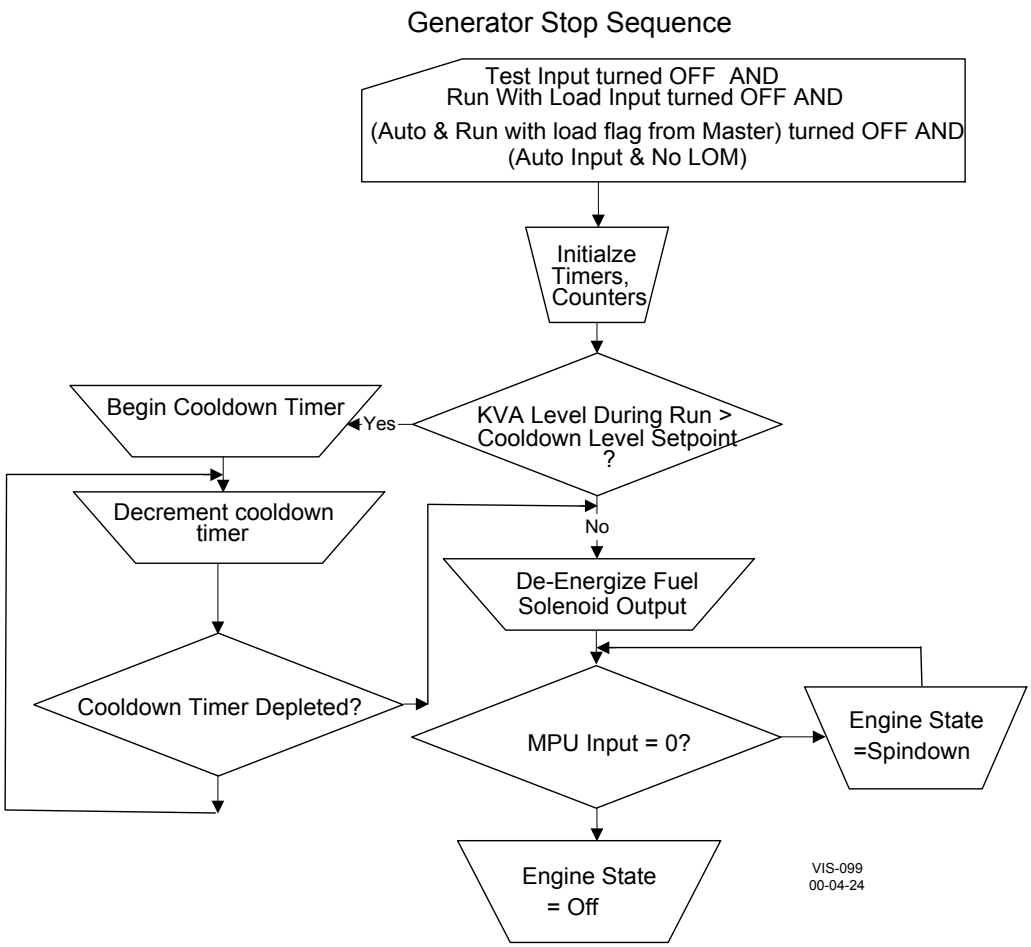


Figure 7-7. Generator Stop Sequence

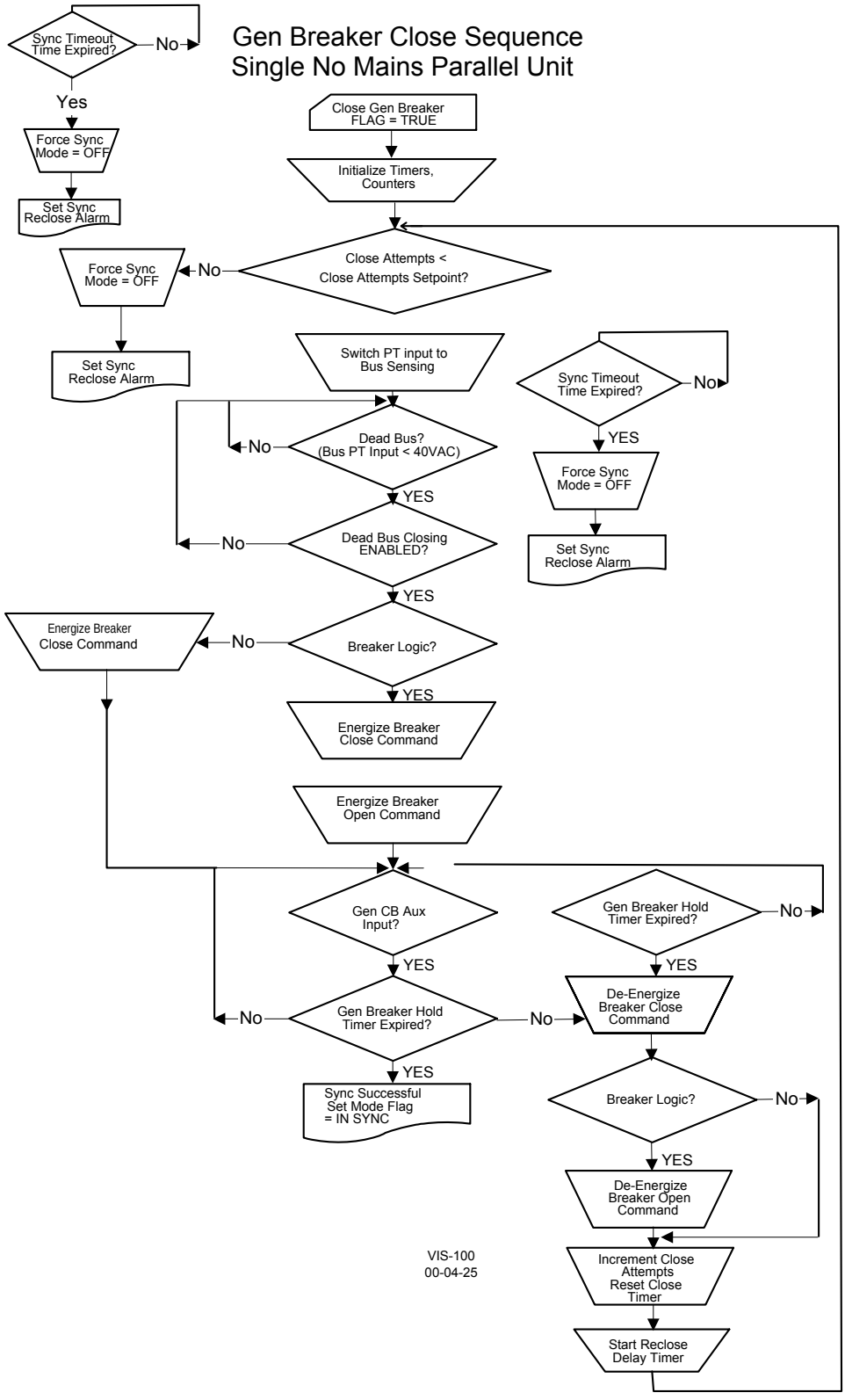


Figure 7-8. Generator Breaker Close Sequence
(Single No Mains Parallel)

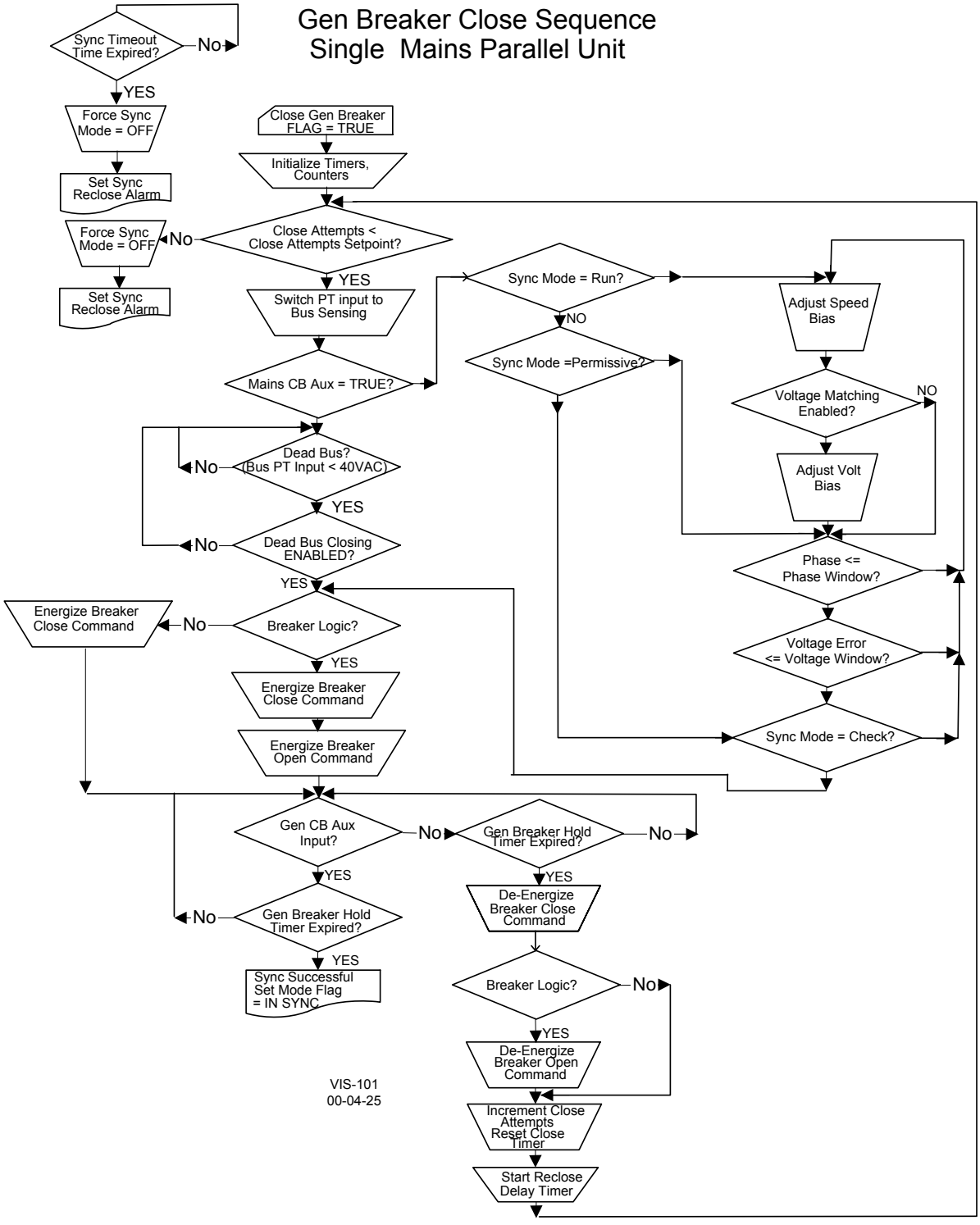


Figure 7-9. Generator Breaker Close Sequence (Single Mains Parallel)

