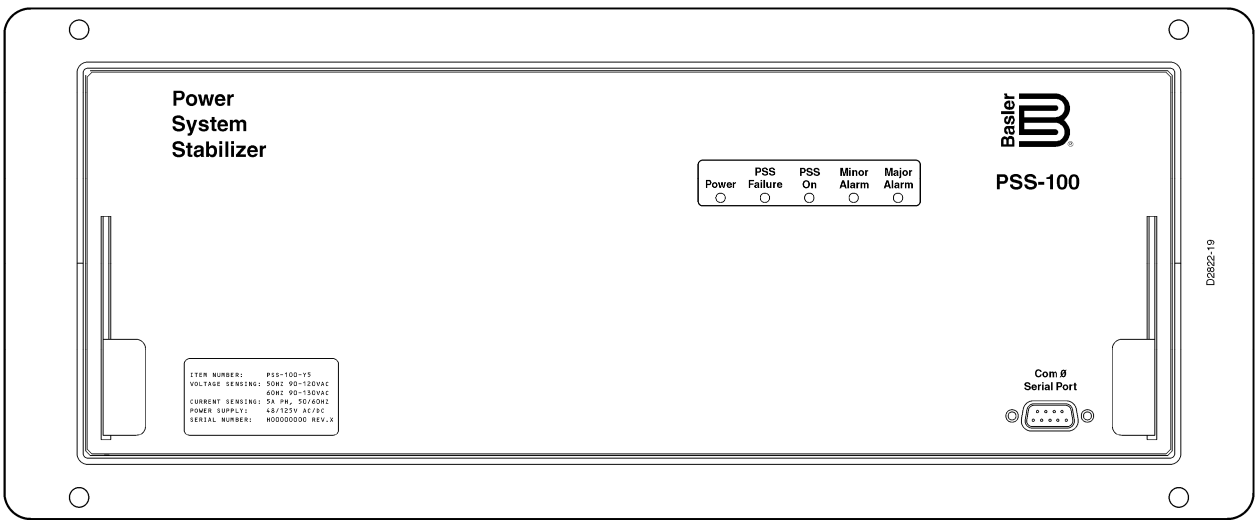
INSTRUCTION MANUAL

FOR

POWER SYSTEM STABILIZER

PSS-100



Basler Electric

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INTRODUCTION

This instruction manual provides information about the operation and installation of the PSS-100 Power System Stabilizer. To accomplish this, the following information is provided:

- General Information and Specifications
- Controls and Indicators
- Functional Description
- Installation
- Maintenance

WARNING!

To avoid personal injury or equipment damage, only qualified personnel should perform the procedures in this manual.

NOTE

Be sure that the device is hard-wired to earth ground with no smaller than 12 AWG copper wire attached to the ground terminal on the rear of the unit case. When the PSS-100 is configured in a system with other devices, it is recommended to use a separate lead to the ground bus from each unit.

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It is not the intention of this manual to cover all details and variations in equipment, nor does this manual provide data for every possible contingency regarding installation or operation. The availability and design of all features and options are subject to modification without notice. Should further information be required, contact Basler Electric.

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REVISION HISTORY

The following information provides a historical summary of the changes made to the PSS-100 hardware, firmware, and software (BESTCOMS). The corresponding revisions made to this instruction manual (9318600990) are also summarized. Revisions are listed in chronological order.

Hardware Version and Date	Change
—, 03/99	• Initial release
A, 06/02	• Modified the device hardware to correct occasional production dielectric test failures
B, 12/02	• Added identification label to front panel • Shortened case screws to prevent interference with draw-out assembly components
C, 05/04	• Modified paint preparation process
D, 06/05	• Implemented a more robust current sensing terminal block
E, 06/09	• Updated power supply and I/O circuit boards
F, 10/09	• Updated front panel overlay, labeling

Firmware Version and Date	Change
1.01.XX, 06/99	• Initial release
1.03.XX, 08/01	• Implemented Modbus™ communication with function codes 3, 6, 8, and 16 supported. • Torsional filters, high/low voltage limiter, a fourth lead/lag phase compensation block, and two-wattmeter sensing method was added. • Timer for the external test input was increased to 49,999 seconds. • Lead and lag time constant adjustment steps changed to 0.001 seconds. • Output scale factor adjustment range was changed to +300 to –300 in 0.01 increments. • Upper output limit was changed to +0.5 and the lower output limit was changed to –0.5. • Prevented all test inputs (except TSW1) from being connected to the output when SSW7 is open.
1.04.XX, 03/03	• Added SL-OP command

BESTCOMS Version and Date	Change
1.04.XX, 03/03	• Added motor/phase rotation mode for PSS output control
1.05.XX, 10/09	• Expanded operating system compatibility to include Microsoft Vista®

Manual Revision and Date	Change
—, 03/99	• Initial release
A, 08/99	• Various minor errors were corrected. • Throughout the manual, the analog output range was changed from $\pm$10 Vdc to $\pm$9 Vdc. • The analog output burden stated in Section 1 was changed from 10 kΩ to 1 kΩ, minimum. • The frequency specification given in Section 1 was clarified. • Programmable alarm 24 was added to Table 4-9. • A *Typical Settings List* section was added to Appendix B. • The manual style was changed. Where appropriate, a detailed table of contents was placed before each section. The table of contents at the front of the manual was simplified to include only section headings and page numbers.
B, 09/99	• Error in title of Section 7 was corrected
C, 09/01	• Functional description was added and the style chart and appropriate drawings were modified to accommodate the addition of torsional filter. • Enhancements to the SG-CT command were covered. • A description of the fourth lead/lag time constants added to the phase compensation of the derived speed signal was added (S<g>-TCON2 command). • Functional description of the logic limiter and S<g>-TW5 and S<g>-LLG commands was added. • Information was added regarding the S<g>-SW8 command for software switches S8 and S9. • Testing section was modified to accommodate new functions. • Manual change information of Section 9 was moved to the introduction section and Section 9 was deleted. • Contact sensing turn-on ranges in Table 4-1 were revised.
D, 01/02	• Added BESTCOMS section
E, 03/03	• Removed all references to the torsional filter being optional. • Modified the input labels for software switches SSW3 and SSW4 to show “Washed Out Speed” and “Washed Out Power”. • Changed the upper limit of wn parameter in Equation 3-8 from 42.0 to 150.0. • Updated Section 7 to reflect changes and additional features of BESTCOMS version 1.04. • Added text and illustration describing PSS Motor Mode/Phase Rotation Control function block. • Added description of the SL-OP command.
F, 07/05	• Restructured manual and replaced ASCII commands with the BESTCOMS interface as the preferred method of user interaction with the PSS-100.
G, 10/09	• Removed xxT digit from all style number references. (Torsional filter style number digit is not required for ordering.) • Added panel cutting and drilling diagram to Section 8. • Added *Storage* subsection to address maximizing of electrolytic capacitor life. • Updated page footers to show publication part number and revision letter.

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SECTION 1 • GENERAL INFORMATION

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SECTION 1 • GENERAL INFORMATION

GENERAL

The microprocessor based PSS-100 Power System Stabilizer modulates the excitation system to provide supplementary damping for low frequency power oscillations. This is achieved by utilizing a two input sensing configuration that measures speed (compensated frequency) and power to produce the integral of accelerating power. This provides superior performance over single input stabilizers that measure only power, frequency, or speed.

The PSS-100 can be used in new or existing applications where excitation is applied directly into the brush or brushless rotating exciter as well as static excitation systems. The open design is compatible with any analog or digital excitation system that can accept a bipolar dc input.

Some of the PSS-100 features are described in the following paragraphs.

- Generates stabilizing signal based solely on inputs from standard three-phase generator VT and CT circuits.
- User selections for choice of conventional PSS input structure (e.g. accelerating power design, frequency input, power input,...) and settings.
- Torsional filters compensate for the torsional frequency components present in the input signal.
- Integrated test facility and data acquisition system for ease of testing and commissioning.
- Accurate drift-free settings.
- Extensive self-monitoring features.

MODEL NUMBERS

The PSS-100 is available in one of two power supply ranges (Y or Z) and current sensing ranges (1 or 5). Torsional filtering is standard on all models. Model number designations are summarized in Table 1-1.

Table 1-1. PSS-100 Model Numbers

Model	Power Supply (Y or Z)	Nominal Current Sensing (1 or 5)
PSS-100-Y1	48/125 Vac/Vdc	1 Aac
PSS-100-Y5	48/125 Vac/Vdc	5 Aac
PSS-100-Z1	125/230 Vac/Vdc	1 Aac
PSS-100-Z5	125/230 Vac/Vdc	5 Aac

SPECIFICATIONS

The PSS-100 has the following features and capabilities.

Power Supply

Models PSS-100-Y1 and PSS-100-Y5
48, 110, and 125 Vdc — Range: 35 to 150 Vdc
67, 110, and 120 Vac — Range: 55 to 135 Vac
Models PSS-100-Z1 and PSS-100-Z5
110, 125, and 250 Vdc — Range: 90 to 300 Vdc
110, 120, and 240 Vac — Range: 90 to 270 Vac

AC Voltage Sensing

50 Hz: Three-Phase, 90 to 120 Vac
60 Hz: Three-Phase, 90 to 130 Vac
Burden: Less than 0.1 VA at 120 Vac

AC Current Sensing

Nominal: 0.5 to 1.0 A (PSS-100-Y1 and PSS-100-Z1)
2.5 to 5.0 A (PSS-100-Y5 and PSS-100-Z5)

Continuous:	1 A (PSS-100-Y1 and PSS-100-Z1) 5 A (PSS-100-Y5 and PSS-100-Z5)
30 second rating:	15 A
1 second rating:	50 A
Burden:	Less than 0.2 VA, nominal

Test Signal

Input Range	±15 Vdc, maximum
Burden	180 kΩ, nominal

Voltage Metering Accuracy

±2% or ±1.2 Vac, whichever is greater

Current Metering Accuracy

PSS-100-Y1 and PSS-100-Z1:	±2% or ±10 mA, whichever is greater
PSS-100-Y5 and PSS-100-Z5:	±2% or ±50 mA, whichever is greater

Operating Frequency Range

50 Hz system frequency:	50 Hz ±5 Hz ∗
60 Hz system frequency:	60 Hz ±6 Hz ∗

∗ System frequency outside the operating range will inhibit stabilizer operation.

Analog to Digital Converter

Sampling Rate:	24 samples per cycle

Contact Sensing Inputs

Number of inputs:	8
Recognition time:	Programmable 4 to 250 milliseconds
Voltage range:	Same as power supply
Input burden:	Burden per contact for sensing depends on the power supply model and the input voltage. Table 1-2 lists typical burden levels.

Table 1-2. Burden

Power Supply	Burden
Y (48/125 Vac/Vdc)	36 kΩ/93.4kΩ
Z (125/230 Vac/Vdc)	94 kΩ/189 kΩ

Analog Output

Range:	±9 Vdc, ±10%, isolated
Burden:	1 kΩ, minimum
Digital to Analog Converter Resolution:	12 bits

Output Contacts

Make and carry for tripping duty:	30 A for 0.2 seconds per ANSI C37.90; 7 A continuous
Break Resistive or Inductive:	0.3 A at 125 or 250 Vdc (L/R = 0.04 maximum)

Communication Ports

Fully Isolated Interface	
Front RS-232 (COM0):	300 to 19,200 baud, 8N1 full duplex
Rear RS-232 (COM1):	300 to 19,200 baud, 8N1 full duplex
Rear RS-485 (COM2):	300 to 19,200 baud, 8N1 half duplex

BESTlogic Update Rate

4 milliseconds

Automatic Setting Group Characteristics

Number of Settings Groups:	4
Switch Level Range:	0 to 150% of the setting group power level setting
Switch Level Accuracy:	±2%
Switch Timer Range:	0 to 60 minutes with 1 minute increments. (0 = disabled)
Switch Timer Accuracy:	±5% or ±2 seconds, whichever is greater

General Purpose Timers (62, 162)

Level Triggered, Edge Triggered, Retriggerable, Oscillator, and Integrating

Range:	0 to 999 seconds
Increments:	1 millisecond from 0 to 999 milliseconds 0.1 second from 1.0 to 9.9 seconds 1 second from 10 to 999 seconds
Accuracy:	±5% or 4 milliseconds, whichever is greater

Real-Time Clock

Accuracy:	1 second per day at 25°C (free running) ±2 milliseconds (with IRIG synchronization)
Resolution:	1 millisecond
Date and time setting provisions:	Communications ports and IRIG interface Leap year correction provided.
Power Supply Holdup:	8 to 24 hours, depending on conditions

IRIG

Input Signal:	Demodulated (dc level-shifted digital signal)
Logic-High Voltage:	3.5 Vdc, minimum
Logic-Low Voltage:	0.5 Vdc, maximum
Input Voltage Range:	±20 Vdc, maximum
Resistance:	Non-linear, approximately 4 kΩ at 3.5 Vdc, and approximately 3 kΩ at 20 Vdc

Isolation

Meets IEC 255-5 and exceeds IEEE C37.90 one-minute dielectric tests as follows:

All circuits to ground:	2,828 Vdc
Input circuits to output circuits:	2,000 Vac or 2,828 Vdc

Surge Withstand Capability

Oscillatory:	Qualified to IEEE C37.90.1-1989 *Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems.*
Fast Transient:	Qualified to IEEE C37.90.1-1989 *Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems.*

Radio Frequency Interference

Tested using a 5 W handheld transceiver in the ranges of 144 and 440 MHz with the antenna placed within six inches of the PSS-100.

Impulse

Qualified in accordance with IEC 255.5

UL Recognition

UL recognized per Standard 508, UL File Number E97035.

CSA Certification

CSA certified per Standard CAN/CSA-C22.2 Number 14-M91, CSA File Number LR 23131

CE Compliance

This product meets or exceeds the standards required for distribution in the European Community.

Environment

Operating Temperature Range:	–40°C to +60°C (–40° F to +140°F)
Storage Temperature:	–40°C to +85°C (–40°F to +185°F)
Humidity:	Qualified to IED 68-2-38, 1st Edition 1974, *Basic Environmental Test Procedures, Part 2: Test Z/AD: Composite Temperature Humidity Cyclic Test*

Shock

Qualified to IEC-255-21-2.

Vibration/Seismic

Qualified to IEC-255-21-1

Weight

11 pounds (5 kilograms)

SECTION 2 • HUMAN-MACHINE INTERFACE

CONTROLS, INDICATORS, AND TERMINALS

The PSS-100 human-machine interface (HMI) consists of front panel controls, indicators, and a communications connector. Table 2-1 describes each component of the front panel HMI.

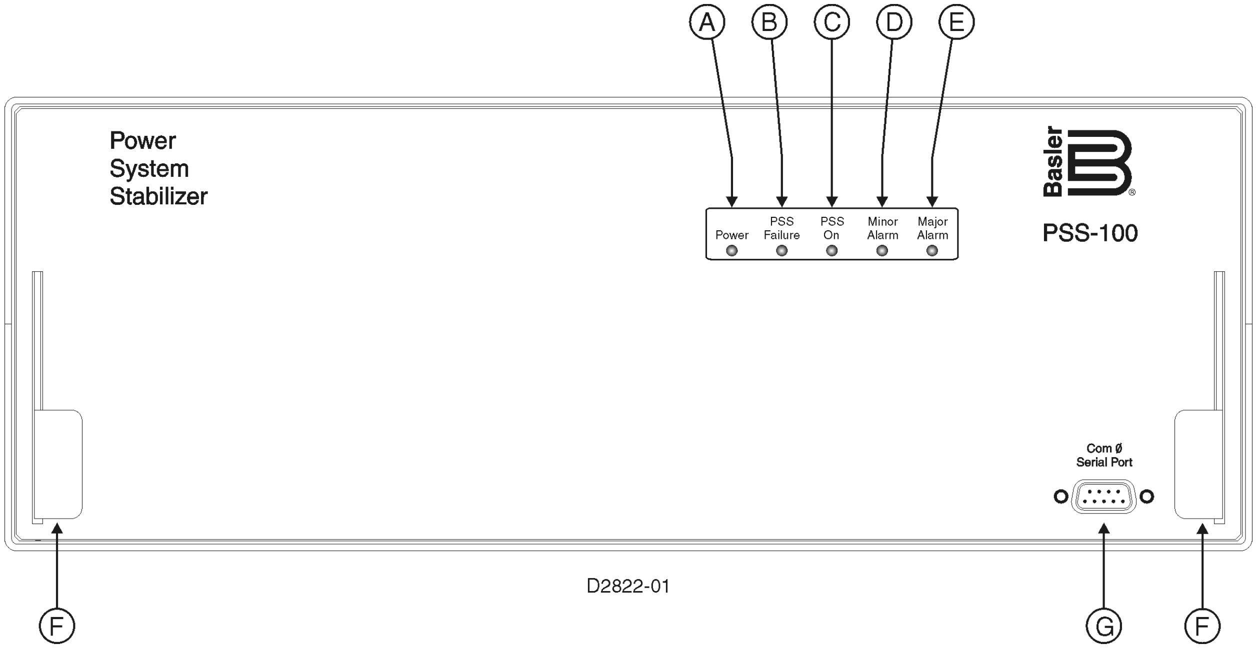

Figure 2-1. PSS-100 Front Panel

Table 2-1. PSS-100 HMI Components

Locator	Description
A	*Power Indicator.* This green LED lights when operating power is applied to the unit.
B	*PSS Failure Indicator.* When lit, this red LED annunciates an internal hardware or software failure. This condition will automatically take the unit off-line.
C	*PSS On Indicator.* This green LED lights to indicate that the PSS-100 is enabled. In this mode, it would generate a stabilizing signal on a system disturbance. This PSS On indicator turns off to indicate that the stabilizer is disabled. The stabilizer can be disabled by an intentional and explicit control action, or as a result of an abnormal condition such as excessive voltage unbalance or very low power. Once the abnormal condition is cleared, the unit is enabled again.
D, E	*Minor Alarm, Major Alarm Indicators.* These red LEDs light to indicate that a programmable alarm has been set. Each indicator can be programmed to annunciate one or more conditions. Section 4, *Functional Description, Programmable Alarms* provides detailed information about programming these alarm indicators.
F	*Latches.* The two latches are used to install and remove the PSS-100 draw-out assembly. The draw-out assembly is removed by pulling the latches upward and then sliding the assembly out of the case.

Locator	Description
F (continued)	**CAUTION** If the PSS-100 analog output is connected in series with the voltage regulator output, case terminals C11 and C12 must be shorted prior to removing the draw-out assembly. This will allow the voltage regulator to function when the PSS-100 is removed from service. Installation is accomplished by aligning the draw-out assembly with the case guides, sliding the assembly into the case, and then locking the draw-out assembly in the case by pushing the latches down until they are parallel with the front panel. **NOTE** Remove any temporary jumpers installed on the case terminals when returning the PSS-100 into service.
G	*Communication Port 0.* This serial communication port consists of a female RS-232 (DB-9) connector and is intended for short-term, local communication. A PC operating with BESTCOMS software can be connected to this port to configure PSS-100 settings and read metering values. Permanent communication connections are provided at the rear panel.

SECTION 3 •OPERATING PRINCIPLES

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SECTION 3 • OPERATING PRINCIPLES

INTRODUCTION

The Power System Stabilizer (PSS-100) improves the damping of generator electromechanical oscillations. Stabilizers have been employed on large generators for several decades, permitting utilities to improve stability-constrained operating limits. In order to describe the application of the PSS-100, it is necessary to introduce some general concepts of power system stability and synchronous generator operation.

To deliver electrical power to the grid, synchronous generators must first be synchronized to the power system. Once synchronized, and operating in steady state, the following two conditions exist:

- The generator operates at the same average electrical speed as all other generators on the system. Electrical speed is defined as the machine's mechanical speed multiplied by the number of generator pole pairs. For a 60 hertz power system, the electrical speed equals 377°rad/s (2π∗60).
- The electrical power delivered by the generator to the power system is equal to the mechanical power applied to the turbine, minus losses.

When disturbed by a sudden change in operating conditions, the generator speed and electrical power will vary around their steady-state operating points. The relationship between these quantities can be expressed in a simplified form of the "swing equation":

$$\frac{d\omega}{dt} = \frac{(T_m - T_e)}{2H}$$

Equation 3-1

where

ω	= angular speed of rotor
T_m	= mechanical torque in per-unit
T_e	= electrical torque in per-unit
H	= combined turbine and generator inertia constant expressed in MW-s/MVA

For small deviations in rotor speed, the mechanical and electrical torque is approximately equal to the respective per unit power values. The base value of power is selected to be equal to the generator nameplate MVA. The "swing equation" dictates that, when disturbed from equilibrium, the rotor accelerates at a rate that is proportional to the net torque acting on the rotor divided by the machine's inertia constant.

Equation 3-1 can be rewritten in terms of small changes about an operating point:

$$\frac{d}{dt}\Delta\omega = \frac{1}{2H}(\Delta T_m - \Delta T_e)$$

Equation 3-2

$$= \frac{1}{2H}(\Delta T_m - K_D\,\Delta\omega - K_S\,\Delta\delta)$$

where the expression for electrical-torque-deviation has been expanded into its synchronizing and damping components,

K_S	= synchronizing coefficient
K_D	= damping coefficient

and

$\Delta\delta$	= rotor angle change

From Equation 3-2, it can be seen that for positive values of K_S, the synchronizing torque component opposes changes in the rotor angle from the equilibrium point (i.e. an increase in rotor angle will lead to a net decelerating torque, causing the unit to slow down relative to the power system, until the rotor angle is restored to its equilibrium point, $\Delta\delta$ = 0). Similarly, for positive values of K_D, the damping torque component opposes changes in the rotor speed from the steady-state operating point. A generator will remain stable as long as there are sufficient positive synchronizing and damping torques acting on its rotor for all operating conditions.

Damping of Electromechanical Oscillations

For positive values of the damping coefficient, and constant input power (ΔTm= 0), the rotor angle's response to small disturbances (i.e. the solution of equation 3-2) will take the form of a damped sinusoid. The relationship between rotor speed and electrical power, following small disturbances, is illustrated in Figure 3-1.

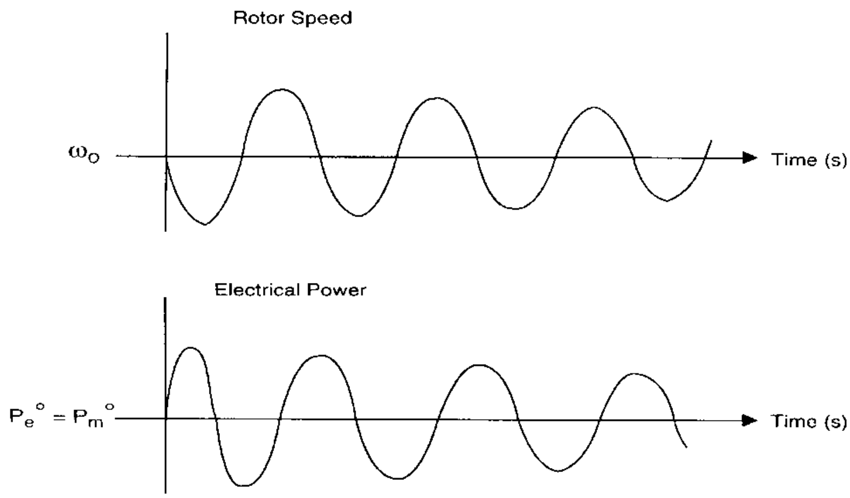


Figure 3-1. Response of Generator Speed and Electrical Power to Small Disturbances

A number of factors can influence the damping coefficient of a synchronous generator, including the generator's design, the strength of the machine's interconnection to the grid, and the setting of the excitation system. While many units have adequate damping coefficients for normal operating conditions, they may experience a significant reduction in the value of K_D , following transmission outages, leading to unacceptably low damping ratios. In extreme situations, the damping coefficient may become negative, causing the electromechanical oscillations to grow, and eventually resulting in loss of synchronism. This form of instability is normally referred to as dynamic, small-signal or oscillatory instability to differentiate it from the familiar concepts of steady-state stability and transient stability.

A power system stabilizer can increase a generator's damping coefficient, thus allowing a unit to operate under conditions where there is insufficient natural damping.

THEORY OF OPERATION

Modulation of generator excitation can produce transient changes in the generator's electrical output power. Obviously varying the generator's excitation cannot produce steady-state changes in the real electrical power, as this must remain equal to the mechanical input power. Fast-responding exciters equipped with high-gain automatic voltage regulators (AVRs) use this effect to increase a generator's synchronizing torque coefficient (K_S), resulting in improved steady-state and transient stability limits. Unfortunately improvements in synchronizing torque are often achieved at the expense of damping torque, resulting in reduced levels of oscillatory or small-signal stability. To counteract this effect, many units that utilize high-gain AVRs are also equipped with power system stabilizers to increase the damping coefficient (K_D) and improve oscillatory stability.

Speed Based Stabilizers

To supplement the unit's natural damping, the stabilizer must produce a component of electrical torque that opposes changes in rotor speed. One method of accomplishing this is to introduce a signal proportional to measured rotor speed deviation into the voltage regulator input, as depicted in Figure 3-2.

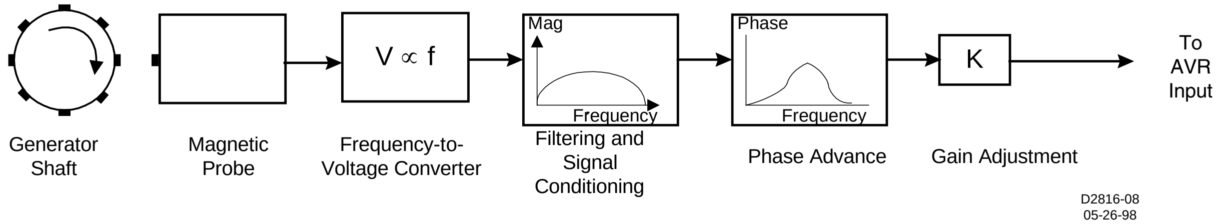


Figure 3-2. Simplified Representation of Speed-Based Stabilizer

Figure 3-2 illustrates the steps used within the speed-based stabilizer, to generate the output signal. These steps are summarized below.

- Measure shaft speed using a magnetic-probe and gear-wheel arrangement.
- Convert the measured speed signal into a dc voltage proportional to the speed.
- High-pass filter the resulting signal to remove the average speed level, producing a "change-in-speed" signal; this ensures that the stabilizer reacts only to changes in speed and does not permanently alter the generator terminal voltage reference.
- Apply phase lead to the resulting signal to compensate for the phase lag in the closed-loop voltage regulator.
- Adjust the gain of the final signal applied to the AVR input.

With some minor variations, many of the early power system stabilizers were constructed using this basic structure.

Dual Input Stabilizers

While speed-based stabilizers have proven to be extremely effective, it is frequently difficult to produce a noise-free speed signal that does not contain other components of shaft motion such as lateral shaft runout (hydroelectric units) or torsional oscillations (steam-driven turbogenerators). The presence of these components in the input of a speed-based stabilizer can result in excessive modulation of the generator's excitation and, for the case of torsional components, in the production of potentially damaging electrical torque variations. These electrical torque variations led to the investigation of stabilizer designs based upon measured power.

The simplified swing equation (Equation 3-2) can be rearranged to reveal the principle of operation of early power-based stabilizers.

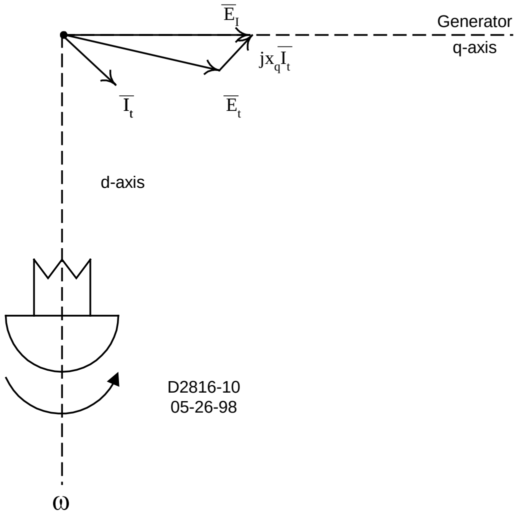
$$\Delta\omega = \frac{1}{2H}\int(\Delta P_m - \Delta P_e) \qquad \text{Equation 3-3}$$

Based on equation 3-3, it is apparent that a speed deviation signal can be derived from the net accelerating power acting on the rotor; i.e., the difference between applied mechanical power and generated electrical power. Early attempts at constructing power-based stabilizers used the above relationship to substitute measured electrical and mechanical power signals for the input speed. The electrical power signal was measured directly using an instantaneous watt transducer. The mechanical power could not be measured directly, and instead was estimated based on the measurement of valve or gate positions. The relationship between these physical measurements and the actual mechanical power varies based on the turbine design and other factors, resulting in a high degree of customization and complexity.

This approach was abandoned in favor of an indirect method that employed the two available signals, namely electrical power and speed. The goal was to eliminate the undesirable components from the speed signal while avoiding a reliance on the difficult to measure mechanical power signal. To accomplish this, the relationship of Equation 3-3 was rearranged to obtain a derived integral-of-mechanical power signal from electrical power and speed:

$$\int \Delta P_m = 2H\Delta\omega + \int \Delta P_e \qquad \text{Equation 3-4}$$

Since mechanical power normally changes slowly relative to the electromechanical oscillation frequencies, the derived mechanical power signal can be bandlimited using a low-pass filter, designated G(s). The low-pass filter attenuates high-frequency components (e.g. torsional components,



measurement noise) from the incoming speed signal while maintaining a reasonable representation of mechanical power changes. The resulting bandlimited derived signal is then used in place of the real mechanical power in Equation 3-3 to derive a change-in-speed signal with special properties:

$$\Delta\omega' = \frac{1}{2H}\left[G(s)\left(2H\Delta\omega + \frac{1}{s}\Delta P_e\right) - \frac{1}{s}\Delta P_e\right]$$
$$= G(s)\Delta\omega + \frac{[G(s)-1]}{2H}\frac{1}{s}\Delta P_e$$

Equation 3-5 has been written in the frequency domain using the Laplace operator "s", to represent complex frequency. The final derived speed signal is derived from both a band-limited, (G(s)), measured speed signal and a high-pass filtered (G(s)-1) integral-of-electrical power signal. At lower frequencies the measured speed signal dominates this expression while at higher frequencies the output is determined primarily by the electrical power input.

The integral-of-accelerating-power arrangement described in equation 3-5, is illustrated in the block diagram of Figure 3-3. The structure depicted in Figure 3-3 matches the IEEE Type PSS2A dual input power system stabilizer model.

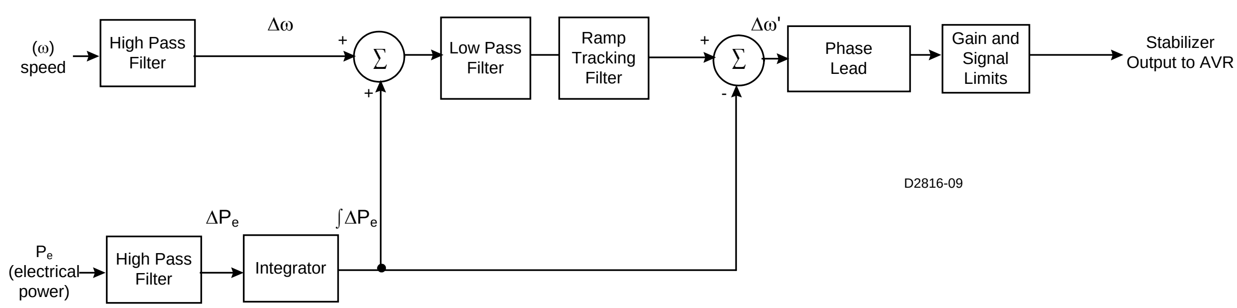


Figure 3-3. Block Diagram of Dual Input Power System Stabilizer

Speed Signal

The derivation of shaft speed from the frequency of a voltage phasor is depicted graphically in Figure 3-4. The internal voltage phasor is obtained by adding the voltage drop associated with a q-axis impedance (note: for salient pole machines the synchronous impedance provides the required compensation) to the generator terminal voltage phasor. The magnitude of the internal phasor is proportional to field excitation and its position is tied to the quadrature axis. Therefore, shifts in the internal voltage phasor position correspond with shifts in the generator rotor position. The frequency derived from the compensated phasor corresponds to shaft speed, and can be used in place of a physical measurement. On round-rotor machines, the selection of the correct compensating impedance is somewhat more complicated; simulations and site tests are normally performed to confirm this setting.

In either case, the resulting signal must be converted to a constant level, proportional to speed (frequency). Two high-pass filter stages are applied to the resulting signal to remove the average speed level, producing a speed deviation signal; this ensures that the stabilizer reacts only to changes in speed and does not permanently alter the generator terminal voltage reference. Each high-pass filter is implemented with the transfer function illustrated in Equation 3-6.

$$G_{HP}(s) = \frac{T_W s}{1 + T_W s}$$ Equation 3-6

where the range of adjustment of the time constant is:

$$1.0\ s \le T_W \le 20.0\ s$$

Figure 3-4. Rotor Position and Compensated Frequency Relationship

Figure 3-5 shows the high-pass filter transfer function blocks in frequency domain form (the letter s is used to represent the complex frequency or Laplace operator).

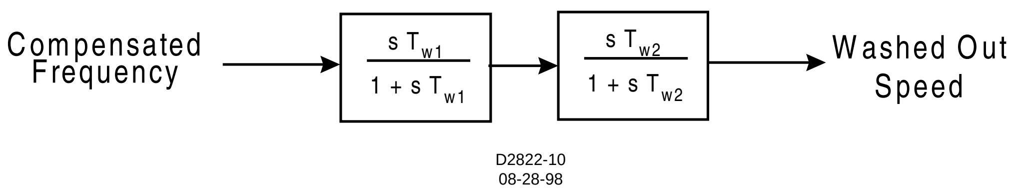


Figure 3-5. Frequency Input Signal

Generator Electrical Power Signal

The generator electrical power output is derived from the generator VT secondary voltages and CT secondary currents. The power output is high-pass filtered to produce the required power deviation signal. This signal is then integrated and scaled, using the generator inertia constant (2H) for combination with the speed signal. Figure 3-6 depicts the operations performed on the power input signal to produce the integral-of-electrical power deviation signal.

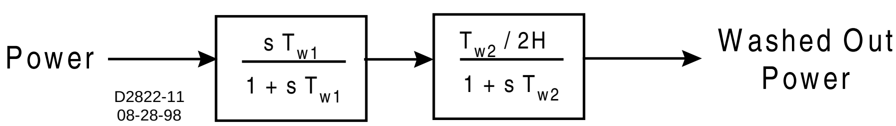


Figure 3-6. Power Input Signal

Derived Mechanical Power Signal

As previously described, the speed deviation and integral-of-electrical power deviation signals are combined to produce a derived integral-of-mechanical power signal. This signal is then low-pass filtered, as depicted in the block diagram of Figure 3-7.

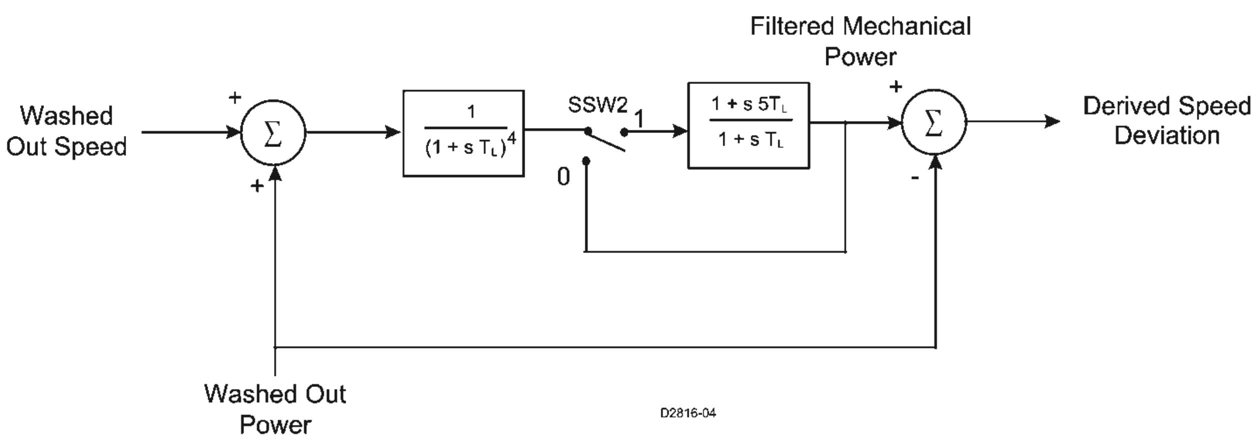


Figure 3-7. Speed and Power Signal Metering

The low-pass filter, G(s) in s-domain form, can be configured using software selector switch SSW2 to take on one of the following two transfer functions.

$$G_1(s) = \frac{1}{(1+T_L s)^4} \qquad G_2(s) = \frac{(1+5T_L s)}{(1+T_L s)^5} \qquad \text{Equation 3-7}$$

The first filter, a simple four-pole low-pass filter, was the original filter used to provide attenuation of torsional components appearing in the speed input path. For thermal units, time constant, T_L , is selected to provide 40 decibels of attenuation at the lowest torsional frequency of the turbogenerator set. Unfortunately, this design requirement may conflict with the production of a reasonable derived mechanical power signal, which can follow changes in the actual prime mover output. This is particularly problematic on hydroelectric units where rates of mechanical power change can easily exceed 10 percent per second. Excessive band-limiting of the mechanical power signal can lead to excessive stabilizer output signal variations during loading and unloading of the unit.

The second low-pass filter configuration, G_2(s), deals with this problem. This filter, referred to as a "ramp-tracking" filter, produces a zero steady-state error to ramp changes in the input integral-of-electrical power signal. This limits the stabilizer output variation to very low levels for the rates-of-change of mechanical power which are normally encountered during operation of utility-scale generators.

The range of adjustment of the filter time constant is:

$$0.05 \text{ s} \leq T_L \leq 0.2 \text{ s}$$

Stabilizing Signal Selection

Figure 3-8 illustrates how software configuration switches SSW3 and SSW4 are used to select an alternate configuration based on the available input signals. With switches SSW3 and SSW4 in the closed position, the derived speed deviation is used as the stabilizing signal. Section 4, *Functional Description* provides more information about configuring the software switches.

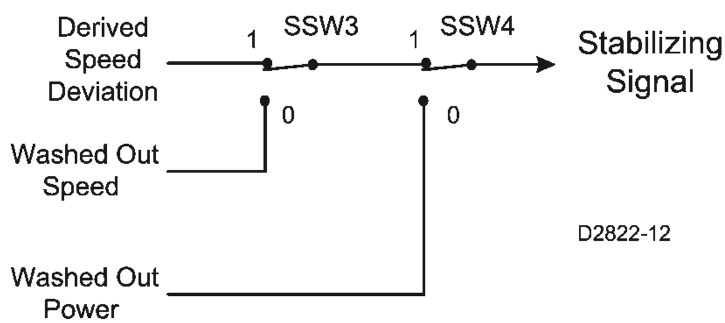


Figure 3-8. Stabilizing Signal Selection

Torsional Filter

The stabilizing signal is applied to the torsional filters depicted in the block diagram of Figure 3-9. Torsional filters provide the desired gain reduction at a specified frequency. The filters compensate the torsional frequency components present in the input signal.

The two torsional filters are available after the stabilizing signal and before the lead-lag blocks. Software switches SW0 and SW1 are used to select torsional filter 1 and 2 respectively.

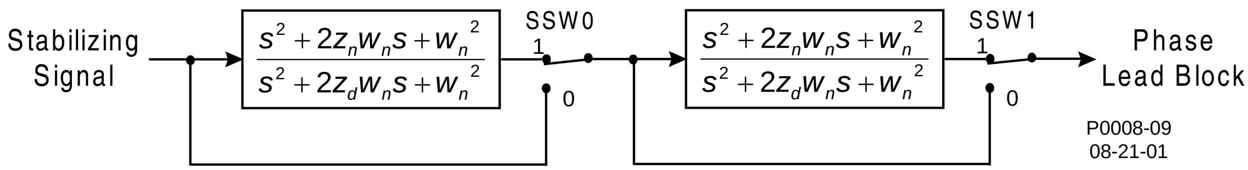


Figure 3-9. Torsional Filters

The transfer function of the torsional filters is a biquadratic type filter:

$$G_t(s) = \frac{s^2 + 2z_n w_n s + w_n^2}{s^2 + 2z_d w_n s + w_n^2} \qquad \text{Equation 3-8}$$

The torsional parameters of Equation 3-8 are adjustable within the range:

$$0.00 \le z_n \le 1.00$$
$$0.00 \le z_d \le 1.00$$
$$10.0 \le w_n \le 150.0$$

Phase Compensation

Figure 3-10 illustrates the phase compensation portion of the digital stabilizer. As depicted in Figure 3-10, the derived speed signal is modified before it is applied to the voltage regulator input. The signal is filtered to provide phase lead at the electromechanical frequencies of interest i.e., 0.1 to 5.0 hertz. The phase lead requirement is site-specific, and is required to compensate for phase lag introduced by the closed-loop voltage regulator. The first two lead-lag blocks are normally adequate to match the phase compensation requirements of a unit. However, additional stages may be added by opening software switches SSW5 and SSW9 respectively.

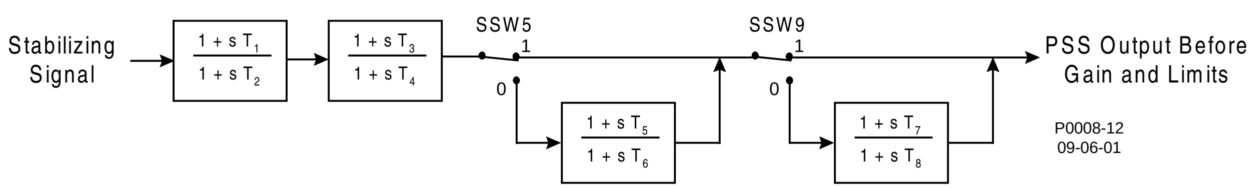


Figure 3-10. Phase Compensation

The transfer function for each stage of phase compensation is a simple pole-zero combination:

$$G_P(s) = \frac{1 + T_{LD}\,s}{1 + T_{LG}\,s} \qquad \text{Equation 3-9}$$

The lead and lag time constants of Equation 3-9 are adjustable within the range:

$$0.01\text{ s} \le T_{LD} \le 6.0\text{ s}$$
$$0.01\text{ s} \le T_{LG} \le 6.0\text{ s}$$

Washout Filter and Logic Limiter

The washout filter has two timed constants: normal and limit (less than normal).

The logic limiter compares the signal with the upper and lower limit value. If the signal is outside the limit, a counter is started. If the counter reaches the set delay time, the time constant for the washout filter changes from the normal time constant to the limit time constant. When the signal is within the specified limit, the counter resets and the washout filter time constant changes back to the normal time constant.

Figure 3-11 illustrates the washout filter and logic limiter.

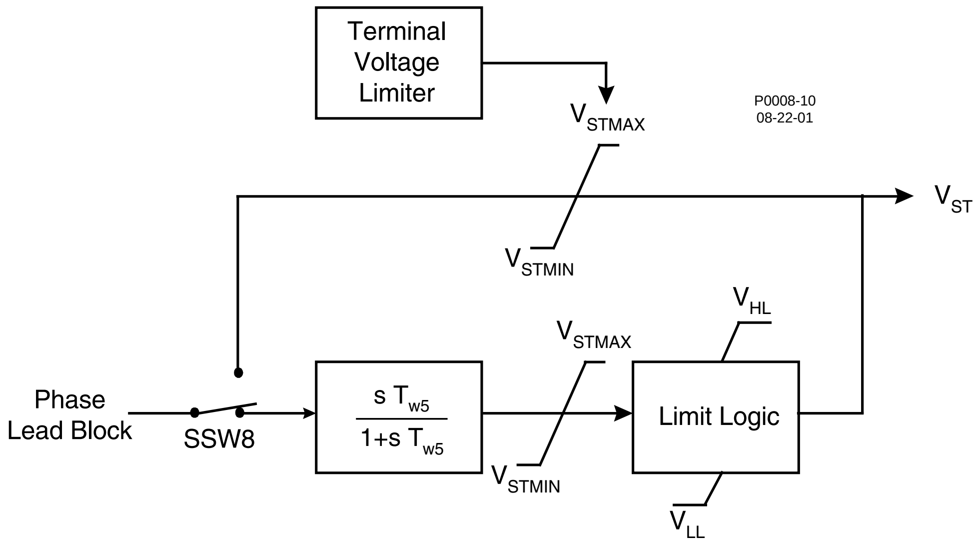


Figure 3-11. Washout Filter and Logic Limiter

The transfer function of the washout filter is shown below.

$$G_w(s) = \frac{s\,T_{w5}}{1 + s\,T_{w5}} \qquad \text{Equation 3-10}$$

The time constants of Equation 3-10 are adjustable within the following ranges.

$$5.0\text{ s} \le T_{w5}(\text{normal}) \le 30.0\text{ s}$$
$$0.00\text{ s} \le T_{w5}(\text{limit}) \le 1.00\text{ s}$$

The parameters for the logic limiter are adjustable within the following ranges.

$$0.010 \le \text{lmt\_hi} \le 0.040$$
$$-0.040 \le \text{lmt\_lo} \le 0.010$$
$$0.00\text{ s} \le \text{lmt\_dly} \le 5.00\text{ s}$$

Stabilizer Output

Prior to connecting the stabilizer output signal to the voltage regulator input, adjustable gain and limiting are applied as depicted in Figure 3-12. The stabilizer output is connected to the voltage regulator input when software switch S7 is closed.

The gain adjustment and limiting ranges are:

$$0.0\text{ pu }E_{t\text{-ref}} / \text{pu }\Delta\omega \le K_S \le 50.0\text{ pu }E_{t\text{-ref}} / \text{pu }\Delta\omega$$
$$0.0\text{ pu }E_{t\text{-ref}} \le \text{PSS\_+ SELECTED} \le 0.5\text{ pu }E_{t\text{-ref}}$$
$$-0.25\text{ pu }E_{t\text{-ref}} \le \text{PSS\_-} \le 0.0\text{ pu }E_{t\text{-ref}}$$

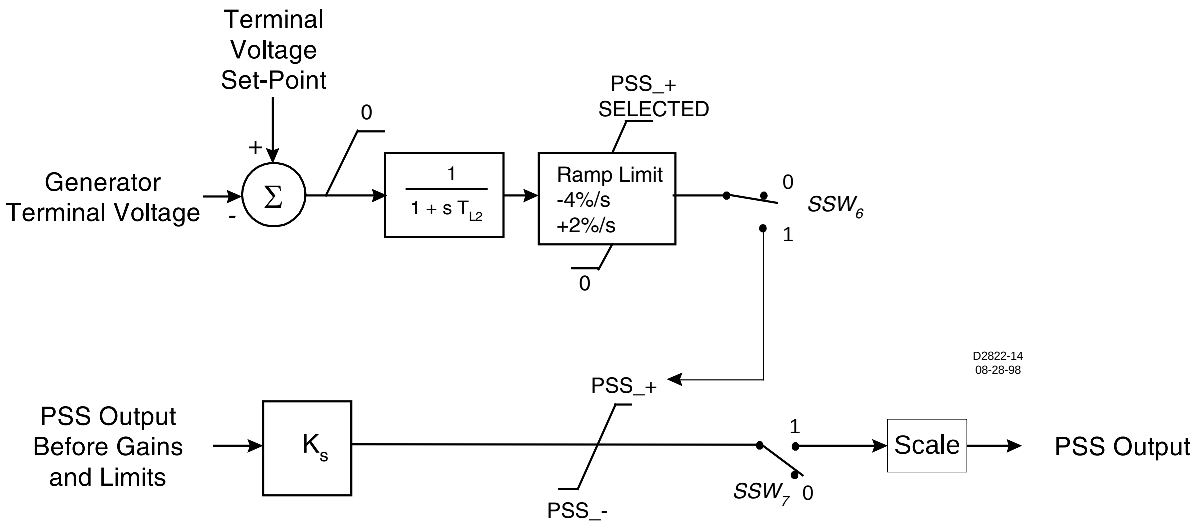


Figure 3-12. Output Stage

Terminal Voltage Limiter

Since the Power System Stabilizer operates by modulating the excitation, it may counteract the voltage regulator's attempts to maintain terminal voltage within a tolerance band. To avoid producing an overvoltage condition, the PSS-100 is equipped with a terminal voltage limiter that reduces the upper output limit to zero when the generator terminal voltage exceeds the Terminal Voltage Set-Point. The limit setpoint may be adjusted within the range:

$$0.9 \text{ pu } E_t \leq \text{Terminal Voltage Setpoint} \leq 1.25 \text{ pu } E_t$$

This level is normally selected such that the limiter will operate to eliminate any contribution from the PSS-100 before the generator's timed overvoltage or V/Hz protection operates.

The limiter will reduce the stabilizer's upper limit, PSS_+, at a fixed rate until zero is reached, or the overvoltage is no longer present. The limiter does not reduce the AVR reference below its normal level; it will not interfere with system voltage control during disturbance conditions. The error signal (terminal voltage minus limit start point) is processed through a conventional low-pass filter to reduce the effect of measurement noise.

$$G_T(s) = \frac{1}{1 + T_{L2}\, s} \qquad \text{Equation 3-11}$$

The range of time constant adjustments is as follows:

$$0.0 \text{ s} \leq T_{L2} \leq 5.0 \text{ s}$$

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SECTION 4 • HARDWARE

INTRODUCTION

This section describes PSS-100 hardware and circuit operation.

MOUNTING HARDWARE

Hardware provided with the PSS-100 allows panel or rack mounting. An escutcheon plate is provided for panel mounting; brackets are supplied for rack mounting. Two mounting depths are made possible by alternate escutcheon plate and mounting bracket screw holes. PSS-100 mounting dimensions are provided in Section 9, *Installation*.

CIRCUIT OPERATION

The description of PSS-100 circuit operation is divided into three categories: inputs, outputs, and communication ports.

Inputs

There are seven types of PSS-100 inputs:

- Operating Power
- Current Sensing
- Voltage Sensing
- Contact Sensing
- Test Signal
- Communication Ports
- IRIG Interface

Operating Power

Operating power for the internal circuitry is applied to the isolated, internal switching power supply. To enhance user flexibility, the PSS-100 uses wide-range ac/dc power supplies that cover several common control voltage ratings in the same version of the PSS-100. Power supply input voltage may be either 48/125 Vdc/120 Vac or 125/250 Vdc/240 Vac and is determined by the model number of the PSS-100. The power supply input voltage range for each model is summarized in Section 1, *General Information, Model Numbers* and *Specifications*. The power supply input is not polarity sensitive.

Current Sensing

Internal current transformers (CTs) provide isolation from the monitored line currents. The CTs step down the monitored line currents to levels appropriate for the PSS-100 circuitry.

Voltage Sensing

Monitored line voltages are applied to internal differential amplifiers and stepped down to internal circuit levels. PSS-100 voltage inputs can be supplied by either wye- or delta-connected system voltage transformers (VTs).

