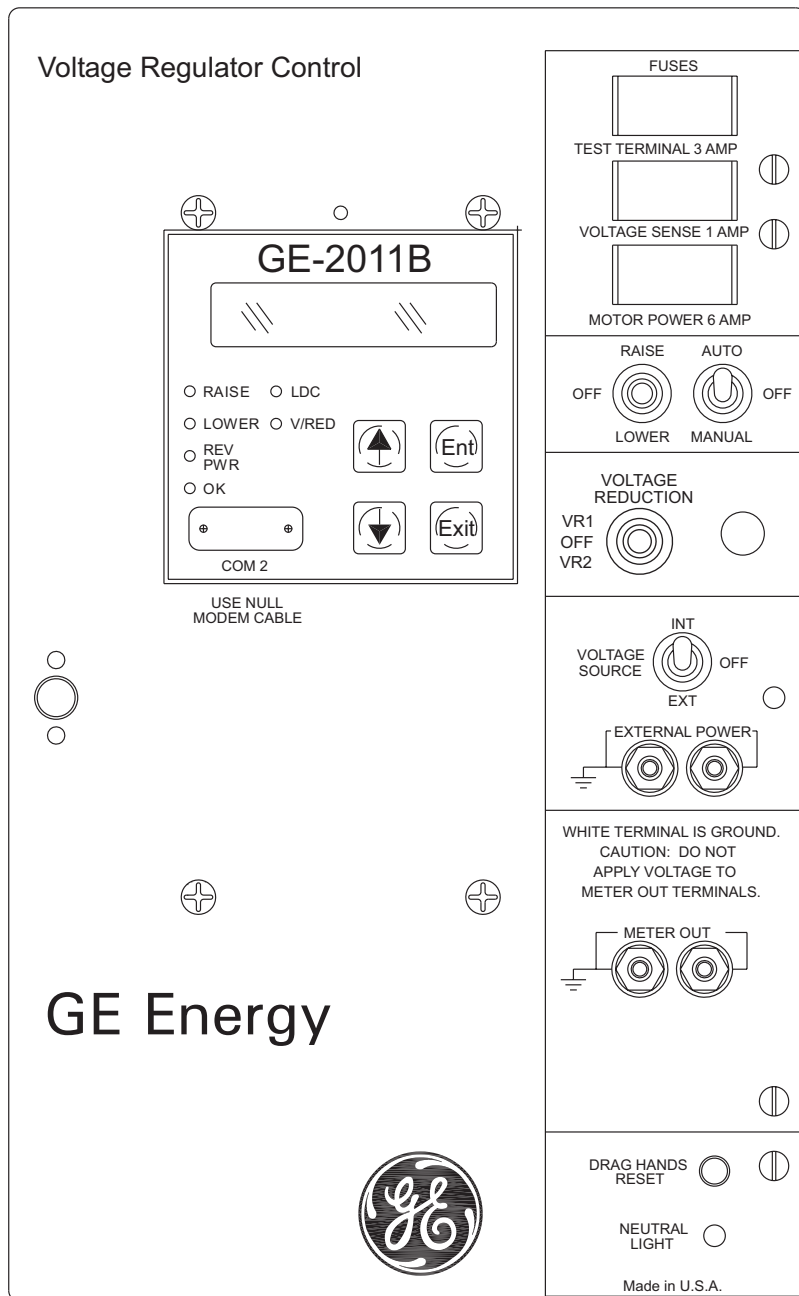




GE-2011B

Digital Tapchanger Control

Instruction Book

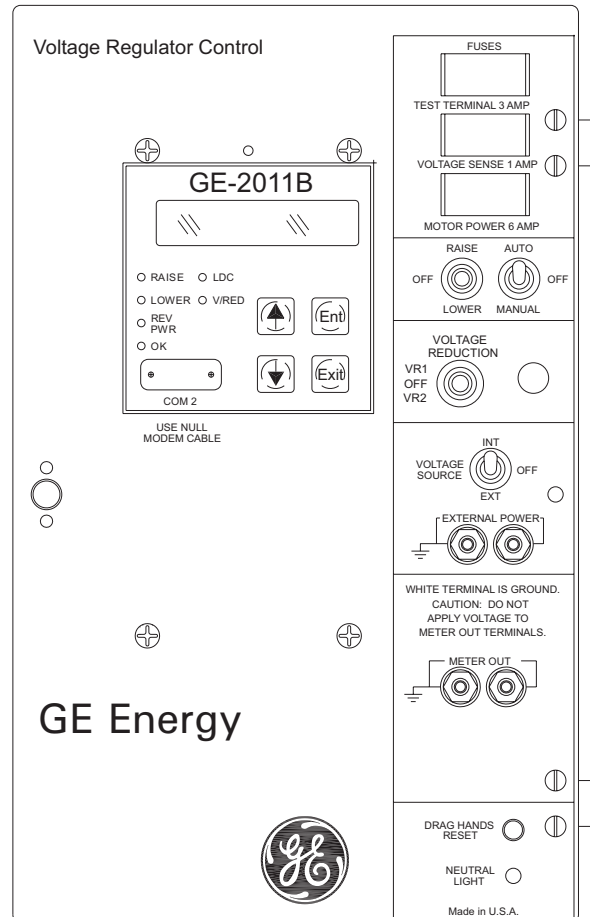




GE-2011B

Digital Tapchanger Control

- **LTC transformer and regulator control provides reliable operation and expanded capabilities**
- **Interfaces with conversion front panels to replace popular GE tapchanger controls**
- **Count Window - Works even with noisy operation counter contacts**
- **Field-updatable programming**
- **Reverse power detection/operation**
- **Demand metering/Data Logging with Date/Time Stamp**
- **Entire control configuration prints out from GE-2029A**
- **Suppression of unused status screens**
- **Overcurrent protection**
- **LDC with R & X or Z-compensation**
- **Increased Bandwidth to 10 Volts**
- **Supports terminal mode for modem communications in GE-2029A**
- **New Standard LCD display (rated -20 to +70 degrees Celsius.) Vacuum Fluorescent display optionally available (rated -40 to +80 degrees Celsius.)**
- **New four-pushbutton interface**
- **Data Reader and HMI software for Palm OS® PDA's**
- **GE-2829 Tap Plotting and Analysis software for Windows™ allows the plotting, printing and analysis of tap information**



Features

Bandcenter: Adjustable from 100 V to 135 V in 0.1 V increments.

Bandwidth: Adjustable from 1 V to 10 V in 0.1 V increments.

Line Drop Compensation: R and X compensation. Adjustable from –24 V to +24 V in 1 V increments. Z compensation available with adjustment of voltage raise from 0 V to +24 V, in increments of 1 V.

Time Delay: Definite; adjustable from 1 second to 120 seconds, in 1 second increments. Inverse; adjustable from 1 second to 120 seconds, in 1 second increments.

InterTap Time Delay: Used to introduce time delay between tap operations when control is in sequential mode; adjustable from 0 to 60 seconds in 1.0 second increments. Counter input required.

Selectable Outputs: Continuous or pulsed. Normally, an output (raise or lower) signal is maintained when the voltage remains outside the band. A pulsed output length is programmable from 0.2 to 12 seconds, in increments of 0.1 second.

Reverse Power Operation:

Transformer LTC Application: Can be set to ignore, block, regulate rev, or return to neutral operation with reverse power.

Single-Phase Regulators: If "keep track" tap position indication is applicable, unit may be set to "Return to Neutral" or "Regulate Reverse". The Regulate Reverse feature allows separate setpoints and regulation in the reverse direction without the installation of source-side VTs.

CT to VT Phasing Correction: Adjustable from 0° to +330° in 30° increments.

Real-Time Metering: The following measured and calculated values are available in real-time:

- Local Voltage
- Load kVA, or MVA
- Load Center Voltage
- Load kW, or MW
- Line Current
- Load kVAr, or MVAR
- Power Factor
- Line Frequency

Demand Metering: Time interval selected as 15, 30, or 60 minutes.

Drag Hands Operation:

The following "drag-hand" values are stored with date and time stamping and are averaged over 32 seconds:

- Minimum Local Voltage
- Maximum Local Voltage

The following "drag-hand" values are stored with date and time stamping and are calculated over the demand time interval (15, 30, or 60 minutes) as selected by the user:

- Maximum Primary Line Current
- Maximum Load kW, or MW
- Maximum Load kVAr, or MVAR
- Maximum Load kVA, or MVA (and Power Factor at time of Maximum Load kVA, or MVA)

Line Overcurrent Tapchange Inhibit: Adjustable from 200 mA to 640 mA of line current for 200 mA CT or 1.0 A to 3.2 A for 1 A CT display and 5.0 A to 16.0 A for 5 A CT display. External auxiliary CT required for 1.0 A and 5 A CT inputs.

Voltage Limits, Tap Position Limits, and Runback: Overvoltage and Undervoltage limits are independently adjustable from 95 V to 135 V in 0.1 V increments. Upper and lower tap position limits may be set by user, with tap position knowledge active. An adjustable deadband (above the overvoltage limit) of 1 V to 4 V is available, which can be used to set the runback limit.

Voltage Reduction: Three independent steps, each adjustable from 0% to 10% in 0.1% increments of the bandcenter setpoint.

VT Ratio Correction: VT correction from –15 V to +15 V in 0.1 V increments.

Tap Position Knowledge

Single-Phase Regulators: In most applications, tap position information can be maintained by means of an internal "keep track" logic.

Operations Counter: A software counter increments by one count per either an open/close/open contact operation (X1) or an open/close or close/open contact operation (X2), and is preset by the user. A count window mode registers any activity as a valid input within the count window time setting.

Resettable Operations Counter: A second software counter, similar to the operations counter, which may be reset by the user.

Harmonic Analysis: Provides the total harmonic distortion and the harmonic content of the load voltage and current up to the 31st harmonic (using GE-2029A with BECO 2200 protocol).

Tap Position Record: Provides a record of the number of times each tap position has been passed through (using GE-2029A with BECO 2200 protocol). The tap position record can be reset by the user.

AUTO/OFF/MANUAL Switch Status: Provides the user with the Auto/Off/Manual switch position status through the Comm port. When the GE-2011B is configured for a switch status input, the switch status is read using the seal-in input on the control.

A or B Regulator Type: Allows the user to select the type of regulator being used to provide a more accurate source voltage calculation.

Inputs

Control Voltage Input: Nominal 120 V ac, 60 Hz (50 Hz optional); operates properly from 90 V ac to 140 V ac. If set at 60 Hz, the operating system frequency is from 55 to 65 Hz; if set at 50 Hz, the operating system frequency is from 45 to 55 Hz. The burden imposed on the input is 8 VA or less. The unit should be powered from a voltage transformer connected at the controlled voltage bus. The unit will withstand twice the voltage input for one second and four times the voltage input for one cycle.

Motor Power Input: Nominal 120 V ac to 240 V ac, at up to 6 A as required by the load, with no wiring changes required.

Line Current Input: Line drop compensation is provided by a current transformer input with a 0.2 A full scale rating. A Beckwith Electric model M-0121 (5 A to 0.2 A) or M-0169A (5 A or 8.66 A to 0.2 A) Auxiliary Current Transformer is available when required. The burden imposed on the current source is 0.03 VA or less at 200 mA. The input will withstand 400 mA for two hours and 4 A for 1 second.

Binary Inputs

Voltage Reduction 1 & 2 Inputs: These inputs provide three levels of programmable voltage reduction which can be manually invoked.

Neutral Position Detect: The Neutral Position Detect Input detects the neutral tap position, which assists the "keep track" tap position function. This Neutral Position Detect Input also facilitates disabling the paralleling mode Delta Var2.

Counter Input: The Counter Input detects tap position changes and updates two counters, one pre-settable and one re-settable.

Outputs

Raise Output: Capable of switching 6 A at 120 Vac to 240 V ac motor power.

Lower Output: Capable of switching 6 A at 120 Vac to 240 V ac motor power.

Front Panel Controls

Menu-driven access to all functions by way of four pushbuttons and a two-line alphanumeric display. There are two programmable passwords available to provide various levels of access to the control functions.

The GE-2011B offers a 2-line by 20 character LCD display for enhanced viewing in direct sunlight. It also offers a low-level LED backlight for reading in darker environments. An optional Vacuum Fluorescent Display (VFD) is available for industrial temperature range operations (–40° C to +80° C).

LED Indicators

Front panel LED indicators show the following control conditions: Out-of-Band **RAISE**, Out-of-Band **LOWER**, Reverse Power Flow **REV PWR** detected, CPU **OK.**, Line Drop Compensation **LDC IN EFFECT** and Voltage Reduction **V/RED IN EFFECT**.

Voltage Measurement Accuracy

Control accuracy of $\pm 0.3\%$ when tested in accordance with the ANSI/IEEE C57.15.9-1999 standard over a temperature range of -30°C to $+65^{\circ}\text{C}$. The control accuracy is $\pm 0.5\%$ when tested over the full operational temperature range of -40°C to $+85^{\circ}\text{C}$.

Communications

The communication port provides access to all features, including metering, software updates, and programming of all functions. This is accomplished using a modem or direct serial connection from any IBM PC-compatible personal computer running the GE-2029A Communications Software. COM2 is an RS-232 front port for local communications with BECO 2200 and for software updates.

Protocols: COM2 uses BECO 2200 for local communications.

Communications Via Direct Connection: GE-2029A supports direct communication with a GE-2011B Digital Tapchanger Control using a serial “null modem” cable with a 9-pin connector (DE9P) for the control, and the applicable connector (usually DE9S or DE25S) for the PC.

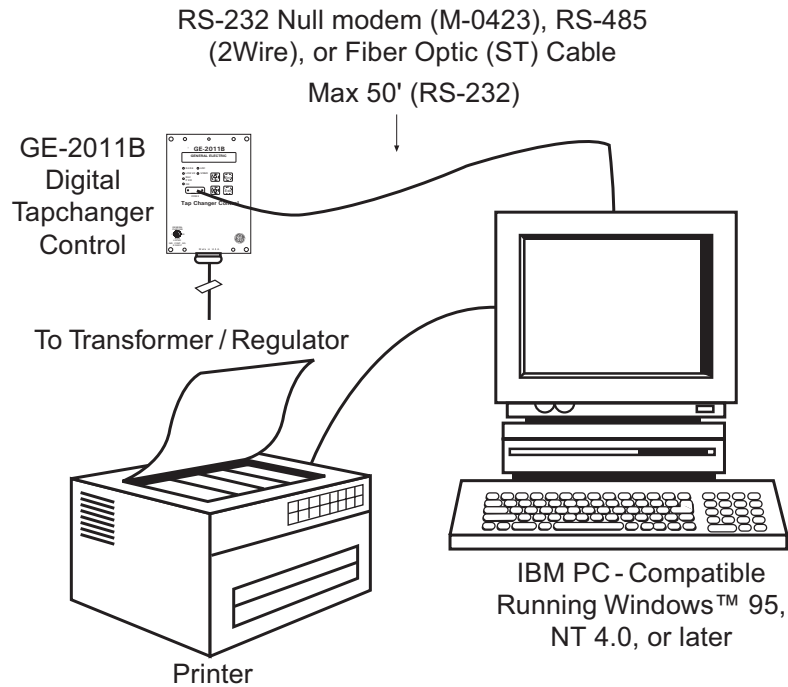


Figure 1 Direct Connection

Communications Via Modem: GE-2029A supports remote (modem) communications with a GE-2011B Digital Tapchanger Control. A Hayes-compatible modem and proper cabling is required.

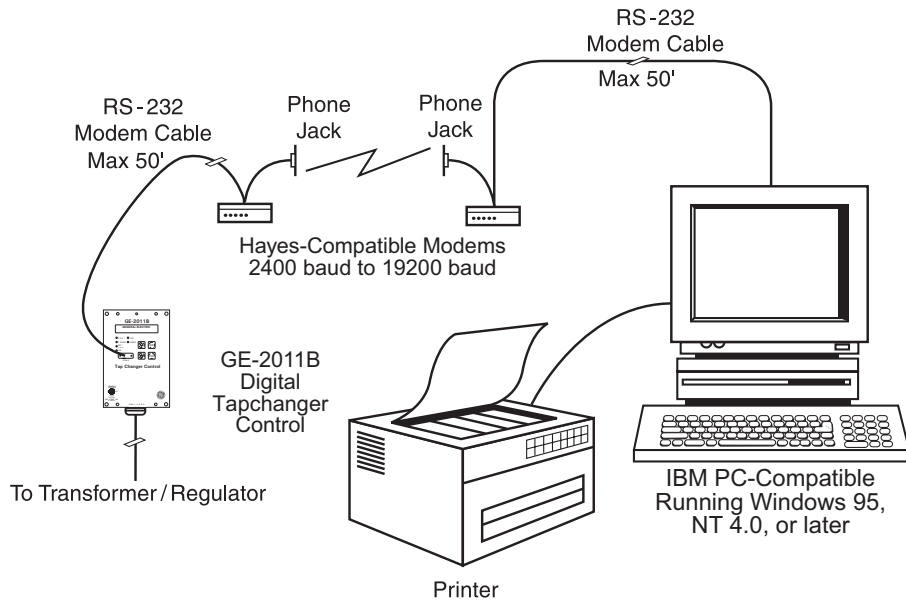


Figure 2 Modem Connection

Communications Using Networking: The addressing capability of TapTalk allows networking of multiple digital tapchanger controls. Each tapchanger control can be assigned an address ranging from 1 to 200. Selected commands may be broadcast to all controls on the network. Figure 3 illustrates typical network configurations.

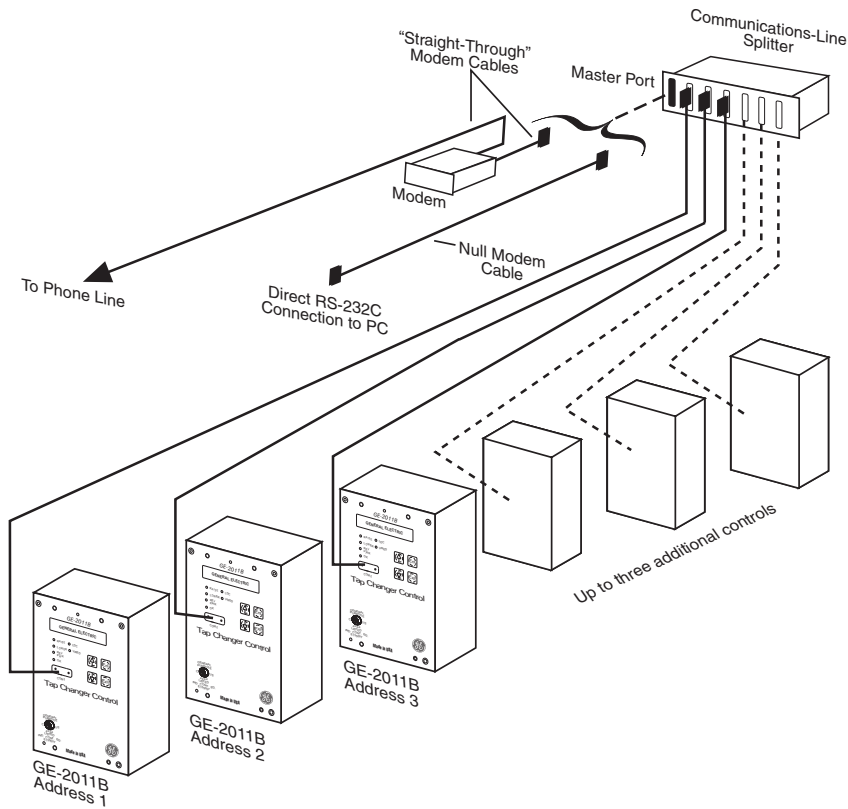


Figure 3 Network Connection

GE-2011B Digital Tapchanger Control

Application: Using a PC, the operator has real-time, remote access to all functions of the GE-2011B Digital Tapchanger Control. The control can act as the monitoring point for all voltage, current, and related power quantities, thereby simplifying operation while avoiding transducers and multiple Remote Terminal Unit (RTU) analog inputs. The protocols implement half-duplex, two-way communications. This allows all functions, which would otherwise require the presence of an operator at the control, to be performed remotely. Communication capabilities include:

- Interrogation and modification of setpoints
- Broadcast of commands, such as tap change inhibit and voltage reduction (up to three steps) to networked controls
- Recognition of alarm conditions, such as voltage extremes and excessive load
- Selective control of raise and lower tap change operations
- Re-configuration of the control, such as a change to the demand integration time period or a selection of different alarm parameters

Unit Identifier: A 2-row by 15-character alphanumeric sequence, set by the user, can be used for unit identification.

GE-2829 Tap Plotting Software for Windows™: This plotting and analysis software allows the user to plot, print and analyze tap information downloaded utilizing the GE-2029A data logging feature.

Environmental

Temperature: Control operates from -40°C to $+85^{\circ}\text{C}$ with either the LCD or Vacuum Fluorescent displays.

■ **NOTE:** The LCD display's functional temperature range is -20°C to 70°C . The optional Vacuum Fluorescent display's will functional temperature range is -40°C to $+80^{\circ}\text{C}$.

IEC 60068-2-1 Cold, -40°C for 96 hours

IEC 60068-2-2 Dry Heat, $+80^{\circ}\text{C}$ for 96 hours

IEC 60068-2-3 Damp Heat, $+40^{\circ}\text{C}$ @ 95% RH for 96 hours

Transient Protection

High Voltage

All input and output terminals will withstand 1500 V ac rms to chassis or instrument ground for one minute with a leakage current not to exceed 25 mA, for all terminals to ground. Input and output circuits are electrically isolated from each other, from other circuits and from ground.

■ **NOTE:** RS-232 communication ports is excluded.

Surge Withstand Capability

IEEE C37.90.1-2002 2,500 Vpk-pk Oscillatory
 4,000 Vpk Fast Transient Burst

IEEE C37.90.1-1989 2,500 Vpk-pk Oscillatory
 5,000 Vpk Fast Transient

■ **NOTE:** Disturbance is applied to the digital data circuit RS-232 port through a capacitive coupling clamp.

Radiated Electromagnetic Withstand Capability

All units are protected against electromagnetic radiated interference from portable communications transceivers.

Electrostatic Discharge Test

EN 60255-22-2-1997 (EN61000-4-2)

Class 4 (8 Kv) – Point Contact Discharge
 (15 Kv) – Air Discharge

Fast Transient Disturbance Test

EN 60255-22-4-2002 (EN61000-4-4)

Class A (4 Kv, 2.5 kHz)

■ **NOTE:** Disturbance is applied to digital data circuits (RS-232) ports through capacitive coupling clamp.

Industrial Certifications

UL Listed (508 – Industrial Control Equipment)

Physical

Size: 9.25" wide x 15" high x 4.185" deep (23.5 cm x 38.1 cm x 10.5 cm)

Approximate Weight: 6 lbs, 2 oz (2.78 kg)

Approximate Shipping Weight: 11 lbs, 2 oz (5.05 kg)

Patent & Warranty

The GE-2011B Tapchanger Control is covered by U.S. Patents 5,315,527 and 5,581,173.

The GE-2011B Tapchanger Control is covered by a five year warranty from date of shipment.

Specification subject to change without notice.

WARNING

DANGEROUS VOLTAGES, capable of causing death or serious injury, are present on the external terminals and inside the equipment. Use extreme caution and follow all safety rules when handling, testing or adjusting the equipment. However, these internal voltage levels are no greater than the voltages applied to the external terminals.

DANGER! HIGH VOLTAGE



- This sign warns that the area is connected to a dangerous high voltage, and you must never touch it.

PERSONNEL SAFETY PRECAUTIONS

The following general rules and other specific warnings throughout the manual must be followed during application, test or repair of this equipment. Failure to do so will violate standards for safety in the design, manufacture, and intended use of the product. Qualified personnel should be the only ones who operate and maintain this equipment. Beckwith Electric Co., Inc. assumes no liability for the customer's failure to comply with these requirements.



- This sign means that you should refer to the corresponding section of the operation manual for important information before proceeding.



Always Ground the Equipment

To avoid possible shock hazard, the chassis must be connected to an electrical ground. When servicing equipment in a test area, the Protective Earth Terminal must be attached to a separate ground securely by use of a tool, since it is not grounded by external connectors.

Do NOT operate in an explosive environment

Do not operate this equipment in the presence of flammable or explosive gases or fumes. To do so would risk a possible fire or explosion.

Keep away from live circuits

Operating personnel must not remove the cover or expose the printed circuit board while power is applied. In no case may components be replaced with power applied. In some instances, dangerous voltages may exist even when power is disconnected. To avoid electrical shock, always disconnect power and discharge circuits before working on the unit.

Exercise care during installation, operation, & maintenance procedures

The equipment described in this manual contains voltages high enough to cause serious injury or death. Only qualified personnel should install, operate, test, and maintain this equipment. Be sure that all personnel safety procedures are carefully followed. Exercise due care when operating or servicing alone.

Do not modify equipment

Do not perform any unauthorized modifications on this instrument. Return of the unit to a Beckwith Electric repair facility is preferred. If authorized modifications are to be attempted, be sure to follow replacement procedures carefully to assure that safety features are maintained.

PRODUCT CAUTIONS

Before attempting any test, calibration, or maintenance procedure, personnel must be completely familiar with the particular circuitry of this unit, and have an adequate understanding of field effect devices. If a component is found to be defective, always follow replacement procedures carefully to that assure safety features are maintained. Always replace components with those of equal or better quality as shown in the Parts List of the Instruction Book.

Avoid static charge

This unit contains MOS circuitry, which can be damaged by improper test or rework procedures. Care should be taken to avoid static charge on work surfaces and service personnel.

Use caution when measuring resistances

Any attempt to measure resistances between points on the printed circuit board, unless otherwise noted in the Instruction Book, is likely to cause damage to the unit.

GE-2011 “SimpleStart” Initial Setup Instructions

Communicating with the GE-2011

Determine the method of communicating with the GE-2011:

Utilizing the front panel four pushbutton Human Machine Interface (HMI).

By connecting to the front panel RS-232 communications port with a laptop PC utilizing GE-2029A for Windows Communications Software.

By connecting to the SCADA communications ports on the top of the unit.

Apply Power to the GE-2011

If the control is attached to an adapter panel, control power can be applied to the front “**External Power**” input or to the proper panel control input pins.

If the control is not attached to an adapter panel, or the “blue plug” is removed, the control may be energized utilizing a “**Blue Plug**” adapter cord (part number B-0849 available from Beckwith Electric) and a 120 V ac wall outlet.

GE-2011 Setup Procedure using the Front Panel HMI

1. Press the **↑**, **↓** or **Ent** pushbutton, the screen will display **LOCAL VOLTAGE**.
2. Confirm input voltage.
3. Press and hold the **↑** pushbutton until **TIME OF DAY** is displayed, then press **Ent**, a flashing “**C**” will be displayed indicating that changes may be made.
4. Set the first digit of the time (indicated by an underline of the digit) with the **↑** or **↓** pushbutton, then press **Ent** to shift to the next digit. Repeat for each time digit.
5. When all time digits have been set, then press **↓** once, **DATE** will be displayed.
6. Press **Ent** to set the first digit of the date (indicated by an underline of the digit) with the **↑** or **↓** pushbutton, then press **Ent** to shift to the next digit. Repeat for each date digit.
7. When all date digits have been set, then press **↓** once, **VAR HRS R 1PH E** will be displayed.
8. Each demand quantity will display an “**E**” on the right side of the screen. Press **Ent** to reset the demand value to zero.
9. Press **↓** to display the next demand quantity, then press **Ent**.
10. Repeat Step 9 for each demand quantity, the last demand quantity is **OPER CNTR RSET**.
11. Press **Exit**, the screen will extinguish.
12. Review the default configuration settings in the GE-2011 Instruction Book, Appendix A or B, and determine if any of the settings need to be changed for this application.
13. If no configuration settings need to be changed, then go to Step 15.

GE-2011 “SimpleStart” Initial Setup Instructions Cont’d

14. If configuration settings need to be changed, then proceed as follows:

- a) Press the **↑**, **↓** or **Ent** pushbutton, the screen will display **LOCAL VOLTAGE**.
- b) Confirm input voltage.
- c) Press **↓** once, **TO CONFIGURE COMMUNICATION** will be displayed.
- d) Press **Ent**, **LEVEL 2 PASSWORD** will be displayed.

■ **NOTE:** The default Level 2 Password is 2222 on new controls.

- e) Set the first digit of the Level 2 Password (indicated by an underline of the first digit) with the **↑** or **↓** pushbutton, then press **Ent** to shift to the next digit. Repeat for each digit.

When the last digit has been entered, the control will briefly display **LEVEL 2 ACCESS GRANTED!**. The control will then display **COMM PASSWORD**.

- f) Press the **↑** or **↓** pushbutton as necessary to advance to the desired configuration parameter.
- g) Press **Ent**, a flashing “**C**” will be displayed indicating that changes may be made.
- h) Press the **↑** or **↓** as necessary to toggle between the available settings, then press **Ent** to save the setting.
- i) When the required changes have been completed, press **EXIT**, the screen will extinguish.

15. Review the default setpoints in the GE-2011 Instruction Book, Appendix A or B, and determine if any of the settings need to be changed for this application.

16. If no setpoints need to be changed, then go to the Data Logging section.

17. Press the **↑**, **↓** or **Ent** pushbutton, the screen will display **LOCAL VOLTAGE**.

18. Confirm input voltage.

19. Press **↓** twice, **BANDCENTER F** will be displayed. This screen marks the beginning of the setpoints.

20. Press the **↑** or **↓** pushbutton as necessary to advance to the desired setpoint, then press **Ent**.

- a) If a flashing “**C**” is displayed on the right side of the screen, then go to Step 21.

■ **NOTE:** The default Level 1 Password is 0000 (password disabled) on new controls.

- b) If **LEVEL 1 PASSWORD** is displayed (indicating a user defined password has been entered), then set the first digit of the Level 1 Password (indicated by an underline of the digit) with the **↑** or **↓** pushbutton, then press **Ent** to shift to the next digit. Repeat for each digit.

When the last digit has been entered and the proper password has been entered, then a flashing “**C**” will be displayed indicating that changes may be made. Go to Step 21.

21. Press the **↑** or **↓** as necessary to toggle between the available settings, then press **Ent** to save the setting.

22. For additional setpoint changes press the **↑** or **↓** pushbutton as necessary to advance to the desired setpoint, then repeat Step 21 for each setpoint to be changed.

23. When the required setpoint changes have been completed press **EXIT**, the screen will extinguish.

GE-2011 “SimpleStart” Initial Setup Instructions Cont’d

GE-2029A Communications Software for Windows

PC hardware requirements, communications utilizing a modem, communicating with multiple units and an overview of GE-2029A software operation can be found in the GE-2011 Instruction Book, Chapter 9.

GE-2029A Communications Software is provided on a CD-ROM with each unit.

Insert the GE-2029A software into your CD-ROM drive.

Select **Run** from the **Start Menu**.

1. From the **Run** dialog box, initiate software installation by typing **D:\Setup.exe** (or other drive designator:\Setup.exe, depending on the letter designation for the CD-ROM drive or location of the downloaded file).

The Installation Wizard will prompt the user through the installation process. After installation, the GE-2029A program icon (located in the Becoware folder) can be placed on the desktop.

GE-2011 Setup Procedure using GE-2029A

1. Connect a Null Modem Cable from the active PC COM Port to COMM 2 on the front of control.
2. Select the GE-2029A program-item icon from the Becoware group in the Program Manager, or select GE-2029A from the program list using the Start Menu.

The GE-2029A toolbar is displayed along with the Access dialog screen.

3. The Access dialog screen contains the following new control default values:

Password – no changes needed

Comm Address – 1

Control Comm Protocol – BECO2200

PC Communication Device – Serial Comm Port

PC COM Port – COM1

PC Baud Rate – 9600

4. On the Access dialog screen verify the following:

PC COM Port is set to the active PC COM Port that the Null Modem Cable is connected to.

Active PC COM Port baud rate is set to 9600.

■ **NOTE:** The local display screen must be extinguished (press **EXIT**) in order to access the control through the communication ports.

5. From the Access dialog screen select **OPEN** to open communications. If the correct COM Port parameters have been entered GE-2029A will respond with:

“Communication has been opened successfully”.

6. From the Access screen, select **OK** to close the Access screen.

7. From the drop down menu, select **Utilities/Set Control Date/Time**. The Set Control Date/Time dialog screen will be displayed.

GE-2011 “SimpleStart” Initial Setup Instructions Cont’d

8. The Set Control Date/Time dialog screen **Set Control Time** section, default setting for Current Address or Broadcast is set to Current Address. If multiple controls are being set, then select Broadcast.
9. If the control is to be set to PC Time, then select **Set Control Time to PC Time**. GE-2029A will respond with a confirmation screen that states:

“Control’s time has been successfully set to PC’s time.
Do you want to reset the following points:
Demand Metering, Energy Metering, Drag Hands and Resettable Op Count?
Click Yes to reset the values,
Click No to continue without resetting.”

Select **Yes**, Tap Talk will respond with the confirmation screen that states:
“Demand Metering, Energy Metering, Drag Hands and Resettable Op Count have been reset.”
10. If the control is to be set to a time that is manually input, then input the desired time and select **Set**. GE-2029A will respond with a confirmation screen that states:

“Control’s time has been successfully set to PC’s time.
Do you want to reset the following points:
Demand Metering, Energy Metering, Drag Hands and Resettable Op Count?
Click Yes to reset the values,
Click No to continue without resetting.”

Select **Yes**, GE-2029A will respond with the confirmation screen:
“Demand Metering, Energy Metering, Drag Hands and Resettable Op Count have been reset.”
11. From the Set Control Date/Time screen select **Exit**.
12. From the drop down menu, select **Control Setup/Configuration**. The Configuration dialog screen will be displayed.
13. Review the default configuration settings and determine if any of the settings need to be changed for this application.
14. If no configuration settings need to be changed, then go to Step 16.
15. If configuration settings need to be changed, then proceed as follows:
 - a) From the Configuration Dialog screen, select and edit the desired configuration setting(s).
 - b) Select **Write To Control**, GE-2029A will respond with a confirmation screen that states:
“Configuration settings have been successfully written to the control.”
 - c) Select **Exit**.
16. From the drop down menu, select **Control Setup/Setpoints**. The Setpoints dialog screen will be displayed.
17. Review the default setpoints and determine if any of the setpoints need to be changed for this application.
18. If no setpoints need to be changed, then go to the Data Logging section.

GE-2011 “SimpleStart” Initial Setup Instructions Cont’d

19. If setpoints need to be changed, then proceed as follows:

- a) From the Setpoint Dialog screen, select and edit the desired setpoint(s).
- b) Select **Write To Control**, GE-2029A will respond with a confirmation screen that states: “Setpoints have been successfully written to the control.”
- c) Select **Exit**.

Data Logging

The control data logger has been preset to automatically begin collecting partial data when power is applied to the control. If changes to the values to be logged or the logging interval are desired, then proceed as follows:

1. From the GE-2029A drop down menu, select **Utilities/Data Logging/Control Setup and Download**. The Data Logging Control Setup and Download dialog screen will be displayed.
2. When all Data Logging and Download parameters have been set, then perform the following:
 - a) Select **Erase Existing Data and Start Logging data to Control**.
 - b) Select **Yes** to confirm.
 - c) Select **OK** to close the Data Logging Control Setup and Download dialog screen.

GE-2011 “SimpleStart”
Initial Setup Instructions Cont'd

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1 Introduction

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1.0 Description

The GE-2011B Digital Tapchanger Control is a microcontroller-based transformer and step-voltage regulator load tapchanger control.

The control is supplied with a panel that is designed for initial regulator installation. The panel is designed to mechanically and electrically replace an old control, with matching mounting hardware to facilitate the replacement. See Figure 1-2, Typical Adapter Panel Mounting.

Interrogation of the control and setting changes are made through the user interface (HMI), or through the communications port (COM2.) User interface consists of a 20-character by 2-line display and four pushbuttons. Two passwords available to the user are accessed by the buttons and a third is accessed through the communications port. All setpoints are stored in non-volatile memory which is unaffected by control voltage disturbances.

Two operation counters are provided. One counter may be reset; the other may be pre-set by the user.

Six LEDs are used to indicate Tapchanger Raise and Lower command status, Reverse Power detection, CPU OK, LDC In Effect, and V/RED Voltage Reduction in Effect.

The control uses a Motorola microcontroller which has a self-testing watchdog system. Refer to Figure 1-1 for the functional diagram. The alphanumeric display and four-button interface provides complete front panel access to the scrolling menu program shown in the Appendix, Figure A-1. The control applies to tapchanger designs with many configurations of taps (e.g., ± 16 taps, 1 to 17 taps, 0 to 33 taps, etc.).

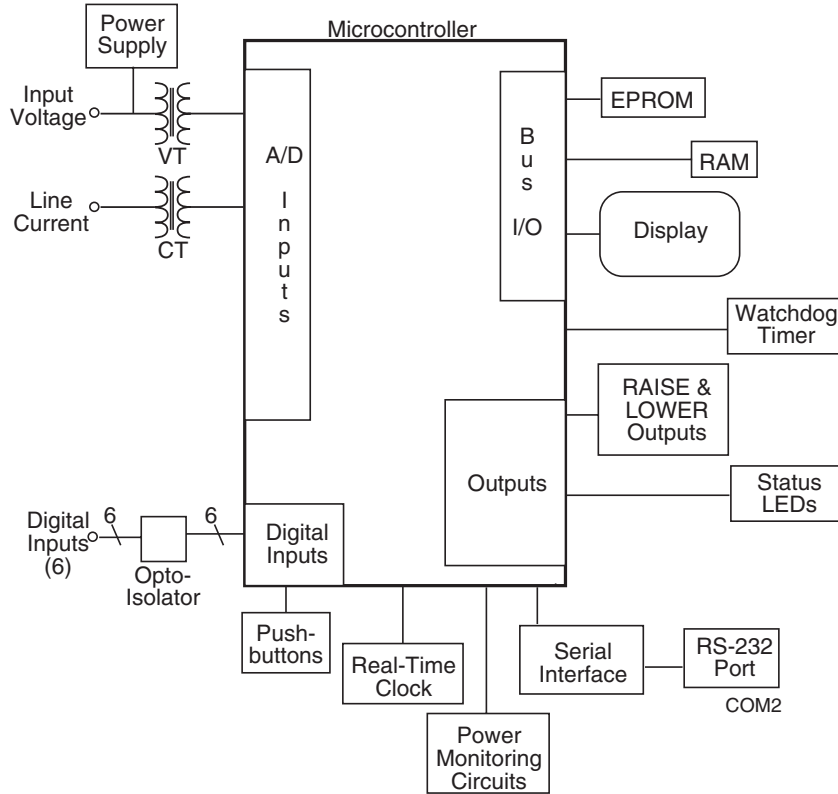


Figure 1-1 Functional Diagram

1.1 Accessories

GE-2029A Communications Software

GE-2029A is a Windows-based communications software program available for remote control and metering of the GE-2011B Tapchanger Control. It is designed to interface with the microcontroller of the control through an RS-232 port (COM2.) The RS-232 port supports baud rates up to 19200 bps. The GE-2029A software displays all pertinent operating information. All operations that can be performed from the front panel user interface of the control can be duplicated remotely, through GE-2029A. These operations include:

- Changing setpoint values. (This includes those values for normal tapchanger control operation, as well as custom configuration to the site.)
- Observing values. (This includes measured and calculated values of real-time operating parameters.)
- Data logging. The control can internally store various parameters at selected intervals. The GE-2029A program can download this data into an Excel® spreadsheet and display. Alternatively, the PC can be programmed to poll the control and obtain a pre-selected list of parameters at selected intervals.

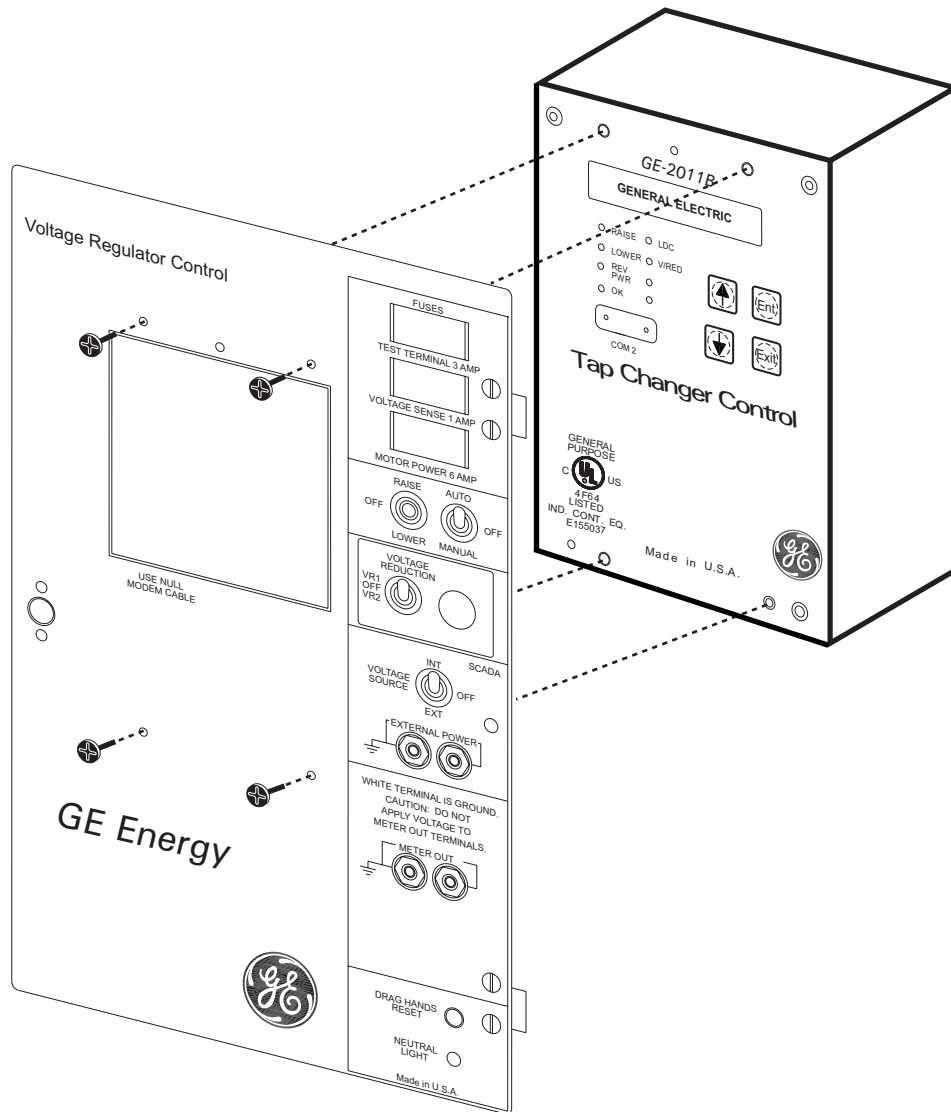


Figure 1-2 Typical Adapter Panel Mounting

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2.0 Introduction

The front-panel user interface consists of a standard Liquid Crystal Display (LCD) or optional Vacuum Fluorescent Display (VFD), **↑**, **↓**, **EXIT**, and **ENT** pushbuttons, status indicators, and the control switches as shown in Figure 2-1, GE-2011B Front Panel.

2.1 Display/Tapchanger Control

The display shows the desired function and its current status or setpoint value. The function is displayed on the top line, and the bottom line displays its current status. The display is normally blank and remains so until the **↑**, **↓**, or **ENT** pushbutton is depressed. Pressing any pushbutton will display the User Lines screen, and then the Local Voltage screen.

Power Up Screens

Each time the control is powered up, it will briefly display a series of screens that include:

- General Electric GE-2011B
- Serial Number
- Control Firmware Number
- Date
- Time of Day
- User Lines

Screen Blanking

The display automatically goes blank after exiting from any menu, or from any screen after 15 minutes of unattended operation. Manual screen blanking is accomplished by pressing the **EXIT** pushbutton.

Flashing C “CHANGE” Prompt

This prompt, in the bottom right corner of a screen, is enabled by initially pressing **ENT**. This prompt indicates that the user can change a setting using the **↑** or **↓** pushbuttons to increment or decrement the settings. Values have factory preset increments, such as 0.1 volt or 1 second. Press **ENT** the second time to execute the setting change.

“ENT” Prompt

When the “E” prompt appears in the top right corner of the drag-hand parameter screens and the operation counter reset screen, it indicates that the value of display will reset if the **ENT** pushbutton is pressed.