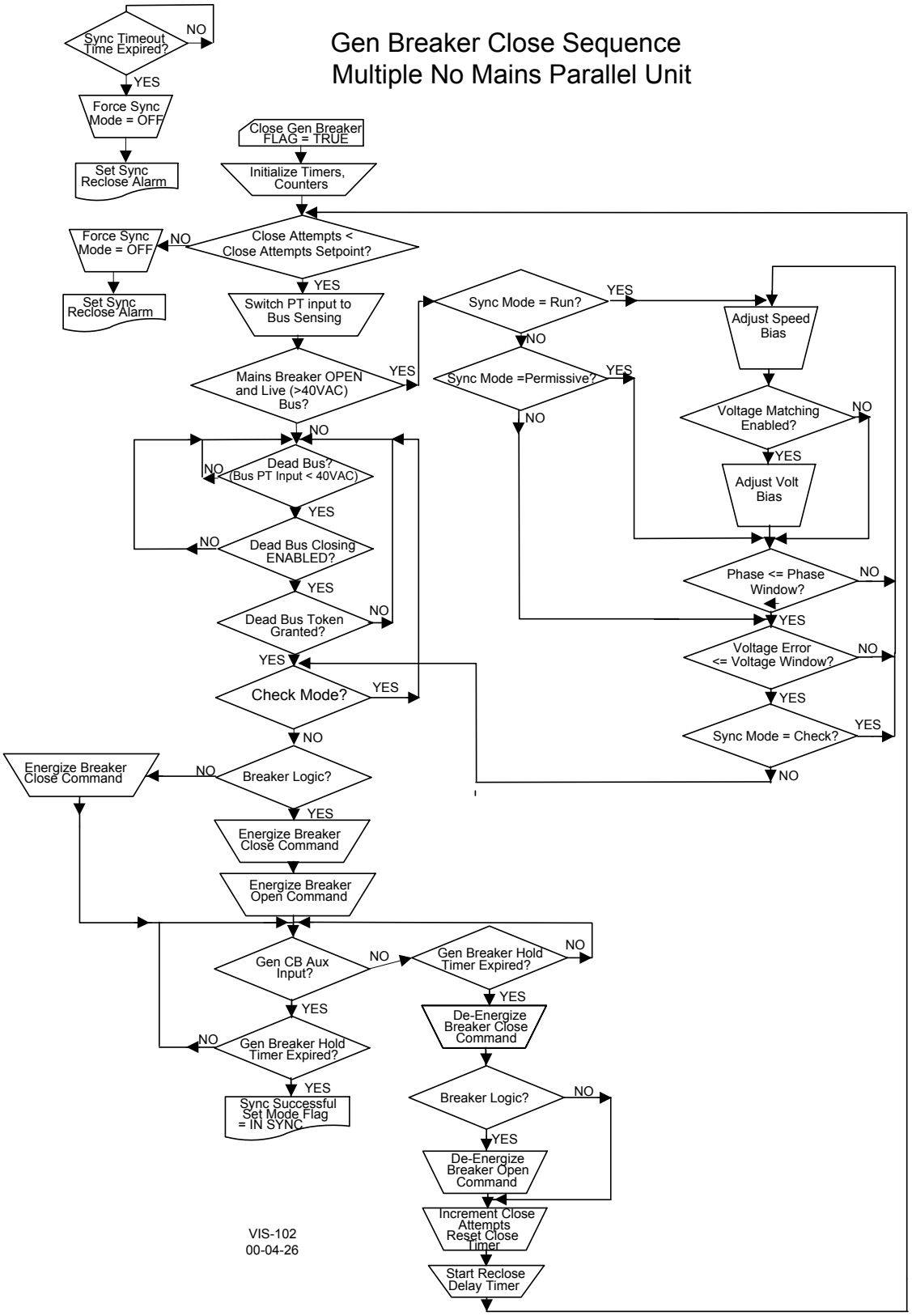


Figure 7-10. Generator Breaker Close Sequence (Multiple No Mains Parallel)