Contact Sensing

Eight contact sensing inputs receive external stimulus to initiate PSS-100 actions. An external wetting voltage is required for the contact sensing inputs. The nominal voltage level of the external dc source must comply with the dc power supply input voltage ranges listed in Section 1, *General Information*, *Specifications*. The input circuits are designed to respond to voltages at the lower end of the control voltage range, while not overheating at the high end of the control voltage range. It may be necessary to set internal jumpers to apply the PSS-100 according to the limits stated in Table 4-1. A procedure for adjusting these jumpers in provided in Section 9, *Installation*. All contact sensing inputs are programmable and individually isolated.

Table 4-1. Contact Sensing Voltage Ranges

Nominal Control Voltage	Turn-On Range	
	Jumper Installed	Jumper Removed
48/125 Vac/Vdc	26 to 38 V	69 to 100 V
125/250 Vac/Vdc	69 to 100 V	138 to 200 V

Contact sensing input circuits are polarity sensitive. When an ac wetting voltage is applied, the input signal is half-waved rectified by the opto-isolator diodes.

The contact sensing inputs drive BESTlogic variables IN1, IN2, IN3, IN4, IN5, IN6, IN7, and IN8. Each input can be assigned a meaningful name by the user.

Test Signal Input

This input accepts an external voltage signal of ±15 volts, peak and is used to test the stabilizer algorithm. Applying a 1.0 volt signal to the input is equivalent to a 1.0 per-unit test signal. The test signal input can also be used to record external signals by the data recording function.

IRIG Interface

IRIG connections at the rear panel accept a demodulated IRIG signal and provide the capability to time-synchronize the PSS-100 internal clock to within one millisecond of the IRIG source.

Outputs

The PSS-100 has three types of outputs.

- Output Relays
- Analog Output
- PSS Failure Output

Output Relays

Output relays OUT1 through OUT6 are operated by programmable logic when the corresponding logic expressions (SL-VO1 through SL-VO6) are true. OUT5 is a dedicated, internal output that is used to enable and disable the analog output of the stabilizer. Although OUT5 is programmable, it should always be programmed to be on when the stabilizer output is enabled. OUT1 through OUT4 have normally-open SPST contacts. OUT6 has SPDT contacts.

Analog Output

This output supplies a ±9 Vdc stabilizing signal that is connected to the summing junction of the voltage regulator. An optically-isolated amplifier fully isolates the analog output from the PSS-100 power supply, internal circuitry, and ground. The analog output can be programmed to operate anywhere within the ±9 Vdc range to match the range of the excitation input. Output relay OUT5 can be used to disable the analog output to allow the voltage regulator to function normally without the stabilizer. Open-loop output gain will be within 10 percent of nominal.

PSS Failure Output

This output uses normally-closed contacts for failsafe operation. This normally-energized output de-energizes if operating power is removed from the PSS-100, a power supply failure occurs, or an internal software execution error occurs. OUTA can also be driven by BESTlogic expression SL-VOA. However, the logic expression will be overridden if a failure condition occurs.

Front Panel Indicators

Five front panel LED indicators light to indicate various alarms and operating modes. Section 2, *Human-Machine Interface* provides more information about the front panel indicators.

Communication Ports

Isolated, serial communication ports provide programming capability and remote access to stabilizer setup, control, and diagnostic functions. PSS-100 communication ports consist of two female, RS-232 (DB-9) connectors and one RS-485 terminal block. The front RS-232 connector is designated as COM 0, the rear RS-232 connector is designated as COM 1, and the RS-485 terminal block is designated as COM 2.

SECTION 5 • FIRMWARE

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SECTION 5 • FIRMWARE

INTRODUCTION

Embedded software (firmware) monitors and controls all aspects of PSS-100 operation. BESTCOMS software provides the means to change stabilizer settings, obtain reports, and perform testing.

Section 7, *BESTCOMS Software* provides information about installing BESTCOMS and configuring if for communication with the PSS-100.

CHANGING SETTINGS

PSS-100 settings are arranged in six groups.

- System Configuration
- Stabilizer and Control
- Testing
- Setting Group Alarm and Output Selection
- Metering and Alarm/Status Parameters
- Data Records and Reports

Each setting group has a corresponding button (shown in Figure 5-2) that can be clicked to access that group of settings. The six setting groups can also be accessed by clicking **Screens** on the menu bar and then selecting the desired setting group from the list. Once a setting group is accessed, the individual settings of the group can be viewed and changed.

A setting is changed by clicking within the setting field and typing the new setting. The range limits of a setting can be viewed by double-clicking the setting field. Setting changes are saved to the PSS-100 by pressing the Enter key or clicking the **Send To PSS** button. This button is located to the right of the six setting group buttons.

When the Enter key is pressed or the Send To PSS button is clicked to save the first setting change, the Password Entry box (Figure 5-1) appears. The correct password must be entered in the Password Entry box field before PSS-100 settings can be changed. All PSS-100 stabilizers are delivered with *pss* as the password. Subsequent setting changes do not require password entry. More information about password security is provided in the paragraphs under *Password Protection*.

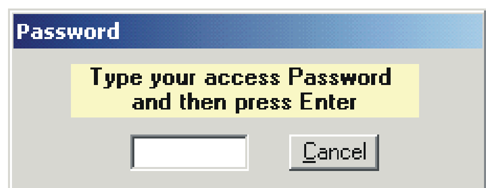

Figure 5-1. Password Entry Box

SENDING AND RECEIVING SETTINGS

When communication between BESTCOMS and the PSS-100 is active, settings can be sent to, or received from the PSS-100.

Sending Settings

To send data to the PSS-100, click the **Send To PSS** button, click **Communications** on the menu bar and select **Send To PSS-100**, or press the PC's **Enter** key. Settings displayed on the current setting screen become the active PSS-100 settings.

Receiving Settings

To retrieve data from the PSS-100, click the **Get From PSS** button or click **Communications** on the menu bar and select **Get From PSS**. Settings previously saved to the PSS-100 are displayed on the setting screens.

Saving Setting Changes to Nonvolatile Memory

Default settings are saved in electronically-erasable, programmable, read-only memory (EEPROM). In the event of a power loss, these are the active settings at power-up. If setting changes are sent to the PSS-100, but not to EEPROM, the changed settings are lost if operating power is lost.

Settings can be saved to EEPROM in two different ways. When communication with the PSS-100 is closed, BESTCOMS asks if you want to save settings to EEPROM. This question is asked even if no changes are made. During active communication with the PSS-100, the EEPROM button can be clicked to save the settings.

SYSTEM CONFIGURATION SETTINGS

System configuration settings are accessed through the BESTCOMS System Configuration screen and consist of power system parameters and product identification information. Click the **Configure** button to access the System Configuration screen or click **Screens** on the menu bar and click **System Configuration**.

Power System Parameters

The power system parameter settings match the PSS-100 with the transformer ratings, generator ratings, and power measurement method used. All power system parameters can be viewed and adjusted on the Power System Parameters tab of the BESTCOMS System Configuration screen (Figure 5-2).

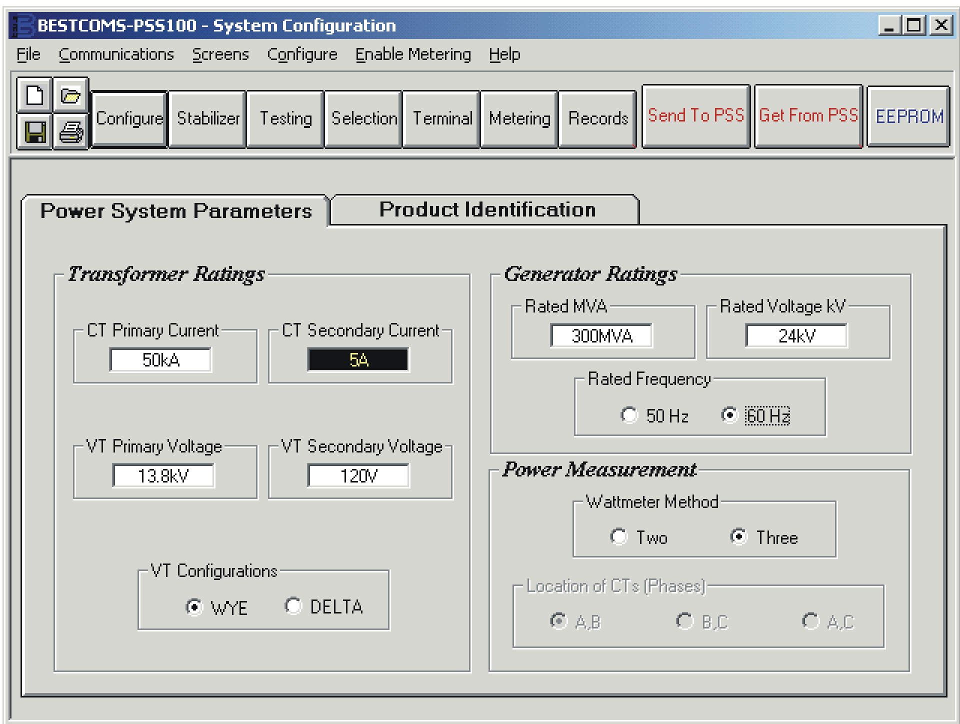

Figure 5-2. System Configuration Screen, Power System Parameters Tab

<u>*Transformer Ratings*</u>

The following settings are used to match the PSS-100 with the power system transformer ratings.

CT Primary Current. The PSS-100 is matched to the system CTs by entering the CT primary current rating. This setting selects the current transformer ratio (primary/secondary). A value of 1 to 50,000 may be entered.

CT Secondary Current. This setting indicates the nominal CT secondary current value and is fixed at the nominal current sensing value for your PSS-100. Stabilizers with a model number of PSS-100-X1 have 1 ampere nominal current sensing. Stabilizers with a model number of PSS-100-X5 have 5 ampere nominal current sensing.

The PSS-100 is matched to the system VTs by entering the VT primary voltage rating, VT secondary voltage rating, and VT configuration.

VT Primary Voltage. This setting selects the voltage transformer ratio (primary/secondary). A value of 1 to 50,000 may be entered.

VT Secondary Voltage. This field indicates the nominal VT secondary voltage value and can be adjusted over a range of 90 to 130 Vac.

VT Configurations. This setting is used to select either a wye or delta voltage sensing configuration.

<u>*Generator Ratings*</u>

The PSS-100 is matched to the generator by entering the generator voltampere rating, output voltage rating, and frequency rating.

Rated MVA. This setting selects the voltampere rating of the generator. A value of 0.001 to 20,000.000 MVA may be entered.

Rated Voltage kV. This setting selects the output voltage rating of the generator. A value of 85.0 to 1,000,000 Vac may be entered.

Rated Frequency. This setting is used to select a nominal system operating frequency of 50 hertz or 60 hertz.

<u>*Power Measurement*</u>

Wattmeter Method. This setting is used to select either the two-wattmeter or three-wattmeter method of power measurement.

Location of CTs (Phases). When the two-wattmeter method of power measurement is used, this setting selects the two phases monitored by the metering CTs. This setting is not used (grayed out) when the three-wattmeter method of power measurement is used.

Product Identification Information

Product identification information can be viewed on the Product Identification tab of the System Configuration screen (Figure 5-3). All product information fields are fixed and cannot be changed by the user.

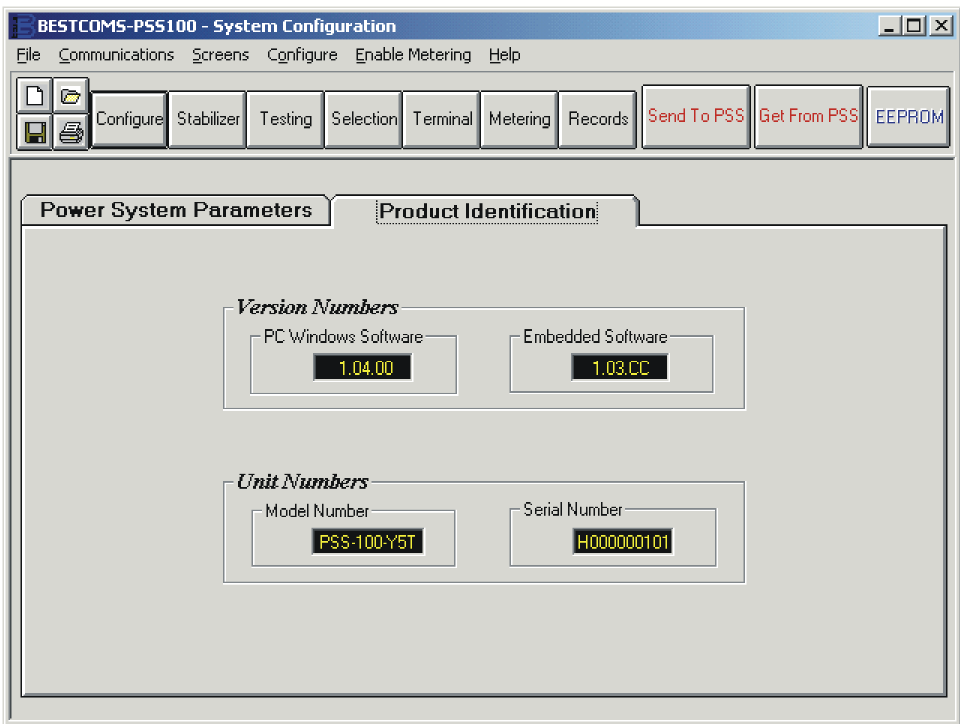

Figure 5-3. System Configuration Screen, Product Identification Tab

<u>*Version Numbers*</u>

These product identification fields consist of the version numbers for BESTCOMS and PSS-100 firmware.

<u>*Unit Numbers*</u>

These product identification fields consist of the PSS-100 model and serial numbers.

STABILIZER PARAMETERS

Stabilizer parameters are accessed through the BESTCOMS Stabilizer Parameters screen and consist of stabilizer control settings, stabilizer parameter settings, and output limiter settings. Click the **Stabilizer** button to access the Stabilizer Parameters screen or click **<u>S</u>creens** on the menu bar and click **Stabilizer and Control Parameters**.

Stabilizer Control

Stabilizer control settings consist of software switch settings, PSS algorithm control, supervisory control, and setting group selection. Stabilizer control settings can be viewed and adjusted on the Stabilizer Control tab of the Stabilizer Parameters screen (Figure 5-4).

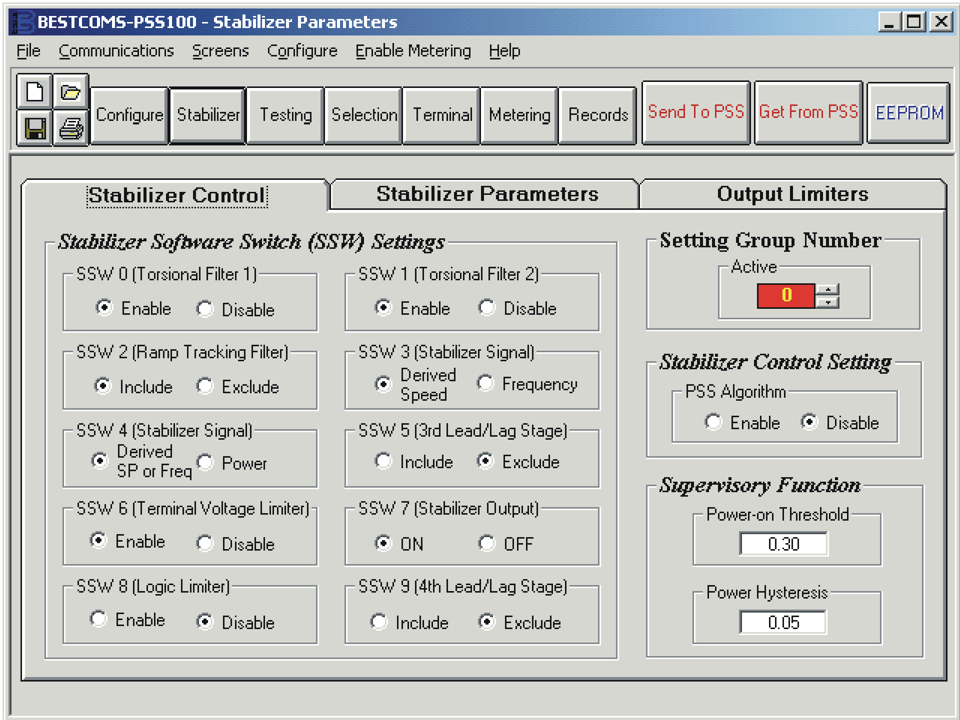

Figure 5-4. Stabilizer Parameters Screen, Stabilizer Control Tab

<u>*Software Switches*</u>

Stabilizer configuration is programmed using the software control switches. Figure 5-5 illustrates the location of each software switch. Software switch settings are described in the following paragraphs.

SSW 0 (Torsional Filter 1). This setting enables and disables optional torsional filter 1.

SSW 1 (Torsional Filter 2). This setting enables and disables optional torsional filter 2.

SSW 2 (Ramp Tracking Filter). This setting is used to include and exclude the ramp tracking filter.

SSW 3 (Stabilizer Signal). This setting selects either derived speed or frequency as the stabilizer signal.

SSW 4 (Stabilizer Signal). This setting selects between derived speed or frequency and power as the stabilizer signal.

SSW 5 (3rd Lead/Lag Stage). This setting is used to include and exclude the third lead/lag stage of the stabilizer output.

SSW 6 (Terminal Voltage Limiter). This setting enables and disables the terminal voltage limiter

SSW 7 (Stabilizer Output). This setting turns the stabilizer output on and off.

SSW 8 (Logic Limiter). This setting enables and disables the logic limiter.

SSW 9 (4th Lead/Lag Stage). This setting is used to include and exclude the fourth lead/lag stage of the stabilizer output.

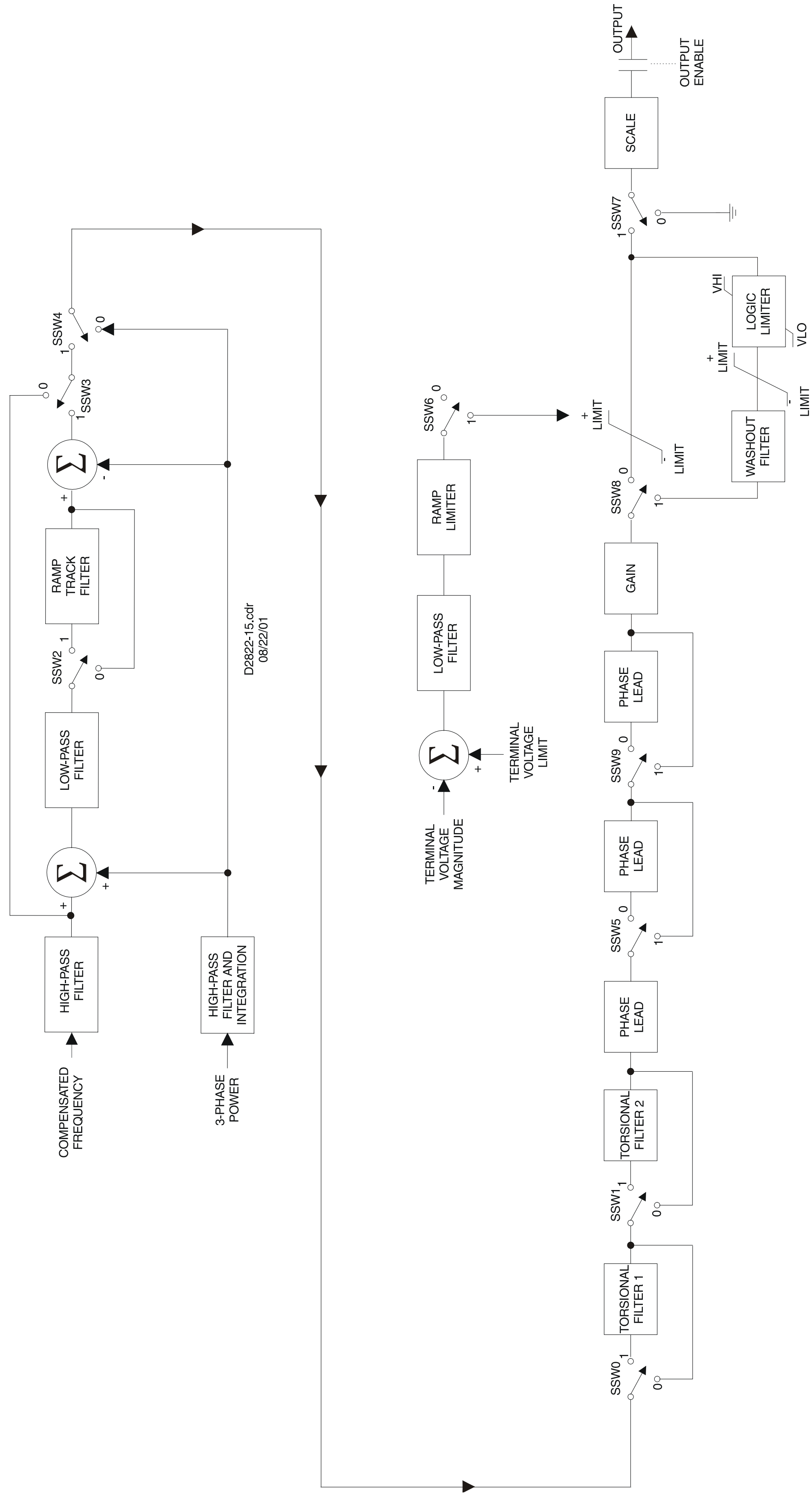

Figure 5-5. Software Switch Locations

The settings of software switches SSW 2, SSW 3, and SSW4 can be combined to obtain the functions listed in Table 5-1.

Table 5-1. Software Switch Functions

Stabilizer Configuration	SSW 2	SSW 3	SSW 4
Dual input (frequency and power) with ramp tracking feature	1	1	1
Dual input (frequency and power) without ramp tracking feature	0	1	1
Frequency input	X	0	1
Integral of electrical power	X	X	0

1 = switch closed 0 = switch open X = switch position does not matter

<u>*PSS Algorithm Control*</u>

PSS Algorithm. This setting enables and disables the PSS-100 algorithm. After a reset (software or power-up), the algorithm is automatically disabled.

<u>*Supervisory Functions*</u>

Two types of supervisory functions exist in the PSS-100: user-programmable and automatic.

User-programmable supervisory functions consist of a power-on threshold setting and power hysteresis setting.

Power-on Threshold. This per-unit setting is based on the generator MVA rating entered on the Power System Parameters tab of the System Configuration screen. The power-on threshold defines the power level required to enable PSS-100 operation.

Power Hysteresis. This per-unit setting is based on the generator MVA rating entered on the Power System Parameters tab of the System Configuration screen. Power hysteresis provides a margin below the power-on threshold setting so that transient dips in power will not disable the stabilizer. When the power level decreases below the power hysteresis threshold, a fixed timer of 20 half-cycles (160 milliseconds at 60 Hz) begins timing. If the power increases above the power-on threshold setting before the timer expires, the PSS-100 will remain enabled. If the power level fails to increase above the Power-on Threshold setting before the timer expires, the PSS-100 will be disabled.

Automatic supervisory functions are described in the following paragraphs.

Instantaneous Power Level. If the power level drops below 10% of the per-unit value (defined by the Rated MVA setting (System Configuration screen, Power System Parameters tab)), the stabilizer is disabled. When the power level increases above 15% of the Rated MVA setting, the stabilizer is automatically enabled. Hysteresis is provided to prevent quick changes near the threshold level.

Voltage/Current Unbalance. If the voltage or current unbalance increases above 40% for 18 half-cycles, (about 150 milliseconds at 60 Hz), the stabilizer is disabled. Voltage and current balance is determined by the ratio of negative-sequence quantities to positive sequence quantities. When an unbalance condition decreases below the 40% threshold for 18 half-cycles, the stabilizer is enabled again. This feature is active only when the positive sequence voltage magnitude is above 10% of the Rated Voltage setting (System Configuration screen, Power System Parameters tab)).

Speed Error. If the calculated compensated speed deviation is greater than 10% of nominal for six half-cycles (50 milliseconds at 60 Hz), the stabilizer is disabled. The stabilizer is enabled when the speed deviation decreases below 10% for six half-cycles. This diagnostic feature is active only when the system power level is above 10% of the Rated MVA setting (System Configuration screen, Power System Parameters tab).

Speed Limit Rate of Change. If the generator speed is seen changing too quickly, there is probably some error in the speed calculation. The stabilizer algorithm automatically limits the speed change based on the generator inertia. This feature will not disable the stabilizer.

<u>*Setting Groups*</u>

Four different sets of stabilizer parameters and settings can be saved in nonvolatile memory. These four settings groups are designated as SG0, SG1, SG2, and SG3. Settings groups can be used to accommodate different system conditions such as large load changes, unavailable transmission lines, or different power system network configurations. Provisions for selecting the settings of setting group 0, 1, 2, or 3 are provided on the Stabilizer Parameters screen, Testing Parameters screen, and the Log Settings & Download tab of the Records screen. The label above the setting field will indicate Active when the active setting group number is displayed and Non-active when an inactive setting group number is displayed.

More information about setting group selection is provided in *Selection Parameters, Setting Groups*.

Stabilizer Parameter Settings

Stabilizer parameter settings consist of the quadrature axis compensation setting (rotor frequency calculation), low-pass/ramp tracking filter time constant, high-pass filtering and integration settings, phase compensation time constants, and torsional filter parameters. Stabilizer parameter settings can be viewed and adjusted on the Stabilizer Parameters tab of the Stabilizer Parameters screen (Figure 5-6).

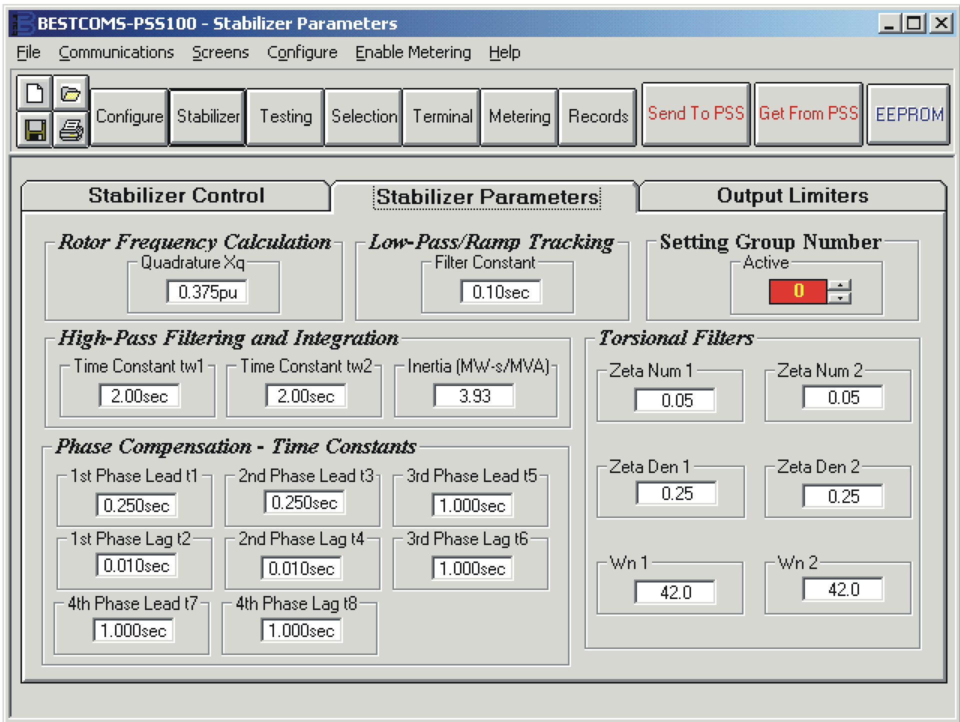

Figure 5-6. Stabilizer Parameters Screen, Stabilizer Parameters Tab

<u>*Rotor Frequency Calculation*</u>

During steady-state conditions, the terminal frequency of the generator is a good measure of rotor speed. However, this may not be the case during low frequency transients, due to the voltage drop across the machine reactance. To compensate for this effect, the PSS-100 first calculates the terminal voltages and currents. It then adds the voltage drop across the quadrature reactance to the terminal voltages to obtain internal machine voltages. These voltages are then used to calculate the rotor frequency. This gives a more accurate measure of rotor speed during low frequency transients when stabilizing action is required.

The quadrature axis compensation used in the rotor frequency calculation is entered through the BESTCOMS Quadrature Xq setting.

Quadrature Xq. This per-unit setting adjusts the level of quadrature axis compensation made by the PSS-100. The quadrature reactance setting range is 0 to 5.000.

<u>*Low-Pass/Ramp Tracking Filter*</u>

A fourth-order, low-pass filter processes the calculated mechanical power deviation signal. This filtering may be excessive for hydroelectric units with high rates of mechanical power change. An optional filter stage is provided to allow for ramp changes to the input mechanical power.

Filter Constant. This setting adjusts the mechanical low-pass filter time constant. The filter constant setting range is 0.05 to 0.20 seconds.

High-Pass Filtering and Integration

High-pass filtering is used to remove low frequency components from electrical power and rotor speed (or compensated frequency) signals. This ensures that the stabilizer does not alter the steady-state reference to the voltage regulator. High-pass filtering is implemented using the Time Constant tw1 setting (also called the washout time constant).

Time Constant tw1. This setting adjusts the high-pass filtering (for compensated frequency) time constant. The setting range for tw1 is 1.0 to 20.0 seconds.

Integration of the electrical power signal is accomplished using the Time Constant tw2 setting (also called the washout time constant) and the (rotor) Inertia setting (for integration of power signal).

Time Constant tw2. This setting adjusts the high-pass filtering (for integration of power signal) time constant tw2. The setting range for tw2 is 1.00 to 20.0 seconds.

Inertia (MW-s/MVA). This setting adjusts the rotor inertia (for integration of power signal) time constant H. The inertia setting range is 0.01 to 25.00 MW-seconds/MVA.

Time constant tw2 is also used in another high-pass filter for the compensated frequency signal. This allows the frequency signal to match the output of the integral of electric power deviation signal so they can be added together to obtain integral of mechanical power deviation.

Phase Compensation

Filtering of the derived speed signal provides a phase lead at the electromechanical frequency of interest. This phase lead compensates for the phase lag introduced by the closed loop voltage regulator. Four stages of lead/lag are included. Two stages should be adequate for most applications.

Each time constant has a lead and lag setting which is adjustable over the range of 0.001 to 6.00 seconds.

Torsional Filters

The PSS-100 is equipped with two torsional filters. Each torsional filter has three parameters: the numerator damping ratio (Zeta Num 1 and Zeta Num 2), the denominator damping ratio (Zeta Den 1 and Zeta Den 2), and the resonant frequency (Wn 1 and Wn 2). Zeta Num 1, Zeta Den 1, Zeta Num 2, and Zeta Den 2 have a setting range of 0 to 1.00. Wn 1 and Wn 2 have a setting range of 10.0 to 150.

Output Limiters

Output limiter parameters consist of settings for stabilizer output limiting, stabilizer gain, output scaling, the terminal voltage limiter, the logic limiter, and the logic output limiter. Output limiter settings can be viewed and adjusted on the Output Limiters tab of the Stabilizer Parameters screen (Figure 5-7).

Stabilizer Output Limiting

The stabilizer gain stage output has an upper limit setting and a lower limit setting.

Upper Limit. This setting adjusts the stabilizer output gain stage (Kg) maximum limit. The upper limit field has a setting range of 0 to 0.50.

Lower Limit. This setting adjusts the stabilizer output gain stage (Kg) minimum limit. The lower limit has a setting range of –0.5 to 0.

Figure 3-9 illustrates the relationship of the stabilizer gain stage to the stabilizer output.

Stabilizer Gain

The stabilizer gain constant is expressed by Equation 5-1.

$$\frac{(pu)E_t - ref}{(pu)speed}$$

Equation 5-1. Stabilizer Gain Constant

The stabilizer gain constant has a setting range of 0 to 50.00.

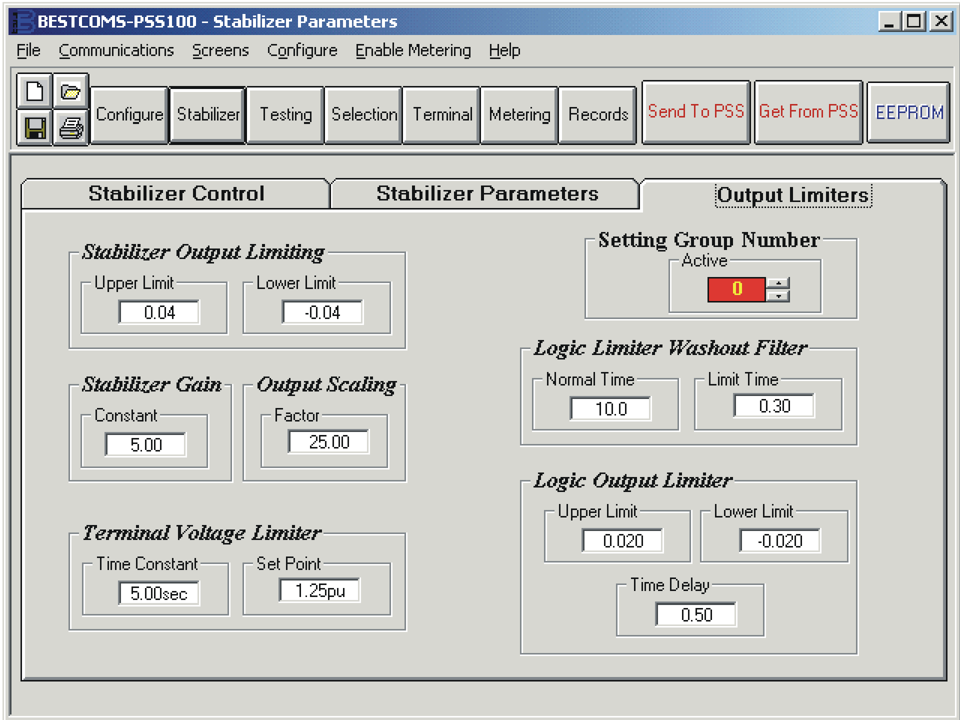

Figure 5-7. Stabilizer Parameters Screen, Output Limiters Tab

Output Scaling

When configuring the PSS-100, the output should be matched to the voltage regulator being used. Stabilizer output scaling allows the output signal to match the voltage regulator gain. With a scale setting of 8.0, a 0.5 per unit output before the output scaling stage will produce a 4.0 Vdc signal at the analog output.

The output scaling factor has a setting range of –300 to 300.

Terminal Voltage Limiter

To prevent an overvoltage condition, the upper limit of the stabilizer can be reduced to zero if the terminal voltage exceeds the setpoint. If the terminal voltage becomes greater than the setpoint, the upper limit on the stabilizer output will be steadily lowered to zero. If the overvoltage condition goes away, the upper limit will be steadily raised until it reaches the set upper limit. To avoid errors, a low-pass filter is used in the path to measure the deviation of the terminal voltage from the setpoint. The terminal voltage limiter has two settings: Time Constant and Set Point.

Time Constant. This setting adjusts the time constant for the generator terminal voltage limiter. The time constant setting range is 0.02 to 5.00 seconds.

Set Point. This per-unit setting adjusts the setpoint for the generator terminal voltage limiter. The setpoint setting range is 0.90 to 1.25.

Logic Limiter

The logic limiter compares the signal from the phase lead block with an upper and lower limit value. If the signal is outside the limits, a counter is started. If the counter increments to the delay time setting of the limiter, the filter time constant changes from normal to limit. When the signal returns to a value that is within the limits, the counter resets and the time constant changes from limit to normal.

The logic limiter is adjusted with the Upper Limit, Lower Limit, and Time Delay settings.

Upper Limit. This per-unit setting adjusts the high limit value for the logic output limiter. The upper limit has a setting range of 0.01 to 0.04.

Lower Limit. This per-unit setting adjusts the low limit value for the logic output limiter. The lower limit has a setting range of –0.04 to –0.01.

Time Delay. This setting adjusts the time delay of the logic output limiter. The time delay has a setting range of 0 to 2.00 seconds.

The logic limiter washout filter is adjusted with the Normal Time and Limit Time settings.

Normal Time. This setting adjusts the normal time constant of the washout filter. The normal time constant has a setting range of 5 to 30 seconds.

Limit Time. This setting adjusts the limit time constant of the washout filter. The lower limit time constant has a setting range of 0 to 1 second.

TESTING

Stabilizer testing is valuable because it can identify problems with the exciter and generator or system models. Unanticipated interactions with other excitation controls can also be revealed through testing. By simulating disturbances, appropriate stabilizer settings that improve the damping of the electromechanical modes can be established.

Information about using the testing capabilities of the PSS-100 and BESTCOMS is provided in Section 8, *Testing*.

SETTING GROUP ALARM AND OUTPUT SELECTION

Settings for the selection of PSS-100 setting groups, outputs, and alarms are accessed through the BESTCOMS Selection Parameters screen. Click the **Selection** button to access the Selection Parameters screen or click **Screens** on the menu bar and click **Group Alarm and Output Selection**.

Setting Groups

Setting groups can be used to accommodate different system conditions such as large load changes, unavailable transmission lines, or different power system network configurations. Four different sets of stabilizer parameters and settings can be saved in nonvolatile memory. These four groups are designated as SG0, SG1, SG2, and SG3. Settings groups can be changed in three ways.

- Manual control (control override)
- Logic control
- Automatic control

Settings group changes are annunciated by a programmable alarm.

Settings group selection and alarm settings can be viewed and adjusted on the Group Selection tab of the Selection Parameters screen (Figure 5-8).

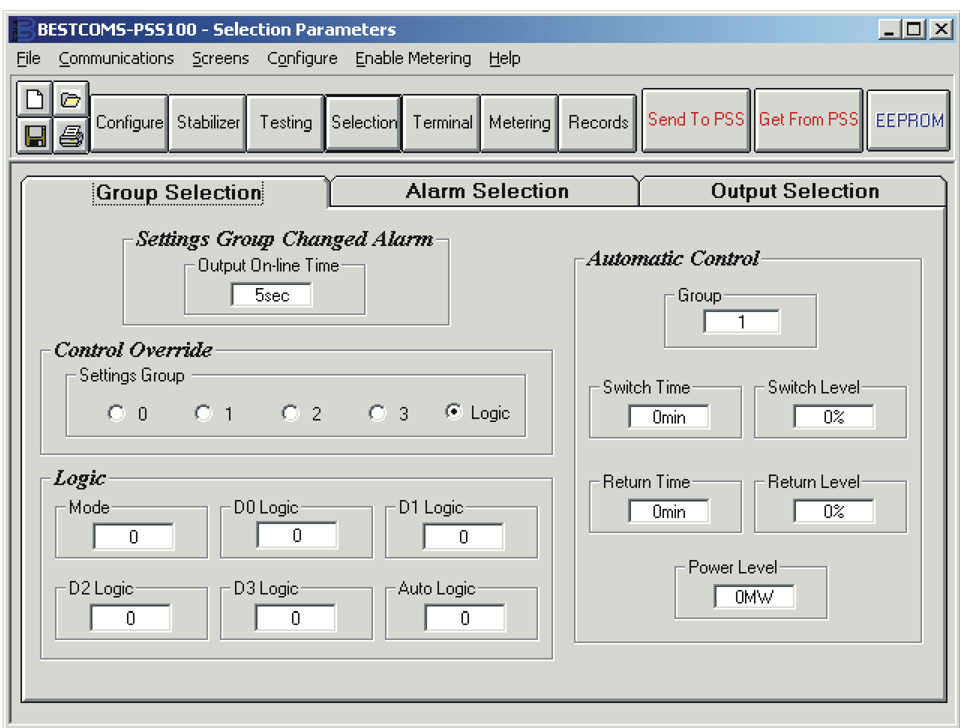

Figure 5-8. Selection Parameters Screen, Group Selection Tab

Settings Group Changed Alarm

This programmable alarm (SGC alarm) sets for a programmable time period when a group change occurs for any reason. After a group change, any further group change commands will be ignored for a duration equal to twice the programmable time period.

The SGC output can be used to provide a contact closure as an external acknowledgement that a settings group change has occurred. The setting group changed alarm duration is set by the Output On-Line Time setting.

NOTE

A settings group change cannot be implemented faster than twice the period of the Output On-Line Time setting. If a new request for a change occurs during this period, it is ignored.

Settings Group Changed Alarm – Output On-Line Time. Entering a value of 1 to 10 in this field selects a 1 to 10 second alarm duration when a setting group change occurs. Entering a zero (0) in this field disables the alarm.

Control Override of Settings Groups

Manual control of the settings groups is achieved through the Control Override – Settings Group setting.

Control Override – Settings Group. This setting changes the active setting group. The numbers 0, 1, 2, and 3 correspond to setting groups with the same numbers. Selecting Logic returns setting group control to PSS-100 logic. When Logic is selected, the Logic – Mode setting field should be set at 1 to change groups from control override.

When a settings group control operation is accepted, any automatic timers associated with automatic group changes will reset and the GROUP OVERRIDE alarm will be set. The GROUP OVERRIDE alarm remains set until settings group control is returned to the digital or automatic logic by selecting Logic in the Control Override – Settings Group setting. Settings group status is saved in nonvolatile memory so if operating power is lost, the previous status is restored after power returns.

Logic Control of Settings Groups

Logic control of settings groups is configured through the Mode, D0 Logic, D1 Logic, D2 Logic, D3 Logic, and Auto Logic setting fields. The function block shown in Figure 5-9 illustrates the elements of settings group logic control.

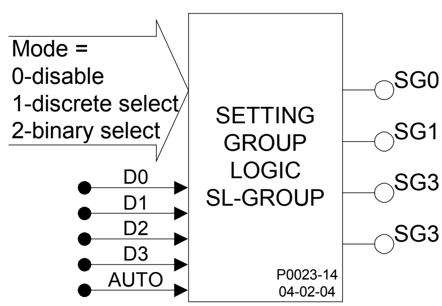

Figure 5-9. Setting Group Logic

Logic – Mode. This setting affects the logic control of the setting groups and can be set at 0, 1, or 2.

A setting of 0 (disabled) limits setting group selection to SG0. Auxiliary settings groups SG1, SG2, and SG3 are disabled.

When mode 1 (discrete selection) is enabled, the active settings group is selected by applying pulses to discrete inputs D0 through D3. This requires a separate logic term for each input (entered in the D1 Logic, D2 Logic, and D3 Logic setting fields) if all settings groups are to be used. If more than one input is true at the same time, then the higher D# will take priority. Figure 5-10 shows how the active settings group follows the D inputs except when blocked by the AUTO input. Note that the first D3 pulse is blocked by the AUTO input.

Figure 5-10. Input Control Mode

When mode 2 (binary selection) is enabled, the active settings group is selected by applying a binary signal to discrete inputs D0 and D1. Inputs D2 and D3 are ignored when mode 2 is selected. This requires a separate logic term for inputs D0 and D1. Table 5-2 lists the binary codes for each settings group.

Table 5-2. Settings Group Binary Codes

D1	D0	Decimal Equivalent	Settings Group
0	0	0	SG0
0	1	1	SG1
1	0	2	SG2
1	1	3	SG3

Figure 5-11 shows how the active settings group follows the binary sum of the D0 and D1 inputs except when blocked by the AUTO input. Note that a pulse on the D1 input while D0 was also active does not cause a settings group change to SG3 because the AUTO input is active.

Figure 5-11. Input Control Mode 2

Logic – D0, D1, D2, D3 Logic. These setting fields can contain OR logic terms that are used to select the active setting group as determined by the mode setting. Use of these settings depends on the control mode used. When mode 1 (discrete selection) is enabled, a pulsed or steady-state true signal is applied to an input and the corresponding settings group is selected. When mode 2 (binary selection) is enabled, a settings group is selected by applying the appropriate binary-coded signal to inputs D0 and D1.

Logic – Auto Logic. This setting field can contain an OR logic term that is used to select the active setting group as determined by the mode setting. When the auto logic becomes true, the D0 through D3 input logic is disabled and automatic logic selection is enabled. Any OR logic term can be used for the auto logic.

<u>*Automatic Control of Settings Groups*</u>

Automatic control of the active settings group allows the PSS-100 to change the active settings group based on the active power levels. In this way, the PSS-100 can be automatically configured for optimum control based on the power system conditions. For example, in locations where seasonal variations can cause large variations in power generation, the automatic mode allows the PSS-100 to stay optimally configured as the network conditions change.

Settings associated with automatic control of settings groups are Group, Switch Time, Switch Level, Return Time, Return Level, and Power Level.

Automatic Control – Group. This setting field is used to select the setting group before making the automatic control setting changes for that group. The number 1, 2, or 3 can be entered to select setting group 1, 2, or 3.

Automatic Control – Switch Time. This setting establishes the time that the conditions required to change groups must stay valid before a group change is allowed. The switch time has a setting range of 0 to 60 seconds, where 0 disables the switch time.

Automatic Control – Switch Level. This setting selects the power level percentage that the measured power must stay greater than for the switch time setting to permit an automatic group change. The switch level has a setting range of 0 to 150 percent.

Automatic Control – Return Time. This setting establishes the time that the conditions required to change groups must stay valid before returning to the prior setting group. The return time has a setting range of 0 to 60 minutes, where 0 disables the return time.

Automatic Control – Return Level. This setting selects the power level percentage that the measured power must stay greater than for the return time setting to permit an automatic return from SGn.

Automatic Control – Power Level. This setting selects the setting group control power level. The power level setting range is 0 to 5,000 megawatts.

Figure 5-12 shows how the active settings group follows the automatic control settings of the Group Selection tab. Note that the AUTO input must be at a true (1) logic state in order to allow the automatic logic to operate. A false (0) input to the AUTO input also resets any active timers to zero.

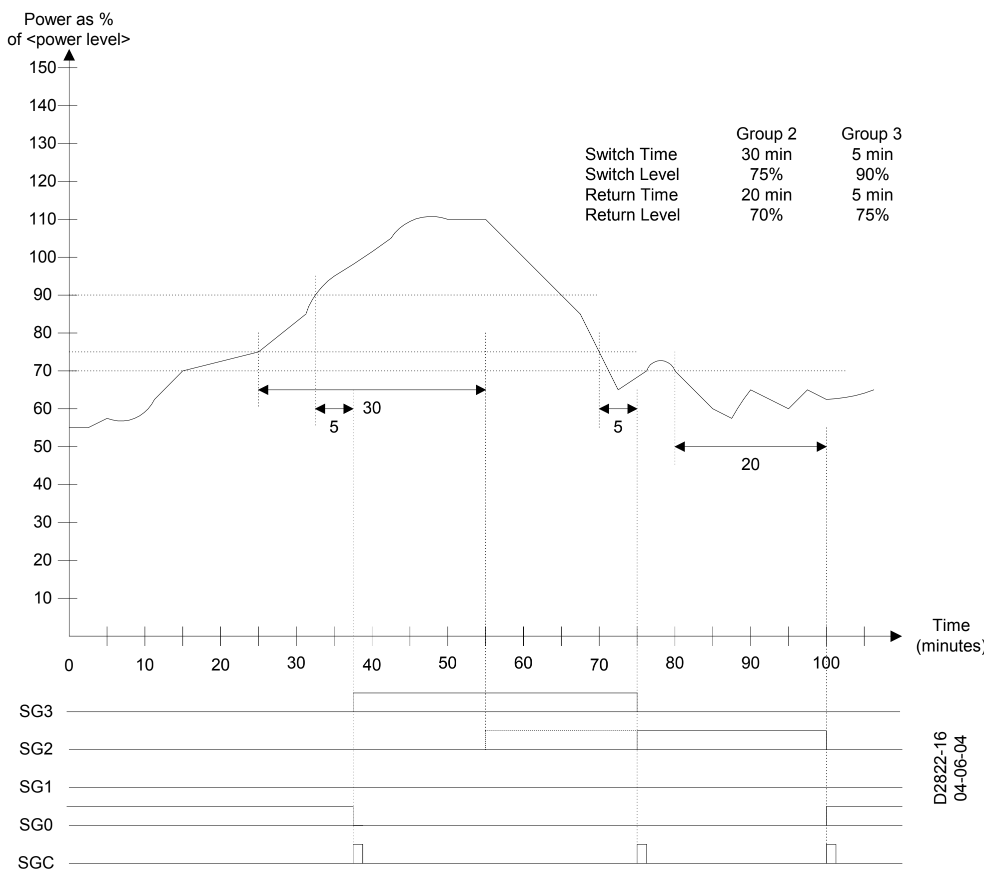

Figure 5-12. Automatic Settings Group Operation Based on Power

Output Selection

Output selection settings in BESTCOMS provide control of the stabilizer output, selection of operation in Motor mode, and phase sequence selection.

Output selection settings can be viewed and adjusted on the Output Selection tab of the Selection Parameters screen (Figure 5-13).

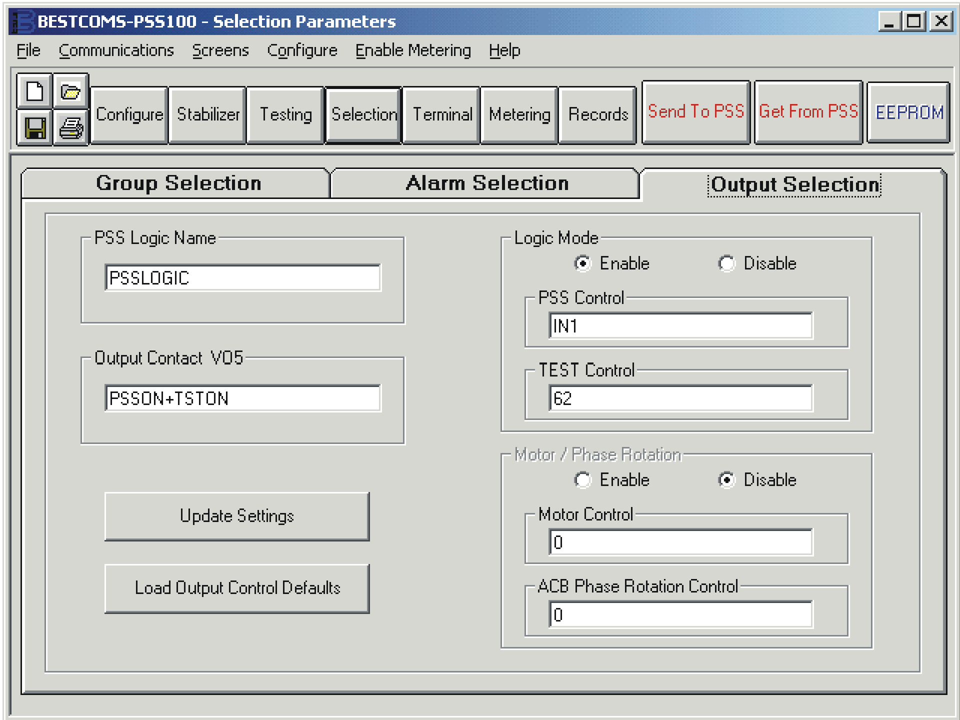

Figure 5-13. Selection Parameters Screen, Output Selection Tab

<u>*Stabilizer Output and Test Function Control*</u>

Control of the stabilizer output and test functions is provided by the PSS Control function block. Figure 5-14 illustrates the function block inputs and outputs. The following paragraphs describe the function block inputs and outputs and the associated settings.