2.2 User Interface Controls

▲ and ▼ Pushbuttons

The ▲ and ▼ pushbuttons have two functions. First, they are used to change screens and scroll through selections. Second, they are used to enter new values by incrementing or decrementing the displayed value. The new value is not stored until the **ENT** pushbutton is pressed a second time.

Pressing the ▲ or ▼ pushbutton for longer than one second will cause faster scrolling, either when selecting screens or when selecting setpoint values.

ENT Pushbutton

The **ENT** pushbutton is used to perform the following functions:

- Enter the change mode of a screen
- Store a setpoint or condition in memory
- Enter an access code
- Reset certain status screens

When entering an access code, the **ENT** pushbutton will move the cursor (an underline) to the selected digit location and the ▲ or ▼ pushbutton will change the value. When the final digit is selected, and "C" is flashing, the new access code is entered using the **ENT** pushbutton.

In some cases, it is desirable to leave a screen without making a change. In selecting setpoints or settings, wait 20 seconds without pressing the **ENT** pushbutton and the "C" will stop flashing. At that point, the ▲ and ▼ pushbuttons will again change screens rather than scroll the previous setpoint number or setting choice. The previous changes of that screen will not be recorded and the older setpoints or configuration choices will still be in effect.

When setting passwords, programmable alarm function or user lines in the Configuration Menu, the 20-second time-out is not functional and the user cannot cancel once a new entry has been started.

EXIT Pushbutton

The **EXIT** pushbutton is used to exit from any screen, causing the display to go blank. If **EXIT** is selected while the "C" is flashing, the control will exit without keeping the changed setting.

2.3 Status Indicators

RAISE LED

The red LED indicates when the voltage is below the lower band edge and the timer has started timing for a tapchanger raise operation.

LOWER LED

The red LED indicates that the voltage is above the upper band edge and the timer has started timing for a tapchanger lower operation.

REV PWR LED

The red LED will light to indicate when the unit detects reverse power flow.

OK LED

The green LED light will remain lit whenever power is applied to the unit and the watchdog circuit indicates the microcontroller is working properly.

LDC LED

The yellow LED will illuminate when any non-zero setting has been entered as LDC Fwd resistance or reactance, or LDC-Z. It will also illuminate when any non-zero setting has been entered as LDC Rev resistance or reactance with the "Rev Power Oper" configuration set to "regulate in Reverse" and the control in reverse power mode.

V/RED LED

The yellow LED will illuminate when any level of voltage reduction has been invoked. This is true for any voltage reduction process whether it came from an external contact or any Com input.

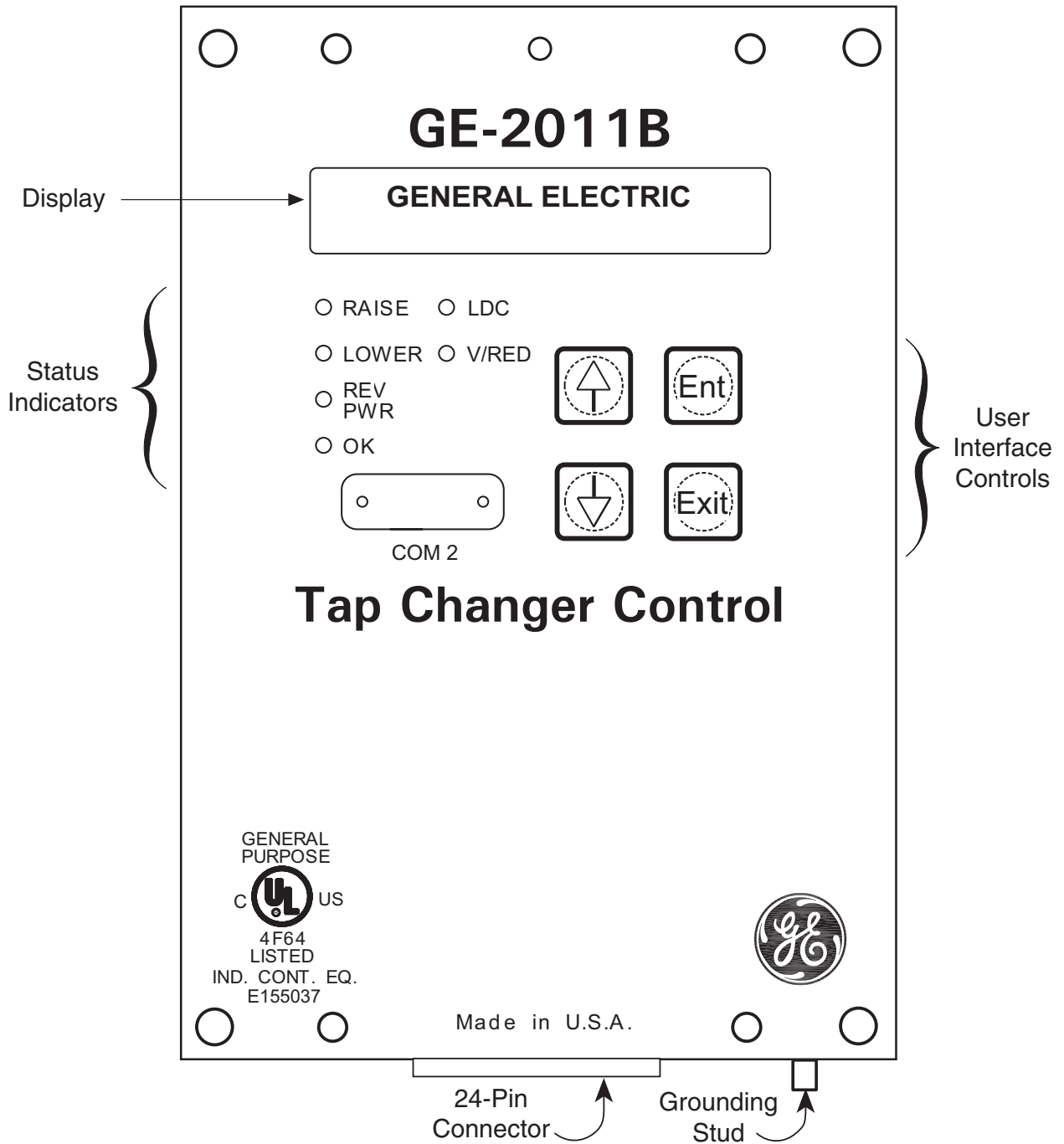


Figure 2-1 GE-2011B Tapchanger Control

2.4 Voltage Regulator Control Panel User Interface

The Voltage Regulator Control front panel includes three replaceable fuses: Test Terminal (3 A), Voltage Sense (1 A), and Motor Power (6 A).

Control Switches

RAISE/LOWER/OFF switch allows local manual raise and lower commands to be initiated

AUTO/OFF/MANUAL switch allows manual operation of the control.

VOLTAGE REDUCTION VR1/OFF/VR2(Optional) switch allows voltage reduction 1 or 2 to be initiated from the front panel.

VOLTAGE SOURCE switch disconnects the voltage transformer input and connects the **EXTERNAL POWER** binding posts to the voltage input and motor circuit.

▲ **CAUTION:** Do not reverse the ground and hot wires when connecting an external source. A 3 AG fuse (F2) is installed to protect the relay from damage if these connections are accidentally reversed.

With the **VOLTAGE SOURCE** switch in the **EXT** position, the sensing and motor power circuits are connected to the External Power binding post on the front panel. The unit can be tested using an external 120 V RMS source of proper polarity applied to these terminals. Testing can be accomplished by adjusting the amplitude of the external source.

The **VOLTAGE SOURCE** switch will disconnect all power from the unit when selected to the **EXT** position with no source connected to the front panel voltage inputs.

DRAG HANDS RESET pushbutton resets the tapchanger position indicator drag hands.

Binding Posts

EXTERNAL POWER binding posts allow application of a 120 V RMS nominal voltage to the unit for test procedures.

METER OUT binding posts allow reading of the input voltage when used in conjunction with the **BIAS TEST VOLTAGE** screen of the GE-2011B Tapchanger Control.

Status Indicators

NEUTRAL light illuminates when the regulator is in the neutral tap position.

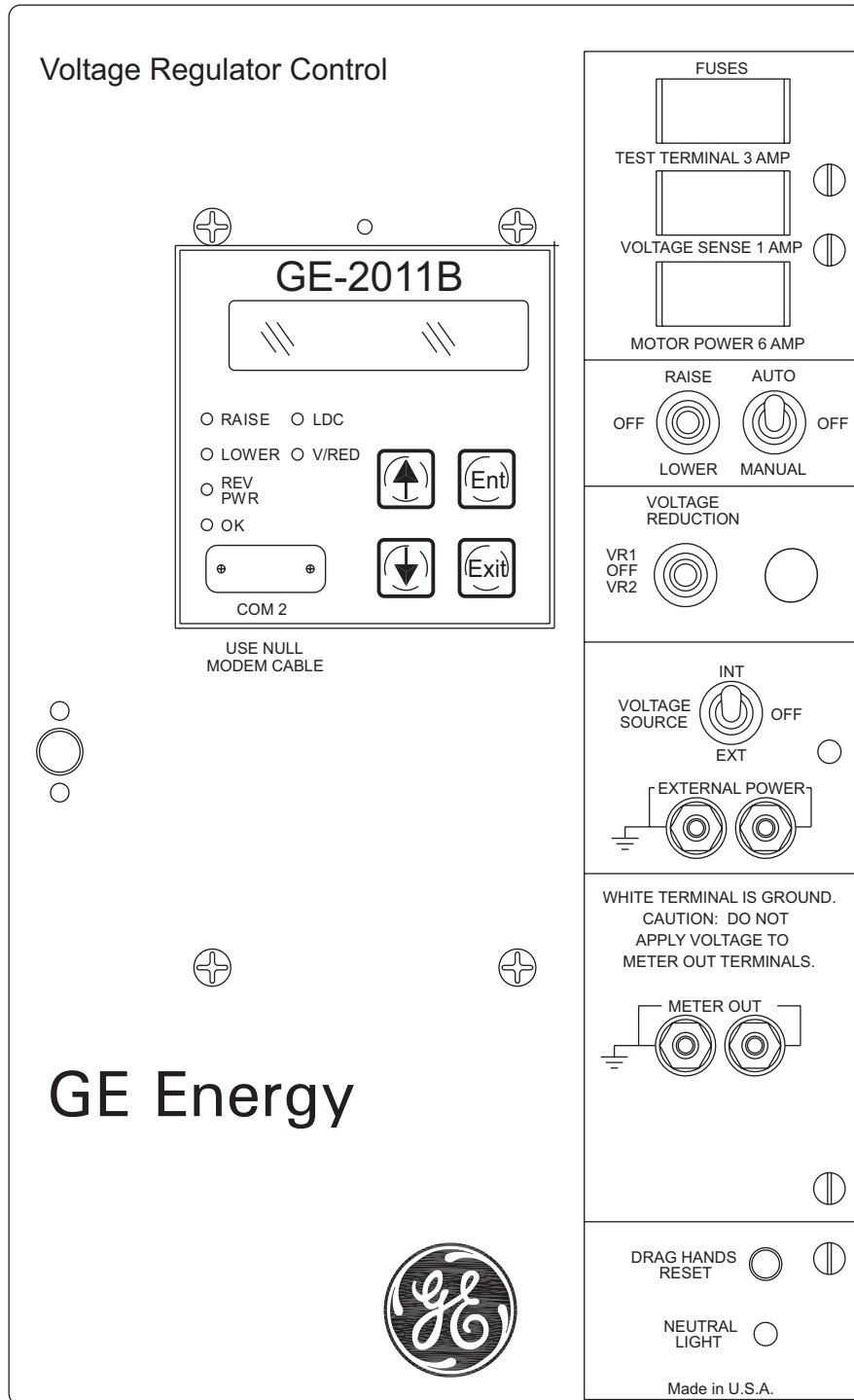


Figure 2-2 GE-2011B Front Panel

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3.0 Introduction

If the control will not execute Raise or Lower operations due to remote blocking using GE-2029A, front panel operation can be restored by using the Remote Control screen to remove the block, or momentarily removing power from the control. In order to restore front panel operation, the Save Comm Block at Power Off setting must be set to Disable.

Local and remote control may be used at the same time by designating “Local Mode” disabled.

Settings Entry

Use the **↑** and **↓** pushbuttons to scroll to the desired setpoint entry screen and press **ENT** to enter the change mode. A password is required for entry into change mode, unless the Level 1 password has been disabled. Use the **↑**, **↓** and **ENT** pushbuttons to change the setting.

When the control is first energized, the quickest way to properly initialize the control prior to entering the setpoints is to set the real-time clock. This action will initiate a prompt from the control to perform a reset operation for the following items:

- Demand Metering
- Energy Metering
- Drag Hands Reset Registers
- Resettable Operations Counter

It is then easy to proceed with the remainder of the control setup.

3.1 Passwords

Password Access Screens

To prevent unauthorized access to the control functions, there are provisions in the software for assigning up to three passwords. Two are for use with the front panel controls and one is for use with the communication interface. The passwords can be set in the Configuration Menu. For more information, refer to the **Passwords** section of the **Configuration** chapter.

Access Levels

General access to read setpoints, to monitor status, to reset drag-hand parameters and the resettable operations counter do not require a password.

The **Level 1** password, if enabled, is required to make local setting changes including the date and time of day. If the Level 1 password is set to all zeros, this request for a password will not be seen and changes can be made without a password.

The **Level 2** password, if enabled, is required to make changes to the configuration, passwords, and user identification. If the Level 2 password is set to all zeros, this request for a password will not be seen and changes can be made without a password.

The **COMM** password is for use with the GE-2029A Communications Software. This password provides secure remote operation. If the communications password is set to all zeros in the GE-2011B Digital Tapchanger Control, the communications program will not ask for a password.

● WARNING: Please record all passwords in a secure location. If the password is lost or forgotten, please contact the factory.

3.2 Voltage Regulation

Standard Control Settings

Refer to the Appendix, Figure A-4. With the Level 1 password, six forward and six reverse setpoints are available (see Table 3-1) from the Setpoint Menu. They are: bandcenter, bandwidth, time delay, inverse time, and line drop compensation resistance and reactance for each direction and Z-compensation.

The control will send commands to the tapchanger to change taps as needed to hold the voltage within the bandwidth setting as modified by the line drop compensation settings and by paralleling.

The control will only respond to an out-of-band voltage excursion after the timer has reached the time delay setting. The timer can be set as an integrating timer or an instantaneous reset timer upon the voltage return to an in-band condition. As an integrating timer, it increments during time out-of-band and decrements during time in band, but not below zero.

Voltage Regulation Without LDC

When the control is just used to regulate the voltage on the transformer or regulator low-side bus, the only input required is voltage from a line-to-line or line-to-ground VT with a nominal 120 V ac secondary.

Bandcenter (BC)

The center of the voltage band is adjustable from 100 to 135 V ac in 0.1 volt increments (for example, 120 V ac).

Bandwidth (BW)

The LTC uses discrete steps and the Bandwidth must have a width that allows at least one tapchange position where the control remains satisfied. To minimize excessive operations on the tapchanger, this bandwidth is usually set to include two or three in-band tap operation positions.

The range is settable from 1 to 10 volts in 0.1 volt increments, and 2 volts minimum is recommended. This setting is the total bandwidth.

Time Delay (TD)

The time delay setting is needed to inhibit the tapchanger from unnecessary operations on temporary voltage excursions and is commonly set at 30 to 60 seconds.

The control has two types of timers for time delay: definite time and inverse time. The kind of time delay the control will use depends on the setting found in the configuration menu called **TIMER SELECTION**. Both types of delay will work in forward or reverse power flow. The inverse time delay will follow the curve in Figure 3-1, Inverse Time Delay Curve.

Inverse Time Example

Bandcenter 120 V

Bandwidth 3 V

Inverse Time Delay Setting 120 s

$$\Delta V = (\text{Bandwidth}/2) = 1.5 \text{ V}$$

$$V_{in} = 123 \text{ V}$$

Voltage deviation in multiples of ΔV

$$= [V_{in} - \text{Bandcenter}]/\Delta V$$

$$= (123 - 120)/1.5$$

$$= 2$$

Time delay from Figure 3-1

= 50% of Inverse Time Delay setting

= 60 sec.

FUNCTION	SETPOINT RANGE	INCREMENT	DEFAULT SETTING
Bandcenter	100.0 V to 135.0 V	0.1 V	120.0 V
Bandwidth	1.0 V to 10.0 V	0.1 V	2.0 V
Time Delay	1 second to 120 seconds	1 second	30 seconds
Inverse Time Delay	1 second to 120 seconds	1 second	30 seconds
LDC Resistance	-24 V to +24 V	1 V	0 V
LDC Reactance	-24 V to +24 V	1 V	0 V
LDC-Z	0 V to 24 V	1 V	0 V

Table 3-1 Bandcenter, Bandwidth, Time Delay & Line Drop Compensation Setpoint Ranges

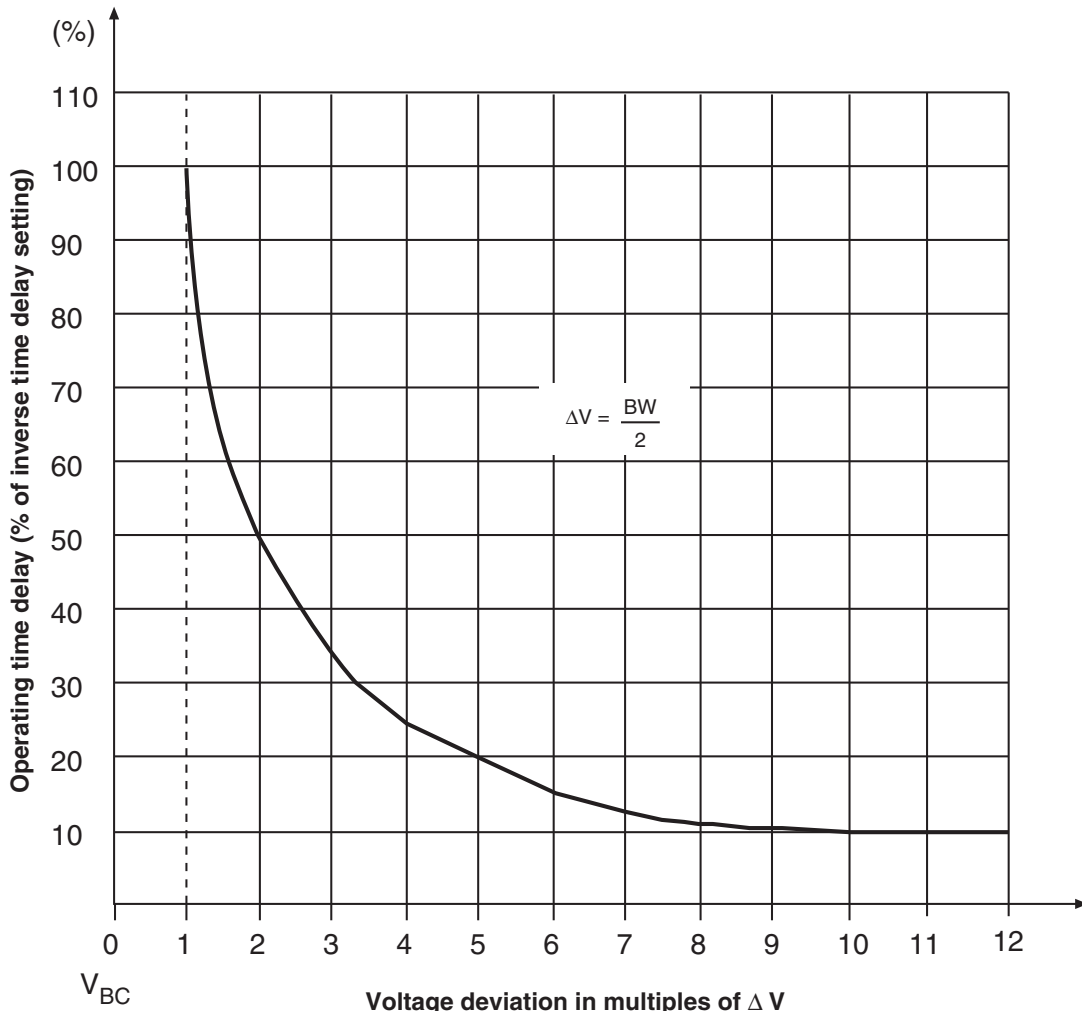


Figure 3-1 Inverse Time Delay Curve

Voltage Regulation with LDC

When it is desirable to regulate the voltage at some distance from the transformer or voltage regulator, or in general to raise the voltage during high load conditions, the Line Drop Compensation (LDC) feature is used.

Two different LDC methods are available in the GE-2011B Digital Tapchanger Control. A configuration setpoint called LDC Selection allows the user to select from either of these methods.

The Bandcenter, Bandwidth, and Time Delay functions are set the same as if LDC were not used.

LDC X/R

A classical approach can be used to determine the X/R settings for the LDC, however this assumes a load center point and is usually not applicable to the typical distribution feeder. For more information, contact Beckwith Electric for **Application Note #17**.

A simpler method, which will work for most applications, is recommended. This involves looking at the lines leaving the station and determining the reactance/resistance (X/R) ratio for the main line. The reactive and resistive line drop compensation setpoints should then be entered in this same X/R ratio.

If the CT and VT phasing corrections have been made to remove any phase angles between measured voltage and live current, only positive values of R and X compensation need to be used.

Table 3-2 gives the X/R ratio for various wire sizes and typical conductor spacings.

By knowing the ratio of the maximum expected load to the present load, the amount of voltage compensation needed is found as shown in the following example.

Example

Desired

local voltage @ min load = 120 volts

local voltage @ max load = 124 volts

Using the following assumptions:

Desired Bandcenter = 120 volts

Desired Bandwidth = 2 volts

The device being controlled is 50% loaded

Setting

Start with R=0 and X=0 and increase both values using the ratio shown in the table for the feeder conductor. Keeping the X/R ratio, increase R_{set} and X_{set} until the difference between the compensated voltage and the local voltage is 2.0 volts.

This example would let the voltage vary from 119 V at no load to 125 V at maximum load taking into account the bandwidth.

With this simplified method of LDC setting, the first customer's voltage will be limited by the upper voltage limit at the highest daily load, depending on the accuracy of the daily load projection. At the same time, the furthest customer will receive the highest voltage possible under the line and loading conditions. The first customer protection can be set on the control. Refer to the **Regulation Limits** section of this chapter.

Since the daily load projections will likely have a seasonal variation, the best balance of first customer to furthest customer voltage may require seasonal adjustment of the LDC settings. Note that the settings of R and X compensation are proportional to the peak load projection and that new settings can be scaled from the first setting obtained by the experimental process just described.

ACSR		COPPER	
MCM	X/R	MCM	X/R
795	4.0	750	6.0
477	2.5	500	4.5
336	2.0	350	3.3
266	1.5	250	2.4
AWG	X/R	AWG	X/R
4/0	1.2	4/0	2.0
2/0	1.0	2/0	1.5
2	0.5	2	0.7
6	0.2	6	0.3

Table 3-2 Approximate Ratio of Line Reactance to Resistance (X/R) of Typical Distribution Circuits

LDC-Z

The second available compensation method is called Z-compensation (LDC-Z). LDC-Z must be selected in the control configuration portion of the menu or software and the **VOLTAGE RAISE** (V_R) setpoint must be set in order for this feature to be implemented. The LDC-Z application is especially useful on systems where several lines exist with different load centers where the proper compensation is not related to any single R & X values as set in R & X compensation.

Basically, LDC-Z compensation consists of designating a target bus voltage increase (line drop compensation) that correlates to the **magnitude** of the control current rather than to the calculation of input R & X line drop at control current magnitude and angle values.

The setting, (V_R), is the calculated line voltage drop (at maximum load) in the circuit or line that has the highest voltage drop at maximum load condition - ratio'd to the rated CT output (200 ma).

$V_R = 0$ to 24 volts in increments of 1 volt.

Example:

- Calculated voltage drop = 5 volts at load level of 150 ma control current.
- V_R setting = $200/150 \times 5 = 6.7$ volts (rounded) = 7 volts

To calculate the line drop compensation at any given control current level (I):

- $V = I/200 \times 7$ (setting):
If $I = 50$ ma; $V = 50/200 \times 7 = 1.75$ volts

As with R & X compensation applications, the “block raise” and “deadband” settings are used for first house protection on all circuits or lines.

■ **NOTE:** For additional information about LDC-Z applications, contact Beckwith Electric to obtain Distributech Paper 1/27/05, “*Maximizing Automatic Reverse Power Operations with LTC Transformers and Regulators.*”

3.3 Voltage Reduction

Refer to the Appendix, Figure A-4. The control allows three steps of voltage reduction via external dry contacts or by serial port connection. The percentage voltage reduction at each step is adjustable from 0 to 10% in 0.1% increments. When one or more contacts are closed, the effect is to shift the bandcenter setpoint lower thus causing the LTC to lower the voltage.

Recognize that the “effective” bandcenter may have been raised by line drop compensator action when the voltage reduction is initiated and that the resultant voltage setting will be the combination of the two effects. Note also that the undervoltage block setting may limit the lowering of voltage, especially if there is little raising of the local voltage due to LDC action.

When first initiated, or when a subsequent step of voltage reduction is needed, the control will respond immediately to the voltage reduction command without regard to either the intertap time delay setting or the control time delay setting. After the desired voltage reduction, operation will revert back to normal operation with the time delay. Refer to Section 6, Connections, for contact connections.

Wired SCADA dry contacts or serial port connection can be used to provide stepped voltage reduction as described earlier. However, these should *not* be used together, since the resulting reduction would be the “or” combination of the inputs.

3.4 Regulation Limits

Overvoltage Limit & Voltage Runback

Refer to the Appendix, Figure A-4. Setpoints are available to establish a block raise limit and voltage runback. The overvoltage limit is adjustable from 95.0 V to 135.0 V in 0.1 V increments. The overvoltage limit must be set above the upper control band limit. This limit is equivalent to a First Customer Protector to limit overvoltage from line drop compensation action during heavy loading.

The voltage runback level is the Block Raise setting plus the Dead Band setting. This deadband should not be confused with the control deadband above and below the center voltage setpoint, which is generally called the control “bandwidth”.

The voltage runback deadband is used to assure that the runback setting is above the upper voltage limit setting. It is adjustable from 1.0 to 4.0 V in 0.1 V increments.

If the voltage exceeds the runback limit, as might be caused by combinations of LDC action and load shifts or by a system disturbance without LDC action, the control will immediately call for an “automatic” lower without any time delay. The lower command will continue until the voltage is reduced below the runback voltage limit. After this occurs, the timer will reset. If the voltage is still high, normal control action will bring the voltage down to within the normal control band.

Overvoltage block can be effectively disabled by setting it to 135 V. By setting the runback deadband to 4 V, the runback voltage becomes 139 V which effectively disables the feature.

Undervoltage Block

Refer to the Appendix, Figure A-4. This limit is adjustable from 95.0 V–135.0 V in 0.1 V increments. This limit can be set to limit low customer voltage to safe limits and will block voltage reduction action that could cause motor stalling and other undesirable low voltage effects. Undervoltage block can be effectively disabled by setting it to 95 volts. If the voltage is below the Block Lower setpoint, the control will not respond to further lower commands. Raise commands are not affected. Operation of the overvoltage limit, voltage runback and undervoltage block is illustrated in Figure 3-2.

Coordination with Backup Relay

The GE-2011B Digital Tapchanger Control provides the first customer protection functions. Use of a back-up relay, such as the M-0329B, is recommended since the GE-2011B (or any independent control) cannot be expected to be its own backup. The back-up relay bandcenter setting is usually set the same as the primary control, with the bandwidth setting 1 or 2 volts greater than the primary control bandwidth, the block raise setting 1 volt greater than the primary control, and the deadband setting 1 or 2 volts. These settings create a runback level 1 or 2 volts above the runback level of the primary control.

If primary control operation is desired first, the block raise setting and the resulting runback level of the backup relay must be higher than those of the primary control and the block lower setpoint must be lower than the primary control setting.

Tap Position Block

Since Keep-Track is the sole method of tap position knowledge on the GE-2011B, Tap Block Raise and Tap Block Lower are fixed at +16 and -16, respectively.

The Tap Position Block is disabled by setting the Tap Information screen to the Disable condition. Refer to the Appendix, Figure A-5. If the Tap Information screen is not disabled, the Tap Position block can be disabled by setting the Tap Limits screen to Disable.

Overcurrent Block Operation

● WARNING: The current input to the control is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for 1 second.

Refer to the Appendix, Figure A-4 for the Line Limit I screen of the Setpoint Menu. The Line Limit Current setpoint is available to block operation whenever the current exceeds the setting. Depending on the current scaling choice made in the **Configure** menu, the setting is adjustable from 0.2 to 0.64 amps in 0.01 amp increments, when using a 200 mA CT scale. If “Curr Transformer” is set for 1 A, the setting is adjustable from 1.0 to 3.2 Amps, and if the “Curr Transformer” is set for 5 A, the setting is adjustable from 5.0 to 16.0 Amps.

This feature can be used to protect the tapchanger switch during periods of excessive current. This feature can be effectively disabled by setting the blocking current to 0.64 amps, 3.2 Amps or 16-0 amps, depending on scaling CT choice.

3.5 Pulsed Output

When the output selection is “pulsed”, the pulse width can be programmed from 0.2 to 12 seconds, in increments of 0.1 seconds.

When the output is set to pulse and the control is calling for Raise/Lower, an output will turn on for the preprogrammed time, or until a counter contact operates, and then turn off the output for a time period of 0.5 seconds plus the intertap time delay setting value. When the control is calling for a Raise/Lower and no counter input is applied, the output will activate for the full preprogrammed time and deactivate for 0.5 seconds, plus the intertap time delay.

When enabling the pulse feature on an LTC without a counter contact, to prevent hunting, care must be taken to set the ON pulse width less than the time it takes for a complete tap change to occur, but long enough for the seal-in circuit to be activated. The Intertap Time Delay should be longer than the time it takes for a complete tapchange to occur.

When a counter input is applied, and there is an intertap delay, the pulse will cease immediately (triac is turned off) with counter contact closure for the intertap time delay. After the counter contact opens, the intertap timer will start at the end of the time delay. If there is still a Raise/Lower condition, another pulse will start.

3.6 Application Considerations

Sequential

The control operates in Sequential Mode. In this mode, the tap change output is initiated after the time delay timer has timed out. The tap change output will remain “on” until the control senses that the voltage has returned in-band. This permits successive tap changes to be made in a “sequential” mode with no delay between tap changes.

If a delay between successive tap changes is desired, an intertap time delay may be used. This value is set at the Intertap Delay screen in the Configuration Menu. The value is set from 0 to 60 seconds and will interrupt tap change outputs for the preset time after a counter-contact closure is detected by the control's operations counter input #1.

Intertap Time Delay

The intertap time delay may be used in conjunction with sequential operation or pulsed output. The normal operation of this delay timer is as follows: once a tapchange command is initiated, when there would normally be a continuous command (raise or lower) to run the tapchanger until the voltage has returned to within the band setting, there is now an intertap time delay initiated between tapchanges. When the intertap time delay is set to zero, it is disabled.

When invoked by a user who possesses Level 2 security access (or above), the intertap time delay will:

1. Recognize that a tapchange has occurred, indicated by the counter contact input.
2. Remove the output signal and wait for the intertap time delay, even though the voltage remains outside the designated voltage band.
3. Command another tapchange after the intertap time delay has expired, without regard to the basic time delay setting, if the voltage remains out of band in the same direction as the previous tapchange.

■ **NOTE:** The intertap time delay applies a short delay after every tapchange, for the user-selected time delay (0 to 60 seconds). It is enabled via a menu screen. For application with pulsed output, see Section 3.5, **Pulsed Output**.

FUNCTION	SETPOINT RANGE	INCREMENT	INITIAL SETTING
Inter tap Time Delay	0 to 60 seconds	1 second	0 seconds

Table 3-3 Intertap Time Delay Setpoint Range

Test Mode/Status Screen

This convenient screen permits entering a bias voltage for simulating the raising or lowering of the sensed input voltage. This exercises the control as if the input voltage were being changed. The contacts actually operate.

The Test Mode/Status screen displays control status information that includes:

- Output Status
- Compensated Voltage
- Band Status
- Runback/Blocking Status
- Voltage Reduction Status

This screen automatically resets on exit or in 15 minutes if not exited. Refer to Appendix A, Figures A-2 and A-3.

Neutral Light Circuit

The GE-2011B with Group 01 Harness is prepared for use with regulators which use a neutral light. General Electric products typically require that the Neutral Light terminal TB1-11, be grounded inside the regulator when the light is to be illuminated. A switch on the printed circuit board is used to select the desired configuration (Up– Neutral, Down– Hot).

To configure the Neutral Light to be illuminated when TB1-11 is grounded inside the regulator, place the **S1** toggle switch (located on the upper right hand corner of the adapter panel printed circuit board) in the “Up” (Neutral) position (see Figure 6-3.)

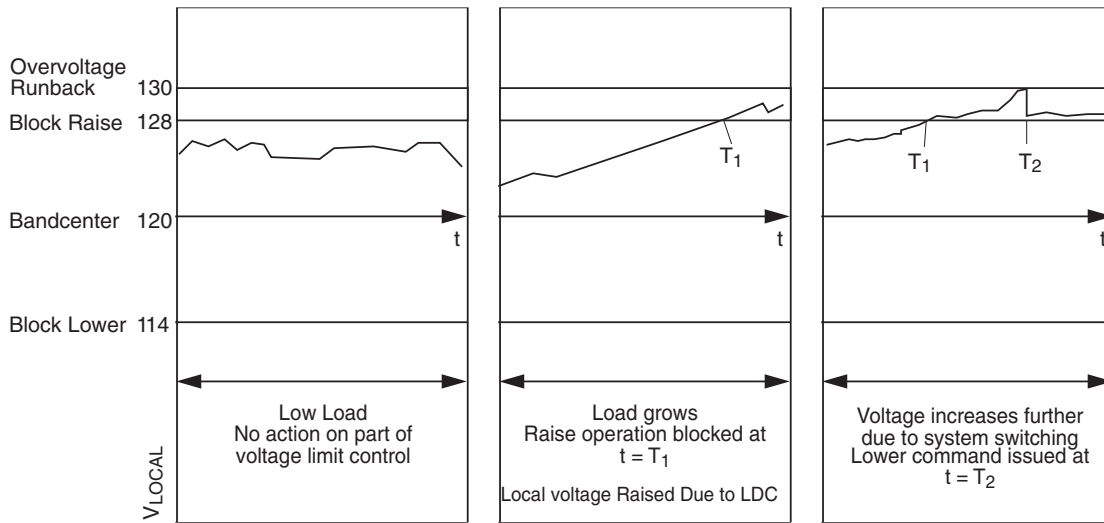


Figure 3-2 Local Voltage as Function of Load Current When Using Line Drop Compensation/ Action of Overvoltage and Overvoltage Runback Control

4 Configuration

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4.0 Introduction

This section describes the Configuration Menu of the software flow. Refer to Appendix A, Figures A-5 and A-8.

■ **NOTE:** Panel display for configured items do not refresh. In order to reflect the change, user must scroll past the screens and then return.

4.1 Passwords

Initializing Passwords (Control)

Refer to the Appendix, Figure A-5. The Level 1 and the communications passwords are set to all 0000 at the factory. The Level 2 password is set to 2222 at the factory and that password must initially be used to access the Configuration Menu. See Chapter 9, **GE-2029A**, Utilities/Set New Passwords section.

New passwords may be entered from the screen within the Configuration Menu as described below. As soon as new passwords are entered, they will be required. Changing any setpoint or configuration will require the password, if enabled. *Enter passwords with care and record them for future use!*

● WARNING: Please record all passwords in a secure location. If the password is lost or forgotten, please contact the factory.

Configuring Passwords

The user who possesses the current Level 2 password may change any password using four new numbers. *A password is not required if the Level 2 password has been set to 0000.*

When **ENT** is pressed while viewing the password at its screen within the **Configuration** menu, an underline cursor is displayed under the digit furthest to the right of the password.

Each digit is changed by using the **↑** and **↓** pushbuttons to select the number. Use the **ENT** pushbutton to move the underline to the left. When the underline is on the far left digit, press **ENT** and the new password is stored into nonvolatile memory. If a wrong number has been entered, press **ENT** as many times as necessary and the underline will move to the digit furthest to the right for entry of the correct password. This should be done immediately to ensure that an incorrect password is not stored in memory.

If interrupted for approximately 15 minutes and the screen goes blank and the digit furthest to the left has not been entered, the password will revert to the previous one regardless of digits that have been changed. After a new Level 2 password has been entered, the new password must be used to reenter the **Configuration** menu. *Be sure to record the new password for future use.*

When a communication password has been configured at the control, the communication password allows the user to bypass both the configuration and setpoint passwords otherwise required by a control.

■ **NOTE:** The communication password is identified as a string #. Therefore, the passwords "001" and "1" are not interchangeable.

Each control can be given a unique, 4-digit password ranging from 0 to 9999. If the password has been configured at the control as 0000, communication is not restricted a password does not need to be identified by GE-2029A. The control is shipped with communication password disabled (set to 0000).

Disabling Passwords

Any one of the three passwords can be disabled within the screens of the Configuration Menu by changing the password to zero (0000). When a password is disabled, its access screens will not be seen and the password will not be required.

Configuration Changes

Use the **↑** and **↓** pushbuttons to display the To Configuration Menu prompt and press **ENT**. The Level 2 password is required for entry, unless disabled. Use the **↑**, **↓** and **ENT** pushbuttons to change the configuration.

4.2 User Identification

Changing User Lines

Refer to the Appendix, Figure A-8. The user station identification lines allow the user to uniquely identify the unit. In normal operation, after 15 minutes without pressing a pushbutton on the display, the screen will be blank. If the screen is blank, any pushbutton press will reactivate it and display the User Lines screen. Each line of this display can have up to fifteen ASCII characters. Both of the lines are factory preset with asterisks.

When **ENT** is pressed at the User Line screen in the **Configuration** menu, an underline cursor is displayed under the left-most digit. Each digit is changed by using the **↑** and **↓** pushbuttons to select the ASCII character (the ASCII character list begins with "!"). The **ENT** pushbutton is used to move the underline to the next digit. When the **ENT** pushbutton is pressed for the right-hand digit, the new user line is stored into nonvolatile memory.

4.3 Counters

The GE-2011B includes three configuration setpoints for the proper operation of the counter functions. These are necessary due to the different types of counter contacts on various equipment using these Digital Tapchanger (DTC) controls and the effect of wear on older counter operating mechanisms.

In most cases, a counter event is defined by the counter input receiving an "open-close-open" event. This is properly interpreted by the control as a single event when the Operation Counter configuration screen is set to the times-one (X1) option. This terminology is a leftover from the days of electromechanical counters where an open-close-open event would register as one event.

The closed state may be as short as 25 ms. It can be no longer than 175 ms, due to the fact some mechanisms operate very quickly. This type of operation is normally found on GE regulators. Using the X2 setting with this type of counter contact would result in a double count for each tapchange.

The second most likely counter event is an open-close or close-open transition. In effect, the counter contact performs one-half of the previous operation, and performs the other half on the subsequent tapchange. Since the electromechanical counters used to record these events were called times-two (X2) counters, that name is the option selected in the Operation Counter configuration screen. The times-two option is most often found in Siemens products. Using the X1 setting with this type counter contact would result in incorrect operation.

A third option has been added to the GE-2011A control, called Count Window. It has a second configuration screen associated with it, called the Counter Time Window. This parameter is user-selectable between 0.5 and 10 seconds. The count window observes any and all activity on the counter contacts and records one even during its open window, regardless of how much switch activity or noise it registers. The counter time window should be set for a time period less than the characteristic time lapse between successive tap changes. Half of the characteristic time is probably a good starting point. This feature electrically de-bounces the noisiest counter contacts.

It is recommended that X1 or X2 settings be used as a first choice for properly operating counter contacts.

The importance of the correct operation of the counter function extends beyond recording the correct number of operations. The correct counting function is required for "Keep Track" tap position operation and for proper Reverse Power Operation.

4.4 Correction Factors

VT Ratio Correction

Refer to the Appendix, Figure A-5. The operation of some regulators is such that the internal VT does not provide the desired voltage ratio. In these cases, it is desirable to correct the VT secondary voltage to a 120 V ac reference base. This change is easily made in software, eliminating the need for a multi-tap sensing transformer.

The correction is derived from information provided by the regulator original equipment manufacturer (OEM). The numerical value of the correction is the value, in volts, required to adjust the VT nominal secondary voltage to 120.0 volts. The correction range is ± 15 volts in 0.1 volt increments.

■ **NOTE:** The maximum allowable continuous VT secondary voltage is 140 volts. The correction is made only in software. As a result, the value of V_{LOCAL} read on the control display will differ from that measured at the voltmeter test terminals by the percent of the correction voltage.

CT/VT Phase Shift

Refer to the Appendix, Figure A-5. The control will recognize forward and reverse power flow to the load. With the CT and VT (reference) signals in-phase for unity power flow to the load, it will properly calculate line drop compensation. Depending on the connection of the CT and VT, the phasors may not be in-phase. If this is the case, the phase shift can be corrected in software. The usual characteristics of three phase systems only allow multiples of 30° phase shifts. The control, therefore, has a range of 0° to 330° in 30° increments.

By comparing system operating conditions with power flow direction and power factor as shown on the GE-2011B Tapchanger Control, improper phase shift can be determined. An incorrect connection may be resolved using well-known phasor methods. The following procedure may be useful to check the choice of correction or even to determine the correction by trial and error:

1. Put the transformer or regulator on manual control.
2. Determine the Watts and VArS load on the transformer or regulator from other metering.
3. Read the Watts and VArS indicated by the control, and make certain that they are of the same sign and ratio of magnitudes as obtained from the external readings.
4. If not, change the correction in 30° increments until the control and external readings are in best agreement.

When two single-phase regulators are connected in open delta, the current signals will be out-of-phase with the voltage signals. For one regulator, the current will lead the voltage by 30° and is called the "leading" regulator. For the "lagging" regulator, the current will lag the voltage by 30°.

Contact Beckwith Electric for **Application Note #17** for more information on VT and CT connections.

4.5 Ratio Multipliers

Voltage & Current Multipliers

Refer to the Appendix, Figure A-5. Primary quantities are displayed when voltage and current multipliers are set into the control. The voltage multiplier is:

$$V_{\text{mult}} = V_{\text{pri}} / (V_{\text{sec}} + V_{\text{corr}})$$

For a VT ratio of 7620/117 V and a voltage correction of 3 V, the multiplier is:

$$V_{\text{mult}} = 7620 / (117 + 3) = 63.5$$

The voltage multiplier setting range is from 0.1 to 3260 in 0.1 steps.

The current multiplier is the value of the line CT primary rating divided by 0.2 A. For a CT primary rating of 1000 A, the multiplier is:

$$CT_{\text{mult}} = 1000 / 0.2 = 5000$$

The current multiplier setting range is from 1 to 32600 in 1.0 steps.

Both multipliers are entered in the **Configuration** menu.

● **WARNING:** The current input to the control is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for 1 second.

■ **NOTE:** The current transformer selection in the Configure menu only changes the scaling factor for current reading and setting.

4.6 Tap Information

The GE-2011B Digital Tapchanger Control tap position information applies to ± 16 taps. The user is able to select the Keep Track or to disable this feature. Table 4-1, below, outlines the two selections available for the Tap Information screen.

Tap Position by Keep Track (Reg Internal)

▲ **CAUTION:** This feature is applicable to single-phase regulators only.

▲ **CAUTION:** This feature is only applicable for \pm tap ranges with neutral tap and neutral indicator. The source voltage will only be applicable with a tap range of ± 16 taps.

This feature allows the control to keep track of the present tap position. The “Reg Internal” setting is selected for this method.

● **WARNING:** Do not rely on the tap position indication on the GE-2011B Tapchanger Control display for neutral position when bypassing voltage regulators.

The motor power source for the manual, automatic, or external (SCADA) initiated tap changes must be the same as the motor power input to the control. The operations counter and neutral light circuit should be operational. The counter input and power source is required for detecting tap changes and determining direction of the tap change. Connecting a regulator neutral tap position indicating contact to the control will reset the tap position to neutral each time the tap goes through the neutral position. It is recommended that the indicated tap position be compared to the mechanical tap position indicator at regular intervals, and that the indicated value be corrected, if necessary.

The tap position stored in memory is not affected by a loss of power. The tap position record is checked and corrected to neutral, if necessary, with the closure of a neutral contact (when the neutral tap position contact is connected to the controls).

▲ **CAUTION:** When the keep-track tap position method is used, it must be calibrated for proper voltage control with reverse power operation.