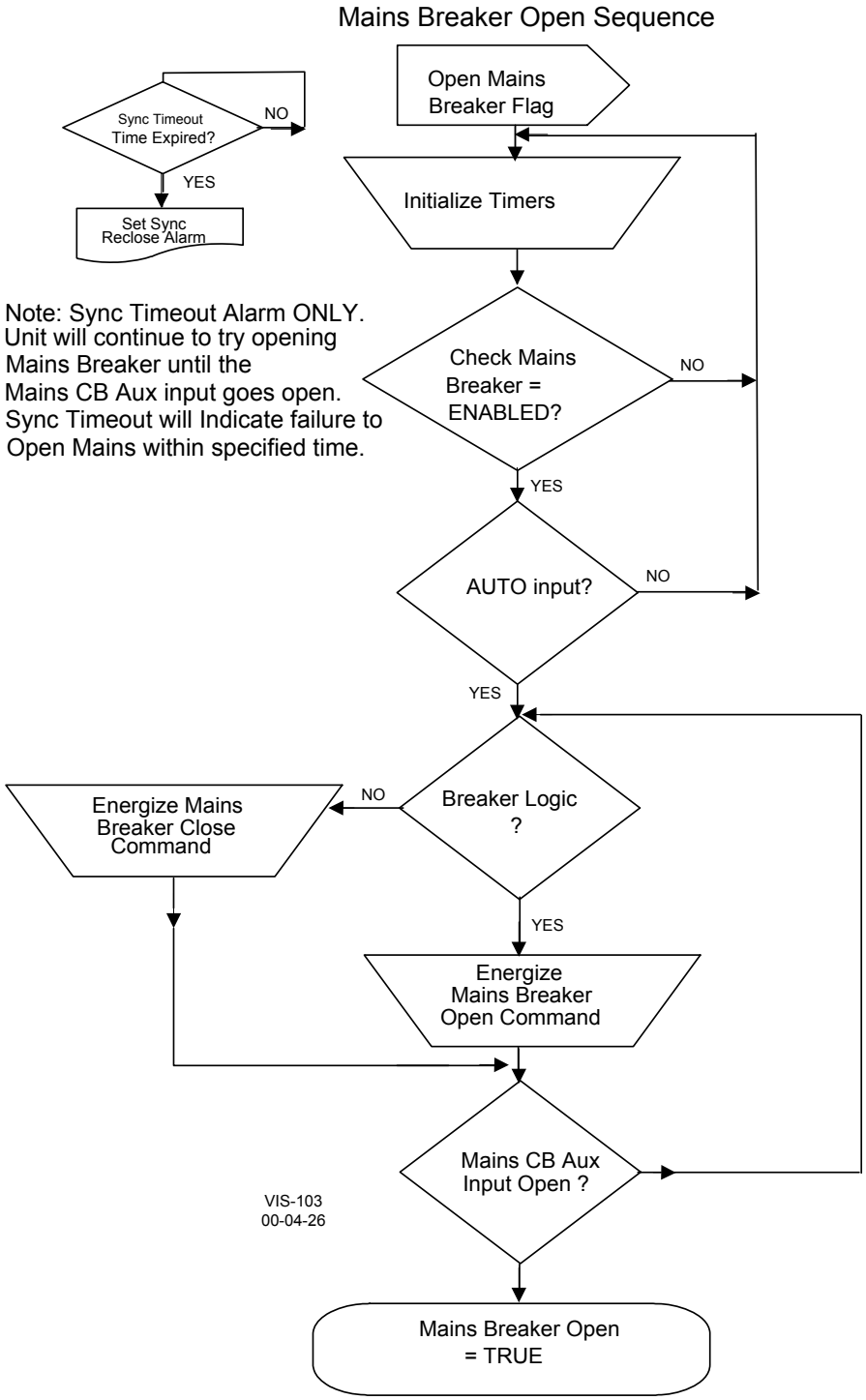


Figure 7-11. Main Breaker Open Sequence

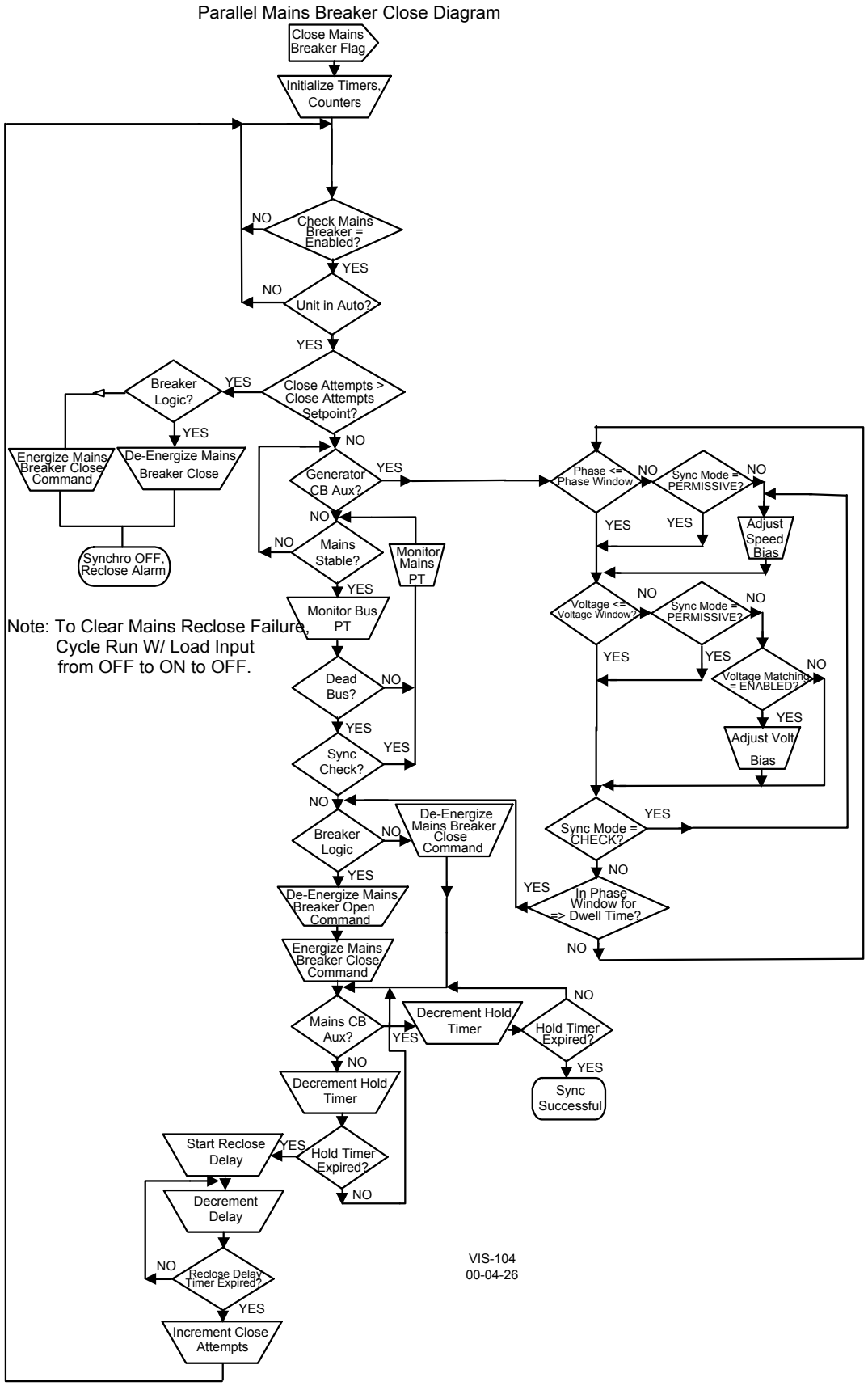


Figure 7-12. Mains Breaker Close Sequence (Mains Parallel)

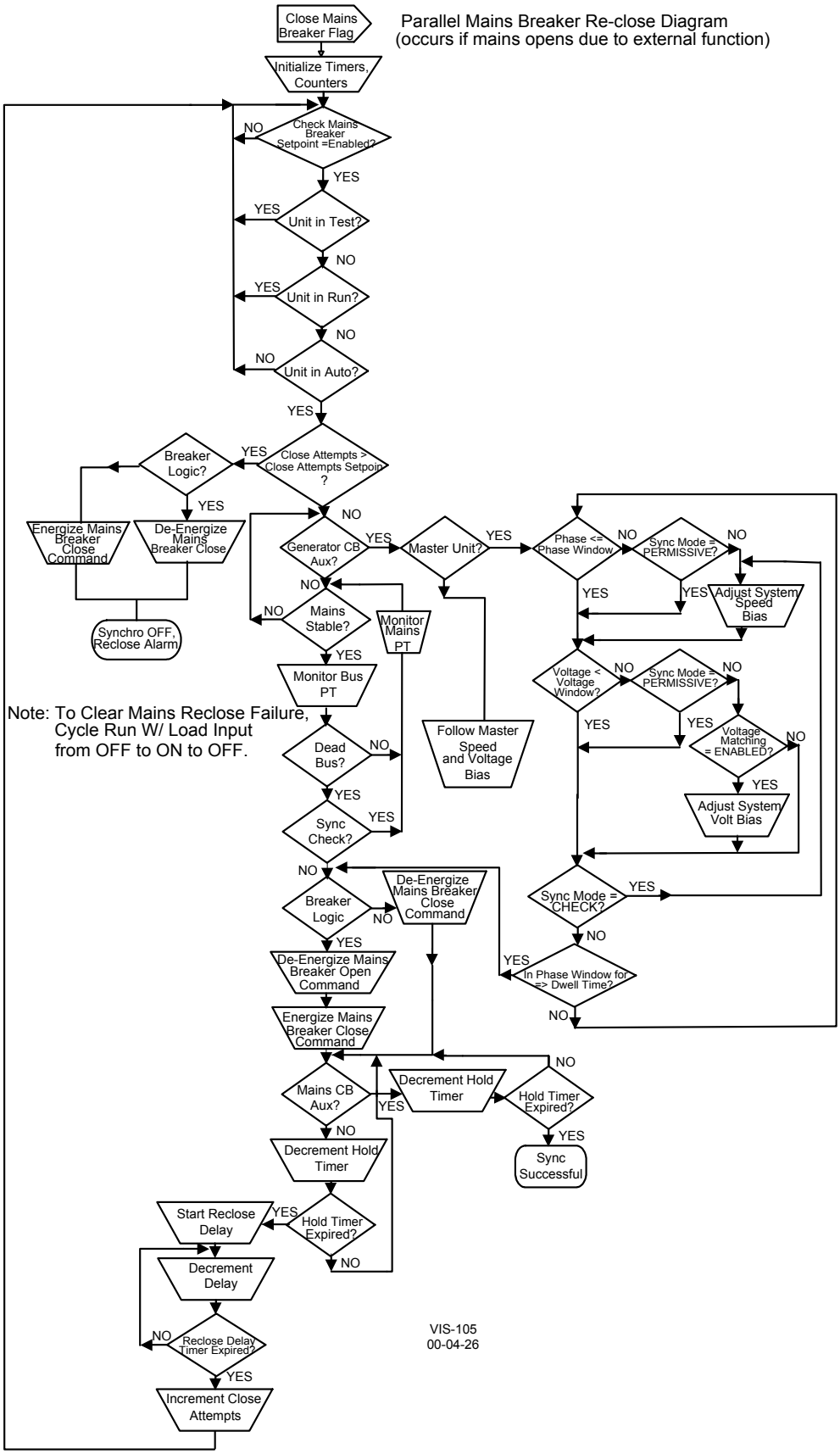


Figure 7-13. Mains Breaker Reclose Sequence (Mains Parallel)

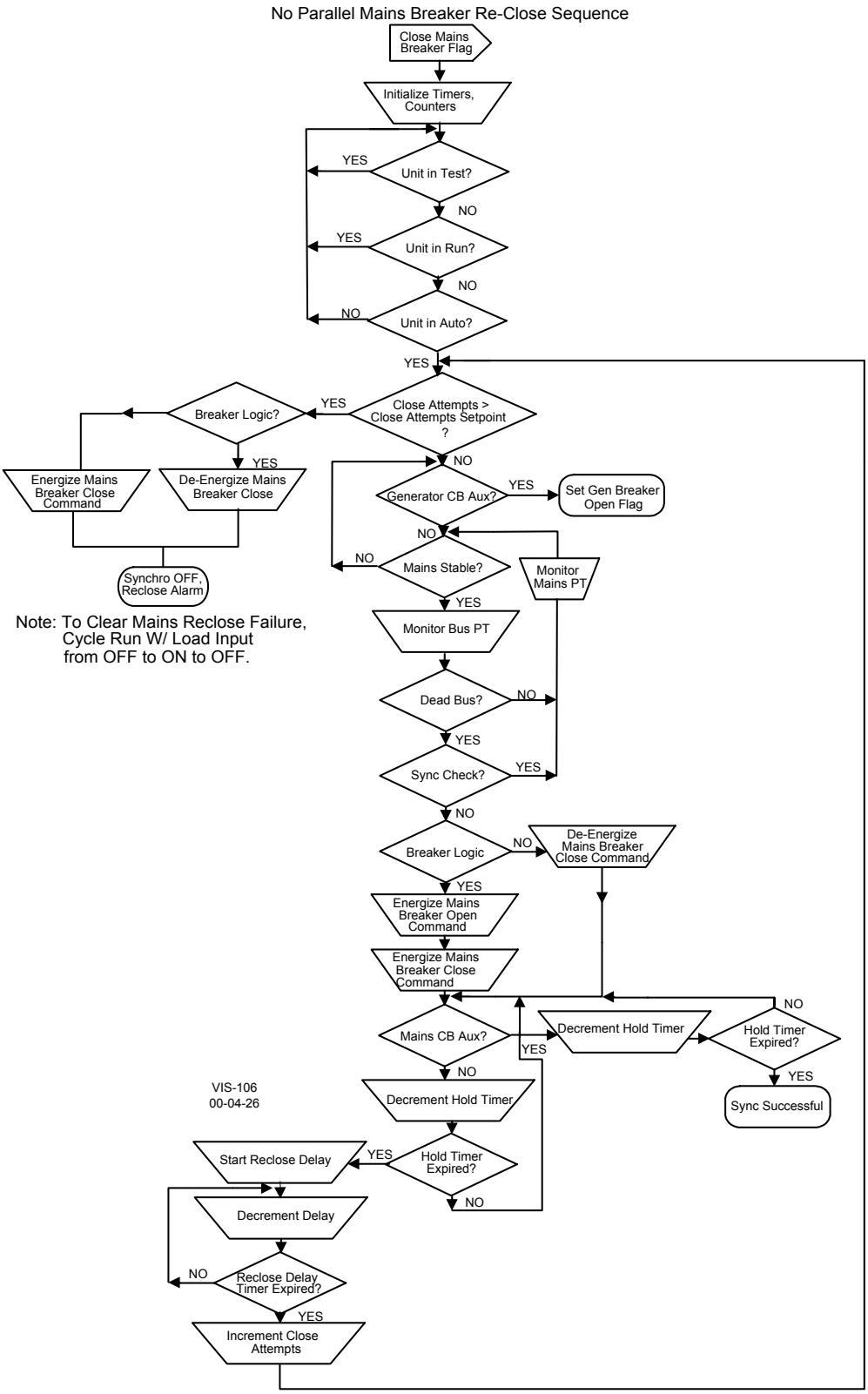


Figure 7-14. Mains Breaker Reclose Sequence (No Parallel)