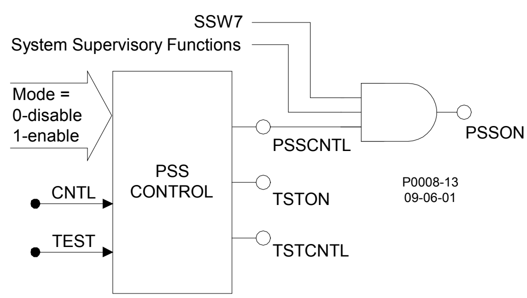

Figure 5-14. PSS Control Block

PSS Logic Name. This field displays the name of the active logic scheme used in the PSS-100.

Logic Mode. This setting enables and disables the PSS Control block. Selecting Disable sets all block outputs to the false (0) state.

PSS Control. This setting is defined by an OR logic term and determines when the PSSCNTL output is enabled. Unless overridden by a supervisory function, the stabilizer output is enabled when this logic term is true.

The PSSON and PSSCNTL outputs differ in that the PSSCNTL output is true when the PSS-100 recognizes an enable signal, either through BESTCOMS or from a logic input. Usually, the stabilizer will be enabled and PSSON will also be true. However, certain supervisory conditions such as excessive negative sequence voltage or low power may disable the stabilizer in the course of operation. In that case, PSSCNTL will stay true, but PSSON will be false and the stabilizer will be disabled. When the supervisory condition goes away, the stabilizer will be enabled automatically and PSSON will change to true. PSSCNTL would have stayed true throughout.

PSSCNTL will go false when the PSS-100 receives a disable command through BESTCOMS or from input logic. The stabilizer is then disabled and PSSON goes false as well.

TEST Control. This setting is defined by an OR logic term and determines when Test mode is enabled (TSTON and TSTCNTL outputs are true).

The difference between the TSTON and TSTCNTL outputs is similar to the PSSON and PSSCNTL outputs. The TSTCNTL output is true when the PSS-100 has received a command to run the test signal. If the test signal stops because its time duration expires, then TSTON will turn false but TSTCNTL will stay true.

Output Contact VO5. This setting field accepts any OR logic term that defines the state of virtual output VO5. This virtual output controls OUT5, which enables and disables the stabilizer output.

Motor Mode Control and Phase Rotation Control

Selection of operation in Motor mode and/or ACB phase sequence is made possible by the PSS Motor/Phase Rotation Control function block. Figure 5-15 illustrates the function block's inputs and outputs. The following paragraphs describe the function block inputs and outputs and the associated settings.

Motor/Phase Rotation (Mode). This setting enables and disables the control block. Selecting Disable sets all block outputs to the false (0) state.

Motor Control. This setting is defined by an OR logic term and determines when the MOTCTL output is enabled. The PSS-100 operates in Motor mode when the MOTCTL output is enabled. When the MOTCTL output is disabled, the PSS-100 operates in Generator mode.

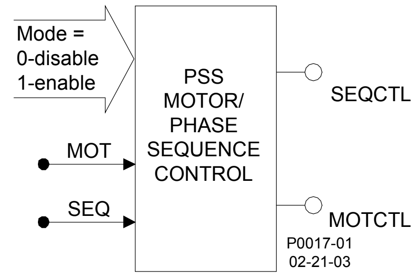

Figure 5-15. PSS Motor/Phase Sequence Control Block

ACB Phase Rotation Control. This setting is defined by an OR logic term and determines when the SEQCTL output is enabled. ACB phase sequence sensing is enabled when the SEQCTL output is enabled. When the SEQCTL output is disabled, the PSS-100 uses ABC phase sequence sensing.

Alarms

Alarm functions monitor the PSS-100 internal systems and the external interfaces. Alarm points are segregated into PSS-100 failure alarms and programmable alarms. The status of each alarm point is stored in nonvolatile memory so that if the PSS-100 is powered down, it will restore any alarm information that has not been acknowledged and/or reset.

Failure Alarms

Systems that affect the PSS-100's ability to perform core functions are monitored by the continuous self-test diagnostics function and are included in the failure alarms function. If any one of the self-test diagnostic functions listed below asserts, the fail-safe alarm output closes the OUTA contact, the front panel PSS Failure LED lights, all output relays are disabled, logic variable ALMFAIL is set, and the PSS-100 is taken off-line. PSS-100 failure alarms are not programmable.

1. Static RAM read/write error
2. EPROM program memory checksum error
3. Microprocessor exception or self-test error
4. EEPROM fatal read/write error
5. Analog-to-digital converter (ADC) error
6. Device not calibrated or calibration checksum error
7. Power supply out of tolerance
8. Watchdog timer timed out
9. Device using setting defaults
10. Device using calibration defaults
11. DSP microprocessor operation/self-test error

A failure alarm other than 4, 6, 9, or 10 (from above list) indicates that the PSS-100 is not functional and will cause the self-test diagnostics to force a microprocessor reset to try to correct the problem. Alarms 4, 6, 9, or 10 indicate that the PSS-100 is functional but needs recalibration or the settings programmed.

Any PSS-100 failure alarm will disable the logic functions, place the output contacts in their normal, de-energized state, and light the PSS-100 Failure LED. If a PSS-100 failure alarm is cleared, then the PSS-100 will attempt a recovery to return itself back on-line by using a software reset. The PSS-100 will reset by going through a full startup and initialization cycle. If no new problems are detected, the logic functions will be enabled and the stabilizer will return on-line.

Alarm Selection

Programmable alarms cover all systems monitored by the continuous, self-test diagnostics function that do not affect the PSS-100's ability to perform core functions. Programmable alarms also cover all alarm functions used to monitor the power system. Alarm points can be prioritized into major, minor, and logic alarms.

Major, minor, and logic alarms are configured on the Alarm Selection tab of the Selection Parameters screen (Figure 5-16). Conditions that can be configured as major, minor, or logic alarms are listed as follows:

- Power below threshold ∗
- Speed failure ∗
- Voltage unbalance ∗
- Current unbalance ∗
- New record triggered
- Access lost
- Group override ∗
- System I/O delay
- Communication error
- Clock error ∗
- Microprocessor reset
- Settings changed
- Nonfatal E^2 error
- Output override ∗
- Loss of IRIG signal ∗
- SGC active
- VO13 logic ∗
- VO14 logic ∗
- VO15 logic ∗
- Logic = NONE

Conditions marked by an asterisk (∗) are non-latching. A non-latching alarm clears automatically when the alarm condition is cleared. All other conditions trigger latching alarms, which must be manually reset.

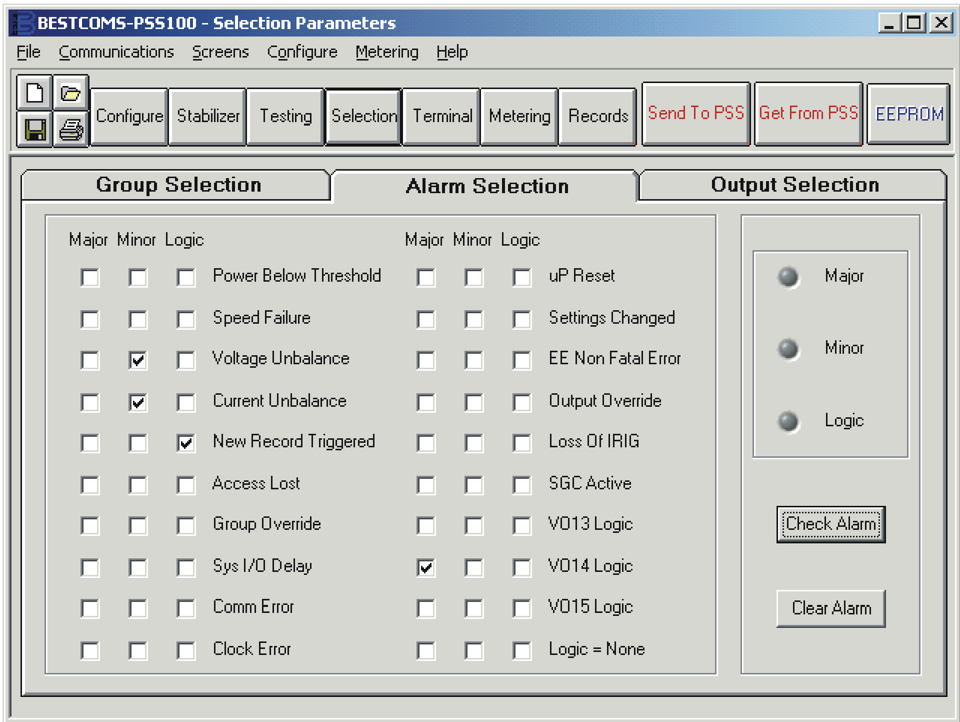

Figure 5-16. Selection Parameters Screen, Alarm Selection Tab

Alarms set to be monitored as major alarms will cause the Major Alarm indicator to light on the front panel and Alarm Selection tab, and BESTlogic variable ALMMAJ to assert. Alarms set to be monitored as minor alarms will cause the Minor Alarm indicator to light on the front panel and Alarm Selection tab, and the BESTlogic variable ALMMIN to assert. Alarms set to be monitored as Logic alarms will cause the Logic Alarm indicator to light on the Alarm Selection tab and the BESTlogic variable ALMLGC to assert. No front panel LED is associated with variable ALMLGC.

Check Alarm Button. Clicking this button updates the status of all alarms.

Clear Alarm Button. Clicking this button clears all latched alarms after the alarm conditions have cleared.

METERING AND ALARMS/STATUS

Metering, alarms, and status information are accessed through the BESTCOMS Metering and Alarm/Status screen. Click the **Metering** button to access the Metering and Alarm/Status screen or click **Screens** on the menu bar and click **Metering and Alarm/Status**.

Metering

The PSS-100 provides metering of phase A, B, and C parameters. Metered values include current, voltage, true power, apparent power, power factor, generator terminal voltage, current, frequency, and compensated frequency.

Metering values can be viewed on the Metering tab (Figure 5-17) of the Metering and Alarm/Status screen. The metering values are described in the following paragraphs.

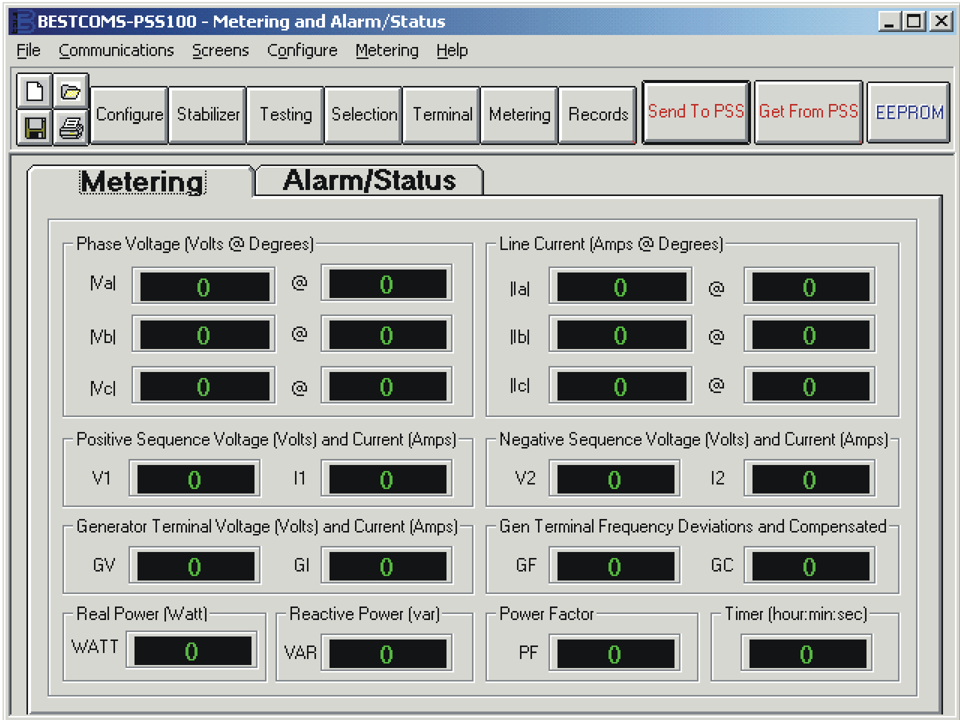

Figure 5-17. Metering and Alarm/Status Screen, Metering Tab

Phase Voltage/Line Voltage (Volts @ Degrees). These fields display the magnitude and angle for Va, Vb, and Vc when wye VT configuration is selected on the System Configuration screen. These fields display the magnitude and angle for Vab, Vbc, and Vca when delta VT configuration is selected on the System Configuration screen.

Line Current (Amps @ Degrees). These fields display the magnitude and angle of each of the three phases of current.

Positive Sequence Voltage (Volts) and Current (Amps). The V1 field displays the positive sequence voltage in volts or kilovolts. The I1 field displays the positive sequence current in amperes or kiloamperes.

Negative Sequence Voltage (Volts) and Current (Amps). The V2 field displays the negative sequence voltage in volts or kilovolts. The I2 field displays the negative sequence current in amperes or kiloamperes.

Generator Terminal Voltage (Volts) and Current (Amps). The GV field displays the generator terminal voltage in volts or kilovolts. The GI field displays the generator terminal current in amperes or kiloamperes.

Gen Terminal Frequency Deviations and Compensated. The GF field displays the per-unit generator terminal frequency deviation. The GI field displays the compensated generator terminal frequency deviation (per unit).

Real Power (Watt). This field displays three-phase power in watts, kilowatts, or megawatts.

Reactive Power (var). This field displays three-phase vars, kilovars, or megavars.

Power Factor. This field displays the machine power factor (per unit).

Timer (hour:min:sec). This field indicates the setting of the PSS-100 real-time clock.

Alarm/Status

The Alarm/Status tab (Figure 5-18) of the Metering and Alarm/Status screen provides system status information, front panel indicator status, alarm status, and the status of the PSS-100 inputs and outputs. Alarm/Status tab indicators and controls are described in the following paragraphs.

System Status. Nineteen indicator arrays provide system and PSS-100 status information. In order for the status indicators to annunciate alarm conditions, they must be programmed through the settings of the Alarm Selection tab of the Selection Parameters screen. Refer to the paragraphs under *Alarm Selection* for more information.

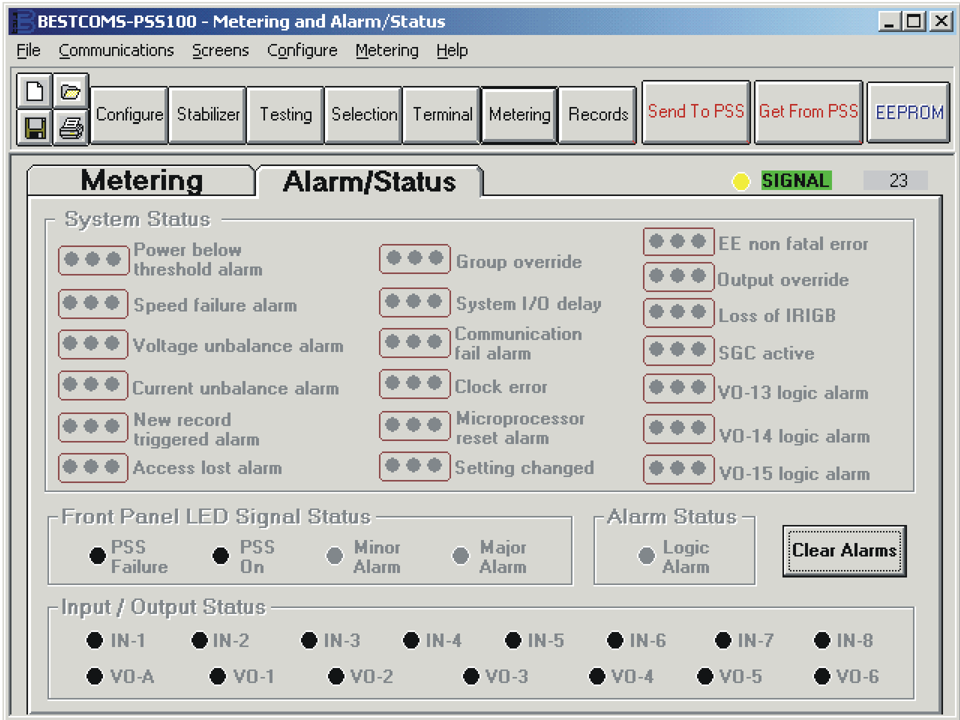

Figure 5-18. Metering and Alarm/Status Screen, Alarm/Status Tab

Each indicator array consists of three indicators. The indicators for an alarm condition are grayed out if the alarm function has not been enabled through programming. The indicators for an alarm condition are black if the alarm function has been enabled but the alarm condition does not exist.

The left-hand indicator of an array annunciates a minor alarm and changes from black to yellow when the minor alarm condition becomes true. The center indicator annunciates a major alarm and changes from black to red when the major alarm condition becomes true. The right-hand indicator annunciates a logic alarm and changes from black to blue when the logic alarm condition becomes true.

Front Panel LED Signal Status. These indicators represent four of the PSS-100 front panel LEDs: PSS Failure, PSS On, Minor Alarm, and Major Alarm. When the PSS Failure, PSS On, or Major Alarm LED on the front panel lights, the corresponding BESTCOMS indicator changes from black to red. When the Minor Alarm LED on the front panel lights, the corresponding BESTCOMS indicator changes from black to yellow.

Alarm Status. The Alarm Status Logic Alarm indicator changes from black to blue when any logic alarm is triggered.

Input/Output Status. The contact input indicators (IN-1 through IN-8) change from black to red when the corresponding contact input energizes. The virtual output indicators (VOA, VO-1 through VO-6) change from black to red when the corresponding output becomes active.

Clear Alarms. Clicking this button clears all latched alarms after the conditions causing the alarms have cleared.

DATA RECORDS AND REPORTS

Data reporting functions provide recording and reporting of stabilizer variables over a defined period of time. Typically, data records are used to record stabilizer behavior during testing or system disturbances. These records are then downloaded from the PSS-100 and analyzed.

Data records are configured and viewed through the Log Settings & Download tab, Logic Trigger tab, and Sequence of Events tab of the Records screen. Click the **Records** button to view the Records screen or click **Screens** on the menu bar and click **Data Records and Reports**.

Log Settings and Download

The log settings and record downloading settings of the Log Settings & Download tab are shown in Figure 5-19 and described in the following paragraphs.

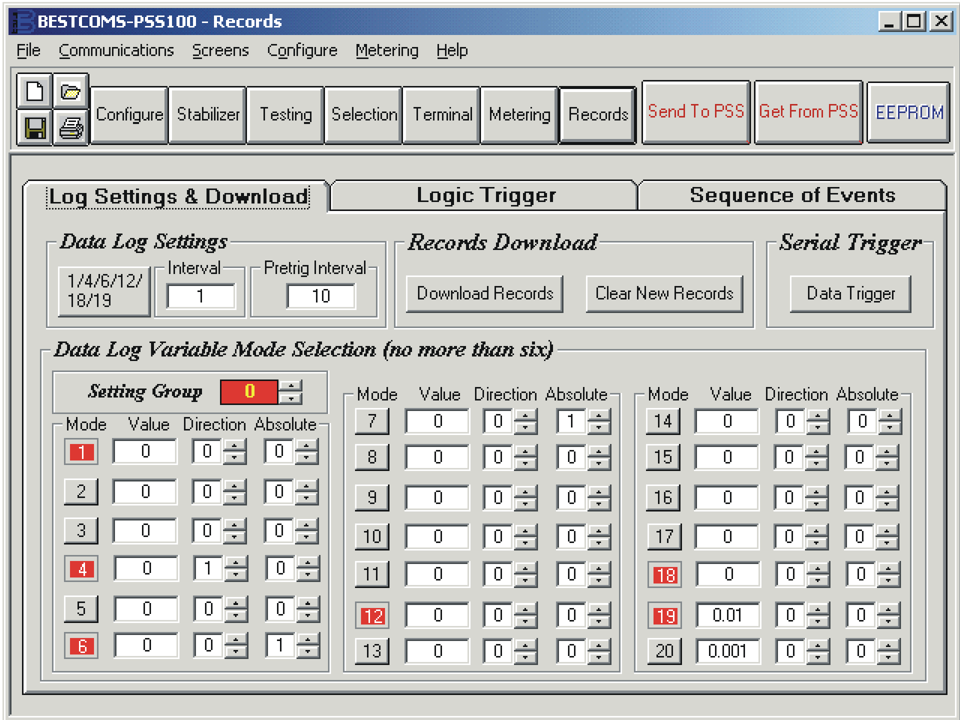

Figure 5-19. Records Screen, Log Settings & Download Tab

Data Log Settings

Up to six variables can be logged in a record. The sampling interval can be set in multiples of half-cycles of the power system frequency. Variables are logged for 600 sampling intervals. Up to 599 pre-trigger data points can be included in a record and at least one post-trigger data point will be recorded. A data record may be terminated before it is full by trigger logic, as described later.

Once a data record is completed, the PSS-100 will start on the next data record immediately, recording the data in a circular buffer in preparation for saving the pre-trigger data. If the next trigger occurs too soon before the correct number of pre-trigger data points have been recorded, then only as many pre-trigger data points will be recorded as are available.

Data Log Variable Selection

This area of the Log Settings & Download tab contains a list of 20 parameters available for inclusion in a data record. No more than six parameters can be included for logging in a data record. A parameter is selected by clicking the corresponding Mode button. A description of the Mode button parameter is given when the mouse pointer is placed over the button. When selected, the Mode button changes from gray to red. Table 5-3 lists the parameter associated with each Mode button and the setting range of the value field for each parameter. All setting range values are expressed as per-unit values.

Table 5-3. Mode Button Parameter Descriptions

Mode Button	Parameter	Value Range
1	3-phase watts	–2.0000 to +2.0000 (0 disables)
2	3-phase vars	–2.0000 to +2.0000 (0 disables)
3	Power factor	–1.0000 to +1.0000 (0 disables)
4	Generator terminal voltage	–2.0000 to +2.0000 (0 disables)
5	Generator terminal current	–2.0000 to +2.0000 (0 disables)
6	Generator terminal frequency deviation	–1.0000 to +1.0000 (0 disables)
7	Compensated generator terminal frequency deviation	–1.0000 to +1.0000 (0 disables)
8	Positive sequence voltage magnitude	–2.0000 to +2.0000 (0 disables)
9	Positive sequence current magnitude	–2.0000 to +2.0000 (0 disables)
10	Negative sequence voltage magnitude	–2.0000 to +2.0000 (0 disables)
11	Negative sequence current magnitude	–2.0000 to +2.0000 (0 disables)

Mode Button	Parameter	Value Range
12	Auxiliary input magnitude	–2.0000 to +2.0000 (0 disables)
13	Washed-out speed	–2.0000 to +2.0000 (0 disables)
14	Washed-out power	–2.0000 to +2.0000 (0 disables)
15	Mechanical power low-pass filter	–2.0000 to +2.0000 (0 disables)
16	Synthesized speed	–2.0000 to +2.0000 (0 disables)
17	PSS preliminary output	–2.0000 to +2.0000 (0 disables)
18	PSS post limit output	–2.0000 to +2.0000 (0 disables)
19	PSS output	–2.0000 to +2.0000 (0 disables)
20	PSS test output	–2.0000 to +2.0000 (0 disables)

Direction. This setting defines a variable value's direction of crossing that will trigger a data record. A setting of 0 (up) or 1 (down) may be entered. A setting of 0 means that a data record will be triggered if the variable value crosses from below the setting to above the setting.

Absolute. This setting establishes the actual or absolute value of the trigger level value. A setting of 0 (actual) or 1 (absolute) may be entered. For a setting of 0, the variable value and the setting value will be compared as programmed to generate a data record trigger. For a setting of 1, the absolute value of the variable will be compared with the programmed setting to generate the trigger. This enables data record triggers by variables that are nominally zero, but could jump too high in either direction.

Download Records

The Download Records button of the Log Settings & Download tab is used to initiate the download of a data record. Clicking the Download Records button opens the Download Comtrade Files dialog box shown in Figure 5-20. This box lists the records available for down-loading. Either "all records" or "new records" can be selected for viewing. To download a data file, perform the following steps.

1. From the file list displayed in the Download Comtrade Files dialog box (Figure 5-20), select the desired file type for downloading (either Comtrade or Log).
2. Highlight the desired file in the file list and click the **OK** button. The Save As dialog box (Figure 5-21) appears.
3. Enter a file name and select the location where the file will be saved. Click the **Save** button. The Download Status dialog box (Figure 5-22) appears and indicates the progress of the file saving process. When the download process is complete, click the **Close** button.

Clicking the Clear New Records button clears the new records displayed by transferring the new records to the All Records category of the Download Comtrade Files dialog box.

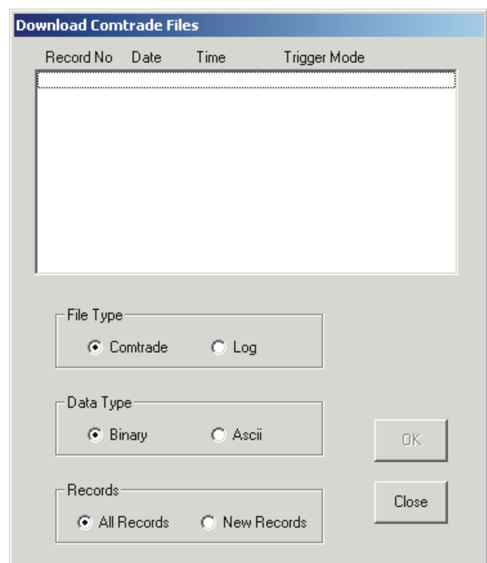

Figure 5-20. Download Comtrade Files Dialog Box

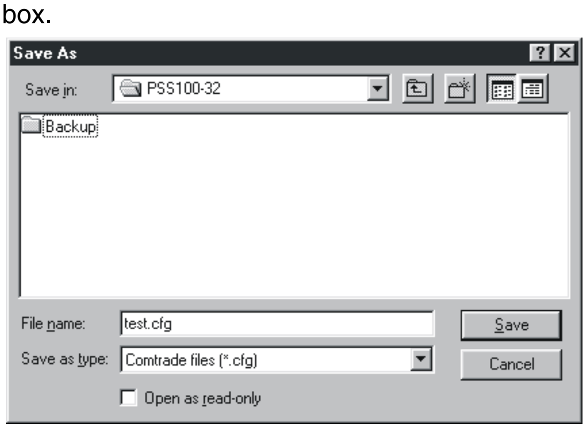

Figure 5-21. Save As Dialog Box

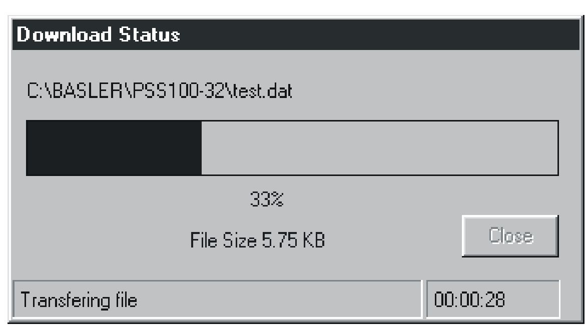

Figure 5-22. Download Status Dialog Box

Serial Trigger
Clicking the Data Trigger button manually triggers a new data record.

Logic Trigger

The settings of the Logic Trigger tab are shown in Figure 5-23 and described in the following paragraphs.

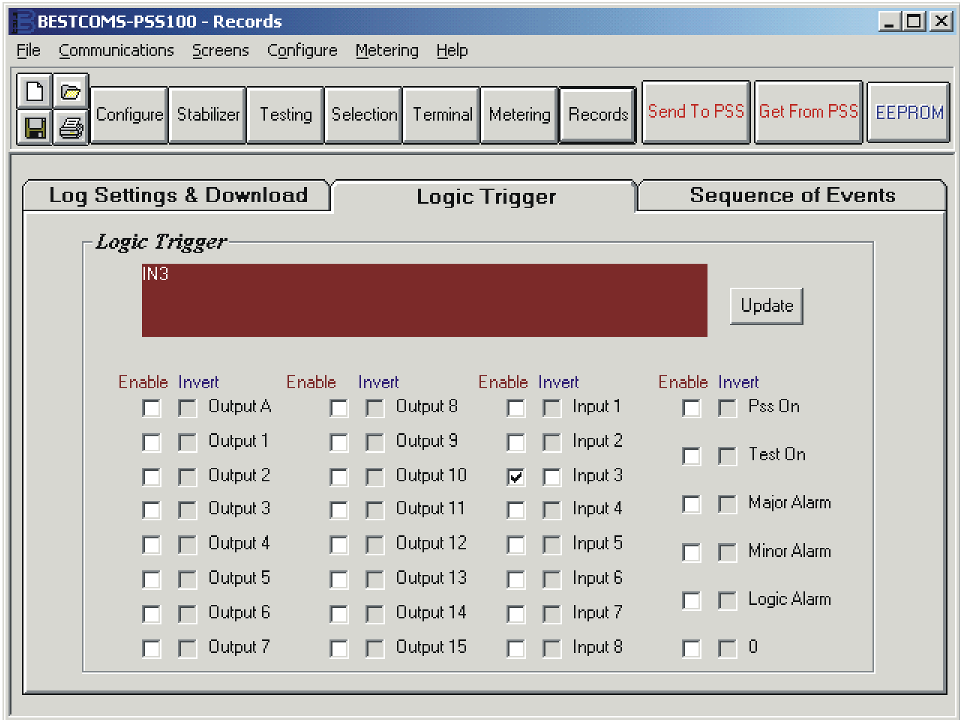

Figure 5-23. Records Screen, Logic Trigger Tab

The Logic Trigger tab consists of three components that are used when creating a logic trigger equation: logic element checkboxes, an equation window, and an Update button.

Logic Element Checkboxes. Elements are ORed together in a logic trigger equation by clicking in the Enable checkbox of the desired elements. Checked elements appear as an ORed equation in the logic trigger window. An element can be inverted by clicking the Enable checkbox and the Invert checkbox. Inverted equation elements are preceded by a NOT symbol (/).

Equation Window. This window displays the ORed element equation that will cause a logic trigger of a data record. A false-to-true transition on this expression triggers a data record. The record terminates when 600 data points are logged or when the trigger logic transitions from true to false. An equation can be entered directly by typing in the window.

Update Button. Clicking this button updates the equation displayed in the equation window, the logic element checkboxes, and the logic trigger equation in PSS-100 memory.

Sequence of Events

A sequence of events report is very useful in reconstructing the exact sequence and timing of events during a power disturbance or even normal system operations. The internal and external status of the PSS-100 is monitored to provide the functionality of a 127 point sequence of events recorder (SER). The SER time-tags all changes of state that occur during each scan to one millisecond resolution and stores the last 127 changes in volatile memory. Data points are scanned every half-cycle. If the SER memory is full, then the latest acquired record replaces the oldest one.

A sequence of events record is logged if one of the following events occur.

- OUTPUT – any contact output changes state
- INPUT – any contact sensing input changes state
- LOGIC – any BESTlogic bit changes state
- GROUP – any change in the active settings group occurred
- SETTINGS CHANGE – the EXIT with SAVE command was entered
- ALARMS – any alarm is set or cleared

In an SER report, columns are provided for the time stamp, the name of the monitored point, and the name of the state that it changed to. A list of all possible events is shown in Appendix C, *Sequence of Events Summary*.

The Sequence of Events tab is shown in Figure 5-24 and described in the following paragraphs.

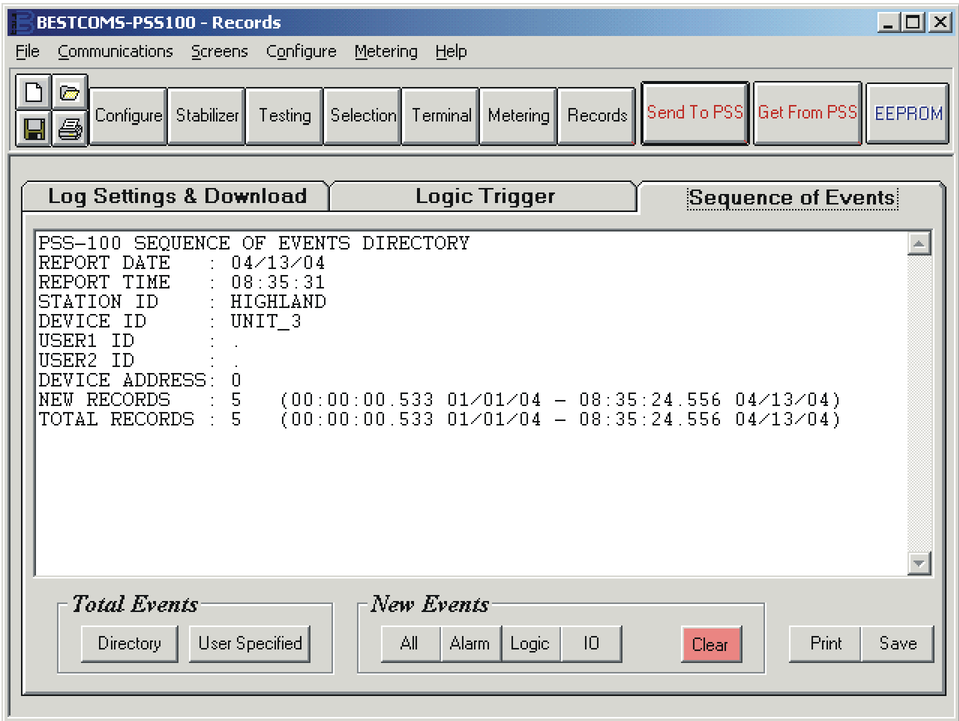

Figure 5-24. Records Screen, Sequence of Events Tab

When the Sequence of Events tab is selected, BESTCOMS retrieves unit information and sequence of events information from the PSS-100.

Total Events – Directory. Clicking the Directory button displays all available data records, user-defined identification information for the PSS-100, and the date and time of the directory inquiry.

Total Events – User Specified. Clicking the User Specified button displays the dialog box of Figure 5-25. The number (quantity) of the most recent records can be entered for display in the sequence of events window. The selected records are then displayed with a brief description, status, and the date and time of occurrence.

Figure 5-25. Event Record Selection Box

New Events – All Button. Clicking the All button displays all new events with their point description, status, and date and time.

New Events – Alarm Button. Clicking the Alarm button displays the new events that were triggered by an alarm.

New Events – Logic Button. Clicking this button displays the new events triggered by logic.

New Events – IO Button. Clicking this button displays the new events triggered by an input or output change.

Clear Button. Clicking this button erases all new records by placing them into the All Records category.

Print Button. Information displayed in the sequence of events window can be printed by clicking this button.

Save Button. The information displayed in the sequence of events window can be saved by clicking this button.

PASSWORD PROTECTION

Password protection guards against unauthorized changing of PSS-100 settings. A global password protects all PSS-100 settings. If desired, a limited-access setting password can be implemented. The PSS-100 is delivered with a default, global password of *pss*. Once the passwords are changed, they should be stored in a secure location.

Changing the Passwords

A new password can be programmed, through BESTCOMS, by performing the following steps.

NOTE

A password change can be made only after communication between BESTCOMS and the PSS-100 is established.

1. Click **Communications** on the menu bar and click **Password Change** on the drop-down menu. The Changing a Password dialog box of Figure 5-26 appears.
2. Select either Global Password or Setting Password and type the new password in the appropriate field. Each field will accept a maximum of eight alphanumeric characters.
3. Click the **Change** button to enable the new password.

Figure 5-26. Changing a Password Dialog Box

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SECTION 6 • BESTCOMS SOFTWARE

INTRODUCTION

BESTCOMS software provides a communication link between the PSS-100 and the PC user. It provides a user-friendly environment for changing PSS-100 settings and provides real-time metering of system parameters. Within BESTCOMS, PSS-100 settings can be saved in a computer file, edited, and then uploaded back into the PSS-100.

INSTALLATION

BESTCOMS operates with IBM-compatible personal computers (PCs) using Microsoft® Windows® 95 or later operating systems. The minimum recommended operating requirements are listed below.

- IBM-compatible PC, 486DX2 or faster (100 MHz or higher microprocessor is recommended)
- CD-ROM drive
- One available serial port

Installing BESTCOMS

BESTCOMS software contains a setup utility that installs the program on your PC. An uninstall utility, loaded with the program, can be used to remove BESTCOMS from your PC is desired. Use the following procedure to install BESTCOMS.

1. Insert the PSS-100 CD-ROM into your PC CD-ROM drive.
2. When the PSS-100 Setup and Documentation CD Menu appears, click the Install button for the BESTCOMS PC Program. The BESTCOMS setup utility automatically installs the BESTCOMS software.

When BESTCOMS is installed, a Basler Electric folder is added to the Windows® program menu. This folder is accessed by clicking the Start button and pointing to Programs. The Basler Electric folder contains icons for the BESTCOMS program and a utility to remove BESTCOMS.

Connecting the PSS-100 and PC

Connect a communication cable between the front RS-232 connector (Com 0) and the appropriate communication port of the PC. Refer to Figure 8-12 for the required connections between the PSS-100 and a PC.

STARTING BESTCOMS

BESTCOMS is started by clicking the Windows® Start button, pointing to Programs, the Basler Electric folder, and then clicking the BESTCOMS icon. At startup, a dialog box with the program title and version number is displayed briefly (Figure 6-1). After this dialog box appears, the System Configuration screen is displayed.

Figure 6-1.BESTCOMS Title and Version

Configuring Communication

Click Communications on the menu bar and click Port Configuration. The Communication Port Settings dialog box appears (not shown here). This dialog box allows selection of any of the three PSS-100 communication ports and contains setting fields for baud rate, parity, number of data bits, number of stop bits, and Modbus™ parameters when the desired communication port has been configured, click the OK button to save the settings.

Establishing Communication

Communication between BESTCOMS and the PSS-100 must be established before viewing metering values or reading or changing settings.

Open the PSS-100 communication port by clicking **Communications** on the menu bar, hovering the mouse pointer over **Open**, and clicking **Front Port – RS-232**. Figure 6-2 illustrates the menu selections for opening the PSS-100 communication port.

When **Front Port – RS-232** is selected, the Comm Port screen of Figure 6-3 appears. Select Comm1, Comm 2, Comm 3, or Comm 4 as the active communication port on your PC and click the Initialize button. BESTCOMS initiates communication by obtaining the configuration settings from the PSS-100.

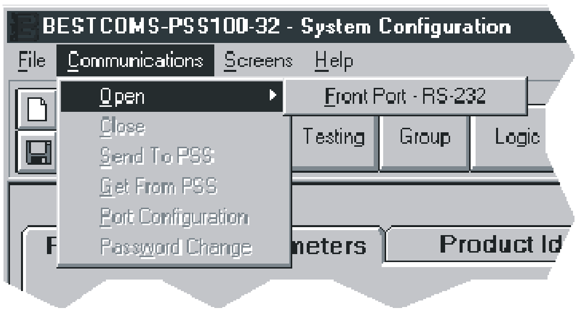

Figure 6-2. Communication Port Menu Selection

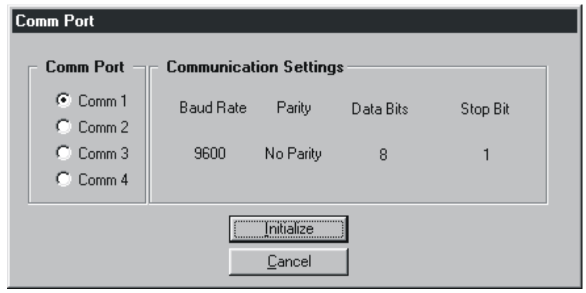

Figure 6-3. Communication Initiation Screen

NOTE

BESTCOMS may display the dialog box of Figure 6-4 when initiating PSS-100 communication, obtaining PSS-100 configuration settings, or performing other tasks. It's important to wait until the box disappears before trying to execute communication commands. Issuing commands while the Wait dialog box is present may disrupt communication between BESTCOMS and the PSS-100.

Figure 6-4. Wait Dialog Box

CHANGING SETTINGS

Settings are arranged in six groups.

- System Configuration
- Stabilizer and Control
- Testing
- Setting Group Alarm and Output Selection
- Metering and Alarm/Status Parameters
- Data Records and Reports

In BESTCOMS, each setting group has a corresponding button that can be clicked to access that group of settings. The six setting groups can also be accessed by clicking Screens on the menu bar and then selecting the desired setting group from the list. Once a setting group is accessed, the individual settings of the group can be viewed and changed.

A setting is changed in BESTCOMS by clicking within the setting field and typing the new setting. The range limits of a setting can be viewed by double-clicking the setting. Setting changes are saved to the PSS-100 by pressing the PC's Enter key or clicking the **Send To PSS** button. This button is located to the right of the six setting group buttons.

When the PC's Enter key is pressed or the Send To PSS button is clicked to save the first setting change, the Password Entry box (Figure 6-5) appears. The correct password must be entered before PSS-100 settings can be changed. All PSS-100 stabilizers are delivered with *pss* as the password. Subsequent setting changes do not require password entry.

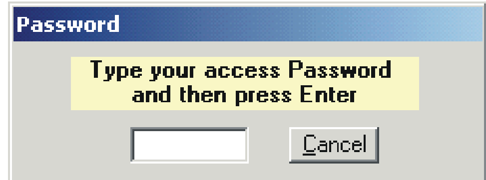

Figure 6-5. Password Entry Box

SENDING AND RECEIVING SETTINGS

When communication between BESTCOMS and the PSS-100 is active, settings can be sent to or received from the PSS-100.

Sending Settings

To send data to the PSS-100, click **Communications** on the menu bar and select **Send To PSS** or press the PC's Enter key. Settings displayed on the current setting screen become the active PSS-100 settings. Clicking the **Send To PSS** button also sends the data to the PSS-100.

Receiving Settings

To retrieve data from the PSS-100, click **Communications** on the menu bar and select **Get From PSS**. Settings previously saved to the PSS-100 are displayed on the setting screens. Clicking the **Get From PSS** button also retrieves the data from the PSS-100.

Saving Setting Changes to Nonvolatile Memory

Default settings are saved in the PSS-100's electronically-erasable, programmable, read-only memory (EEPROM). In the event of a power loss, these are the active settings at power-up. If setting changes are sent to the PSS-100 but not to EEPROM, the changed settings are lost if operating power is lost.

Settings can be saved to EEPROM in two different ways. When communication with the PSS-100 is closed, BESTCOMS asks if you want to save settings to EEPROM. This question is asked even if no changes are made. During active communication with the PSS-100, the EEPROM button can be clicked to save the settings.

TERMINATING COMMUNICATION

PSS-100 communication is terminated through BESTCOMS by clicking on **Communications** on the menu bar and clicking Close. A dialog box appears and confirms that communication with the PSS-100 has been terminated.

Closing communication while viewing the metering and Alarm/Status screen requires that metering be disabled before terminating communication. Click **Metering** on the menu bar and click **Disable Metering**. Then, proceed to terminate communication as described above.

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SECTION 7 • TESTING

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SECTION 7 • TESTING

INTRODUCTION

Stabilizer testing is valuable because it can identify problems with the exciter and generator or system models. Unanticipated interactions with other excitation controls can also be revealed through testing. By simulating disturbances, appropriate stabilizer settings that improve the damping of the electromechanical modes can be established.

PSS-100 TEST FEATURES

PSS-100 testing features are accessed through the BESTCOMS Testing Parameters screen (Figure 7-1) and described in the following paragraphs.

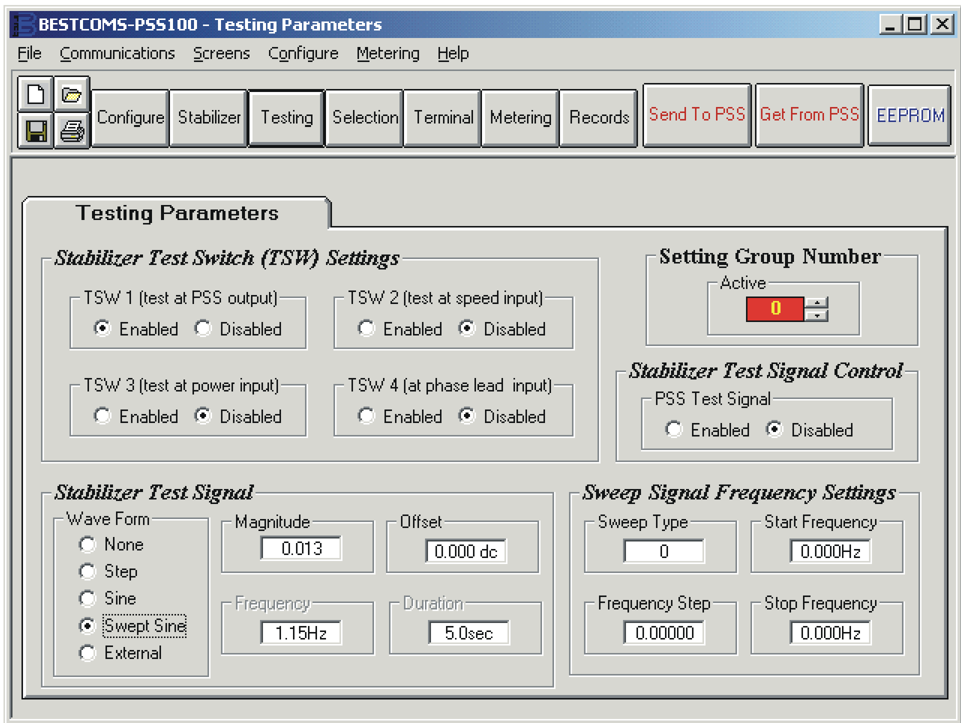

Figure 7-1. Testing Parameters Screen

Stabilizer Test Switch Settings

Either self-generated or external test signals can be injected at different points within the stabilizer transfer function. Test signal application points are listed below and illustrated in Figure 7-2.

- Stabilizer output
- Speed input
- Power input
- Phase compensation stage input

The stabilizer test switch settings are described in the following paragraphs. For meaningful results, only one switch should be enabled at a time.

Stabilizer Test Switch 1 (TSW 1). This setting enables and disables test switch 1. When enabled, TSW 1 applies the test signal at the stabilizer output.

Stabilizer Test Switch 2 (TSW 2). This setting enables and disables test switch 2. When enabled, TSW 2 applies the test signal at the speed input.

Stabilizer Test Switch 3 (TSW 3). This setting enables and disables test switch 3. When enabled, TSW 3 applies the test signal at the power input.

Stabilizer Test Switch 4 (TSW 4). This setting enables and disables test switch 4. When enabled, TSW4 applies the test signal at the phase compensation stage input.

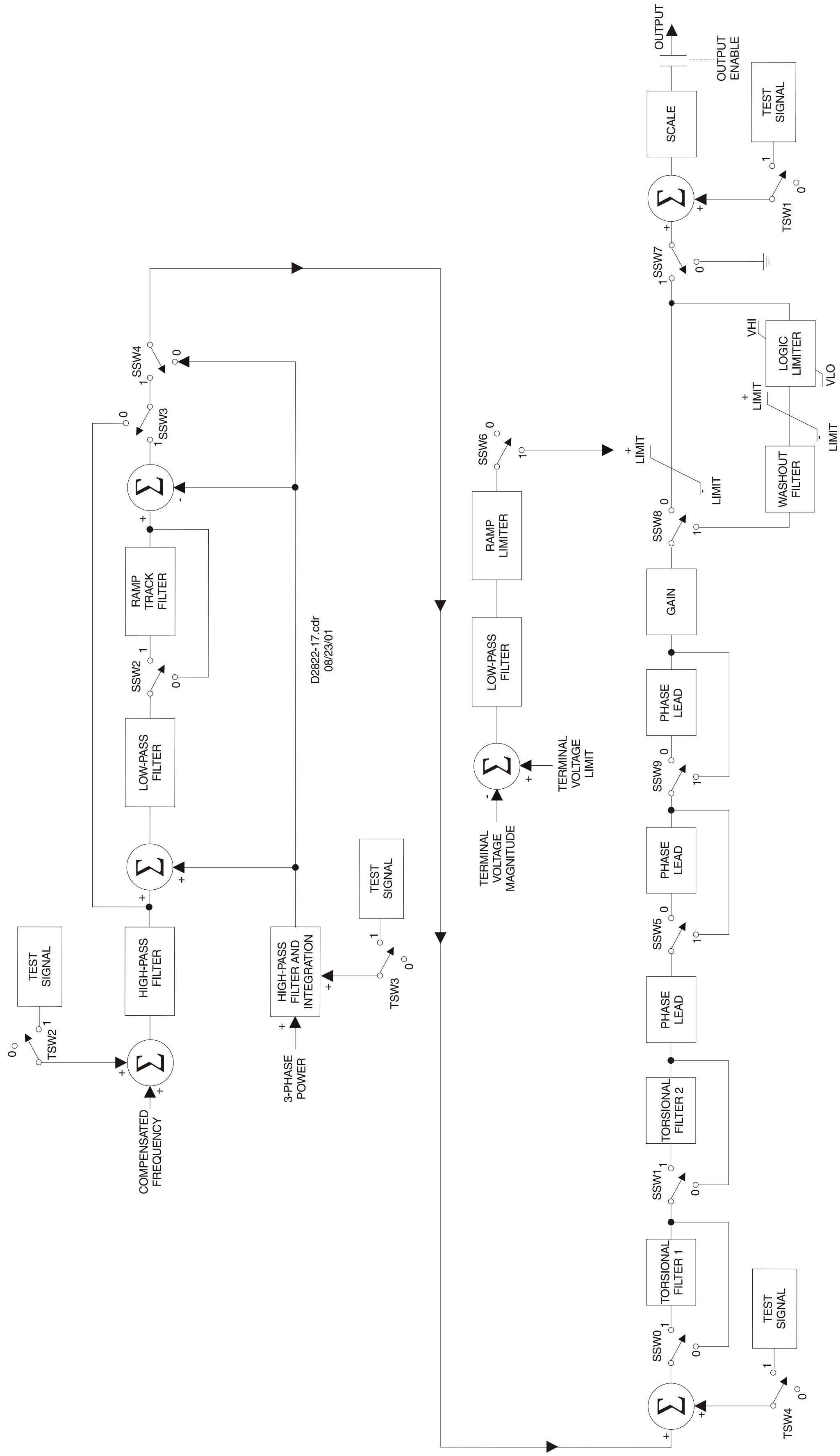

Figure 7-2. Test Signal Application Points

Stabilizer Test Signal Control

Test signals are switched on and off by the stabilizer test signal control setting. This setting is enabled only when the active setting group is selected in the Setting Group Number – Active field.

Stabilizer Test Signals

Four types of test signals are possible: step change, sinusoid, swept sinusoid, and auxiliary (external). Test signal type is selected through the Wave Form setting.

Wave Form. This setting is used to disable the internal test signal or select any one of four test signal types: step, sine, swept sine, or external.

Test signal characteristics (magnitude, offset, frequency, and duration) can be adjusted according to the type of test signal selected.