If desired, the keep-track feature can be disabled in which case the screen will indicate “**Disabled.**”

The user initializes the control at a given, known, tap position upon installation, by selecting Reg Internal in the Tap Information screen in the Configuration Menu and performing the following steps:

1. Determine the actual tap position from the external tap position indicator on the regulator.
2. Scroll through the display to the Tap Calibrate screen in the **Configuration** menu. Press **ENT**. A flashing “C” indicates that the control is ready to accept data. Press the **▲** or **▼** pushbutton until the correct tap position is displayed. Press **ENT** again. The tap position is now calibrated to recognize all subsequent operations so as to “keep-track” of the present tap position.
3. The present tap position is indicated in the Status Menu at the Tap Position screen.

Or, if the neutral tap position contact is connected to the control, run the regulator to neutral as shown by the tap position indicator on the regulator. The control will recognize the neutral light signal and set the tap position accordingly.

The keep-track procedure recognizes tapchanges commanded via **manual, automatic or external (SCADA)** contacts. The power source for the manual- or SCADA-initiated tapchanges must be the same as the motor power source used for the automatic tapchangers.

The keep-track position knowledge is based on the detection of a closed switch (manual or automatic), and feedback from the operation counter input.

The control includes two Zero Voltage Detection (ZVD) circuits. These circuits individually monitor the AC voltage across the internal raise and lower triacs. This is done since any external raise or lower contacts or manual switches have to be placed in parallel with the triacs to run the tapchanger motor. When the triacs (or any contact paralleled across the triacs) closes, the voltage measure decreases to almost zero. When a counter input event is received while the raise circuit is activated, the Keep Track will increment the tap count by one. When a counter input event is received while the lower circuit is activated, the Keep Track will decrement the tap count by one.

Screen Selections	Tap Position Knowledge Method	Current Range	Screens Disabled
REG INTERNAL	Keep Track	Not Applicable	None
DISABLE	None	None	Source Voltage, Tap Position

Table 4-1 Tap Information Screen Selections

If the tapchanger reaches the mechanical tap limits of operation, (± 16), limit switches open up the appropriate circuit so the control cannot force a raise above +16, or force a lower below -16. This is potentially confusing to the ZVD circuits, since they can see zero voltage on the output with a closed triac and also see zero voltage on the other output due to an open limit switch. When this condition is encountered, the control can only make a best guess of which operation really occurs and moves one step in the direction of neutral, which should be away from the side with the open limit switch.

An additional feature is the neutral zero feature. When a regulator passes through the neutral position, a neutral contact closes. This is most often used to drive a neutral light that is an indicator that the mechanism is in the neutral position, and it is safe to bridge the input and output of the regulator because they are at the same voltage. Upon detection of a neutral circuit closure, Keep track resets the tap position to neutral to resynchronize the circuit.

4.7 Reverse Power Operation

Detecting Reverse Power

Reverse power flow exists whenever the real component of the power changes direction. The control reliably determines current direction with as little as 2% of the real component of the nominal 200 mA line current (4.0 mA).

Power Direction Bias Configuration

The Power Direction Bias Configuration screen contains three settings to determine how the control will switch between forward and reverse power operation. The three settings are **No Bias**, **Forward Bias**, and **Reverse Bias**.

"No Bias" Setting

When the Power Direction Bias function is set to "No Bias", the control applies an 8 mA hysteresis band with a bandcenter of 0 load current (+4 mA to -4 mA) to switch between forward and reverse power. The control will switch from forward power to reverse power when the load current exceeds -4 mA (reverse direction). The control will switch from reverse power to forward power when the load current exceeds +4 mA (forward direction).

"Forward Bias" Setting

When the Power Direction Bias function is set to "Forward Bias", the control applies a 0 mA to -4 mA hysteresis band to switch between forward and reverse power. The control will switch from reverse power to forward power when load current is ≥ 0

mA (forward direction). The control will switch from forward power to reverse power when the load current exceeds -4 mA (reverse direction).

"Reverse Bias" Setting

When the Power Direction Bias function is set to "Reverse Bias", the control applies a 0 mA to +4 mA hysteresis band to switch between forward and reverse power. The control will switch from forward power to reverse power when load current is ≤ 0 mA (reverse direction). The control will switch from reverse power to forward power when the load current exceeds +4 mA (forward direction).

Upon detection of power reversal, after a 5 second delay, the control will operate in the selected mode. The operating mode is selected from the following options:

Ignore – Continue control action exactly as though forward power flow continued to exist.

This mode is intended to be used where the transformer or regulator is feeding power to a load which includes an induction generator. In this case, power can reverse with the generator feeding power into the power system yet the system is determining the generator and associated load voltage.

Block – Inhibits automatic tapchange operation. This locks the tapchanger on the tap position in use at the time reverse power flow is detected. It is the recommended setting for independent power producers or in situations when reverse power flow is not expected. The control will revert to normal operation when forward power flow resumes.

Regulate REV (single-phase regulators only) – The control will detect reverse power flow and regulate according to reverse power settings as selected in the Setpoint Menu. With tap position knowledge, the control calculates the source-side potential without the use of a source side VT. This feature is designed for use with feeder voltage regulators which continue to operate in a radial mode after system switching causes the power flow reversal.

The source voltage is calculated by knowing the local voltage, the load current, and the tap position using a presumed regulator impedance. That impedance is a function of the tap position. The calculated source voltage is only valid with a 5/8% step-voltage regulator.

With the control recognizing reverse power flow, the following occurs:

- The **REV PWR** LED is illuminated.
- Reverse power setpoints are used.
- Source voltage is calculated and motor output commands are reversed. For example, when the voltage is high, the control raises the tap thereby lowering the voltage and a lower is indicated on the front panel LEDs.

Return to Neutral – To use this feature, a counter input must be provided, and one of the tap information modes must be enabled.

The Return to Neutral feature will cause the tap position to be driven to neutral when reverse power is detected. Tap position will be driven to neutral regardless of the voltage or currents present at the control. Once neutral is reached, the tap position will remain unchanged as long as reverse power is present. Normal operation will resume when forward power is detected.

This feature is designed to provide a safe response to the detection of a REV Power condition by attempting to move the tapchanger to the neutral position.

4.8 Output Selection

Output Selection

There are two setup screens associated with this feature. This screen is located in the **Configuration** menu. A selection of continuous or pulse may be chosen.

Output Pulse

Located in the Setpoint menu. The output pulse can be programmed from 0.2 to 12 seconds, in increments of 0.1 seconds. An initiated pulse will continue until the pulse time has been reached or a counter contact operates.

■ **NOTE:** When enabling the pulse feature on an LTC without a counter contact, care must be taken to make the ON pulse width less than the time it takes for a complete tap change to occur, but long enough for the seal-in circuit to be activated. The Intertap Time Delay should be longer than the time it takes for a complete tapchange to occur.

Continuous

The output is continuous until the voltage returns into the bandwidth.

4.9 Protocols/Communication

The front communications port, COM2, uses BECO 2200 exclusively.

4.10 Basic Timer Types

The time delay of the control may be selected from two different types. Selection of an *Integrating* timer type increments the timer when the voltage is outside the band, and decrements the timer towards zero when the voltage is within the band. Selection of *Instantaneous* timer type increments the timer when the voltage is outside the band, and resets to zero instantly when the voltage returns within the band.

4.11 Data Logging

This feature allows you to configure the parameters that the control will use to log data (with GE-2029A software) to an Excel or Lotus123 compatible spreadsheet file. Once the log parameters are uploaded through GE-2029A, the control will log data to on-board memory. Logging will continue indefinitely until a new set of log parameters are uploaded, at which point all previously logged data will be lost. It is necessary that the log parameters are set up, and logging be initiated, through the Data Logger for this feature to work as expected.

There are 19 communication points associated with the data logging on the control. Data logging may be set/read from the BECO 2200 protocol.

There are four command points:

Log Sample Period – This is a read/write point. Data range is 1–9,999 minutes in increments of one minute.

Full Record Flag – This is a read only point. It reads zero if the memory has not yet been written over. Reads one if the data has wrapped around, and overwritten previous data.

Log Point Select – This is a read/write point. Data is set in binary format.

Log Status – This point is a command/status/read/write point. Command/status is as follows:

- 0 Not logging (command)
When a zero is written to this point, logging will stop.
- 1 Logging (status)
If log status reads 1, logging is in progress.
- 3 Start Logging (command)
When a three is written to log status, logging will start. Points 9-00 and 9-02 must be set up prior to issuance of a logging command. Logging will continue indefinitely, or until a stop logging command (0) is issued, in a circular buffer manner. The absolute size of the data logging array is 311,040 bytes. The start address of this buffer is 90000 hex. Data will always be logged in records. If the last record exceeds this number (311,040), then the first record at address 90000 hex will be overwritten.
- 4 Download (command)
When a four is written to log status:
 - *The oldest record time stamp can be read in BECO 2200 9-04, 9-05, 0-06.*
 - *The newest record time stamp can be read in BECO 2200 9-07, 9-08, 9-09.*
 - *The current logged data pointer can be read from BECO 2200 9-10, 9-11.*
 - *The ready to download logged data pointer can be written in 9-12, 9-13.*
 - *The first parameter of a record (a 16 bit word of information pointed by 9-12 and 9-13), along with the next 14 words will be ready for query with BECO 2200 protocol. You must issue a read of 15 points (only), starting with point number 9-14. Be aware that this scheme will not read records. It will read 15 words at a time, crossing record boundaries. It will start by reading the 1st parameter in a record, then it will read the next 15 words. As this happens, the control will set up the next 15 words to be read, starting with point 9-14, by incrementing the ready-to-download logged data pointer accordingly.*

4.12 Current Display/Scaling

The current input rating of the GE-2011B Tapchanger Control is 200 mA, continuous. Auxiliary CT's are necessary if primary currents exceed this value.

The Current Transformer scaling selection is set in the Configure menu to be 200 mA, 1 A or 5 A. This choice fixes the scale of both the metering readout quantities and the settings of current values.

The status screen showing this information, **CONTROL LOAD I**, will be updated accordingly

● **WARNING: This selection is for scaling purposes only, and neither 1 A nor 5 A should be input to the control.**

The values of the current displayed in the control load I, and on circulating current screens can be displayed in either 200 mA, 1 A or 5 A scale.

● **WARNING: The current input to the control is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for 1 second.**

The Line Limit Current setpoint screen is also affected by this selection.

4.13 Regulator Type

Regulator Type A or B can be selected in the **Configuration** menu. This will allow the source voltage to be calculated correctly for either type of regulator (see Figure 4-1). It will also allow the control to operate more accurately when in the "regulate in reverse power" mode.

General Electric VR-1 voltage regulators are available in two winding configurations; Type "A" non-inverted configuration and type "B" inverted configuration. These types refer to the internal power component connections. See Figure 4-1.

The Type "A" non-inverted configuration regulator has a wire jumper on the NN terminal block for Potential Transformer tap selection.

On the older regulator controls (those not having power disconnect and CT shorting knife switches), the PT tap selection jumper is usually connected between terminals NN-9 and NN-20, NN-21 or NN-22. On newer regulator controls, (those with power disconnect and CT shorting knife switches), the PT tap selection jumper is usually connected between terminals NN-8 and NN-20, NN-21 or NN-22. There are special cases when a PT ratio correcting

transformer is supplied and the jumper position is different. **In all cases please consult the regulator tank nameplate for the proper jumper connections.**

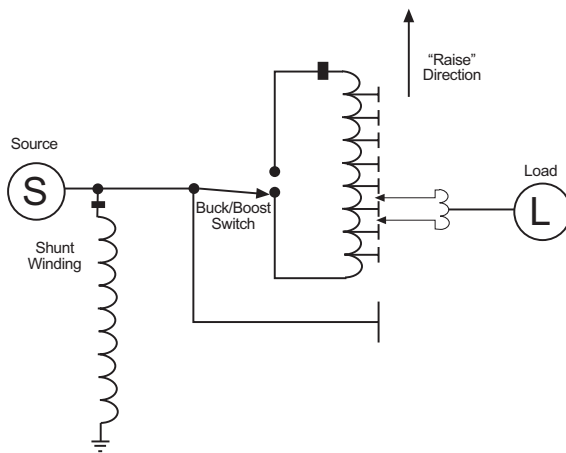
The Type “B” inverted configuration regulator is supplied from the factory with a standard 0.75 ohm resistor installed on the NN terminal block in addition to the PT tap selection jumper. This series resistor limits short circuit currents in the event of an external fault.

On the older regulator controls (those not having a power disconnect and CT shorting knife switches), the resistor is usually connected between terminals NN-9 and NN-22. The PT tap selection jumper is usually connected between terminals NN-22 and NN-20 or NN-21. On newer regulator controls, (those with power disconnect and CT shorting knife switches) the resistor is usually connected between terminals NN-8 and NN-22. The PT tap selection jumper is usually connected between terminals NN-22 and NN-20 or NN-21. **In all cases please consult the regulator tank nameplate for the proper jumper connections.**

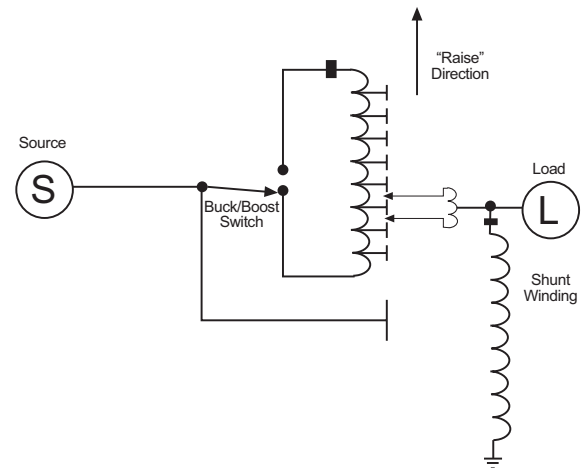
The control can be damaged if the PT tap selection jumper is not connected properly when the regulator is energized.

The control is not powered if either the PT tap selection jumper or resistor is missing or open.

The user should always verify proper connections by **consulting the nameplate on the regulator tank**. The user is cautioned that the nameplate on the control cabinet could possibly be incorrect if the control has ever been replaced. If the serial number on the control cabinet matches the serial number on the regulator tank or nameplate, the control cabinet nameplate may be consulted for proper jumper configuration.



Schematic Diagram;
Single-Phase, Type A Step-voltage
Regulator



Schematic Diagram;
Single-Phase, Type B Step-voltage
Regulator

Figure 4-1 Regulator Type

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5 Status

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5.1	Metering	5-1
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5.0 Introduction

Refer to Figures 5-1 and 5-2.

The control has the capability of displaying measured and calculated secondary quantities and calculated primary quantities.

5.1 Metering

Secondary

The display will show local voltage, source voltage, compensated voltage, line frequency, and load current in secondary quantities along with load power factor. The voltage is displayed on a 120 V base and the current is displayed on a 200 mA base.

■ **NOTE:** The local voltage displayed will not match the voltage measured at the test terminals on the adapter panel if a sensing VT ratio correction other than 0.0 V has been entered.

Primary

Refer to the Appendix, Figure A-5. In order to use the calculated primary quantities feature, the user must enter the following data in the Configuration Menu:

1. Select line-to-line or line-to-ground VT configuration.
2. Select single-phase quantities based on measured inputs, or three-phase quantities based on measured inputs and assume a balanced system.
3. Select primary voltage and current multipliers needed to calculate primary quantities.

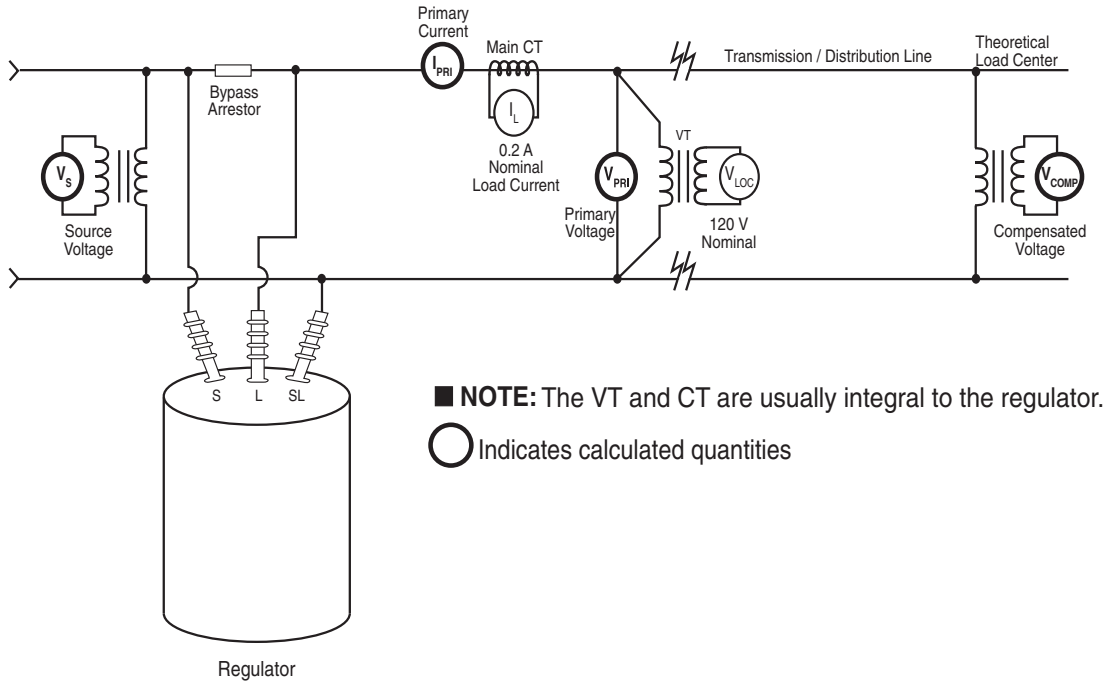


Figure 5-1 Secondary Quantity Metering and Primary Quantity Calculations for Regulator Applications

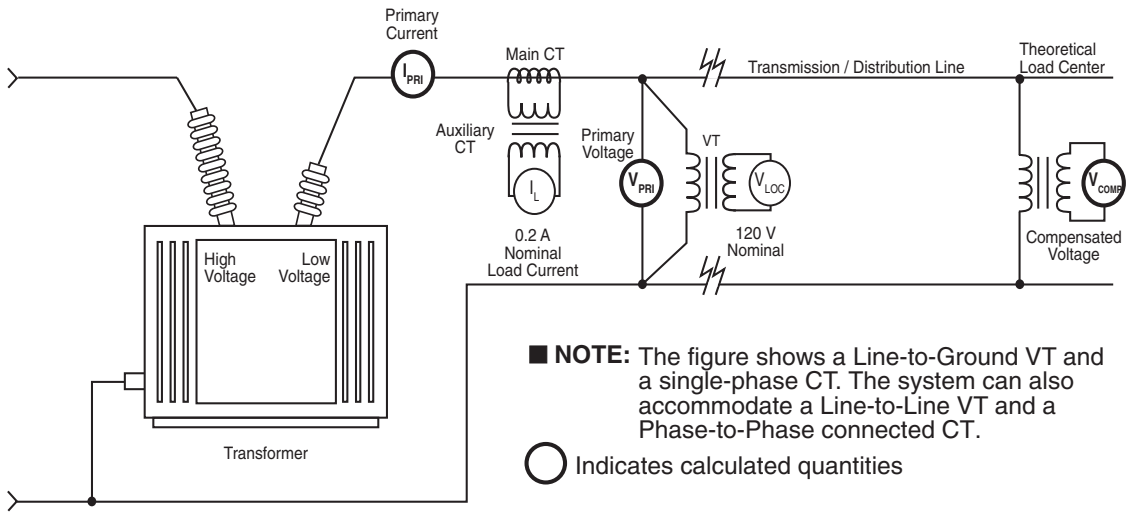


Figure 5-2 Secondary Quantity Metering and Primary Quantity Calculations for Transformer Applications

Demand Metering

Refer to the Appendix, Figure A-5. The demand metering capability provided in the control follows the concept of a lagged demand meter. The demand time interval is selected by the user as 15, 30 or 60 minutes. This is the time it takes for a thermal meter to indicate 90% of a change in load.

Quantitative Metering

Refer to Appendix A, Figure A-2. The quantitative metering function of the control displays the following measured values on the individual status screens:

- Total Reverse VAR Hours (KVARHR, MVARHR or GVARHR)
- Total Forward VAR Hours (KVARHR, MVARHR or GVARHR)
- Total Reverse Watt Hours (KWHR, MWHR or GWHR)
- Total Forward Watt Hours (KWHR, MWHR or GWHR)

The measured values are retained in non-volatile memory. A real time clock is utilized to record a date/time stamp for each quantity to indicate when the period of measurement was initiated.

When a quantitative metering screen is selected, three screens cycle continuously to indicate the total value, date and time the measurement was initiated. The **E** indicates that the measured value can be reset by pushing **ENT**.

5.2 Drag-Hand Display Quantities

Refer to the Appendix, Figure A-5. Drag-hand quantities are the maximum and minimum values for the period since the last reset command. These are retained in non-volatile memory. A real-time clock allows the recording of a date/time stamp with each drag-hand quantity. The following are available for drag-hand use:

- Min/Max tap position (when Tap Position is enabled)
- Min local voltage (120 V base)
- Max local voltage (120 V base)
- Max load current
- Max watts, kW or MW
- Max VAR, kVAR or MVAR
- Max VA, kVA or MVA
- Power Factor at max VA

Where primary quantities are used, values displayed are single-phase or three-phase as defined in the Pri Pwr Display Screen of the Configuration Menu.

▲ **CAUTION:** When the GE-2011B Tapchanger Control is used with a Beckwith Electric adapter panel, the panel's drag hands reset button only resets the mechanical drag hands of the regulator or LTC transformer. The button does **not** reset the tap draghands information stored in the control. The maximum and minimum tap position of the control should always be reset when the mechanical drag hands are reset.

The values retained in memory are time-tagged quantities that are calculated using the demand period selected (15, 30 or 60 minutes). For voltage, values are the average of samples taken over a period of 32 seconds which avoids undue retention of momentary voltage transients. The load power factor retained is the value at the time of max VA.

When selected, three screens for each parameter cycle continuously and indicate the value, date and time of each parameter. The **E** indicates that the drag-hand can be reset by pushing **ENT**.

5.3 Real-Time Clock

Refer to the Appendix, Figure A-2. The control is equipped with a real-time, 24-hour clock which is used with the drag-hand feature to record date/time stamp information on quantities saved in memory. The power source for the clock is maintained for at least 24 hours during a system power outage by a charged capacitor (no battery). If the power outage lasts longer than 24 hours, check the clock and reset if necessary.

5.4 Line Frequency

Refer to the Appendix, Figure A-2. The control provides for real-time metering of the line frequency. If the control is a 60 Hz model, the operating frequency is 55 to 65 Hz; if the control is a 50 Hz model, the operating frequency is 45 to 55 Hz.

5.5. Voltage Reduction Status

■ **NOTE:** Enabling this function may shorten the life of the screen.

Refer to Figure A-5. The control has a flashing voltage reduction status which can be enabled/disabled in the Flash V Red Mode screen of the **Configuration** menu. When enabled, and voltage reduction mode is active, the display will show the local voltage for approximately two seconds, then turn off for approximately 7 seconds. Then the voltage reduction status will be displayed for approximately two seconds, then turn off for about 7 seconds. Then the cycle will repeat, as long as voltage reduction mode is active and the front panel pushbuttons have not been used in the past five minutes.

5.6 Removal of Select Status Screens

Select status screens can be removed by pressing and holding the **ENT** pushbutton, and then also pressing the **↓** pushbutton. This will cause the present status screen to be removed from the status menu for quicker status access. Only the screens that do not use the **ENT** button in any way can be removed. The status screens that can be removed are: Comp. V, Source V, Circ I, Load I, Power Factor, Primary screens (V, I, VA, Watts, VAr), Total Op Count, Pf at Max VA, and Timers. All of the screens can be restored from the "Restore Status Screens" menu item in the **Configuration** menu.

6 Connections

6.0	Installation	6–1
6.1	External Connections	6–1
6.2	Multi-Step Voltage Reduction	6–6
6.3	Communication Port	6–7
6.4	Grounding	6–7
6.5	Backup Control	6–7

6.0 Installation

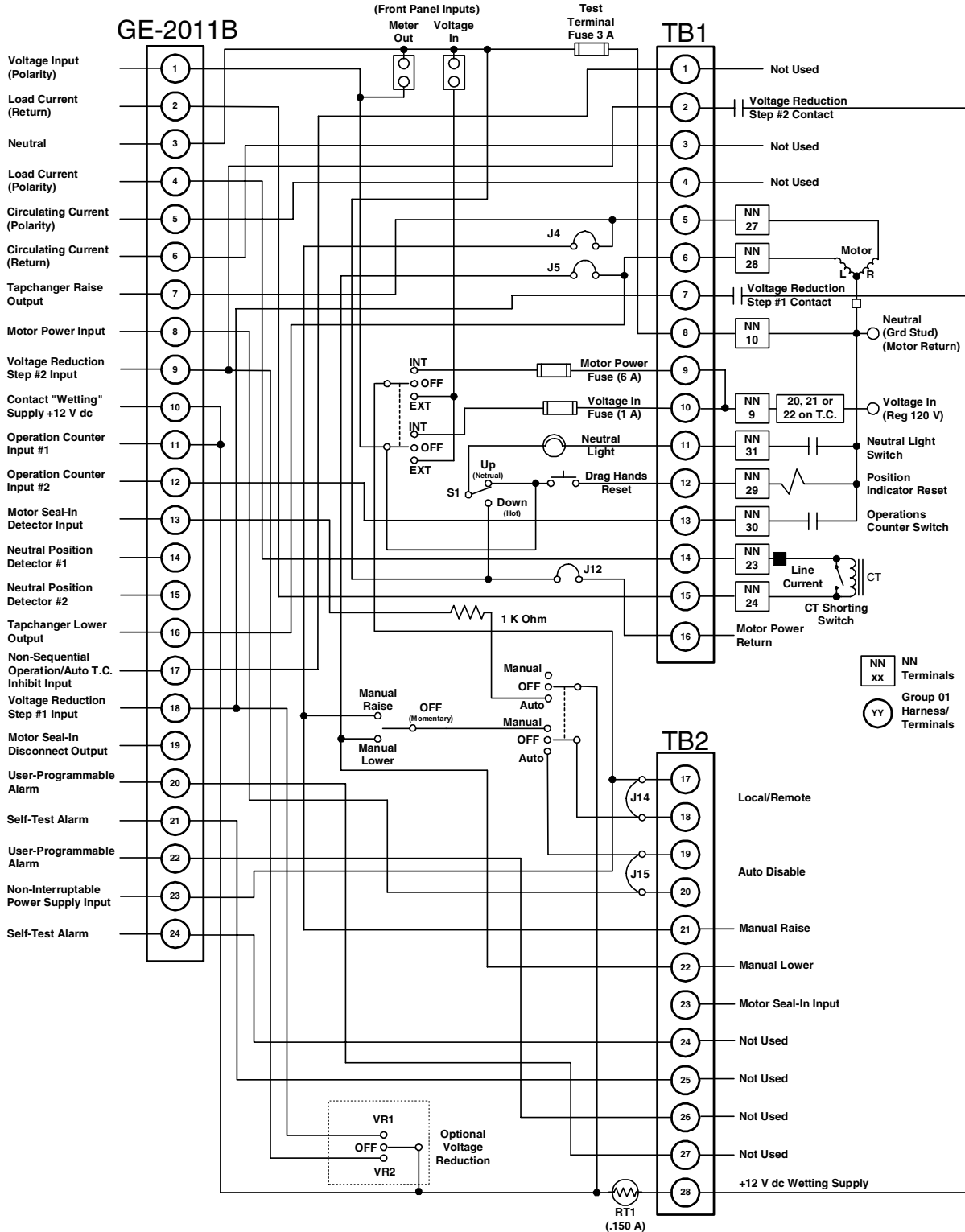
An adapter panel or a M-2050 Surface Mounting Kit must be used with the GE-2011B Tapchanger Control. Each panel adapts the control as a transformer or regulator control replacement and provides the external connections necessary for operation via terminal blocks on the rear of the adapter panel.

In lieu of using an adapter panel to mount the control, the M-2050 Surface Mounting Kit permits surface mounting. The kit consists of two right angle mounting brackets which bolt to the rear top and bottom of the control. All necessary hardware is included in the kit. Also included is a 24-pin, in-line female connector with six-foot pigtails on each pin to facilitate custom connection of the control in original equipment manufacturers' applications.

6.1 External Connections

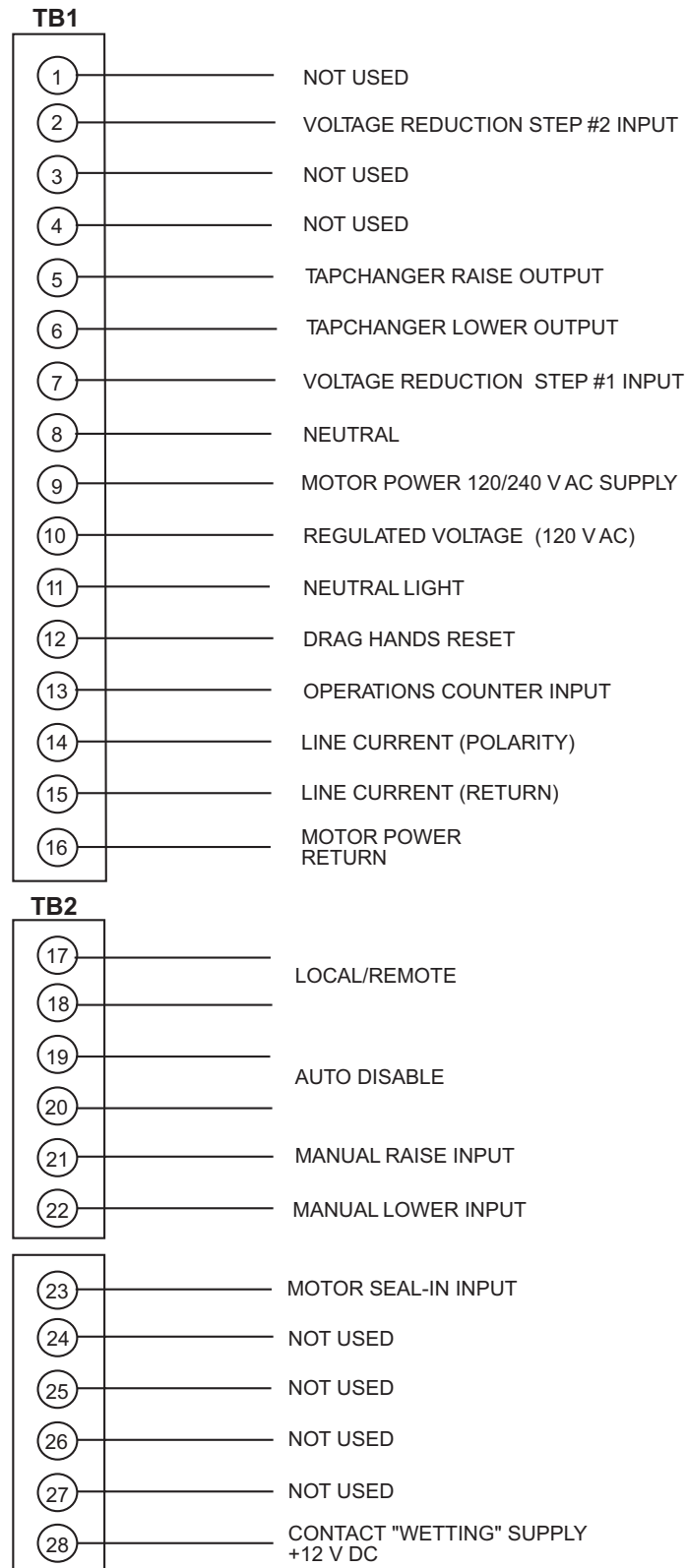
The external connections for the control are shown in Figure 6-1.

The communication port provides remote access to the tapchanger control using the GE-2029A Communications Software.



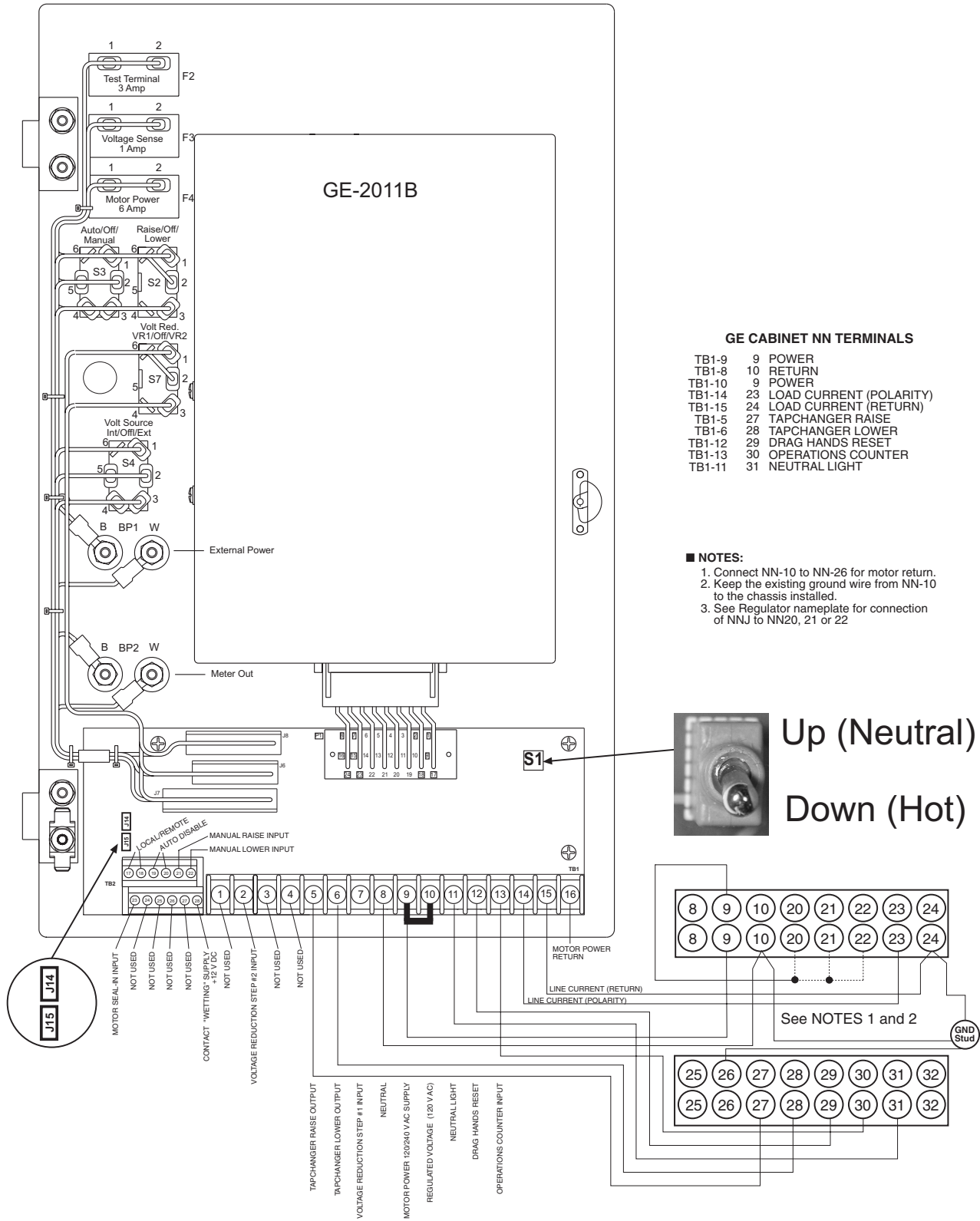
WARNING: In no case should the line current circuit be interrupted with the regulator or transformer energized. Do not remove auxiliary current transformers without shorting the current inputs. Death or severe electrical shock can occur.

Figure 6-1 GE-2011B Group 01 Harness/Panel Typical Connections



● WARNING: Open CT secondary will result in high voltage at CT terminals. Death, severe injury or damage to equipment can occur. Do not operate with CT secondary open. Short circuit or apply burden at CT secondary during operation.

Figure 6-2 External Connections



NOTE: See Section 3.6 for S1 switch details

Figure 6-3 Wiring Harness

GE-2011B Control (Blue Connector)

▲ **CAUTION:** These binary inputs must be "wetted" by connecting to Pin 10 ONLY - a nominal 12 V dc source. If the contacts are connected to a 120 V ac source, it will result in damage to the control. External connections to the control are shown in Figure 6-1.

■ **NOTE:** The communication port provides remote access to the tapchanger control using the GE-2029A Communications Software.

Pin 1 Voltage Input

This input accepts nominal 120 V ac, 60 Hz (or 50 Hz as ordered) to operate the control's power supply and voltage sensing input. The acceptable voltage range for proper control operation is from 90–140 V ac.

Power consumption is less than 8 VA. The input voltage is referenced to line neutral (Pin 3).

Control users may encounter situations where actuating the Drag Hands Reset pushbutton on one of any of our adapter panels results in the loss of a Voltage Sense fuse. The Drag Hands reset solenoid is powered from the circuit that powers the control, and provides the control with sensing voltage. Initially, a 1/4 Ampere fuse was used in this circuit, and most recently a 1 Ampere fuse was substituted to prevent further loss of the fuse. This phenomenon is due to the fact that, as solenoids age, they may become sticky due to mechanical misalignment, hardened grease, or shortened windings.

The adapter panels include a one ampere fuse in the voltage sense circuit. This value should be adequate for all but the most extreme problems. When a Drag Hands Reset Solenoid that consistently blows a one amp fuse is encountered, it is recommended that the customer either remove the solenoid for cleaning and adjustment, or replace it completely.

Pin 2 Load Current Return

This is the non-polarity input to the load current measuring transformer. The companion polarity input is Pin 4. The line current transformer input is isolated from other pins.

Pin 3 Neutral

This is the return for the Voltage Input (Pin 1), and nominal +12 V dc "wetting" voltage (Pin 10).

Pin 4 Load Current Polarity

The line current input range is 0–640 mA (200 mA continuous) with 200 mA representing the 1.0 per-unit value. The measured current value is used for line drop compensation and metering calculation.

● **WARNING:** The current input to the GE-2011B is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for 1 second.

Pin 5 Not Used

Pin 6 Not Used

Pin 7 Tapchanger Raise

This switched output connects the tapchanger raise winding to the source of motor power. When the control calls for a raise, it is capable of switching up to 6 A at 120/240 V ac.

Pin 8 Motor Power Input

The source for powering the tapchanger motor is connected here. It may have a maximum voltage of 240 V ac.

Pin 9 Voltage Reduction Step #2

This digital input is typically enabled by connecting it to the nominal +12 Vdc wetting source (Pin 10), through an external Form "a" dry contact. The amount of voltage reduction implemented is determined by the setting.

Pin 10 +12 V dc Wetting Voltage

This is the output of an unregulated dc power supply internal to the control. It is referenced to neutral and can supply up to 100 mA. It is used for powering the digital inputs of the control through external relays. Depending on the voltage supplied to Pin 1 and loading, its output can vary from +10 to +18 V dc. It is not fused in the control.

Pins 11 & 12 Operations Counter Inputs 1 and 2

This digital input registers the counter contact closure. The pins are isolated from neutral to permit placing the external contact in series with either the wetting voltage or neutral. The operation count will increment when Pin 12 is grounded via the transformer or regulator dry operation count switch.

This contact is needed for using the intertap time delay. Once the contact is opened, the intertap time delay will begin counting down.

Pin 13 Input 1 - Motor Seal-In/Switch Status Input

When the **Input Selection (1)** screen in the **Configuration** menu is set to **Seal-In Input**, this input will operate as a seal-in input. In this configuration, the digital input is referenced to line neutral, but is unique in that it is configured to accept only the output of the motor seal-in current detection transformer, from the B-0553 motor seal-in printed circuit board subassembly. The B-0553 is a supplemental circuit board used in the appropriate adapter panels.

When the **Input Selection (1)** screen in the **Configuration** menu is set to **Switch Status Input**, this input will only operate as a switch status input. All seal-in input functions will be disabled. In this mode, the switch status on the adapter panel can be read to determine if it is in Auto or Manual ON/OFF. The status can be read through the seal-in/switch status data point in the communications protocols.

Pins 14 & 15 Neutral Position Detector Input

This digital input registers neutral position switch closures on regulators. The pins are isolated from neutral to permit placement of the external contact in series with either the wetting voltage or neutral. Normally the wetting supply (Pin 10) will be connected to Pin 14.

Pin 16 Tapchanger Lower Output

This switched output connects the tapchanger lower winding to the source of motor power. When the control calls for a lower, it is capable of switching up to 6 A at 120/240 V ac.

Pin 17 Not Used

Pin 18 Voltage Reduction Step #1

This digital input is typically enabled by connecting it to the nominal +12 V dc wetting source (Pin 10) through an external Form "a" dry contact. The amount of voltage reduction implemented is determined by the setting.

■ **NOTE:** Enabling both voltage reduction step #1 and step #2 inputs simultaneously will result in the level of voltage reduction as specified on the voltage reduction step #3 screen of the control.

Pin 19 Motor Seal-In Disconnect Output

This output connects to the B-0553 motor seal-in printed circuit board subassembly. When the seal-in detector input is actuated, this output drives a triac on the B-0553 motor seal-in printed circuit board subassembly to temporarily disconnect the motor power to the control. The B-0553 is a supplemental circuit board used in the appropriate adapter panels.

Pins 20 & 22 Not Used

Pins 21 & 24 Not Used

Pin 23 Non-Interruptible Power Supply Input

This input is normally connected to Pin 8, the motor power input. The power to Pin 8 is interrupted by the motor seal-in process of the B-0553 motor seal-in printed circuit board. The purpose of Pin 23 is to provide continuous power to the raise and lower keep-track detection circuits. It should be connected ahead of any motor power interruption (for example, auto/manual, local/remote) of the seal-in circuitry to maintain keep-track raise and lower operation.

6.2 Multi-Step Voltage Reduction

On the GE-2011B Tapchanger Control, Pin 9 and Pin 18 on connector P2 are used together to provide up to three levels of voltage reduction. The external connections to achieve these steps are shown in Table 6-1. Voltage reduction amounts are set within the GE-2011B Tapchanger Control software. If these voltage reduction steps are instituted by communications, the contacts are not being used simultaneously.

▲ **CAUTION:** Voltage applied through dry contacts to actuate voltage reduction inputs; counter contacts and neutral contacts *must* be nominal +12 V dc obtained from Pin 10 of the GE-2011B Tapchanger Control. The use of 120 V ac will result in damage to the control.

Voltage Reduction Setpoint: Multiplier Range	Apply "Wetting Voltage" from Pin 10 to Pin #
Voltage Reduction Setpoint #1: 0 to 10%	Pin 18
Voltage Reduction Setpoint #2: 0 to 10%	Pin 9
Voltage Reduction Setpoint #3: 0 to 10%	Pins 18 and 9

Table 6-1 Multi-Step Voltage Reduction External Connections

6.3 Communication Port

COM2 is an internal port, and supports only BECO 2200 protocol and software updates. COM2 supports baud rates from 1200 to 19200.

6.4 Grounding

Ground the control by either the ground stud on the bottom of the case, or by insuring that the mounting screws provide a solid connection to ground.

6.5 Backup Control

Although usually employed in LTC applications, the M-0329B LTC Backup Control can be useful in preventing excessive voltage excursions on regulators in applications where voltage control is critical.

The M-0329B is a single-phase, solid-state backup control that prevents a defective tapchanger control from running the voltage outside the upper and lower voltage limits. The Block Raise and Block Lower voltage levels are set by accurately calibrated dials. Refer to the M-0329B Instruction Book for details.

The M-0329B LTC Backup Control or M-5329 Multiphase Backup Relay are connected as two-terminal devices to the voltage transformer.

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7 Test Procedure

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7.1	Bench-Test	7-3
7.2	Check-out Procedure.....	7-4
7.3	Operational Test	7-5
7.4	In-Service Test.....	7-5

This chapter assumes that the GE-2011B Tapchanger Control is **not** being used with an M-2050B Mounting Kit or an adapter panel (for example, when used by an original equipment manufacturer for use in a control panel). If the control is being used with an M-2050B Mounting Kit or an adapter panel, refer to the Test Procedures chapter of the corresponding Application Guide rather than this chapter.

7.0 Set-up Procedure

Equipment List

● **WARNING:** The current input to the GE-2011B is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for 1 second.