Switch Based Logic
(Speed Raise/Lower Contact Functionality)

GEN BRKR	TIE BRKR	PROCESS	
	X	X	SPEED BIAS RAISE & LOWER *
1		X	DISABLED
1	1		BASELOAD SETPOINT RAISE & LOWER *
1	1	1	PROCESS SETPOINT RAISE & LOWER *

1 = Breaker/Contact closed
X = Breaker/Contact open or closed
*** = If both the Raise & Lower contacts are closed at the same time all functionality is disabled.**

Figure 7-15. Speed Raise/Lower Switch Based Logic

Switch Based Logic
(Voltage Raise/Lower Contact Functionality)

GEN BRKR	TIEBREAKER	
	X	VOLTAGE BIAS RAISE & LOWER *
1		DISABLED
1	1	UNIT VAR/PF SETPOINT RAISE & LOWER*

1 = Breaker/Contact closed
X = Breaker/Contact open or closed
*** = If both the Raise & Lower contacts are closed at the same time all functionality is disabled.**

Figure 7-16. Voltage Raise/Lower Switch Based Logic

Chapter 8.
Manual Operation

Manual (Droop) operation

Manual operation is obtained by selecting the Test or Run with Load discrete inputs, with the EGCP-2 in either:

1. Configured Droop
    a. In “Real Load Control” menu
        i. “Load Control Mode” is set for KW Droop
    b. The EGCP-2 is operated with Discrete Input # 8, Generator Breaker Aux Contact, being closed when connected to a load or the mains (utility).

2. Manual Droop
    a. In “Real Load Control” menu
        i. “Load Control Mode” is set for Normal or Soft Transfer
    b. The EGCP-2 is operated with Discrete Input # 8, Generator Breaker Aux Contact, being kept open when connected to a load or the mains (utility).

Discrete Input #1, Automatic mode, *cannot be closed* for Manual operation.

Manual Operation – Configured Droop

1. TEST, Discrete Input #2, or RUN with LOAD, Discrete input #3, is selected
    a. The EGCP-2 goes through the start sequence.
    b. The operator can manually raise and lower the speed and voltage.
    c. The generator breaker (G52) can be manually closed.
        i. Discrete Output #10, “Generator Breaker Trip (open)”, will stay in the Trip position. The user must wire around the Trip command in order to manually close the breaker.
    d. The EGCP-2 can be in a single or multiple unit / Mains Parallel
    e. Mains is Stable
    f. Mains Breaker is closed
    g. Unit operates in KW Droop
        i. Adjust Load with Speed Raise and Lower inputs
        ii. Adjust Power Factor with Voltage Raise and Lower inputs
    h. Unload Generator
    i. Open Generator Breaker Externally (Manually)
    j. Open Test or Run with Load input
    k. Engine will “cool down” and then shutdown
2. Shutdowns and Alarms
    a. The EGCP-2 does NOT control the Generator Breaker when in a Manual operating mode. This means that during a Soft or Hard shutdown sequence, the EGCP-2 cannot open the Generator Breaker (G52).
    b. A Soft or Hard shutdown command will react the same.

3. Operating Information
    a. The Generator Breaker can be manually closed before the "Generator Stable Delay" time is reached.
    b. If the Test or Run with Load input is opened BEFORE the generator breaker is closed, the engine will shutdown.
    c. If the Test or Run with Load input is opened AFTER the generator breaker is closed – Nothing Changes
        i. Engine mode stays in RUN
        ii. Operating State is Manual
        iii. Load Control State is KW Droop
        iv. The operator can still adjust the Load and PF using the speed and voltage raise and lower inputs
    d. When the Generator Breaker is opened, the speed and voltage bias will be reset to there "0" bias points.
    e. If the AUTO input is closed, with the Test input or no input the "Operating State" changes to AUTO. The "Load Control State" remains in KW Droop
    f. If the AUTO input is closed with the Run with Load input the "Operating State" changes to AUTO. The "Load Control State" remains in KW Droop
        i. The "Generator Breaker Trip (open)" output will energize and be in the "close" position. If the manual override of the generator breaker trip (open) is now removed, the EGCP-2 will control the opening of the generator breaker. This allows the soft and hard shutdowns in the EGCP-2 to be fully functional.

Manual Operation – Manual Droop

1. TEST, Discrete Input #2, or RUN with LOAD, Discrete Input #3, is selected
    a. The EGCP-2 goes through the start sequence
    b. The operator can manually raise and lower the speed and voltage
    c. The generator breaker (G52) can be manually closed
        i. Discrete Output #10, "Generator Breaker Trip (open)", will stay in the Trip position. The user must wire around the Trip command in order to manually close the breaker.
    d. The EGCP-2 can be in a single or multiple unit / Mains Parallel
    e. Mains is stable
    f. Mains Breaker is closed
    g. Unit operates in KW Droop
        i. Adjust Load with Speed Raise and Lower inputs
        ii. Adjust Power Factor with Voltage Raise and Lower inputs
    h. Unload Generator
    i. Open Generator Breaker Externally (Manually)
    j. Open Test or Run with Load input
    k. Engine will "cool down" and then shutdown

2. Shutdowns and Alarms
    a. The EGCP-2 does NOT control the Generator Breaker when in a Manual operating mode. This means that during a Soft or Hard shutdown sequence, the EGCP-2 cannot open the Generator Breaker (G52).
    b. A Soft or Hard shutdown command will react the same.
3. Operating Information
    a. The Generator Breaker can be manually closed before the "Generator Stable Delay" time is reached.
    b. If the Test or RUN with LOAD input is opened BEFORE the generator breaker is closed, the engine will shutdown.
    c. If the TEST or RUN with LOAD input is opened AFTER the generator breaker is closed - the EGCP2
        i. Engine State changes from "Run" to "Cool Down" or "Shutdown"
            1.) This resets the "Speed Bias" and 'Voltage Bias" to there "0" bias points.
            2.) Depending on where the "0" speed bias was set, the generator set could start to Load or Unload.
            3.) When the Engine State goes to "Shutdown"
                i.) The Fuel Solenoid output will de-energize and the engine will be in a Reverse Power state. At this point the EGCP2 cannot open the generator breaker.
        ii. Operating State will remain in Manual
        iii. Load Control State is KW Droop
        iv. The operator should open the generator breaker if in this state.
    d. If the AUTO input is closed with the TEST input already closed
        i. The Operating State changes to AUTO
        ii. The Load Control State remains KW Droop
        iii. The operator can still adjust the Load and PF using the speed and voltage raise and lower inputs.
    e. If the AUTO input is closed with the RUN with LOAD input already closed
        i. The Operating State changes to AUTO
        ii. The Load Control State remains KW Droop
        iii. The EGCP-2 will Synchronize and give Breaker Close commands until a Synch Reclose Alarm is gotten. The "Generator Breaker Trip (open)" output will be in the Trip position.

Chapter 9.
EGCP-2 Communications

Overview

This Chapter is the MODBUS addresses for the following part numbers.

EGCP-2	Software
8406-115	5418-002 NEW, A, & B
8406-116	5418-002 NEW, A, & B

To view the software version in the EGCP-2:
1. Select **Config** key on front panel
2. The right side of the display will say **Security Code**
3. Select **Enter** key on front panel
4. The software version will be displayed on the **bottom of the right side of the display**

The EGCP-2 panel RS-422 port protocol may be selected for Modbus RTU or ServLink protocol, which uses an open protocol used by many third party software manufacturers, or UPLOAD SETPOINTS, which allows a setpoint transfer to and from the EGCP-2.

To select which protocol will be used, enter the configuration menu of the EGCP-2 panel using the proper software password, and scroll to the menu item labeled: 422 Protocol. The selections under this menu item are:
1. Modbus
2. Upload Setpoints
3. ServLink

NOTE
Whenever the 422 Protocol setpoint is changed, the EGCP-2 panel must be powered down, then powered up again, to reset to the proper protocol.

If ServLink is chosen for the protocol selection, the EGCP-2 panel will communicate in the ServLink protocol. Woodward Governor Company's ServLink communications protocol is a proprietary DDE interface to the EGCP-2 Control. This interface allows access to readout and setpoint variables in the unit. ServLink software must be purchased from Woodward, or its distributors, and resident on the host computer in order to access the EGCP-2 data over the RS-422 communication port. For more information about Woodward products, which use ServLink, contact your local Woodward Distributor.

If Modbus is chosen, the EGCP-2 panel will communicate in MODBUS RTU protocol, and make its information available according to the address list as shown in Table 9-2. Also, the Modbus Address, Modbus Time-out, and Modbus Reset menu items become functional when the 422 Protocol is set to Modbus.

NOTE

If Upload Setpoints is chosen, the EGCP-2 panel will switch to a communications mode where it is waiting to see characters on the 422 serial ports that set it to transfer the contents of the setpoint file to the PC. This task is run on the PC using the Download_D.exe DOS program. The Download_D.exe program is available for download on Woodward's Internet web page.
1) Go to www.woodward.com/software.
2) In the box, select EGCP-2 Tools for all EGCP-2 related software available at present time.