Magnitude. This setting adjusts the magnitude (excludes gain for external signal) of the stabilizer test signal. The magnitude has a setting range of –10.000 to +10.000. When the selected waveform type is None, this setting is disabled.

Offset. This setting adjusts the dc offset of the stabilizer test signal. The offset can be adjusted over the range of –10.000 to +10.000. When the selected waveform type is None or Step, this setting is disabled.

Test signal magnitude and offset are set in per-unit values and are used in proper context wherever they are applied. For example, magnitude and offset added at test switch 1 are interpreted as per-unit terminal voltage reference. When added at test switches 2 and 4, they are interpreted as per-unit frequency/speed. If added at test switch 3, they are interpreted as per-unit power.

Frequency. This setting adjusts the frequency of the stabilizer test signal. The frequency can be adjusted over a range of 0.000 to 20.000 hertz. When the selected waveform type is None, Swept Sine, or External, this setting is disabled.

Duration. This setting adjusts the duration of the test signal. For sine and external test signals, this is the total test duration. For step test signals, this is the “on” period of the step signal. The duration can be adjusted over a range of 0 to 49,999.0 seconds. When the selected waveform type is None or Swept Sine, this setting is disabled.

Table 7-1 summarizes the test signal characteristics that can be adjusted for each test waveform type.

Table 7-1. Test Signal Characteristics Summary

Waveform Type	Magnitude	Offset	Frequency	Duration
None				
Step	●		●	●
Sine	●	●	●	●
Swept Sine	●	●	●*	
External	●	●		●

* Swept sine waveform type uses sweep signal frequency settings.

<u>*Sweep Signal Frequency Settings*</u>

When the selected test waveform type is Swept Sine, test signal frequency is adjusted using the Sweep Signal Frequency settings.

Sweep Type. A linear sweep type is selected by entering a 0 and a logarithmic sweep type is selected by entering a 1.

Start Frequency. The starting frequency for the swept sine test signal is selected with this setting. The start frequency has a setting range of 0.000 to 20.000 hertz.

Frequency Step. The frequency step for the swept sine test signal is selected with this setting. For linear sweeps, the test signal frequency is incremented by “step” every half-cycle of the system frequency. For logarithmic sweeps, the test signal frequency is multiplied by 1.0 + step every half-cycle of the system frequency. The frequency step has a setting range of 0.000 to 1.00000000.

Stop Frequency. The end frequency for the swept sine test signal is selected with this setting. The stop frequency has a setting range of 0.000 to 20.000 hertz.

RECOMMENDED TESTING

The following paragraphs describe desired tests to evaluate and confirm stabilizer operation in your system.

Closed-Loop Voltage Regulator Response Measurements

Proper operation of the automatic voltage regulator (AVR) and exciter are critical to the performance of the stabilizer. Step response measurements of the voltage regulator should be performed to confirm the AVR gain and other critical parameters. A transfer function measurement between terminal voltage reference and terminal voltage should be performed with the unit operating at very low load. This test provides an indirect measurement of the PSS-100 phase requirement. As long as the unit is operating at very low load, the terminal voltage modulation does not produce significant speed and power changes.

Input Signal Measurements

Tests should be performed at various load levels to confirm that the input signals are calculated or measured correctly. Since the PSS-100 uses compensated terminal frequency in place of speed, the derived mechanical power signal should be examined carefully to ensure that it does not contain any components at the electromechanical oscillation frequencies. If such components are present, it indicates that the frequency compensation is less than ideal, or that the unit inertia value is not correct.

Stabilizer Step Response Measurements

A standard technique for verifying overall system response is through step response measurements. This involves exciting the local electromechanical oscillation modes through a fixed step change in the AVR reference. Damping ratio and frequency of oscillation can be measured directly from recordings of generator speed and power for different operating conditions and settings. Normally this test is performed with variations of the following:

- Generator active and reactive power loading
- Stabilizer gain
- System configuration (e.g., lines out of service)
- Stabilizer parameters (e.g., phase lead, frequency compensation)

As the stabilizer gain is increased, the damping should increase continuously while the natural frequency of oscillation should remain relatively constant. Large changes in the frequency of oscillation, a lack of improvement in damping, or the emergence of new modes of oscillation are all indications of problems with the selected settings.

Large Disturbance Measurements

Depending on the location, tests may be performed to measure the response of the system to large disturbances. These disturbances can include line switching, load rejection, or generation run-back. For example, on hydroelectric units, high mechanical power rates of change (in excess of 20 percent per second) may be possible. This requires an examination of the terminal voltage excursion that can be caused in dual-input stabilizers that band limit the mechanical power signal.

Disturbance Recording

The PSS-100 is equipped with a powerful data recorder that can capture up to six quantities. Some of these quantities include terminal voltage, field voltage, active power, reactive power, speed, generator current, and stabilizer output. The recorder can be set to trigger automatically on 20 different calculated trigger sources and store up to 12 records of captured data. This feature allows the user to obtain direct recordings of actual system disturbances for comparison with simulated responses. This can be very important since it may not be possible to configure the system to perform staged tests of worst-case configurations and contingencies.

TYPICAL TEST PROCEDURE

A typical test procedure consists of the following steps.

1. Select the test parameters.
2. Enter the serial commands.
3. Perform the tests.
4. Download and review the test data.

The following paragraphs list the detailed steps of a suggested test procedure. These steps can be modified according to your specific requirements.

1. Select the test signal type and the parameters associated with the test signal. If an external test signal is selected, then the test signal generator should be connected to the test input of the PSS-100 (terminals B7 (+) and B8 (–)). Select the desired test signal waveform on the BESTCOMS Testing Parameters screen.
2. Select the location to apply the test signal using Figure 7-2 as a guide. Enable the appropriate test switch (TSW 1, TSW 2, TSW 3, or TSW 4) through the test switch settings of the BESTCOMS Testing Parameters screen.
3. Select the data points to be logged using Table 5-3 as a guide. Enter the data points on the Log Settings & Download tab of the Records screen.
4. Select the duration of the test and calculate the frequency for the data points to be recorded. Enter the number of half-cycles as the interval parameter on the Log Settings & Download tab of the Records screen.
5. Select the mechanism to trigger the data log. An input contact can be assigned to trigger a data log on the Logic Trigger tab of the Records screen.
6. Perform the test. Use the stabilizer test signal control setting of the Testing Parameters screen to enable and disable the test signal.
7. After testing is complete, download and view the data log from the PSS-100 using the record download controls on the Log Settings & Download tab of the Records screen.

TRANSFER FUNCTION TESTING

The following paragraphs describe the necessary steps to configure the PSS-100 for transfer function testing. A suitable means of controlling the contact inputs and monitoring the output contacts is recommended.

Configuration and Setup

1. Make the following operating logic changes to the Output Selection tab settings of the Selection Parameters screen. These changes are illustrated in Figure 7-3.
    a. Enable the PSS-100 standard logic scheme, PSSLOGIC, as the active logic scheme.
    b. Enable the operating logic for the stabilizer output and test functions, configure contact input 1 (IN1) to enable the PSS Control output, and configure contact input 3 (IN3) to enable the Test Control output.
2. Access the Terminal screen and use the ASCII commands shown in Figure 7-4 to configure virtual output 13 (VO13) to turn on when the test signal is enabled. When the Terminal screen is exited to view another screen, the opportunity to save the setting changes will be given.
3. On the Alarm Selection tab of the Selection Parameters screen (Figure 7-5), configure virtual output 13 (VO13), when true, to trigger a minor alarm. Since VO13 turns on when the test signal is enabled, a minor alarm will be triggered when the test signal is enabled.
4. On the Log Settings & Download tab of the Records screen (Figure 7-6), select the data variables to be logged when a data record is created.
    a. Click mode button 1 (three-phase watts), 2 (three-phase vars), 4 (generator terminal voltage), 7 (compensated generator terminal frequency deviation), 14 (washed out power), and 19 (stabilizer output enabled).
    b. Click the Data Log Settings – Data Log Variable button to send the selected data variables to the PSS-100.
    c. Select a logging interval of once every half-cycle by entering a Data Log Settings – Interval setting of 1.
5. View the Logic Trigger tab of the Records screen (Figure 7-7) and clear all of the Enable and Invert checkboxes. Place a checkmark in the Enable box for Input 4. This will cause a data record to be triggered when contact input 4 (IN4) is energized.
6. Connect a low-frequency function generator to PSS-100 Test input terminals B7 (+) and B8 (–).

7. Configure the test signal, as required, by adjusting the Stabilizer Test Signal settings of the Testing Parameters screen.
8. Select where the test signal enters the stabilizer algorithm by using the Stabilizer Test Switch settings of the Testing Parameters screen. Typically, only one of the four switches will be enabled at one time.
9. Apply and remove the test signal by energizing and de-energizing contact sensing input 3 (IN3) or using the Stabilizer Test Signal Control of the Testing Parameters screen.

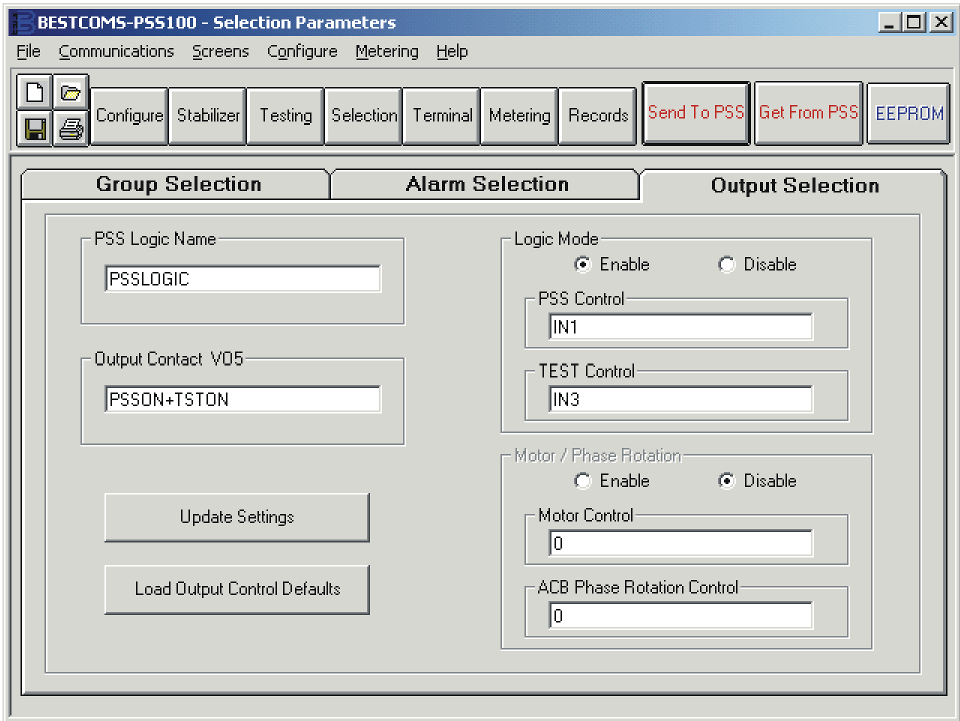

Figure 7-3. Configuration and Setup Settings, Part 1

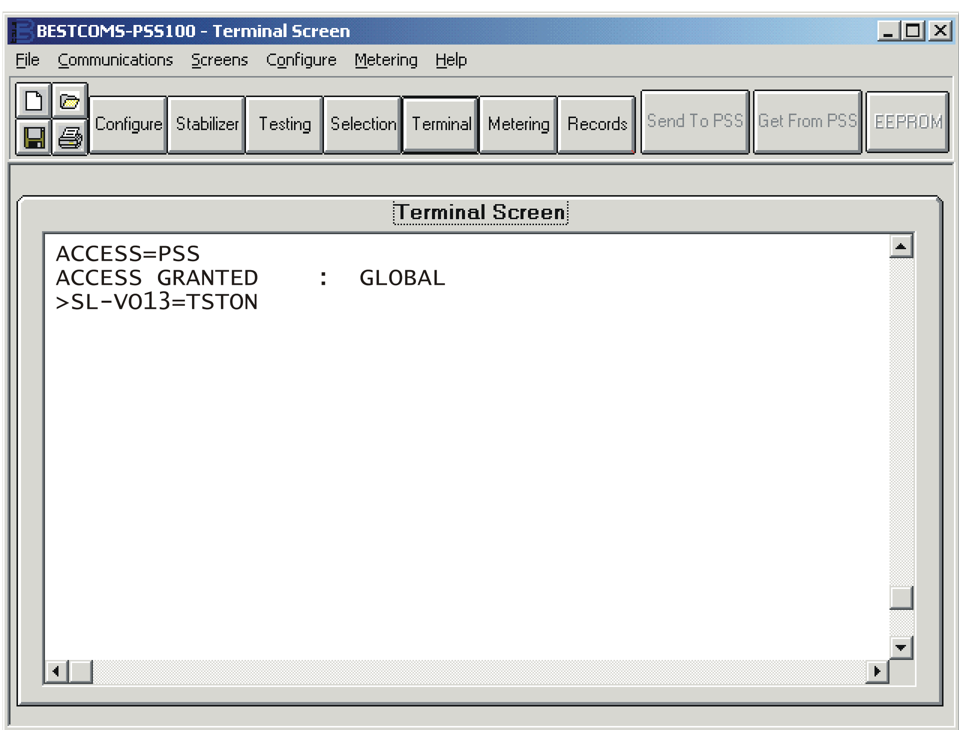

Figure 7-4. Configuration and Setup Settings, Part 2

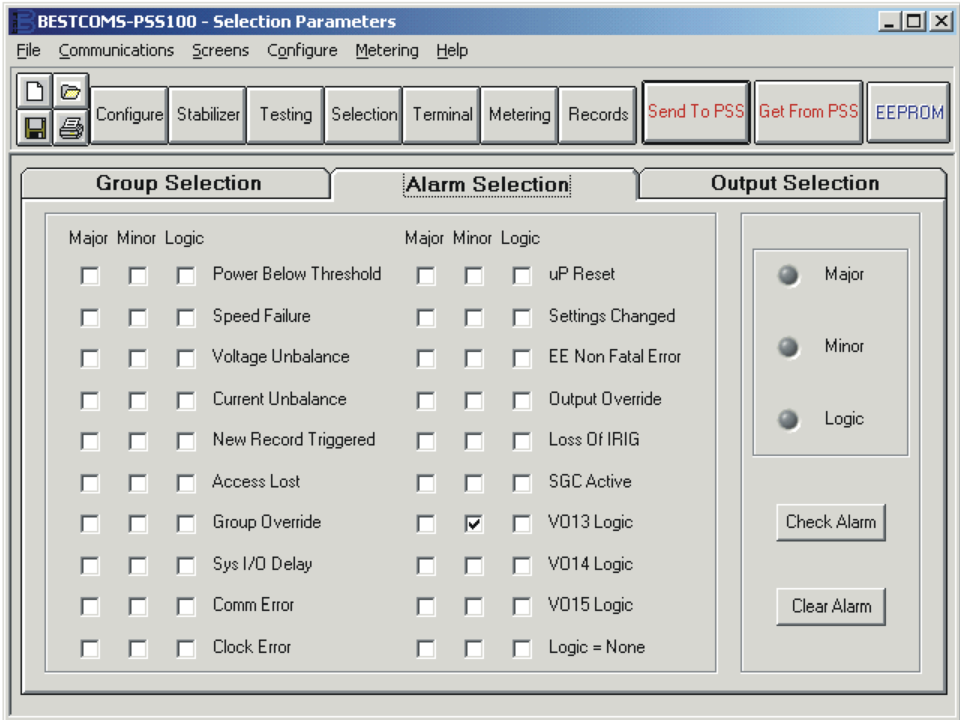

Figure 7-5. Configuration and Setup Settings, Part 3

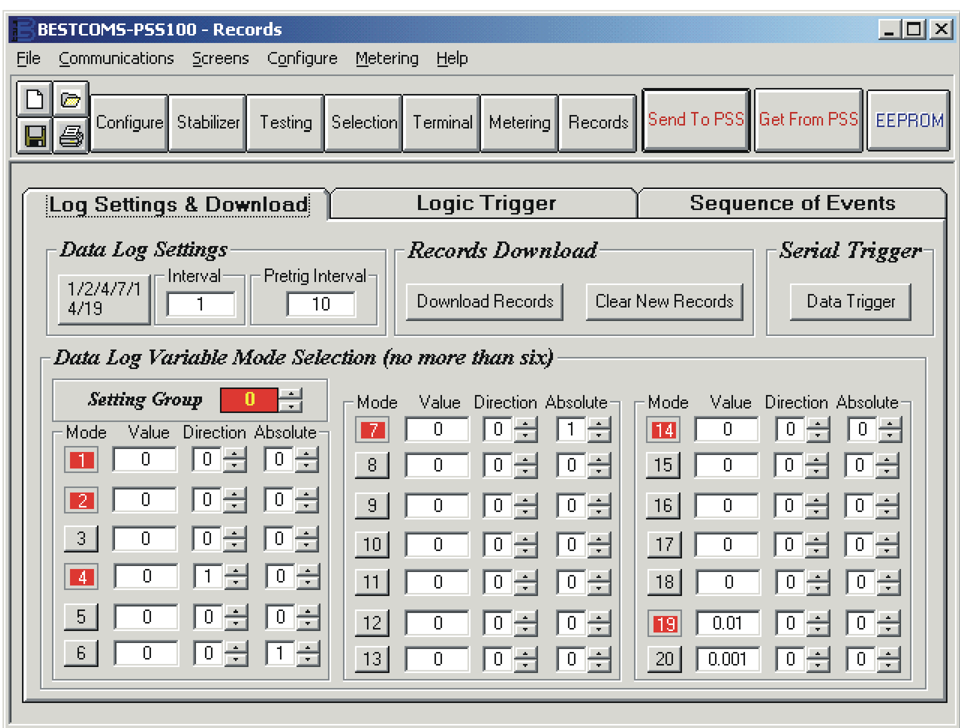

Figure 7-6. Configuration and Setup Settings, Part 4

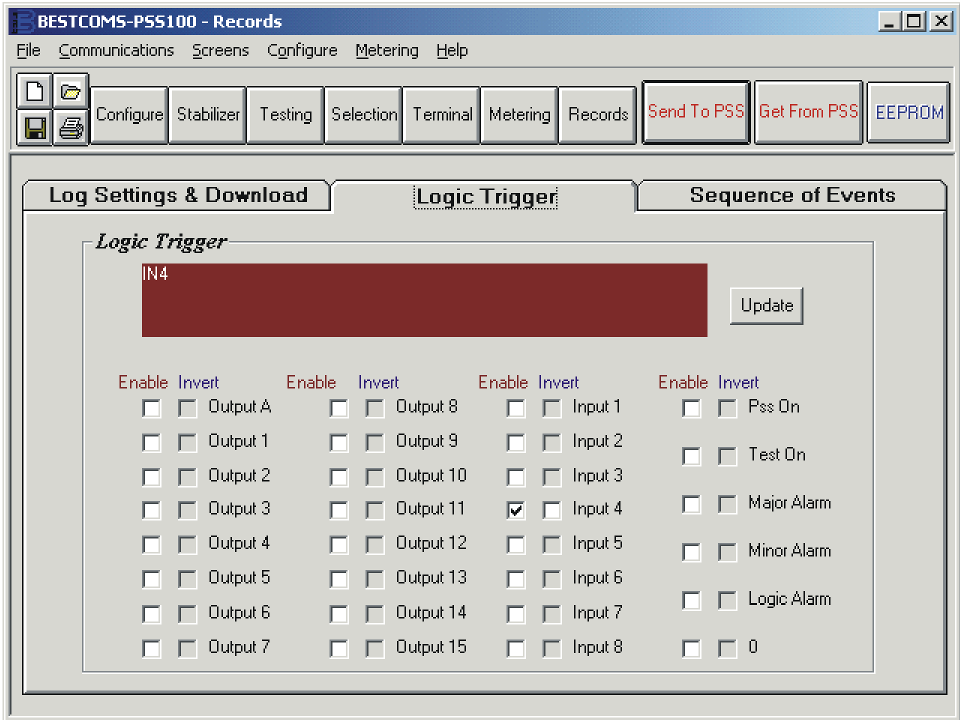

Figure 7-7. Configuration and Setup Settings, Part 5

Output Test

1. On the Testing Parameters screen (Figure 7-8), enable stabilizer test switch 1 (TSW 1) so that the test signal is applied at the stabilizer output. Ensure that all other test switches are disabled. Select External as the stabilizer test signal waveform. Enter a test signal magnitude of 1.0, an offset of 0, and a duration of 999.0 seconds.

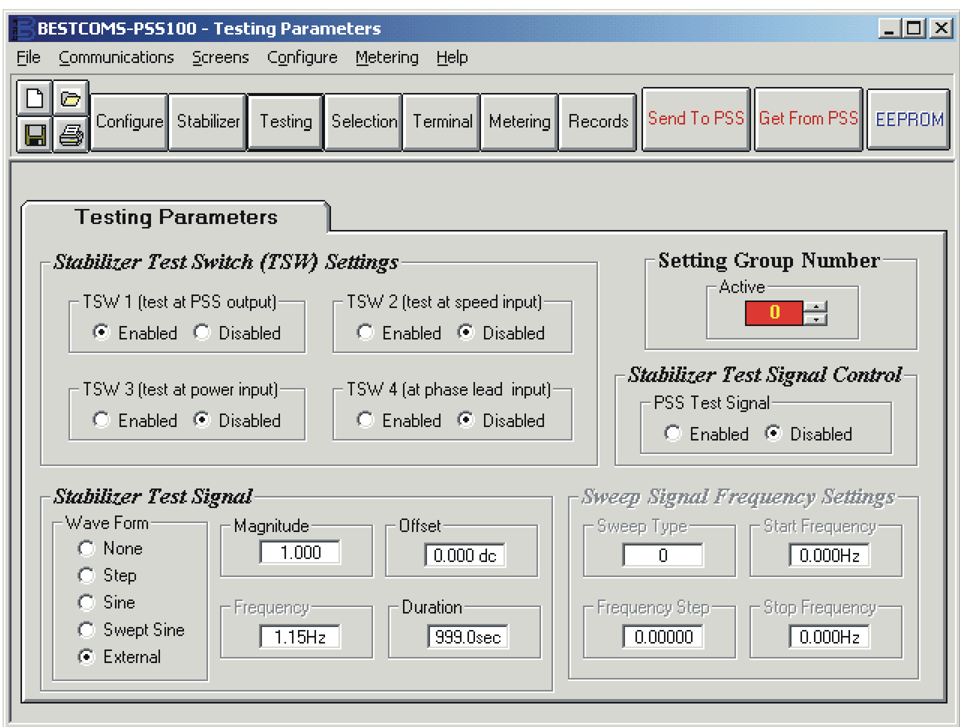

Figure 7-8. Output Test Settings, Part 1

2. On the Stabilizer Control tab of the Stabilizer Parameters screen (Figure 7-9), disable the stabilizer output by turning off software switch 7 (SSW 7).

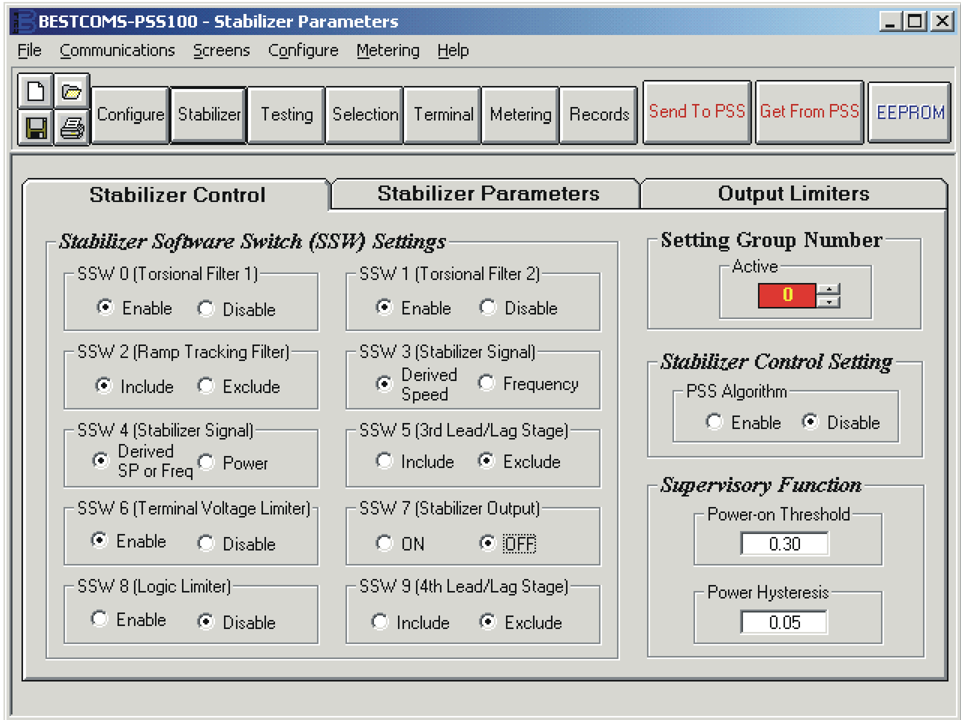

Figure 7-9. Output Test Settings, Part 2

3. On the Output Limiters tab of the Stabilizer Parameters screen (Figure 7-10), enter an output scaling factor of 1.0.

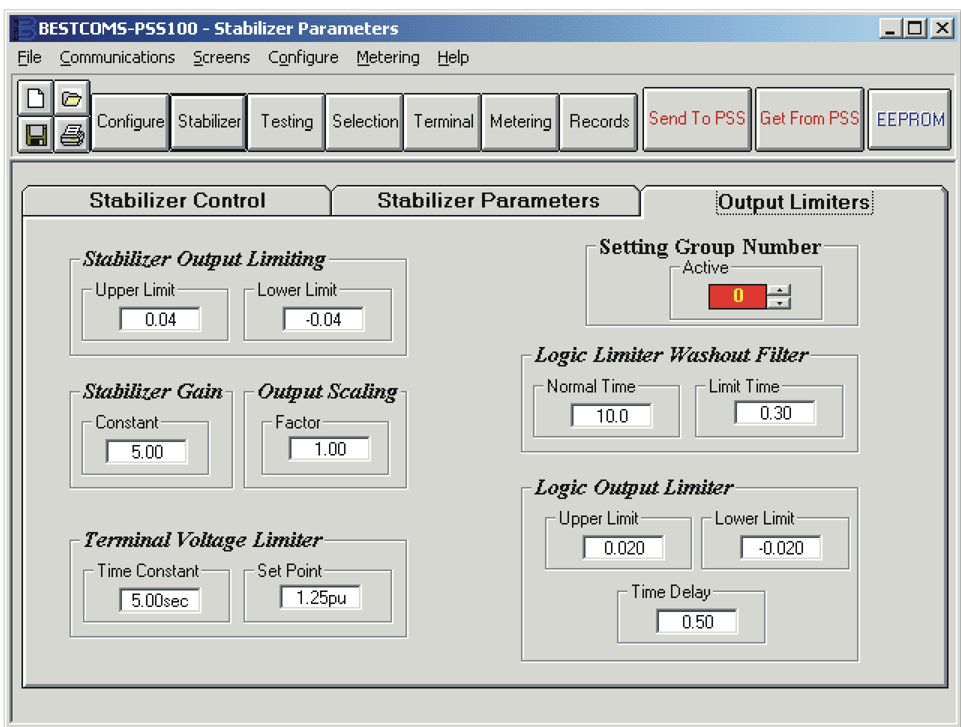

Figure 7-10. Output Test Settings, Part 3

4. Apply the test signal to the PSS-100 Test input and verify that the test signal is reproduced at the PSS-100 output. If needed, the output scaling factor can be modified on the Output Limiters tab of the Stabilizer Parameters screen.

High-Pass Filter Test

1. On the Testing Parameters screen (Figure 7-11), enable stabilizer test switch 2 (TSW 2) so that the test signal is applied at the speed input. Ensure that all other test switches are disabled. Select External as the stabilizer test signal waveform. Enter a test signal magnitude of 1.0, an offset of 0, and a duration of 999.0 seconds.

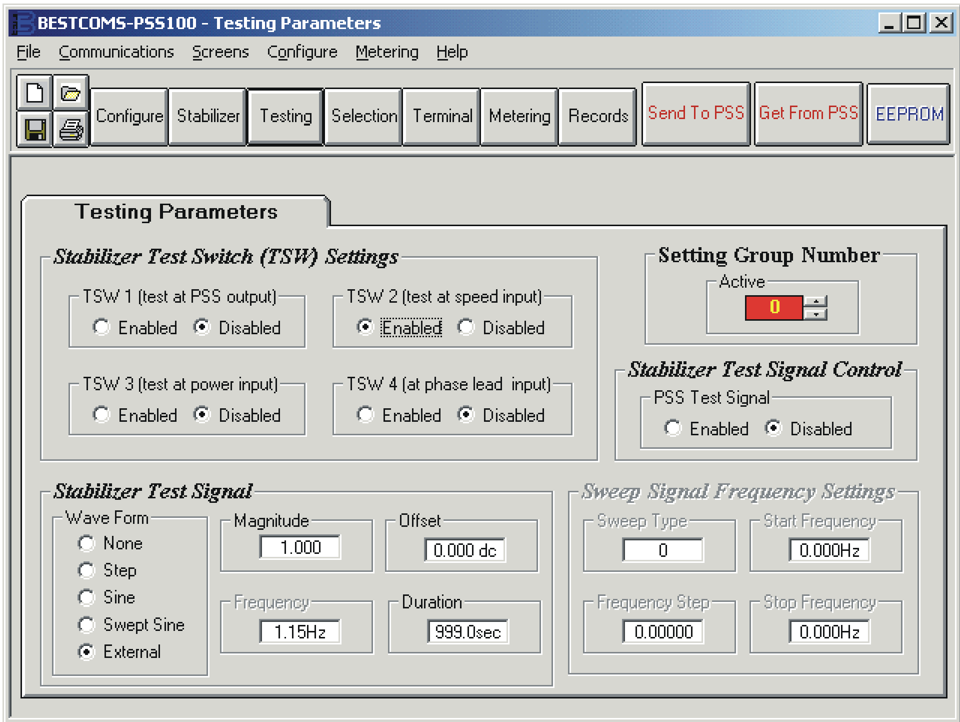

Figure 7-11. High-Pass Filter Test Settings, Part 1

2. On the Stabilizer Control tab of the Stabilizer Parameters screen (Figure 7-12), make the following software switch settings.
   a. Disable torsional filter 1 (SSW 0)
   b. Disable torsional filter 2 (SSW 1)
   c. Exclude the ramp tracking filter (SSW 2)
   d. Select derived speed as the stabilizer signal (SSW 3)
   e. Select derived speed or frequency as the stabilizer signal (SSW 4)
   f. Include the third lead/lag stage of the stabilizer output (SSW 5)
   g. Disable the terminal voltage limiter (SSW 6)
   h. Enable the stabilizer output (SSW 7)
3. On the Output Limiters tab of the Stabilizer Parameters screen (Figure 7-13), enter a stabilizer gain constant of 1.0 and an output scaling factor of 1.0. Set the stabilizer output limiting upper limit at 0.25 and the lower limit at –0.25.
4. On the Stabilizer Parameters tab of the Stabilizer Parameters screen (Figure 7-14), make the following settings changes.
   a. Enter 1.0 for the first, second, and third phase compensation time constants (lead and lag).
   b. Set the first (tw1) and second (tw2) washout (high-pass filtering and integration) time constant settings at 1.0.
5. Apply the test signal and verify the frequency response of the stabilizer output.

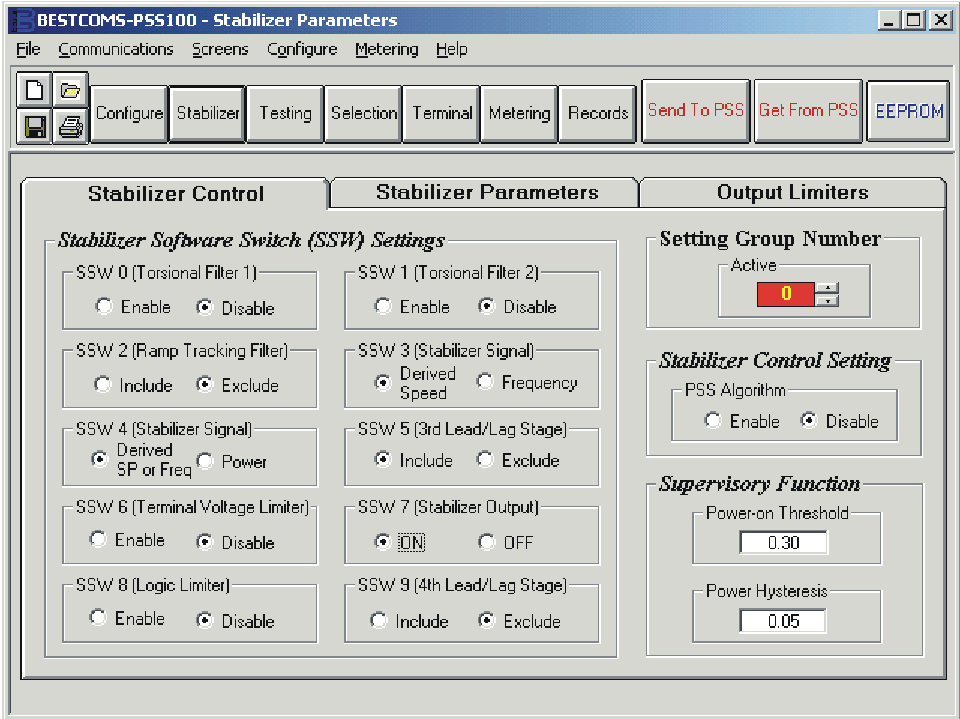

Figure 7-12. High-Pass Filter Test Settings, Part 2

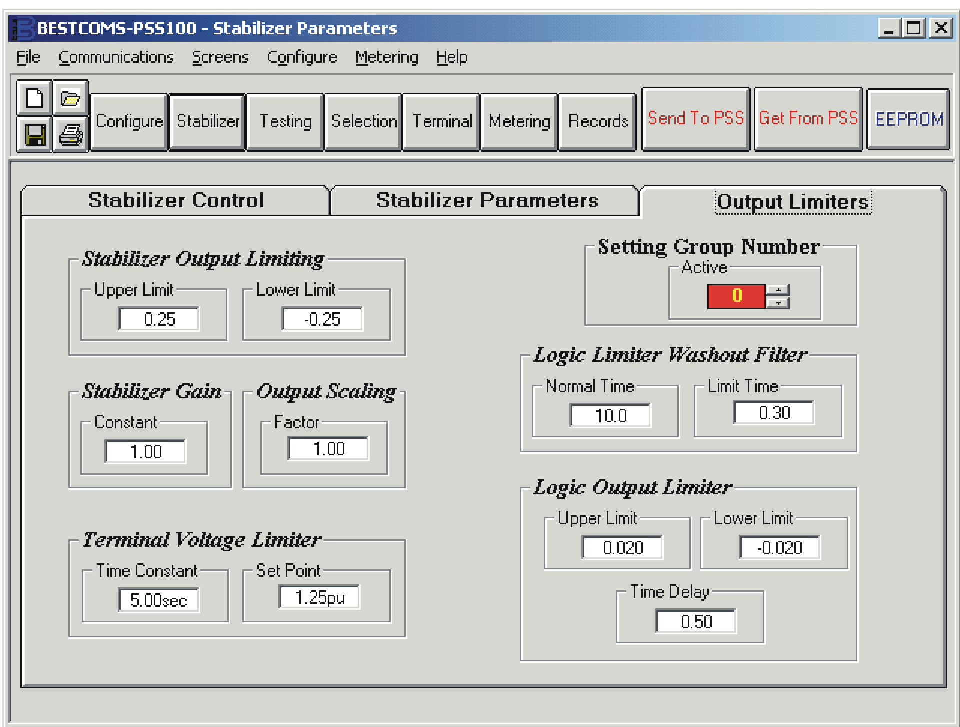

Figure 7-13. High-Pass Filter Test Settings, Part 3

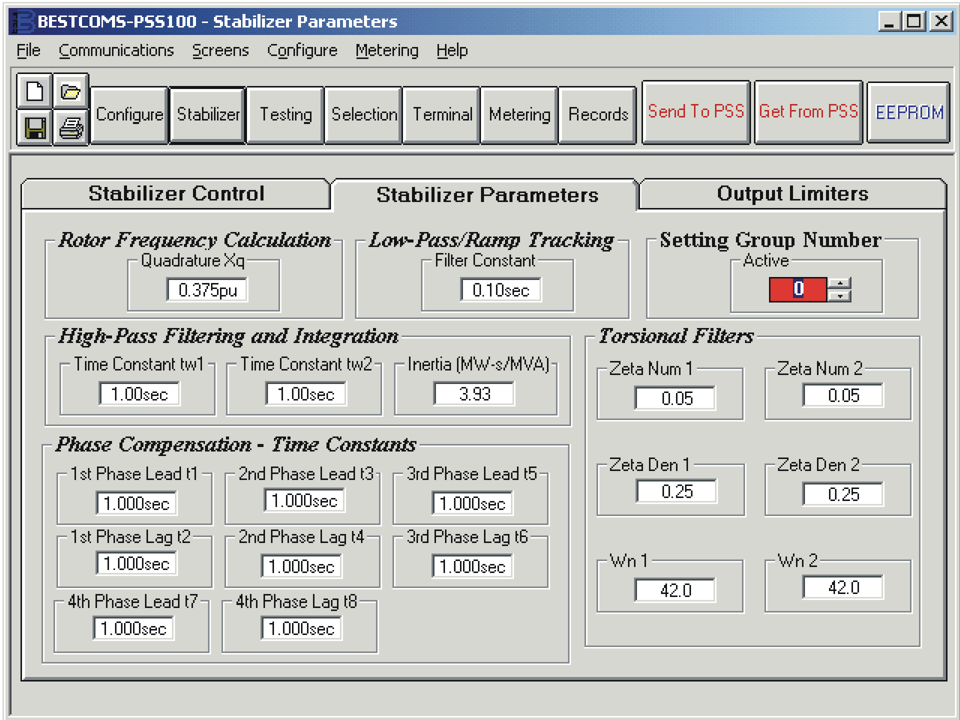

Figure 7-14. High-Pass Filter Test Settings, Part 4

High-Pass Filter and Integrator Test

1. On the Testing Parameters screen (Figure 7-15), make the following settings changes.
   a. Enable stabilizer test switch 2 (TSW 2) so that the test signal is applied at the speed input. Ensure that all other test switches are disabled. Select External as the stabilizer test signal waveform.
   b. Enter a test signal magnitude of 1.0, an offset of 0, and a duration of 999.0 seconds.

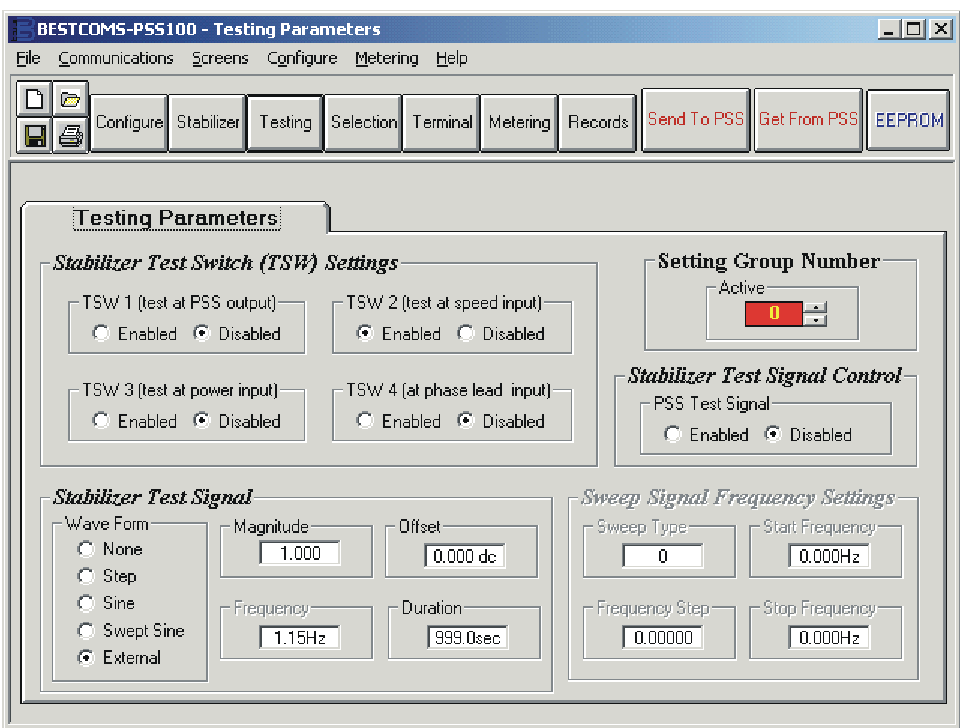

Figure 7-15. High-Pass Filter and Integrator Test Settings, Part 1

2. On the Stabilizer Control tab of the Stabilizer Parameters screen (Figure 7-16), make the following software switch settings.
   a. Disable torsional filter 1 (SSW 0)
   b. Disable torsional filter 2 (SSW 1)
   c. Exclude the ramp tracking filter (SSW 2)
   d. Select derived speed as the stabilizer signal (SSW 3)
   e. Select derived speed or frequency as the stabilizer signal (SSW 4)
   f. Include the third lead/lag stage of the stabilizer output (SSW 5)
   g. Disable the terminal voltage limiter (SSW 6)
   h. Turn the stabilizer output on (SSW 7)

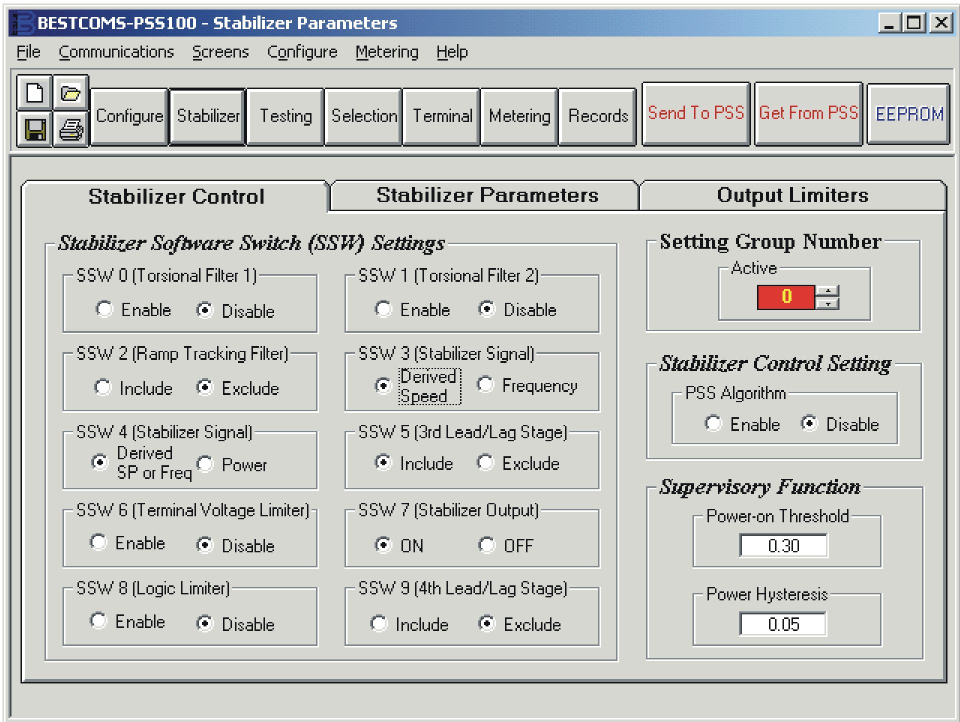

Figure 7-16. High-Pass Filter and Integrator Test Settings, Part 2

3. On the Output Limiters tab of the Stabilizer Parameters screen (Figure 7-17), enter a stabilizer gain constant of 1.0 and an output scaling factor of 1.0. Set the stabilizer output limiting upper limit at 0.25 and the lower limit at –0.25.
4. On the Stabilizer Parameters tab of the Stabilizer Parameters screen (Figure 7-18), make the following settings changes.
   a. Enter 1.0 for the first, second, and third phase compensation time constants (lead and lag).
   b. Set the first (tw1) washout (high-pass filtering and integration) time constant setting at 10.0. Set the second washout time constant setting at 1.0. Set the inertia (MW-s/MVA) setting at 0.5.
5. Apply the test signal and verify the frequency response of the stabilizer output.

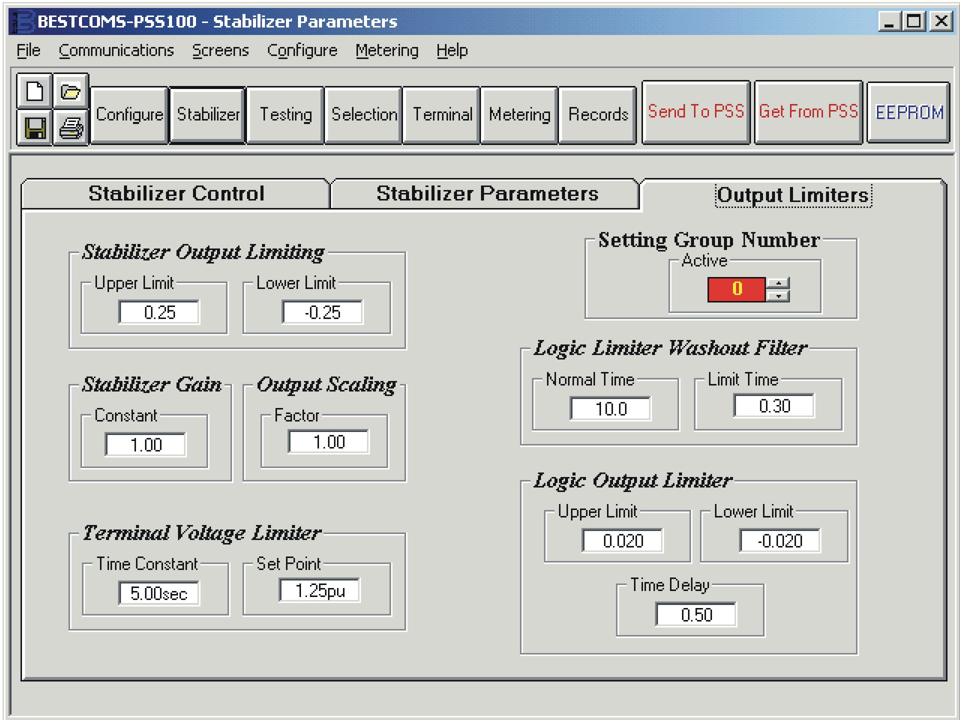

Figure 7-17. High-Pass Filter and Integrator Test Settings, Part 3

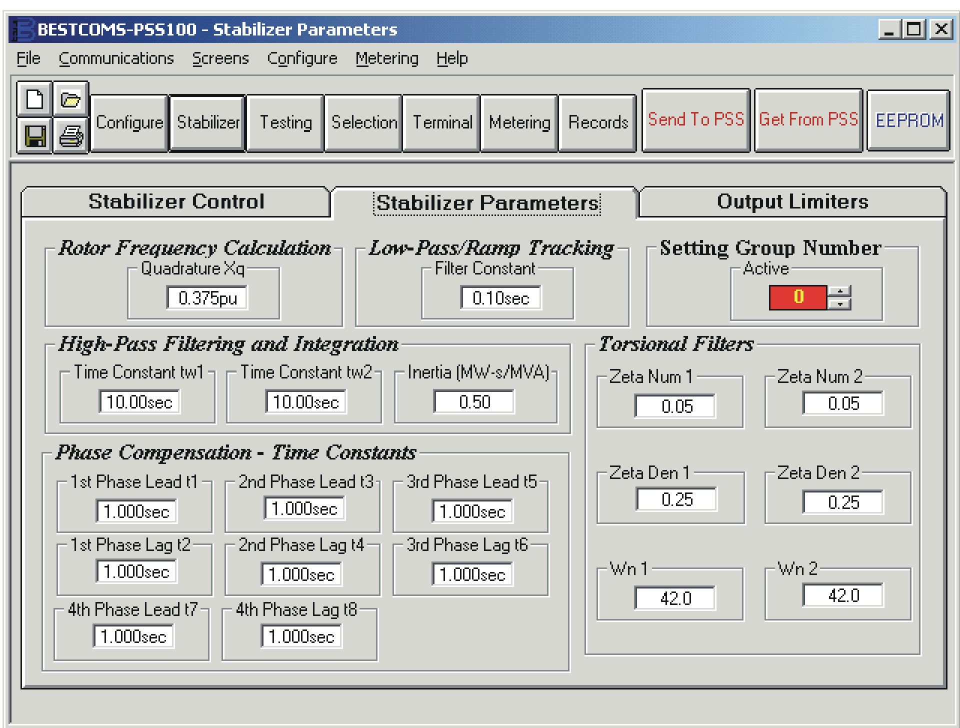

Figure 7-18. High-Pass Filter and Integrator Test Settngs, Part 4

Low-Pass Filter Test

1. On the Testing Parameters screen (Figure 7-19), enable stabilizer test switch 2 (TSW 2) so that the test signal is applied at the speed input. Ensure that all other test switches are disabled. Select External as the stabilizer test signal waveform. Enter a test signal magnitude of 1.0, an offset of 0, and a duration of 999.0 seconds.