- 0–200 mA current supply with phase angle settings of 0° to +90°
- 90–145 Vac voltage source at 60 Hz
- High impedance true RMS voltmeter with accuracy on ac of at least ±0.2% of reading
- Accurate stop watch

Procedure

1. Make electrical connections as shown in Figure 7-1, External Connections for Test Procedure.

■ **NOTE:** Refer to the Appendix, Figures A-1 through A-13, for the locations of screens within the software.

■ **NOTE:** There is a one-second delay between the out-of-band condition and panel LED indication.

2. Enter initial settings:

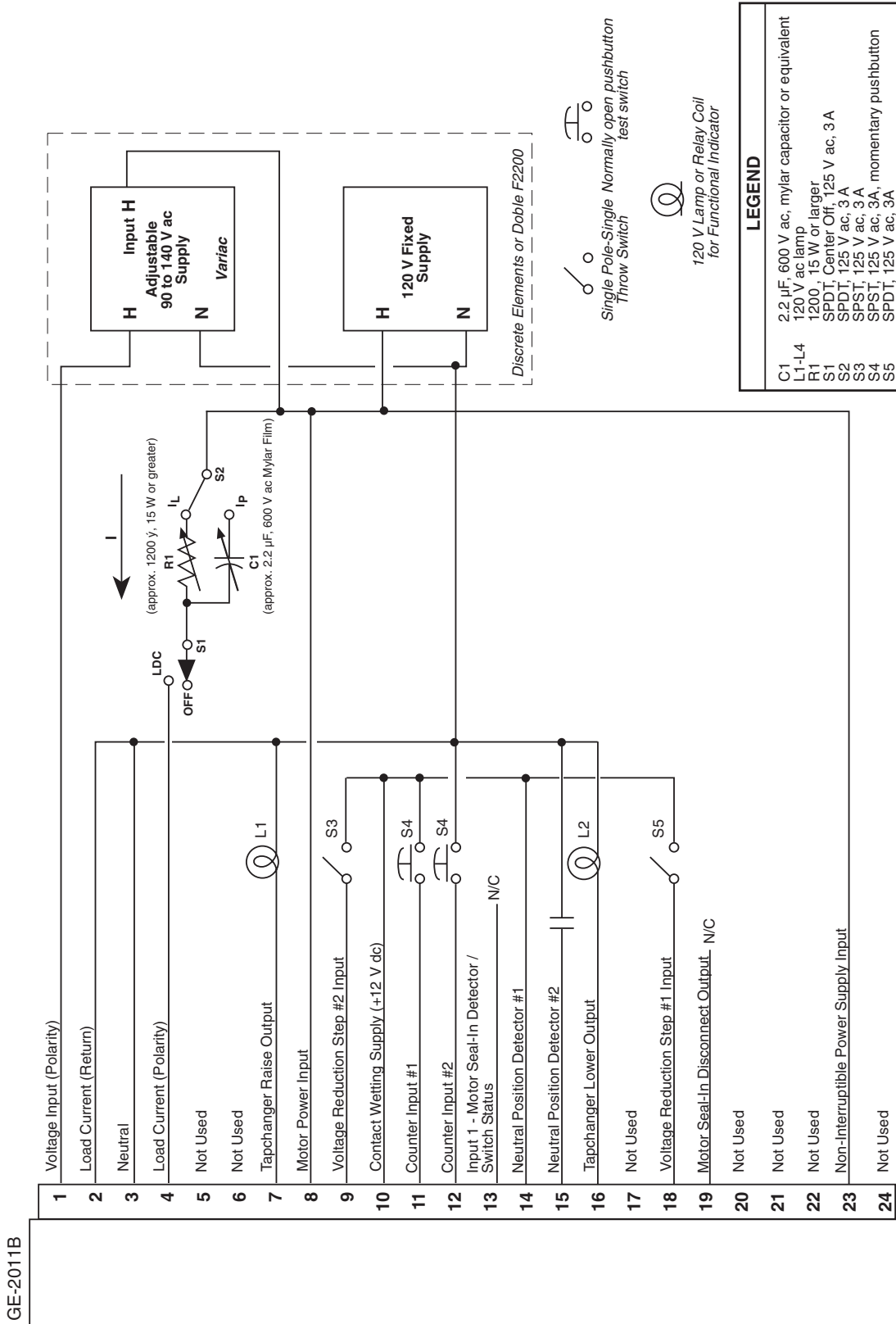


Figure 7-1 External Connections for Test Procedure

FUNCTION	INITIAL SETTING
Bandcenter	120.0 V
Bandwidth	2.0 V
LDC Resistance	0.0 V
LDC Reactance	0.0 V
Paralleling	Circulating Current Method
Block Raise	135.0 V
Block Lower	105.0 V
Deadband	2.0 V
Time Delay	5.0 seconds

Table 7-1 Initial Settings

7.1 Bench Test

▲ CAUTION: Do not reverse the ground and hot wires when connecting an external source.

1. Apply 120 V ac from power source. The display of the GE-2011B will automatically advance to the Local Voltage screen.
2. Increase voltage to 121.2. The **LOWER** LED should illuminate.
3. Decrease voltage to 118.8. The **RAISE** LED should illuminate.
4. Set the input voltage to 120.0 V ac. Wait for **RAISE** and **LOWER** LEDs to extinguish.
5. Increase voltage to 122.0 V ac, then start timing when voltage passes 121.0 V.
6. Stop timing when the lamp connected to the **LOWER** output illuminates (should be approximately 5 seconds).

Resistance

1. Apply a 100.0 mA in-phase current to Pin 4 (load current-polarity) and Pin 2 (load current-return) of the P2 connector.
2. Set S_1 to LDC and S_2 to I_L .
3. Set LDC Resistance to 24.0 V. The **RAISE** LED should illuminate.
4. Increase the input voltage to 132.0 V ac. The **RAISE** and **LOWER** LEDs should be extinguished.

5. Set the LDC Resistance to –24.0 V. The **LOWER** LED should light.
6. Decrease the input voltage to 108.0 V ac. Both **RAISE** and **LOWER** LEDs should extinguish.
7. Set the LDC Resistance to 0.0 V.
8. Decrease the input voltage to 120 V ac.

Reactance

1. Apply 100.0 mA 90° leading current to Pin 4 (load current-polarity) and Pin 2 (load current-return) of the P2 connector.
2. Set S_1 to LDC and S_2 to I_L .
3. Set LDC Reactance to 24.0 V. The **LOWER** LED should illuminate.
4. Decrease the input voltage to 108.0 V ac. The **RAISE** and **LOWER** LEDs should be extinguished.
5. Set LDC Reactance to –24.0 V; the **RAISE** LED should illuminate.
6. Increase input voltage to 132.0 V ac. Both **RAISE** and **LOWER** LEDs should be extinguished.
7. Set the LDC Reactance to 0.0 V.
8. Decrease the input voltage to 120 V ac.

Voltage Reduction

1. Set Voltage Reduction Step #1 to 2.5% (default setting).
2. Close S_5 to enable Voltage Reduction Step #1. The **LOWER** LED should illuminate.
3. Decrease the voltage to 117.0 V ac. The **LOWER** LED should be extinguished.
4. Open S_5 and decrease the input voltage to 120.0 V.
5. Set Voltage Reduction Step #2 to 5% (default setting).
6. Close S_3 to enable Voltage Reduction step #2. The **LOWER** LED should illuminate.
7. Decrease voltage to 114.0 V ac. The **LOWER** LED should extinguish.
8. Open S_3 and decrease the input voltage to 120.0 V ac.

Counter

1. Set the GE-2011B Tapchanger Control to display the Operations Count screen for the Total Operations Counter.
2. Verify counter operation by depressing S4 wired to Pin 11 and Pin 12 (counter in).
3. The operations counter should increment.

Block Raise/Block Lower/Deadband

1. Set Block Raise to 126.0 V.
2. Set Block Lower to 114.0 V.
3. Set the unit to display the Bias Voltage screen.
4. Press **ENT**.
5. Increase voltage to 126.5 V. BR should be displayed on the screen.
6. Increase voltage to 128.5 V. FL is displayed on the screen.
7. Decrease voltage to 113.5 V. BL is displayed on the screen.

—Bench Test Complete—

7.2 Check-out Procedure

■ **NOTE:** All GE-2011B units are fully calibrated at the factory. There is no need to recalibrate the units before initial installation.

Applying Power

1. Remove any external connection between Pin 1 (voltage input) and Pin 8 (motor power input).
2. Using a voltmeter, ensure that the voltage applied to Pin 1 is nominal 120 V ac with respect to Pin 3 (neutral).

▲ **CAUTION:** Do not reverse the ground and hot wires when connecting an external source.

3. Apply motor auxiliary voltage to Pin 8 (motor power input) and Pin 3 (neutral).

4. Verify that the motor runs in the proper direction when conditions of sensed voltage result in activation of Raise and Lower outputs.

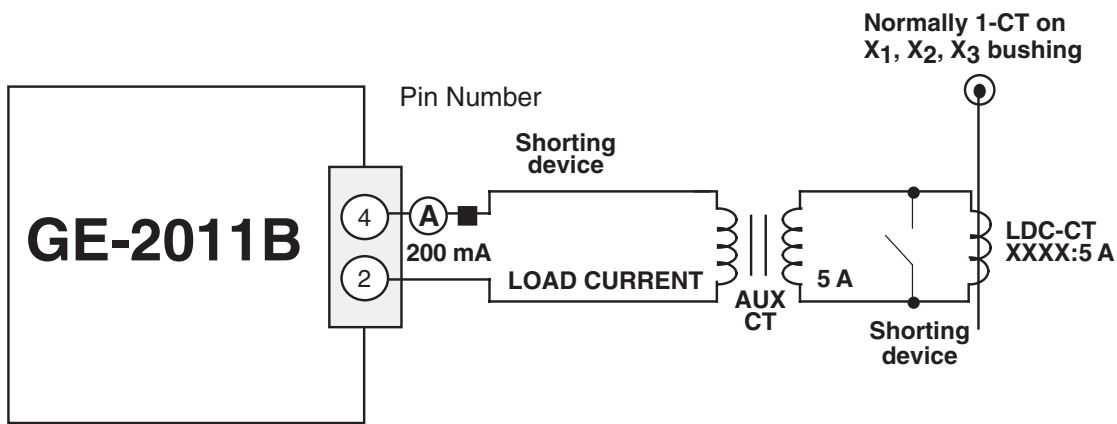
● **WARNING:** In no case should the load current circuit be interrupted with the regulator or transformer energized.

● **WARNING:** Do not remove auxiliary current transformers without shorting the current inputs. Death or severe electrical shock can occur.

5. As shown in Figure 7-2, Setup for Current Checkout Procedures, temporarily place a shorting device across the LDC-CT secondary to short the line drop compensator circuit, and place another shorting device to short the circulating current paralleling output, for the load current check.
6. Insert an ammeter between the polarity input and Pin 4.
7. Open the load current shorting device and with a known load on the transformer or regulator, measure the current in the load current circuit to ensure that this current is correct for 0.2 A full load.

● **WARNING:** The current input to the control is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for 1 second.

8. Replace the shorting device across the load current input and remove the ammeter.
9. Reconnect polarity to the unit and remove both jumpers. The Line Drop Compensator will be activated. Correct CT polarity can be checked by simply incorporating sufficient +R compensation. The regulator should time out and run so as to raise the output voltage.



■ **NOTE:** Pin numbers indicated above are accurate for the M-2050B Mounting Kit only; check the Application Guide of the specific adapter panel used for proper pin numbers.

Figure 7-2 Setup for Current Checkout Procedure

7.3 Operational Test

1. Set VT Ratio Correction = 0 V; CT/VT phasing = 0° from the appropriate screen in the software.
2. Return to the Local Voltage screen.
3. Apply 120.0 V ac to Pin 1 (hot) and Pin 3 (neutral) of the adapter panel.
4. Verify local voltage = input voltage ± 0.3 V.
5. Apply 100.0 mA in-phase current to Pin 4 (load current-polarity) and Pin 2 (load current-return).
6. Verify Control Load I = 100 mA and Power Factor = 1.0 ± 0.02 from the appropriate software screens.
7. Apply 100.0 mA 90° leading current to Pin 5 (circulating current-polarity) and Pin 6 (circulating current-return).
8. Verify Control Circ I = 100.0 mA ± 2 mA.
9. Verify the \uparrow , \downarrow and ENT pushbuttons function properly.
10. De-energize the current source.

—Checkout Procedure Complete—

7.4 In-Service Test

1. Set the GE-2011B Tapchanger Control to display the Bias Voltage screen.
2. Press ENT.
3. Use the \uparrow and \downarrow pushbuttons to cause RAISE and LOWER outputs.
If either output is blocked, verify that the unit is not at the maximum tap position.
4. Press ENT to return to the Local Voltage screen.

—In-Service Test Complete—

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8

GE-2011B Replacement Panels

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8.0 GE-2011B Replacement of the SM-3 Regulator Control

Standard Features

The GE-2011B with Group 09 Harness replacement panel provides a solid-state voltage control relay designed to directly replace the General Electric SM-3 regulator control. The combination of tapchanger control and adapter panel includes the following features:

- Voltage waveform sampling and digital processing circuitry to ensure accurate voltage sensing.
- Control accuracy is $\pm 0.3\%$ when tested in accordance with the ANSI/IEEE C57.15.9-1999 standard over a temperature range of -30°C to $+65^{\circ}\text{C}$. The control accuracy is $\pm 0.5\%$ when tested over the full operational temperature range of -40°C to $+85^{\circ}\text{C}$.
- Input and output circuits are protected against system transients. Units pass all requirements of ANSI/IEEE C37.90.1-1989, which defines surge withstand capability. All input and output terminals will withstand 1500 V ac RMS to chassis or instrument ground for one minute with a leakage current not to exceed 25 mA, for all terminals to ground. Input and output circuits are electrically isolated from each other, from other circuits and from ground.

Control Switches

RAISE/LOWER/OFF switch allows local manual raise and lower commands to be initiated

AUTO/OFF/MANUAL switch allows manual operation of the control.

VOLTAGE REDUCTION VR1/OFF/VR2(Optional) switch allows voltage reduction 1 or 2 to be initiated from the front panel.

VOLTAGE SOURCE switch disconnects the voltage transformer input and connects the **EXTERNAL POWER** binding posts to the voltage input and motor circuit.

▲ CAUTION: Do not reverse the ground and hot wires when connecting an external source. A 3 AG fuse (F2) is installed to protect the relay from damage if these connections are accidentally reversed.

With the **VOLTAGE SOURCE** switch in the **EXT** position, the sensing and motor power circuits are connected to the External Power binding post on the front panel. The unit can be tested using an external 120 V RMS source of proper polarity applied to these terminals. Testing can be accomplished by adjusting the amplitude of the external source.

The **VOLTAGE SOURCE** switch will disconnect all power from the unit when selected to the **EXT** position with no source connected to the front panel voltage inputs.

DRAG HANDS RESET pushbutton resets the tapchanger position indicator drag hands.

Binding Posts

EXTERNAL POWER binding posts allow application of a 120 V RMS nominal voltage to the unit for test procedures.

METER OUT binding posts allow reading of the input voltage when used in conjunction with the **BIAS TEST VOLTAGE** screen of the GE-2011B Tapchanger Control.

Status Indicators

NEUTRAL light illuminates when the regulator is in the neutral tap position.

The Voltage Regulator Control front panel includes three replaceable fuses: Test Terminal (3 A), Voltage Sense (1 A), and Motor Power (6 A).

8.1 GE-2011B with Group 09 Harness Application

Typical Connections

In general, the tapchanger motor must be operated from a different transformer than the VT used to measure regulated voltage. If this is not done, hunting at the upper band edge may result. As soon as the motor starts, and before it is sealed in, the motor current can drop the voltage within the band and reset the control. Some motor seal-in schemes are fast enough to prevent this, but others are not.

Pulsed output can be used on the GE-2011B (see Section 3.5, Pulsed Output).

A typical connection for the GE-2011B with Group 09 Harness is shown in Figure 8-1, GE-2011B with Group 09 Harness Typical Connections. Connections are simplified and may not show all functions required in a typical load tapchanging transformer control scheme – for example, limit switches, etc.

External Connections

Power and voltage sensing are obtained either from a common source or from independent sources having a nominal 120 V ac output. Normally, this is line-to-neutral voltage, although line-to-line voltage can also be used if recognition is made of any phase shift between the voltage and current signals when using line drop compensation.

Load current must be reduced by an appropriate auxiliary current transformer to 0.2 A “full scale”

before connecting to the GE-2011B with Group 09 Harness current inputs. The Beckwith Electric M-0121 (5.0 A to 0.2 A) or M-0169A (5.0 A or 8.66 A to 0.2 A) Auxiliary Current Transformer can be used for this purpose.

The M-0121 can be used with Beckwith Electric Tapchanger Controls when the only burden present is the Line Drop Compensator circuit of the voltage regulating relay.

The M-0169A is used in high burden circuits, such as are found in paralleling schemes. Outputs of the auxiliary CTs are protected against overvoltage.

For further information, obtain Beckwith Electric Application Note #17, “*Basic Considerations for the Application of LTC Transformers and Associated Controls*” (available for download at www.beckwithelectric.com).

The external connections for the GE-2011B with Group 09 Harness are shown in Figure 8-1, GE-2011B with Group 09 Harness/Panel Connections.

Lightning Protection

▲ **CAUTION:** For proper protection against system surges, chassis ground must be connected to earth ground.

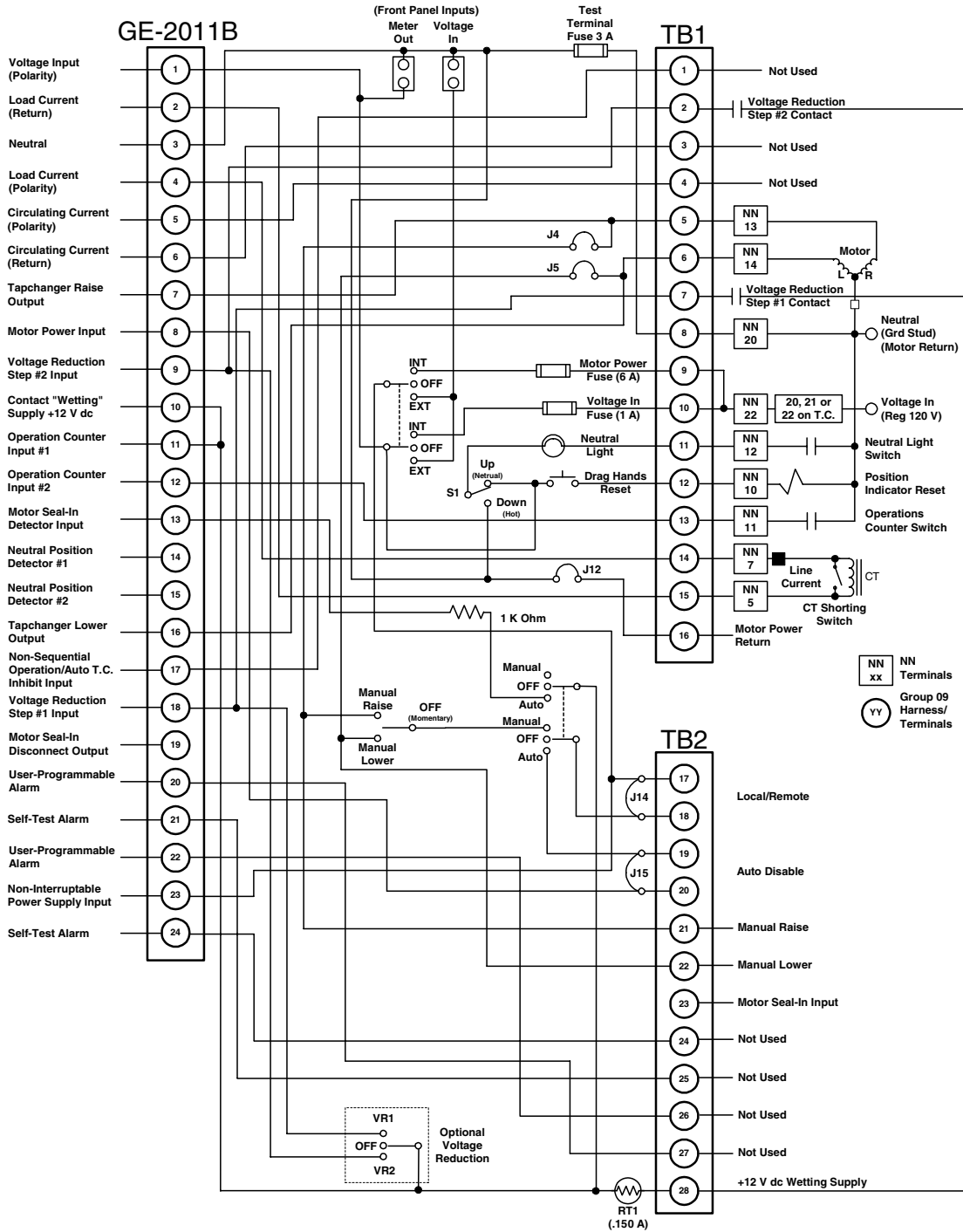
It has been determined that transient voltages in excess of 1500 V ac RMS can exist on the “ground” lead normally tied to TB1-8. In the tapchanger controls, these voltages are suppressed by varistors which still permit the unit to pass a 1500 V ac hi-pot test for one minute, with a leakage of approximately 15 mA, all terminals to ground.

Multiple VT grounds far apart must be avoided, since a varying difference in ground voltage could add or subtract from the effective voltage, and cause variation in the tapchanger control’s bandcenter voltage setpoint.

Neutral Light Circuit

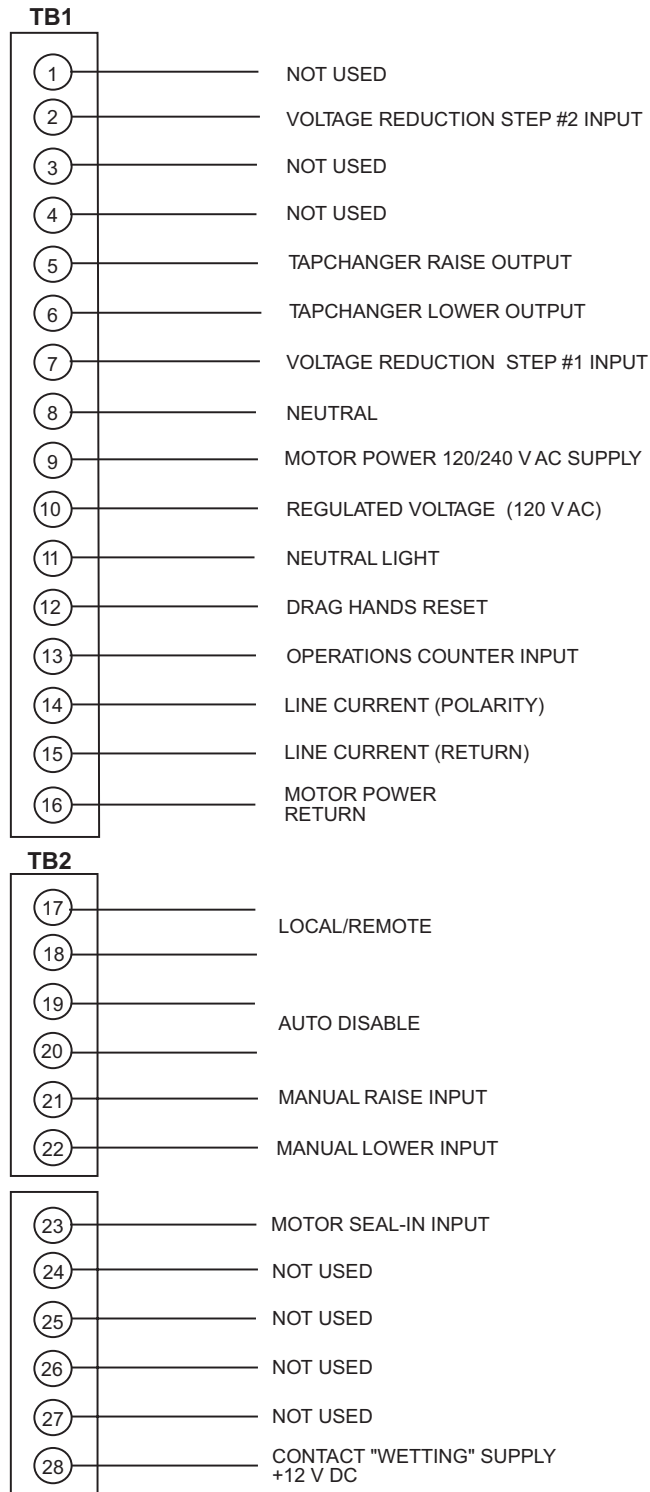
The GE-2011B with Group 09 Harness is prepared for use with regulators which use a neutral light. General Electric products typically require that the Neutral Light terminal TB1-11, be grounded inside the regulator when the light is to be illuminated. A switch on the printed circuit board is used to select the desired configuration (Up–Neutral, Down–Hot).

To configure the Neutral Light to be illuminated when TB1-11 is grounded inside the regulator, place the **S1** toggle switch (located on the upper right hand corner of the adapter panel printed circuit board) in the “Up” (Neutral) position.



WARNING: In no case should the line current circuit be interrupted with the regulator or transformer energized. Do not remove auxiliary current transformers without shorting the current inputs. Death or severe electrical shock can occur.

Figure 8-1 GE-2011B with Group 09 Harness/Panel Typical Connections



● WARNING: Open CT secondary will result in high voltage at CT terminals. Death, severe injury or damage to equipment can occur. Do not operate with CT secondary open. Short circuit or apply burden at CT secondary during operation.

Figure 8-2 External Connections

Automatic Disable Input

To disable automatic operation of the GE-2011B, remove Jumper #15 (See Figure 8-10, for location) on the printed circuit board.

If SCADA is used to enable and disable this function, a contact rated at 6 A minimum can be connected between the terminals.

Operations Counter Input

▲ CAUTION: Do not apply +12 V dc or 120 V ac to this terminal.

An operations count is registered by momentarily grounding TB1-13 through an external dry contact from the load tapchanger. The input is level-sensitive. Make sure that any “wetting” voltages are removed from the counter contacts before installing the GE-2011B Tapchanger Control.

Local/Remote Input

Removing Jumper #14 (See Figure 8-10, for location) prohibits GE-2011B operation by disabling the automatic raise and lower outputs and also by disabling the control's manual **RAISE/OFF/LOWER** toggle switch. Removing this jumper does *not* disable the SCADA-supplied motor voltage input to the manual raise/manual lower contacts on the adapter panel.

Multi-Step Voltage Reduction

▲ CAUTION: Voltage applied through dry contacts to actuate Voltage Reduction Steps 1, 2, and 3 *must* be +12 V dc obtained from pin TB2-28.

TB1-2 and TB1-7 on the printed circuit board are used together to provide up to three levels of voltage reduction. The external connections to achieve these steps are shown in Table 8-1 and Figure 8-2, External Connections. Voltage reduction amounts are set within the GE-2011B Tapchanger Control software.

Voltage Reduction Setpoint: Multiplier Range	Apply "Wetting Voltage" from TB2-27 to Terminal #
Voltage Reduction Setpoint #1: 0 to 10%	TB1-7
Voltage Reduction Setpoint #2: 0 to 10%	TB1-2
Voltage Reduction Setpoint #3: 0 to 10%	TB1-7 and TB1-2

Table 8-1 GE-2011B with Group 09 Harness Multi-Step Voltage Reduction External Connections

8.2 GE-2011B with Group 09 Harness Installation

Removal of the SM-3

1. Release the SM-3 control panel thumb screw latch, then swing the control panel out to access the rear of the enclosure.
2. Remove the power disconnect circuit board from the holder by pressing the ejection ears on the circuit board (Item #1, Figure 8-3).
3. Disconnect the 24-pin connector from the power disconnect circuit board (Item #2, Figure 8-3).
4. Disconnect the 2-pin ground connector (Item 3, Figure 8-4).
5. While supporting the control panel, remove the control panel hinge pins (2), then remove the control panel from the enclosure. Save hinge pins.

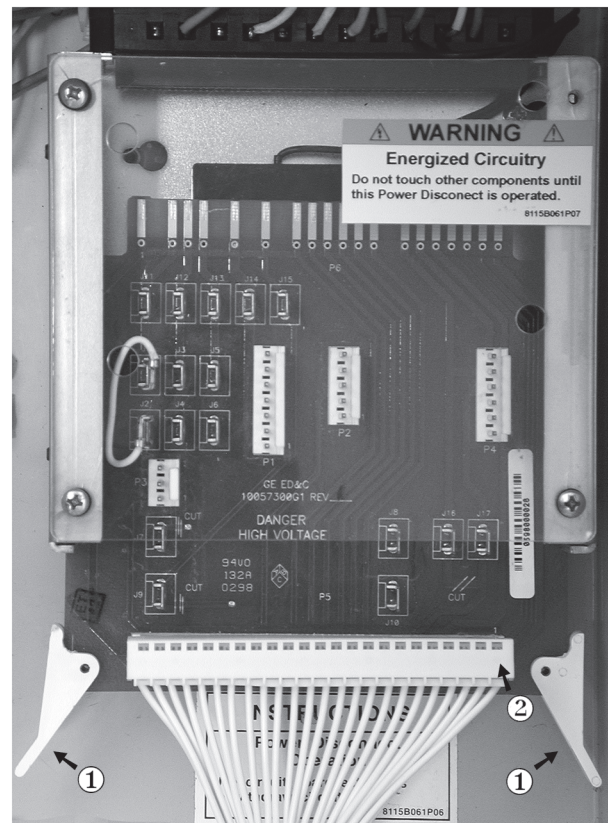


Figure 8-3 Power Disconnect Circuit Board

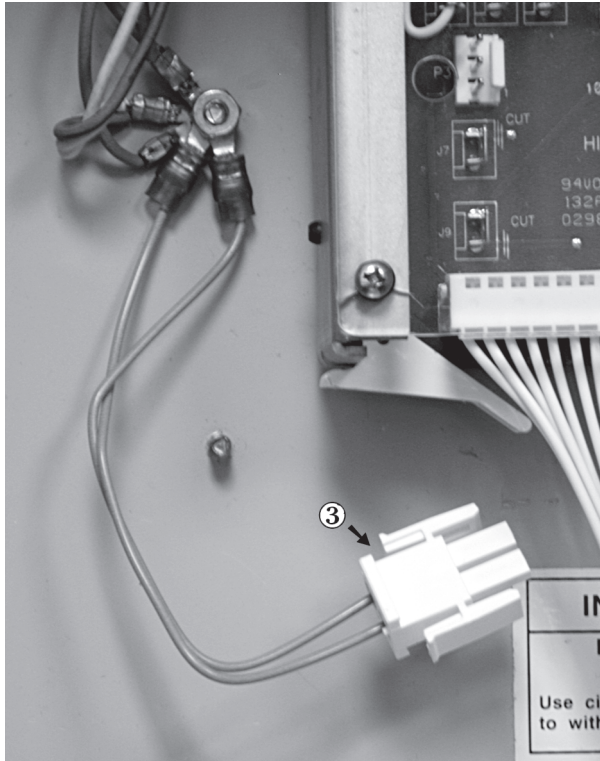


Figure 8-4 2-Pin Ground Connector

Installing the GE-2011B with Group 09 Harness

1. Mount the GE-2011B with Group 09 Harness/panel by using the hardware provided in the cloth bag. Use the lock washers supplied between the screws and the top of the front panel.

■ **NOTE:** The blue connector is keyed by a “V” notch in the middle to prevent incorrect mating (see below). Check location of the key before plugging connector into the GE-2011B.

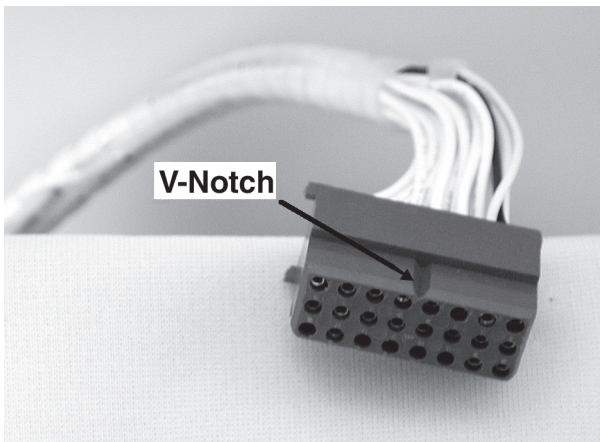


Figure 8-5 GE-2011B Harness Connector

2. Plug the blue connector into the bottom of the GE-2011B (below).

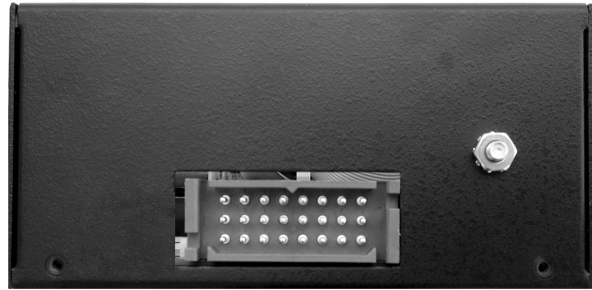


Figure 8-6 GE-2011B V-Notch Orientation

3. Place the control onto the enclosure hinges, then insert hinge pins.
4. Connect the 24-pin connector to the power disconnect circuit board (item #2, Figure 8-3).
5. Connect the 2-pin ground connector (see Figure 8-4).
6. Connect the power disconnect circuit board to the holder (Item #1, Figure 8-3).
7. Secure the control panel thumb screw latch.
8. Set the toggle switch to the **Manual** position.
9. Set up the desired configuration and settings on the GE-2011B. See Chapter 4.0, Configuration.
10. Verify manual operation of the unit.
11. Set the toggle switch to the **Auto** position and verify automatic operation.

8.3 GE-2011B with Group 09 Harness Checkout Procedure

■ **NOTE:** All GE-2011B units are fully calibrated at the factory. There is no need to recalibrate the units before initial installation.

Pre-Test Conditions

1. Place the **AUTO/OFF/MANUAL** switch in the **OFF** position.
2. Verify that the **MOTOR POWER** and **VOLTAGE** fuses are correctly sized and have not blown.

Power

1. Remove any external connections between TB1-9 (Motor Power) and TB1-10 (Regulated Voltage), which are located on the adapter panel printed circuit board.
2. Remove any voltage applied to TB1-9 externally.
3. Apply a nominal 120 V ac test voltage source between TB1-10 (hot) and TB1-8 (neutral).
4. Using a voltmeter, verify that the voltage applied to TB1-10 is nominal 120.0 V ac with respect to TB1-8.

● **WARNING: Do not connect any voltage source at the METER OUT test terminal. Applying a voltage source may energize the regulator or transformer to a high voltage through the voltage transformer. Death or electrical shock can occur.**

▲ **CAUTION:** Do not reverse the ground and hot wires when connecting an external source.

5. Apply motor power to TB1-9 (hot) and TB1-8 (neutral).
6. Place the **AUTO/OFF/MANUAL** switch in the **MANUAL** position.
7. Using the **RAISE/OFF/LOWER** switch, verify that the motor runs in the proper direction when the switch is placed in the **RAISE** and **LOWER** positions.
8. Set the **AUTO/OFF/MANUAL** switch to the **AUTO** position.
9. Refer to Chapter 3, **Setting the Control**, for setup and test procedures for the GE-2011B.

Load Current CT

● **WARNING: In no case should the load current circuit be interrupted with the regulator or transformer energized.**

● **WARNING: Do not remove auxiliary current transformers without shorting the current inputs. Death or severe electrical shock can occur.**

1. Short the line drop compensator circuit by placing a shorting device of adequate capacity, across the LDC-CT secondary (See Figure 8-7).
2. Connect an ammeter (set to the 200 mA range) between the polarity input and TB1-14.
3. Open the load current shorting device.
4. With a known load on the transformer or regulator, measure the current in the load current circuit.
5. Verify that the current measured in Step 4 is correct for 0.2 A full load.

LDC

1. Replace the shorting device across the load current input and remove the ammeter.
2. Reconnect polarity to the unit, then remove both shorting devices. The **LINE DROP COMPENSATOR** will be activated.

Verify correct CT polarity by incorporating sufficient +R compensation. The regulator should time out and run to raise the output voltage.

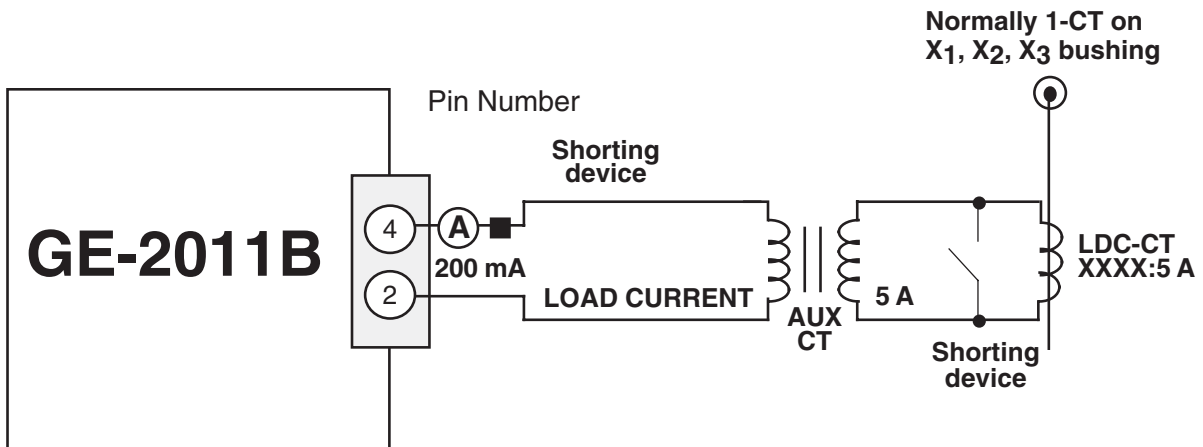


Figure 8-7 GE-2011B Setup for Current Checkout Procedure

8.4 GE-2011B Replacement of the ML-32 and VR-1 Regulators, and SM-1, SM-2, and SM-2A Regulator Controls

Standard Features

The GE-2011B with Group 05 Harness Adapter Panel provides a solid-state voltage control relay designed to directly replace the General Electric ML-32 and VR-1 Regulators and SM-1, SM-2, and SM-2A regulator controls. The combination of tapchanger control and adapter panel includes the following features:

- Voltage waveform sampling and digital processing circuitry to ensure accurate voltage sensing.
- Control accuracy is $\pm 0.3\%$ when tested in accordance with the ANSI/IEEE C57.15.9-1999 standard over a temperature range of -30°C to $+65^{\circ}\text{C}$. The control accuracy is $\pm 0.5\%$ when tested over the full operational temperature range of -40°C to $+85^{\circ}\text{C}$.
- Input and output circuits are protected against system transients. Units pass all requirements of ANSI/IEEE C37.90.1-1989, which defines surge withstand capability. All input and output terminals will withstand 1500 V ac RMS to chassis or instrument ground for one minute with a leakage current not to exceed 25 mA, for all terminals to ground. Input and output circuits are electrically isolated from each other, from other circuits and from ground.

Control Switches

RAISE/LOWER/OFF switch allows local manual raise and lower commands to be initiated

AUTO/OFF/MANUAL switch allows manual operation of the control.

VOLTAGE REDUCTION VR1/OFF/VR2 switch allows voltage reduction 1 or 2 to be initiated from the front panel.

VOLTAGE SOURCE switch disconnects the voltage transformer input and connects the **MOTOR PWR IN** and **VOLTAGE IN** binding posts to the voltage input and motor circuit.

▲ **CAUTION:** Do not reverse the ground and hot wires when connecting an external source. A 3 AG fuse (F2) is installed to protect the relay from damage if these connections are accidentally reversed.

With the **VOLTAGE SOURCE** switch in the **EXT** position, the sensing and motor power circuits are connected to the External Power binding post on the front panel. The unit can be tested using an external 120 V RMS source of proper polarity applied to these terminals. Testing can be accomplished by adjusting the amplitude of the external source.

The **VOLTAGE SOURCE** switch will disconnect all power from the unit when selected to the **EXT** position with no source connected to the front panel voltage inputs.

DRAG HANDS RESET pushbutton resets the tapchanger position indicator drag hands.

Binding Posts

EXTERNAL POWER binding posts allow application of a 120 V RMS nominal voltage to the unit for test procedures.

METER OUT binding posts allow reading of the input voltage when used in conjunction with the **BIAS TEST VOLTAGE** screen of the GE-2011B Tapchanger Control.

Status Indicators

NEUTRAL light illuminates when the regulator is in the neutral tap position.

The Voltage Regulator Control front panel includes three replaceable fuses: Test Terminal (3 A), Voltage Sense (1 A), and Motor Power (6 A).

8.5 GE-2011B with Group 05 Harness Application

Typical Connections

In general, the tapchanger motor must be operated from a different transformer than the VT used to measure regulated voltage. If this is not done, hunting at the upper band edge may result. As soon as the motor starts, and before it is sealed in, the motor current can drop the voltage within the band and reset the control. Some motor seal-in schemes are fast enough to prevent this, but others are not.

Pulsed output can be used on the GE-2011B (see Section 3.5, Pulsed Output).

A typical connection for the GE-2011B with Group 05 Harness is shown in Figure 8-8, GE-2011B with Group 05 Harness Typical Connections. Connections are simplified and may not show all functions required in a typical load tapchanging transformer control scheme – for example, limit switches, etc.

External Connections

Power and voltage sensing are obtained either from a common source or from independent sources having a nominal 120 V ac output. Normally, this is line-to-neutral voltage, although line-to-line voltage can also be used if recognition is made of any phase shift between the voltage and current signals when using line drop compensation.

Load current must be reduced by an appropriate auxiliary current transformer to 0.2 A “full scale” before connecting to the GE-2011B with Group 05 Harness current inputs. The Beckwith Electric M-0121 (5.0 A to 0.2 A) or M-0169A (5.0 A or 8.66 A to 0.2 A) Auxiliary Current Transformer can be used for this purpose.

The M-0121 can be used with Beckwith Electric Tapchanger Controls when the only burden present is the Line Drop Compensator circuit of the voltage regulating relay.

The M-0169A is used in high burden circuits, such as are found in paralleling schemes. Outputs of the auxiliary CTs are protected against overvoltage.

For further information, obtain Beckwith Electric Application Note #17, “*Basic Considerations for the Application of LTC Transformers and Associated Controls*” (available for download from www.beckwithelectric.com).

The external connections for the GE-2011B with Group 05 Harness are shown in Figure 8-8, GE-2011B with Group 05 Harness/Panel Typical Connections.

Lightning Protection

▲ **CAUTION:** For proper protection against system surges, chassis ground must be connected to earth ground.