Modbus RTU Communications for the EGCP-2 Panel

The Modbus ID configuration menu item is adjustable from 1 to 247. This address identifies the Modbus Slave to the Modbus Master using this address. The Modbus address chosen for any particular EGCP-2 panel should be unique from any other devices on the Modbus network.

NOTE

The Network Address of the EGCP-2 panel is not linked to the Modbus ID in any way.

Modbus Time-out is located in the Sequencing and Comms configuration menu. This item is the time, in seconds, which the EGCP-2 panel will wait before either receiving a valid message from the Modbus master, or indicating a Modbus failure. The EGCP-2 panel indicates a Modbus failure in the bottom two lines of the Modbus Timeout and Modbus Reset Sequencing and Comms configuration menu items. This display shows Link failure (failure to receive a valid message from the master) as true/false, and an error number, which is associated with the type of failure. For example LF-XF 0 is the indication of a healthy Modbus connection with a Link failure of False and a failure number of 0. The Link failure is a latching-type indication, and requires the Modbus Reset menu item to be toggled from True to False in order to reset. See Table 9-3 for a list of common error numbers that may be seen in the Load Control Monitor Display.

The Modbus Reset is located in Sequencing and Comms configuration menu. It is used to reset any failures indicated on the Modbus serial communications, and also to restart the Modbus Time-out timer from zero seconds. The Modbus Reset should be left at FALSE, and only turned to TRUE to provide a reset action on the Modbus. Once the reset is accomplished, the Modbus Reset must be taken back to False once again.

The Modbus communications used by the EGCP-2 panel operate at 9600 baud, with 8 data bits, 1 stop bit, NO parity, and NO flow control. The protocol used is Modbus RTU (Master/Slave).

Reply Time-out, Delay, and Number of Retries for the Modbus Master must be configured to meet the requirements of the entire Modbus network and the devices communicating on that network. See Table 9-4 for more information on typical settings.

Modbus Information

Addresses 00001–00016 Boolean Writes

The Boolean write variables can be used for remote control of the EGCP-2 over Modbus. Fourteen variables are available to mimic the fourteen discrete input switches. The Gen CB Aux input and Mains CB Aux input are not included in the Modbus addresses. They must be hard wired to the control.

If remote control is desired the control must first be placed in the "Modbus Control Mode". The Auto, Test, and Run With Load inputs are used to determine whether the control is in the Modbus control or Hardware control mode. To activate the Modbus mode all three of the addresses 00001, 00002, and 00003 must be set. It is not required that these Modbus inputs be different than the actual hardware inputs, but all three must be set before any remote control can take place. For example, if the Auto, Test, and Run With Load inputs were all open, the user could send a False command to the addresses 00001, 00002, and 00003 and the control would switch from the Hardware control mode to Modbus control, but no action would take place. Table 9-1 shows some examples of how this switching takes place.

Table 9-1. Examples of Modbus Control Mode Switching Logic

Starting Mode	Auto Input 1	Test Input 2	Run WL Input 3	Auto 00001	Test 00002	Run WL 00003
Hardware	Open	Open	Open	Set to False	Set to False	Set to False
Result	All three Modbus commands were sent so the Control mode changes from Hardware to Modbus. No action is taken because the control remains in the OFF mode.					
Hardware	Open	Open	Open	Set to False	Set to True	Set to False
Result	All three Modbus commands were sent so the Control mode changes from Hardware to Modbus. The Test input is set to True so the control will go into the TEST mode and the engine will start. If the Modbus commands were sent one at a time in the order of Auto, Test, Run WL, it would be after the Run WL input was sent that the engine would start, because it was the third one required, not after the Test input was set True.					
Modbus	Open	Open	Open	Set to True	False	False
Result	Modbus control has already been established. None of the discrete inputs change, so the unit is placed in the AUTO mode.					
Modbus	Open	Open to close	Open	True	False	False
Result	Modbus control was established in the AUTO mode, and the Test hardware input was closed. This will switch the control into the Hardware control mode. The unit would go in to the TEST mode and would start.					
Modbus	Open to close	Open	Open	True	False	False
Result	Modbus control has already been established. The Auto hardware input was closed. Since the hardware now matches the Modbus, no action is taken. The control remains in the Modbus mode until the switch configuration is made different from the Modbus inputs.					

Once Modbus control has been established, the Modbus inputs can be viewed on the I/O Status screen. There is no indication that the control has seen three successful Modbus input messages.

The four momentary switch inputs to the EGCP-2 (Voltage Raise/Lower, Speed Raise/Lower) are internally (EGCP-2 software) timed to open after a one second ON time.

This means that if the EGCP-2 receives an ON command via Modbus for any of these four switches, the unit will turn the switch ON for one second, and then turn the input OFF. If the Modbus update for the ON command occurs again within the one-second period, the EGCP-2 will continue holding the switch ON until one second after the last active Modbus On update is received.

Addresses 10001–10071 Boolean Read
The Boolean Read variables are True/False inputs that show the positions of the hardware, the alarm status, and some system status readings.

Boolean Read one (10001) will be true whenever the control is switching between the Mains and Bus PT's via the PT disconnect relays.

For the engine and generator alarms, variables 34 through 62 (10034–10062), these will only go true after the delay time has been satisfied and will remain true until the alarm is cleared from the alarm log. If the corresponding alarm is set to the Disable level, it will not be seen in the Modbus variable.

Boolean Read 71 (10071), PF indication will be True to indicate a leading voltage and False to indicate a lagging voltage.

Addresses 30001–30073 Analog Read
The Analog Read variables are numeric representations showing the measured values of the control inputs, the alarm level type, and the mode of operation for certain functions of the control.
These values use a signed integer format that does not support decimal places. In order to view the decimal places on certain variables the value is multiplied by a scaling variable.

For analog reads 20 through 48 (30020–30048), the engine and generator alarm types, the alarm type is defined as follows:
0 = Disabled
1 = Warning
2 = Visual Alarm
3 = Audible Alarm
4 = Soft Shutdown
5 = Hard Shutdown

For analog reads 49 through 53 (30049–30053), the Loss Of Mains Alarms, the alarm type is defined as follows:
0 = Disabled
1 = Warning
2 = Loss of Mains
3 = Loss of Mains with Alarms

For the analog read 67, the Load Control Mode, the mode is defined as follows:
0 = Off
1 = Droop (Generator frequency will decrease as load is increased)
2 = Isochronous (On load, not in parallel with the Mains)
3 = Baseload (In parallel with the Mains, at a fixed kW setpoint)
4 = Process (In parallel with the Mains, controlling the process input)

For the analog read 68, the Synchronizer Mode, the mode is defined as follows:
0 = Off
1 = ATS (Auto Transfer State. Trying to open the Mains breaker
2 = Parallel (Trying to close Mains breaker)
3 = In Sync (Gen breaker or Mains breaker was synchronized successfully.)
4 = ATS Return (Trying to Open Gen breaker)
5 = Parallel Mains (Trying to Close Mains breaker)
6 = Gen Close Timer (Gen breaker close issued, waiting for feed back to show closed)
7 = Mains Close Timer (Mains breaker close issued, waiting for feed back to show closed)
8 = Gen Sync Timer (checking for successful synchronization of the generator)
9 = Mains Sync Timer (checking for successful synchronization of the Mains breaker)

For the analog read 71 (30071), the Address of the Master Unit, is only valid on controls that are in the Auto mode. Units not in Auto are not communicating with the master and cannot be relied upon.

For the analog read 72 (30072), the Engine state the state is defined as follows:
1 = Off
2 = Preglow
3 = Crank
4 = Run
5 = Cooldown (engine has ran above the Cooldown setpoint and will wait before stopping)
6 = Spindown (fuel solenoid is open but engine speed is still sensed as the engine coasts down)
7 = Restart (previous start attempt has failed, so trying again.)

For the analog read 73 (30073), the Synchroscope Phase Angle, will give a value between –180 and 180 degrees. Zero degrees would be in phase, negative measurements occur when in the right half of the synchroscope, and positive measurements occur when in the left half of the synchroscope. For example, if the synchroscope were showing a rotation in the clockwise direction for a generator that was slightly faster than the bus the sequence of angles would be 0, -30, -60, -90, -120, -150, 180, 150, 120, 90, 60, 30, 0…

Address 40001 Analogs Write
The Analog Write variable can be used to change the priority of the EGCP-2 over Modbus.

To change the priority the unit must be in the AUTO mode. When multiple units are in Auto the following rules apply to changing the priority.

When decreasing (incrementing value) a unit's priority, every active unit (in multiple unit configuration and auto mode) on the same network with a higher priority (lower value) than the unit, which is currently having its priority, changed, will increase (decrement value) priority when the priority change is committed.

And inverse to this:
When increasing (decrementing value) a unit's priority, every active unit (in multiple unit configuration and auto mode) on the same network with a lower priority (higher value) than the unit, which is currently having its priority, changed, will decrease (increment value) priority when the priority change is committed.

A delay occurs after a priority change of master units to allow proper record sorting for all units on the network.