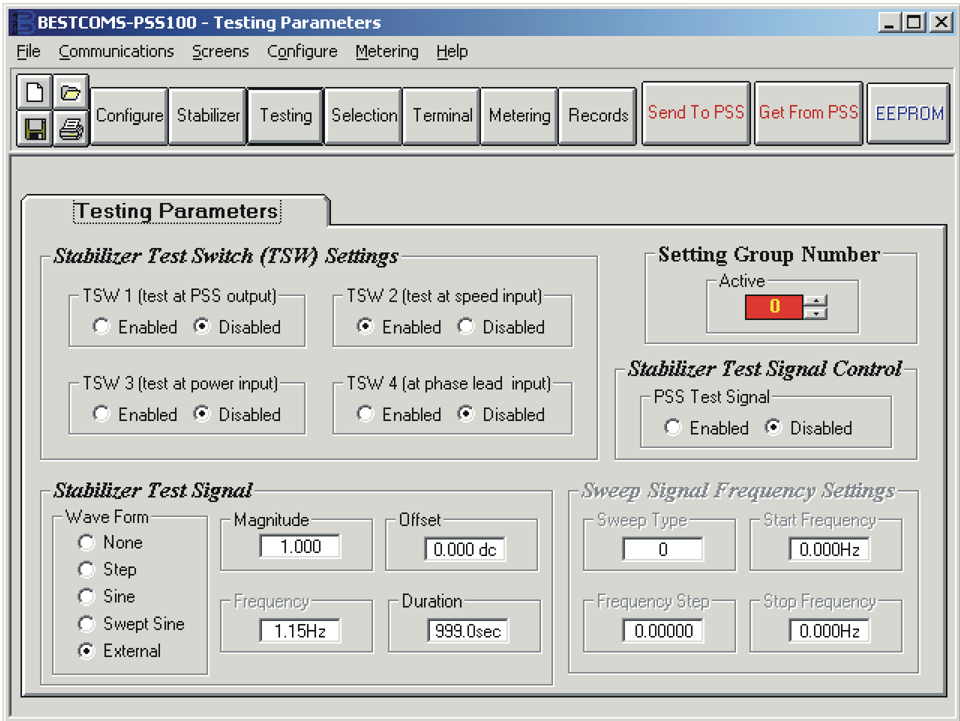

Figure 7-19. Low-Pass Filter Test Settings, Part 1

2. On the Stabilizer Control tab of the Stabilizer Parameters screen (Figure 7-20), make the following software switch settings.
   a. Disable torsional filter 1 (SSW 0)
   b. Disable torsional filter 2 (SSW 1)
   c. Exclude the ramp tracking filter (SSW 2)
   d. Select frequency as the stabilizer signal (SSW 3)
   e. Select derived speed or frequency as the stabilizer signal (SSW 4)
   f. Include the third lead/lag stage of the stabilizer output (SSW 5)
   g. Disable the terminal voltage limiter (SSW 6)
   h. Turn the stabilizer output on (SSW 7)
3. On the Output Limiters tab of the Stabilizer Parameters screen (Figure 7-21), enter a stabilizer gain constant of 1.0 and an output scaling factor of 1.0. Set the stabilizer output limiting upper limit at 0.25 and the lower limit at –0.25.
4. On the Stabilizer Parameters tab of the Stabilizer Parameters screen (Figure 7-22), make the following settings changes.
   a. Enter 1.0 for the first, second, and third phase compensation time constants (lead and lag).
   b. Set the first (tw1) and second (tw2) washout (high-pass filtering and integration) time constant settings at 20.0.
   c. Set the low-pass/ramp tracking filter constant at 0.1 seconds.
5. Apply the test signal and verify the frequency response of the output.

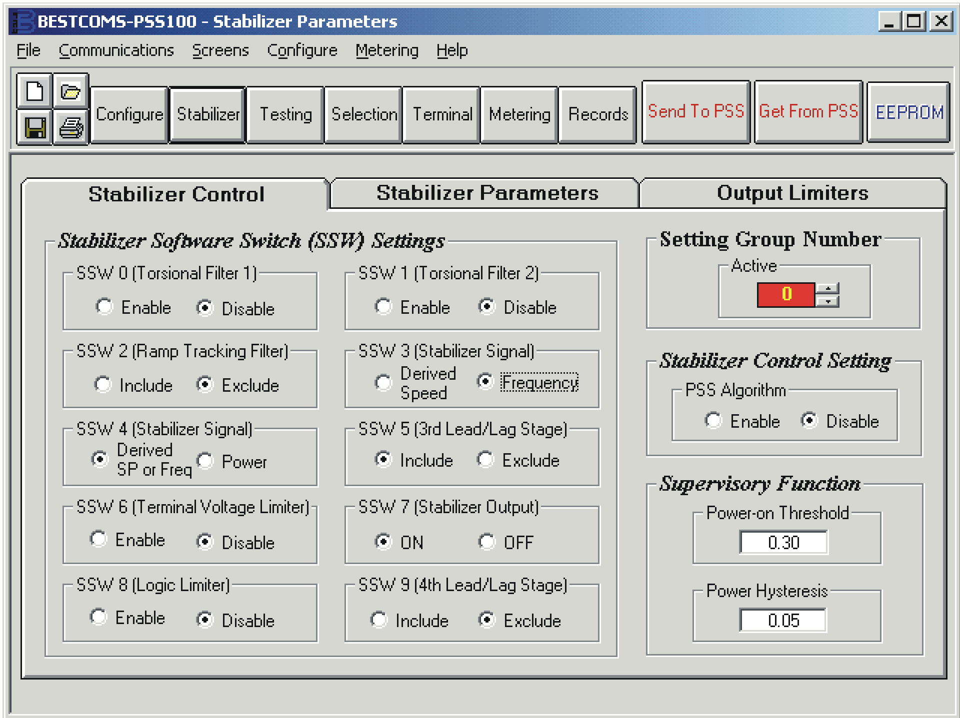

Figure 7-20. Low-Pass Filter Test Settings, Part 2

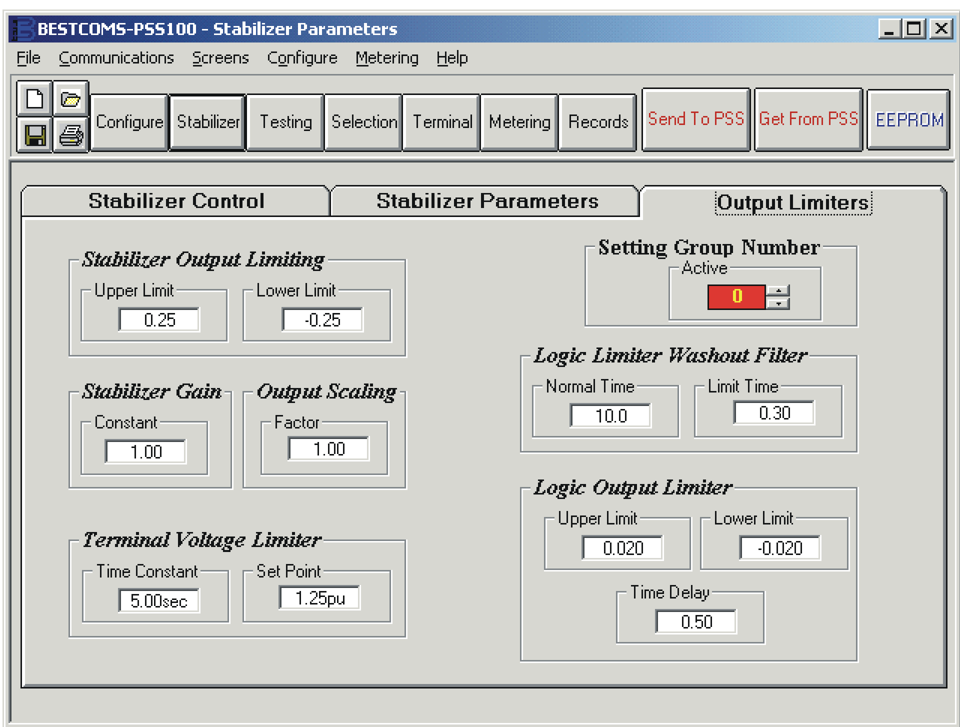

Figure 7-21. Low-Pass Filter Test Settings, Part 3

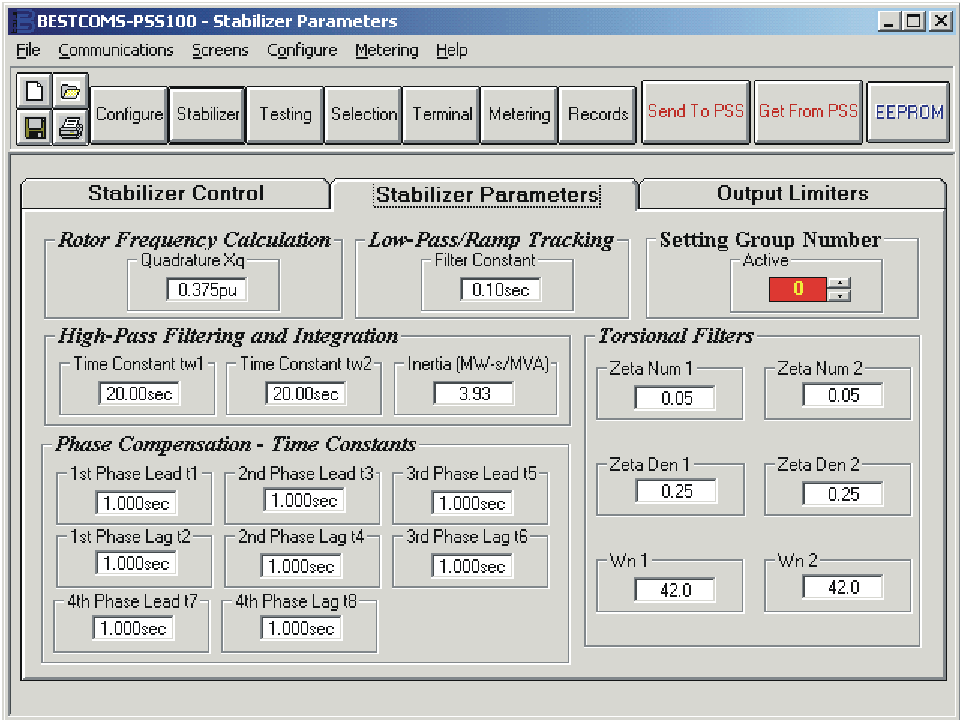

Figure 7-22. Low-Pass Filter Test Settings, Part 4

Low-Pass Filter with Ramp-Tracking Filter Test

1. On the Testing Parameters screen (Figure 7-23), enable stabilizer test switch 2 (TSW 2) so that the test signal is applied at the speed input. Ensure that all other test switches are disabled. Select External as the stabilizer test signal waveform. Enter a test signal magnitude of 1.0, an offset of 0, and a duration of 999.0 seconds.

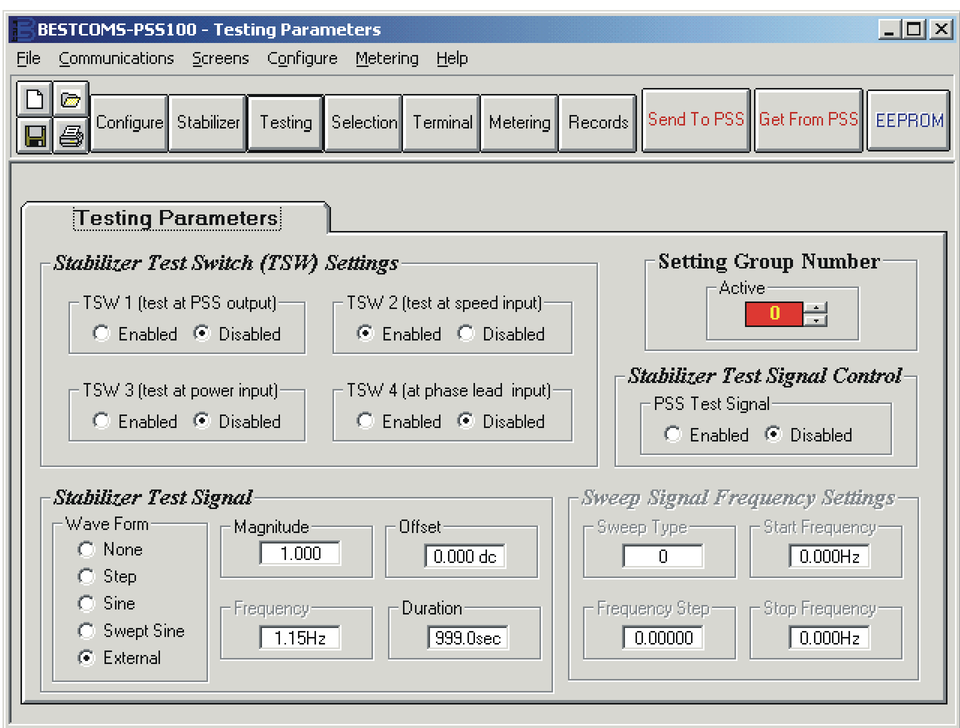

Figure 7-23. Low-Pass Filter with Ramp-Tracking Filter Test Settings, Part 1

2. On the Stabilizer Control tab of the Stabilizer Parameters screen (Figure 7-24), make the following software switch settings.
    a. Disable torsional filter 1 (SSW 0).
    b. Disable torsional filter 2 (SSW 1).
    c. Include the ramp tracking filter (SSW 2).
    d. Select derived speed as the stabilizer signal (SSW 3).
    e. Select derived speed or frequency as the stabilizer signal (SSW 4).
    f. Include the third lead/lag stage of the stabilizer output (SSW 5).
    g. Disable the terminal voltage limiter (SSW 6).
    h. Enable the stabilizer output (SSW 7).

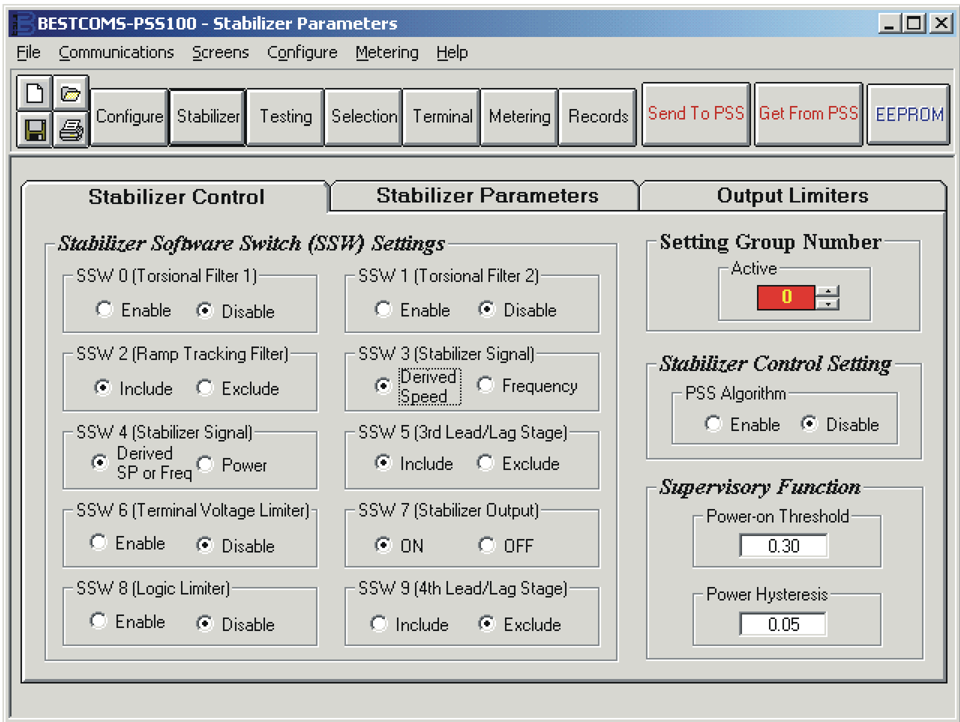

Figure 7-24. Low-Pass Filter with Ramp-Tracking Filter Test Settings, Part 2

3. On the Output Limiters tab of the Stabilizer Parameters screen (Figure 7-25), enter a stabilizer gain constant of 1.0 and an output scaling factor of 1.0. Set the stabilizer output limiting upper limit at 0.25 and the lower limit at –0.25.
4. On the Stabilizer Parameters tab of the Stabilizer Parameters screen (Figure 7-26), make the following settings changes.
    a. Enter 1.0 for the first, second, and third phase compensation time constants (lead and lag).
    b. Set the first (tw1) and second (tw2) washout (high-pass filtering and integration) time constant settings at 20.0. Set the inertia (MW-s/MVA) setting at 0.1.
    c. Set the low-pass/ramp tracking filter constant at 0.1 seconds.
5. Apply the test signal and verify the frequency response of the output.

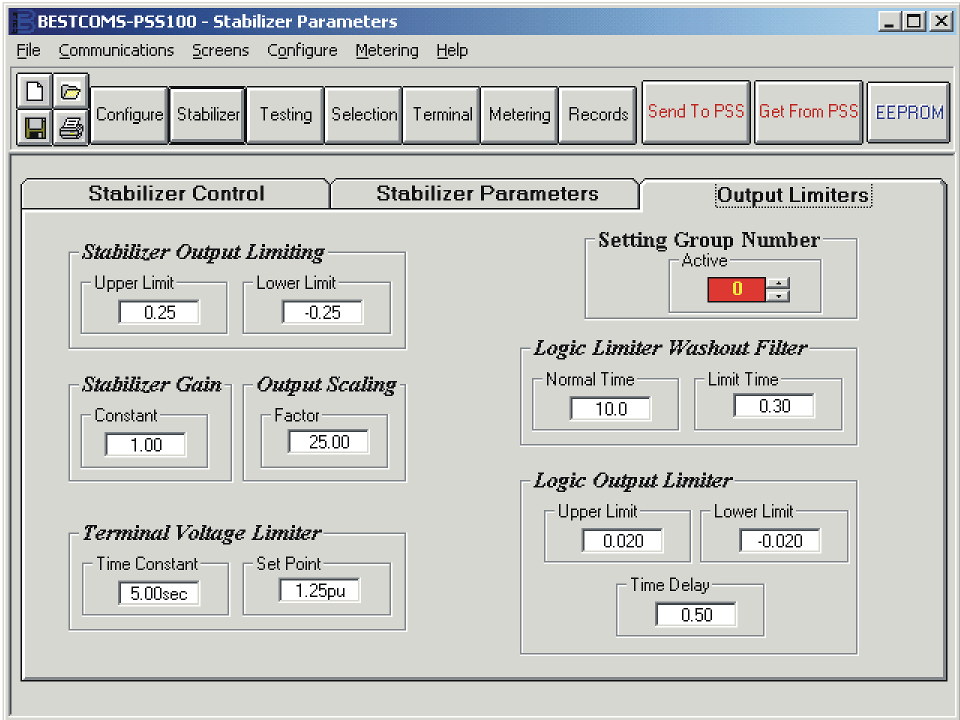

Figure 7-25. Low-Pass Filter with Ramp-Tracking Filter Testing, Part 3

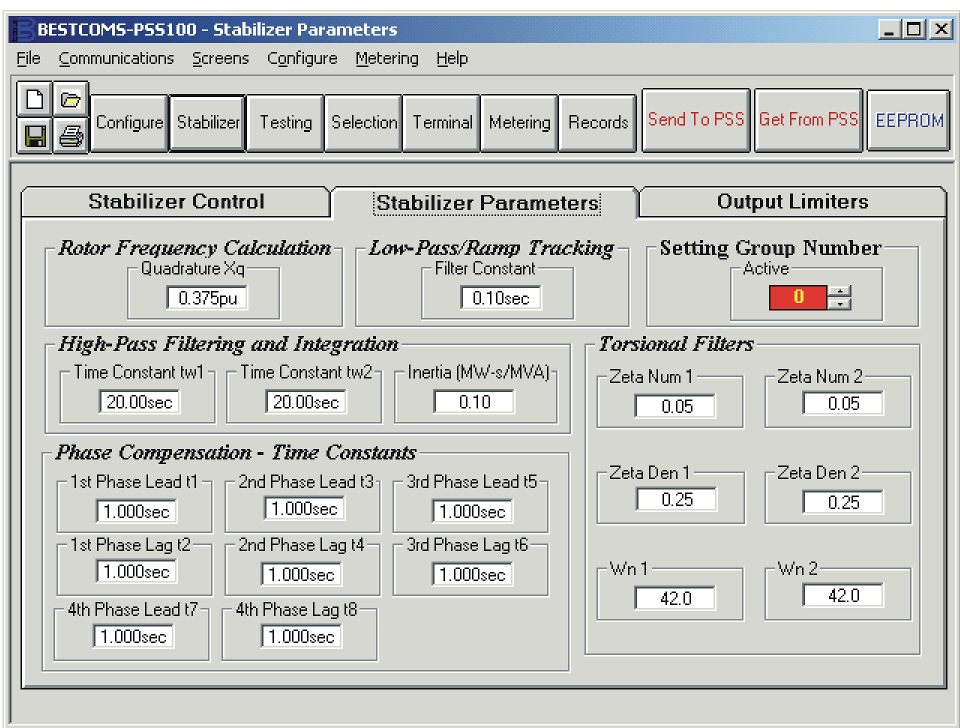

Figure 7-26. Low-Pass Filter with Ramp-Tracking Filter Test, Part 4

Phase Lead Test (Two Stages)

1. On the Testing Parameters screen (Figure 7-27), enable stabilizer test switch 4 (TSW 4) so that the test signal is applied at the phase lead input. Ensure that all other test switches are disabled. Select External as the stabilizer test signal waveform. Enter a test signal magnitude of 1.0, an offset of 0, and a duration of 999.0 seconds.

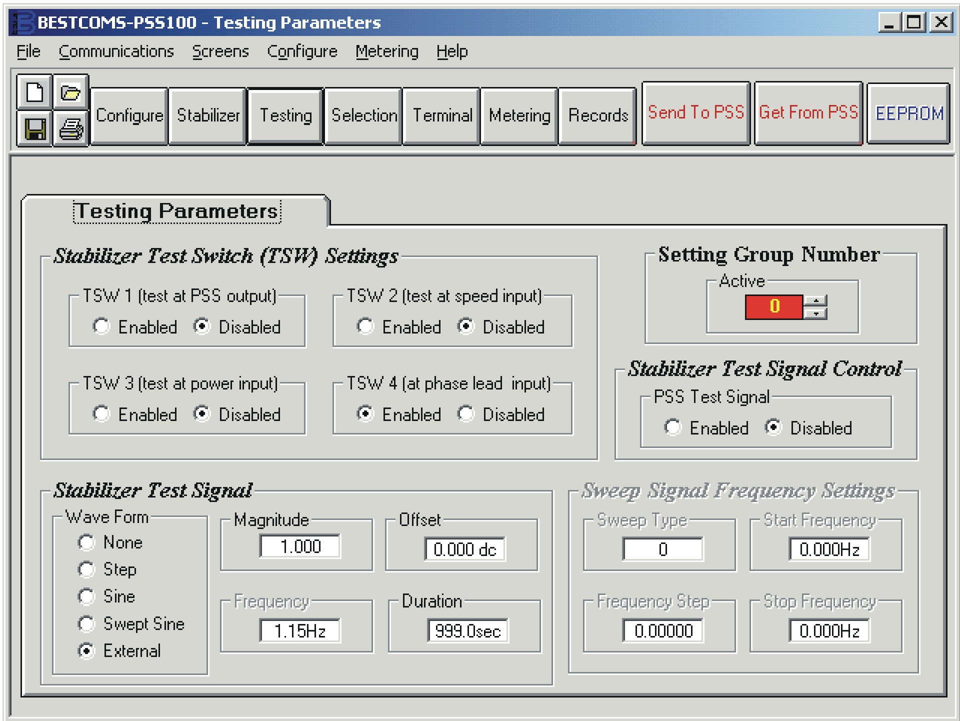

Figure 7-27. Phase Lead Test (Two Stages) Settings, Part 1

2. On the Stabilizer Control tab of the Stabilizer Parameters screen (Figure 7-28), make the following software switch settings.
   a. Select power as the stabilizer signal (SSW 4).
   b. Include the third lead/lag stage of the stabilizer output (SSW 5).
   c. Disable the terminal voltage limiter (SSW 6).
   d. Enable the stabilizer output (SSW 7).
3. On the Output Limiters tab of the Stabilizer Parameters screen (Figure 7-29), enter a stabilizer gain constant of 1.0 and an output scaling factor of 1.0. Set the stabilizer output limiting upper limit at 0.25 and the lower limit at –0.25.
4. On the Stabilizer Parameters tab of the Stabilizer Parameters screen (Figure 7-30), make the following settings changes.
   a. Enter 0.16 seconds as the lead time constant for the first, second, and third phase compensation time constants.
   b. Enter 0.64 seconds as the lag time constant for the first, second, and third phase compensation time constants.
   c. Set the first (tw1) and second (tw2) washout (high-pass filtering and integration) time constant settings at 20.0.
5. Apply the test signal and verify the frequency response of the output.

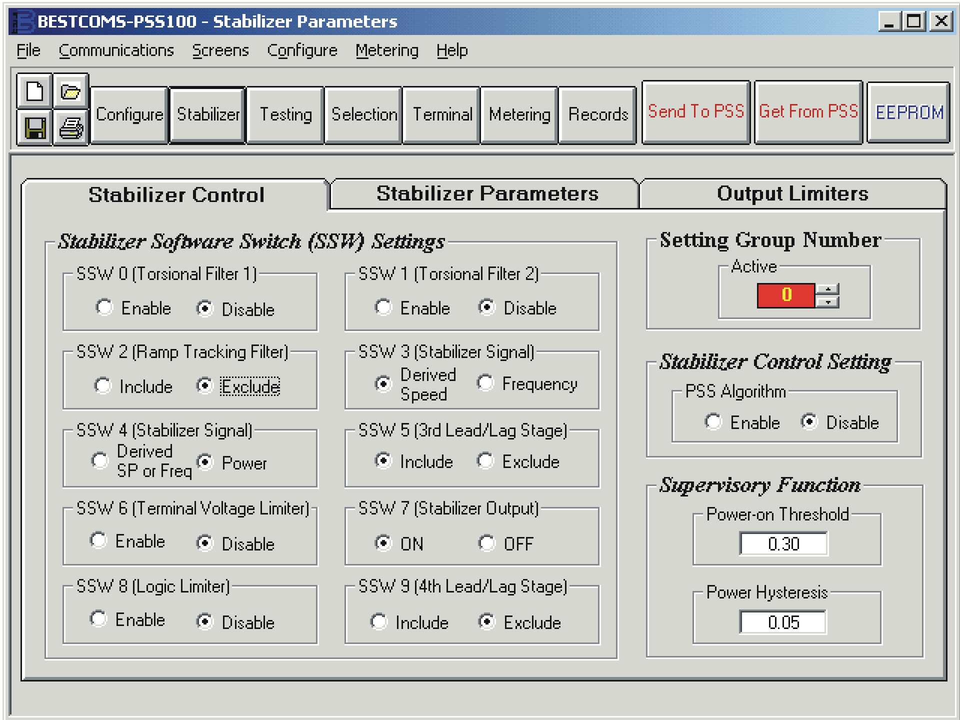

Figure 7-28. Phase Lead Test (Two Stages) Settings, Part 2

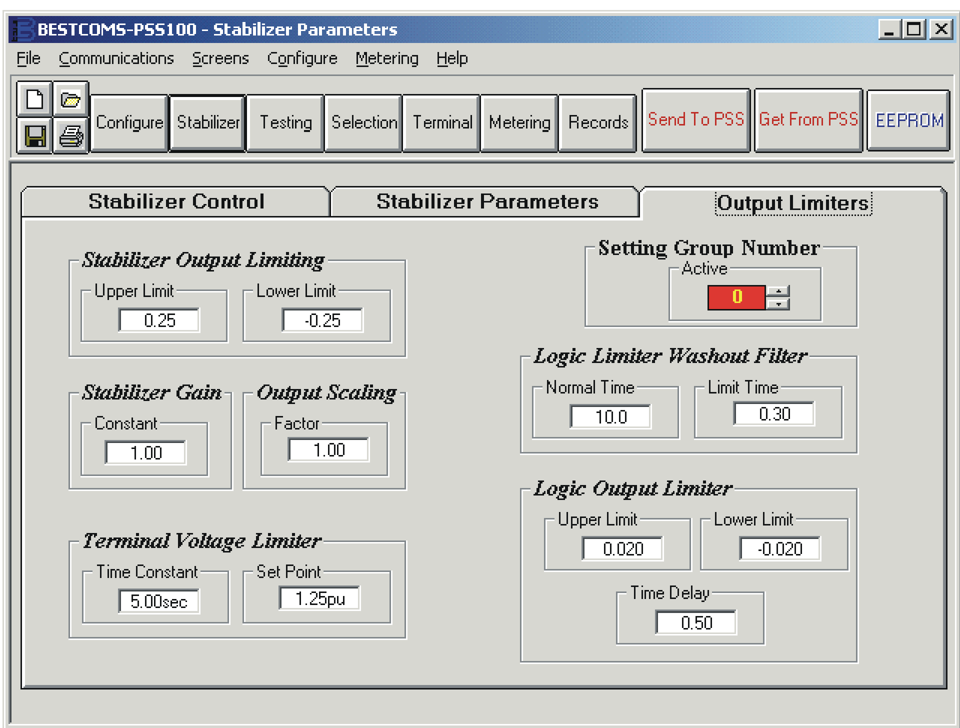

Figure 7-29. Phase Lead Test (Two Stages) Settings, Part 3

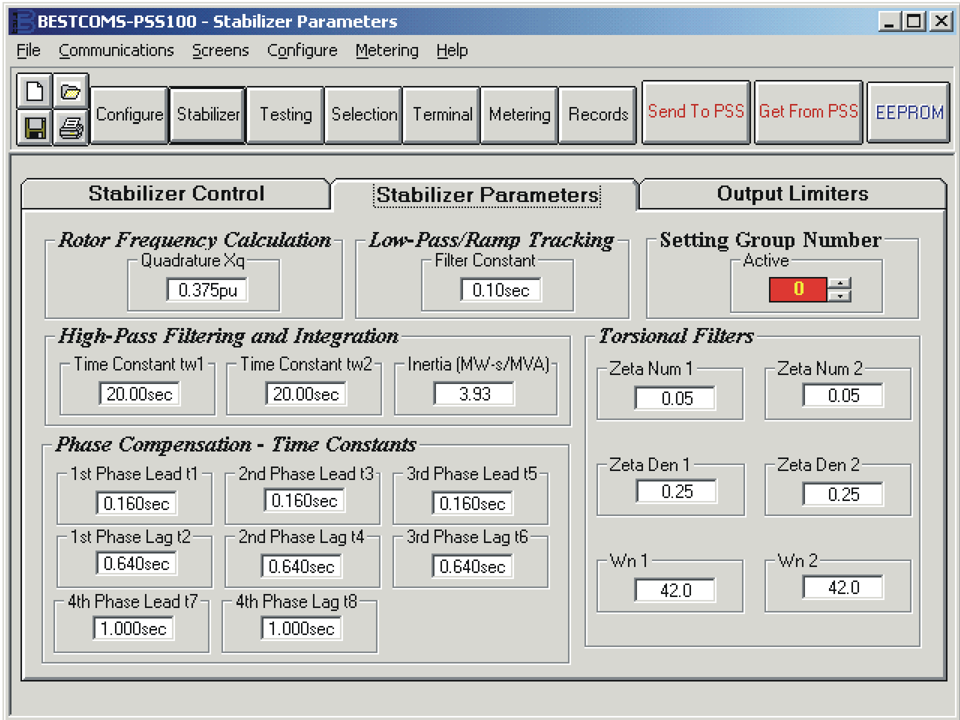

Figure 7-30. Phase Lead Test (Two Stages) Settings, Part 4

Phase Lead Test (Three Stages)

1. On the Testing Parameters screen (Figure 7-31), enable stabilizer test switch 4 (TSW 4) so that the test signal is applied at the phase lead input. Ensure that all other test switches are disabled. Select External as the stabilizer test signal waveform. Enter a test signal magnitude of 1.0, an offset of 0, and a duration of 999.0 seconds.

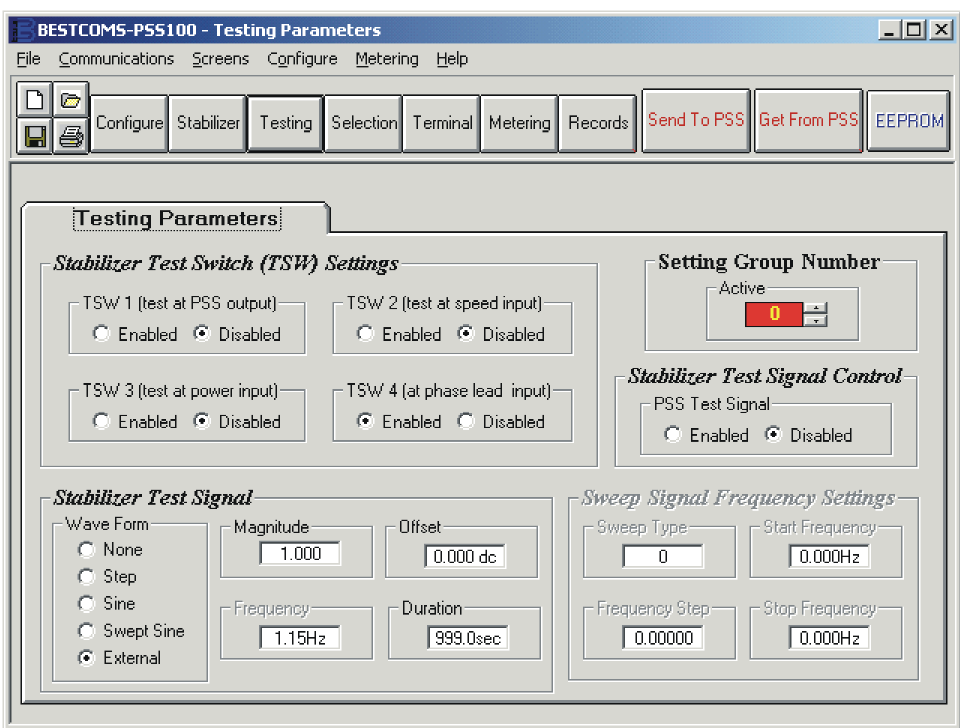

Figure 7-31. Phase Lead Test (Three Stages) Settings, Part 1

2. On the Stabilizer Control tab of the Stabilizer Parameters screen (Figure 7-32), make the following software switch settings.
   a. Select power as the stabilizer signal (SSW 4).
   b. Exclude the third lead/lag stage of the stabilizer output (SSW 5).
   c. Disable the terminal voltage limiter (SSW 6).
   d. Enable the stabilizer output (SSW 7).

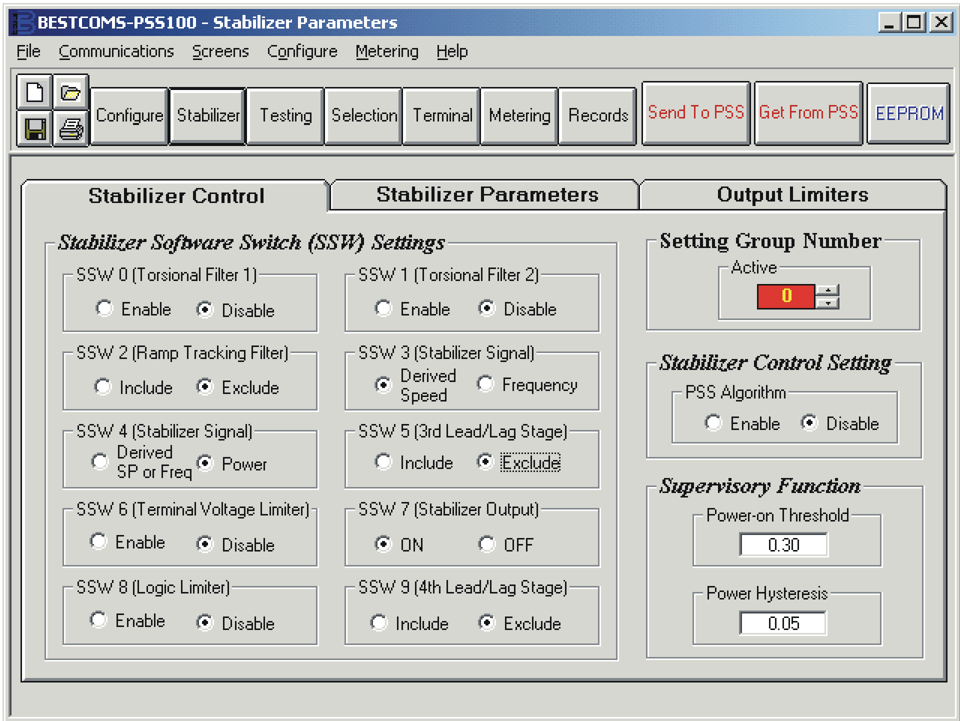

Figure 7-32. Phase Lead Test (Three Stages) Settings, Part 2

3. On the Output Limiters tab of the Stabilizer Parameters screen (Figure 7-33), enter a stabilizer gain constant of 1.0 and an output scaling factor of 1.0. Set the stabilizer output limiting upper limit at 0.25 and the lower limit at –0.25.
4. On the Stabilizer Parameters tab of the Stabilizer Parameters screen (Figure 7-34), make the following settings changes.
   a. Enter 0.16 seconds as the lead time constant for the first, second, and third phase compensation time constants.
   b. Enter 0.64 seconds as the lag time constant for the first, second, and third phase compensation time constants.
   c. Set the first (tw1) and second (tw2) washout (high-pass filtering and integration) time constant settings at 20.0.
5. Apply the test signal and verify the frequency response of the output.

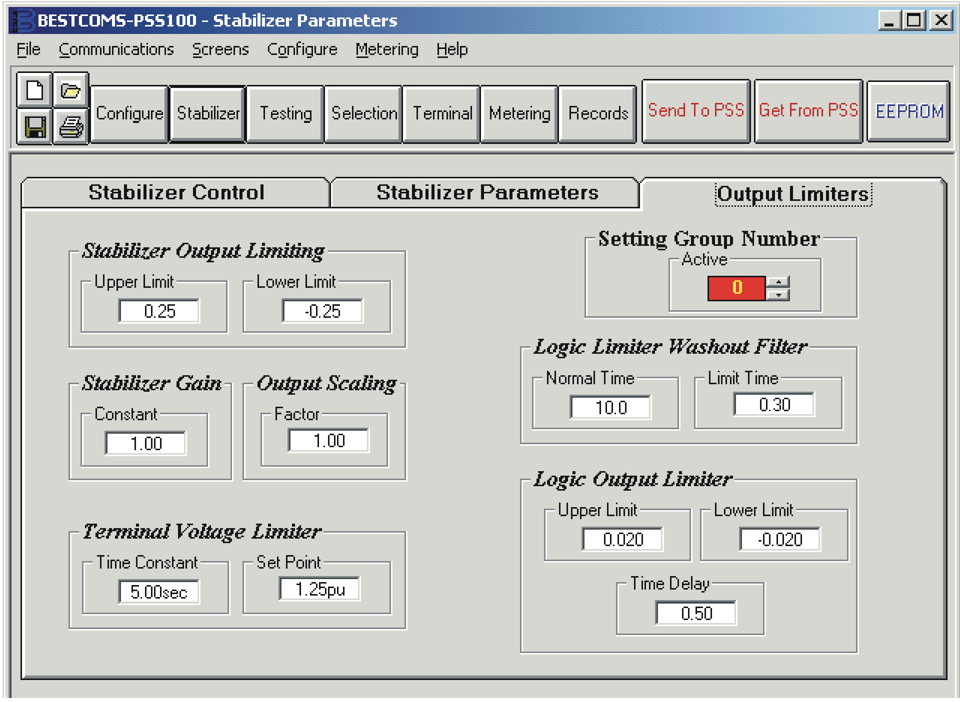

Figure 7-33. Phase Lead Test (Three Stages) Settings, Part 3

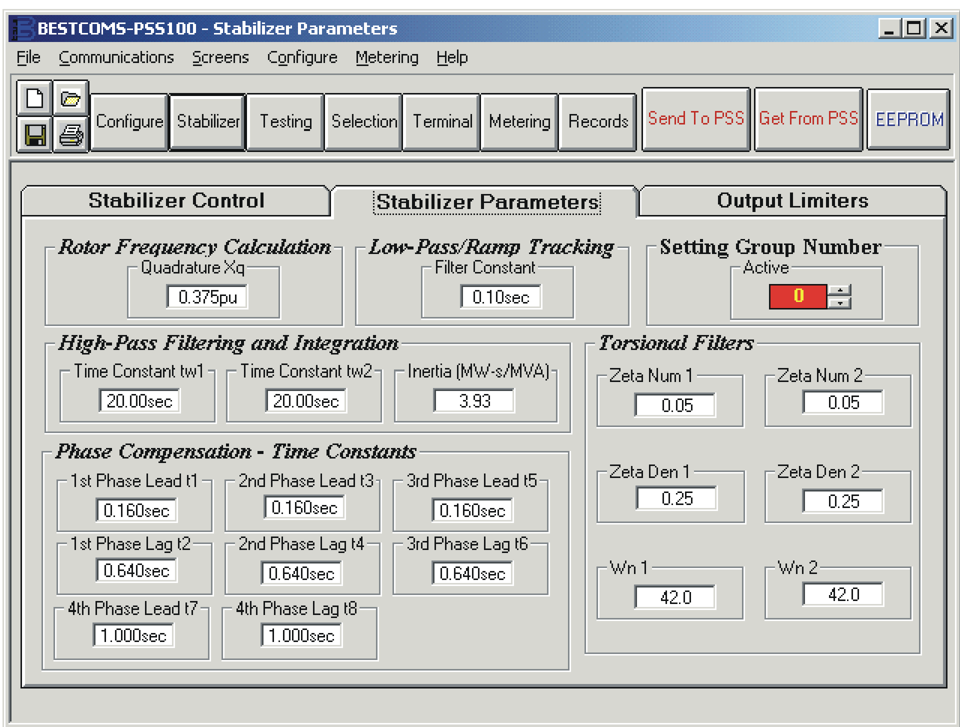

Figure 7-34. Phase Lead Test (Three Stages) Settings, Part 4

Phase Lead Test (Four Stages)

1. On the Testing Parameters screen (Figure 7-35), enable stabilizer test switch 4 (TSW 4) so that the test signal is applied at the phase lead input. Ensure that all other test switches are disabled. Select External as the stabilizer test signal waveform. Enter a test signal magnitude of 1.0, an offset of 0, and a duration of 999.0 seconds.

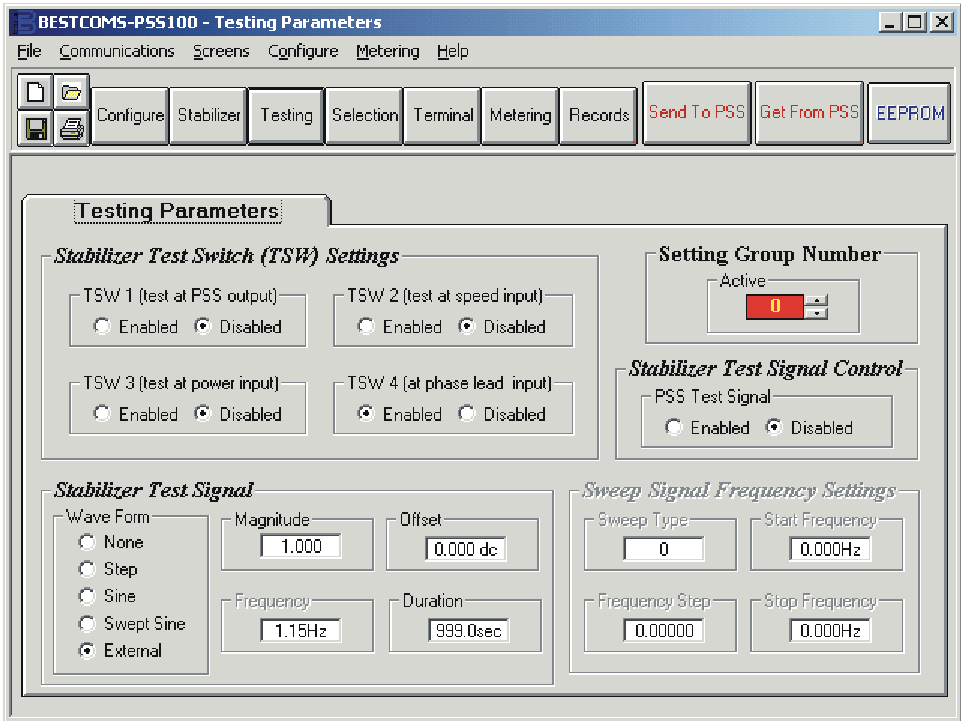

Figure 7-35. Phase Lead Test (Four Stages) Settings, Part 1

2. On the Stabilizer Control tab of the Stabilizer Parameters screen (Figure 7-36), make the following software switch settings.
   a. Select power as the stabilizer signal (SSW 4).
   b. Include the third lead/lag stage of the stabilizer output (SSW 5).
   c. Disable the terminal voltage limiter (SSW 6).
   d. Enable the stabilizer output (SSW 7).
   e. Exclude the fourth lead/lag stage of the stabilizer output (SSW 9).
3. On the Output Limiters tab of the Stabilizer Parameters screen (Figure 7-37), enter a stabilizer gain constant of 1.0 and an output scaling factor of 1.0. Set the stabilizer output limiting upper limit at 0.25 and the lower limit at –0.25.
4. On the Stabilizer Parameters tab of the Stabilizer Parameters screen (Figure 7-38), make the following settings changes.
   a. Enter 0.16 seconds as the lead time constant for the first, second, third, and fourth phase compensation time constants.
   b. Enter 0.64 seconds as the lag time constant for the first, second, third, and fourth phase compensation time constants.
   c. Set the first (tw1) and second (tw2) washout (high-pass filtering and integration) time constant settings at 20.0.
5. Apply the test signal and verify the frequency response of the output.

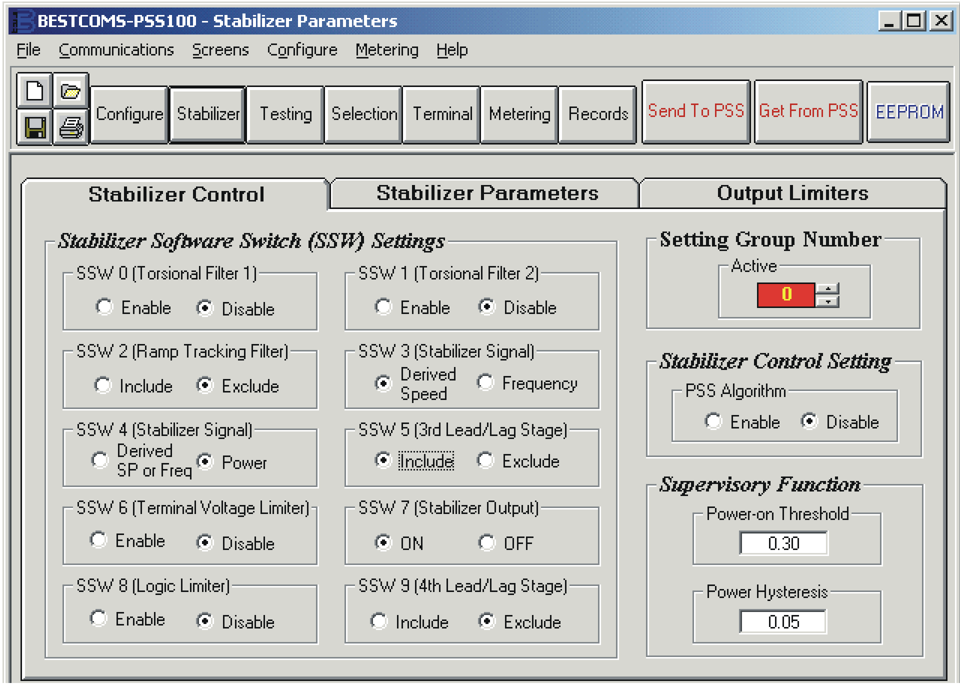

Figure 7-36. Phase Lead Test (Four Stages) Settings, Part 2

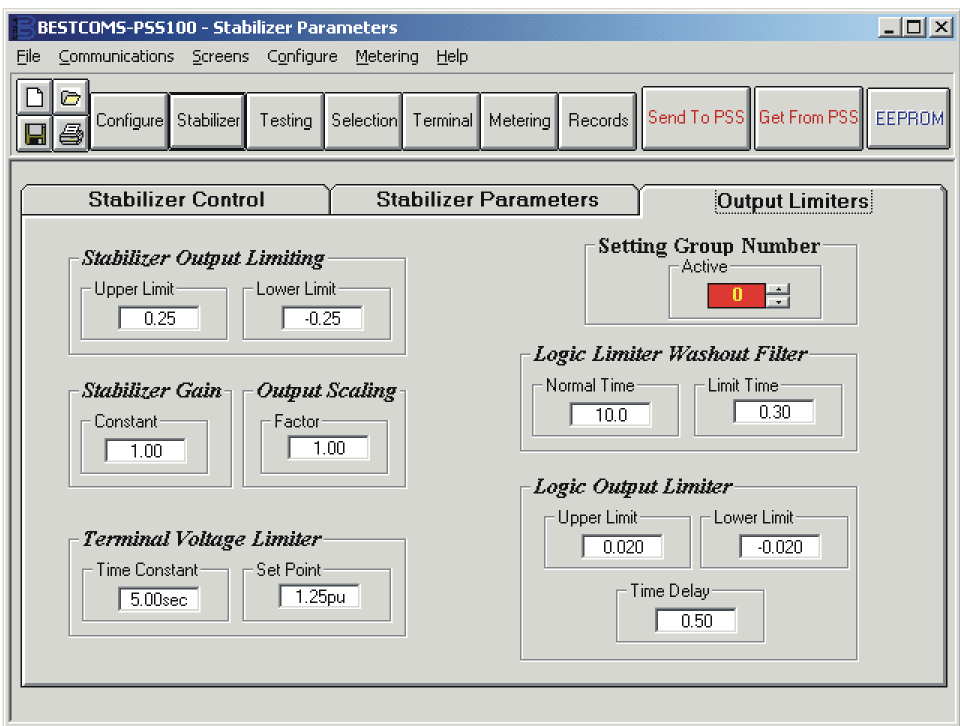

Figure 7-37. Phase Lead Test (Four Stages) Settings, Part 3

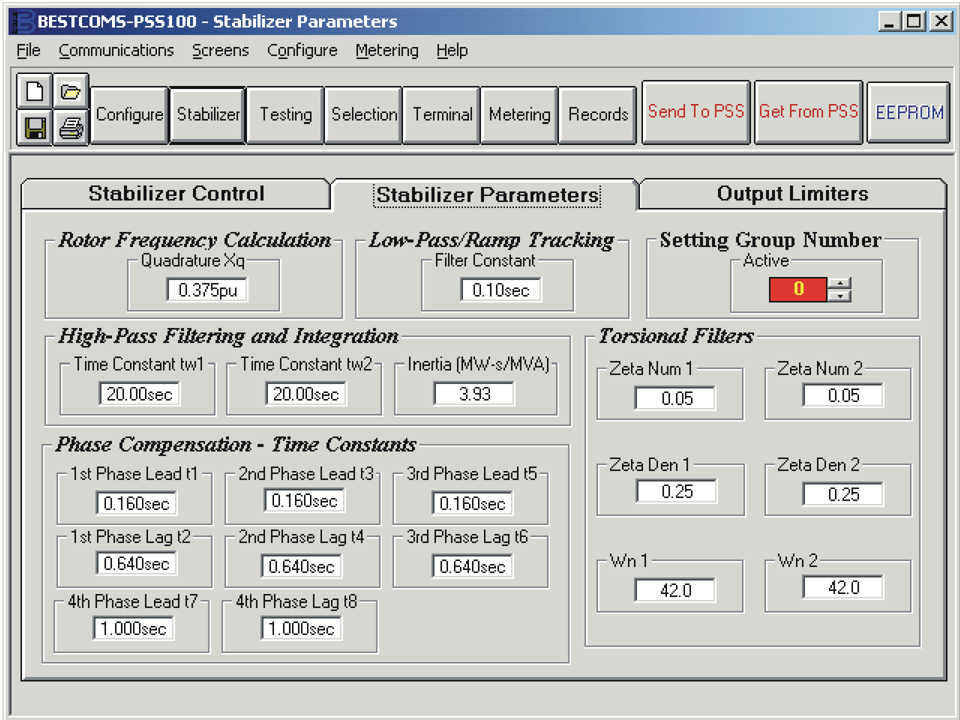

Figure 7-38. Phase Lead Test (Four Stages) Settings, Part 4

Torsional Filter 1 Test (One Stage)

1. On the Testing Parameters screen (Figure 7-39), enable stabilizer test switch 4 (TSW 4) so that the test signal is applied at the phase lead input. Ensure that all other test switches are disabled. Select External as the stabilizer test signal waveform. Enter a test signal magnitude of 1.0, an offset of 0, and a duration of 999.0 seconds.