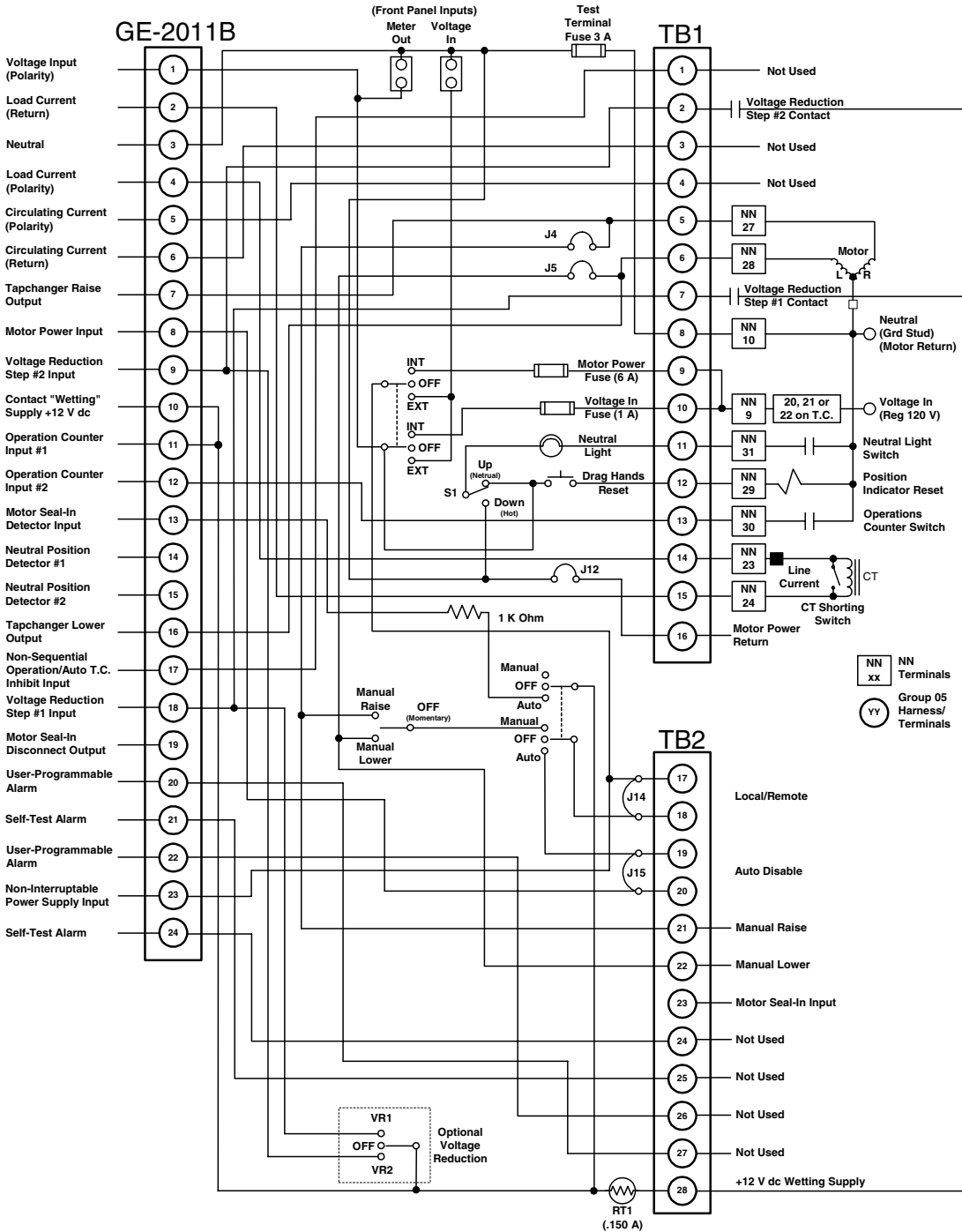
It has been determined that transient voltages in excess of 1500 V ac RMS can exist on the “ground” lead normally tied to TB1-8. In the tapchanger controls, these voltages are suppressed by varistors which still permit the unit to pass a 1500 V ac hi-pot test for one minute, with a leakage of approximately 15 mA, all terminals to ground.

Multiple VT grounds far apart must be avoided, since a varying difference in ground voltage could add or subtract from the effective voltage, and cause variation in the tapchanger control’s bandcenter voltage setpoint.

Neutral Light Circuit

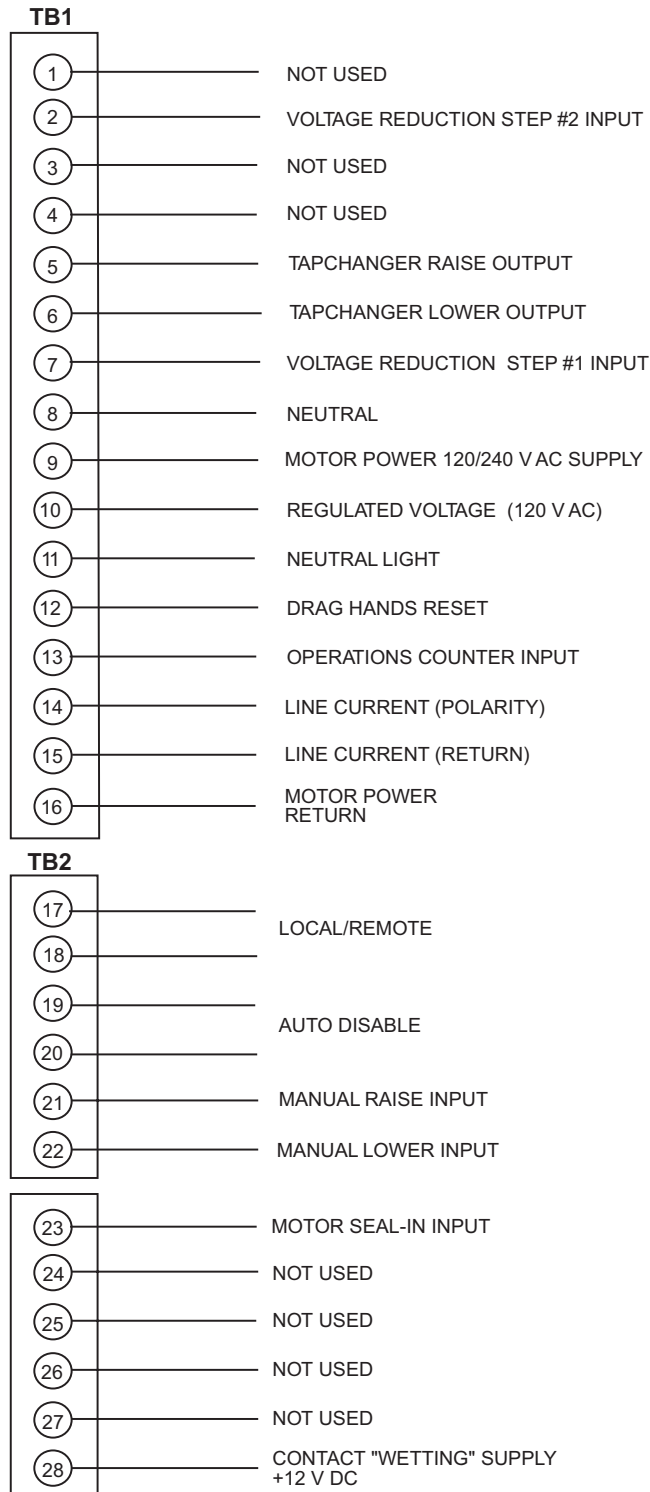
The GE-2011B with Group 05 Harness is prepared for use with regulators which use a neutral light. General Electric products typically require that the Neutral Light terminal TB1-11, be grounded inside the regulator when the light is to be illuminated. A switch on the printed circuit board is used to select the desired configuration (Up–Neutral, Down–Hot).

To configure the Neutral Light to be illuminated when TB1-11 is grounded inside the regulator, place the **S1** toggle switch (located on the upper right hand corner of the adapter panel printed circuit board) in the “Up” (Neutral) position.



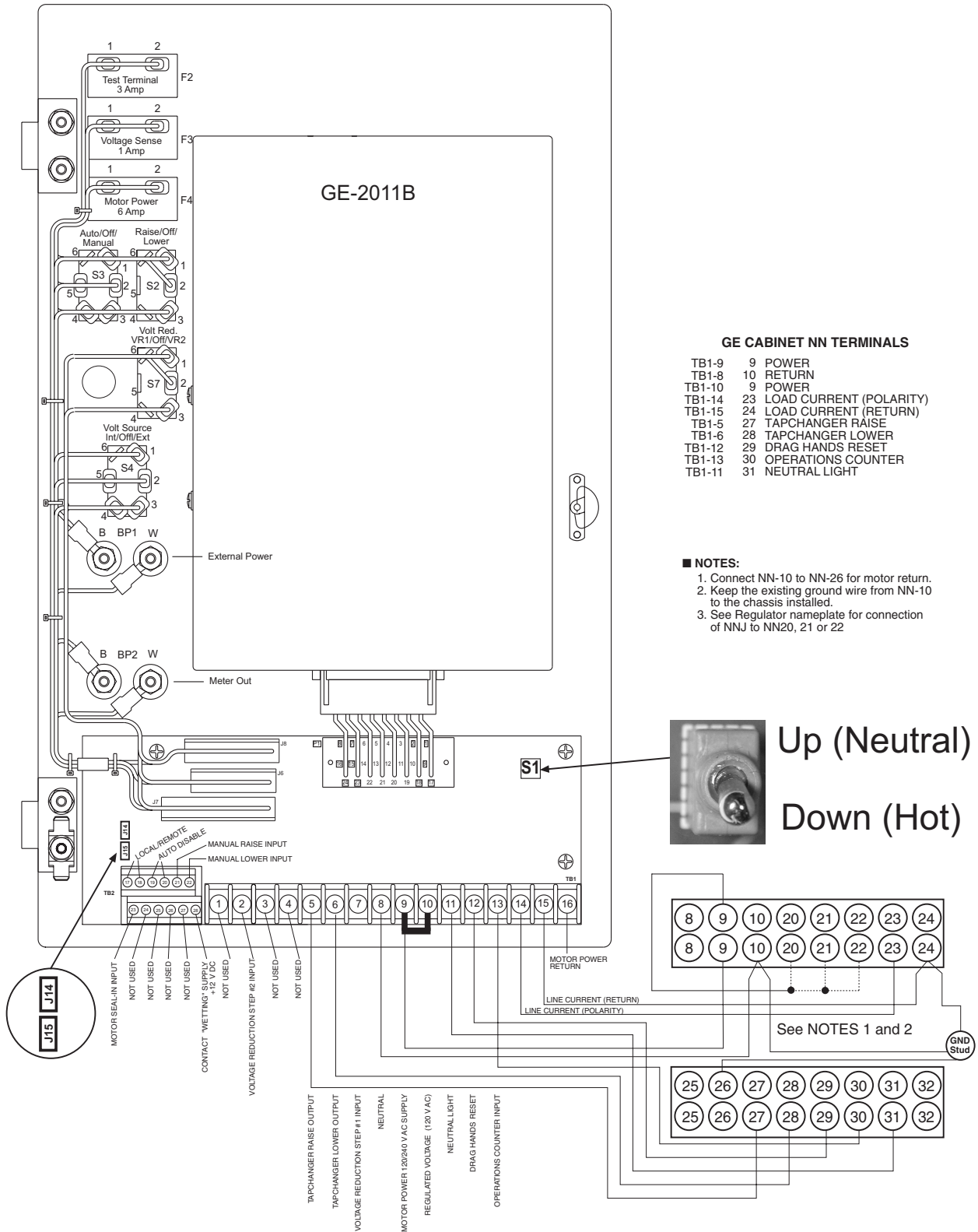
WARNING: In no case should the line current circuit be interrupted with the regulator or transformer energized. Do not remove auxiliary current transformers without shorting the current inputs. Death or severe electrical shock can occur.

Figure 8-8 GE-2011B with Group 05 Harness/Panel Typical Connections



● **WARNING:** Open CT secondary will result in high voltage at CT terminals. Death, severe injury or damage to equipment can occur. Do not operate with CT secondary open. Short circuit or apply burden at CT secondary during operation.

Figure 8-9 External Connections



■ **NOTE:** See Section 8.5, GE-2011B with Group 05 Harness Application, Neutral Light Circuit, for S1 Switch details.

Figure 8-10 GE-2011B Group 05 Wiring Harness and External Connections

Automatic Disable Input

To disable automatic operation of the GE-2011B, remove Jumper #15 (See Figure 8-10, for location) on the printed circuit board.

If SCADA is used to enable and disable this function, a contact rated at 6 A minimum can be connected between the terminals.

Auto disable may also be accomplished by closing a contact between TB1-1 and TB2-28.

Operations Counter Input

▲ CAUTION: Do not apply +12 V dc or 120 V ac to this terminal.

An operations count is registered by momentarily grounding TB1-13 through an external dry contact from the load tapchanger. The input is level-sensitive. Make sure that any “wetting” voltages are removed from the counter contacts before installing the GE-2011B Tapchanger Control.

Local/Remote Input

Removing Jumper #14 (See Figure 8-10, for location) prohibits GE-2011B operation by disabling the automatic raise and lower outputs and also by disabling the control’s manual **RAISE/OFF/LOWER** toggle switch. Removing this jumper does *not* disable the SCADA-supplied motor voltage input to the manual raise/manual lower contacts on the adapter panel.

Multi-Step Voltage Reduction

▲ CAUTION: Voltage applied through dry contacts to actuate Voltage Reduction Steps 1, 2, and 3 *must* be +12 V dc obtained from pin TB2-28.

TB1-2 and TB1-7 on the printed circuit board are used together to provide up to three levels of voltage reduction. The external connections to achieve these steps are shown in Table 8-2 and Figure 8-9, External Connections. Voltage reduction amounts are set within the GE-2011B Tapchanger Control software.

Voltage Reduction Setpoint: Multiplier Range	Apply "Wetting Voltage" from TB2-27 to Terminal #
Voltage Reduction Setpoint #1: 0 to 10%	TB1-7
Voltage Reduction Setpoint #2: 0 to 10%	TB1-2
Voltage Reduction Setpoint #3: 0 to 10%	TB1-7 and TB1-2

Table 8-2 GE-2011B with Group 05 Harness Multi-Step Voltage Reduction External Connections

8.6 GE-2011B with Group 05 Harness Installation

Removal of the GE Control

1. Open the cabinet door of the General Electric control.
2. Loosen the two thumbscrews at the interface of the control cable plug (Item #1, Figure 8-11) and the tap position indicator on the regulator, then pull down on the plug to disconnect it.
3. Turn the knob on the control panel (Item #2, Figure 8-11), then swing the panel outward.
4. Disconnect the three plugs that connect the wiring harness of the front panel to the component board.
5. Remove all connections from the component board to the NN terminal blocks.
6. Using a screwdriver or other appropriate tool, remove the component board.
7. While supporting the panel, remove and save the two hinges pins (Item 3, Figure 8-11), then lift the panel off the hinges.

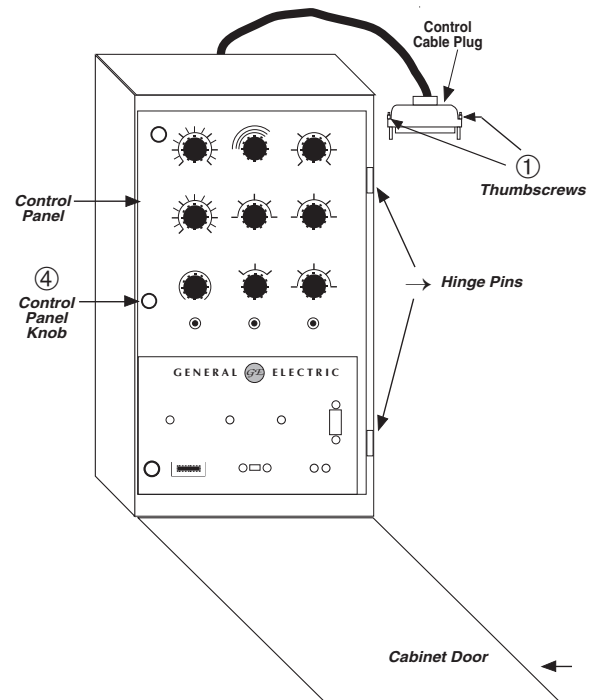


Figure 8-11 General Electric Control in Cabinet

Installing the GE-2011B

1. Mount the GE-2011B to the adapter panel by using the hardware provided in the cloth bag. Use the lock washers supplied between the screws and the top of the front panel.

■ **NOTE:** The blue connector is keyed by a “V” notch in the middle to prevent incorrect mating (see below). Check location of the key before plugging connector into the GE-2011B.

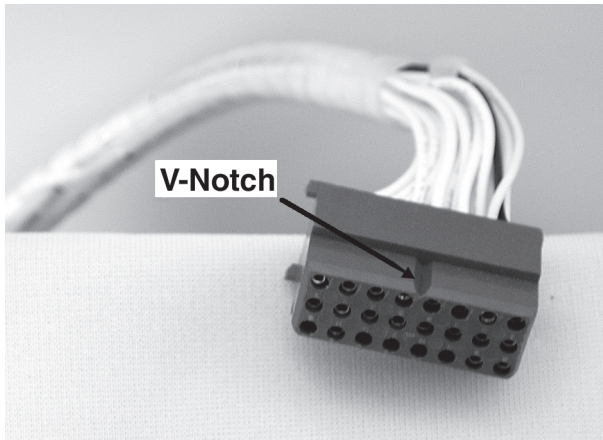


Figure 8-12 GE-2011B Harness Connector

2. Plug the blue connector into the bottom of the GE-2011B.

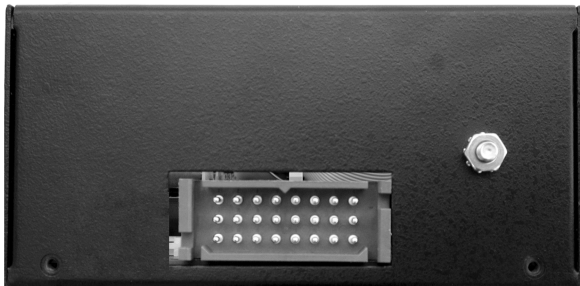


Figure 8-13 GE-2011B V-Notch Orientation

3. Place the control panel onto the enclosure hinges, then insert hinge pins.
4. Connect the wiring harness to the NN terminal blocks (refer to Figure 8-8).
5. Secure the control panel thumb screw latch.
6. Reconnect control cable plug to tap position indicator (Item #1, on Figure 8-11).
7. Set the toggle switch to the **Manual** position.

8. Set up the desired configuration and settings on the GE-2011B. See Chapter 4.0, Configuration.
9. Verify manual operation of the unit.
10. Set the toggle switch to the **Auto** position and verify automatic operation.

8.7 GE-2011B with Group 05 Harness Checkout Procedure

■ **NOTE:** All GE-2011B units are fully calibrated at the factory. There is no need to recalibrate the units before initial installation.

Pre-Test Conditions

1. Place the **AUTO/OFF/MANUAL** switch in the **OFF** position.
2. Verify that the **MOTOR POWER** and **VOLTAGE** fuses are correctly sized and have not blown.

Power

1. Remove any external connections between TB1-9 (Motor Power) and TB1-10 (Regulated Voltage), which are located on the adapter panel printed circuit board.
2. Remove any voltage applied to TB1-9 externally.
3. Apply a nominal 120 V ac test voltage source between TB1-10 (hot) and TB1-8 (neutral).
4. Using a voltmeter, verify that the voltage applied to TB1-10 is nominal 120.0 V ac with respect to TB1-8.

● **WARNING:** Do not connect any voltage source at the **METER OUT** test terminal. Applying a voltage source may energize the regulator or transformer to a high voltage through the voltage transformer. Death or electrical shock can occur.

▲ **CAUTION:** Do not reverse the ground and hot wires when connecting an external source.

5. Apply motor power to TB1-9 (hot) and TB1-8 (neutral).
6. Place the **AUTO/OFF/MANUAL** switch in the **MANUAL** position.
7. Using the **RAISE/OFF/LOWER** switch, verify that the motor runs in the proper direction when the switch is placed in the **RAISE** and **LOWER** positions.

8. Set the **AUTO/OFF/MANUAL** switch to the **AUTO** position.
9. Refer to Chapter 3, **Setting the Control** for setup and test procedures for the GE-2011B.

Load Current CT

● **WARNING:** In no case should the load current circuit be interrupted with the regulator or transformer energized.

● **WARNING:** Do not remove auxiliary current transformers without shorting the current inputs. Death or severe electrical shock can occur.

1. Short the line drop compensator circuit by placing a shorting device of adequate capacity, across the LDC-CT secondary (See Figure 8-14).
2. Connect an ammeter (set to the 200 mA range) between the polarity input and TB1-14.
3. Open the load current shorting device.
4. With a known load on the transformer or regulator, measure the current in the load current circuit.
5. Verify that the current measured in Step 4 is correct for 0.2 A full load.

LDC

1. Replace the shorting device across the load current input and remove the ammeter.
2. Reconnect polarity to the unit, then remove both shorting devices. The **LINE DROP COMPENSATOR** will be activated.

Verify correct CT polarity by incorporating sufficient +R compensation. The regulator should time out and run to raise the output voltage.

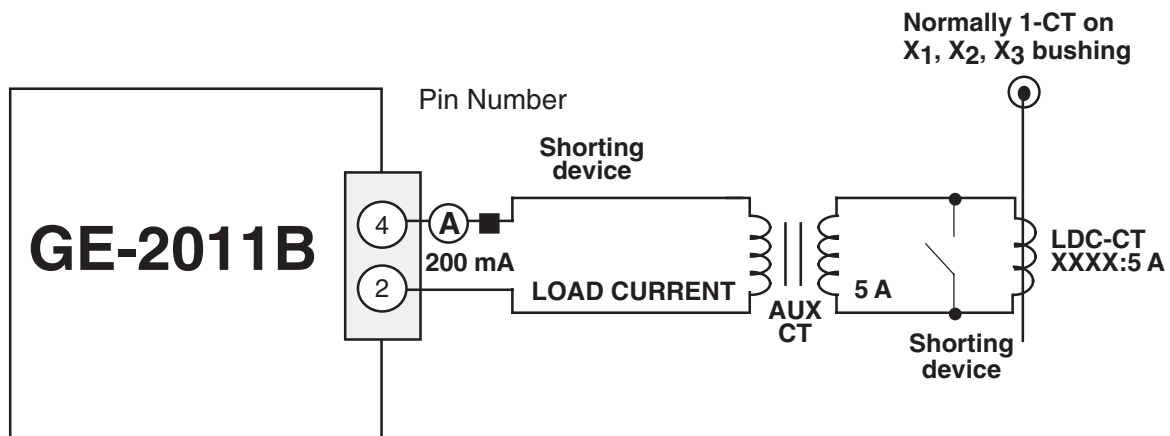


Figure 8-14 GE-2011B Setup for Current Checkout Procedure

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9 GE-2029A

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This chapter contains information necessary to configure and interrogate General Electric digital tapchanger controls using a personal computer, running GE-2029A Communications Software. GE-2029A is backward compatible with older Digital Tapchanger Controls. Firmware version is displayed when power is applied to the control or through the display panel. While the software has been carefully designed for easy use and installation, we suggest that first-time users acquaint themselves with its operation prior to use by carefully reading this chapter.

9.0 Availability

GE-2029A Communications Software is available on CD-ROM. Also included on the CD-ROM is the companion Instruction Book in Adobe® Acrobat™ (*.pdf) format.

9.1 Hardware Requirements

GE-2029A will run on any IBM-compatible PC that provides at least the following:

- Microsoft® Windows™ 95, 98, NT 4.0, 2000 or XP
- one CD-ROM drive
- one serial (RS-232) communications port
- for remote communication, either a modem or TCP/IP connection is required

Hardware Required for Modem Communication

In order to use GE-2029A to communicate with a General Electric digital tapchanger control using a modem, the control must be equipped with the following:

- A compatible modem (300, 600, 1200, 2400, 4800, 9600, or 19200 baud)
- Serial modem cable with 9-pin connector for the control and the applicable connector for the modem or fiber-optic cable with RS-232 converter.

Similarly, the host computer must also have access to a modem and an appropriate cable.

■ **NOTE:** Pinouts for communications cables are provided in Section 9.8, Communication Cables.

Hardware Required for Direct Serial Communication

To use GE-2029A to communicate with a General Electric digital tapchanger control using a direct serial connection, a serial “null modem” cable is required with a 9-pin connector (DB9P) for the control and an applicable connector for the computer (usually DE9S or DE25S).

9.2 Installing GE-2029A

The GE-2029A installation program has been written to overwrite previous versions of GE-2029A. However, considering variations in installed software, hardware and operating systems, if you are upgrading from a previous version of GE-2029A, it is recommended that any older versions of the GE-2029A program be removed before installing the new GE-2029A.

GE-2029A runs with the Microsoft Windows 95, 98, NT 4.0, 2000, or XP operating system. Familiarity with Windows is important in using GE-2029A, as the conventions defined in the Windows documentation are strictly followed therein.

GE-2029A will be installed on the host PC’s hard disk. While it does not require special installation procedures, an installation utility has been provided to make the process easier.

To install GE-2029A:

1. Insert the GE-2029A software into your CD-ROM drive.
2. Select **Run** from the **Start Menu**.
3. In the **Run** dialog box, initiate software installation by typing **D:\Setup.exe** (or other drive designator:\Setup.exe, depending on the letter designation for the CD-ROM drive).
4. The Installation Wizard will prompt the user through the installation process. After installation, the GE-2029A program icon (located in the Becoware folder) can be placed on the desktop (Figure 9-1).

Starting GE-2029A

1. Select the GE-2029A program-item icon from the Becoware group in the Program Manager, or select GE-2029A from the program list using the **Start Menu**. The GE-2029A toolbar is displayed along with the **Communication Access** dialog screen (Figure 9-8).



Figure 9-1 GE-2029A Program-Item Icon

When the control is first energized, the quickest way to properly initialize the control prior to entering the setpoints is to set the real-time clock. This action will initiate a prompt from the control to perform a reset operation for the following items:

- Demand Metering
- Energy Metering
- Drag Hands Reset Registers
- Resettable Operations Counter

It is then easy to proceed with the remainder of the control setup.

9.3 Communications using Direct Serial Connection

To use GE-2029A to interrogate, set, or monitor the GE-2011B Digital Tapchanger Control using a direct serial connection, the control and the GE-2029A software must be setup for serial communications. Elements of the setup process include protocol definition and communication port settings. Refer to Section 4.9, Protocols/Communication, Section 6.5, Communication Port, and Figure A-5, Communication Screens, for additional setup information. The steps necessary to configure the control, and GE-2029A, for communication using a direct serial connection are outlined below.

Configuring the Control for Communication Using Direct Serial Connection

1. Ensure the control is energized.
2. From the Human-Machine Interface (HMI) panel, located on the front of the control, access the **Configuration** Menu, and set the control's **Baud Rate** (19,200 bps maximum) to a value that can match the baud rate of the PC.
3. From the control's **Configuration** Menu, set the **Communication Address** of the control to a number not used by any other control sharing the same modem (serial connections can be shared through the use of a communications line splitter, refer to Figure 9-4).

■ **NOTE:** All GE-2011B Series Digital Tapchanger Controls are shipped with communications password disabled (set to 0000).

4. If desired, set the **Communication Password**.
5. The GE-2011B only supports BECO 2200 Communication Protocol. Protocol configuration is not required.

▲ **CAUTION:** Control serial communication is disabled when the control is in the local mode. (GE-2011B) may be set to disable local control mode remote communication blocking)

6. Position the control menu to the **EXIT** Screen, then select **ENT** (the control will display a blank screen even though the unit remains operational).

■ **NOTE:** Communication cable connections are provided in Section 9.8, **Communication Cables**.

▲ **CAUTION:** Successful operation cannot be guaranteed for RS-232 cable lengths exceeding 50 feet in length. Every effort should be made to keep cable length as short as possible (< 50 feet).

7. Connect the PC to the desired control Com Port utilizing a standard RS-232 cable.

Configuring GE-2029A for Communication using Direct Serial Connection

After the control has been correctly configured for serial communication, GE-2029A and the PC can be configured. GE-2029A utilizes the resident Windows™ operating system COM port configuration setup features. Com Port settings made in either the Windows environment or from GE-2029A affect all programs on the PC that have direct serial communication.

1. Start the GE-2029A program, GE-2029A will display the **Access** dialog screen (Figure 9-8).
2. Select **Serial COM Port** from the **PC Communication Device** drop-down menu.
3. Ensure that the correct COM port is displayed.
4. Some devices that include extended service ports require a character string prior to the COM Port value for COM10 and higher. If applicable, then check the appropriate box and input the appropriate character string.

9.4 Communications using a Modem

To use GE-2029A to interrogate, set or monitor the GE-2011B Digital Tapchanger Control using a modem, the control and the GE-2029A software must be setup for modem communications. Elements of the setup process include protocol definitions, communication port settings and modem commands. Refer to Section 4.9, Protocols/Communication, Section 6.4, Communication Port, and Figure A-5, Communication Screens, for additional setup information. The steps necessary to configure the control and GE-2029A for communication using a modem are outlined below.

Configuring the Control for Communication Using a Modem

1. Ensure the control is energized.

■ **NOTE:** Any compatible modem may be used; however, it is not recommended to communicate at less than 2400 bps.

2. From the control's **Configuration** Menu, set the control's **Baud Rate** (19200 bps maximum) to a value that can be matched by the baud rate of both the control's modem and the PC modem.
3. From the control **Configuration** Menu, set the **Communication Address** of the control to a number not used by any other control sharing the same modem (serial connections and modems can be shared through the use of a communications line splitter, refer to Figure 9-4).

■ **NOTE:** All GE-2011B Series Digital Tapchanger Controls are shipped with communications password disabled (set to 0000).

4. If desired, set the **Communication Password**.
5. The GE-2011B only supports BECO 2200 Communication Protocol. Protocol configuration is not required.

▲ **CAUTION:** Control remote communication is disabled when the control is in the local mode. (GE-2011B) may be set to disable local control mode remote communication blocking).

6. Position the control menu to the **EXIT** Screen, then select **ENT** (the control will display a blank screen even though the unit remains operational).

■ **NOTE:** Communication cable connections are provided in Section 9.8, Communication Cables.

▲ **CAUTION:** Successful operation cannot be guaranteed for RS-232 cable lengths exceeding 50 feet in length. Every effort should be made to keep cable length as short as possible (< 50 feet).

7. Connect the modem to the desired control COM Port utilizing a standard RS-232 cable.
8. Connect the modem to the desired telephone line, then energize the modem.

■ **NOTE:** The control does not issue or interpret modem commands, or adjust modem baud rate. The control should be considered a "dumb" peripheral. The control communicates utilizing 1 Start, 8 Data and 1 Stop Bit.

9. Configure the modem connected to the control to the following AT Command settings (these settings are mandatory):
 - E0 No Echo
 - Q1 Don't return result code
 - &D3 ON to OFF DTR, hang-up and reset
 - &S0 DSR always on
 - &C1 DCD ON when detected
 - S0=2 Answer on second ring
 - V0 Number Codes

There are variations in the AT commands supported by modem manufacturers. The following commands may be required at the modem:

- &Q6 Constant DTE to DCE speed
- N0 Answer only at specified speed
- \J Disable serial data rate adjust
- \Q3 Bidirectional RTS/CTS control
- \N0 Normal mode
- &B1 Fixed serial port rate
- &D2 ON to OFF DTR, hang up and reset
- B1 U.S. Answer Tone

It is recommended that the user save these settings to the profile that is recalled at boot-up.

The modem connected to GE-2029A should be set as follows:

- E0 No Echo
- Q0 Return Reset Code
- V1 Verbal Codes

Configuring GE-2029A for Communication using a Modem

After the control and the control's modem have been correctly configured for remote communication, GE-2029A and the PC modem can be configured. GE-2029A utilizes the resident Windows™ operating system modem configuration setup features. Modem, Com Port and dialing settings made in either the Windows environment or from GE-2029A affect all programs on the PC that have modem communication capabilities.

■ **NOTE:** The following instructions are based on the existence of an installed and functioning modem. If the PC is *not* equipped with a functioning modem then install a modem following the modem manufacturers instructions and then return to this instruction to configure GE-2029A.

1. Start the GE-2029A program, GE-2029A will display the **Communication Access** (Serial) dialog screen (Figure 9-8).
2. Select modem from **PC Communication Device** section, GE-2029A will display Figure 9-9, **Communication Access** (Modem) Dialog Screen, then proceed as follows to input information required for modem communication:
 - a. Ensure that the correct modem is displayed, then select **Setup**, GE-2029A will display the **Modem Communication Setup** screen (Figure 9-10).
 - b. Select **Add Number**, GE-2029A will display the **Edit Phone Book** dialog screen (Figure 9-11).
 - c. Input the telephone number of the remote modem associated with the control, then select **OK** to save the telephone number to the **Phone Book** or **Cancel** to return to the **Modem Communication Setup** screen.

■ **NOTE:** The **Configure Line** and **Dialing Properties** section of the **Modem Communication Setup** screen are used to access Windows modem settings. If it becomes necessary to modify modem settings ensure that the Baud Rate, Data bits, Parity and Stop Bit values required by GE-2029A are maintained.

- d. Select **Configure Line...**, GE-2029A displays the **Modem Plug and Play Properties** dialog screen (Figure 9-2).

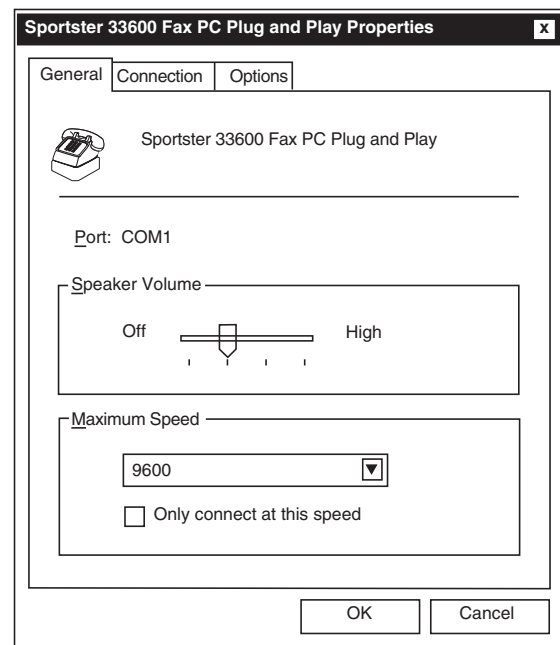


Figure 9-2 Modem Plug and Play Properties Dialog Screen

- e. Select the **Connection** tab (or **Advanced** for Windows 2000 or later), GE-2029A displays the **Connection** dialog screen, then enter the following:

Data Bits = **8**

Parity = **None**

Stop Bits = **1**

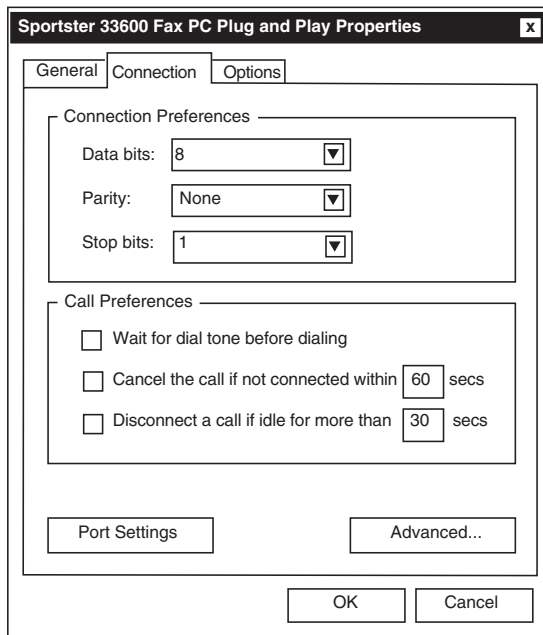


Figure 9-3 Modem Plug and Play Connection Dialog Screen

- f. Select **OK** to save **Connection Preferences** or **Cancel** to return to the **Modem Plug and Play Properties** dialog screen.
 - g. Select **OK** to save modem communication settings or **Cancel** to return to the **Control Access** dialog screen.
5. GE-2029A is now configured to communicate with GE-2011B Series controls using a modem.

9.5 Communications with Multiple Controls

▲ CAUTION: Each control connected to either a direct or modem connection configuration must have a unique communications address. If two or more controls share the same address, corrupted communication will result.

The remote addressing capability of GE-2029A and the digital tapchanger control allows multiple controls to share a direct or modem connection. This can be done with standard RS-232 connections using a communications line splitter (see Figure 9-4, Multiple Control Addressing Using Communications Line Splitter). See Chapter 3, **Setting the Control** for more information on specific menu commands.

A control address of zero is a “wild card” that will illicit a response from all controls on a shared connection and result in corrupted communication.

With these arrangements, any control can be selected from within GE-2029A by specifying it’s unique communications address, ranging from 1 to 200. The communications address must have previously been set from the control’s front panel.

9.6 Cautions

Control and GE-2029A Compatibility

Every attempt has been made to maintain compatibility with previous control software versions. In some cases (most notably, with older controls), compatibility cannot be maintained. However, GE-2029A should work correctly with more than one version of the GE-2011B Series Digital Tapchanger Controls on a single bus, provided that the controls are all set to use the same protocol. If there is any question about compatibility, contact the factory.

Control Priority

Control conflicts will not occur as local commands initiated from the front panel receive priority recognition. While the unit is in local mode, communication via the serial ports is suspended, unless local mode is disabled. GE-2029A displays an error message to indicate this fact.

Time and Date Stamping

Time and date stamping of events is only as useful as the validity of the control's internal clock. Under the **Utilities** menu, the Set Control Date/Time command allows you to manually set the control's clock. For reference, the computer's clock is also displayed.

Local Mode

In the control's configuration menu, there is an option to enable or disable **Local Mode**. If Local Mode is disabled, the user may access the control via the local screen as well as through communication SCADA.

Serial Port Connections

If the serial port is connected to something other than a modem and a GE-2029A modem command is executed, the results are unpredictable. In some cases, the computer may have to be reset.

If the computer's communications options (baud rate, serial communications port, and communications address) do not match those on the control, the control will return an error message.

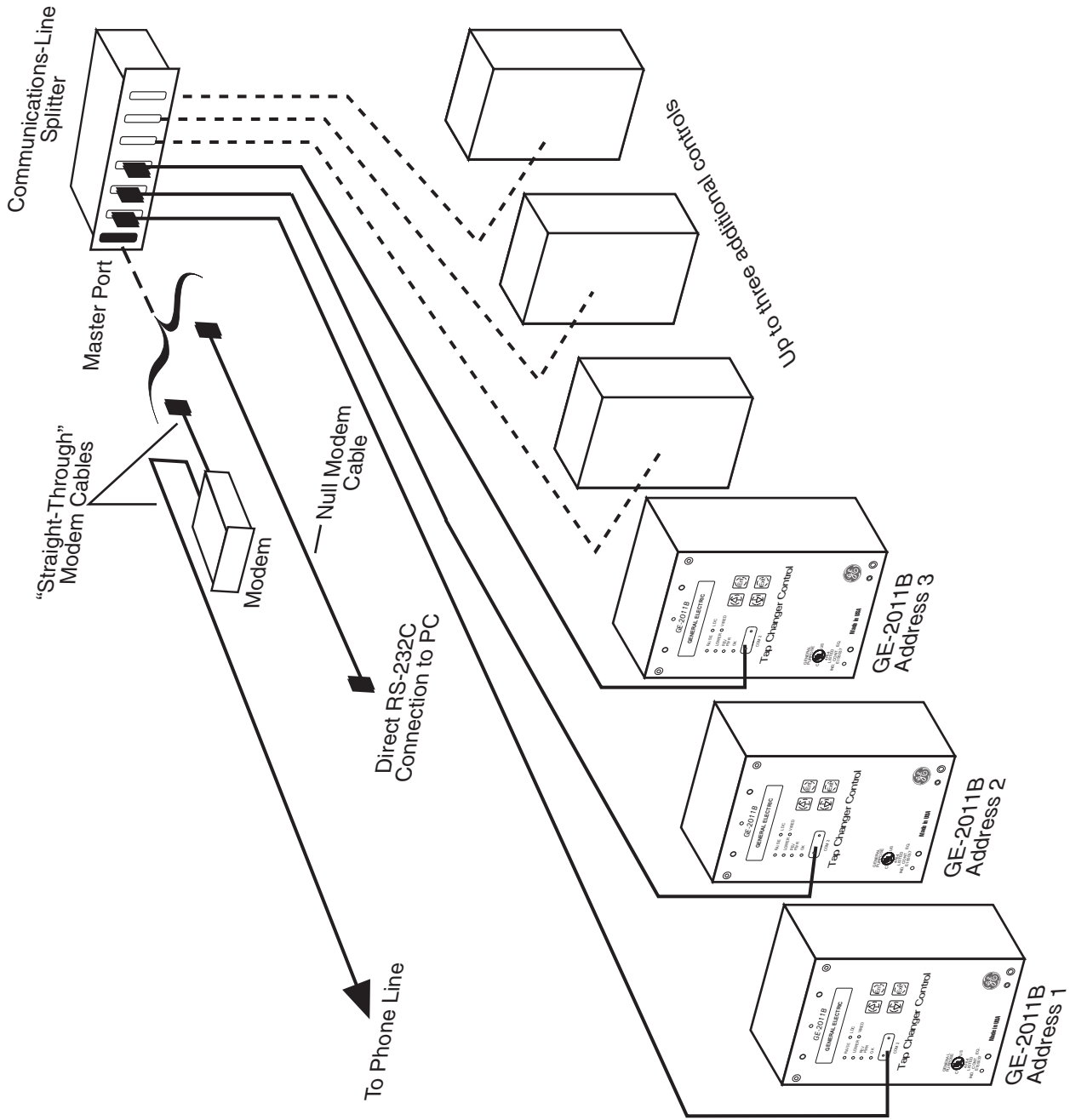
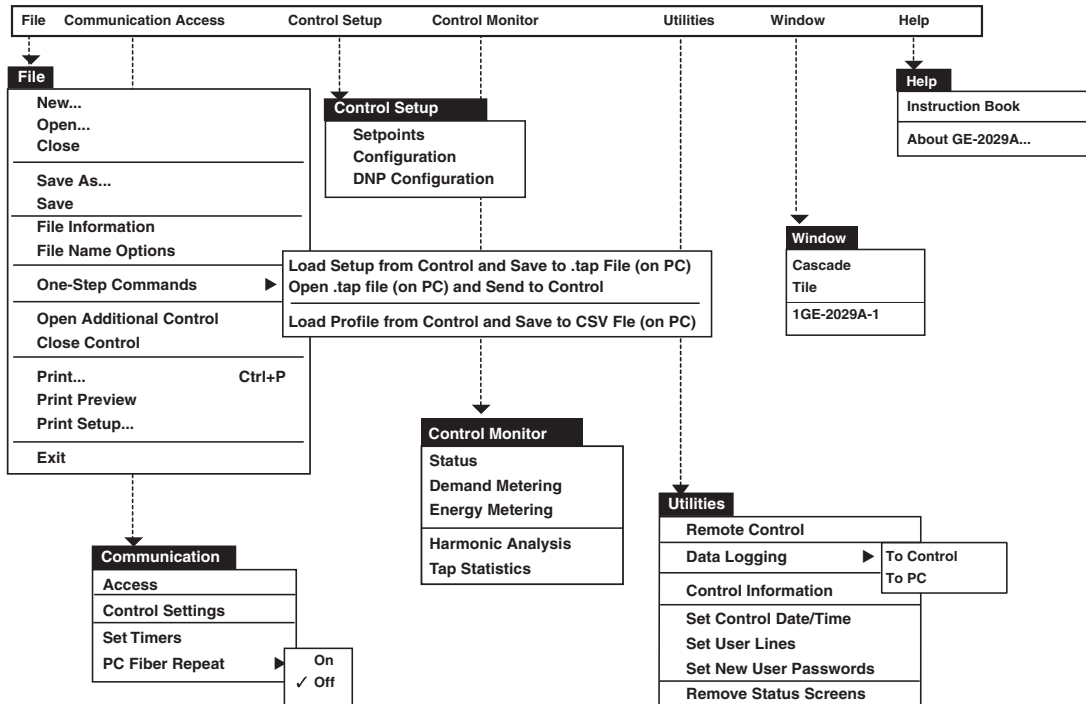


Figure 9-4 Multiple Control Addressing Using Communications-Line Splitter

9.7 Overview of Operation

■ **NOTE:** If not connected and no file is open, items relating to settings, utilities, or monitoring are disabled. If not connected but a file is open, monitoring and utilities screens are displayed without data (Tap and Harmonics display simulated data.)

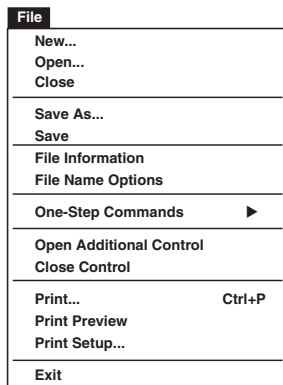
Once installed, the GE-2029A program-item icon is available from the Program Manager and GE-2029A can be run like any other Windows™ program. (The installation utility places GE-2029A in a Program Manager group named General Electric.) When GE-2029A is run, the following menu bar is displayed. Each of the main menu selections is discussed briefly below.



■ **NOTE:** Menu selections and corresponding dialog screens which are unavailable will be greyed-out in display.

Figure 9-5 GE-2029A Menu Selections

File



The **File** toolbar item provides the user with the ability to perform the following functions:

- **New...** Opens the File Information Box to allow the user to pick the Serial #, User Lines, Version Mod and other options.
- **Open...** Opens the file browser window to allow the user to select an existing file. It will not allow the user to create a new file.
- **Close** – Closes the open file in the control window.
- **Save As...** Allows the user to save the open file with a different file name.
- **Save** – Saves the open file.
- **File Information** – Displays the file name, user lines, firmware version, Mod number associated with the open file.