Table 9-2. Modbus Addresses for the RTU Protocol

Address	Data Type/Scaling	Description
00001	BW	Change Input #1 (Auto)
00002	BW	Change Input #2 (Test)
00003	BW	Change Input #3 (Run With Load)
00004	BW	Change Input #4 (Voltage Raise)
00005	BW	Change Input #5 (Voltage Lower)
00006	BW	Change Input #6 (Speed Raise)
00007	BW	Change Input #7 (Speed Lower)
00008	BW	Change Input #10 (Process I/E)
00009	BW	Change Input #11 (Fault #1)
00010	BW	Change Input #12 (Fault #2)
00011	BW	Change Input #13 (Fault #3)
00012	BW	Change Input #14 (Fault #4)
00013	BW	Change Input #15 (Fault #5)
00014	BW	Change Input #16 (Fault #6)
00015	BW	Not Used
00016	BW	Commit All Alarms

Address	Data Type/Scaling	Description
10001	BR	Bus/Mains PT Switch in Transition
10002	BR	Mains Stable Indication
10003	BR	Bus Stable Indication
10004	BR	Alarm Status
10005	BR	Loss of Mains Status
10006	BR	Relay #1 (Mains Brk Close) Status
10007	BR	Relay #2 (Gen Brk Close) Status
10008	BR	Relay #3 (Engine Preglow) Status
10009	BR	Relay #4 (Fuel Solenoid) Status
10010	BR	Relay #5 (Engine Crank) Status
10011	BR	Relay #6 (Visual Alarm) Status
10012	BR	Relay #7 (Bus PT Connect) Status
10013	BR	Relay #8 (Mains PT Disconnect) Status
10014	BR	Relay #9 (Mains Brk Trip) Status
10015	BR	Relay #10(Gen Brk Trip) Status
10016	BR	Relay #11(Audible Alarm) Status
10017	BR	Relay #12 (Idle/Rated) Status
10018	BR	Input #1 Status (Auto)
10019	BR	Input #2 Status (Test)
10020	BR	Input #3 Status (Run with Load)
10021	BR	Input #4 Status (Voltage Raise)
10022	BR	Input #5 Status (Voltage Lower)
10023	BR	Input #6 Status (Speed Raise)
10024	BR	Input #7 Status (Speed Lower)

Address	Data Type/Scaling	Description
10025	BR	Input #8 Status (Gen CB Aux.)
10026	BR	Input #9 Status (Mains CB Aux.)
10027	BR	Input #10 Status (Process I/E)
10028	BR	Input #11 Status (Fault #1)
10029	BR	Input #12 Status (Fault #2)
10030	BR	Input #13 Status (Fault #3)
10031	BR	Input #14 Status (Fault #4)
10032	BR	Input #15 Status (Fault #5)
10033	BR	Input #16 Status (Fault #6)
10034	BR	SYNC TIMEOUT Status
10035	BR	SYNC RECLOSE Status
10036	BR	CRANK_FAIL Status
10037	BR	VOLTAGE_RANGE Status
10038	BR	OVERSPEED Status
10039	BR	OVERCURRENT Status
10040	BR	REVERSE POWER Status
10041	BR	LOSS OF EXCITATION Status
10042	BR	SPEED_FREQ_MISMATCH Status
10043	BR	H2O_HIGH_LIMIT Status
10044	BR	H2O_LOW_LIMIT Status
10045	BR	OIL PRESS HIGH LIMIT Status
10046	BR	OIL PRESS LOW LIMIT Status
10047	BR	BATT VOLT LOW LIMIT Status
10048	BR	BATT VOLT HIGH LIMIT Status
10049	BR	GEN_VOLT_LOW_LIMIT Status
10050	BR	GEN_VOLT_HIGH_LIMIT Status
10051	BR	GEN_FREQ_HIGH_LIMIT Status
10052	BR	GEN FREQ LOW LIMIT Status
10053	BR	LOAD HIGH LIMIT Status
10054	BR	LOAD LOW LIMIT Status
10055	BR	PROCESS_HIGH_LIMIT Status
10056	BR	PROCESS_LOW_LIMIT Status
10057	BR	REMOTE_FAULT1 Status
10058	BR	REMOTE FAULT2 Status
10059	BR	REMOTE FAULT3 Status
10060	BR	REMOTE FAULT4 Status
10061	BR	REMOTE_FAULT5 Status
10062	BR	REMOTE_FAULT6 Status
10063	BR	Not Used
10064	BR	Not Used
10065	BR	Not Used
10066	BR	Not Used
10067	BR	Not Used
10068	BR	Not Used
10069	BR	Not Used
10070	BR	Not Used
10071	BR	PF Leading/Lagging Indicator

NOTE: Analog inputs are signed integer data.

Address	Data Type/Scaling	Description
30001	AR X10	Battery Voltage
30002	AR X10	Engine Oil Pressure
30003	AR	Engine Coolant Temperature
30004	AR	Engine Run Time
30005	AR	Engine KW/Hours
30006	AR	Engine RPM
30007	AR	Phase A Volts
30008	AR	Phase B Volts
30009	AR	Phase C Volts

Address	Data Type/Scaling	Description
30010	AR	Total KW
30011	AR	Total KVA
30012	AR X100	Generator Power Factor
30013	AR	Phase A kVAR
30014	AR	Phase B kVAR
30015	AR	Phase C kVAR
30016	AR	Total kVAR
30017	AR X10	Bus Output Frequency
30018	AR X10	Generator Output Frequency
30019	AR	Network Address
30020	AR	SYNC_TIMEOUT Alarm Type
30021	AR	SYNC_RECLOSE Alarm Type
30022	AR	CRANK_FAIL Alarm Type
30023	AR	VOLTAGE_RANGE Alarm Type
30024	AR	OVERSPEED Alarm Type
30025	AR	OVERCURRENT Alarm Type
30026	AR	REVERSE_POWER Alarm Type
30027	AR	LOSS_OF_EXCITATION Alarm Type
30028	AR	SPEED_FREQ_MISMATCH Alarm Type
30029	AR	H2O_HIGH_LIMIT Alarm Type
30030	AR	H2O_LOW_LIMIT Alarm Type
30031	AR	OIL_PRESS_HIGH_LIMIT Alarm Type
30032	AR	OIL_PRESS_LOW_LIMIT Alarm Type
30033	AR	BATT_VOLT_LOW_LIMIT Alarm Type
30034	AR	BATT_VOLT_HIGH_LIMIT Alarm Type
30035	AR	GEN_VOLT_LOW_LIMIT Alarm Type
30036	AR	GEN_VOLT_HIGH_LIMIT Alarm Type
30037	AR	GEN_FREQ_HIGH_LIMIT Alarm Type
30038	AR	GEN_FREQ_LOW_LIMIT Alarm Type
30039	AR	LOAD_HIGH_LIMIT Alarm Type
30040	AR	LOAD_LOW_LIMIT Alarm Type
30041	AR	PROCESS_HIGH_LIMIT Alarm Type
30042	AR	PROCESS_LOW_LIMIT Alarm Type
30043	AR	REMOTE_FAULT1 Alarm Type
30044	AR	REMOTE_FAULT2 Alarm Type
30045	AR	REMOTE_FAULT3 Alarm Type
30046	AR	REMOTE_FAULT4 Alarm Type
30047	AR	REMOTE_FAULT5 Alarm Type
30048	AR	REMOTE_FAULT6 Alarm Type
30049	AR	LOAD_SURGE Alarm Type
30050	AR	MAINS_VOLT_LOW_LIMIT Alarm Type
30051	AR	MAINS_VOLT_HIGH_LIMIT Alarm Type
30052	AR	MAINS_FREQ_HIGH_LIMIT Alarm Type
30053	AR	MAINS_FREQ_LOW_LIMIT Alarm Type
30054	AR	Generator Phase A/Neutral Volts
30055	AR	Generator Phase B/Neutral Volts
30056	AR	Generator Phase C/Neutral Volts
30057	AR	Mains/Bus Phase A/Neutral Volts
30058	AR	Phase A current
30059	AR	Phase B current
30060	AR	Phase C current
30061	AR	Phase A KVA
30062	AR	Phase B KVA
30063	AR	Phase C KVA
30064	AR	Voltage Bias Analog Output (0-100%)
30065	AR	Speed Bias Analog Output (0-100%)
30066	AR	Load Control Mode
30067	AR	Synchronizer Mode
30068	AR	Number of Unacknowledged Alarms
30069	AR	Unit Network Priority

Address	Data Type/Scaling	Description
30070	AR	Address of Master Unit.
30071	AR	Not Used
30072	AR	Engine State.
30073	AR	Synchroscope Phase Angle

Address	Data Type/Scaling	Description
40001	AW 1 to 8	Priority Change Address

Table 9-3. Common Modbus Error Numbers

CODE	Name	Meaning
00	NO ERROR	No Modbus communication faults detected.
01	Illegal Function	The function received is not an allowable action for the addressed slave.
02	Illegal Data Address	The address referenced in the data field is not an allowable address for the addressed slave.
03	Illegal Data Value	The amount of data requested from the slave was too large for the slave to return in a single response.
09	Checksum Error	There was an error in the message checksum. This can indicate link quality problems and/or noise on the line.
10	Garbled Message	The slave received data, however it is too short to be a valid Modbus message/command.
12	Buffer Overflow	Input buffer overflow. This indicates that the length of the received message from the master has exceeded the input buffer capacity of the EGCP-2. Reduce message sizes to correct.
20	Unsolicited Response	Unsolicited message received by the slave.

Table 9-4. Typical Modbus Communications Settings

Poll Time	Number of Retries	Retry Delay	Timeout
1.0 seconds	3	1.0 second*	10 seconds

1 second is the minimum recommended retries delay time. Setting the retry delay to less than one second may cause the control to fail to boot up properly upon a power cycle.

NOTE

Communications settings will vary based on the Modbus system configuration. These settings are the recommended typical settings for a multiple unit EGCP-2 system connected to Modbus master.

Chapter 10.
Service Options

Product Service Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact the manufacturer or packager of your system.
- Contact the Woodward Full Service Distributor serving your area.
- Contact Woodward technical assistance (see "How to Contact Woodward" later in this chapter) and discuss your problem. In many cases, your problem can be resolved over the phone. If not, you can select which course of action to pursue based on the available services listed in this chapter.

OEM and Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.
- A **Recognized Engine Retrofitter (RER)** is an independent company that does retrofits and upgrades on reciprocating gas engines and dual-fuel conversions, and can provide the full line of Woodward systems and components for the retrofits and overhauls, emission compliance upgrades, long term service contracts, emergency repairs, etc.
- A **Recognized Turbine Retrofitter (RTR)** is an independent company that does both steam and gas turbine control retrofits and upgrades globally, and can provide the full line of Woodward systems and components for the retrofits and overhauls, long term service contracts, emergency repairs, etc.

A current list of Woodward Business Partners is available at **www.woodward.com/support**.