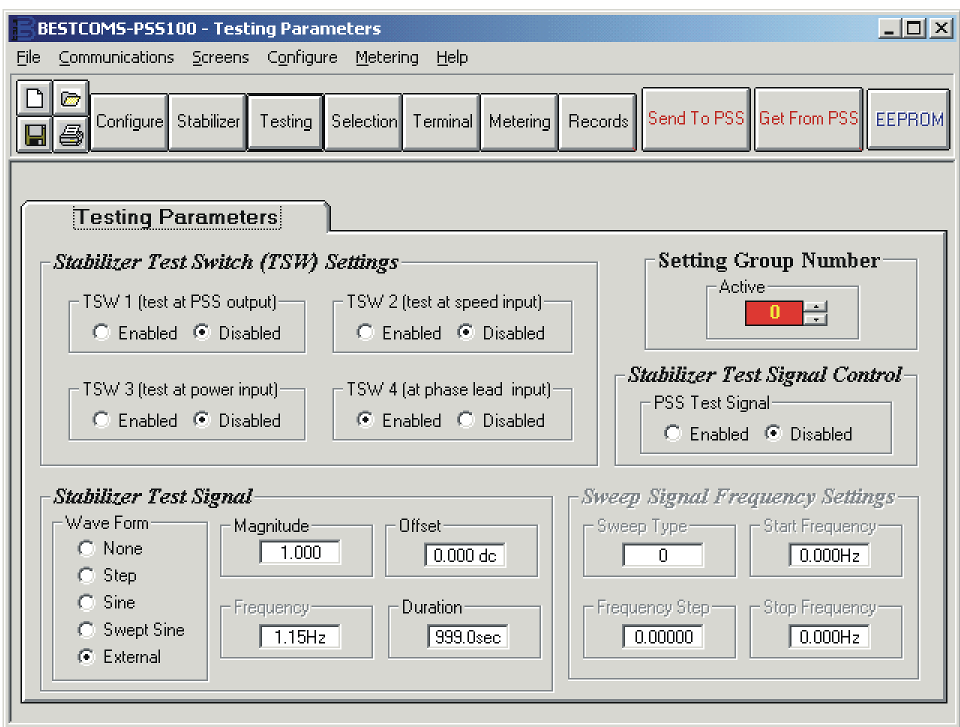

Figure 7-39. Torsional Filter 1 Test (One Stage), Part 1

2. On the Stabilizer control tab of the Stabilizer Parameters screen (Figure 7-40), make the following software switch settings.
   a. Enable torsional filter 1 (SSW 0).
   b. Disable torsional filter 2 (SSW 1).
   c. Select power as the stabilizer signal (SSW 4).
   d. Include the third lead/lag stage of the stabilizer output (SSW 5).
   e. Disable the terminal voltage limiter (SSW 6).
   f. Enable the stabilizer output (SSW 7).

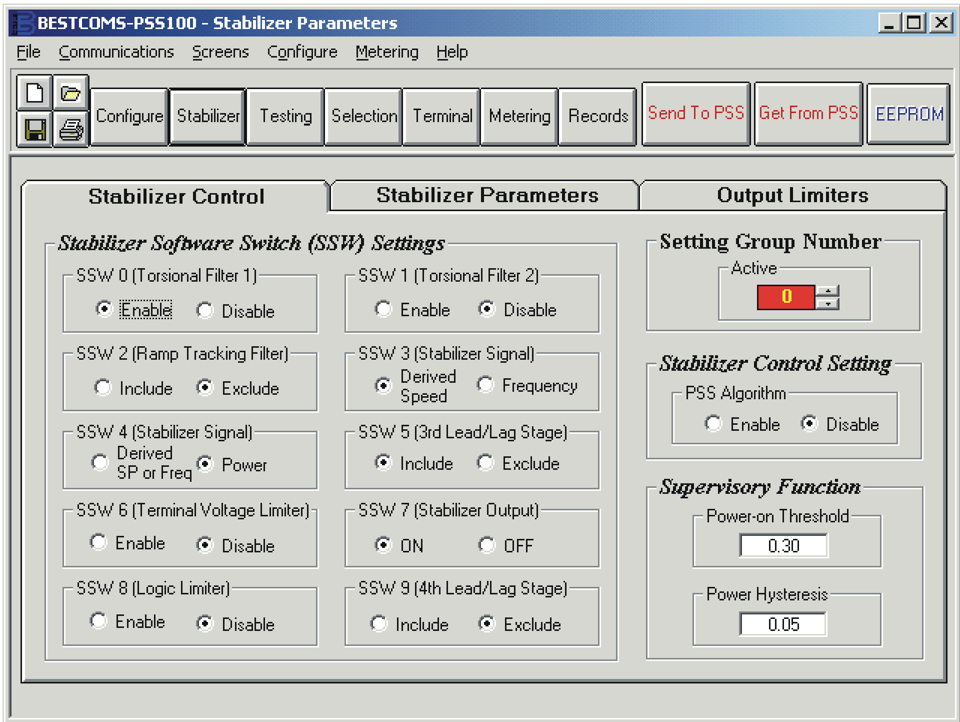

Figure 7-40. Torsional Filter 1 Test (One Stage) Settings, Part 2

3. On the Output Limiters tab of the Stabilizer Parameters screen (Figure 7-41), enter a stabilizer gain constant of 1.0 and an output scaling factor of 1.0. Set the stabilizer output limiting upper limit at 0.5 and the lower limit at –0.5.
4. On the Stabilizer Parameters tab of the Stabilizer Parameters screen (Figure 7-42), make the following settings changes.
   a. Set the first (tw1) and second (tw2) washout (high-pass filtering and integration) time constant settings at 20.0.
   b. For torsional filter 1, set the numerator damping ratio (Zeta Num 1) at 0.3, denominator damping ratio (Zeta Den 1) at 0.4, and resonant frequency at 32.0 Hz.
5. Apply the test signal and verify the frequency response of the output.

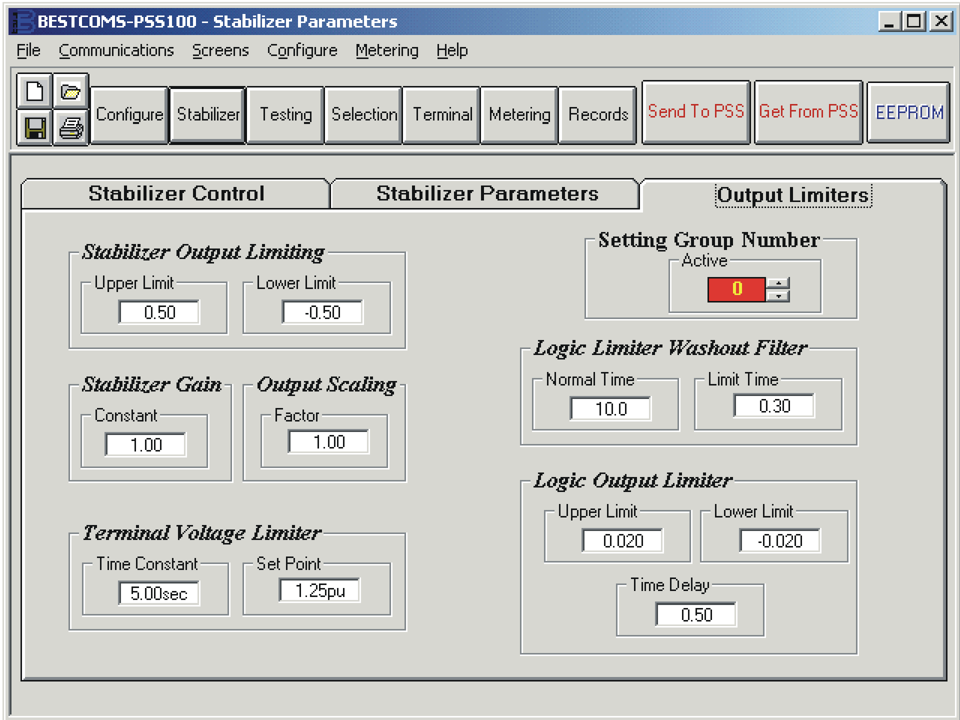

Figure 7-41. Torsional Filter 1 Test (One Stage) Settings, Part 3

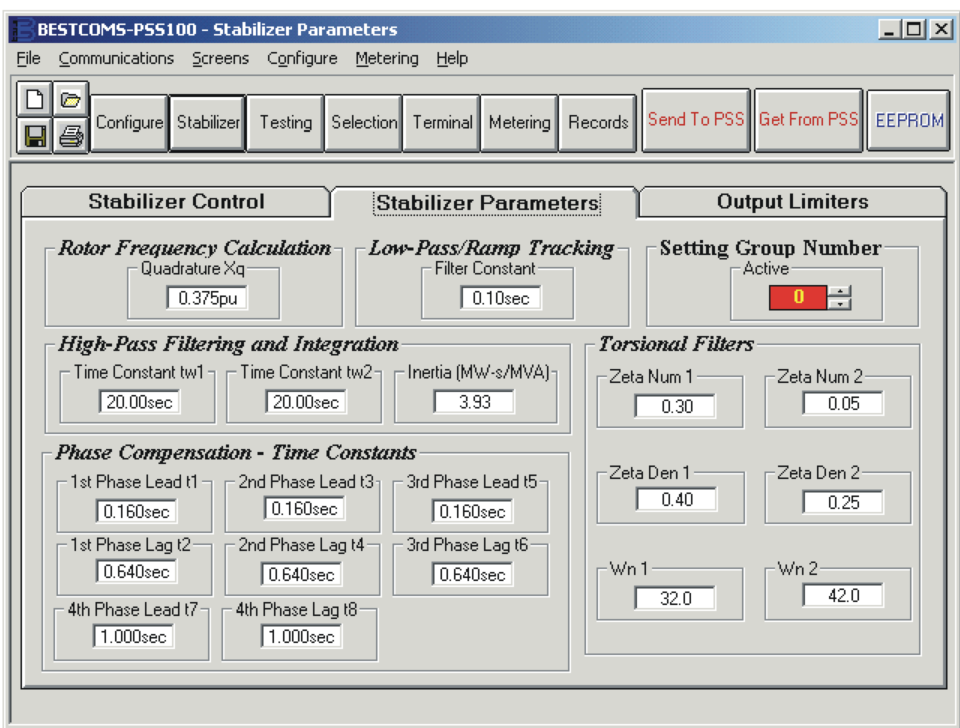

Figure 7-42. Torsional Filter 1 Test (One Stage) Settings, Part 4

Torsional Filter 1 and 2 Test (Both Stages)

1. On the Testing Parameters screen (Figure 7-43), enable stabilizer test switch 4 (TSW 4) so that the test signal is applied at the phase lead input. Ensure that all other test switches are disabled. Select External as the stabilizer test signal waveform. Enter a test signal magnitude of 1.0, an offset of 0, and a duration of 999.0 seconds.

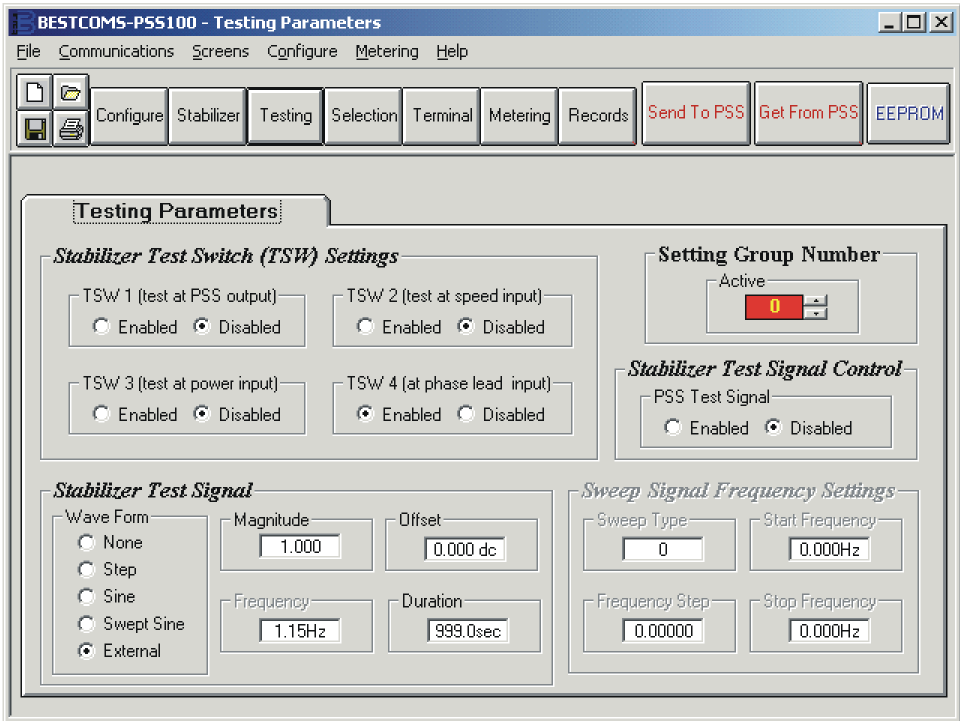

Figure 7-43. Torsional Filter 1 and 2 Test (Both Stages) Settings, Part 1

2. On the Stabilizer control tab of the Stabilizer Parameters screen (Figure 7-44), make the following software switch settings.
   a. Enable torsional filter 1 (SSW 0).
   b. Disable torsional filter 2 (SSW 1).
   c. Select power as the stabilizer signal (SSW 4).
   d. Include the third lead/lag stage of the stabilizer output (SSW 5).
   e. Disable the terminal voltage limiter (SSW 6).
   f. Enable the stabilizer output (SSW 7).
3. On the Output Limiters tab of the Stabilizer Parameters screen (Figure 7-45), enter a stabilizer gain constant of 1.0 and an output scaling factor of 1.0. Set the stabilizer output limiting upper limit at 0.5 and the lower limit at –0.5.
4. On the Stabilizer Parameters tab of the Stabilizer Parameters screen (Figure 7-46), make the following settings changes.
   a. Set the first (tw1) and second (tw2) washout (high-pass filtering and integration) time constant settings at 20.0.
   b. For torsional filter 1, set the numerator damping ratio (Zeta Num 1) at 0.3, denominator damping ratio (Zeta Den 1) at 0.4, and resonant frequency at 32.0 Hz.
   c. For torsional filter 2, set the numerator damping ration (Zeta Num 2) at 0.35, denominator damping ratio (Zeta Den 2) at 0.42, and resonant frequency at 35.0 Hz.
5. Apply the test signal and verify the frequency response of the output.

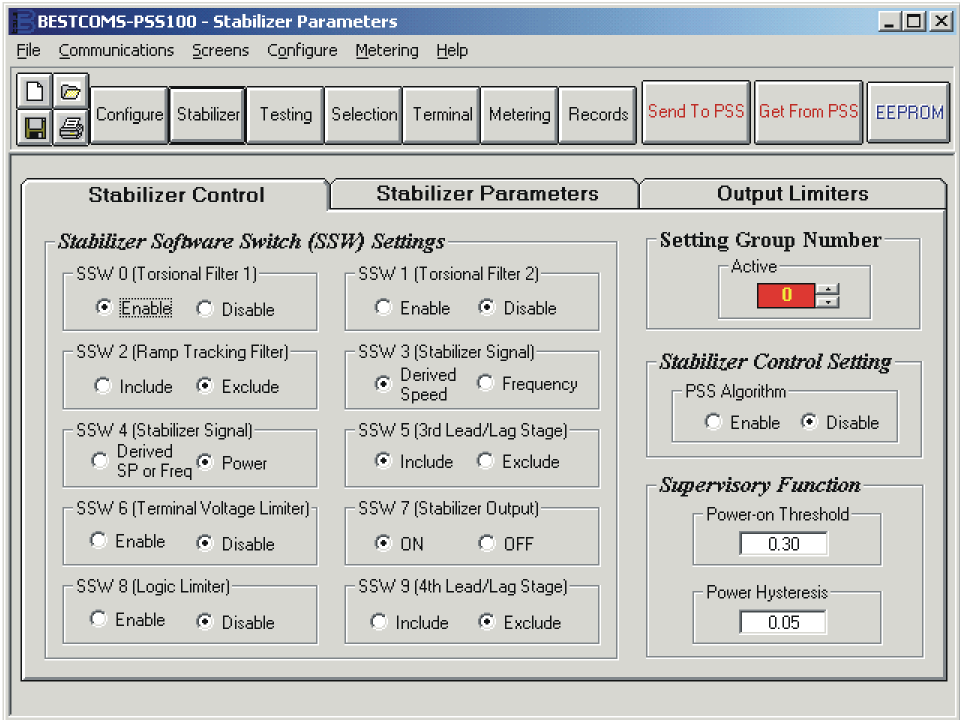

Figure 7-44. Torsional Filter 1 and 2 Test (Both Stages) Settings, Part 2

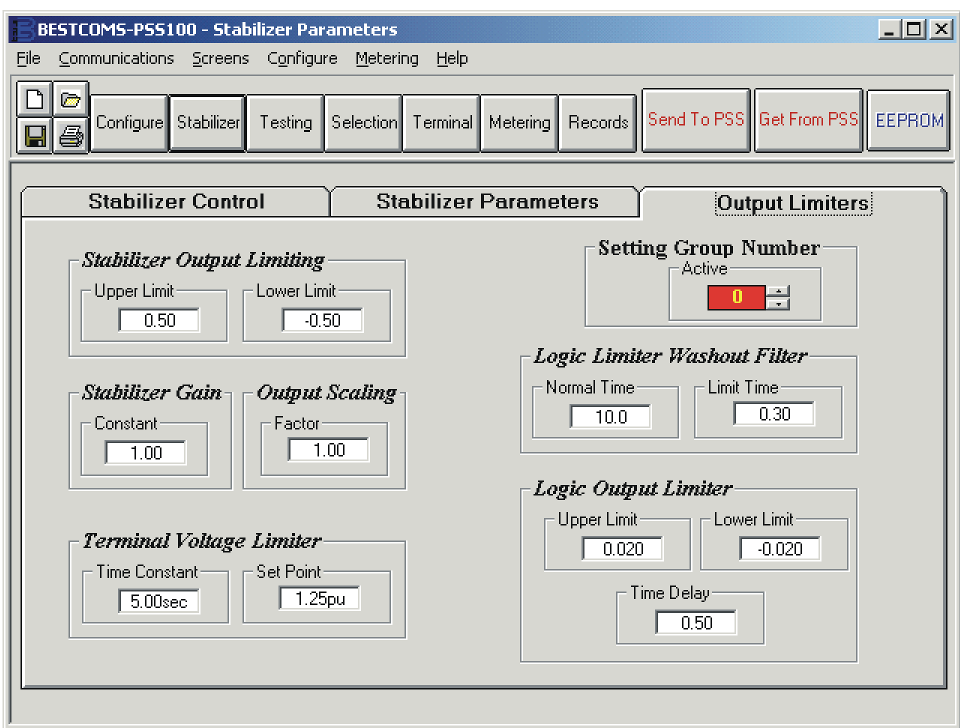

Figure 7-45. Torsional Filter 1 and 2 Test (Both Stages) Settings, Part 3

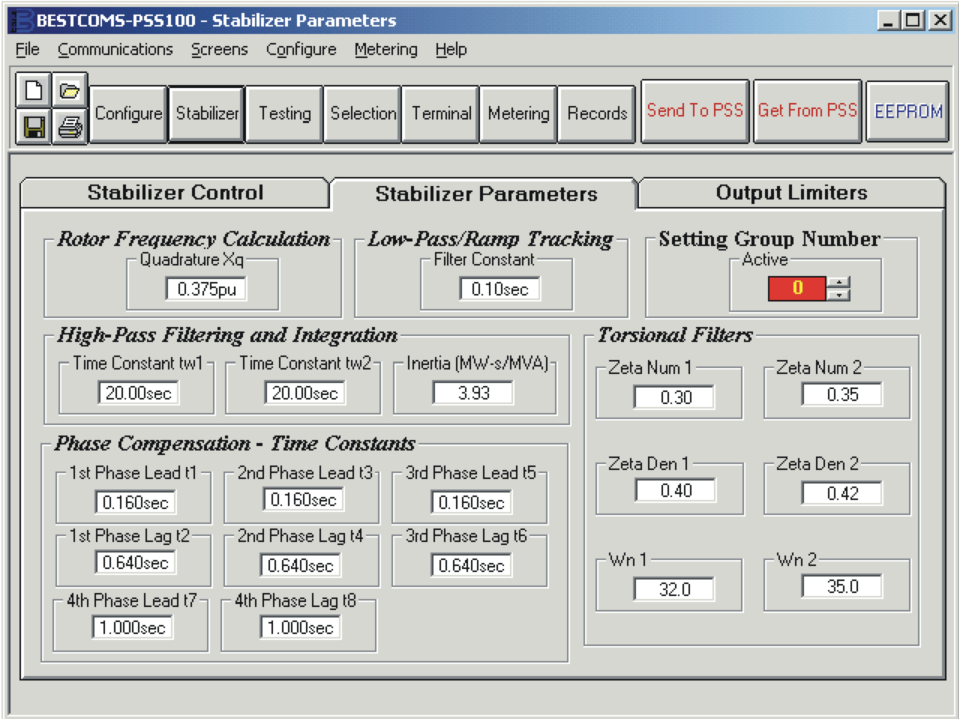

Figure 7-46. Torsional Filter 1 and 2 Test (Both Stages) Settings, Part 4

SECTION 8 • INSTALLATION

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SECTION 8 • INSTALLATION

GENERAL

PSS-100 Power System Stabilizers are delivered in sturdy cartons to prevent shipping damages. Upon receipt of the device, check the model number against the requisition and packing list for agreement. Inspect for damage, and if there is evidence of such, immediately file a claim with the carrier and notify, your sales representative, the Basler Electric Regional Sales Office, or Basler Electric's customer service department at 618-654-2341.

If the PSS-100 is not installed immediately, store it in the original shipping package in a moisture- and dust-free environment.

MOUNTING

Hardware provided with the PSS-100 allows panel or rack mounting. An escutcheon plate is provided for panel mounting; brackets are supplied for rack mounting. Two mounting depths are made possible by alternate escutcheon plate and mounting bracket screw holes. Overall dimensions for a unit using rack mounting brackets are shown in Figure 8-1, Figure 8-2, and Figure 8-3. Figure 8-4, Figure 8-5, and Figure 8-6 show the overall dimensions for a stabilizer using the escutcheon plate for panel mounting. A panel cutting and drilling diagram for panel mounting the PSS-100 is provided in Figure 8-7.

CONNECTIONS

PSS-100 connections are dependent on the operating scheme used. Incorrect wiring may result in damage to the stabilizer. Be sure to check the model number against the Model Numbers Table in Section 1 before connecting and energizing your stabilizer.

NOTE

Be sure that the stabilizer is hard-wired to earth ground with no smaller than 12 AWG copper wire attached to the ground (GND) terminal on the rear of the case. When the PSS-100 is configured in a system with other devices, it is recommended to use a separate lead to the ground bus from each device.

Except as noted above, connections should be made with minimum wire size of 14 AWG. Be sure to use the correct input power for the power supply specified.

Figure 8-8 shows typical connections for an application with three wire voltage sensing.

Figure 8-9 shows typical connections for an application using the two wattmeter method of power measurement. Three-wire voltage sensing and two CTs (B-phase and C-phase) are used.

Figure 8-10 shows typical connections for a four wire sensing application.

Figure 8-11 illustrates the output contacts configuration and proper connections for the control inputs.

Figure 8-12 is a rear view of the PSS-100 case showing the terminal connections.

SETTINGS

The settings for your application need to be entered and confirmed prior to placing the stabilizer in service. A list of all settings is provided in Appendix B, *PSS-100 Settings.*