- **File Name Options** – Allows user to select the parameters that will be included in the suggested file name.
- **One Step Commands** –
 - Load Setup from Control and Save to *.tap File (on PC):** When connected to a control and no file is previously open, this function allows the user to recall the setpoints, configuration and DNP configuration (if applicable) and save the data to a file in one step.
 - Open *.tap File (on PC) and Send to Control:** When connected to a control and no file is previously open, this function allows the user to open a file and send the setpoints, configuration and DNP configuration (if applicable) to the control in one step.
 - Load Profile from Control and Save to CSV File (on PC):** When connected to a control and no file is previously open, this function allows the user to recall the control profile and save the data to a comma-separated value file.
- **Open Additional Control** – Opens another GE-2029A window to allow the user to connect to multiple controls.
- **Close Control** – Closes the active window.
- **Print...** Prints the control information.
- **Print Preview** – Displays a preview of what will be printed.
- **Print Setup...** Allows the user to set up printer options.
- **Exit** – Exits the GE-2029A program.

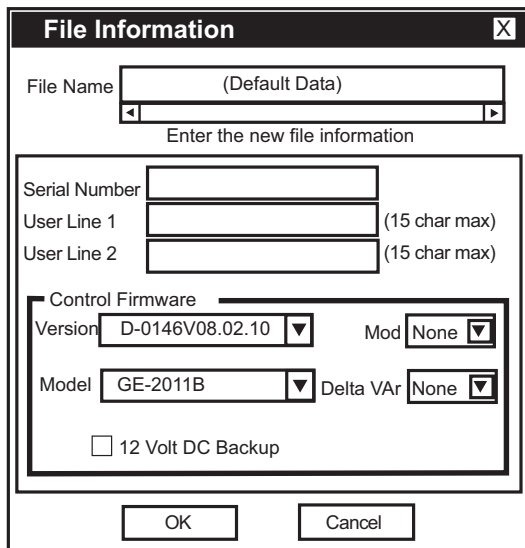


Figure 9-6 File Information Dialog Screen

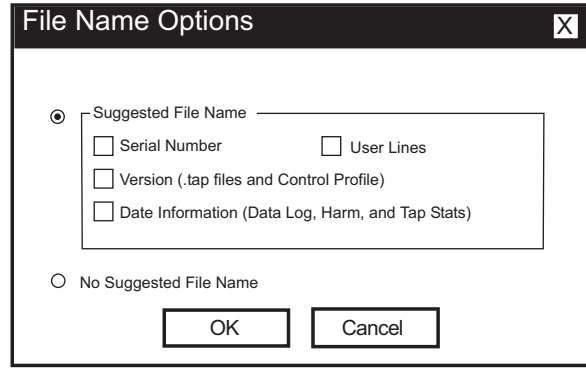
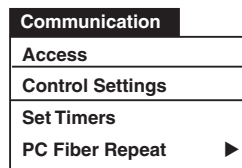


Figure 9-7 File Name Options Screen

Communication



The **Communication** menu provides the user with access to the screens that are necessary to set control communication parameters.

The **Access** menu selection initiates the **Access** dialog screen. The user is prompted to input the necessary communications information to open serial, modem or ethernet (TCPIP) communications with the target control.

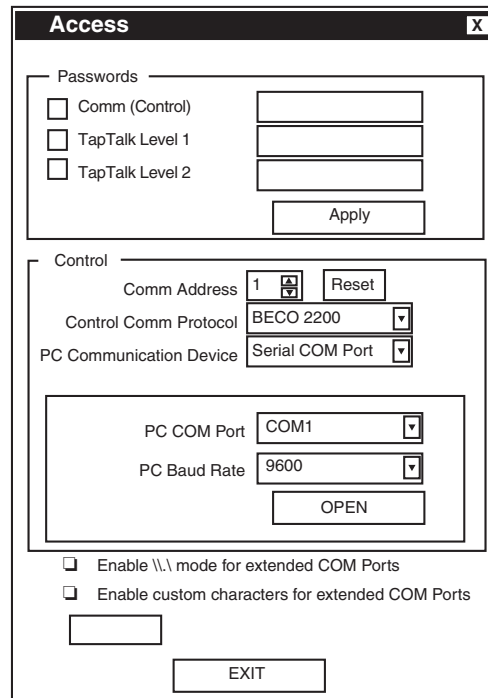


Figure 9-8 Communication Access (Serial) Dialog

To establish or change PC or modem communication parameters perform the following:

1. Ensure that communication with the control is closed.
2. Select **Access** from the **Communication** menu to display the **Access** dialog screen.

■ **NOTE:** All GE-2011B Series Digital Tapchanger Controls are shipped with the communication password disabled (set to 0000).

3. Select the desired password protection (Comm, GE-2029A Level1, GE-2029A Level2) by checking the corresponding checkbox.
4. Enter the required passwords. See Utilities/Set New User Passwords section of this chapter.

▲ **Caution:** Entering a Comm Address of zero (0) where multiple controls can be addressed will cause communication to be corrupted.

5. Input the **Comm Address** identification number (between 1 and 200) of the desired control.
6. Select **Control Comm Protocol** (BECO 2200)
7. Select **PC Communication Device** (Serial Comm Port, Modem or TCPIP)
8. If **Serial COM Port** has been selected, then select the desired COM Port and Baud Rate.
9. If **Modem** has been selected, then proceed as follows to input information required for modem communication:

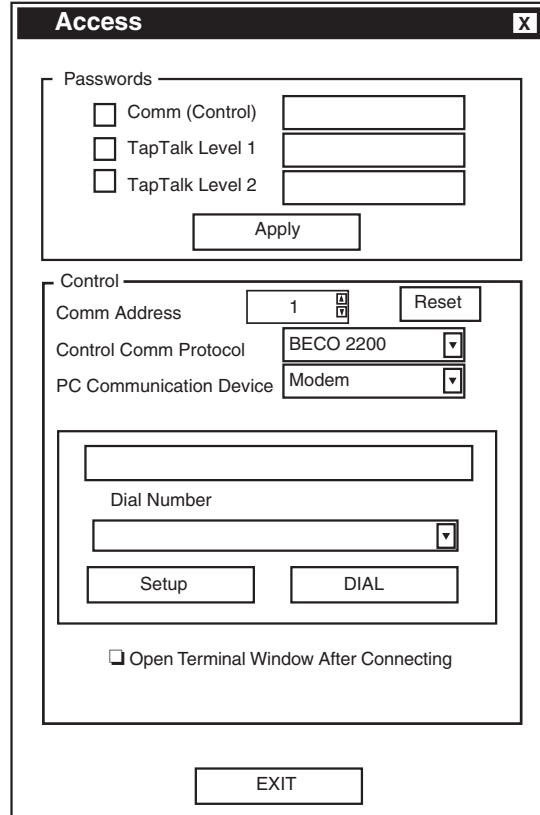


Figure 9-9 Communication Access (Modem) Dialog

- a. Ensure that the correct modem is displayed, then select **Setup**, GE-2029A will display the **Modem Communication Setup** screen.

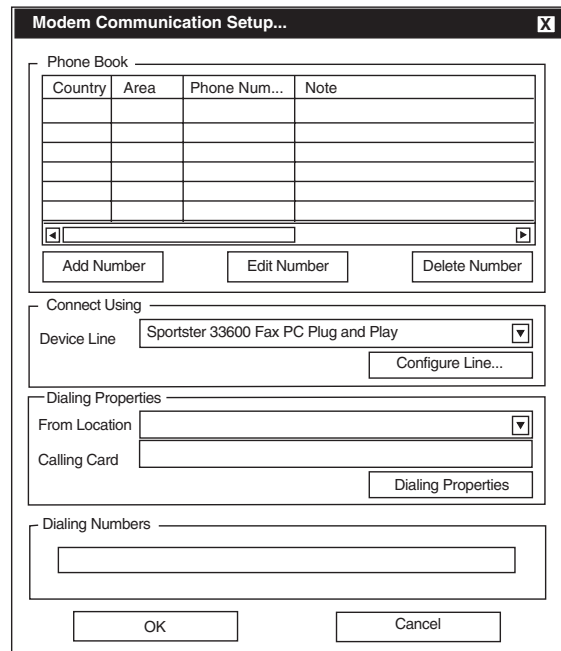


Figure 9-10 Modem Communication Setup

- b. Select **Add Number** or **Edit Number**; GE-2029A will display the **Edit Phone Book** dialog screen.

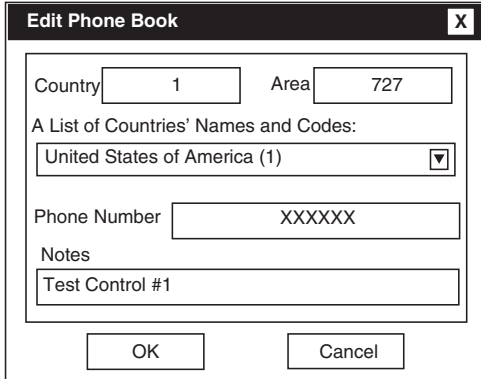


Figure 9-11 Edit Phone Book Dialog Screen

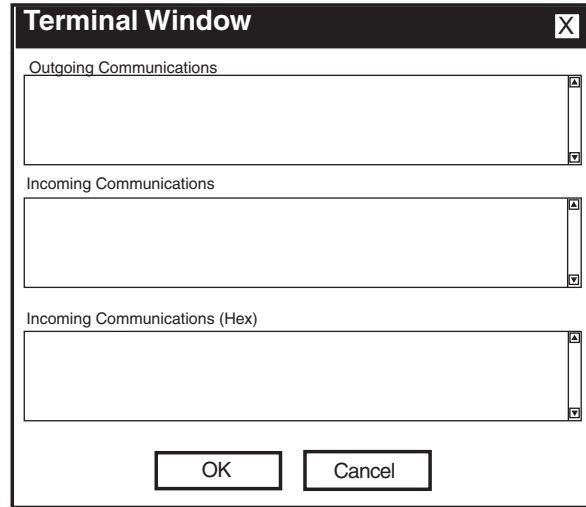


Figure 9-12 Terminal Window

- c. Input the telephone number of the remote modem associated with the control, then select **OK** to save the telephone number to the Phone Book or **Cancel** to return to the **Modem Communication Setup** screen.
- d. If it becomes necessary to modify modem Windows™ settings, then select either the **Configure Line** or **Dialing Properties** section of the **Modem Communication Setup** screen to access modem settings.
- e. Select **OK** to save modem communication settings or **Cancel** to return to the **Communication Access** dialog screen.
- f. If terminal commands are to be issued to the corresponding terminal device (via modem), then check the **“Open Terminal Window After Connection”** box on the **Access** Dialog Screen.

When connected to another terminal device, the Terminal Window allows the user to send messages or commands. Outgoing communications are displayed in the top pane and incoming messages are displayed in the bottom two panes, in ASCII and HEX format.

- 10. If TCPIP has been selected, then input an IP port value of 8800 (for internal ethernet cards) and the desired IP Address. If a third-party device (i.e., Lantronix DS-10) is used, then the port will have to match the setting of the device.

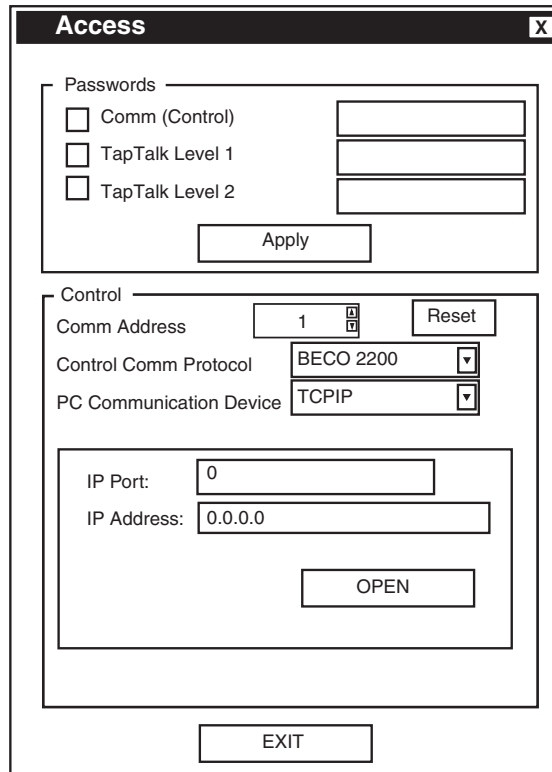


Figure 9-13 TCP/IP Communication Setup

11. To open serial communications, select **Open**. The passwords are sent to the control.
 - a. If proper passwords and Control Address have been sent, GE-2029A will respond with a confirming dialog screen.
 - b. If improper passwords and Control Address have been input, GE-2029A will respond with an error screen.

12. To open modem communications, select **Dial**. The passwords and Control Address are sent to the control.
 - a. If proper passwords and Control Address have been sent, GE-2029A will respond with a confirming dialog screen.
 - b. If improper passwords and Control Address have been input, GE-2029A will respond with an error screen.

13. To open Ethernet communications, select **Open**. The IP Address, Control Address and passwords are sent to the control.
 - a. If proper IP Address, Control Address and passwords have been sent, GE-2029A will respond with a confirming dialog screen.
 - b. If improper IP Address, Control Address and passwords have been input, GE-2029A will respond with an error screen.

Multiple Control Addressing

To address additional controls at the same location (Not applicable to Ethernet connections), the user must reset the control address from the Communication Access Screen (Figure 9-8). When RESET is selected, GE-2029A will respond with a confirming dialog screen, shown below. As long as communication to the remote location is maintained, the user can switch between controls.

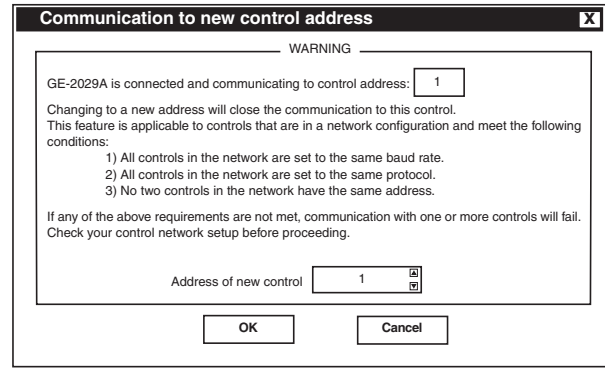


Figure 9-14 Communication To New Control Address Dialog Screen

Control Settings

The **Control Settings** menu selection initiates the **Control Settings** dialog screen which allows the user to set protocols and toggle fiber repeat on and off.

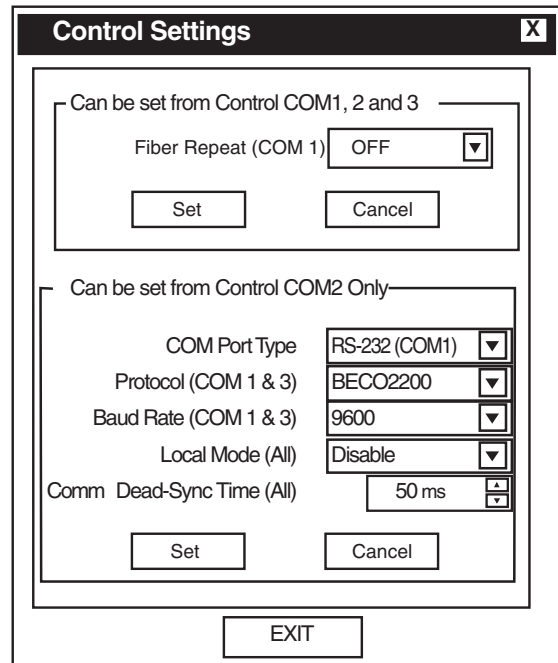


Figure 9-15 Control Settings Dialog Screen

Fiber Repeat COM1 is not available with GE-2011B, and will be greyed out in display.

COM Port Type is not available with GE-2011B, and will be greyed out in display.

COM1 Protocol is not available with GE-2011B, and will be greyed out in display.

COM1 Baud Rate is not available with GE-2011B, and will be greyed out in display.

Local Mode – Allows control of reading/writing setpoints and configurations using communications. There are 4 settings associated: **Disable**, **Read Only**, **Always Read Only**, and **No Read or Write**. When set to **Disable**, read/write communication will be available at all times. When set to **Read Only**, read/write communications will be available only when the front panel of the control is inactive. If the front panel is active, only reads via communications will be allowed. When set to **Always Read Only**, only reads via communications will be allowed, regardless of whether the front panel is active or not. When set to **No Read or Write**, read/write communication will be available only when the front panel to the control is inactive. If the front panel is active, no communication will be allowed.

Dead-Sync Time – This time delay improves robust operation when communication lines are intermittent. Communication dead-sync time is the time that the control will wait from the last received character and continue without attempting to resynchronize.

Set Timers

The **Set Timers** menu feature initiates the display of the Set Timers dialog box which displays the current timeout values, and allows the user to change timing values.

The **Time Out** setting determines time period at which GE-2029A will stop attempting to establish communication with the target control.

The **Wait Time** setting determines the time between individual commands when multiple commands are being performed. If errors occur, then increase the wait time setting before adjusting the timeout setting.

This feature also includes the capability to adjust the timing (**Monitoring Timer**) at which GE-2029A refreshes control monitoring screen parameters.

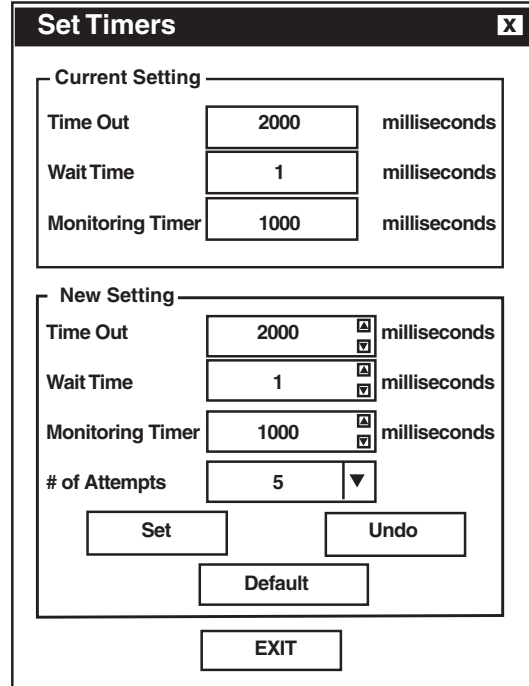
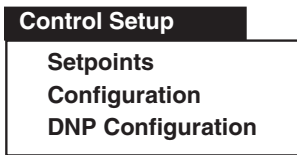


Figure 9-16 Set Communication Timers Screen

PC Fiber Repeat

This feature is not available with the GE-2011B and will be grayed out in the display.

Control Setup



The **Control Setup** menu selection provides the user with means to access and modify **Setpoints**, **Configuration** and **DNP Configuration**.

Control Setup/Setpoints

The **Setpoints** submenu item displays the **Setpoints** Dialog Screen. The **Setpoints** screen includes the Control Identification Number, the Comm Address, and User Lines #1 and #2 information. The setpoint information displayed is from the control or from an open GE-2029A file.

Elements of the **Setpoints** screen are described on the following page.

The **Setpoints** screen commands include:

- **Read from Control** – This command is available to read setpoints from the target control when the Setpoints screen is selected to “Read From File”. When this command is selected, the button will change to “Connected to Control.”
- **Write to Control** – This command writes the values displayed/modified on the screen to the control.
- **Update File/Update Default** – If an existing file is open, **Update File** will write the values to the file. If a new file with default values is open, **Update Default** will update the values in RAM to be saved later.
- **Read Setpoints from File/Read Default Setpoints** – If a file is open, **Read Setpoints from File** reads the values from the open file. When no new file is open, **Read Default Setpoints** reads the default values from RAM.
- **Undo/Reload** – This command reloads setpoints from either the control or GE-2029A file (whichever is selected) prior to any **Write to Control** or **Write to File** command.

Setpoints
X

GE-2011B

Comm Add: 1

xxxxxxxxxxxxxxxx

xxxxxxxxxxxxxxxx

POWER FLOW

Forward

Band Center	120	V
Band Width	2	V
LDC Resistance	0	V
LDC Reactance	0	V
Time Delay	30	sec
Inverse Time Delay	30	sec

Reverse

Band Center	120	V
Band Width	2	V
LDC Resistance	0	V
LDC Reactance	0	V
Time Delay	30	sec
Inverse Time Delay	30	sec

VOLTAGE

Limit/Runback

Block Raise	128	V
Block Lower	114	V
Dead Band	2	V
Current Limit	400	mA

Reduction

Step #1	2.5	%
Step #2	5	%
Step #3	7.5	%

TAP LIMITS

Block Raise 16 Raise

Block Lower 16 Lower

MISCELLANEOUS

LDC-Z	0	V
Output Pulse Width	1.5	sec

Connected to Control

Read Setpoints from File or
Read Default Setpoints

Write to Control

Update File or
Update Default

Undo/Reload

EXIT

Figure 9-17 Setpoints Dialog Screen

■ **NOTE:** GE-2029A is designed to communicate with all GE-2011B Series controls. However, due to the generational differences between controls, some features may not be available on the target control, and will appear greyed out in the display.

Setpoints

Power Flow/Forward

Band Center – Adjustable from 100 V to 135 V in 0.1 V increments with a factory setting of 120 V.

Band Width – Adjustable from 1 V to 10 V in 0.1 V increments with a factory setting of 2.0 V.

LDC Resistance – Adjustable from –24 V to +24 V in 1 V increments with a factory setting of 0 V.

LDC Reactance – Adjustable from –24 V to +24 V in 1 V increments with a factory setting of 0 V.

Time Delay – Adjustable from 1 sec. to 120 sec. in 1 second increments with a factory setting of 30 sec.

Inverse Time Delay – Adjustable from 1 sec. to 120 sec. in 1 second increments with a factory setting of 30 seconds.

Power Flow/Reverse

Band Center – Adjustable from 100 V to 135 V in 0.1 V increments with a factory setting of 120 V.

Band Width – Adjustable from 1 V to 10 V in 0.1 V increments with a factory setting of 2.0 V.

LDC Resistance – Adjustable from –24 V to +24 V in 1 V increments with a factory setting of 0 V.

LDC Reactance – Adjustable from –24 V to +24 V in 1 V increments with a factory setting of 0 V.

Time Delay – Adjustable from 1 sec. to 120 sec. in 1 second increments with a factory setting of 30 sec.

Inverse Time Delay – Adjustable from 1 sec. to 120 sec. in 1 second increments with a factory setting of 30 seconds.

Voltage/Limit Runback

Block Raise – Over voltage limit is adjustable from 95 V to 135 V in 0.1 V increments with a factory setting of 128 V.

Block Lower – Under voltage limit is adjustable from 95 V to 135 V in 0.1 V increments with a factory setting of 114 V.

Dead Band – Adjustable from 1 V to 4 V in 0.1 V increments with a factory setting of 2.0 V.

Current Limit – Depending on the Current Transformer configuration point, adjustable from 200 mA to 640 mA (200 mA CT), in increments of 1 mA, from 1.0 A to 3.2 A (1 A CT), in increments of 0.1 A, or from 5.0 A to 16.0 A (5 A CT) in increments of 0.1 A. If the value of the current exceeds the current limit setpoint, the unit will not permit automatic control in either the raise or lower direction. Factory setting is 400 mA.

Voltage/Reduction

Step 1 – First of three independent steps of voltage reduction adjustable from 0% to 10% in 0.1% increments of the bandcenter setpoint. Factory setting is 2.5%.

Step 2 – Second voltage reduction step, adjustable from 0% to 10% in 0.1% increments of the bandcenter setpoint. Factory setting is 5.0%.

Step 3 – Third voltage reduction step, adjustable from 0% to 10% in 0.1% increments of the bandcenter setpoint. Factory setting is 7.5%.

Tap Limits

Block Raise/Lower – For GE-2011B controls, both are adjustable from the Tap Maximum configuration point to the Tap Minimum value in 1 step increments (Tap Limit Block Raise cannot be lower than Tap Limit Block Lower +4. Tap Limit Block Lower cannot be higher than Tap Limit Block Raise –4). For all other controls, Block Raise is adjustable from 16 to –12 Raise with a factory setting of 16 Raise, and Block Lower is adjustable from 12 to –16 Lower with a factory setting of 16 Lower. Both have 1 step increments.

Miscellaneous

LDC-Z – Adjustable from 0 V to 24 V in 1 V increments with a factory setting 0 V.

Output Pulse Width – Adjustable from 0.2 seconds to 12 seconds in 0.1 second increments with a factory setting of 1.5 second. C When the output is set to pulse and the control is calling for Raise/Lower (and no non-sequential or counter input is applied), an output will turn on for the preprogrammed time, and then turn off for 0.5 seconds, plus the intertap time delay. A square wave is generated on the output.

Control Setup/Configuration

The **Configuration** submenu item displays the **Configuration** Dialog Screen. The **Configuration** screen includes the Control Identification Number, the Comm Address, and User Lines #1 and #2 information. The configuration information displayed is default values if no GE-2029A file is open, from the control, or from an open GE-2029A file. Elements of the Configuration screen are described on the following page.

The **Configuration** screen commands include:

- **Read from Control** – This command is available to read configuration settings from the target control when the Setpoints screen is selected to “Read From File”. When this command is selected, the button will change to “Connected to Control.”
- **Write to Control** – This command writes the values displayed/modified on the screen to the control.

- **Update File/Update Default** – If an existing file is open, **Update File** will write the values to the file. If a new file with default values is open, **Update Default** will update the values in RAM to be saved later.
- **Read from File/Read Default Config** – If a file is open, **Read from File** reads the values from the open file. When no new file is open, **Read Default Config** reads the default values from RAM.
- **Undo/Reload** – This command reloads configuration settings from either the control or GE-2029A file (whichever is selected) prior to any **Write to Control** or **Write to File** command.

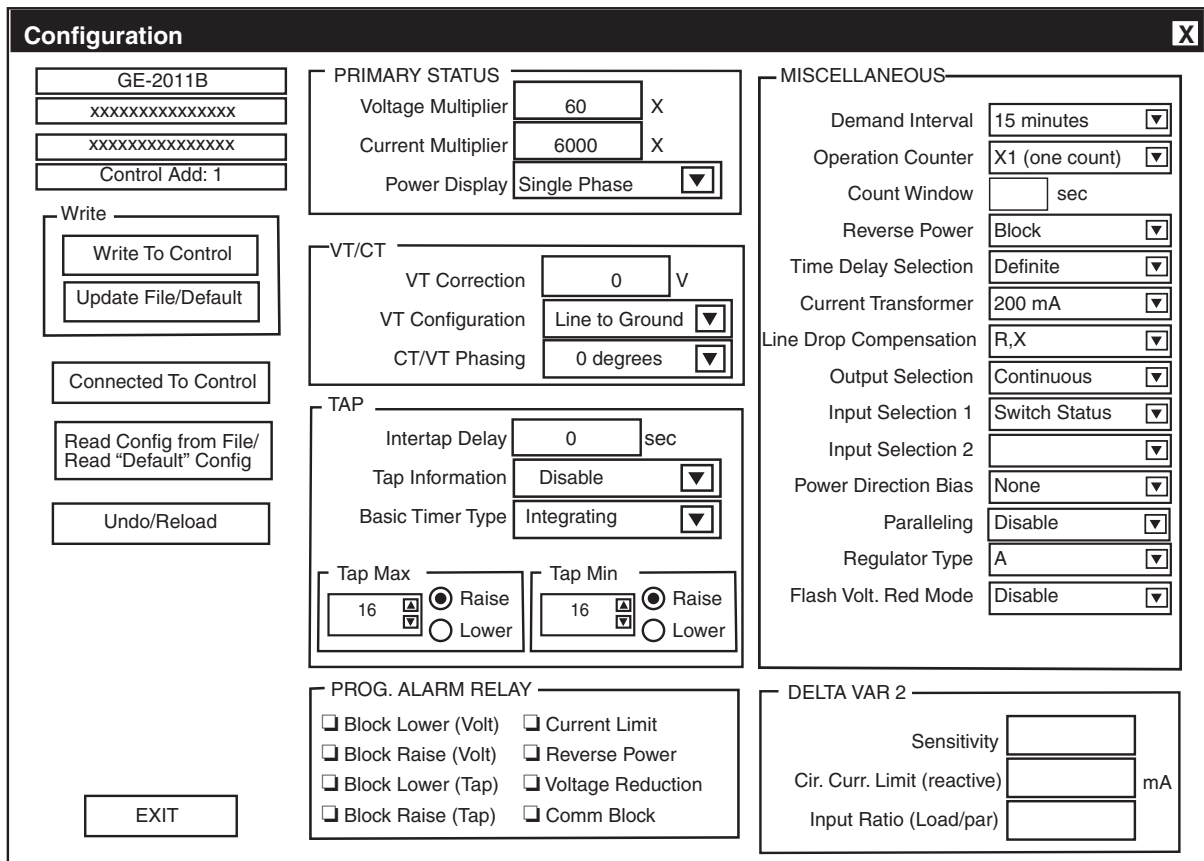


Figure 9-18 Configuration Dialog Screen

Configuration

Primary Status

Voltage Multiplier – Adjustable from 0.1 to 3260 in 0.1 increments with a factory setting of 60. User selection must include knowledge of VT ratio, sensing VT-ratio correction and indication of either line-to-line or line-to-ground voltage.

Current Multiplier – Adjustable from 1 to 32600 in 1.0 increments with a factory setting of 6000. User selection must include knowledge of CT ratio, from primary rating to 0.2 A rating of control.

Power Display – Toggles between two modes of operation: **SINGLE PHASE**, based on measured inputs; and **THREE PHASE**, based on measured inputs and presumed balanced system. Factory setting is **SINGLE PHASE**.

VT/CT

VT Correction – Adjustable from –15 V to +15 V in 0.1 V increments with a factory setting of 0 V.

VT Configuration – Toggles between **LINE-TO-LINE** and **LINE-TO-GROUND** with a factory setting of **LINE-TO-GROUND**.

CT/VT Phasing – Adjustable from 0° to 330° in 30° increments with a factory setting of 0°.

Tap

InterTap Delay – Adjustable from 0 to 60 seconds in 1.0 second increments with a factory setting of 0 seconds.

Tap Information – Toggles between two modes of operation: **DISABLED**, to disable all tap position-related functions and **REG. INTERNAL**, to use “keep track” tap position knowledge.

Basic Timer Type – Toggle between **INTEGRATE** (factory setting) or **INSTANT RESET**.

Tap Max/Tap Min – **Tap Max** is adjustable from 0 to 33R, and **Tap Min** is adjustable from 33L to 29R, both in 1 step increments. Note that **Tap Max** must be 4 taps greater than **Tap Min** (–33 to +29).

PROGRAMMABLE ALARM RELAY

Configuration

This feature is not available on the GE-2011B and will be grayed out in the display.

Miscellaneous

Demand Interval – Toggles between 15, 30 and 60 minute intervals with a factory setting of 15 minutes. The time interval is that amount of time it takes for a thermal meter to indicate 90% of a change of load.

Operation Counter – Selects the contact operation sequence that will cause the software counter to increment by one. Open/close/open (X1), open/close or close/open contact operation (X2). The count window mode registers any activity as a valid input within the count window time setting. Factory setting of X1.

Count Window – Operation count will increment by only one count during a set time period or “Count Window”. This is true no matter how many counter inputs occur during the count window time period. After a counter input is accepted, the count window timer begins and another count won't be accepted until the count window time period expires. The count window time period can be set from 0.5 to 10.0 seconds.

Reverse Power – Toggles between four modes of operation: **BLOCK**, to inhibit automatic tapchange operation; **IGNORE**, to continue unit action as though forward power flow continued to exist; **REG REVERSE**, to detect a reverse power condition and regulate according to reverse power settings; **NEUTRAL**, to detect a reverse power operation and drive tap position to neutral and then stop. The factory setting is **BLOCK**.

Timer Delay Selection – Toggle between two modes of operation: **DEFINITE** (factory setting) and **INVERSE**.

Current Transformer – Toggle between three modes of operation: 200 mA (factory setting), 1 A and 5 A.

Line Drop Compensation – Toggle between two modes of operation: R, X (factory setting), and Z.

Output Selection – Toggle between two modes of operation: **CONTINUOUS** (factory setting) and **PULSE**.

Input Selection 1 – Toggle between two modes of operation: **Seal-in Input** and **Switch Status** (factory setting).

Input Selection 2 – This feature is not available on the GE-2011B and will be grayed out in the display.

Power Direction Bias – The Power Direction Bias Configuration feature includes three settings to determine how the control will switch between forward and reverse power operation. The three settings are **None**, **Forward**, and **Reverse**.

Paralleling – This feature is not available on the GE-2011B and will be grayed out in the display.

Regulator Type – Allows the regulator type to be selected as Type A or B for correct source voltage calculation. Factory setting is Type **A**.

Flash Voltage Reduction Mode – Allows the flashing voltage reduction status screen to be enabled or disabled. Enabling this function may shorten the life of the display screen.

Delta Var 2

Sensitivity – This feature is not available on the GE-2011B and will be grayed out in the display.

Cir.Curr. Limit Reactive – This feature is not available on the GE-2011B and will be grayed out in the display.

Input Ratio (Load/par) – This feature is not available on the GE-2011B and will be grayed out in the display.

Control Setup/DNP Configuration

DNP Configuration is not available with the GE-2011B.

Control Monitor




Control Monitor
Status
Demand Metering
Energy Metering
Harmonic Analysis
Tap Statistics

The **Control Monitor** toolbar item provides the user with the means to display the control's **Status**, **Demand Metering** and **Energy Metering** screens. The screens include the Control Identification Number, the Comm Address, and User Lines #1 and #2 information. These screens and the data that is displayed are available only when communication is established between the control and the PC.

Control Monitor/Status

The **Status** submenu item displays the **Status** Screen. Values displayed are updated based on the monitoring setting in the timers section, and also depending on communication system capabilities.

Each Status screen will also display Communication Status Indicator icons:

-  Unit is connected.
-  Communication lost, attempting to reconnect (time allowed for reconnect attempt is set in the Timers dialog box.)
-  Reconnect failed.

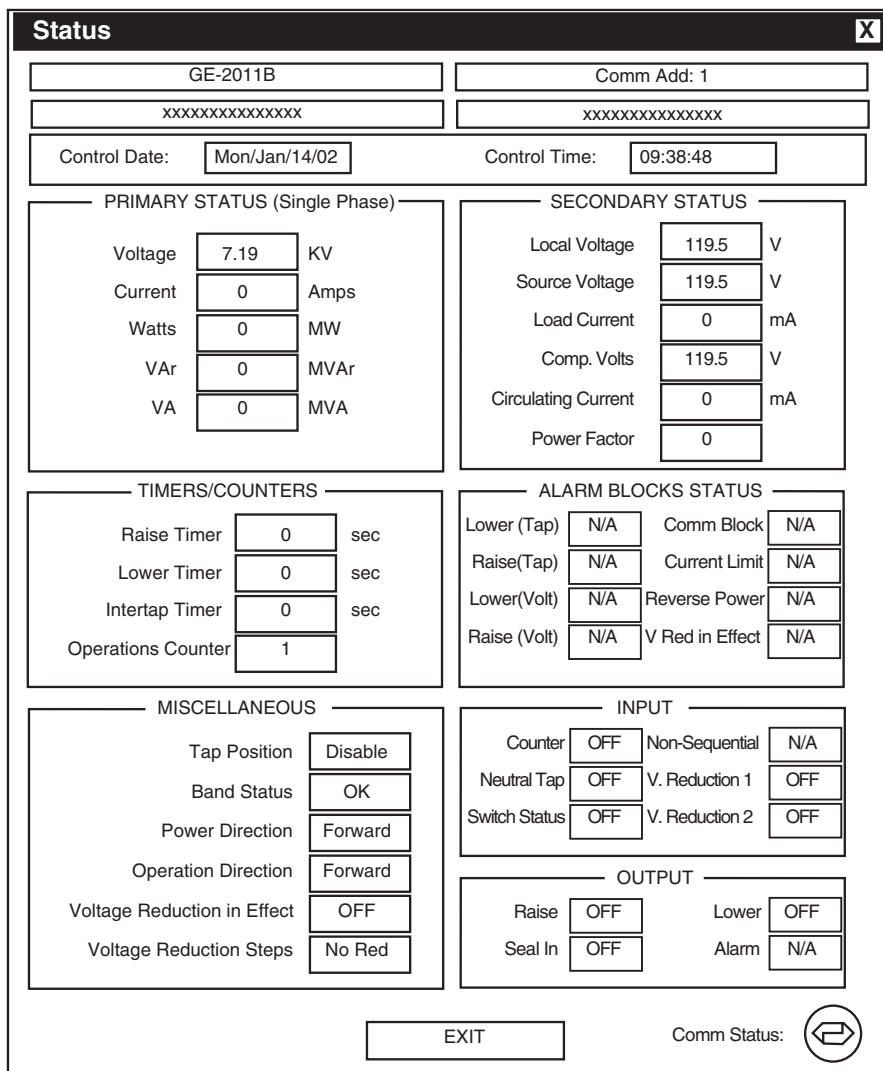


Figure 9-19 Status Screen

Primary Status (single or three phase)

Local Voltage – Displays the calculated primary voltage based on the user-selected voltage multiplier, VT corrections, and measured secondary voltage.

Primary Current – Displays the calculated primary current based on the user-selected current multiplier, and measured secondary current.

Primary Watts – Displays the calculated primary quantity based on the user-selected voltage and current multipliers; VT configuration (line-to-line or line-to-ground), single-phase or three-phase, and measured secondary voltage and current.

Primary VAR – Displays the calculated primary quantity based on the user-selected voltage and current multipliers, VT configuration (line-to-line or line-to-ground), single-phase or three-phase, and measured secondary voltage and current.

Primary VA – Displays the calculated primary quantity based on the user-selected voltage and current multipliers, VT configuration (line-to-line or line-to-ground), single-phase or three-phase, and measured secondary voltage and current.

Timers/Counters

Raise Timer – Displays the integrated out-of-band time for a voltage excursion greater than the upper band limit up to the value of the time delay setpoint.

Lower Timer – Displays the integrated out-of-band time for a voltage excursion less than the lower band limit up to the value of the time delay setpoint.

Intertap Timer – In the sequential mode of operation, displays the integrated out-of-band time for a voltage excursion and the subsequent tap change. Adjustable from 0 to 60 seconds, in 1.0 second increments, with a factory setting of 0 seconds.

Operations Counter – Records the number of raise and lower operations. The operation counter will advance by one or two counts, as set by the user, for each open-close-open contact operations. This counter is not resettable.

Miscellaneous

Tap Position – Displays the tap position of the tapchanger by the internal “keep track” procedure or external tap position sensor. Recognizes tapchanges commanded via manual, automatic or external (SCADA) means.

Band Status – Indicates one of three conditions: **High**, when voltage is out of band high, **Low** when voltage is out of band low, and **OK** when voltage is within band.

Power Direction – Indicates one of two power directions: **Forward** (forward power condition) and **Reverse** (reverse power condition).

Operation Direction – Indicates one of two modes of operation: **Forward**, indicating forward power regulation, due to either actual forward power flow, an Ignore configuration forcing unit action as though forward power flow exists when a reverse power flow is detected, or a Block configuration inhibiting automatic tapchange operation when reverse power flow is detected, or **Reverse**, detecting a reverse power condition, while control is configured for reverse regulation.

Voltage Reduction In Effect – Indicates voltage reduction (any step) is invoked.

Voltage Reduction Steps – No Reduction indicates voltage reduction is not active, blocked either by non-sequential input, a reverse power condition, or by communicated command. Steps 1, 2, and 3 indicate that voltage reduction is in effect for the stated step value.

Secondary Status

Local Voltage – Displays the real-time measured value of voltage at the regulator or transformer and includes any corrections made using the user-selected VT correction voltage.

Source Voltage – Displays the real-time calculated source voltage and includes any corrections made using the user-selected VT correction voltage.

Load Current – Displays the real-time measured value of current.

Compensate Volts – Displays the calculated voltage at the “load center”.

Circulating Current – Displays a representative value of circulating current, if the control is used with the Beckwith Electric M-0115A Parallel Balancing module, or its equivalent.

Power Factor – Displays the real-time calculated value of power factor.

Alarm Blocks Status – This feature is not available on the GE-2011B and will be grayed out in the display.

Lower (Tap) – This feature is not available on the GE-2011B and will be grayed out in the display.

Raise (Tap) – This feature is not available on the GE-2011B and will be grayed out in the display.

Lower (Volt) – This feature is not available on the GE-2011B and will be grayed out in the display.

Raise (Volt) – This feature is not available on the GE-2011B and will be grayed out in the display.

Comm Block – This feature is not available on the GE-2011B and will be grayed out in the display.

Current Limit – This feature is not available on the GE-2011B and will be grayed out in the display.

Reverse Power – This feature is not available on the GE-2011B and will be grayed out in the display.

V. Red in Effect – This feature is not available on the GE-2011B and will be grayed out in the display.

Input

Counter – Indicates operation counter contact input is closed.

Neutral Tap – Indicates neutral position contact input is closed.

Switch Status – Provides the user feedback on the position of the Auto/Off/Manual switch. When the GE-2011B is configured for a switch status input, the switch status is read using the seal-in input on the control.

Non-Sequential – This feature is not available on the GE-2011B and will be grayed out in the display.

Volt Reduction 1 – Indicates Step 1 voltage reduction contact output is closed.

Volt Reduction 2 – Indicates Step 2 voltage reduction contact output is closed.

Output

Raise – Indicates Raise output is active.

Lower – Indicates lower output is active.

Seal-In – Indicates seal-in feature is active, if the control is used with a Cooper (McGraw-Edison) regulator.

Alarm – This feature is not available on the GE-2011B and will be grayed out in the display.

Control Monitor/Demand Metering

The **Demand Metering** submenu item displays the **Demand Metering** screen. Real-time demand metering information can be monitored from an addressed control.

Control Date and **Control Time** displays current time and date of the addressed control.

Demand Metering parameters are described on the following page.

Demand Metering
X

GE-2011B	Comm Address: 1
xxxxxxxxxxxxxxxx	xxxxxxxxxxxxxxxx

Control Date

Control Time

DEMAND PRESENT (Single Phase)

Demand Interval min

Primary Curr. Amps

Primary VAr MVA

Local Volt (32s AVG) V

Primary Watts MW

Primary VA MVA

DEMAND HISTORY (Single Phase)

Parameter	Date	Time	Reset
Local Volt (Min) <input style="width: 40%;" type="text" value="116.9"/> V	<input style="width: 40%;" type="text" value="Jan/08/02"/>	<input style="width: 40%;" type="text" value="15:25:07"/>	<input style="width: 40%;" type="button" value="Reset"/>
Local Volt (Max) <input style="width: 40%;" type="text" value="123.6"/> V	<input style="width: 40%;" type="text" value="Jan/08/02"/>	<input style="width: 40%;" type="text" value="09:08:56"/>	<input style="width: 40%;" type="button" value="Reset"/>
Primary Current (Max) <input style="width: 40%;" type="text" value="0"/> Amps	<input style="width: 40%;" type="text" value="Jan/08/02"/>	<input style="width: 40%;" type="text" value="11:48:57"/>	<input style="width: 40%;" type="button" value="Reset"/>
Primary Watts (Max) <input style="width: 40%;" type="text" value="0"/> MW	<input style="width: 40%;" type="text" value="Jan/08/02"/>	<input style="width: 40%;" type="text" value="11:48:53"/>	<input style="width: 40%;" type="button" value="Reset"/>
Primary VAr (Max) <input style="width: 40%;" type="text" value="0"/> MVA	<input style="width: 40%;" type="text" value="Jan/08/02"/>	<input style="width: 40%;" type="text" value="11:48:59"/>	<input style="width: 40%;" type="button" value="Reset"/>
Primary VA (Max) <input style="width: 40%;" type="text" value="0"/> MVA	<input style="width: 40%;" type="text" value="Jan/08/02"/>	<input style="width: 40%;" type="text" value="09:22:57"/>	<input style="width: 40%;" type="button" value="Reset"/>
Power Fact. (@Max VA) <input style="width: 40%;" type="text" value="-0.76"/> Lag	<input style="width: 40%;" type="text" value="Jan/08/02"/>	<input style="width: 40%;" type="text" value="09:22:57"/>	<input style="width: 40%;" type="button" value="Reset"/>

Draghand Lower

Resetable Op Cnt.

Draghand Raise

Operation Counter

Comm Status:

Figure 9-20 Demand Metering Dialog

Demand Metering

Demand Present (Single Phase)

Demand Interval – Indicates the time interval required for a thermal meter to indicate 90% of a change of load, adjustable from 15, 30, and 60 minutes.

Local Volt – Displays the real-time measured value of voltage at the regulator or transformer. This value continuously averaged over consecutive 32-second intervals.