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 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.

CAUTION—ELECTROSTATIC DISCHARGE

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

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 and reference **www.woodward.com/support**, and then ***Customer Support***.

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
Australia	+61 (2) 9758 2322
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany:	
Kempen	+49 (0) 21 52 14 51
Stuttgart	+49 (711) 78954-0
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 12 618 92 00
United States	+1 (970) 482-5811

Engine Systems

Facility	Phone Number
Australia	+61 (2) 9758 2322
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany:	
Stuttgart	+49 (711) 78954-0
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Turbine Systems

Facility	Phone Number
Australia	+61 (2) 9758 2322
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
United States	+1 (970) 482-5811

You can also contact the Woodward Customer Service Department or consult our worldwide directory on Woodward's website (**www.woodward.com/support**) for the name of your nearest Woodward distributor or service facility.

For the most current product support and contact information, please refer to the latest version of publication **51337** at **www.woodward.com/publications**.

Technical Assistance

If you need to telephone for technical assistance, you will need to provide the following information. Please write it down here before phoning:

General

Your Name_____
Site Location_____
Phone Number_____
Fax Number_____

Prime Mover Information

Engine/Turbine Model Number_____
Manufacturer_____
Number of Cylinders (if applicable)_____
Type of Fuel (gas, gaseous, steam, etc)_____
Rating_____
Application_____

Control/Governor Information

Please list all Woodward governors, actuators, and electronic controls in your system:

Woodward Part Number and Revision Letter _____
Control Description or Governor Type _____
Serial Number _____

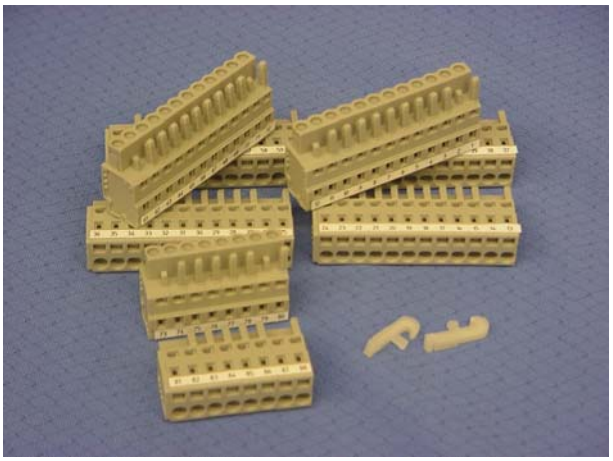
Woodward Part Number and Revision Letter _____
Control Description or Governor Type _____
Serial Number _____

Woodward Part Number and Revision Letter _____
Control Description or Governor Type _____
Serial Number _____

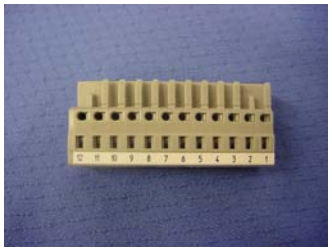
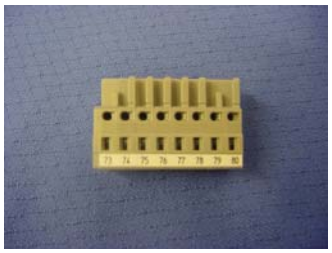
If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

Appendix A.
Connector Information

Wago pluggable style terminal blocks are used on the EGCP-2 to connect the field wiring to the control. THESE CONNECTORS ARE NOT INCLUDED WITH THE EGCP-2. Woodward carries the EGCP-2 connector kit, which contains all of the terminal blocks used on the EGCP-2 as part number 8928-301.



EGCP-2 Connector Kit

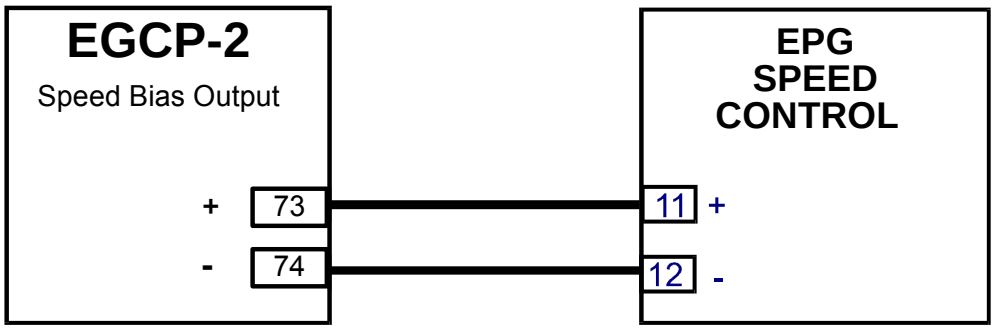
		Woodward P/N	WAGO P/N
	12 pole connector	1751-760	231-112/026-000
	8 pole connector	1751-756	231-108/026-000
	Levers	1751-899	231-131

Woodward provides labels (P/N 3061-303) only as part of the connector kit.

Recommended Wire Types:

Size	Insulation	Type	Use
0.3 mm²/ 22 AWG	600V	Multiple conductor, unshielded	Discrete I/O PT inputs
0.3 mm²/ 22 AWG	300V	Two conductor, shielded	Speed Bias, Voltage Bias, MPU, Oil and Water Sensors
1.0 mm²/ 16 AWG	600V	Four conductor stranded, unshielded	CT inputs
0.3 mm²/ 22 AWG	30V	Two conductor stranded, twisted pair, shielded, 124 Ω impedance	RS-485 RS-422 (TX and RX)

Appendix B.
Speed Bias Connections

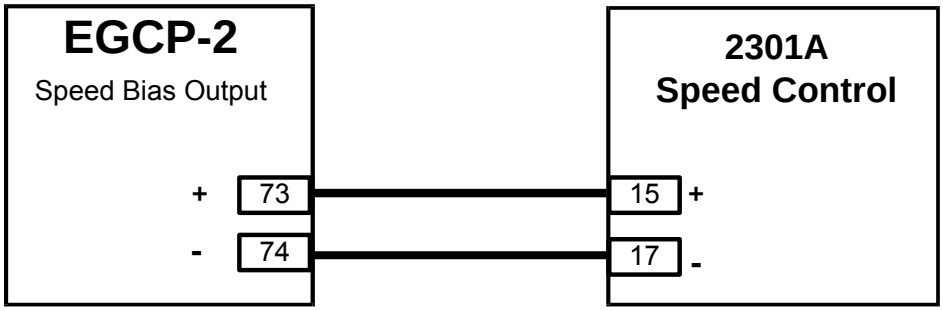


EGCP-2 To EPG Speed Control Wiring and Configuration Settings

VIS-125a
00-06-20

Speed Bias Output Type = +/- 3VDC
0% Speed Bias equals 0 volts DC (Factory set)