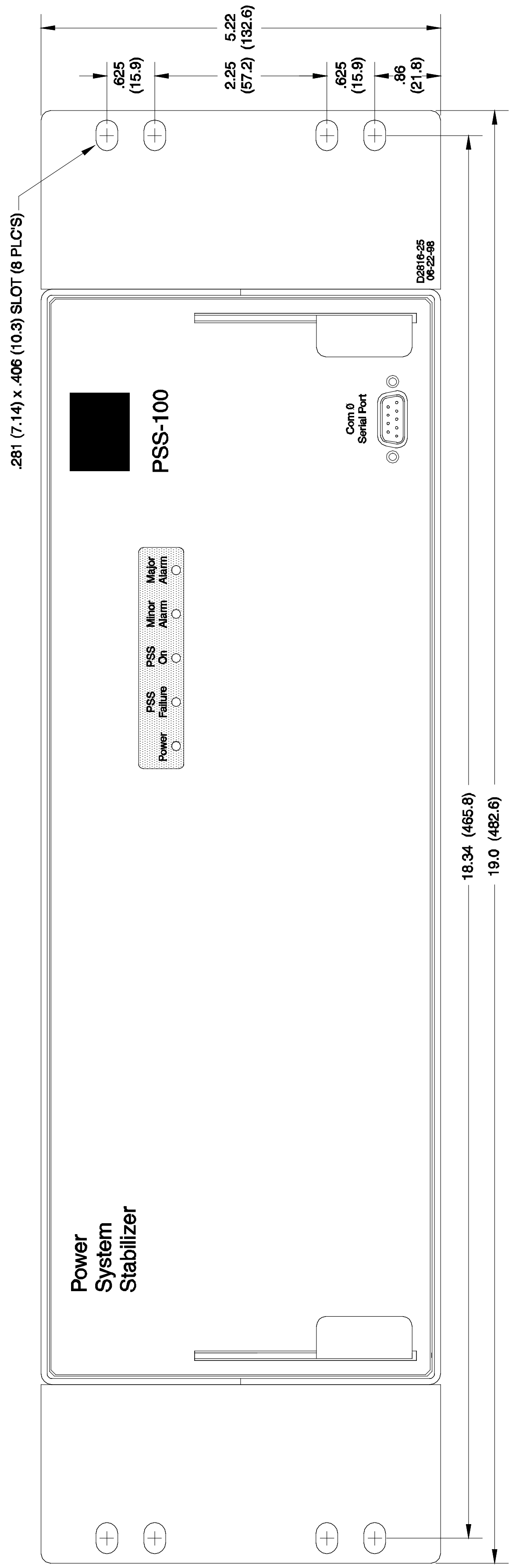

Figure 8-1. Rack Mount PSS-100 Outline Dimensions, Front View

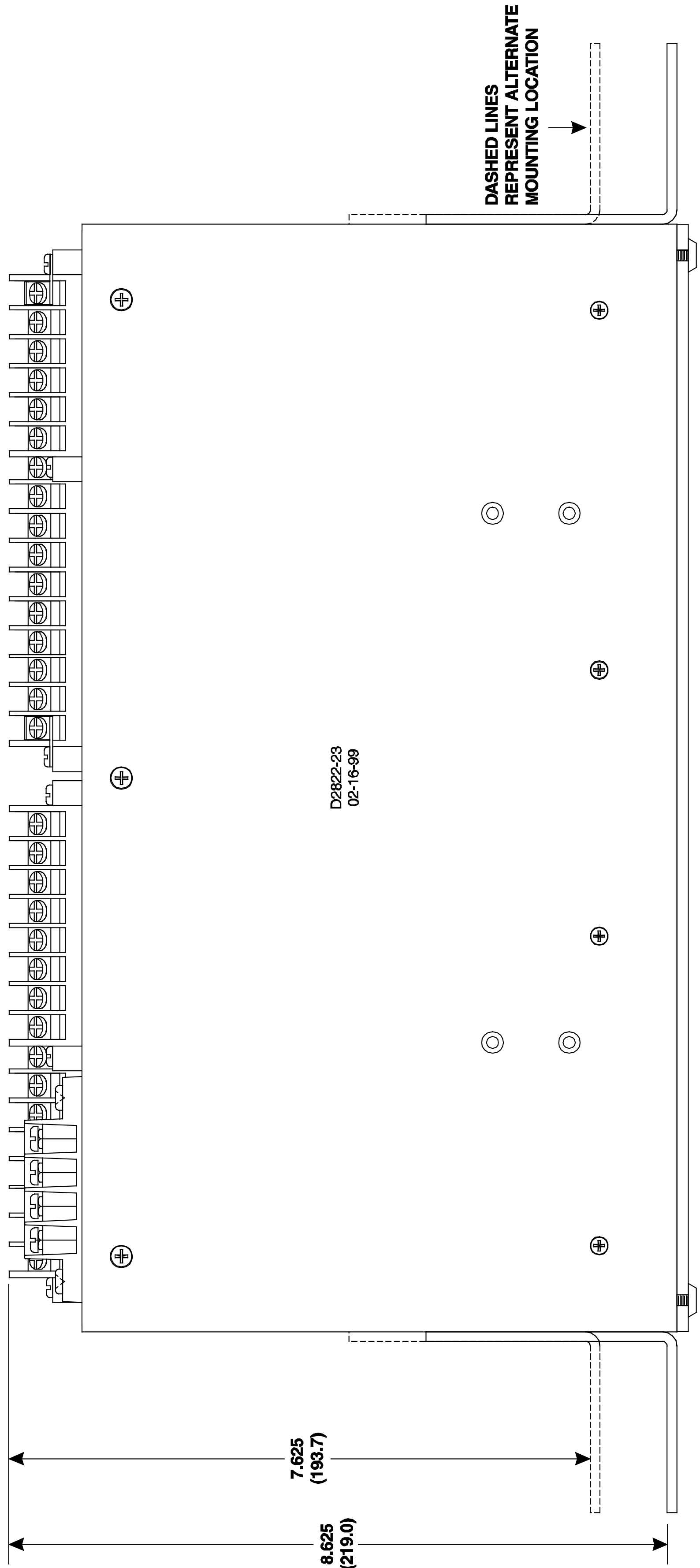

Figure 8-2. Rack Mount PSS-100 Outline Dimensions, Top View

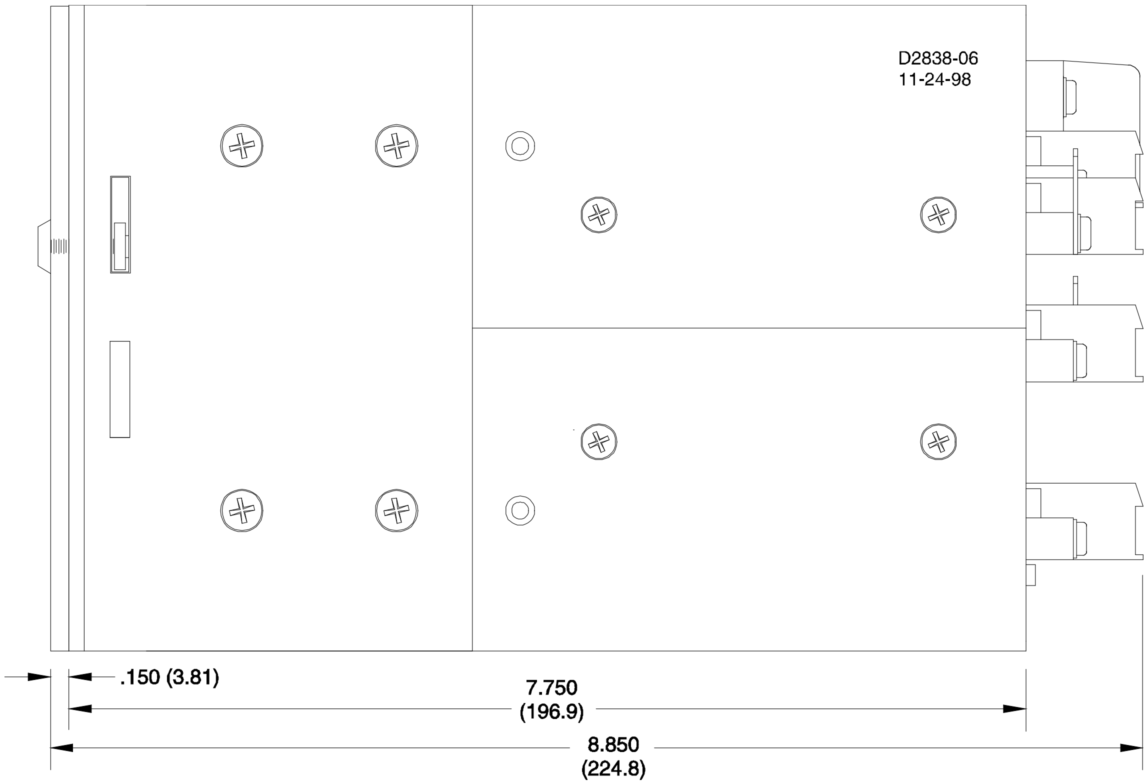

Figure 8-3. Rack Mount PSS-100 Outline Dimensions, Side View

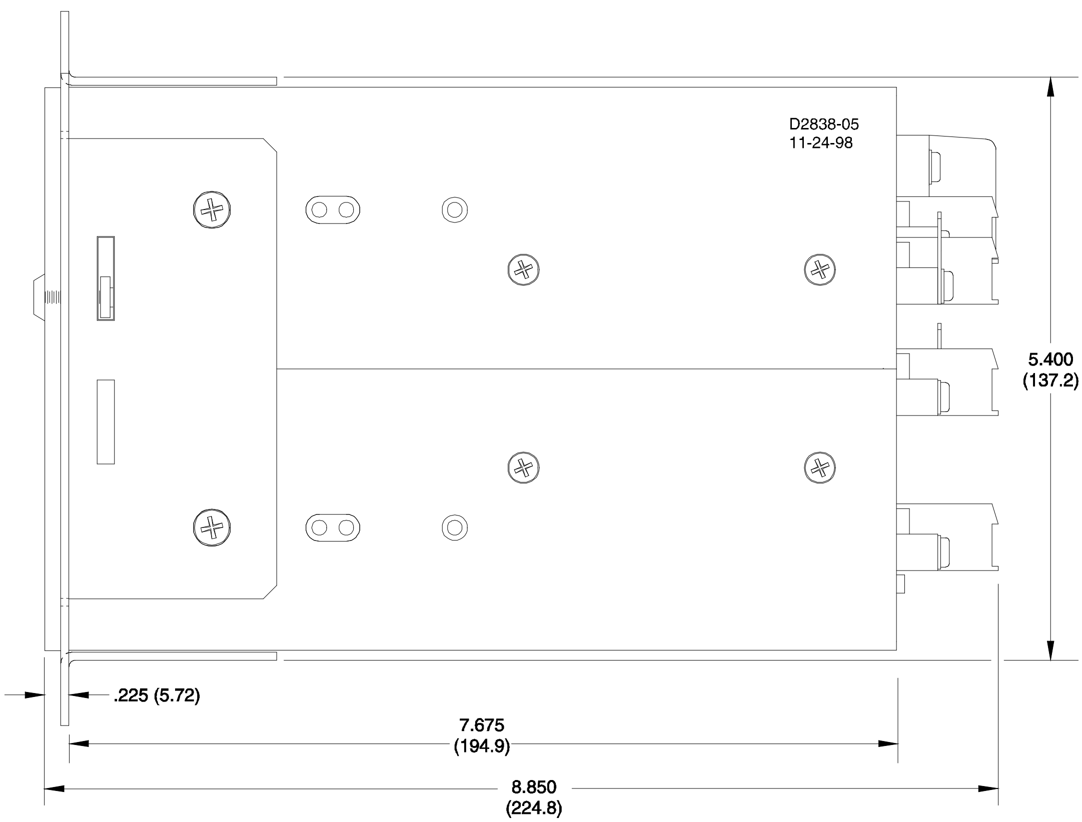

Figure 8-4. Panel Mount PSS-100 Outline Dimensions, Side View

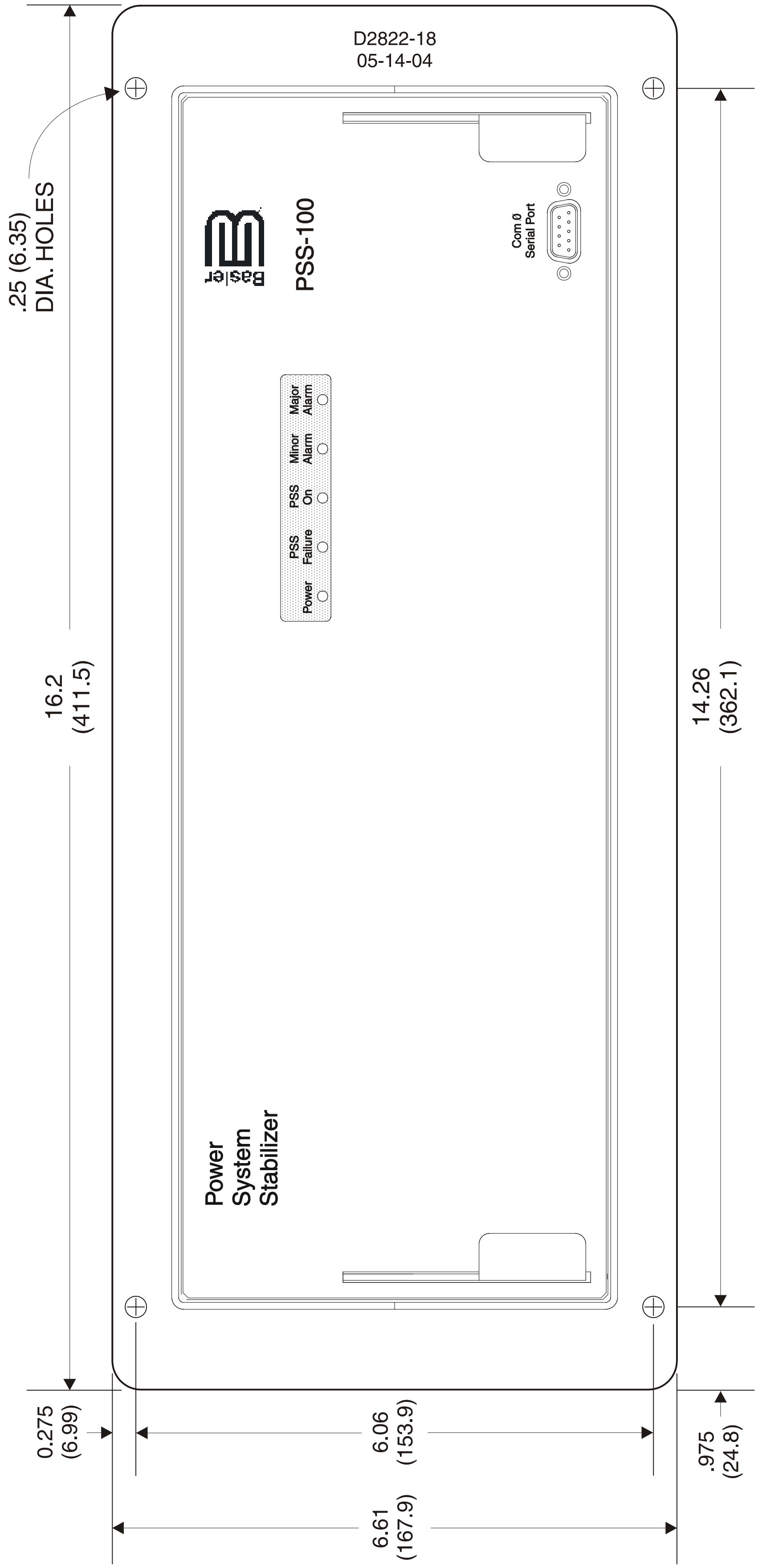

Figure 8-5. Panel Mount PSS-100 Outline Dimensions, Front View

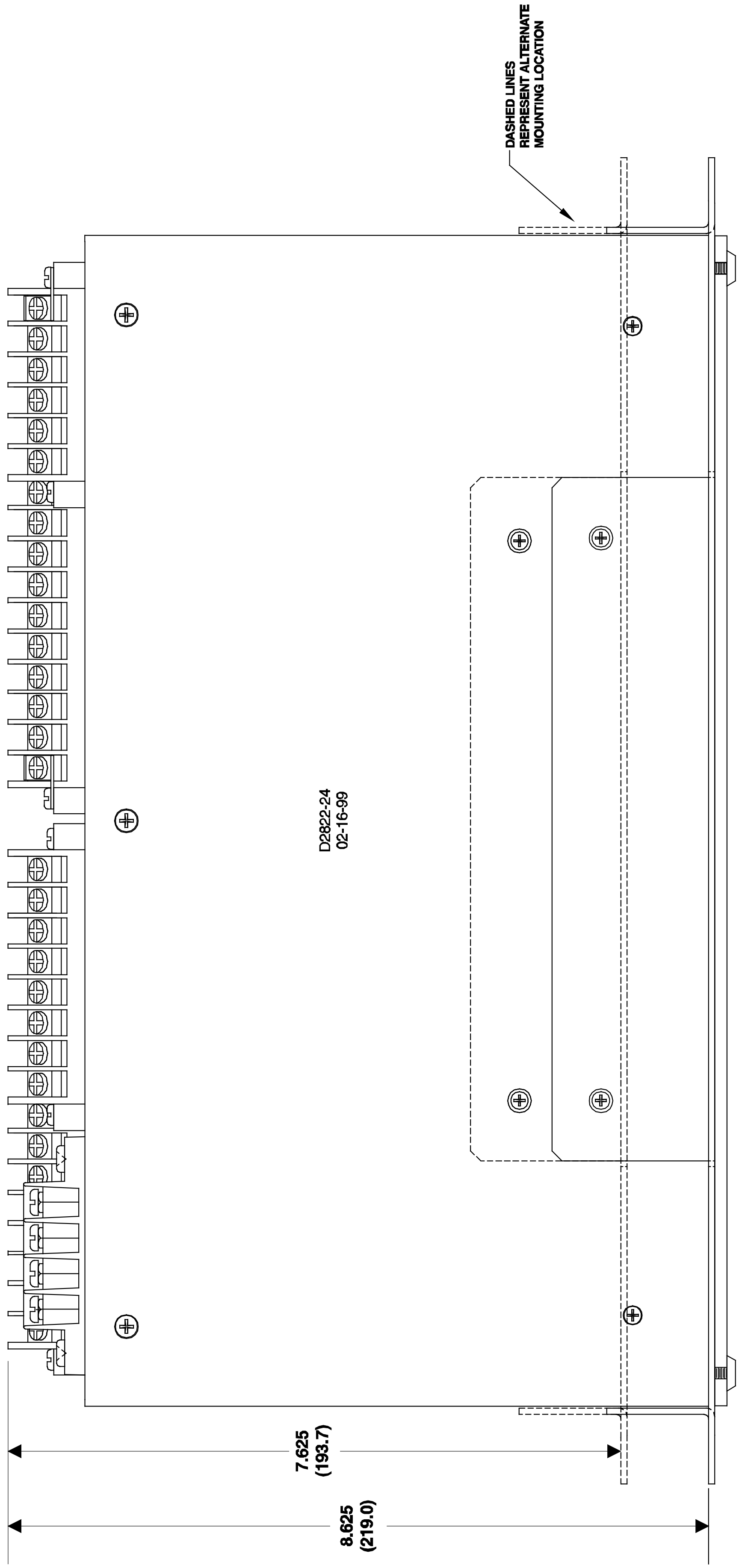

Figure 8-6. Panel Mount PSS-100 Outline Dimensions, Top View

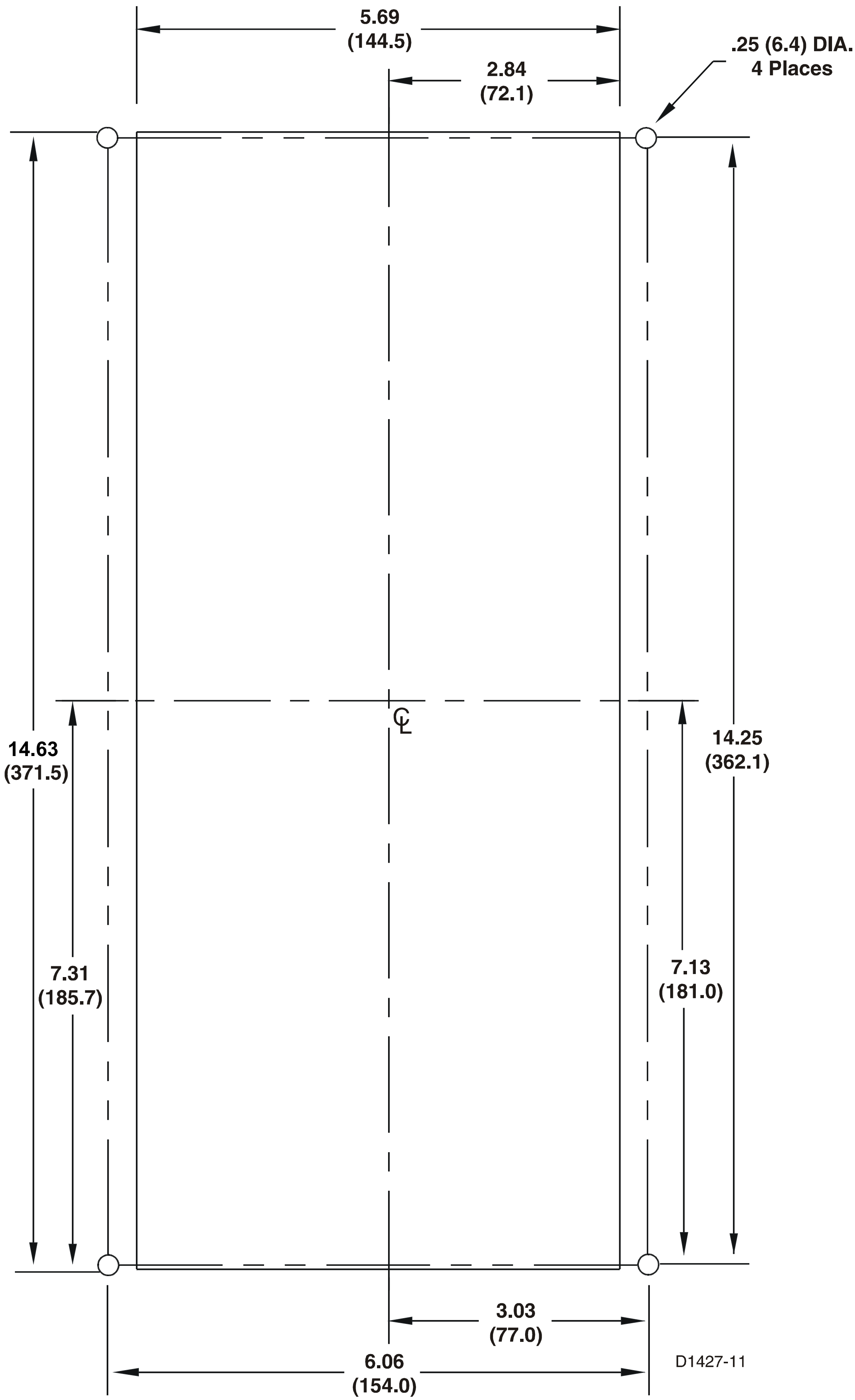

Figure 8-7. Panel Cutting and Drilling Diagram

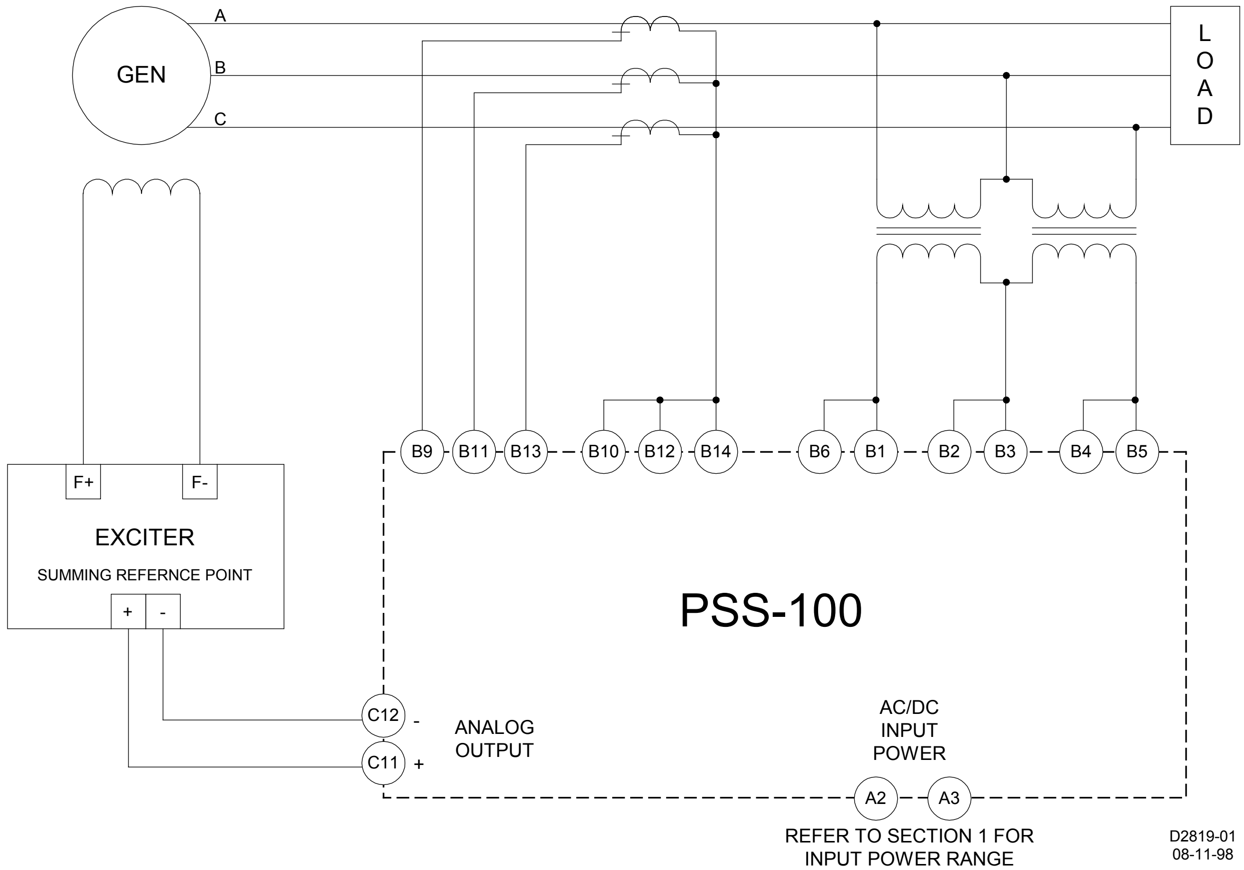

Figure 8-8. Typical Three Wire (Delta) Connections Diagram

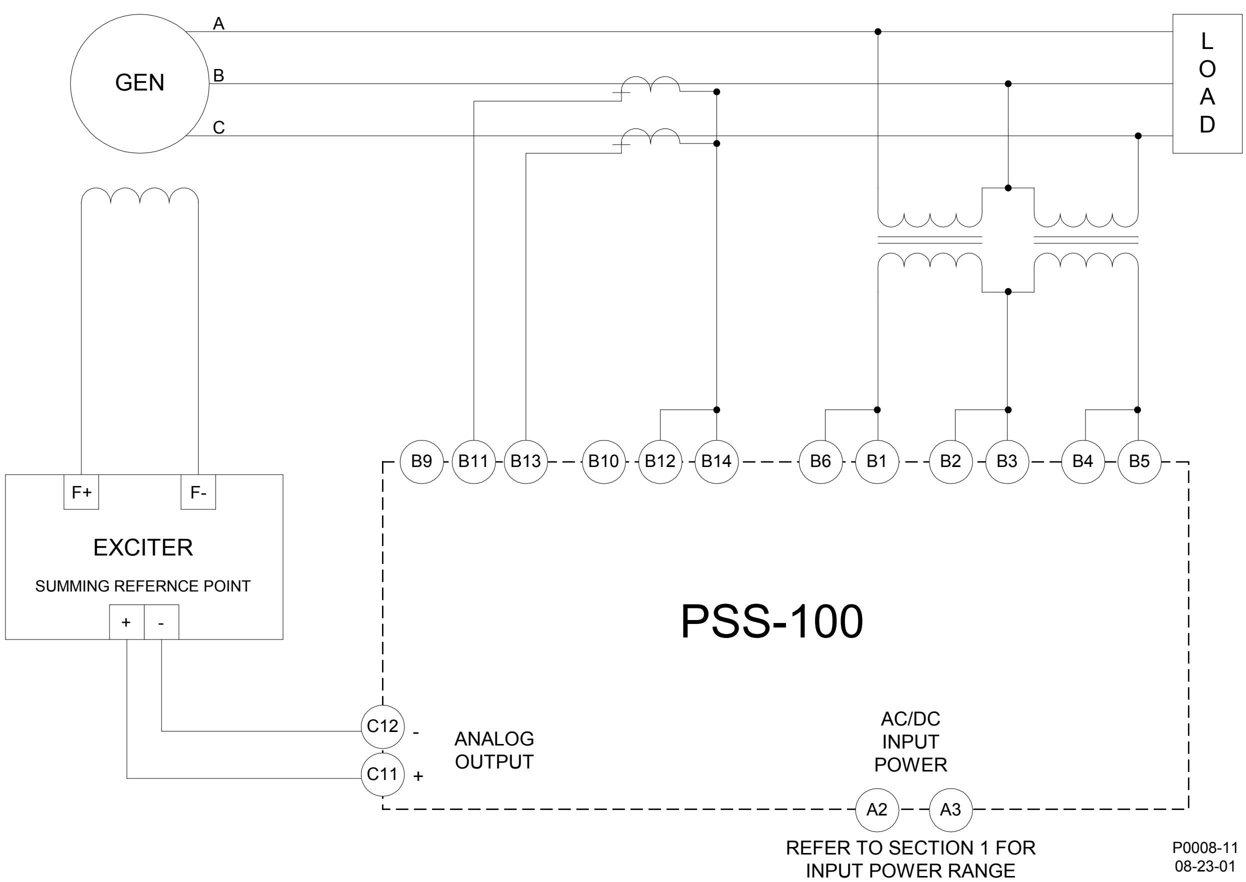

Figure 8-9. Typical Three Wire (Delta) Voltage Connections with Two CTs Diagram

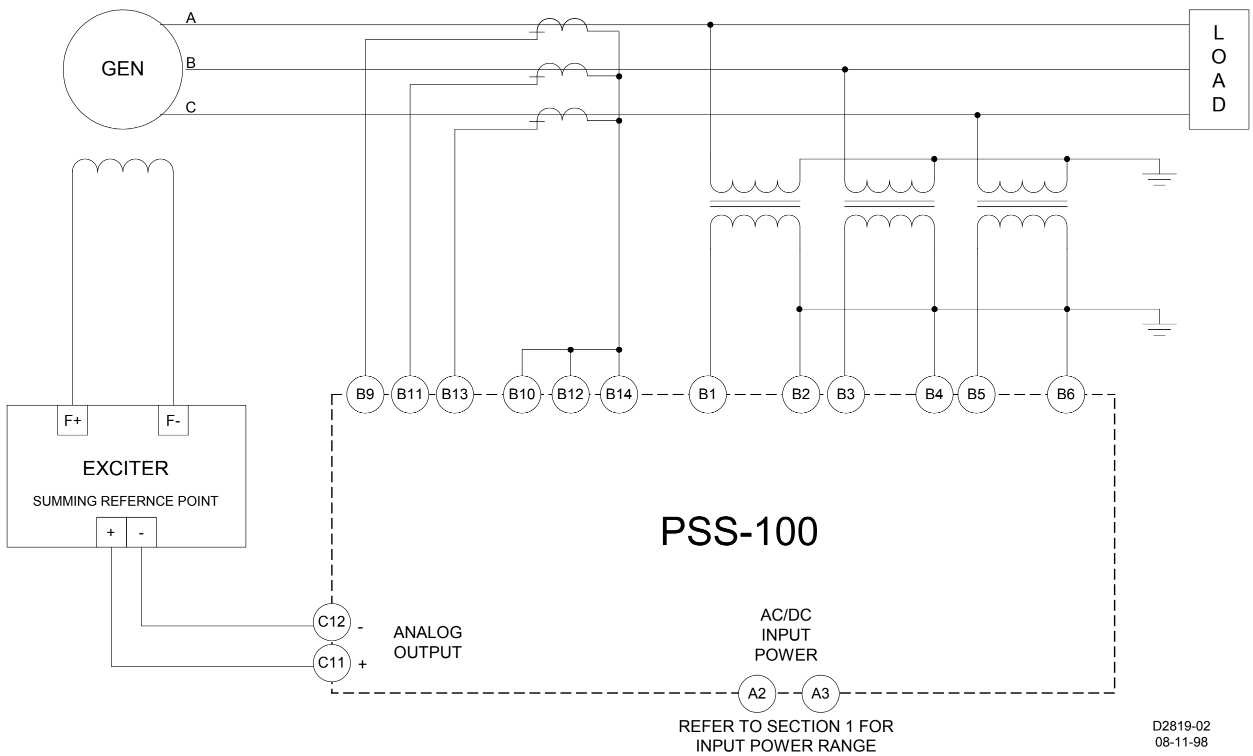

Figure 8-10. Typical Four Wire (Wye) Connections Diagram

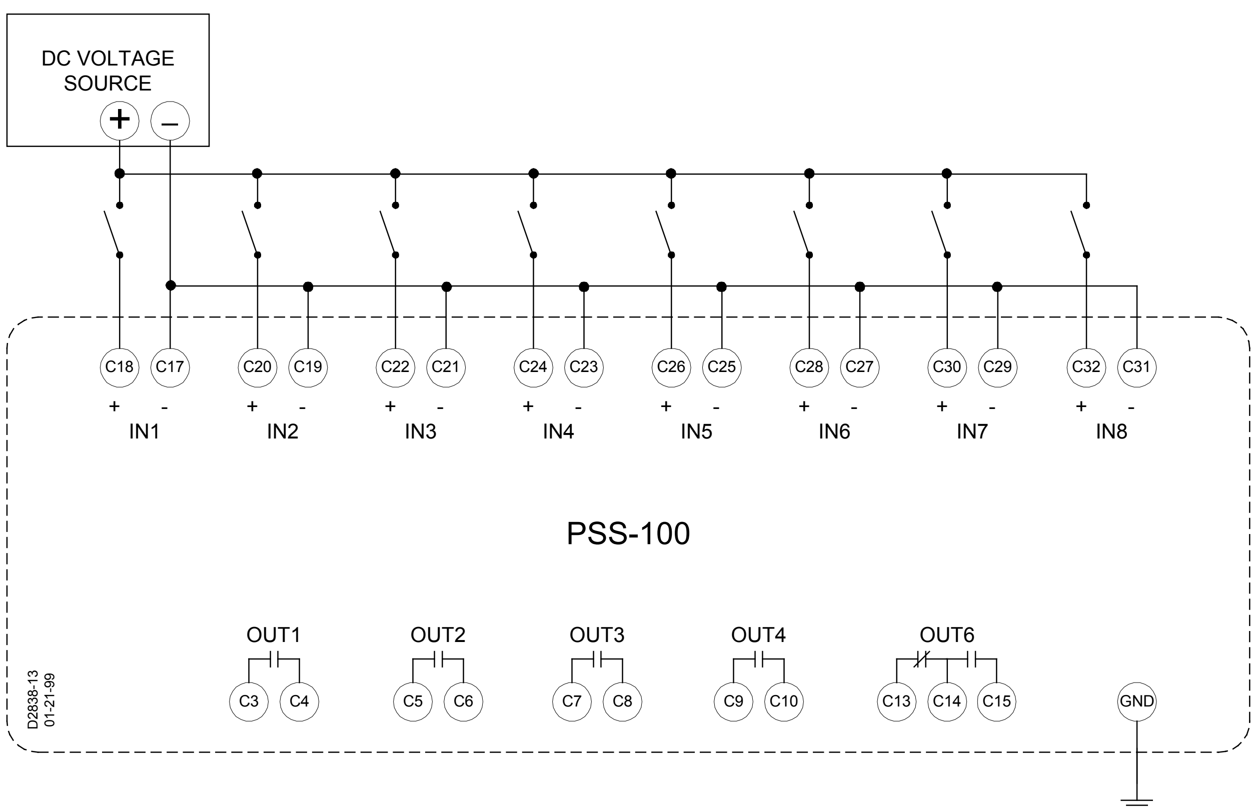

Figure 8-11. Control Input Connections and Output Contact Configurations

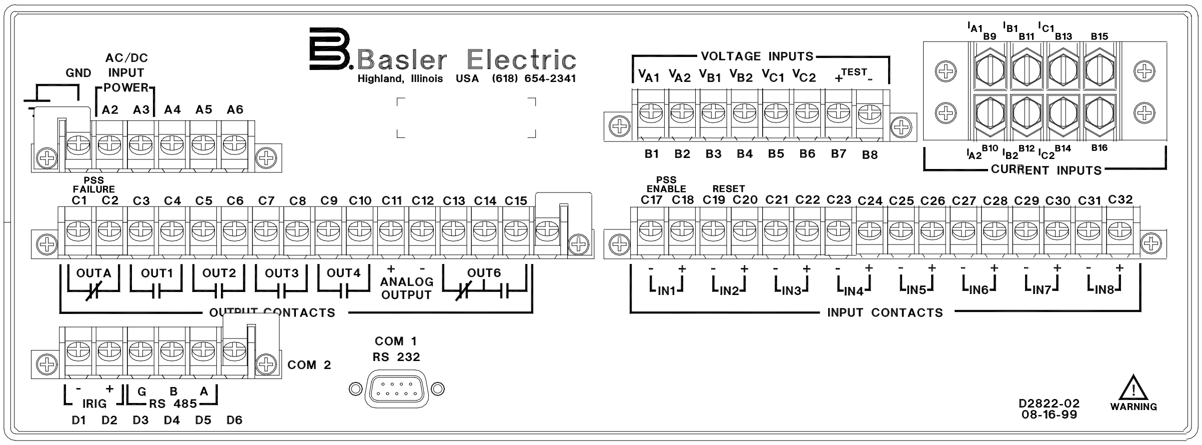

Figure 8-12. PSS-100 Rear View, Terminal Connections

COMMUNICATION CONNECTIONS AND SETTINGS

Front/Rear RS-232 Connectors

Front and rear RS-232 connectors are DB-9 female connectors. Connector pin numbers, functions, names, and signal directions are shown in Table 8-1. Figure 8-13 shows connections from the PSS-100 to a personal computer.

Table 8-1. RS-232 Pinouts (COM0 and COM1)

Pin	Function	Name	Direction
1	Shield	—	N/A
2	Transmit Data	TXD	From PSS-100
3	Receive Data	RXD	Into PSS-100
4	No Connection	—	N/A
5	Signal Ground	GND	N/A
6	No Connection	—	N/A
7	No Connection	—	N/A
8	No Connection	—	N/A
9	No Connection	—	N/A

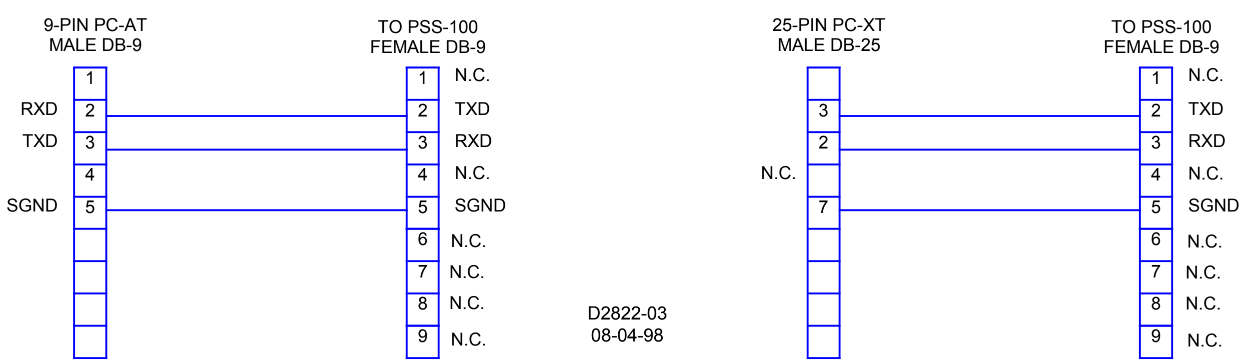

Figure 8-13. Personal Computer to PSS-100

> **NOTE**
>
> The RS-232 communication ports are not equipped with Request To Send (RTS) and Clear To Send (CTS) control lines. This makes the PSS-100 incompatible with systems that require hardware handshaking or systems that use self-powered RS-232 to RS-485 converters connected to the RS-232 ports.

RS-485 Connector

RS-485 connections consist of three terminals designed to interface with a standard communication cable. A twisted pair cable is recommended. Terminal numbers, functions, names, and signal directions are shown in Table 8-2. A cable connection diagram is provided in Figure 8-14.

Table 8-2. RS-485 Terminal Assignments (COM2)

Terminal	Function	Name	Direction
D5 (A)	Send/Receive A	SDA/RDA	In/Out
D4 (B)	Send/Receive B	SDB/RDB	In/Out
D3 (G)	Signal Ground	GND	N/A

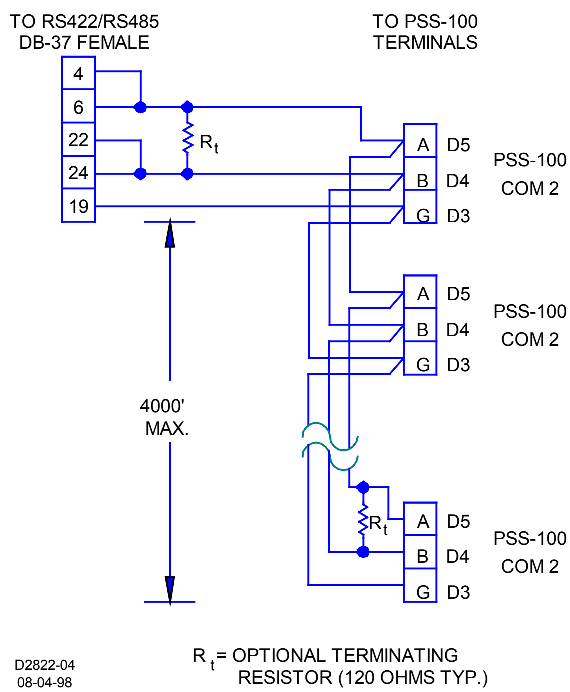

Figure 8-14. RS-485 DB-37 to PSS-100

Communication Settings

Communication settings are the formal set of conventions controlling the format and relative timing of message exchange between two communications terminals. PSS-100 communication settings are stored as BAUD, PARITY, DATA BITS, STOP BITS. The default protocol is 96008N1.

CONTACT SENSING INPUTS

Eight contact sensing inputs provide external stimulus to initiate PSS-100 actions. An external wetting voltage is required for the contact sensing inputs. The nominal voltage level of the external dc source must comply with the dc power supply input voltage ranges listed in Section 1, *General Information, Specifications*. To enhance user flexibility, the PSS-100 uses a wide range ac/dc power supply that covers several common control voltages. The contact sensing input circuits are designed to respond to voltages at the lower end of the control voltage range, while not overheating at the high end of the range.

Each PSS-100 is delivered with the contact sensing jumpers installed for operation in the lower end of the control voltage range. If the contact sensing inputs are to be operated at the upper end of the control voltage range, the jumpers must be changed or removed. Table 4-1 of Section 4, *Functional Description* lists the voltage range for each jumper position.

The following paragraphs describe how to locate and remove/change the contact sensing input jumpers.

1. Remove the drawout assembly by pulling the two latches upward and sliding the assembly out of the case. Observe all electrostatic discharge (ESD) precautions when handling the drawout assembly.

CAUTION

If the PSS-100 analog output is connected in series with the voltage regulator output, case terminals C11 and C12 must be shorted prior to removing the draw-out assembly. This allows the voltage regulator to function when the PSS-100 is removed from service.

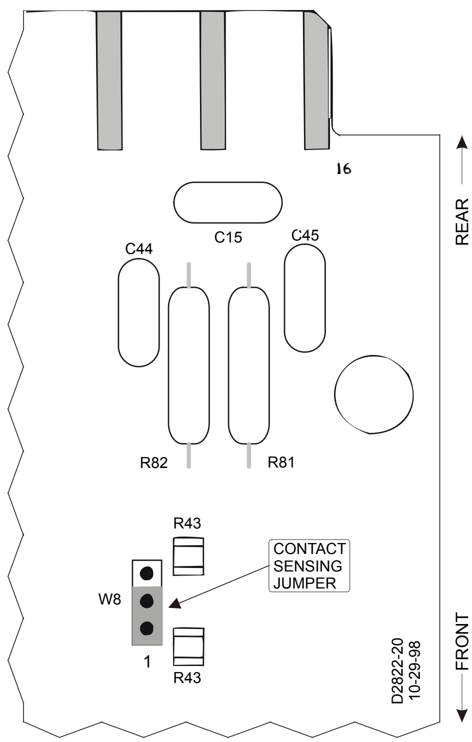

Figure 8-15. Contact Sensing Jumper Location

2. Locate the eight jumper terminal blocks (W1 through W8) that are mounted on the Input/Output Circuit Board. The Input/Output Circuit Board is the middle board in the assembly and the jumper terminal blocks are located on the component side of the circuit board near the left hand side (right hand side when looking at the unit from the rear by the internal connections). Each terminal block has three pins. With the jumper as installed at the factory, one pin should be visible when viewed from the rear of the unit. Figure 8-15 illustrates the location of a jumper placed in the low voltage position.

3. To select operation at the upper end of the control voltage range, remove the blue jumper entirely from the unit or position it on the two terminals closest to the rear of the circuit board. Use care when removing each jumper so that no components are damaged.

4. When all jumpers are positioned for operation in the desired control voltage range, prepare to place the drawout assembly back into the case.

5. Align the drawout assembly with the case guides and slide the assembly into the case.
6. Push the latches down until they are parallel with the front panel.

> **NOTE**
> Remove any temporary jumpers installed on the case terminals when returning the PSS-100 into service.

PREPARING THE PSS-100 FOR SERVICE

Configuring

Prior to putting the stabilizer into service it must be configured for the application. This involves entering a series of ASCII text based commands as described throughout this manual. These commands are entered into the PSS-100 after establishing communication with the stabilizer via a terminal emulation program as previously described.

Testing

Section 7 provides a suggested testing procedure if testing is desired before placing the PSS-100 in service.

MAINTENANCE

PSS-100 Power System Stabilizers require no preventative maintenance. However, testing should be performed according to scheduled practices. If the unit fails to function properly, consult the Basler Electric Technical Services Department at +1 618.654.2341 for a return authorization number prior to shipping.

STORAGE

This device contains long-life, aluminum, electrolytic capacitors. For devices that are not in service (spares in storage), the life of these capacitors can be maximized by energizing the device for 30 minutes once per year.

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APPENDIX A • QUICK START

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APPENDIX A • QUICK START

INTRODUCTION

This appendix provides basic information about connecting, setting, and testing the PSS-100. The intent is to provide the PSS-100 user with enough information to begin interacting with the device and learning about its capabilities.

OPERATING POWER

Verify that the power source that you intend to use is compatible with the power supply of the PSS-100. Table A-1 lists the operating power range for each PSS-100 model.

Table A-1. Operating Power Range

Model	Operating Power Range
PSS-100-YX	35 to 150 Vdc 55 to 135 Vac
PSS-100-ZX	90 to 300 Vdc 90 to 270 Vac

Operating power is applied to the PSS-100 at terminals A2 and A3. The operating power input is not polarity sensitive.

When operating power is applied to the PSS-100, the front panel LEDs will flash several times. Afterwards, the Power LED will light continuously and the PSS Failure LED should light for several seconds.

COMMUNICATION

Communication with the PSS-100 is achieved by connecting a PC, operating BESTCOMS software, to a communication port of the PSS-100.

Connections

Connect a communication cable between your PC serial port and the communication port on the PSS-100 front panel (Com 0). The front panel communication port uses a female, DB9 connector.

BESTCOMS Software

BESTCOMS software provides a communication link between the PSS-100 and PC user. It provides a user-friendly environment for changing PSS-100 settings and provides real-time metering of system parameters. Within BESTCOMS, PSS-100 settings can be saved in a computer file, edited, and then uploaded back into the PSS-100.

Refer to Section 6, *BESTCOMS Software* for information about installing and starting BESTCOMS and configuring BESTCOMS for communication with the PSS-100.

PSS-100 SETTINGS

The following sample settings are provided as a suggested starting point for using the PSS-100.

System Configuration

The sample settings, shown in Figure A-1, configure a PSS-100 (with 5 Aac nominal current sensing) with the generator CT ratio, generator VT ratio, VT configuration, generator voltampere rating, and generator line voltage. The suggested generator voltampere rating for a PSS-100 with 1 Aac nominal current sensing is 0.0002 MVA. These settings need to be modified to match your system. If you are bench-testing the PSS-100 and specific generator ratings are not desired, these settings are appropriate.

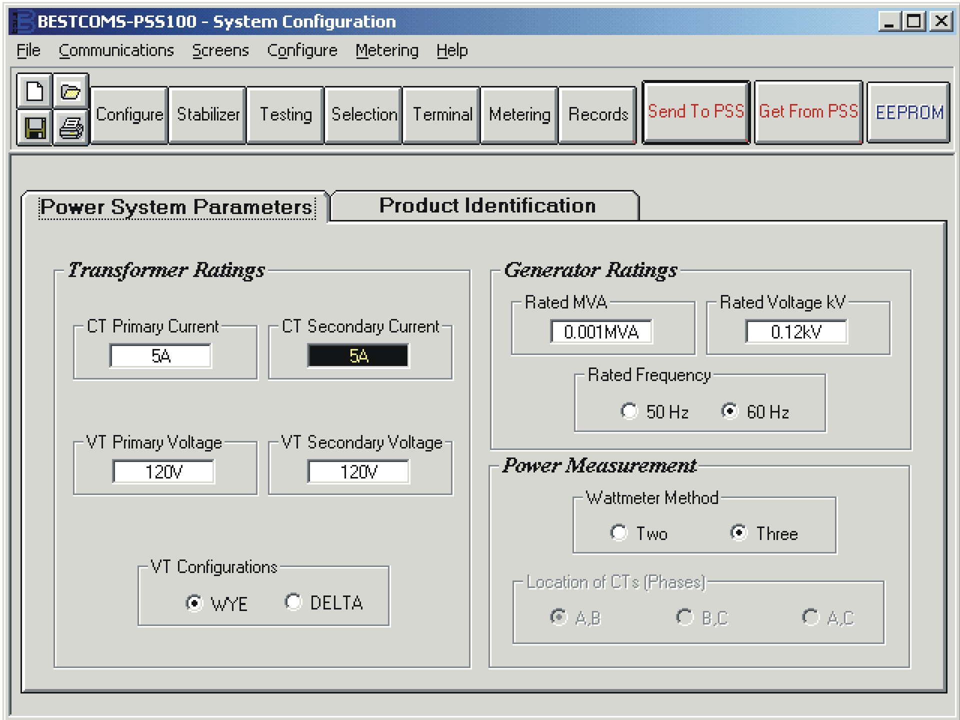

Figure A-1. System Configuration Settings

Stabilizer Parameters

Figures A-2 through A-4 illustrate sample stabilizer control settings (Figure A-2), stabilizer parameters (Figure A-3), and output limiter settings (Figure A-4).

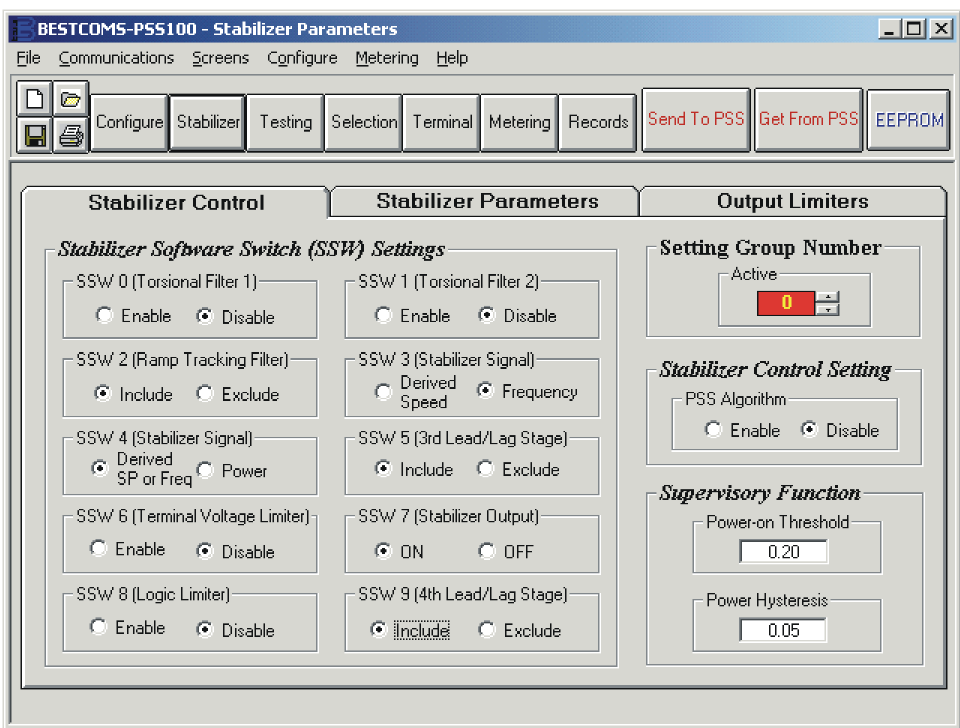

Figure A-2. Stabilizer Control Settings

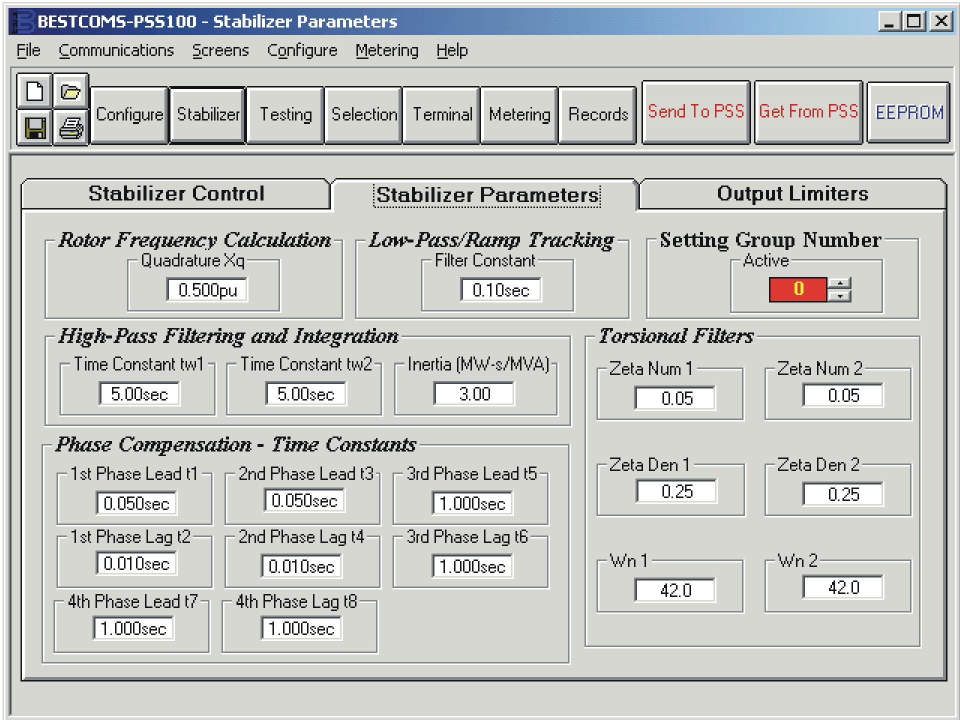

Figure A-3. Stabilizer Parameters

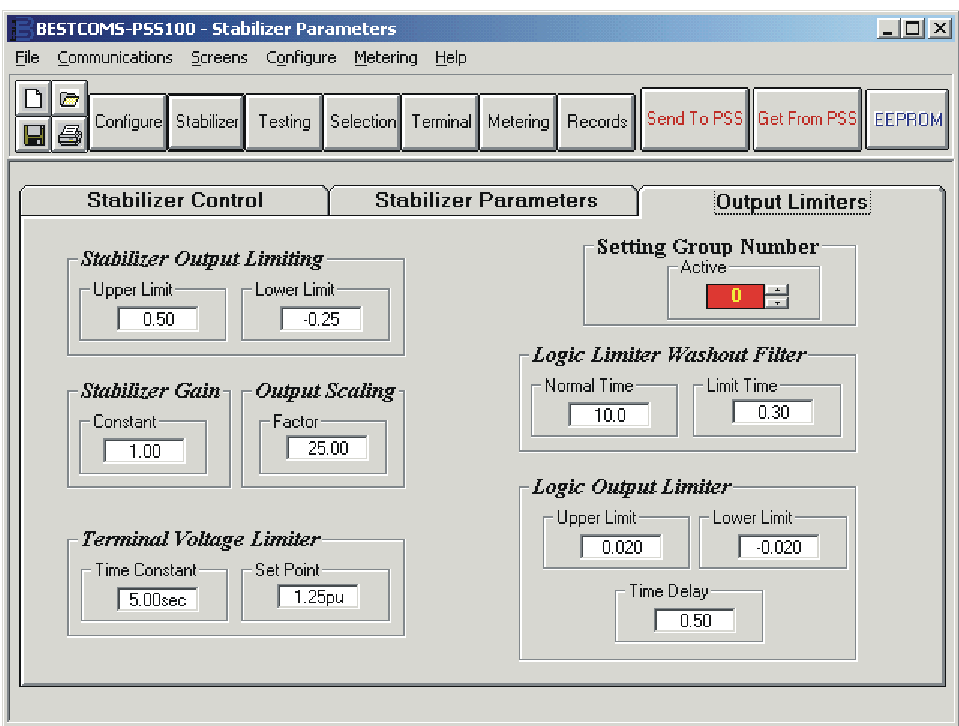

Figure A-4. Output Limiter Settings

Selection Parameters

Figures A-5 through A-7 illustrate sample setting group selection settings (Figure A-5), output selection settings (Figure A-6), and alarm selection settings (Figure A-7).

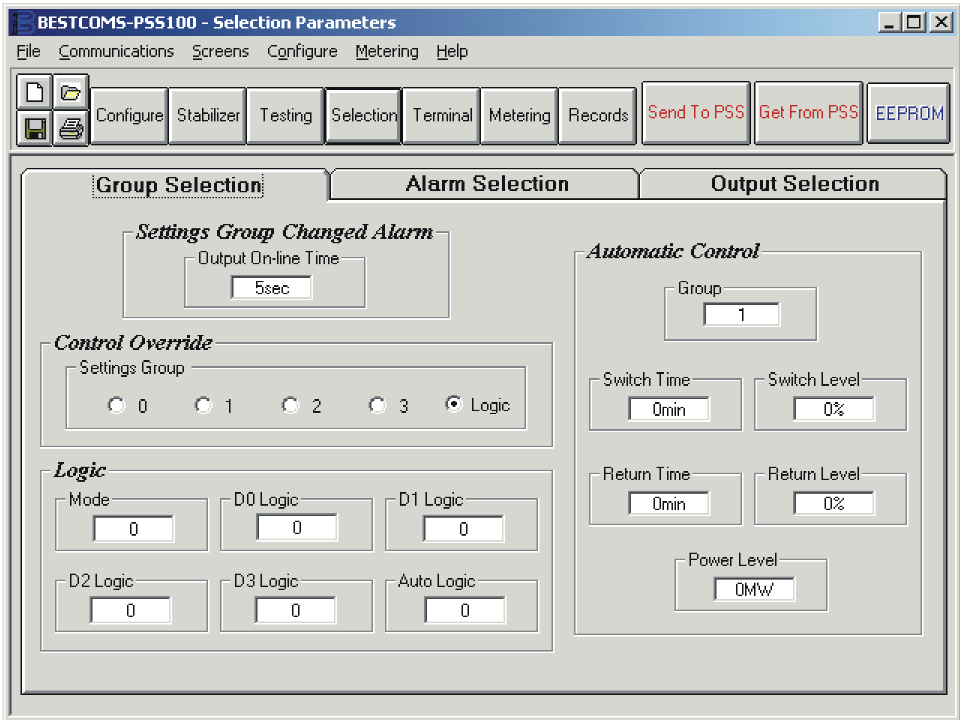

Figure A-5. Setting Group Selection Settings

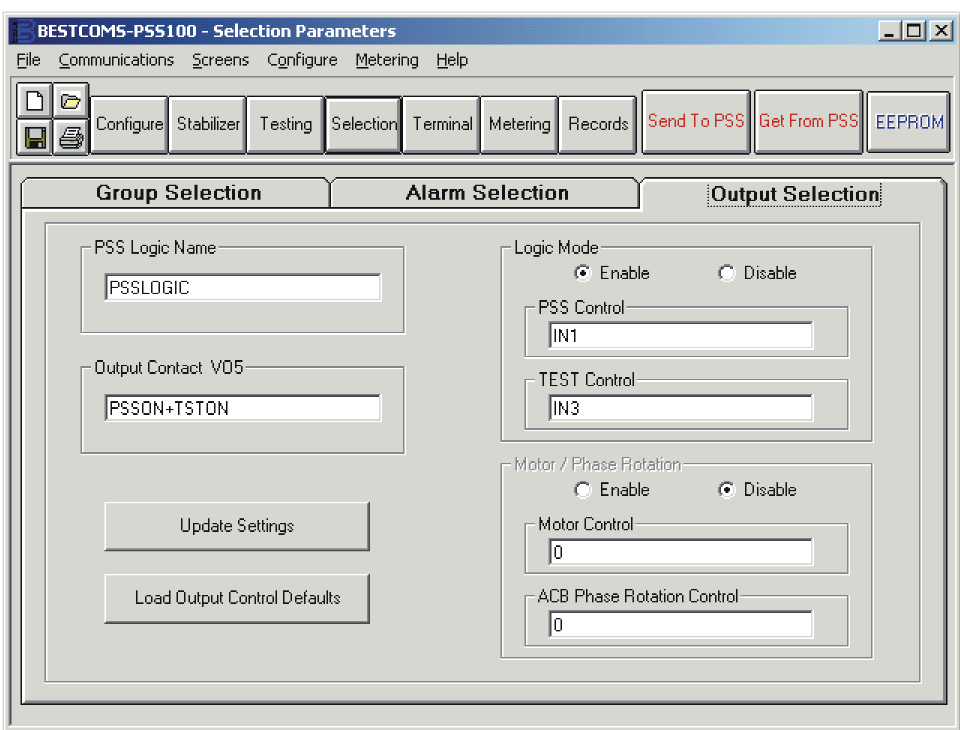

Figure A-6. Output Selection Settings

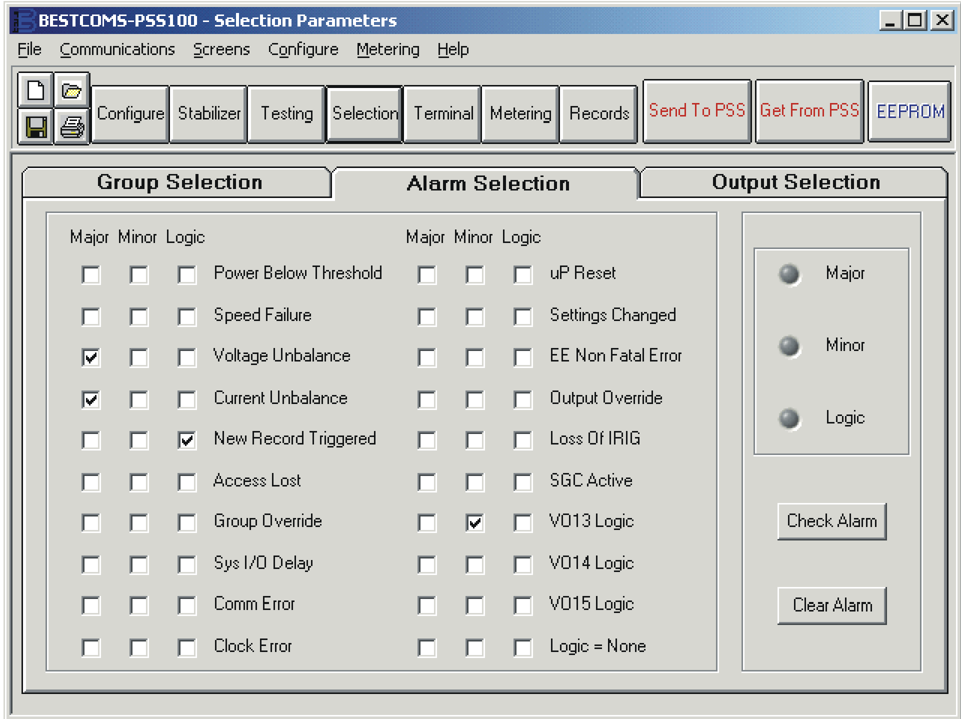

Figure A-7. Alarm Selection Settings

Records

Figures A-8 and A-9 illustrate sample logic trigger settings (Figure A-8) and data log settings (Figure A-9).

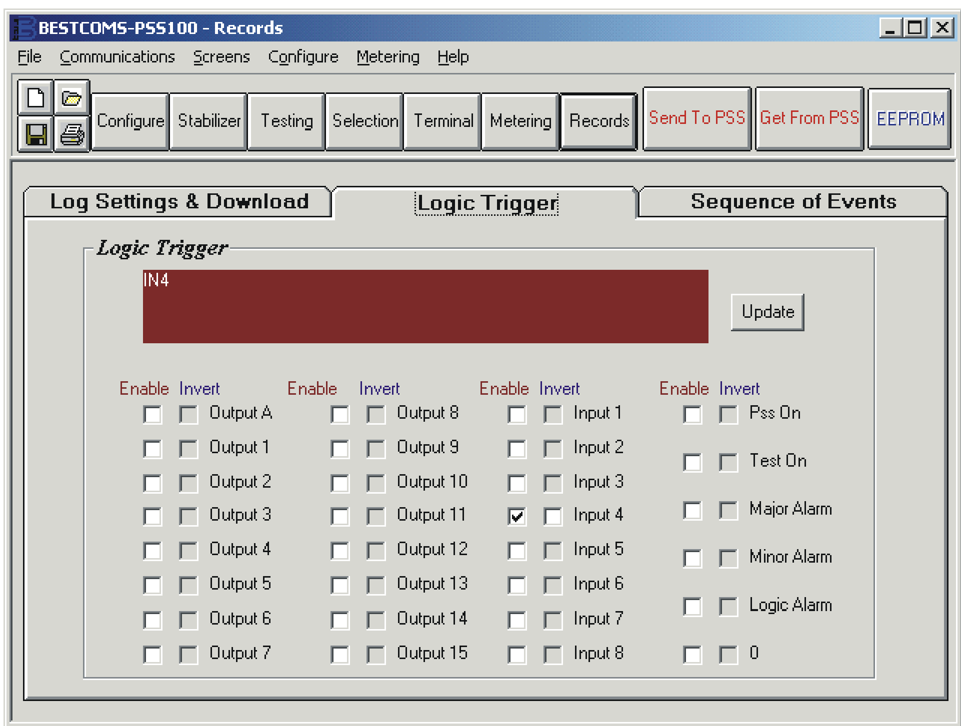

Figure A-8. Logic Trigger Settings

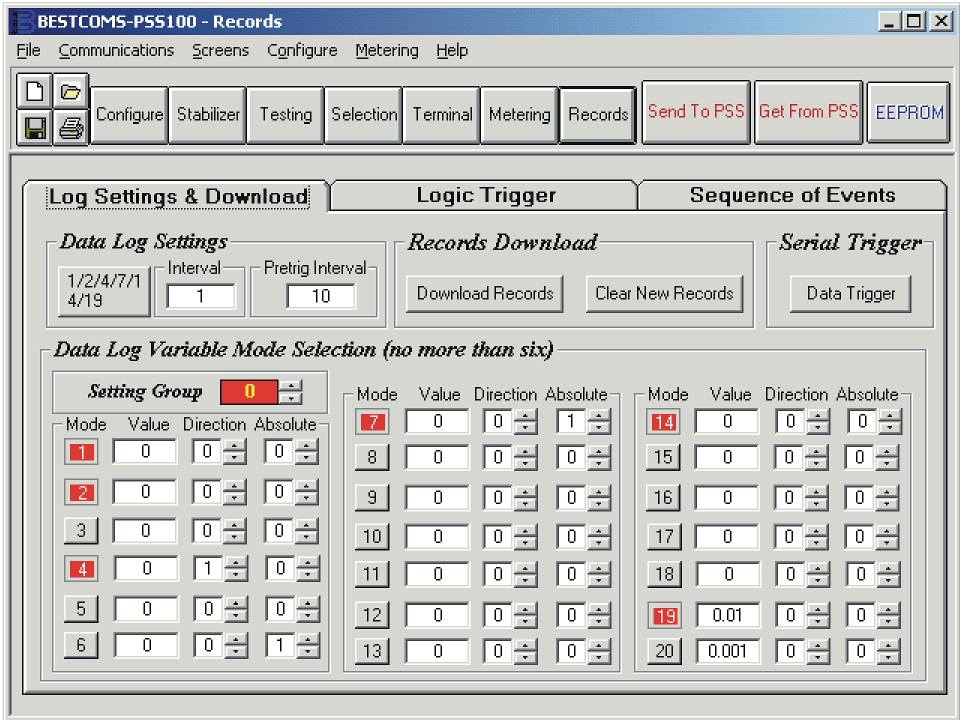

Figure A-9. Data Log Settings

Testing Parameters

Figure A-10 illustrates sample testing parameters.

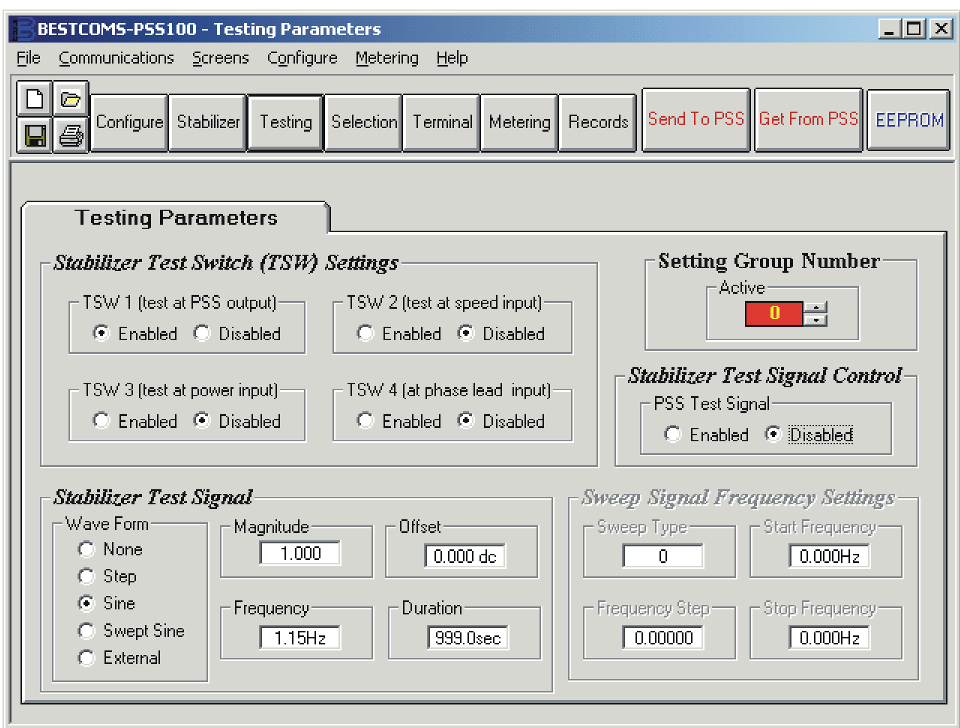

Figure A-10. Testing Parameters

CREATING A SETTINGS FILE

PSS-100 parameters can be saved in a settings file for ease of reference and programming. In BESTCOMS, settings are saved in a file (.pss extension) by clicking the Save File icon, navigating to the desired location, assigning a unique file name to the settings, and clicking the Save button. It may be desirable to make a backup file of the default settings that are programmed into the PSS-100.

VOLTAGE AND CURRENT SENSING INPUTS

Make connections to the PSS-100 voltage and current sensing inputs using Figures 9-7 through 9-9 as guides. The applied voltage should be 115 to 120 Vac_{L-L} for open delta connections and 65 to 70 volts for four-wire, wye connections. Current applied to a PSS-100-X1 should not exceed 1 Aac and current applied to a PSS-100-X5 should not exceed 5 Aac.

METERING DATA

With voltage and current applied, use the Metering tab of the BESTCOMS Metering and Alarm/Status screen to verify PSS-100 metering values.

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APPENDIX B • BESTlogic PROGRAMMABLE LOGIC

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APPENDIX B • BESTlogic PROGRAMMABLE LOGIC

GENERAL

BESTlogic (Basler Electric Standard Test logic) is a simple programming method for controlling output relays based on combinations of inputs, logic/control function blocks, and outputs. Each function block in the PSS-100 acts as a self-contained entity (module). Each entity interacts with other blocks solely through the programmed inputs and outputs. Figure B-2 shows all available PSS-100 function blocks. Section 4, *Functional Description* describes each function block in detail.

WORKING WITH PROGRAMMABLE LOGIC

The group of equations defining the operational logic of the PSS-100 is called a logic scheme. A logic scheme can be given a unique name (of one to eight characters) for identification purposes. It can be saved as a text file for use as a record or backup. A logic scheme is programmed into the PSS-100 through the communication ports, either by transmitting a text file or by entering individual commands.

Different logic schemes can be programmed into the PSS-100 at different times. In practice, this could cause some inconvenience if wiring changes are required. However, each PSS-100 unit at an installation could have a different logic scheme and associated wiring. Different logic scheme names can be used as identifiers in such cases.

The PSS-100 saves the logic scheme it uses in nonvolatile memory. This logic scheme is referred to as the custom logic scheme because it can be customized (programmed) by the user. Future versions of the PSS-100 may include several standard, pre-programmed logic schemes. These read-only schemes will be able to be copied over to the custom logic scheme for use. The RG-LOGIC command is used to read the name of the active logic scheme.

RG-LOGIC Command

Purpose: Reads the custom (active) logic scheme name.
Syntax: RG-LOGIC
Comments: No password access is required to read settings.

RG-LOGIC Command Example

Read the name of the active logic scheme.

RG-LOGIC
`PSSLOGIC`

CREATING A CUSTOM LOGIC SCHEME

A custom logic scheme can be created by modifying the equations of an existing logic scheme, assigning a unique name to the logic scheme, and saving it.

Reading Logic Scheme Names and Settings

PSS-100 logic schemes are identified by unique names. The SL command is used to read these logic names and the equations associated with them.

SL Command

Purpose: Reads the names of logic schemes in memory or the equations for the named logic.
Syntax: SL[:<name>] or SL-<xxx>
Comments: No password access is required to read settings.

Entering SL reads the logic equations associated with the active logic scheme. Entering SL: reads the names of the available logic schemes. Entering SL:<name> reads all logic equations associated with a particular logic scheme. Entering SL-<xxx> reads a logic equation associated with logic variable xxx.

SL Command Examples

1. Reads the list of available logic schemes.

   SL:

   ```
   PSSLOGIC, NONE_1, NONE_2, NONE_3, NONE_4, NONE_5, NONE_6, NONE
   ```

> **NOTE**
>
> Currently, only the custom logic scheme is supported. (This scheme is named PSSLOGIC in the example above.) This name can be changed by the user. All logic schemes labeled NONE are for future expansion.

2. Read all logic equations associated with the custom (PSSLOGIC) logic scheme.

   SL *or* SL:PSSLOGIC

   ```
   SL-N=PSSLOGIC
   SL-PSS=1,IN1,IN3+43
   SL-62=0,0,0
   SL-162=0,0,0
   SL-43=0
   SL-143=0
   SL-243=0
   SL-343=0
   SL-443=0
   SL-543=0
   SL-643=0
   SL-743=0
   SL-GROUP=0,0,0,0,0,0
   SL-VOA=0
   SL-VO1=PSSON
   SL-VO2=TSTON
   SL-VO3=ALMMAJ
   SL-VO4=ALMLGC
   SL-VO5=PSSON+TSTON
   SL-VO6=0
   SL-VO7=0
   SL-VO8=0
   SL-VO9=0
   SL-VO10=0
   SL-VO11=0
   SL-VO12=0
   SL-VO13=TSTON
   SL-VO14=0
   SL-VO15=0
   SL-OP=1,0,0
   ```

For user programmable custom logic, an equals sign (=) is used to separate the command from the setting data. For read only logic schemes, a colon (:) is used to separate the command from the setting data to indicate that the scheme setting cannot be changed.

3. Read the logic equation associated with logic variable VO5.

   SL-VO5

   ```
   PSSON+TSTON
   ```

Programming a Custom Logic Scheme

A new custom logic scheme is created by modifying the current custom logic scheme equations and settings. It is also possible to copy one of the standard logic schemes (if provided) over to the custom logic scheme before modifying it. If the new custom logic scheme is only slightly different from one of the standard schemes (if provided), the required changes would be minor. After the changes are made, the newly created logic scheme should be saved as the new custom logic scheme. There is no need to take the stabilizer offline while the changes are being made. Changes take effect only after they have been saved with an EXIT;YES command.

The new custom logic scheme may be given the same name as the previous custom logic scheme or it may be given an entirely new, unique name. The custom logic scheme name must be different from any of the standard logic scheme names (if provided). All of the commands required to create a custom logic scheme can be entered as a text file and then uploaded to the PSS-100. This is the most convenient method of programming the PSS-100.

Copying a standard logic scheme to the custom scheme and assigning a new name to the custom scheme is accomplished using the SL-N command.