Primary Curr – Displays the calculated primary demand current based on the user-selected current multiplier and measured secondary current.

Primary Watts – Displays the demand value based on the user-selected voltage and current multipliers; VT configuration (line-to-line or line-to-ground), single-phase or three-phase, and measured secondary voltage and current.

Primary VAr – Displays the demand value based on the user-selected voltage and current multipliers, VT configuration (line-to-line or line-to-ground), single-phase or three-phase, and measured secondary voltage and current.

Primary VA – Displays the demand value based on the user-selected voltage and current multipliers, VT configuration (line-to-line or line-to-ground), single-phase or three-phase, and measured secondary voltage and current.

Demand History (Single Phase or Three Phase)

–All demand history values include the date and time at which each occurred. A draghand value is the maximum or minimum value of a measured quantity recorded since the last reset.

Local Volt (Min) – Displays minimum local voltage at the regulator or transformer. This value continuously averaged over consecutive 32-second intervals.

Local Volt (Max) – Displays draghand maximum local voltage at the regulator or transformer. This value continuously averaged over consecutive 32-second intervals.

Primary Current (Max) – Displays draghand maximum primary current.

Primary Watts (Max) – Displays draghand maximum primary watts.

Primary VAr (Max) – Displays draghand maximum primary VAr.

Primary VA (Max) – Displays draghand maximum primary VA. Resets automatically when Power Factor at (Max) VA value, below, is reset.

Power Factor at (Max) VA – Displays draghand power factor at time of maximum VA.

Miscellaneous

Master Reset – Resets all Demand History date and time stamps and values.

Draghand Lower – Displays the lowest tap since last reset.

Draghand Raise – Displays the highest tap since last reset.

Resettable Op Cnt – Displays the number of operations since the last reset.

Operation Counter – Displays the number of operations. Can be set by the user.

Control Monitor/Energy Metering

■ **NOTE:** GE-2011B firmware version must be V-07.06.08 or later.

The **Energy Metering** submenu item displays the **Energy Metering** screen. This feature enables the user to review real-time and historical demand metering information. The screen includes the current date and time, Watt Hour (Single Phase or Three

Phase) forward and reverse, and VAr Hour (Single Phase or Three Phase) forward and reverse metered values.

Each element can be reset individually by selecting **Reset** for the desired parameter. When a **Reset** command is issued, the metered value is reset to zero and the time and date are updated.

Energy Metering X			
GE-2011B	Comm Add: 1		
xxxxxxxxxxxxxxxx	xxxxxxxxxxxxxxxx		
Control Date Wed/Jul/14/04	Control Time 09:22:45		
Watt Hour (Single Phase)		Var Hour (Single Phase)	
<div style="border: 1px solid black; padding: 5px;"> <p>Forward</p> <p>Watt Hours 51.25 MWHrs</p> <p>Time 09:41:28</p> <p>Date Jul/07/04</p> <p style="text-align: center; margin-top: 5px;"><input type="button" value="Reset"/></p> </div>		<div style="border: 1px solid black; padding: 5px;"> <p>Forward</p> <p>VAr Hours 44.00 MVAHrs</p> <p>Time 09:41:28</p> <p>Date Jul/07/04</p> <p style="text-align: center; margin-top: 5px;"><input type="button" value="Reset"/></p> </div>	
<div style="border: 1px solid black; padding: 5px;"> <p>Reverse</p> <p>Watt Hours 23.00 KWHrs</p> <p>Time 09:41:28</p> <p>Date Jul/07/04</p> <p style="text-align: center; margin-top: 5px;"><input type="button" value="Reset"/></p> </div>		<div style="border: 1px solid black; padding: 5px;"> <p>Reverse</p> <p>VAr Hours 7.76 MVAHrs</p> <p>Time 09:41:28</p> <p>Date Jul/07/04</p> <p style="text-align: center; margin-top: 5px;"><input type="button" value="Reset"/></p> </div>	
<input type="button" value="EXIT"/>		Comm Status:	

Figure 9-21 Energy Metering Screen

Control Monitoring/Harmonic Analysis

■ **NOTE:** GE-2011B firmware version must be V-07.09.XX or later .

The **Harmonic Analysis** submenu item displays the **Harmonic Analysis** screen. This feature enables the user to review voltage and current harmonics as a function of % fundamental or RMS. When this feature is selected, GE-2029A acquires 4 cycles of data and calculates the harmonic spectrum for each

cycle, and then displays the average of the four cycles of data for each harmonic. The user can select and view detailed information for each harmonic, save the data to file (text file) for viewing at a later time, or acquire a more current data set for display. When “Show Graph As RMS” is selected, the graph displays RMS values in Volts and mAmps.

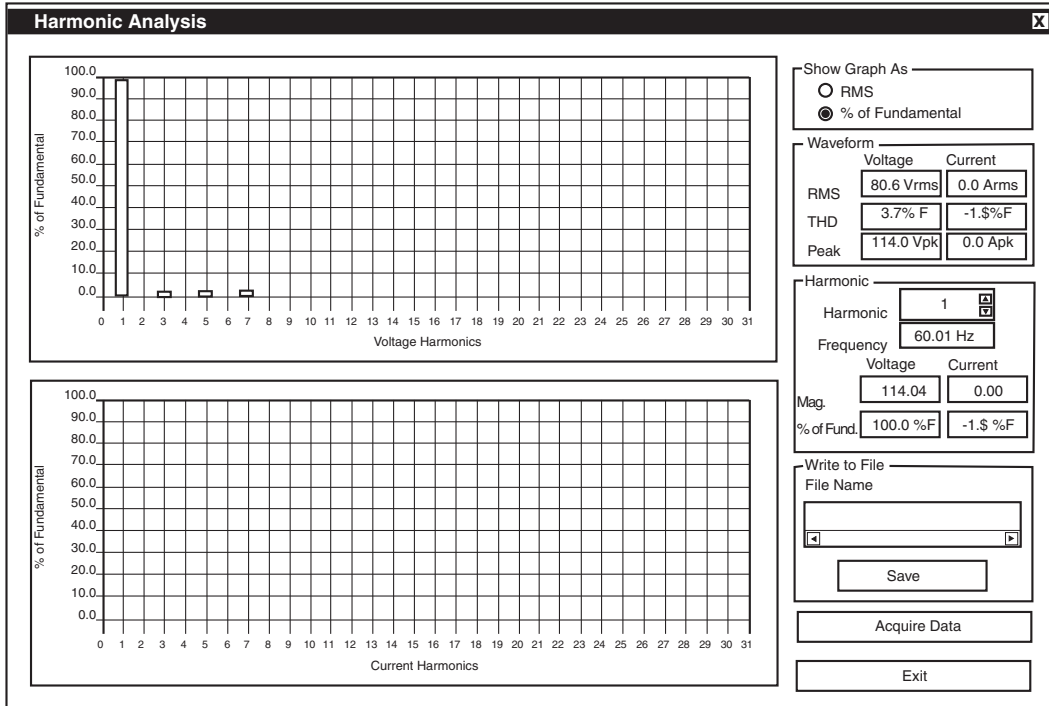


Figure 9-22 Harmonic Analysis Dialog Screen

Control Monitoring/Tap Changed Statistic

▲ **CAUTION:** Selecting **RESET COUNTER** will permanently delete all tap change statistics.

■ **NOTE:** GE-2011B firmware version must be V-07.09.XX or later .

The **Tap Changes Statistic** submenu item displays a statistical representation of the Tapchanger operation. The cumulative (since last visit) number of tapchanges for each tap position is displayed both graphically and numerically. Selecting **REFRESH** updates tap statistical data. Selecting **RESET COUNTER** resets all tap statistic counters to zero.

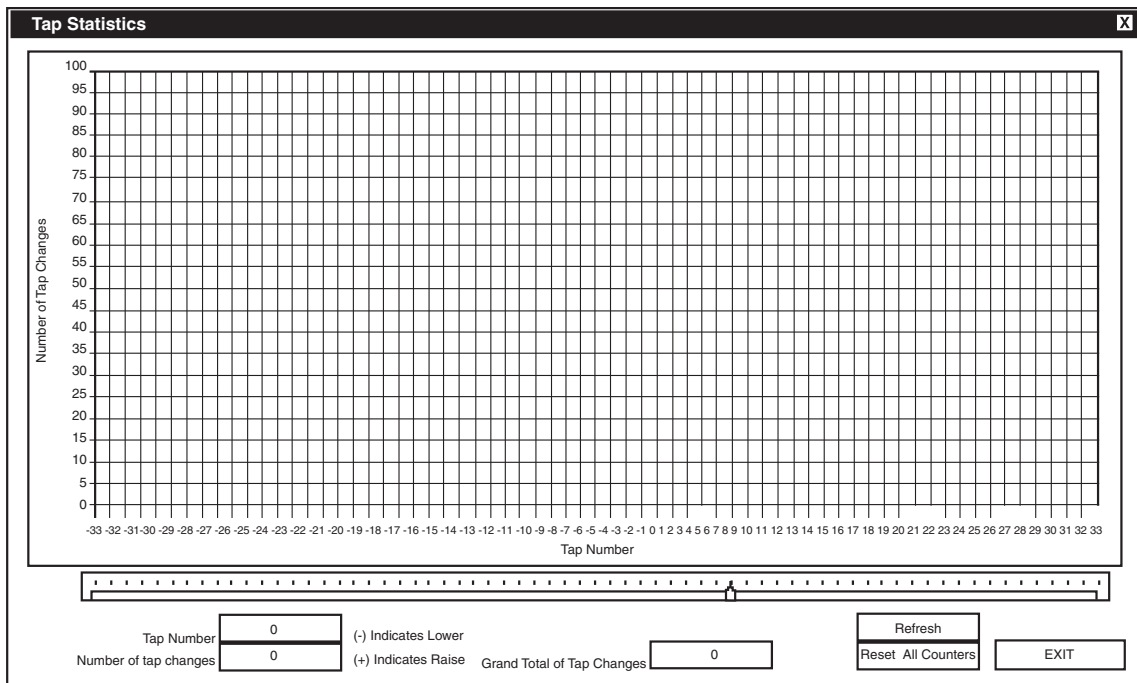


Figure 9-23 Tap Changes Statistic Screen

Utilities

Utilities
Remote Control
Data Logging ▶
Control Information
Set Control Date/Time
Set User Lines
Set New User Passwords

The **Utilities** menu includes the **Remote Control**, **Data Logging**, **Control Information**, **Set Control Date and Time**, **Set User Lines**, and **Set New User Passwords** commands.

Remote Control

▲ **CAUTION:** This feature should be used with extreme caution.

The **Remote Control** menu item displays the **Remote Control** screen. The **To Current Comm Address** selection enables the user to remotely raise or lower the tap position as well as apply voltage reduction to an individual control. The **Broadcast** selection allows the user to remotely apply voltage reduction to one or more controls. Also included is the **Tap Calibrate** command which enables the user to initialize the tap position for a transformer or regulator when the control is installed. Tap calibration is required for keeping accurate tap positions when using a current loop or the “keep track” method.

Remote Control and Automatic Mode Blocking

The Automatic Mode Blocking feature using Remote Control will cause the control to respond in a predefined manner to either a serial communication interruption or power loss to the control. The Control will respond as follows:

- If Automatic control has been Blocked using GE-2029A, then Automatic Control will remain Blocked if serial communication is disrupted or lost.
- If Automatic Control has been Blocked using GE-2029A, and the **Save Comm. Blk** feature is **Enabled**, then the Automatic Control Block will be reinstated at power up.
- If Automatic Control has been Blocked using GE-2029A, and the **Save Comm. Blk** feature is **Disabled**, then the Automatic Control Block will not be reinstated at power up.

Restoring Automatic Operation (Local)

Automatic operation can be restored from the front panel by removing the “Block Auto Control via Communication” through GE-2029A or by performing the following:

1. From the control front panel pushbuttons change the **Comm Block Auto** setting in the **Configuration** menu to **DONT SAVE**.
2. Remove power to the control, then reapply power to the control. Automatic operation will then be restored.

Remote Control
✕

GE-2011B

xxxxxxxxxxxxxxxx

To Current Control Address

Comm Add: 1

xxxxxxxxxxxxxxxx

Broadcast

Tap Control

Tap Position Disable

Local Voltage 120.5 Volt

Tap Raise

Block Raise Inactive

Raise 1 Tap

Tap Lower

Block Lower Inactive

Lower 1 Tap

Voltage Reduction

Step 1
 Step 2
 Step 3

Clear

Block Auto Control via Communication

BLOCK
UNBLOCK

Save Comm. Block at Power Off

Enable
 Disable

Tap Calibrate

Set to MATCH reading of actual tap position

0 Neutral
Set

EXIT

Comm Status:

Figure 9-24 Remote Control Screen

Remote Control

▲ **CAUTION:** This feature should be used with extreme caution.

The **Remote Control** feature enables the user to remotely raise or lower tap position, as well as apply voltage reduction when the control is in Automatic.

Remote Voltage Reduction

Step #1 – Initiates first step voltage reduction command for addressed control.

Step #2 – Initiates second step voltage reduction command for addressed control.

Step #3 – Initiates third step voltage reduction command for addressed control.

Clear – Removes remote voltage reduction commands for addressed control.

Remote Tap Control

Lower 1 Tap – Initiates remote Lower in 1 step increments. Limited by tap Block Lower setpoint and tap position limit settings.

Raise 1 Tap – Initiates remote Raise in 1 step increments. Limited by tap Block Raise setpoint and tap position limit settings.

Block Auto Control via Communication

Block – Blocks automatic operation of the addressed control.

Unblock – Initiates automatic operation of the addressed control.

Save Comm. Block at Power Off – Allows the state of the “Block Auto Operation” communication command to be saved or not saved when power has been lost.

Exit – Returns to the GE-2029A main window. Exiting does not cancel blocking or voltage reduction. *Automatic operation of the control is disabled until the **Unblock** command is chosen.*

Broadcast Control

▲ **CAUTION:** This feature should be used with extreme caution.

The **Broadcast Control** feature enables the user to remotely apply voltage reduction and/or Block (Unblock) Automatic Control to one or more controls.

Remote Voltage Reduction

Step #1 – Initiates first step-voltage reduction command for all controls on the communication network.

Step #2 – Initiates second step-voltage reduction command for all controls on the communication network.

Step #3 – Initiates third step-voltage reduction command for all controls on the communication network.

Clear – Removes remote voltage reduction commands for all controls on the communication network.

Block Auto Control via Communication

Block – Blocks automatic operation of all controls on the communication network.

Unblock – Initiates automatic operation of all controls on the communication network.

Save Comm. Block at Power Off – Allows the state of the “Block Auto Operation” communication command to be saved or not saved when power has been lost.

Tap Calibrate

The Tap Calibrate feature enables the user to initialize the tap position for a transformer or regulator when the control is installed. Tap calibration is required for keeping accurate tap positions when using a current loop or the “Keep Track” method.

Tap Position – Sets actual tap position.

Raise/Lower – Sets actual tap direction.

Set – Writes the currently displayed tap position and direction to the addressed control.

Exit – Returns to the GE-2029A main window. Exiting does not cancel blocking or voltage reduction. *Automatic operation of the control is disabled until the **Unblock** command is chosen.*

Utilities/Data Logging



The **Data Logging** toolbar item includes **Control Setup and Download** and **To PC** data logging features.

When connected to a GE-2011B control the **Data Logging** feature provides the user with the ability to initiate data logging of selectable control parameters to either the selected control for downloading at a later time or directly to a PC.

This feature allows the user to configure the parameters that the control will use to log data, and to download the logged data to a comma separated value (CSV) file or a GE-2829 file. CSV files can be opened in a spreadsheet program such as Microsoft Excel™. GE-2829 files can be viewed with GE-2829.

Data Logging/Control Setup and Download

This submenu item displays the **Data Logging Control Setup and Download** Dialog Screen.

The **Logging** section allows the user to select the parameters to be logged by the control. The number of parameters selected determines the **Max Time Available** duration that the control can store.

In the **Logging Timer** section, the **Sampling Period** allows the user to input the frequency in minutes at which the data will be logged. **Max Time Available** displays the amount of data that can be held in the circular memory block. This field will automatically update with any changes made in the **Sampling Period** or the **Data To Be Logged** section.

To erase the existing data and start logging new data, select **“Erase Existing Data and Start Logging Data to Control...”**

Once the **Data to be Logged** parameters are uploaded to the control by selecting **Erase Existing Data and Start Logging data to Control**, the control will log data to onboard memory. Logging will continue indefinitely until a new set of log parameters are uploaded, at which point all previously logged data will be cleared, and the control will begin logging data with the new parameters.

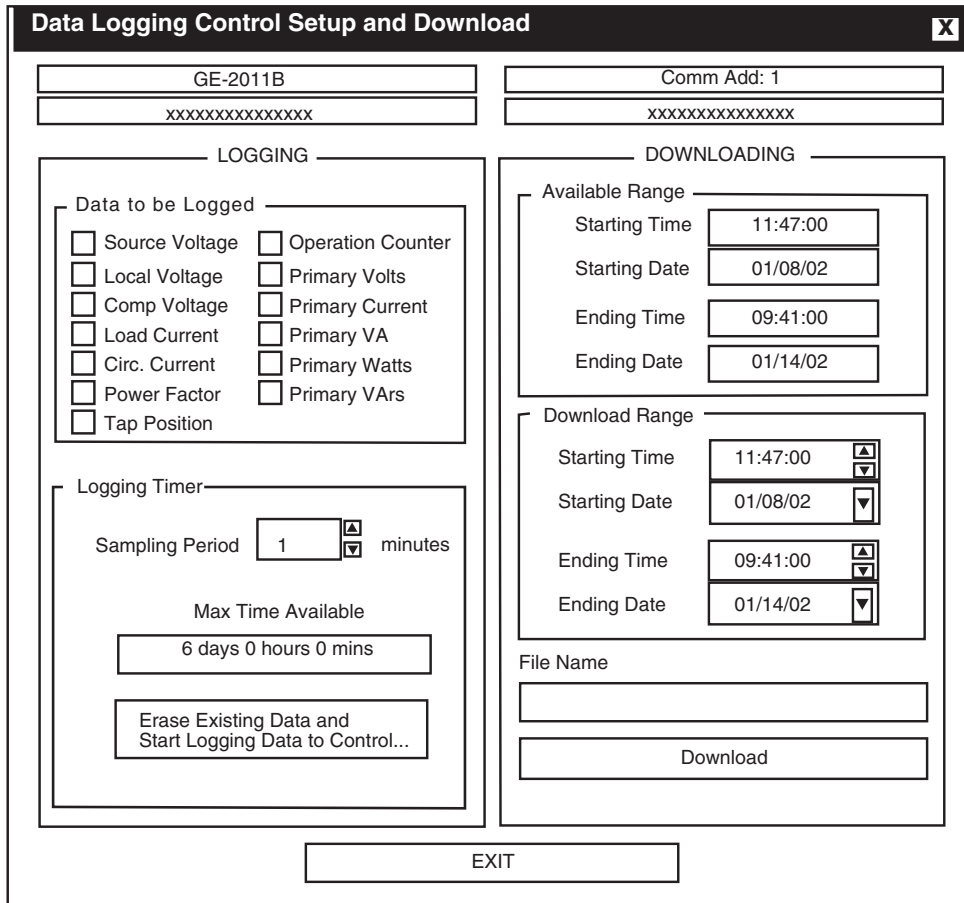


Figure 9-25 Data Logging to Control Dialog Screen

In the **Downloading** portion of the screen, the **Available Range** section will display the oldest and latest dates of the logged data. These dates will also initially appear in the **Download Range** section edit boxes, which indicate the start and end points for the data to be downloaded.

The **File Name** text box contains the name of the file to which the data will be downloaded. The **File Type** box also contains the selection which can be “.CSV”, “.TPF” or both. A “.CSV” file extension is required for these files so that they can be recognized and opened by Excel or Lotus123 compatible spreadsheet applications. A “.TPF” file extension allows the file to be read by GE-2829. If an incorrect file extension or no extension is used, GE-2029A will prompt the user to have GE-2029A apply a correct extension or cancel the operation. Files saved using duplicate file names will be overwritten without warning.

▲ **CAUTION:** Be sure to download your data before changing parameters. Once the **Start Logging to Control** button is selected, all previously logged data will be cleared (and will no longer be available for download), and the control will begin logging new data.

When **Download** is selected, all data selected in the Download Range section will be downloaded to the file displayed in the **File's Name** section. If the range chosen includes a large amount of data, the download may take up to 45 minutes (300 Kb).

If necessary edit the Download Range, then select **Download** to download the data from the selected range.

Data Logging/To PC

The **To PC** submenu item displays the **Data Logging to PC** Dialog Screen (Figure 9-26). The **To PC** feature enables the user to store selected parameter data for review at a later time. One or more of the parameters listed in the **Data To Be Logged** section can be selected for logging. The time displayed in the **Sampling Period** in the **Logging Options** section determines how frequently data samples are acquired, ranging from 1 minute to a maximum of 9999 minutes. The duration of sampling is further regulated by the **Sampling Duration** which restricts data logging to a maximum of 9999 hours or 9999 days. Uninterrupted communication with the control is required while data is being logged.

Data logging is initiated by selecting **Start Data Logging to PC**. The **Start Data Logging to PC** is replaced by **Stop Data Logging to PC** dialog to indicate data logging is active. Logging can be canceled either by choosing the **Stop Data Logging to PC** command or by interrupting communication.

The **Set File Name** selection allows the user to name the file to which data is saved. If the Suggested File Name feature is disabled, then a file name will be required to be entered with a default file extension of *.CSV, (Comma Separated Values is the default for files with data logging information). If the Suggested File Name is enabled, then the file name will be determined by the settings from the Suggested File Name window with a filename extension of “.CSV”. If the user saves a file using a duplicate filename, the previously saved file will be overwritten without warning. The size of the file must not exceed available disk space. The file format “.CSV” can be opened by most spreadsheet applications, allowing the user to analyze the collected data.

Figure 9-26 Data Logging To PC Dialog Screen

Utilities/Control Information

The **Control Information** submenu item displays the **Control Information** Screen (Figure 9-27). The **Control Information** screen provides specific information about the addressed control. The **Control Information** screen includes the following:

- General Electric identification (model) number
- The addressed control’s serial number
- Control’s software version
- Mod Number
- Model of GE-2011B
- The text currently displayed in the User Text Lines 1 and 2
- Control Address
- The Communication Channel status which reflects whether the correct communication password has been identified, “unlocking” the communication channel and allowing access to the control.

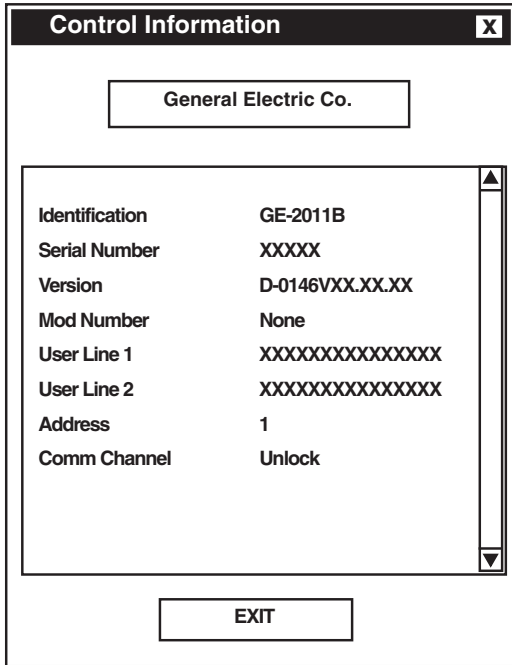


Figure 9-27 Control Information Screen

Utilities/Set Control Date and Time

The **Set Control Date and Time** submenu item enables the user to review the internal clocks for the PC, the addressed control, or all controls in the broadcast mode, as well as the last power-up for the addressed control.

To set control(s) time/date perform the following:

1. Select either **To Current Address** or **Broadcast**
2. Input the desired time/date, then select **Set**

To set control(s) time/date to match PC’s current time/date perform the following:

1. Select either **To Current Address** or **Broadcast**
2. Select **Set Control time to PC’s time**

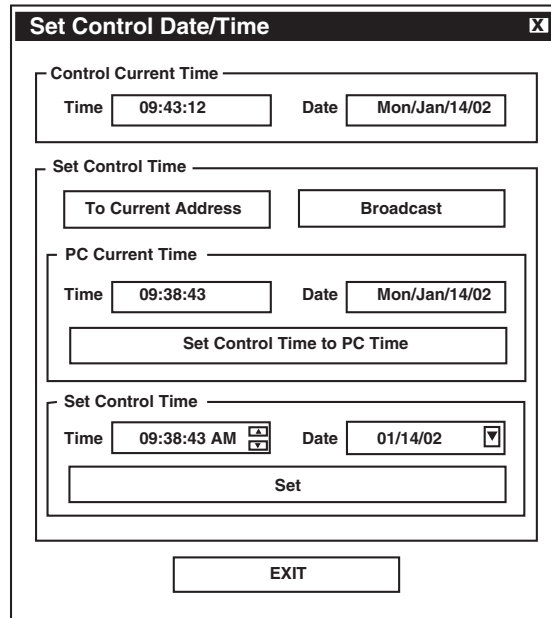


Figure 9-28 Set Control Date and Time Dialog Screen

When the time is set, a prompt will be displayed, asking if the user wants to reset Demand Metering, Energy Metering (if applicable), Drag Hands and Resettable OP Count.

Utilities/Set User Lines

The **Set User Lines** submenu item provides the user with the ability to review and change the user lines for the addressed control.

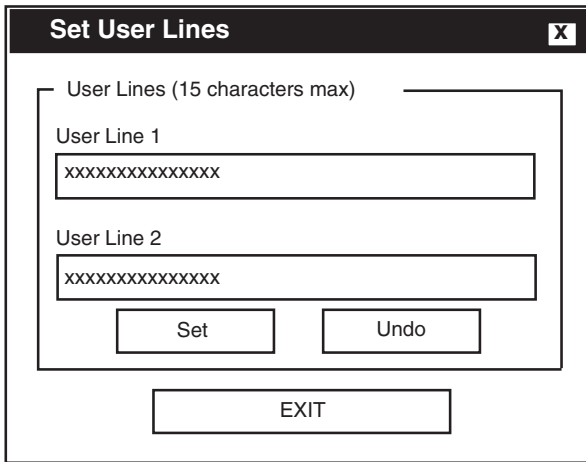


Figure 9-29 Set User Lines Dialog Screen

Utilities/Set New User Passwords

The **Set New Passwords** submenu item displays the **New Passwords Setup** Dialog Screen.

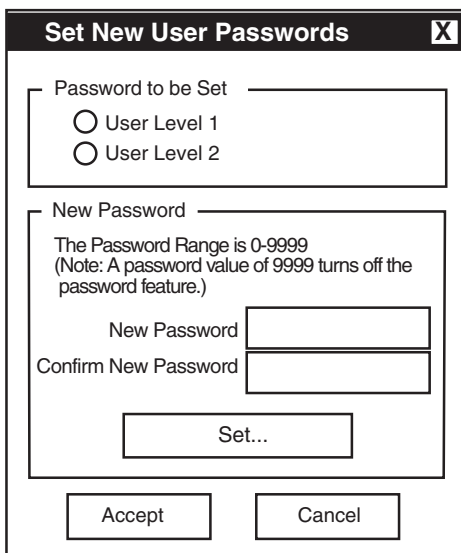


Figure 9-30 New Passwords Setup Dialog Screen

GE-2029A User Level 1 and User Level 2 passwords are unique to GE-2029A only. Control User Level 1 and User Level 2 passwords protect access to the control from the front keypad.

When a communication password has been configured at the control, the communication password allows the user to bypass both the configuration and setpoint passwords otherwise required by a control.

NOTE: The communication password is identified as a string #. Therefore, the passwords "001" and "1" are not interchangeable.

Each control can be given a unique, 4-digit password ranging from 0 to 9999. If the password has been configured at the control as 0000, communication is not restricted a password does not need to be identified by GE-2029A. The control is shipped with communication password disabled (set to 0000).

GE-2029A password protection, when implemented, is as follows:

Default	View All
Level 1	Change Setpoints, Set Control Date/Time
Level 2	Change Setpoints, Configuration, DNP Configuration, Set New Passwords, Start Data Logging, Setup Data Logging, Remote Control, Set User Text Lines, Set Control Date/Time

To change **User Level** passwords perform the following:

1. Select **Control Setup/Set New Passwords** from the GE-2029A toolbar, GE-2029A will display the **Set New Passwords** dialog screen.
2. Select **User Level 1** or **User Level 2**.
3. Input a four digit password between 0 and 9999 in **New Password**.
4. Input the four digit password from Step 4, in **Confirm...**
5. Select **Setting**, then verify that GE-2029A displays the **New User Level Password has been set** confirmation.

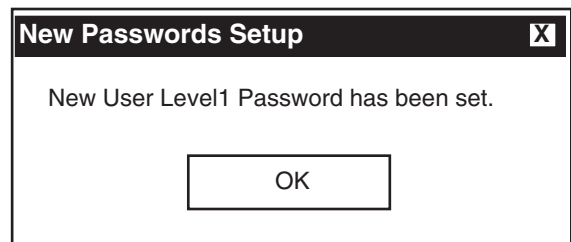


Figure 9-31 New User Level Password Confirmation Screen

Remove Status Screens

The **Remove Status Screen** allows the user to hide or restore status screens on the GE-2011B.

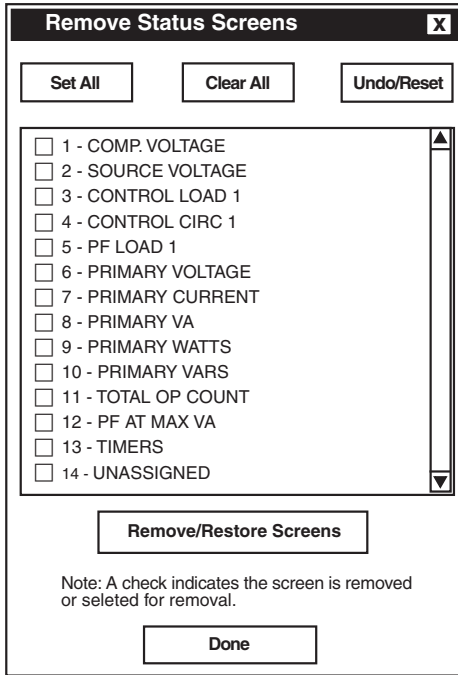
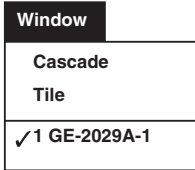


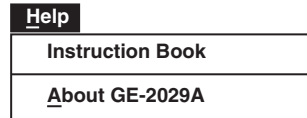
Figure 9-32 Remove Status Screens Selection Screen

Window



The **Window** toolbar item provides the **Cascade** and **Tile** display options. The **Window** toolbar item also allows the user to select between open GE-2029A windows.

Help



The **Help** toolbar item provides the user with information about the control and the software version that is installed in the unit.

Help/Instruction Book

The Instruction Book menu topic has been indexed to its Table of Contents. By selecting the 'Navigator pane' in Adobe Acrobat Read, the user can directly access selected topics.

Help/About GE-2029A

The **About** submenu item provides the GE-2029A software version number and copyright information.

9.8 Communication Cables

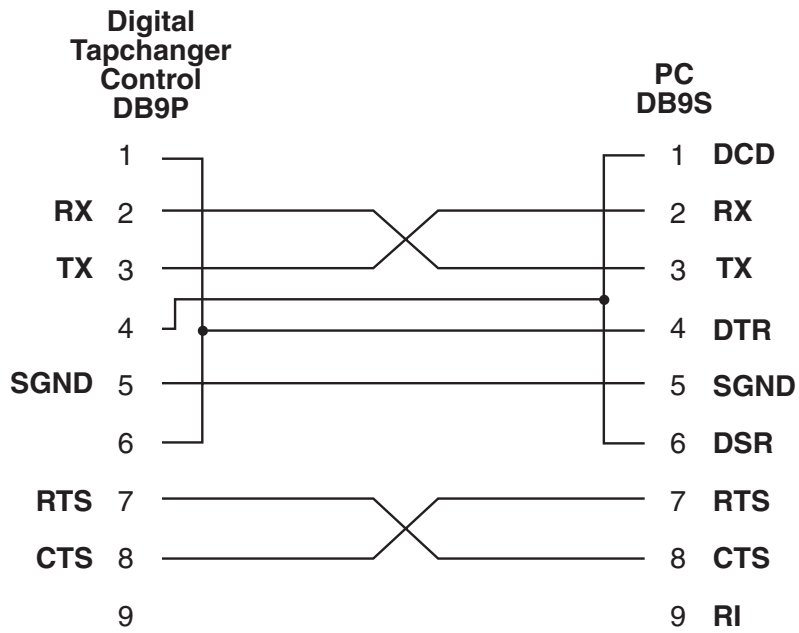


Figure 9-33 Null Modem Cable 9-Pin to 9-Pin

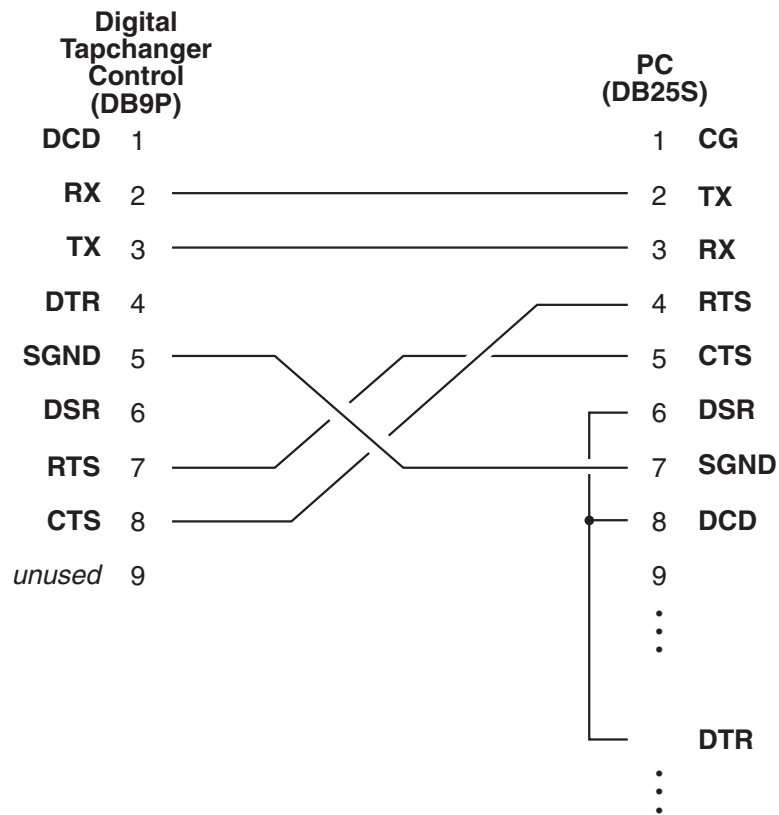


Figure 9-34 Null Modem Cable 9-Pin to 25-Pin

	Digital Tapchanger Control (DB9P)		Modem (DB25S)
DCD	1	—————	8
RX	2	—————	3
TX	3	—————	2
DTR	4	—————	20
SGND	5	—————	7
DSR	6	—————	6
RTS	7	—————	4
CTS	8	—————	5
<i>unused</i>	9		

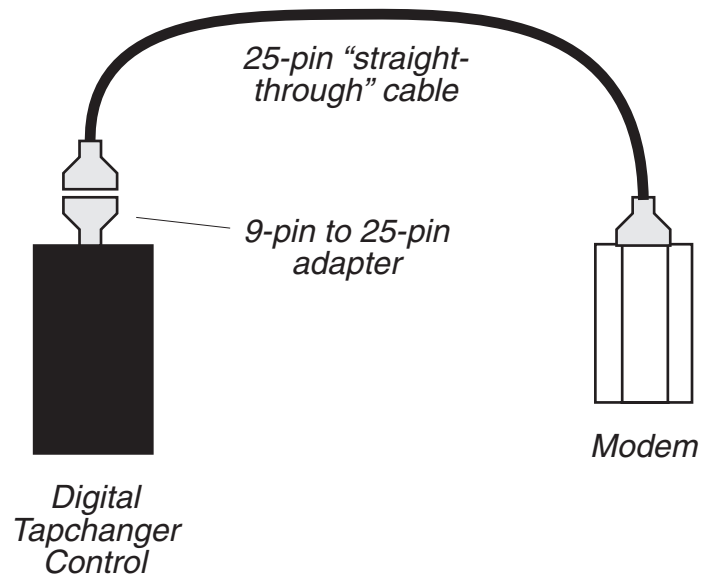


Figure 9-35 Modem Cable 9-Pin to 25-Pin

9.9 GE-2829 Analysis Software

The GE-2829 Analysis Software operates in conjunction with all GE-2029A Communications Software on any IBM PC-compatible computer. GE-2829 allows the user to plot and print tap data retrieved from General Electric GE-2011B series Digital Tapchanger Controls utilizing the Data Logging feature of GE-2029A.

Installation

GE-2829 runs with the Microsoft Windows 95, 98, NT 4.0, 2000, or XP operating system. Familiarity with Windows is important in using GE-2829, as the conventions defined in the Windows documentation are strictly followed therein.

GE-2829 will be installed on the host PC's hard disk. While it does not require special installation procedures, an installation utility has been provided to make the process easier.

To install GE-2829:

1. Insert the GE-2829 software into your CD-ROM drive.
2. Select **Run** from the **Start Menu**.
3. In the **Run** dialog box, initiate software installation by typing **D:\Setup.exe** (or other drive designator:\Setup.exe, depending on the letter designation for the CD-ROM drive).
4. The Installation Wizard will prompt the user through the installation process. After installation, the GE-2829 program icon (located in the General Electric folder) can be placed on the desktop (Figure 9-36).



Figure 9-36 GE-2829 Program-Item Icon

Creating GE-2829 Data Files

To create data files for viewing in GE-2829 proceed as follows:

1. From the "Start" menu select the GE-2029A program.
2. From the GE-2029A Main Menu select **Utilities\Data Logging\Data Logging Control Setup And Download**. GE-2029A will display the Control Setup And Download screen (Figure 9-25).
3. Select the File Type as "GE-2829" file or "Both".
4. Perform the Data Logging download.
5. Close GE-2029A.

Starting GE-2829

1. Select the GE-2829 program-item icon from the Becoware group in the Program Manager, or select GE-2829 from the program list using the **Start** Menu. The GE-2829 Window and Toolbar is displayed (Figure 9-37).
2. Select File->Open from the menu, and browse for the .tpf file.
3. Open the file. GE-2829 should display the saved data, as shown in Figure 9-37.

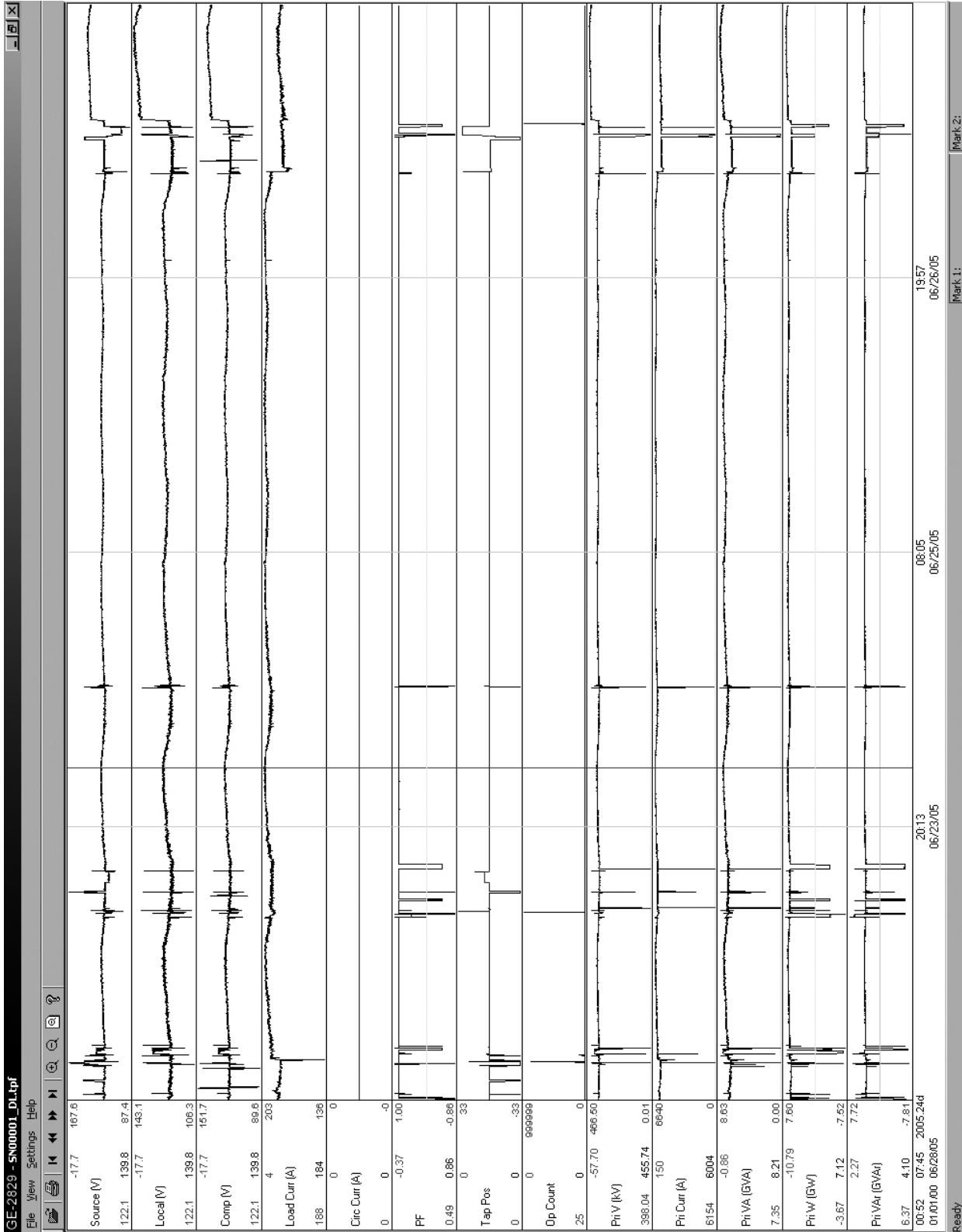


Figure 9-37 GE-2829 Window and Tap Data Example

Markers

GE-2829 includes two user selectable markers. The first is positioned by double clicking on the plotted wave form data. The second is positioned by pressing and holding the **SHIFT** key and then double clicking on the plotted wave form data.

The markers can be dragged by moving the cursor over the marker until the cursor changes to a double-headed arrow \leftrightarrow , then holding down the Left mouse button and dragging the marker. The marker can also be moved an interval at a time by pressing the **UP** or **DOWN** arrow key. The last cursor selected is the one that is moved. To toggle the active cursor, press the **T** key.

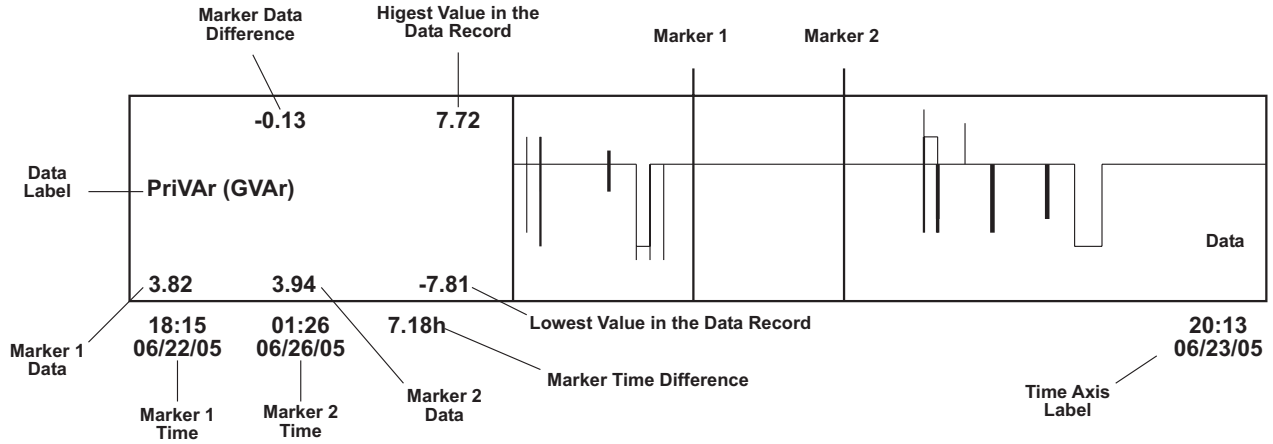


Figure 9-38 GE-2829 Screen With Callouts

Overview

GE-2829 is a windows based program for viewing the data that has been retrieved using the Data Logging feature of GE-2029A.