EPG Speed Controls (common numbers)
8290-184, 8290-185, 8290-186, 8290-187

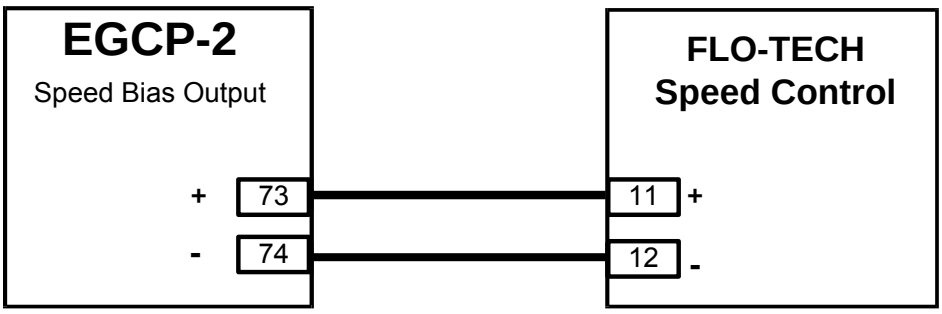


EGCP-2 To 2301A Speed Control Wiring and Configuration Settings

VIS-126a
00-06-20

Speed Bias Output Type = +/- 3VDC
0% Speed Bias Output = 0 VDC

Common 2301A Speed Control Part Numbers:
9905-131, 9905-376, 9907-014

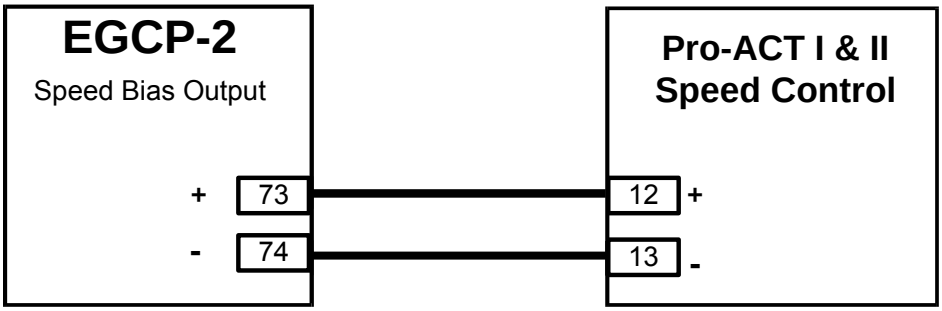


EGCP-2 To FLO-TECH Speed Control Wiring and Configuration Settings

VIS-127a
00-06-20

Speed Bias Output Type = +/- 3VDC
0% Speed Bias Output = 0 VDC

Common FLO-TECH Speed Control Part Numbers:
8290-195, 8290-196

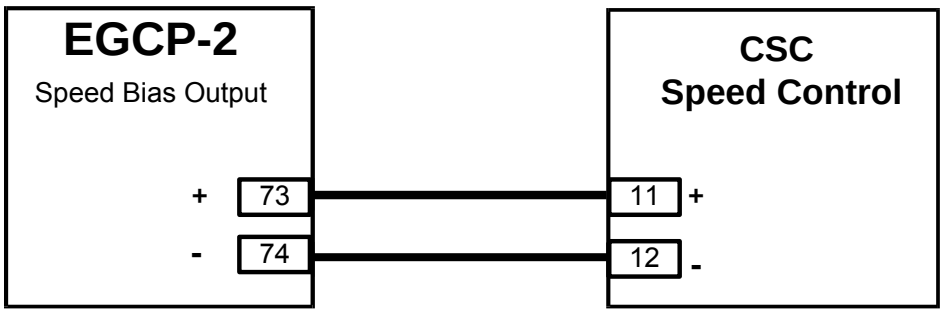


EGCP-2 To Pro-ACT Speed Control Wiring and Configuration Settings

VIS-128a
00-06-20

Speed Bias Output Type = +/- 3VDC
0% Speed Bias Output = 0 VDC

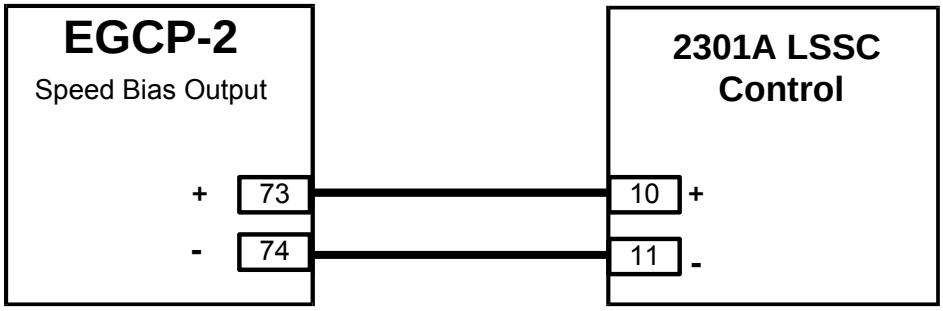
Common Pro-ACT Speed Control Part Numbers:
9905-462, 9905-463



EGCP-2 To CSC Speed Control Wiring and Configuration Settings

VIS-129a
00-06-20

Speed Bias Output Type = +/- 3VDC
0% Speed Bias Output = 0 VDC

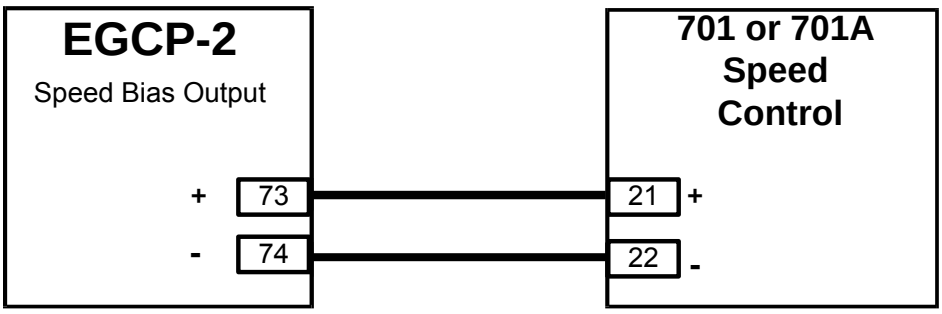


EGCP-2 To 2301A LSSC Wiring and Configuration Settings

VIS-130a
00-06-20

Speed Bias Output Type = +/- 3VDC
0% Speed Bias Output = 0 VDC

NOTE: 2301A LSSC must have terminal 14 powered for the load sharing line inputs (10 and 11) to be active.

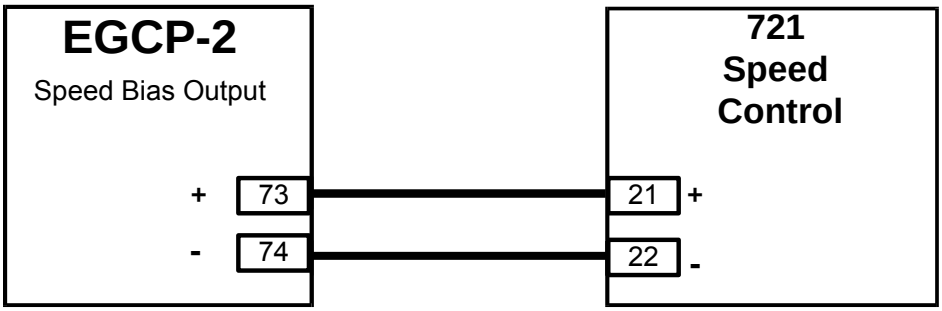


EGCP-2 To 701 and 701A Wiring and Configuration Settings

VIS-131a
00-06-20

Speed Bias Output Type = +/- 3VDC
0% Speed Bias Output = 0 VDC

Common 701 and 701A Speed Control Part Numbers:
8280-102, 8280-193, 9905-211

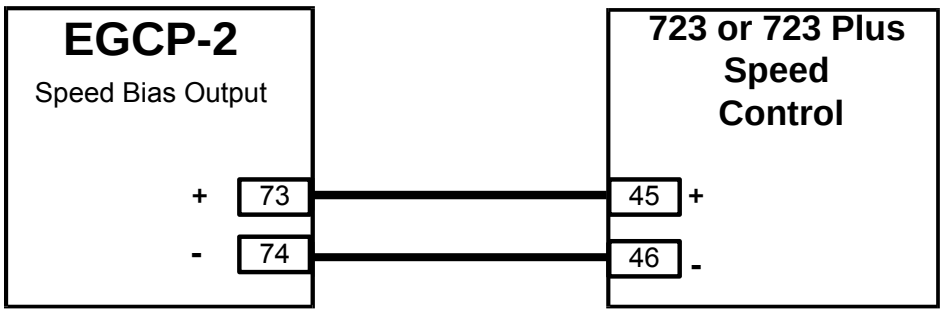


EGCP-2 To 701 and 701A Wiring and Configuration Settings

VIS-132a
00-06-20

Speed Bias Output Type = +/- 3VDC
0% Speed Bias Output = 0 VDC

Common 721 Speed Control Part Numbers:
9905-291, 9907-206, 9907-207



EGCP-2 To 723 or 723 Plus Wiring and Configuration Settings

VIS-133a
00-06-20

Speed Bias Output Type = +/- 3VDC
0% Speed Bias Output = 0 VDC

Common 723 or 723 Plus Speed Control Part Numbers:
9907-031, 8280-412

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name:	WOODWARD GOVERNOR COMPANY (WGC) Industrial Controls Group
Manufacturer's Address:	1000 E. Drake Rd. P.O. Box 1519 Fort Collins, CO USA 80525-1519
European Representative's Name:	WOODWARD GOVERNOR NEDERLAND BV
European Representative's Address:	Hoofdweg 601 P. O. Box 34 2130 AA Hoofddorp, The Netherlands
Model Name(s)/Number(s):	EGCP-2
Conformance to Directive(s):	89/336/EEC COUNCIL DIRECTIVE of 03 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility. 73/23/EEC COUNCIL DIRECTIVE of 19 February 1973 on the harmonization of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits.
Applicable Standards:	EN 50081-2, August 1993: EMC Generic Emission Standard, Part 2: Industrial Environment. EN 61000-6-2, April 1999: EMC Compatibility - Generic Standards - Immunity for Industrial Environments EN 50178, October 1997: Electrical equipment for use in power installations.

We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s).

MANUFACTURER

Jennifer R. Williams
Signature

Jennifer R. Williams
Full Name

Engineering Project/Process Mng.
Position

WGC, Fort Collins, CO, USA
Place

8-22-00
Date

Woodward Governor Company
Industrial Controls Group
Ft. Collins, Colorado, USA

EGCP-2 Control Specifications

Woodward Part Numbers:	
8406-115	EGCP-2 Engine Generator Control, 150–300 Vac PT input
8406-116	EGCP-2 Engine Generator Control, 50–150 Vac PT input
Power Supply Rating	9–32 Vdc (SELV) Maximum input voltage range
Power Consumption	Less than or equal 13 W nominal, 20 W maximum
Input Supply Voltage	Input Supply Current
12 V (nominal)	1.08 A
24 V (nominal)	542 mA
32 V	406 mA
PT input	50–150 Vac, 8406-116 150–300 Vac, 8406-115
CT input	0–5 A rms
Generator Frequency Range	40–70 Hz
Magnetic Pickup	100–15 000 Hz
Discrete Inputs (8)	5 mA source current when CLOSED to Switch Common (65)
Process input	4–20 mA, 1–5 Vdc
Temperature and pressure inputs	0–200 Ω sensors, 4–20 mA transducer, or 0–5V transducer
Speed Bias	±3 Vdc, 0.5–4.5 Vdc, 5 V peak 500 Hz PWM
Voltage Bias	±1 Vdc, ±3 Vdc, ±9 Vdc
Discrete Outputs (Relay Outputs)	10 A, 250 Vac Resistive 249 W (1/3 hp), 125 Vac (7.2 A, 0.4–0.5 PF) 10 A, 30 Vdc Resistive
Communication Ports	RS-485, RS-422
Ambient Operating Temperature	–20 to +70 °C (–4 to +158 °F)(around outside of EGCP-2 chassis)
Storage Temperature	–40 to +105 °C (–40 to +221 °F)
Humidity	95% at 20 to 55 °C (68 to 131 °F)
Mechanical Vibration	SV2 5–2000 Hz @ 4 G and RV1 10–2000 Hz @ .04 G^2/Hz
Mechanical Shock	US MIL-STD 810C, Method 516.2, Procedure I (basic design test), Procedure II (transit drop test, packaged), Procedure V (bench handling)
Equipment Classification	Class 1 (grounded equipment)
Air Quality	Pollution Degree II
Installation Overvoltage	Category III
Ingress Protection	Will meet the requirements of IP56 as defined in IEC529 when installed in a suitable atmospherically vented enclosure. Also meets Type 4 requirements.

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Send comments to: icinfo@woodward.com

Please include the manual number from the front cover of this publication.

WOODWARD

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2008/9/Fort Collins