When GE-2829 is started, a menu and tool bar are displayed (see Figure 9-37). This section describes each GE-2829 menu selection and explains each GE-2829 command in the same order that they are displayed in the software program. Figure 9-39 presents the GE-2829 Menu and Submenu Callouts.

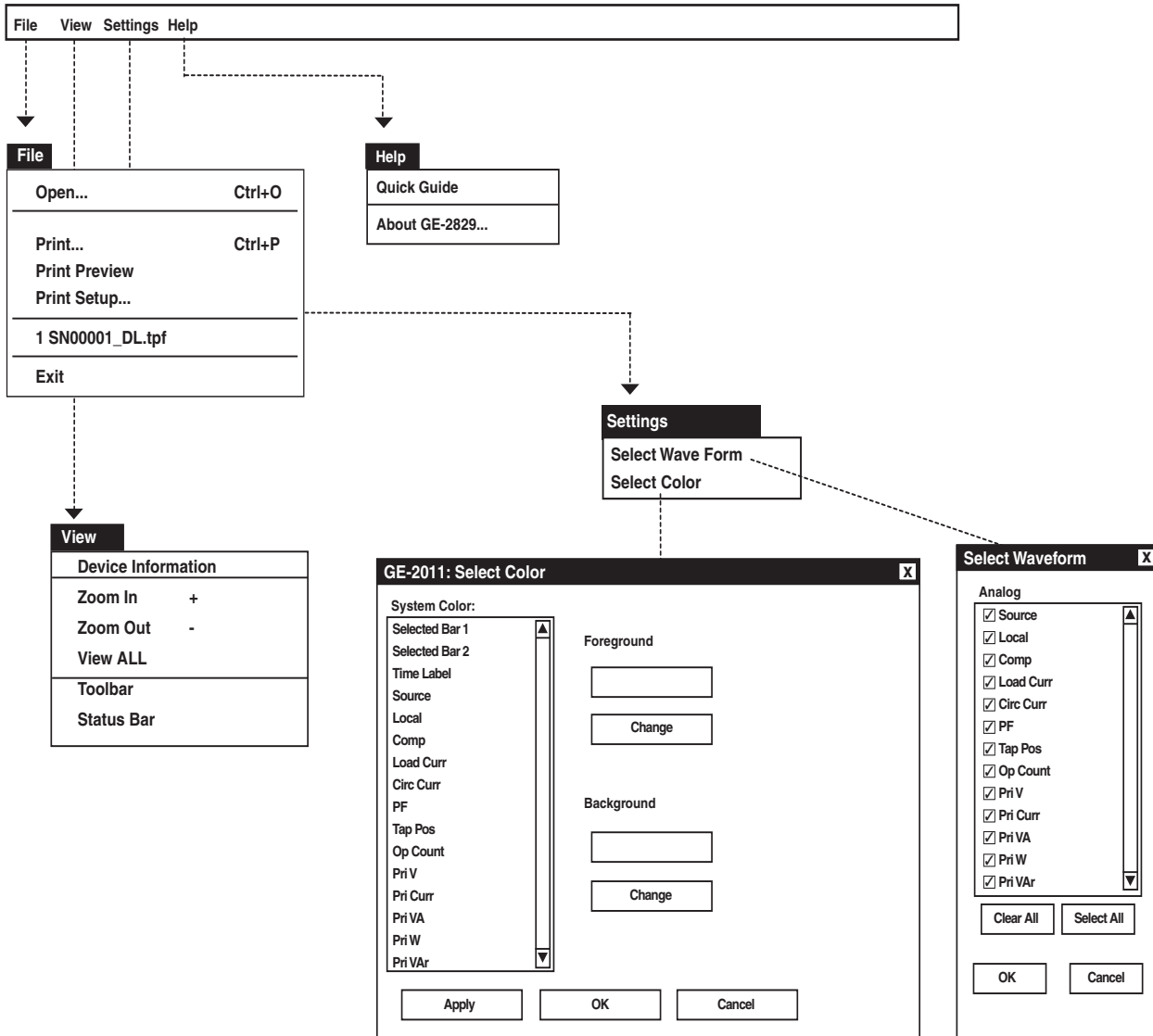
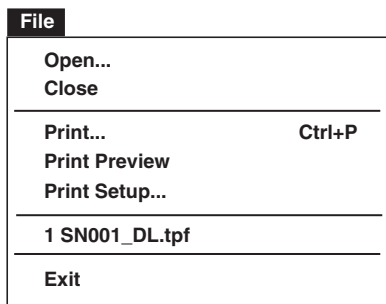


Figure 9-39 GE-2829 Submenu Callouts

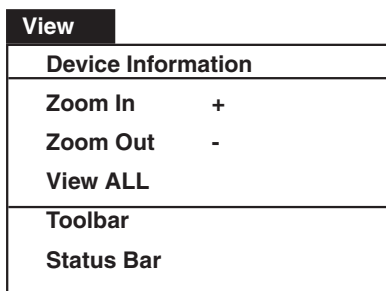
File Menu



The **File** menu allows the user to:

- Open a GE-2829 (.tpf) file previously downloaded by GE-2029A.
- Print the displayed GE-2829 data.
- Print Preview the displayed GE-2829 data.
- Select the printer and printer settings to be used.
- Select from previously viewed .tpf files (the last four files displayed).
- Exit the GE-2829 program.

View Menu



The **View** menu allows the user to:

- Display the Device Information (Figure 9-40) for the corresponding GE-2829 data file.
- Zoom In, increase the resolution of the tap data displayed on the screen.
- Zoom Out, decrease the resolution of the tap data displayed on the screen.
- View ALL, returns the display to include all data within the record.
- Select which Tool Bar (Toolbar/Status Bar) is available on the display window.

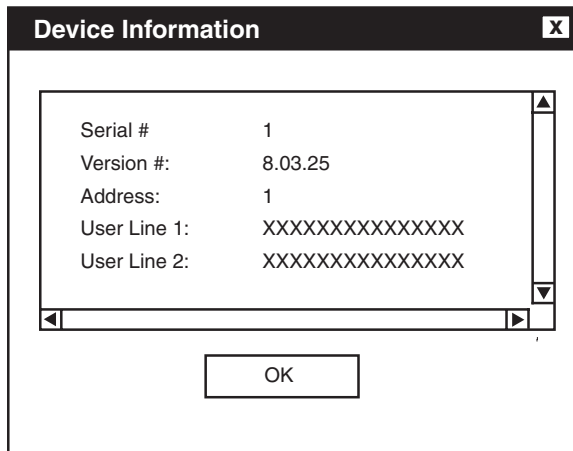
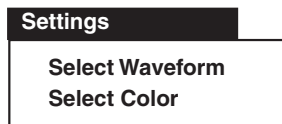


Figure 9-40 Device Information Screen

Settings Menu



The Settings menu allows the selection of the waveforms to be displayed and the format of display colors.

Select Waveform allows the selection of any of the following Tap Parameters to be plotted or printed:

- Source Voltage (V)
- Local Voltage (V)
- Comp Voltage (V)
- Load Current (A)
- Circulating Current (A)
- Power Factor
- Tap Position
- Operation Counter
- Primary Voltage (kV)
- Primary Current (A)
- Primary VA (GVA)
- Primary Watts (GW)
- Primary VAr (GVAR)

The Waveform selections are made from the Select Waveform screen (Figure 9-41).

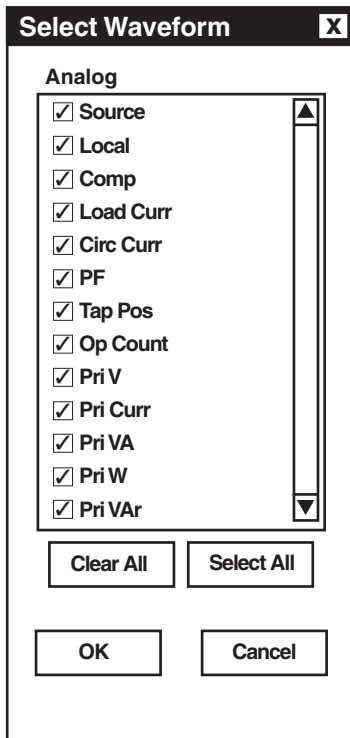


Figure 9-41 Select Waveform Dialog Screen

Select Color provides the user with the capability to change Foreground and Background display color of individual Waveform traces for customized plotting.

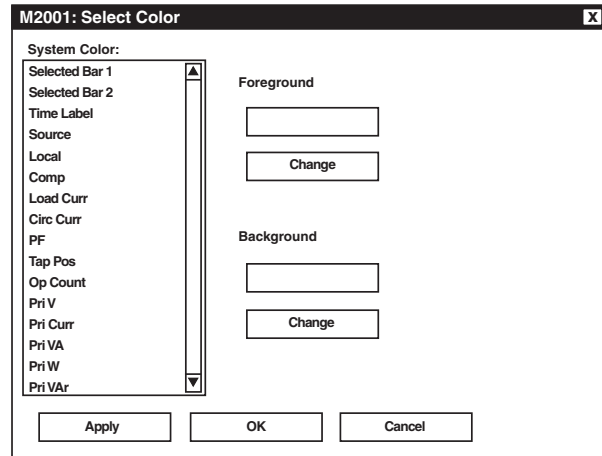
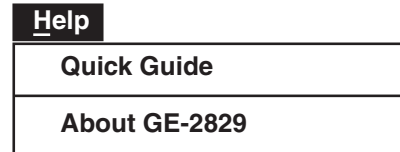


Figure 9-42 Select Color Dialog Screen

Menu/Help Menu



The **Help** menu provides access to the **Quick Guide** which provides basic information about GE-2829 menus and commands. The **About** command provides version information for GE-2829.

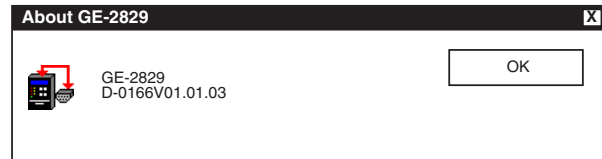


Figure 9-43 About GE-2829 Screen

A Appendix

A.0	Summary of Specifications	A-1
A.1	External Connections	A-1
A.2	Field Checkout Procedure	A-1
A.3	Screen Review	A-3
A.4	Setpoint and Configuration Worksheets	A-14

A.0 Summary of Specifications

The following is a brief summary of specifications that may be required for installation. Please refer to specification sheets for complete information.

Voltage withstand:

140 V continuous
 240 V for one second
 480 V for one cycle
 Voltage measurement linear to 140 V

Current withstand:

0.2 amps continuous
 0.4 amps for 2 hours
 4.0 amps for one second
 Output raise and lower circuits:
 6 amps AC

Recommended external fusing:

Motor power input - 6 A
 Voltage input - 1 A


A.1 External Connections

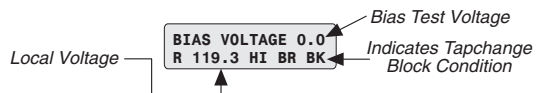
See the Application Guide for the adapter panel being used.

The control's operating frequency can be 50 Hz or 60 Hz. This option may *not* be selected in the field.

A.2 Field Checkout Procedure

■ **NOTE:** The following procedure assumes that the GE-2011B Tapchanger Control is connected to the front panel.

1. To wake unit from blank screen mode, press any pushbutton. Unit will display a series of power-up screens, then the Local Voltage screen.
2. Press the  pushbutton to go to the Bias Voltage-Test Mode screen.
3. Press **ENT** to reach the Bias Voltage input screen.



■ **NOTE:** If a Tapchange Block condition is indicated (see above), unit cannot be tested per this procedure. Therefore, make sure that you have placed the control in Automatic operation by using a communications protocol and resolving blocking condition.

4. Presuming that the unit is not in a Tapchange Block condition, set the **AUTO/OFF/MANUAL** switch to **MANUAL** and run the tapchanger control 3 or 4 steps in the Raise direction. Return the **AUTO/OFF/MANUAL** switch to Automatic.

5. Set the **AUTO/OFF/MANUAL** switch to **MANUAL** and run the tapchanger control 3 or 4 steps in the Lower direction. Return the **AUTO/OFF/MANUAL** switch to **AUTOMATIC**.
6. Press **ENT** to return to the **Bias Voltage Test Mode** screen. To exit from the unit's software, move through the screens using the **▲** and **▼** pushbuttons to one of the Exit screens. Press the **ENT** pushbutton. Unit will display a blank screen.

GE-2011B Instruction Book

<p>LINE FREQUENCY 60.10 Hz</p>	<p>Displays the line frequency. (Section 5.4)</p>
<p>ETHERNET BOARD VER D-0147V01.00.00</p>	<p>Not available on the GE-2011B.</p>
<p>VERSION NUMBER D-0146V01.00.00</p>	<p>Displays the GE-2011B's software version number.</p>
<p>SERIAL NUMBER 00023</p>	<p>Displays the Beckwith Electric GE-2011B serial number.</p>
<p>TIME OF DAY 08:15:00</p>	<p>Displays and allows resetting of the time of day. Press E to set time of day; change mode indicated by flashing C. Used in conjunction with memories where the date/time stamp will be recorded for each drag-hand quantity. (Section 5.3)</p>
<p>DATE 02/01/95</p>	<p>Displays and allows resetting of the date. Press E to set date; change mode indicated by flashing C. Used in conjunction with drag-hands memories where the date/time stamp will be recorded for each drag-hand quantity.</p>
<p>VAR HRS R 1/3 PH E 84.074 MVarHR</p>	<p>Displays total reverse VarHr in 1 or 3 phase determined by the PRI PWR DISPLAY configuration setting (Section 5.1). Bottom line toggles between date/time/VarHr.</p>
<p>VAR HRS F 1/3 PH E 47.879 MVarHR</p>	<p>Displays total forward VarHr in 1 or 3 phase determined by the PRI PWR DISPLAY configuration setting (Section 5.1). Bottom line toggles between date/time/VarHr.</p>
<p>WATT HRS R 1/3 PH E 234.687 MWHR</p>	<p>Displays total reverse WHr in 1 or 3 phase determined by the PRI PWR DISPLAY configuration setting (Section 5.1). Bottom line toggles between date/time/WHr.</p>
<p>WATT HRS F 1/3 PH E 899.002 MWHR</p>	<p>Displays total forward WHr in 1 or 3 phase determined by the PRI PWR DISPLAY configuration setting (Section 5.1). Bottom line toggles between date/time/WHr.</p>
<p>TIMERS R=0 L=0 IT=0</p>	<p>Displays the status of the raise, lower, and intertap timers; inverse or linear.</p>
<p>PF AT MAX VA 0.87 Lag/Lead</p>	<p>Displays power factor at time of maximum VA. Resets automatically when MAX VA screen, below, is reset.</p>
<p>MAX VA 1/3 PH E 2.12 MVA</p>	<p>Displays maximum VA in 1 or 3 phase determined by the PRI PWR DISPLAY configuration setting (Section 5.1). Bottom line toggles between date/time/MVA.</p>
<p>MAX VAR 1/3 PH E 0.67 MVAr</p>	<p>Displays maximum VAR in 1 or 3 phase determined by the PRI PWR DISPLAY configuration setting (Section 5.1). Bottom line toggles between date/time/MVAr.</p>
<p>MAX WATTS 1/3 PH E 1.98 MW</p>	<p>Displays maximum Watts in 1 or 3 phase determined by the PRI PWR DISPLAY configuration setting (Section 5.1). Bottom line toggles between date/time/MW.</p>
<p>MAX PRI CURR E 290 Amps</p>	<p>Displays maximum primary current. (Section 5.1) Bottom line toggles between date/time/Amps.</p>

Figure A-2 Status Screens (page 1 of 3)

■ **NOTE:** For detailed information on the above settings, see the referenced sections.

MAX LOCAL VOLT E 123.1 Volts	Displays maximum local voltage at the regulator or transformer. (Section 5.1) Bottom line toggles between date/time/Volts.
MIN LOCAL VOLT E 116.9 Volts	Displays minimum local voltage at the regulator or transformer. (Section 5.1) Bottom line toggles between date/time/Volts.
TAP DRAGHANDS E L=2L R=3R	Displays minimum and maximum values of tap position since reset. (Section 5.2)
OPER CNTR RSET E 0	Records the total number of raise and lower operations as does the total operations counter, discussed below. This counter is reset by pressing ENT at this screen. This counter can be used to monitor the number of tap changes since the last time it was checked. (Section 4.4)
TOTAL OP COUNT 1285	Records the total number of raise and lower operations. The operation counter will advance by one or two counts, as set by user, for each open-close-open contact operation. This counter is not resettable, but can be preset to any value between 0 and 999,999.(Section 4.4)
PRIMARY VARS 1/3 PH 1.44 mVAr	Displays the calculated primary quantity based on the user-selected multipliers, VT configuration (line-to-line or line-to-ground), single-phase or three-phase and measured secondary voltage and current. (Section 5.1)
PRIMARY WATTS 1/3 PH 3.00 MW	
PRIMARY VA 1/3 PH 3.30 MVA	
PRIMARY CURRENT 133 Amps	Displays the calculated primary current based on the user-selected current multiplier and measured secondary current. (Section 5.1)
PRIMARY VOLTAGE 14.4 kV	Displays the calculated primary voltage based on the user-selected voltage multiplier and measured secondary voltage. (Section 5.1)
TAP POSITION/CAL 4 R	Displays the tap position of the tapchanger. Recognizes tapchanges commanded via manual, automatic or external (SCADA) means, if tap position not disabled. The tap position can be calibrated by selecting ENT, then setting the tap position using the ▲/▼ pushbuttons and then selecting ENT to confirm the new tap position.
PF LOAD I 0.90 Lag/Lead	Displays the real-time calculated value of power factor.
CONTROL CIRC I 1 mA Lead/Lag	In paralleling applications, displays the measured value of circulating current or reactive delta VAr current, at the circulating current input related to the scaling factor Current Transformer of 200 mA, 1 A or 5A.
CONTROL LOAD I 100 mA	Displays the real-time measured value of load current related to the scaling factor Current Transformer of 200 mA, 1 A or 5A.

Figure A-2 Status Screens (page 2 of 3)

■ **NOTE:** For detailed information on the above settings, see the referenced sections.

SOURCE VOLTAGE
117.0 Volts

Displays the real-time calculated source voltage-only applicable in regulator control applications and includes any corrections made using the user-selected VT correction voltage.

COMP. VOLTAGE
120.0 Volts

Displays the calculated voltage at the "load center," based on load current and the LDC settings.

BIAS VOLTAGE
—STATUS/TST MODE—

When **ENT** is pressed, the control status can be checked, and a bias test voltage can be entered to test the control's automatic operation. (Figure A-3)

LOCAL VOLTAGE
120.0 Volts

Displays the real-time measured value of voltage at the regulator or the transformer, including the voltage reduction if applicable and any corrections made using the user-selected VT correction voltage.

Figure A-2 Status Screens (page 3 of 3)

■ **NOTE:** For detailed information on the above settings, see the referenced Instruction Book Sections.

The six status screens shown above indicate “drag-hand values,” that is, minimum or maximum values of a parameter that are retained in non-volatile memory until reset by the user. The three screens for each parameter cycle continuously and indicate, respectively, the value, date and time of each parameter. The “E” located on the right top line indicates that by pressing **ENT** while viewing any of the three pertinent screens, the values retained in drag-hand memory will be reset to the present value. The unit is equipped with a real-time clock to allow a date/time stamp to be recorded in conjunction with each drag-hand quantity.

Bias Voltage Function

When **ENT** is pressed from the Bias Voltage Test Mode screen, the bias test voltage can be entered to test the control's automatic operation. The figure below shows the status conditions indicated by this screen.

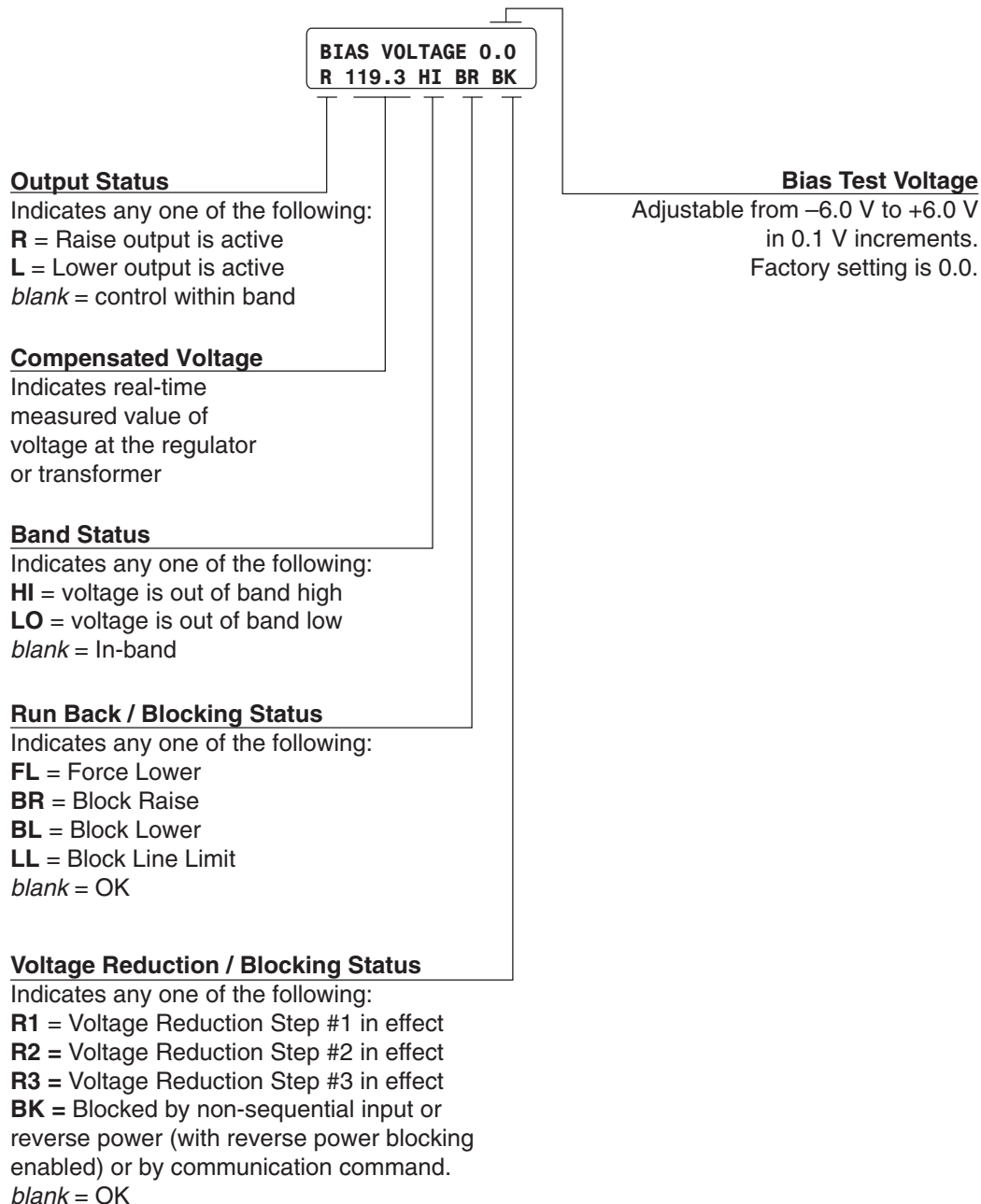


Figure A-3 Bias Test Voltage Screen

BANDCENTER F 120.0 Volts	Forward power bandcenter is adjustable from 100 V to 135 V in 0.1 V increments with a factory setting of 120 V. (Section 3.2)
BANDWIDTH F 2.0 Volts	Forward power bandwidth is adjustable from 1 V to 10 V in 0.1 V increments with a factory setting of 2.0 V. (Section 3.2)
TIME DELAY F 30 Sec	Forward power time delay for a tapchange is adjustable from 1 sec. to 120 sec. in 1 second increments with a factory setting of 30 sec. (Section 3.2)
INVERSE TIME F 30 Sec	Forward power inverse time delay for a tapchange is adjustable from 1 seconds to 120 seconds in 1 second increments, with a factory setting of 30 seconds. (Section 3.2)
LDC RESISTANCE F 0 Volts	Forward power Line Drop Compensation resistance is adjustable from -24 V to +24 V in 1 V increments with a factory setting of 0 V. (Section 3.2)
LDC REACTANCE F 0 Volts	Forward power Line Drop Compensation reactance is adjustable from -24 V to +24 V in 1 V increments with a factory setting of 0 V. (Section 3.2)
BANDCENTER R 120.0 Volts	Reverse power bandcenter is adjustable from 100 V to 135 V in 0.1 V increments with a factory setting of 120 V. (Section 3.2)
BANDWIDTH R 2.0 Volts	Reverse power bandwidth is adjustable from 1 V to 10 V in 0.1 V increments with a factory setting of 2.0 V. (Section 3.2)
TIME DELAY R 30 Sec	Reverse power time delay for a tapchange is adjustable from 1 sec. to 120 sec. in 1 second increments with a factory setting of 30 sec. (Section 3.2)
INVERSE TIME R 30 Sec	Reverse power inverse time delay for a tapchange is adjustable from 1 sec. to 120 sec. in 1 second increments with a factory setting of 30 sec. (Section 3.2).
LDC RESISTANCE R 0 Volts	Reverse power Line Drop Compensation resistance is adjustable from -24 V to +24 V in 1 V increments with a factory setting of 0 V. (Section 3.2)
LDC REACTANCE R 0 Volts	Reverse power Line Drop Compensation reactance is adjustable from -24 V to +24 V in 1 V increments, with a factory setting of 0 V. (Section 3.2)
REDUCTION STP1 2.5 %	First of three independent steps of voltage reduction adjustable from 0% to 10% in 0.1% increments of the bandcenter setpoint. Factory setting is 2.5% (Section 3.3)
REDUCTION STP2 5.0 %	Second voltage reduction step. Factory setting is 5.0% (Section 3.3)
REDUCTION STP3 7.5 %	Third voltage reduction step. Factory setting is 7.5% (Section 3.3)

Figure A-4 Setpoint Screens (page 1 of 2)

■ **NOTE:** For detailed information on the above settings, see the referenced sections.

<p>BLOCK RAISE 126.0 Volts</p>	<p>Overvoltage limit is adjustable from 95 V to 135 V in 0.1 V increments with a factory setting of 126 V. The Block Raise setpoint should always be set above the Block Lower setpoint and above the upper band limit (the bandcenter plus one-half of the bandwidth) for the control to operate. (Section 3.4)</p>
<p>DEAD BAND 2.0 Volts</p>	<p>Deadband is adjustable from 1 V to 4 V in 0.1 V increments with a factory setting of 2.0 V. (Section 3.4)</p>
<p>BLOCK LOWER 114.0 Volts</p>	<p>Undervoltage limit is adjustable from 95 V to 135 V in 0.1 V increments with a factory setting of 114 V. The Block Lower setpoint should always be set below the Block Raise setpoint and below the lower band limit (the bandcenter minus one-half of the bandwidth) for the control to operate. (Section 3.4)</p>
<p>TAP BLOCK RAISE 16 R</p>	<p>A factory setting of 16 Raise.</p>
<p>TAP BLOCK LOWER 16 L</p>	<p>A factory setting of 16 Lower.</p>
<p>LINE LIMIT I 400 mA</p>	<p>Line limit is adjustable from 200 mA to 640 mA in 1 mA increments with a factory setting of 400 mA with hysteresis of 5 mA. If the value of the current exceeds the line limit setpoint, the unit will not permit automatic control. (Section 3.4)</p>
<p>OUTPUT PULSE 7 Sec</p>	<p>Adjustable from 0.2 to 12 seconds in 0.1 second increments. Factory set at 7 seconds. (Section 3.5)</p>
<p>LDC-Z VOLT RAISE 0 Volts</p>	<p>Adjustable from 0 to 24 volts in 1.0 volt increments. (Section 3.2)</p>

Figure A-4 Setpoint Screens (page 2 of 2)

■ **NOTE:** For detailed information on the above settings, see the referenced sections.

GE-2011B Instruction Book

VT CONFIGURATION Line-to-Ground	VT configuration toggles between Line-to-Line and Line-to-Ground with a factory setting of Line-to-Ground.
VT CORRECTION 0.0 Volts	VT ratio correction is adjustable from -15 V to +15 V in 0.1 V increments with a factory setting of 0 V. (Section 4.5)
CT/VT PHASING 0 Deg	CT/VT phasing correction is adjustable from 0° to 330° in 30° increments with a factory setting of 0°. This setting will advance the current phasor by the indicated value. (Section 4.5)
PRI PWR DISPLAY Single_Phase	Toggles between two modes of operation: Single-Phase-based on measured inputs, and Three-Phase-based on measured inputs and presumed balanced system. Factory setting is single-phase.
PRI VOLT MULTPLR 60.0 X	Adjustable from 0.1 to 3260 in 0.1 increments with a factory setting of 60. User selection to include knowledge of VT ratio, sensing VT ratio correction and indication of either line-to-line or line-to-ground voltage. (Section 4.6)
PRI CURR MULTPLR 1500 X	Adjustable from 1 to 32600 in 1.0 increments with a factory setting of 1500. User selection to include knowledge of CT ratio, from primary rating to 0.2 A rating of control. (Section 4.6)
DEMAND INTERVAL 15 Min	Toggles between 15, 30 and 60 minute interval with a factory setting of 15 minutes. The time interval is the amount of time it takes for a thermal meter to indicate 90% of a change of load. (Section 5.1)
INTERTAP DELAY 0 Sec	Adjustable from 0 to 60 Seconds in 1.0 second increments with a factory setting of 0 seconds. (Section 3.6)
BASIC TIMER TYPE INST RESET	Toggles between integrating timer and instantaneous reset (INST_RESET) timer upon voltage return to in-band condition. (Section 4.12)
TAP MAX 16 R	Maximum allowed upper tap. May be set from 0 to 33 R. Tap Range must be less than 34. Factory default = 16R. (Section 4.7)
TAP MIN 16 L	Minimum allowed lower tap. May be set from 33L to 29R. Factory default = 16L. (Section 4.7) Note that Tap Max must be 4 taps greater than Tap Min (-33 to +29).
TAP INFORMATION REG INTERNAL	Toggles between Reg Internal and Disable. Factory setting is Reg Internal. See Table 4.1.(Section 4.6)
TAP POSITION/CAL 0 Neutral	Allows input of known tap position to calibrate the unit tap position. This function is disabled when Tap Information is disabled. (Section 4.7)
CNTR TIME WINDOW 2.0 Sec	Allows the Counter Time Window to be set from 0.5 to 10.0 seconds. This screen is enabled when "Oper Cntr Config" is set to "count window", otherwise, it is disabled. (Section 4.4)
OPER CNTR CONFIG 1 X (2 X count window)	Selects the contact operation sequence that will cause the software counter to increment by one. Open/close/open (X1), open/close or close/open contact operation (X2). The count window mode registers any activity as a valid input within the count window time setting.(Section 4.4)
OPER CNTR PRESET 000000	Presets a number in the Total Operations Counter. (Section 4.4)

Figure A-5 Configuration Screens (page 1 of 4)

<p>REV POWER OPER BLOCK</p>	<p>Toggles between four modes of operation: Ignore-to continue unit action as though Forward Power Flow continued to exist, Block-to inhibit automatic tapchange operation, Regulate Rev-to detect a reverse power condition and regulate according to reverse power settings and Return to Neutral to drive the tap position to Neutral. Factory setting is Block. (Section 4.8)</p>
<p>PWR DIRECTION BIAS none</p>	<p>Allows one of three methods to be used for the control to switch between forward/reverse power operation. The three settings are None, Forward Bias, and Reverse Bias (Section 4.8).</p>
<p>OUTPUT SELECTION PULSED</p>	<p>Allows choice of output at tapchanger Raise/Lower output pin. Choices are continuous or pulsed. For continuous, the control must wait to be in band or counter input valid for output to become disabled. For pulse, an adjustable width pulse will be applied to the output triacs of 0.2 to 12 seconds. (Section 4.10)</p>
<p>TIMER SELECTION DEFINITE</p>	<p>Allows setting control timer for Definite or Inverse time. There are four setpoints associated with this selection: Time Delay F/R, and Inverse Time F/R. (Section 3.2)</p>
<p>LDC SELECTION RES-REAC</p>	<p>Allows Line Drop Compensation to be either Resistance/Reactance or Z-compensated. (Section 3.2)</p>
<p>CURR TRANSFORMER 200 mA</p>	<p>Selection of display current can be made to be either 200 mA, 1 A or 5 A. This screen allows load and circulating current displays to be viewed on 200mA, 1A or 5A scales. Line Limit I settings also affected. (Section 4.14) WARNING: The current input to the control is rated at 0.2 A continuous, 0.4 A for two hours, and 4.0 A for one second.</p>
<p>INPUT SELECTION 1 Switch Status</p>	<p>Allows the seal-in input to be used as a seal-in input or a switch status input. When the Switch Status input mode is selected, all Seal-In input functions will be disabled (Section 6.1). The factory setting is Switch Status.</p>
<p>COMM BLK AUTO dont save</p>	<p>Allow the state of the "Block Auto Operation" communication command to be saved or not saved when power has been lost.</p>
<p>FLASH V RED MODE disable</p>	<p>Allows the flashing voltage reduction status screen to be enabled/disabled (Section 5.5). NOTE: Enabling this function may shorten the life of the screen.</p>

Figure A-5 Configuration Screens (page 2 of 4)

■ **NOTE:** For detailed information on the above settings, see the referenced sections.

RESTORE STATUS SCREENS	Allows any of the status screens which may have been removed to be restored in the status menu (Section 5.6)
REGULATOR TYPE A B	Allows the regulator type to be selected as Type A or B for correct source voltage calculation. (Section 4.15) Factory setting is Type A.
TAP LIMITS DISABLED	Allows the Tap Position Limits to be enabled or disabled (Section 3.4). Factory setting is DISABLED
LEVEL 1 PASSWORD 0000	Configures a four-digit numerical password for Level 1. Factory setting is 0000 (disabled). (Section 4.1)
LEVEL 2 PASSWORD 2222	Configures a four-digit numerical password for Level 2. Factory setting is 2222. (Section 4.1)
COMM PASSWORD 0000	Configures a four-digit numerical password for remote communications. Factory setting is 0000. (Section 4.1)
LCD CONTRAST 0	Allows contrast to be adjusted from +10 (lightest) to -10 (darkest). Factory setting is 0, which provides a neutral contrast.
COMM 2 BAUD 9600	Selects baud rate for COM2, located in front of control. (Section 6.5)
COMM ADDRESS 1	Configures a three-digit numerical address, from 1 to 200, for remote communications, using BECO 2200 protocol. The factory setting is 1. (Section 4.1)

Figure A-5 Configuration Screens (page 3 of 4)

■ **NOTE:** For detailed information on the above settings, see the referenced sections.

COMM DEAD-SYNC
50 msec

This time delay improves robust operation when communication lines are intermittent. Communication dead-sync time is the time that the control will wait from the last received character and continue without attempting to resynchronize. Factory setting is 50 msec; range is 0-32000 msec.

LOCAL MODE
Read Only

Allows control of reading/writing setpoints and configurations via communications. There are 4 settings associated: Disable, Read Only, Always Read Only, and No Read or Write. When set to Disable, read/write communication will be available at all times. When set to Read Only, read/write communication will be available only when the front panel of the control is inactive. If the front panel is active, only reads via communications will be allowed. When set to Always Read Only, only reads via communications will be allowed regardless of whether the front panel is active or not. When set to No Read or Write, read/write communication will be available only when the front panel fo the control is inactive. If the front panel is active, no communications will be allowed.

USER LINE #1

Allows input of 15 ASCII characters to configure a unit locator or description. If not configured, a row of 15 asterisks will appear in top row of User Line #1 screen. (Section 4.2)

USER LINE #2

Allows input of 15 ASCII characters to configure a unit locator or description. If not configured, a row of 15 asterisks will appear in bottom row of User Line #2 screen. (Section 4.2)

Figure A-5 Configuration Screens (page 4 of 4)

■ **NOTE:** For detailed information on the above settings, see the referenced sections.

A.4 Setpoint and Configuration Worksheets

Use these forms to record the GE-2011B unit configuration. These forms can be given to a technician for configuring the GE-2011B, or changing the setpoints, and kept on file for future reference.

BANDCENTER F _____ Volts	REDUCTION STP2 _____ %
BANDWIDTH F _____ Volts	REDUCTION STP3 _____ %
TIME DELAY F _____ Sec	SERIAL RED STP1 _____ %
INVERSE TIME F _____ Sec	SERIAL RED STP2 _____ %
LDC RESISTANCE F _____ Volts	SERIAL RED STP3 _____ %
LDC REACTANCE F _____ Volts	BLOCK RAISE _____ Volts
BANDCENTER R _____ Volts	DEAD BAND _____ Volts
BANDWIDTH R _____ Volts	BLOCK LOWER _____ Volts
TIME DELAY R _____ Sec	TAP BLOCK RAISE _____ R
INVERSE TIME R _____ Sec	TAP BLOCK LOWER _____ L
LDC RESISTANCE R _____ Volts	LINE LIMIT I _____ mA
LDC REACTANCE R _____ Volts	OUTPUT PULSE _____ Sec
REDUCTION STP1 _____ %	LDC-Z VOLT RAISE _____ Volts

Figure A-6 Setpoint Worksheet

V.T. CONFIGURATION line_to_line line_to_gnd	OPER CNTR PRESET _____
VT CORRECTION _____ Volts	REV POWER OPER regulate rev ignore block→
CT/VT PHASING _____ Deg	REV POWER OPER ← return to neutral
PRI PWR DISPLAY single_phase three_phase	PWR DIRECT BIAS rev bias fwd bias none
PRI VOLT MULTPLR _____ X	OUTPUT SELECTION continuous pulse
PRI CURR MULTPLR _____ X	TIMER SELECTION linear inverse
DEMAND INTERVAL 15 30 60 Minutes	LDC SELECTION res_reac z_compensated
INTERTAP DELAY _____ Sec	CURR TRANSFORMER 200mA 1A 5A
BASIC TIMER TYPE integrating inst_reset	INPUT SELECTION 1 seal-in switch status
TAP MAX _____ R	COMM BLK AUTO dont save save at pwr off
TAP MIN _____ L	FLASH V RED MODE enable disable
TAP INFORMATION Reg Internal Disable	REGULATOR TYPE a b
TAP POSITION/CAL _L Neutral _R	TAP LIMITS enable disable
CNTR TIME WINDOW _____ Sec	LEVEL 1 PASSWORD _____
OPER CNTR CONFIG 1X 2X count window	LEVEL 2 PASSWORD _____
	COMM PASSWORD _____

Figure A-7 Configuration Worksheet (page 1 of 2)

LCD CONTRAST _____
COMM 2 BAUD 1200 2400 4800 9600 19200
COMM ADDRESS _____
COMM DEAD-SYNC _____ msec
LOCAL MODE no rd or write always rd only→ ← read only disable
USER LINE #1 _____
USER LINE #2 _____

Figure A-7 Configuration Worksheet (page 2 of 2)

B Appendix B – GE-2029A Data Output

This Appendix contains illustrations of the print-ready screens provided by GE-2029A's Data Output command.

GE-2011B Instruction Book

General Electric
GE-2029A Data Profile

CONTROL INFORMATION:

Identification: GE-2011B
Serial Number: 1
Version: D-0146V09.01.21
Modification Number: -
User Line 1: xxxxxxxxxxxxxxxx
User Line 2: xxxxxxxxxxxxxxxx
Comm Address: 2
Control Date: Mon/Feb/16 / 04
Control Time: 15 :09 : 59

CONNECTION TYPE: Serial Com1

CONTROL COM:
Local Mode: Disable

BASIC SETPOINTS:

Forward Band Center: 120.00 V
Forward Band With: 2.00 V
Forward Time Delay: 4 sec
Forward Inverse Time Delay: 30 secs
Forward LDC Resistance: 0 V
Forward LDC Reactance: 0 V
Reverse Band Center: 120.00 V
Reverse Band With: 2.00 V
Reverse Time Delay: 30 secs
Reverse Inverse Time Delay: 30 secs
Reverse LDC Resistance: 0 V
Reverse LDC Reactance: 0 V
Voltage Reduction 1: 2.50 %
Voltage Reduction 2: 5.00 %
Voltage Reduction 3: 10.00 %
Block Raise (Voltage): 135.00 V
Block Lower (Voltage): 95.00 V
Dead Band: 2.00 V
Current Limit: 640.00 mA
Block Raise (Tap): 16 R
Block Lower (Tap): 16 L
Output Pulse Width: 1.50 sec
Line Drop Compensation - Z: 0 V

CONFIGURATION:

VT Configuration: Line To GroundV
VT Correction: 0.00 Volts
CT/VT Phasing: 0 Degree
Primary Power Display: Single Phase
Primary Voltage Multiplier: 60.00 x
Primary Current Multiplier: 6000.00 x
Demand Interval: 15 minutes
Intertap Delay: 0 sec
Tap Information: Reg. Internal
Operation Counter Configuration: X1
Reverse Power Operation: Regular Reverse
Paralleling: Disable
Basic Timer Type: Integrating
Tap Max: 16 R
Tap Min: 16 L
Output Selection: Continuous
Input Selection 1: Switch Status
Time Delay Selection: Definite
Current Transformer Selection: 200 mA
Line Drop Compensation: X,R
Power Direction Bias: None

Figure B-1 Data Output (Page 1 of 3)

General Electric
 GE-2029A Data Profile

Flash Voltage Reduction Mode: Enable
 Input Selection 2: Non-Sequential
 Regulator Type: B
 Count Window: 2.0 sec

ALARM CONFIGURATION:

Block Lower (Volt): Enabled
 Block Raise (Volt): Enabled
 Block Lower (Tap): Enabled
 Block Lower (Tap): Enabled
 Current Limit: Enabled
 Reverse Power: Enabled
 Voltage Reduction: Enabled
 Block Comm: Enabled

STATUS:

Primary Volts: 17.17 kV
 Primary Current: 1.00 Amps
 Primary Watts: 0.00 MW
 Primary VAR: 0.00 MVAR
 Primary VA: 0.00 MVA
 Frequency: 60.00 Hz
 Local Voltage: 119.60 Volts
 Source Voltage: 119.60 Volts
 Load Current (Secondary): 0.00 mA
 Comp. Voltage: 119.60 Volts
 Circ. Current (Secondary): 0.00 mA
 Power Factor: 0.67 Lag
 Raise Timer: 0 sec
 Lower Timer: 0 sec
 Intertap Timer: 0 sec
 Operation Counter: 793
 Tap Position: 0 Neutral
 Band Status: OK
 Power Direction: Forward
 Operation Direction: Forward
 Voltage Red. In Effect: OFF
 Voltage Red. Step: No Red.

DEMAND METERING:

Present:

Interval: 15 Minutes
 Local Voltage: 119.90 Volts
 Primary Current: 0.00 Amps
 Primary Watts: 0.00 MW
 Primary VAR: 0.00 MVAR
 Primary VA: 0.00 MVA

HISTORY:

Local Voltage (Min): 112.50 Volts [14:43:52 Feb/12/04]
 Local Voltage (Max): 123.10 Volts [07:28:02 Feb/15/04]
 Primary Current (Max): 1.00 Amps [07:49:14 Feb/12/04]
 Primary Watts (Max): 0.00 MW [12:34:22 Feb/12/04]
 Primary VAR (Max): 0.00 MVAR [07:49:14 Feb/12/04]
 Primary VA (Max): 0.00 MVA [20:43:32 Feb/13/04]
 Power Factor at Max VA: 0.58 Lag
 Raise Tap Draghand: 0
 Lower Tap Draghand: 0

Energy Metering:

Figure B-2 Data Output (Page 2 of 3)

General Electric
GE-2029A Data Profile

Watt Hours (Forward):	184.52 MWHrs	[19:08:38 Dec/31/99]
Watt Hours (Reverse):	0.00 KWHrs	[19:08:37 Dec/31/99]
VAr Hours (Forward):	2.58 MVarHrs	[19:08:37 Dec/31/99]
VAr Hours (Reverse):	36.23 MVarHrs	[19:08:38 Dec/31/99]

Figure B-3 Data Output (Page 3 of 3)