SL-N Command

Purpose: Reads or sets the custom logic scheme name or copies a standard logic scheme to the custom logic scheme.
Syntax: SL-N[=<name>]
Comments: Privilege G or S password access is required to change settings.

Parameter name can consist of any alphanumeric string of one to eight characters.

The SL-N command is context sensitive and functions according to the circumstance in which it is invoked. Its function is illustrated by the following examples.

SL-N Command Examples

1. Read the name of the custom logic scheme.

   SL-N
   `PSS1`

2. Copy the standard logic scheme PSS1 over to the custom logic scheme.

   SL-N=PSS1

3. Rename the custom logic by assigning a completely new logic name.

   SL-N=NEWNAME

Note: Assigning the existing custom logic scheme has no effect.

Custom Logic Programming Hints

Making minor changes to an existing logic scheme can be simplified by copying the logic equations for a preprogrammed scheme over to the custom scheme. This requires the following steps.

1. Enter SL-N=<existing name>. This copies the standard logic over to the custom logic. This step may be skipped if you want to edit the custom logic itself.
2. Enter SL-N=<new name>. This assigns a name to the custom logic scheme that you will have at the end of this process. This name must be different from the preprogrammed, standard logic names, but could be the same as the previous custom logic name. This step may be skipped if you want to edit the current custom logic itself.
3. All programming changes may now be made to the custom logic scheme. These changes should be saved at the end of the process.
4. If the new logic scheme to be created is significantly different from one of the schemes in the unit, or if a completely new logic scheme is desired, a text file containing all of the required commands can be created. A sample file is shown in Appendix A, *Quick Start*. The user may use any of the commands from Appendix B, *PSS-100 Settings* in the text file. Global or settings password access should be acquired before transmitting the text file, and the settings should be saved after transmitting the file by using the “EXIT” command. Alternately, these commands can be made part of the text file.

BESTlogic Expressions and Variables

BESTlogic expressions are written using logic variables and operators. Logic operators include AND (∗), OR (+), and NOT (/). The NOT operator is applied to the variable immediately following the symbol. Some operator restrictions exist and are discussed in other sections. Available logic operators, equations, and limits are illustrated in Figure B-1.

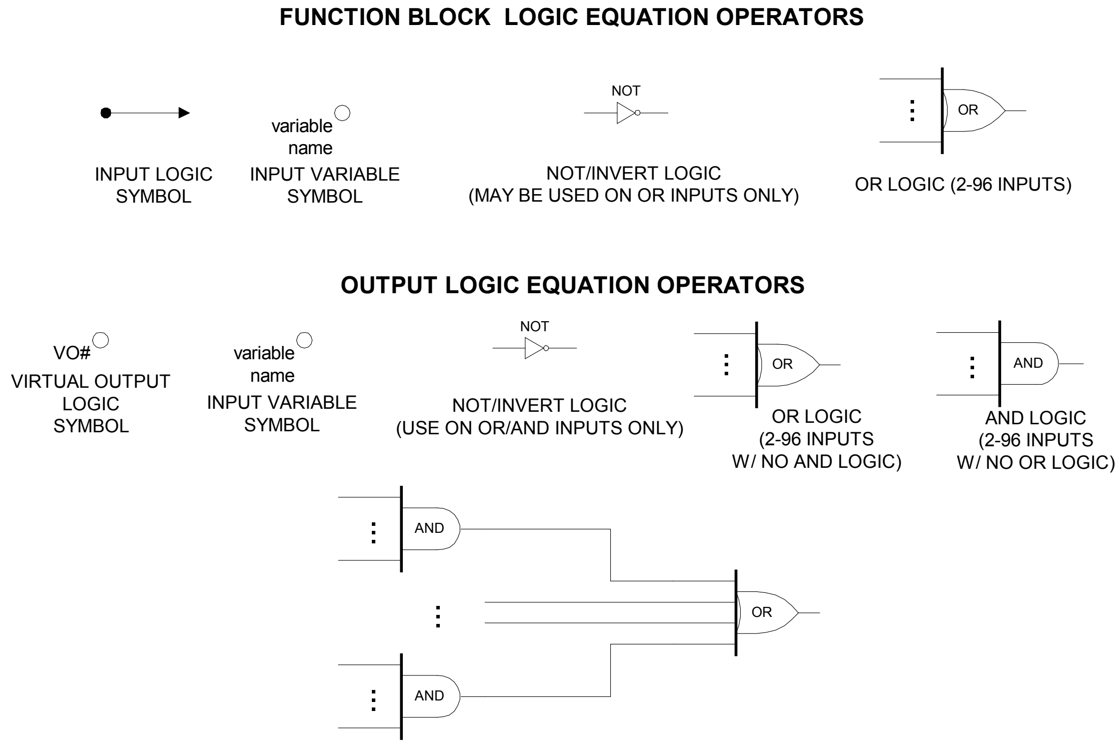

Figure B-1. Logic Expression Operators and Limits

Logic variables reflect the state of the PSS-100 at any given time. A listing of all logic variables is provided in Table B-1. Table B-2 shows the bit map of the variables.

Table B-1. Logic Variable Names and Descriptions

Variable Name	Description
Input And Output Logic Variables	
IN1-8	Input1-8 (IN1-8) Status
VOA	Relay Trouble Alarm Output
VO1-VO6	Virtual Output 1-6 (Drives Hardware Outputs Out1-6)
VO7-VO15	Virtual Output 7-15
Control Logic Variables	
62	62 Timer Output
162	162 Timer Output
43	Virtual Switch 43 Output
143	Virtual Switch 143 Output
243	Virtual Switch 243 Output
343	Virtual Switch 343 Output
443	Virtual Switch 443 Output
543	Virtual Switch 543 Output
643	Virtual Switch 643 Output
743	Virtual Switch 743 Output
SG0	Setting Group 0 Act (Default Group)

Variable Name	Description
SG1	Setting Group 1 Active
SG2	Setting Group 2 Active
SG3	Setting Group 3 Active
Monitor Logic Variables	
ALMLGC	Logic Alarm
ALMMAJ	Major Alarm
ALMMIN	Minor Alarm
Stabilizer Control Variables	
PSSON	Stabilizer ON command
PSSCNTL	Stabilizer status
TSTON	Test ON command
TSTCNTL	Test status
MOTCTL	Motor mode status
SEQCTL	Phase sequence status
Stabilizer Variables Level Data Trigger Variables	
LV1	Three phase watts
LV2	Three phase vars
LV3	Power factor
LV4	Generator terminal voltage
LV5	Generator terminal current
LV6	Generator terminal frequency deviation
LV7	Compensated frequency deviation
LV8	Positive sequence voltage magnitude
LV9	Positive sequence current magnitude
LV10	Negative sequence voltage magnitude
LV11	Negative sequence current magnitude
LV12	Auxiliary input signal magnitude
LV13	Washed out speed
LV14	Washed out power
LV15	Filtered mechanical power
LV16	Stabilizing signal
LV17	PSS pre-limit output
LV18	PSS post-limit output
LV19	PSS output
LV20	PSS test output

Table B-2. Logic Variable Status Report Format

LV1	LV2	LV3	LV4	LV5	LV6	LV7	LV8	LV9	LV10	LV11	LV12	LV13	LV14	LV15	LV16	LV17	LV18	LV19	LV20					PSSON	62	162	SG0	SG1	SG2	SG3	0
00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

VOA	VO1	VO2	VO3	VO4	VO5	VO6	VO7	VO8	VO9	VO10	VO11	VO12	VO13	VO14	VO15	IN1	IN2	IN3	IN4	IN5	IN6	IN7	IN8	PSSCTL	ALMMAJ	ALMMIN	ALMLGC	MOTCTL	SEQCTL		TSTCTL
32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63

																					TSTON			43	143	243	343	443	543	643	743
64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95

Function Block Logic Settings

Some examples of logic function blocks are 62, Active Group Setting, and PSS Control. PSS-100 function blocks are shown in Figure B-2.

The serial commands relating to the function blocks (described in Section 4, *Functional Description*) contain mode and input logic expressions. Mode settings enable or disable a function or determine the way the function block operates. Input settings are the logic expressions that drive the inputs to the function blocks.

Only the OR (+) and NOT (/) operators can be used in input logic expressions. The number of OR inputs is limited to 96.

Output Logic Settings

Output logic settings consist of the logic expressions that drive the outputs. Each variable in the expression corresponds to the current state of an input, output, or timer. Logic expressions are evaluated every four milliseconds. If a logical output corresponding to a hardware output changes state, then the corresponding output relay contact also changes state.

All operators (AND, OR, and NOT) can be used in output logic expressions and are subject to the following rules.

- An expression can have up to 96 OR operators, using all possible logic variables if the logic expression consists only of OR terms.
- An expression can have up to 96 AND operators, using all possible logic variables if the logic expression consists only of AND terms.

The following rules apply to expressions having a combination of AND and OR operators.

- AND terms are evaluated first, then OR terms. For example, in the expression "A∗B+C∗D", the two AND terms (A∗B and C∗D) are evaluated before the OR term is evaluated. Parenthesis are not permitted.
- Each of the AND terms can have up to 96 logic terms.
- An output logic expression can have up to four such AND terms ORed together.

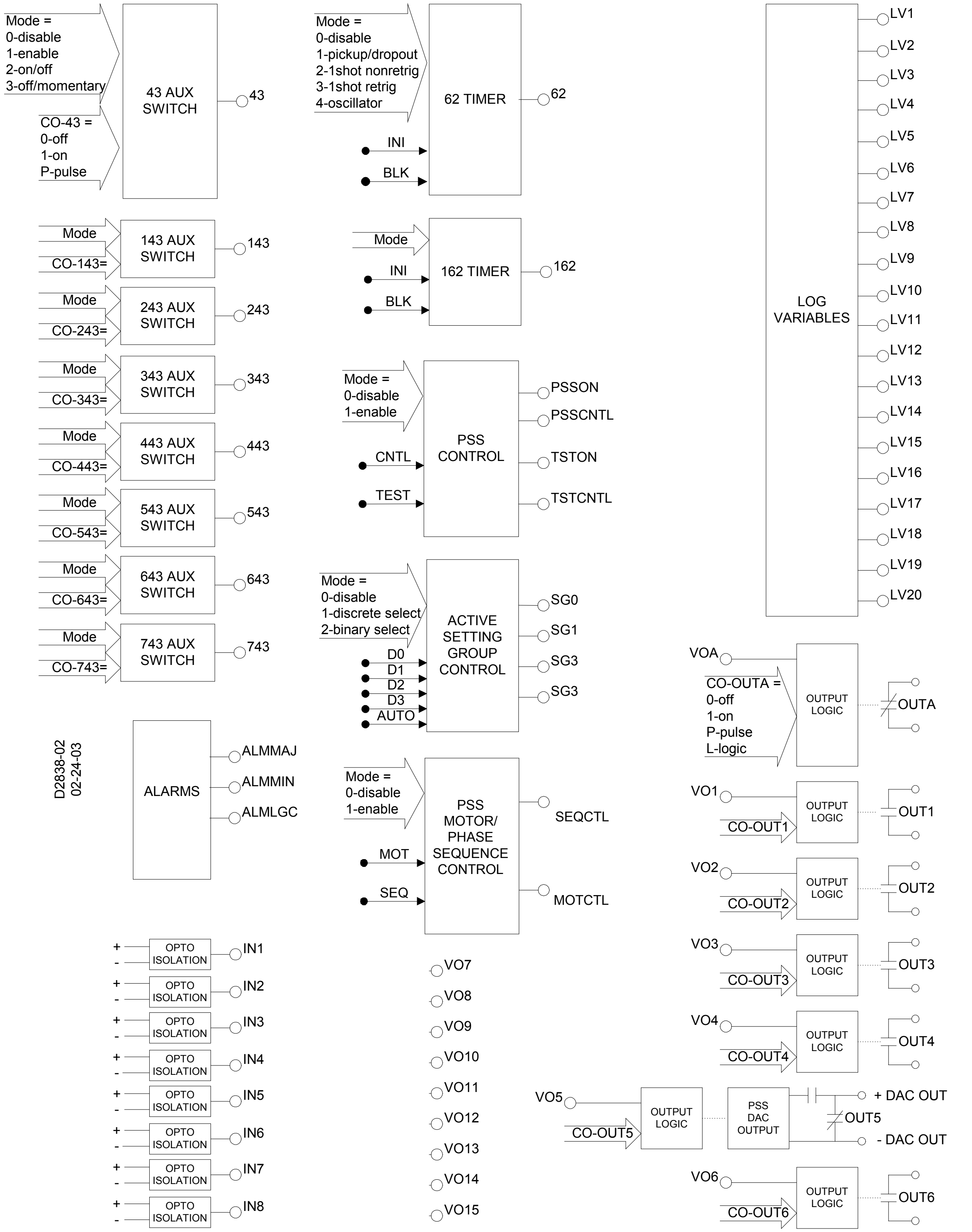

Figure B-2. BESTlogic Function Blocks

BESTlogic Application Tips

Logic Evaluation Order

When designing a logic scheme, you should consider the logic evaluation order. Contact sensing inputs are evaluated first, then the function blocks, and then the virtual outputs. The expression for VO15 is evaluated first and VOA is evaluated last. If a virtual output is used as an argument in a logic expression for another virtual output, you should use a numerically higher virtual output as the argument. Otherwise, a logic expression for a numerically lower virtual output will not be available to a numerically higher virtual output until the next processing interval. Logic is evaluated every four milliseconds.

Making a Record of All Settings

The S command can be used to make a record of the settings at the end of a programming session. This allows you to examine the settings away from the installation and also provides a backup.

External Interface to Normally Closed Outputs

Outputs one through four have normally open contacts (coil is de-energized). They can be used as normally closed outputs in logic schemes by inverting the logic expression that drives them. In this manner, the coil is energized with the contact closed in the normal state. Caution should be taken with normally closed contact logic because there are no shorting bars to maintain the closed circuit if the electronics are removed from the case or if operating power is removed. In situations where a normally closed output is needed even when the electronics are removed or operating power is off, a normally open output can be used to drive a low cost auxiliary relay. The normally closed output of the auxiliary relay will maintain the closed output when the PSS-100 is removed from the case or operating power is off. Alternately, an external switch can be used to short across the normally closed output when necessary. Extra care is required to make sure that the short is removed once the stabilizer is reinstalled or power is reapplied.

Contact output OUT6 is an SPDT contact and has one normally closed contact available if needed.

Debugging the Logic Design

If your logic scheme does not work, you can used the RG-STAT command to look at the status of all logic variables. The RG-STAT command allows you to examine all logic variables and trace your logic function. The bit map of Table B-2 can help in writing down the logic bit sequence reported by the RG-STAT command. For more information about the RG-STAT command, refer to Section 4, *Functional Description, Reporting Functions*.

Links Between the Programmable Alarms and BESTlogic

Several links between the programmable alarms function and BESTlogic programmable logic allow alarm functions to be used in the logic scheme and programmable logic functions to be used in the alarm reporting function.

Programmable alarm settings for Major, Minor, and Logic alarms drive BESTlogic variables ALMMAJ, ALMMIN, ALMLGC. These variables can be used in logic expressions to control logic when the alarm is active.

Virtual outputs VO13, VO14, and VO15 are driven by BESTlogic expressions. These three logic variables are also available in the programmable alarm function. Virtual outputs also have the ability of being assigned user programmable labels (described later). This feature allows the user to design a logic condition that is used for an alarm and assign a label to it that is reported in the alarm reporting function.

VARIABLE LABEL SETTINGS

These settings allow the user to provide meaningful names to the logic variables whose function is entirely user programmable. These functions include the contact sensing inputs, the virtual switches, and the virtual output expressions.

The PSS-100 also allows you to assign a label to each of the two states of these logic variables. For example, the TRUE/FALSE status of the logic variable PSSON can be labeled as ENABLED/DISABLED so that the reported status is more meaningful. Other examples of labels for this and other variables would be ON/OFF and CLOSED/OPEN.

Meaningful variable names make the sequence of events reports easier to analyze. The SN command is used to assign user names to the input and output logic variables and their logic states. All SN labels are used in the sequence of events (RS command) reports.

SN Command

Purpose: Reads or sets user programmable names.
Syntax: SN[=<var>][=<name>,<TRUE label>,<FALSE label>]
Comments: var = logic variable 43 - 743, VOA - VO15, or IN1 - IN8
Privilege G or S password access is required to change settings.
SN command parameters are described in Table B-3.

Table B-3. SN Command Parameters

Parameter	Parameter Description
name	One to 16 character alphanumeric string to replace <var> name in RS report
TRUE label	One to seven character alphanumeric string to replace default TRUE for <var>
FALSE label	One to seven character alphanumeric string to replace default FALSE for <var>

SN Command Examples

1. Read the name settings for IN1.
   SN-IN1
   `SN-IN1=IN1,CLOSED,OPEN`
2. Assign VO5 with a name of ANALOG_OUT, a TRUE label of ON and a FALSE label of OFF.
   SN-VO5=ANALOG_OUT,ON,OFF

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APPENDIX C • ASCII SOFTWARE COMMANDS

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APPENDIX C • ASCII SOFTWARE COMMANDS

INTRODUCTION

ASCII software commands provide an alternative to BESTCOMS for changing stabilizer parameters, obtaining reports, and performing testing. Commands are entered through the BESTCOMS Terminal screen or terminal emulation software such as the HyperTerminal application supplied with the Microsoft Windows operating system. Instructions for configuring HyperTerminal for use with the PSS-100 are provided in Appendix F.

COMMAND STRUCTURE

ASCII software commands consist of a command string and object name separated by a hyphen. The first letter of the command string specifies the general command function. The seconds letter, if used, specifies the function subgroup. The exceptions to these command conventions include the ACESS, EXIT, and HELP commands. Command string designations are defined as follows.

C Control commands perform select-before-operate control actions such as opening/closing and pulsing output relays and changing the active setting group. Subgroups include S (select) and O (operate).

G Global commands are used for password access and are always followed by the subgroup designator of S (security).

M Metering commands read all metering values.

R Reports commands read and reset function such as time, date, statistics, and log summaries. Subgroups include A (alarms), R (data record reporting), G (general information), and S (sequence of events recorder functions).

S Settings commands control all setting parameters that govern PSS-100 operation. Subgroups include # (settings group number), A (alarm settings), G (general settings), and L (logic settings).

A command's object name specifies the function for which the command is intended. A command entered by itself is a read command. A command followed by an equal sign and one or more parameters is a write command.

An object name can be omitted from a read command string to view all object names associated with the command string. For example, entering SA by itself returns all settings associated with the SA command string.

NOTE

PSS-100 responses in all examples are displayed in `Courier` typeface.

SA

```
SA-LGC=11/19
SA-MAJ=11/12/23
SA-MIN=15/16/17/22
SA-RESET=IN3+IN4
```

Entering command string SA with object name MAJ returns only the settings associated with the MAJ object name.

SA-MAJ

```
11/12/23
```

COMMAND HELP

Helpful information about software commands is available by using the HELP command. The HELP command provides a list of available commands or information and syntax regarding a specific command along with an example of its use.

HELP Command

Purpose: Obtains helpful information about ASCII software commands.
Syntax: HELP[<cmd>] *or* HELP1
Comments: HELP or H returns information about using the HELP command. HELP1 or H1 provides a list of stabilizer commands. HELP<cmd> or H<cmd>, where <cmd> is a specific command, returns information on the usage and format of the command and example of its use.

HELP Command Example

Obtain information about using the SG-CT command.

HELP SG-CT

```
Purpose: Read/Set Current Transformer ratio and number of CTs used
Syntax : SG-CT[={ct ratio},{ct config(2/3)},{ct phases(1/2/3)}]
Example: SG-CT=80,2,1 or SG-CT=400:5,2,1 or SG-CT=400/5,2,1
```

CHANGING PARAMETERS AND SETTINGS

PSS-100 settings changes are made using the following process.

1. Gain access to a password-protected access area.
2. Make the desired settings changes.
3. Save and confirm the settings changes.

The ACCESS command is used to enter a password and obtain settings changing privileges. Different passwords give access to change different types of stabilizer parameters.

ACCESS Command

Purpose: Reads or changes programming privileges so that changes can be made
Syntax: ACCESS[=<password>]
Comments: The ACCESS command is used to enter a password and obtain settings changing privileges. Different passwords give access to change different types of PSS-100 parameters. Access privileges are summarized in Table C-1.

Table C-1. Access Command Parameters

Privilege	Description
G	Global access is provided by password G (PWG). Allows all commands to be entered with no restrictions.
S	Setting access is provided by password S (PWS). Allows changes to be made to all settings.
C	Control access is provided by password C (PWC). Allows control operations to be performed.
R	Report access is provided by password R (PWR). Allows report operations to be performed.

An access privilege is obtained when the appropriate password is entered. If password protection is disabled for one or more privileges, then no password is required to gain access to the unprotected privileges. If a valid password is entered, the PSS-100 responds with the access privilege provided by that password. If an invalid password is entered, an error message is returned.

ACCESS Command Examples

1. Obtain global privileges.

   ACCESS=OPENUP
   `ACCESS GRANTED: GLOBAL`

2. Read the current access privileges.

   ACCESS
   `ACCESS=CONTROL`

After changes are made, the new data is saved or discarded using the EXIT command. Prior to saving or discarding any changes, the operator must confirm that exiting the programming mode is desired. There are three exit options: Y (yes), N (no), or C (continue).

EXIT Command

Purpose: Exit programming mode.
Syntax: EXIT
Comments: Exit command options are summarized in Table C-2.

Table C-2. EXIT Command Options

Option	Description
Y	Entering Y (yes) saves the changes and exits the programming mode.
N	Entering N (no) discards the changes and exits the programming mode.
C	Entering C (continue) aborts the EXIT command and allows programming to continue.

EXIT Command Example

Exit the programming mode after making settings changes.

EXIT

`SAVE CHANGES (Y/N/C)?`	prompt to save (Y), discard (N), or continue (C)
`Y`	confirmation to save changes
`CHANGES SAVED`	confirmation that changes were saved

Tune Mode

The PSS-100 is tuned by repeatedly changing the stabilizer parameters and testing them until satisfactory results are obtained. This process can be cumbersome if the changes have to be saved each time. To alleviate this problem, the PSS-100 can be placed in Tune mode. In this mode, the PSS-100 will start using the new parameters directly, without saving them to nonvolatile memory. Once testing is complete and final parameters are selected, the EXIT command can be used to save the settings to nonvolatile memory.

Tune mode should be used only to set parameters for a specific settings group. The desired settings group should be selected and saved before Tune mode is entered. All new parameters that are entered are then used for the selected settings group. Only commands specific to the active settings group (S<g>-COMMAND) may be changed while in Tune mode. Care should be taken so that the active settings group does not change while Tune mode is in use. The CS/CO GROUP commands can be used to override settings group selection and prevent the digital group change logic or automatic change logic from changing settings groups while tuning is in progress.

Tune mode is entered using the SG-TUNE command.

SG-TUNE Command

Purpose: Reads or sets the Tune mode of operation.
Syntax: SG-TUNE[=[<mode>]
Comments: A mode setting of 1 enables Tune mode and a mode setting of 0 disables Tune mode. When operating in Tune mode, the command prompt changes from “>” to “T>”.Tune mode has an access expiration time of one hour. If no command is entered within this period, access expires and Tune mode is exited.

When operating in Tune mode, setting commands use an abbreviated syntax. It is not necessary to use the S<g> prefix when entering setting commands. A few examples of this setting command shorthand are listed in Table C-3.

Table C-3. Abbreviated Tune Mode Commands

Normal Command	Tune Mode Command
S<g>-WASH	WASH
S<g>-TSW	TSW
S<g>-LPF	LPF

COMMAND SUMMARY

ASCII software commands are summarized in the following paragraphs. Commands are presented in alphabetical order.

CS/CO-43/143/243/343/443/543/643/743 Command

Purpose: Controls virtual switch outputs.
Syntax: CS/CO-#43[=<mode>] or CO-#43[=<mode>]
Comments: #43 = virtual logic input 43, 143, 243, 343, 443, 543, 643, or 743.
Privilege C or G password access is required.
Virtual switch selection modes are described in Table C-4.

Table C-4. Virtual Switch Selection Modes

Mode	Description
1	Sets input to 1 state
0	Sets input to 0 state
P	Pulses input to opposite of current state, then restores input to previous state. Pulsed input is active for 200 to 250 milliseconds.

Virtual inputs provide the user with control of the logic operation through the operation of control commands. The virtual input control commands require the use of select-before-operate logic. First, the control must be selected using the CS-#43 command. After the control is selected, there is a 30 seconds window during which the CO-#43 control-operate command can be entered. The control-operate command will be invalid if the control-select and control-operate commands do not match exactly or if the control-operate command is not entered within the 30 second window. Virtual input status is saved to nonvolatile memory. If operating power is lost, the status is restored after operating power returns.

CS-#43 and CO-#43 Command Example

If the 143 virtual input logic variable was configured in a BESTlogic scheme to enable the PSS-100 function, then the CS-#43 and CO-#43 commands could be used as follows.

CS-143=1
Co-143=1

CS-GROUP and CO-GROUP Command

Purpose: Reads or changes the active settings group.
Syntax: CS-GROUP[=<mode>]
Comments: Privilege G or S password access is required to change settings.
Settings group mode selections are described in Table C-5.

Table C-5. Settings Group Mode Selections

Mode	Description
0	Settings group 0 (default)
1	Settings group 1
2	Settings group 2
3	Settings group 3
L	Returns settings group control to PSS-100 logic

Manual settings group changes are accomplished with select-before-operate logic using the CS-GROUP (select) and CO-GROUP (operate) commands in succession. The CS-GROUP command selects a settings group for operation. After the selection is made, a 30 second window exists for a settings group control operation to be made using the CO-GROUP command. If the control command is not entered within the 30 second window, the settings group control operation will be terminated. The CS-GROUP and CO-GROUP commands must match or the desired settings group change will not be carried out.

CS-GROUP and CO-GROUP Command Examples

1. Read the active settings group.

   CO-GROUP
   `0`

2. Change the active settings group to group 3.

   CS-GROUP=3
   CO-GROUP=3

3. Return settings group control to the PSS-100 logic.

   CS-GROUP=L
   CO-GROUP=L

CS/CO-OUT Command

Purpose: Controls output status.
Syntax: CS/CO-OUT[n][=<mode>/ENA/DIS]
Comments: Privilege G or S password access is required to change settings.
Output selection and control modes are described in Table C-6.

Table C-6. CS/CO-OUT Command Parameters

Mode	Description
0	Overrides logic and sets output to 0 state
1	Overrides logic and sets output to 1 state
L	Returns output control to PSS-100 logic
P	Overrides logic and momentarily pulses output to opposite of current state. Output is pulsed for 200 to 250 milliseconds.
ENA	Enables the output select mode
DIS	Disables the output select mode

Output contacts are normally controlled by the corresponding logic equations. These equations can be bypassed and the output contacts operated directly by the CS-OUT and CO-OUT commands. The CS-out command selects an output for operation. After the select command is entered, the corresponding operate command must be entered within 30 seconds. If the select and operate command do not match, or if the 30 seconds time period is exceeded, then the selection will terminate.

The select-before-operate mode must be entered explicitly and saved before the output logic can be bypassed. This is achieved using the CS-OUT and CO-OUT commands with the ENA mode. This mode should be saved after entering. Once this is done, the output contact logic can be bypassed by using the two commands on specific output contacts.

Output contacts can be pulsed or latched in a 0 or 1 state individually or as a group using these commands. However, the ENA or the DIS modes can only be used on all output contacts as a group. The DIS mode (after being saved/confirmed) will return the control to the output logic equations.

CS-OUT and CO-OUT Command Example

Place output 3 (OUT3) in a logic 1 state and then return control of OUT3 to the PSS-100 logic.

ACCESS=	Gains global programming access.
`ACCESS GRANTED:  GLOBAL`	PSS-100 response
CS-OUT=ENA	Selects outputs for operation.
`OUT=ENA SELECTED`	PSS-100 response
CO-OUT=ENA	Enables outputs for operation. This command must be entered within 30 seconds of entering the CS-OUT=ENA command.

`OUT=ENA EXECUTED`	PSS-100 response
EXIT	Saves selection and enables outputs.
`SAVE CHANGES (Y/N/C)?`	
Y	
`CHANGES SAVED`	PSS-100 response
ACCESS=	Gains global programming access.
`ACCESS GRANTED:  GLOBAL`	PSS-100 response
CS-OUT3=1	Selects OUT3 to be placed in a logic 1 state.
`OUT3=1 SELECTED`	PSS-100 response
CO-OUT3=1	Places OUT3 in a logic 1 state. This command must be entered within 30 seconds of entering the CS-OUT3=1 command.
`OUT3=1 EXECUTED`	PSS-100 response
CS-OUT3=L	Selects PSS-100 logic for control of OUT3.
`OUT3=L SELECTED`	PSS-100 response
CO-OUT3=L	Returns control of OUT3 to the PSS-100 logic.
`OUT3=L EXECUTED`	PSS-100 response
EXIT	Exits the output selection and control mode.
`DONE`	PSS-100 response

GS-PW Command

Purpose: Reads or changes passwords.
Syntax: GS-PW[<t>][=<password>,<com ports>]]
Comments: Password access privilege G is required to change settings. Gaining global access and then entering GS-PW by itself will return a listing of parameters for all passwords. GS-PW parameters are described in Table C-7.

Table C-7. GS-PW Command Parameters

Parameter	Parameter Selections
n	G (global), S (settings), C (control), or R (reports)
password	One to eight alphanumeric character string. O disables password protection.
a	0, 1, or 2 where: 0 = Com 0 (front RS-232) 1 = Com 1 (rear RS-232) 2 = Com 2 (rear RS-485) A password can be assigned to multiple ports by combining communication port designators. For example, 0/1/2 enables a password for all ports and ½ enables a password for the rear ports only.

GS-PW Command Examples

1. Assign the text string “OPENUP” as a global password assigned to the rear communication ports.

   GS-PWG=OPENUP,1/2

2. Assign the text string “REPORT” as a report access password assigned to the rear RS-485 port.

   GS-PWR=REPORT,2

3. Read all password parameters, assuming the privilege level G password has already been enterd.

   GS-PW

```
GS-PWG=OPENUP,   1/2;      GS-PWS=ABC,   0/1
GS-PWC=CONTROL,   0/2;     GS-PWR=REPORT,2
```

M Command

Purpose: Reads all metered values.
Syntax: M
Comments: No password access is required to read metered values. Table C-8 lists all of the metered values returned by the M command.

Table C-8. Metered Values Returned by the M Command

Metered Value	Description
WATT	3-phase power in watts, kilowatts, or megawatts
VAR	3-phase vars, kilovars, or megavars
PF	Power factor (per unit)
VAB	Phase A to B voltage, in volts or kilovolts, for 3-wire systems
VBC	Phase B to C voltage, in volts or kilovolts, for 3-wire systems
VCA	Phase C to A voltage, in volts or kilovolts, for 3-wire systems
VAN	A-phase voltage magnitude and angle, in volts or kilovolts, for 4-wire systems
VBN	B-phase voltage magnitude, in volts or kilovolts, and angle, in degrees, for 4-wire systems
VCN	C-phase voltage magnitude, in volts or kilovolts, and angle, in degrees, for 4-wire systems
V1	Positive sequence voltage in volts or kilovolts
V2	Negative sequence voltage in volts or kilovolts
IA	A-phase current magnitude, in amperes or kiloamperes, and angle in degrees
IB	B-phase current magnitude, in amperes or kiloamperes, and angle in degrees
IC	C-phase current magnitude, in amperes or kiloamperes, and angle in degrees
I1	Positive sequence current in amperes or kiloamperes
I2	Negative sequence current in amperes or kiloamperes
GV	Generator terminal voltage in volts or kilovolts
GI	Generator terminal current in amperes or kiloamperes
GF	Generator terminal frequency deviation (per unit)
GC	Compensated generator terminal frequency deviation (per unit)

M Command Example

Read all metered values.

M

```
WATT =    37.155 M
VAR =     4.255 M
PF =      0.99
VAB =     14.407 K, @0.0;    VBC=    14.411, @-120.0;   VCA=    14.397, @120.0
V1 =      14.394 K
V2 =      7.709
IA =      1.501, @-34.9;    IB=    1.500 K,  @-159.9;   IC=    1.500 K, @85.1
I1 =      1.499 K
I2 =      44.167
GV =      14.397 K
GI =      1.500 K
GF =      0.003
GC =      -0.002
```

M-FREQ Command

Purpose: Reads the metered system frequency.
Syntax: M-FREQ
Comments: No password access is required to read metered values.

M-FREQ Example

Read the system frequency.

M-FREQ
```
59.86
```

M-I Command

Purpose: Reads the power system current magnitudes and phase angles.
Syntax: M-I[p]
Comments: No password access is required to read metered values.
p = A (A-phase), B (B-phase), C (C-phase), 1 (positive sequence), 2 (negative sequence)

The M-I command reads the metered magnitudes and angles of the A-phase (IA), B-phase (IB), and C-phase (IC) currents. The magnitudes are the product of the measured currents and the CT ratios. All phase angles are referenced to the A-phase voltage input. Positive sequence current (I1) and negative sequence current (I2) is also returned by the M-I command. A specific current is read by including the current designator in the command string, e.g., M-IC.

M-I Command Examples

1. Read all system current magnitudes and phase angles.

   M-I
   ```
   IA=    1.501 K, @-34.9;    IB=    1.500 K,@-159.9;   IC=    1.500 K, @85.1
   I1=    1.499 K
   I2=    44.105
   ```
2. Read the C-phase current magnitude and phase angle.

   M-IC
   ```
   1.500 K,   @85.2
   ```

M-V Command

Purpose: Reads the power system voltage magnitudes and phase angles.
Syntax: M-V[p]
Comments: No password access is required to read metered values.

The M-V command reads the metered magnitudes and angles of the A-phase (VAN or VAC), B-phase (VBN or VBC), and C-phase (VCN or VCA) voltages. The magnitudes are the product of the measured currents and the CT ratios. All phase angles are referenced to phase A. Positive sequence voltage (V1) and negative sequence voltage (V2) is also returned by the M-V command. A specific voltage is read by including the voltage designator in the command string, e.g., M-VB.

M-V Command Examples

1. Read all system voltage magnitudes and phase angles.

   M-V
   ```
   VAB= 14.406 K,  @0.0;   VBC= 14.395 K,  @-120.1;   VCA= 14.374,  @120.0
   V1=    14.391 K
   V2=    11.298
   ```
2. Read the A-phase voltage magnitude and phase angle.

   M-VA
   ```
   14.402 K,   @0.0
   ```

M-G Command

Purpose: Reads generator terminal voltage, current, frequency deviation, and compensated frequency deviation.
Syntax: M-G[p]
Comments: No password access is required to read metered values.
p = V (volts), I (amperes), F (frequency deviation), C (compensated frequency deviation)

This command reads the metered generator terminal voltage, current, frequency deviation, and compensated frequency deviation. Terminal voltage (GV) is read as the rms sum of the three phase voltages. The current is the rms sum of the three phase currents. Frequency deviation is displayed as the difference between the measured frequency and the nominal system frequency. The compensated frequency deviation shows the internal (rotor) frequency deviation.

M-G Command Examples

1. Read all metered generator values.

   M-G

   ```
   GV=  14.393 K
   GI=  1.500
   FG= -0.004
   GC= -0.009
   ```

2. Read the metered generator terminal voltage.

   M-GV

   ```
   106.7
   ```

M-PF Command

Purpose: Reads the power system power factor.
Syntax: M-PF
Comments: No password access is required to read metered values.

M-PF Command Example

Read the system power factor.

M-PF

```
0.87
```

M-VAR Command

Purpose: Reads the reactive voltamperes.
Syntax: M-VAR
Comments: No password access is required to read metered values.

M-VAR Command Example

Read the three-phase system vars.

M-VAR

```
5125.759
```

M-WATT Command

Purpose: Reads the three-phase system power.
Syntax: M-WATT
Comments: No password access is required to read metered values.

M-WATT Command Example

Read the three-phase system power.

M-WATT

```
27154.293
```

RA Command

Purpose: Reads and resets logic, major, minor, and fail alarm status.
Syntax: RA[-<type>][=0]
Comments: Privilege G or R password access is required to reset alarms.
type = LGC (logic), MAJ (major), MIN (minor), FAIL (failure)

Entering RA by itself reports any active or latched alarm messages. Entering RA[-<type>] will return information specific to the type of alarm entered. Entering RA[-<type>]=0 clears all latched alarms of the specified type that are no longer active.

RA Command Examples

1. Read current alarm status.

   RA

   ```
   RA-LGC   ALARM# 9  - NEW RECORD TRIGGERED ALARM
   RA-MAJ   ALARM# 3  - VOLTAGE UNBALANCE ALARM
   RA-MIN   ALARM# 21 - TEST_ON
   RA-FAIL  NONE
   ```

2. Clear the latched minor alarm.

   RA-MIN=0

RA-FAIL Command

Purpose: Reads or resets failure alarm information.
Syntax: RA-FAIL
Comments: Privilege G or R password access is required to reset alarms.

RA-FAIL Command Example

Reset all failure alarms.

RA-FAIL=0

RA-MAJ Command

Purpose: Reads or resets major alarm information
Syntax: RA-MAJ
Comments: Privilege G or R password access is required to reset alarms.

RA-MAJ Command Example

Read all major alarms.

RA-MAJ

```
RA-MAJ   ALARM# 3  - VOLTAGE UNBALANCE ALARM
```

RA-MIN Command

Purpose: Reads or rests minor alarm information
Syntax: RA-MIN
Comments: Privilege G or R password access is required to reset alarms.

RA-MIN Command Example

Read all minor alarms.

RA-MIN

```
RA-MIN   ALARM# 21 - TEST_ON
```

RA-SER Command

Purpose: Reads alarm sequence of events information.
Syntax: RA-SER
Comments: Privilege G or R password access is required to reset alarms.

RA-SER Command Example

Read all sequence of events alarms.

RA-SER

```
PSS-100 SEQUENCE OF EVENTS RECORD
REPORT DATE   : 01/01/04
REPORT TIME   : 00:05:59
STATION ID    : HIGHLAND
DEVICE ID     : UNIT_3
USER1 ID      : .
USER2 ID      : .
DEVICE ADDRESS: 0
--DATE-- ----TIME---- ----------POINT DESCRIPTION---------- --STATUS--
01/01/04 00:00:00.957 ALARM MAJOR                           TRUE
01/01/04 00:00:00.857 CURRENT UNBALANCE ALARM               SET
01/01/04 00:00:00.709 ALARM MAJOR                           FALSE
01/01/04 00:00:00.457 CURRENT UNBALANCE ALARM               RESET
```

RG Command

Purpose: Reads general information.
Syntax: RG
Comments: No password access is required to read reports.

RG Command Example

Read general PSS-100 status information such as the date and time, the active settings group, active logic scheme, and output contact status.

RG

```
RG-DATE=05/11/04
RG-TIME=11:17:30
RG-ADDR1=    0
RG-ADDR2=    0
RG-43STAT=00000000
RG-GRPACTIVE=0
RG-GRPCNTRL=L
RG-INPUT=00000000
RG-LOGIC=PSSLOGIC
RG-OUTCNTRL=LLLLLLL
RG-OUTSTAT=0000000
```

RG-43STAT Command

Purpose: Reads the status of the virtual selector switches.
Syntax: RG-43STAT
Comments: No password access is required to read status.

The RG-43STAT command reads the status of each of the eight virtual switches. A 1 indicates an on state and a 0 indicates an off state. Switch status is read left to right, where the leftmost digit represents switch 43 and the rightmost digit represents switch 743.

RG-43STAT Command Example

Read the status of all virtual switches.

RG-43STAT

```
00000000
```

RG-ADDR Command

Purpose: Reads or changes the addresses for polled communication ports Com 1 and Com 2.
Syntax: RG-ADDR[n][=<com addr>]
Comments: Privilege G or R password access is required to change settings.
N = 1 for Com 1, 2 for Com 2
com addr = 1 to 65534, 0 disables polled operation

RG-ADDR Command Example

Disable polled operation for Com 1 and assign an address of 5 to Com 2.

RG-ADDR1=0;RG-ADDR2=5

In polled mode operation, the PSS-100 waits until it is polled (receives a command addressed to it), then it responds. Any command that does not begin with the proper ADDR will be ignored.

A unique ADDR is reserved to communicate to all devices operating in multi-drop mode and connected to the same network. Any command prefaced by an ADDR of 0 will cause all units receiving the command to execute the command but not respond (BROADCAST OPERATION - NO RESPONSE). This type of operation allows commands to be executed simultaneously by multiple devices. For example, 17RG-TIME would read the current time setting of Device 17 and 0RG-TIME=12:05:37 would simultaneously set all units on the network to the new time entered.

RG-DATE Command

Purpose: Reads or changes the date.
Syntax: RG-DATE[=<mm/dd/yy>] or RG-DATE[=<dd-mm-yy>]
Comments: Privilege G or S password access is required to change settings.
The order of syntax depends on the SG-CLK setting. RG-DATE command parameters are summarized in Table C-9.

Table C-9. RG-DATE Command Parameters

Parameter	Description
m	One or two digit month setting
d	One or two digit day setting
y	Two digit year setting

RG-DATE Command Example

Read the current date kept by the PSS-100.

RG-DATE

`05/11/04`

RG-GRPACTIVE Command

Purpose: Reads the active setting group.
Syntax: RG-GRPACTIVE
Comments: No password access is required to read status.
Active settings group is reported as a number, from 0 to 3, where 0 = settings group 0, 1 = settings group 1, 2 = settings group 2, and 3 = settings group 3.

RG-GRPACTIVE Command Example

Read the active settings group.

RG-GRPACTIVE

`0`

RG-GRPCNTRL Command

Purpose: Reads the control group setting.
Syntax: RG-GRPCNTRL
Comments: No password access is required to read settings.
Control setting is reported as 0, 1, 2, 3, or L. Number 0 through 3 correspond to settings groups 0, 1, 2, and 3. L indicates that PSS-100 logic is controlling settings group selection.

RG_GRPCNTRL Command Example

Read the settings group control setting.

RG-GRPCNTRL

`L`

RG-INPUT Command

Purpose: Reads the status of the contact sensing inputs.
Syntax: RG-INPUT
Comments: No password access is required to read status.
Input status is returned as eight digits, where the leftmost digit represents input 1 (IN1) and the rightmost digit represents input 8 (IN8). Input status is displayed as a 1 or a 0. A 1 indicates an energized input and 0 indicates a de-energized input.

RG-INPUT Command Example

Read the status of the contact sensing inputs.

RG-INPUT

`10000011`

RG-LOGIC Command

Purpose: Reads the active logic.
Syntax: RG-LOGIC
Comments: No password access is required to read settings.

RG-LOGIC Command Example

Read the name of the active logic scheme.

RG-LOGIC

```
PSSLOGIC
```

RG-OUTCNTRL Command

Purpose: Reads the output control status.
Syntax: RG-OUTCNTRL
Comments: No password access is required to read status.

Output control status is returned as seven digits, where the leftmost digit represents output A and the rightmost digit represents output 6. Output control status is reported as a 0, 1, or L. A 0 or 1 indicates an open or closed output contact controlled by a select-and-operate operation. L indicates that the output is controlled by the logic equations.

RG-OUTCNTRL Command Example

Read the output control status of all outputs.

RG-OUTCNTRL

```
LLLLLLL
```

RG-OUTSTAT Command

Purpose: Report output status.
Syntax: RG-OUTSTAT
Comments: No password access is required to read output status.
An output status of 1 indicates a closed output and a 0 indicates an open output. Output status is returned in order, left to right: A123456.

RG-OUTSTAT Command Example

Read the output control status of all outputs.

RG-OUTCNTRL

```
LLLLLLL
```

RG-STAT Command

Purpose: Reads the status of the PSS-100.
Syntax: RG-STAT
Comments: No password privileges are required to read status information.

The RG-STAT command returns status information in the following format.

```
INPUT(12345678)     STATUS : 00000000
OUTPUT(A123456)     STATUS : 0000000
CO-OUT(A123456)     STATUS : LLLLLLL
CO-43 to CO-743     STATUS : 00000000
CO-GROUP            STATUS : L
ACTIVE LOGIC        STATUS : PSSLOGIC
LOGIC VAR(00-31)    STATUS : 00000000 00000000 00000000 00010000
LOGIC VAR(32-63)    STATUS : 00000000 00000000 00000000 00000000
LOGIC VAR(64-95)    STATUS : 00000000 00000000 00000000 00000000
ACTIVE GROUP        STATUS : 0
DIAG/ALARM   STATUS : 0 FAIL, 0 LOGIC, 0 MAJOR, 0 MINOR
```

Each component of the status report is described in the following paragraphs.

INPUT (12345678). This line reports the contact sensing inputs status. Contact sensing input information is also available through the RG-INPUT command.

OUTPUT (A123456). Output contacts status is reported by this line. This information is also provided by the RG-OUTSTAT command.

CO-OUT(A123456). This line reports the status of the output contacts logic override control. The RG-OUTCNTRL command also provides this information.

C0-43 to CO-743. Virtual switch functions status is reported by this line. Virtual switch function status is also reported by the RG-43STAT command.

CO-GROUP. This line reports the status of the logic override control of the setting group selection function. This information is also available through the RG-GRPCNTRL command.

ACTIVE LOGIC. The active logic scheme is reported by this line. Active logic is also reported by the RG-LOGIC command.

LOGIC VAR 00 to 95. These lines report the status of each of the BESTlogic variables. Table C-10 lists the BESTlogic variable names and number assignments in the same order that they are reported by the RG-STAT command.

Table C-10. BESTlogic Variable Number Assignments

LV1	LV2	LV3	LV4	LV5	LV6	LV7	LV8
00	01	02	03	04	05	06	07

LV9	LV10	LV11	LV12	LV13	LV14	LV15	LV16
08	09	10	11	12	13	14	15

LV17	LV18	LV19	LV20				
16	17	18	19	20	21	22	23

PSSON	62	162	SG0	SG1	SG2	SG3	0
24	25	26	27	28	29	30	31

VOA	VO1	VO2	VO3	VO4	VO5	VO6	VO7
32	33	34	35	36	37	38	39

VO8	VO9	VO10	VO11	VO12	VO13	VO14	VO15
40	41	42	43	44	45	46	47

IN1	IN2	IN3	IN4	IN5	IN6	IN7	IN8
48	49	50	51	52	53	54	55

PSSCTL	ALMMAJ	ALMMIN	ALMLGC				TSTCTL
56	57	58	59	60	61	62	63

64	65	66	67	68	69	70	71

72	73	74	75	76	77	78	79

					TSTON		
80	81	82	83	84	85	86	87

43	143	243	343	443	543	643	743
88	89	90	91	92	93	94	95

Table C-11 cross-references each BESTlogic variable name with a brief description of the variable function. Variables LV1 through LV20 are set when the corresponding automatic triggering level condition is met. This condition is determined by the S<g>-LV command.

Table C-11. BESTlogic Variables

Variable Name	Description	Variable Name	Description
LV1	Three-Phase Watts	SG0	Settings Group 0 Active (Default)
LV2	Three-Phase Vars	SG1	Settings Group 1 Active
LV3	Power Factor	SG2	Settings Group 2 Active
LV4	Generator Terminal Voltage	SG3	Settings Group 3 Active
LV5	Generator Terminal Current	VOA	Relay Trouble Alarm Output
LV6	Generator Terminal Frequency Deviation	VO1 - VO6	Virtual Output 1 - 6 (drives OUT1 - OUT6)
LV7	Compensated Frequency Deviation	VO7 - VO15	Virtual Output 7 - 15
LV8	Positive Sequence Voltage Magnitude	IN1 - IN8	Input 1 - 8 (IN1 - IN8) Status
LV9	Positive Sequence Current Magnitude	PSSCNTL	Stabilizer Status
LV10	Negative Sequence Voltage Magnitude	ALMMAJ	Major Alarm
LV11	Negative Sequence Current Magnitude	ALMMIN	Minor Alarm
LV12	Test Signal Input Signal Magnitude	ALMLGC	Logic Alarm
LV13	Washed Out Speed	TSTCNTL	Test Status
LV14	Washed Out Power	TSTON	Test ON Command
LV15	Mechanical Power Low-Pass Filter Output	43	Virtual Switch 43 Output
LV16	Synthesized Speed	143	Virtual Switch 143 Output
LV17	PSS Pre-Limit Output	243	Virtual Switch 243 Output
LV18	PSS Post-Limit Output	343	Virtual Switch 343 Output

Variable Name	Description		Variable Name	Description
LV19	PSS Output		443	Virtual Switch 443 Output
LV20	PSS Test Output		543	Virtual Switch 543 Output
PSSON	Stabilizer ON Command		643	Virtual Switch 643 Output
62	62 Timer Output		743	Virtual Switch 743 Output
162	162 Timer Output			

RG-TIME Command

Purpose: Reads or sets the time of day.
Syntax: RG-TIME
Comments: Privilege G or S password access is required to change settings.
RG-TIME command parameters are summarized in Table C-12.

Table C-12. RG-TIME Command Parameter Selections

Parameter	Parameter Selections
hr	One or two digit hour setting in 12 or 24 hour format as defined by the SG-CLK command
mn	Two digit minutes setting
sc	Optional two digit seconds setting
f	Format for 12 hour clock format where A = AM and P = PM

RG-TIME Command Example

Read the time of day kept by the PSS-100.

RG-TIME

```
13:19:54
```

RG-VER Command

Purpose: Reads model, serial number, and software version information.
Syntax: RG-VER
Comments: No password privileges are required to read status information.

RG-VER Command Example

Obtain the model, serial number, and software version information for the connected PSS-100.

RG-VER

```
Model  Number : PSS-100-Y5T
App   Program : VER 1.03.CC 12/08/2003
DSP   Program : VER 1.03.04 08/07/2003
Boot  Program : VER 2.10.00 06/21/99
Serial Number : H000000101
```

RL Command

Purpose: Reads logic variables.
Syntax: RL-[n]
Comments: No password access is required to read status information.

Entering RL returns the status of all variables (00 through 95). Entering RL-1 returns the status of variables 00 through 31. RL-2 returns the status of variables 32 through 63. RL-3 returns the status of variables 64 through 95. (Refer to Table C-10 and C-11.)

RL Command Examples

1. Read the status of all logic variables.

   RL

```
LOGIC VAR(00-31)  STATUS : 00000000 00000000 00000000 00010000
LOGIC VAR(32-63)  STATUS : 00000000 00000000 00000000 00100000
LOGIC VAR(64-95)  STATUS : 00000000 00000000 00000000 00000000
```

2. Read the status of logic variables 00 through 31.

   RL-1

   ```
   LOGIC VAR(00-31)  STATUS : 00000000 00000000 00000000 00010000
   ```

RO Command

Purpose: Reads oscillographic COMTRADE reports.
Syntax: RO-nA/B?.[ext]
Comments: XMODEM protocol must be used.
RO command parameters are described in Table C-13.

Table C-13. RO Command Parameters

Parameter	Parameter Selections
n	Data record number (1 to 12)
A/B	A = ASCII format B = binary format ASCII format files (plain text or COMTRADE) can be read using any text editor. ASCII files are larger and take longer to download. Binary format files must be in COMTRADE format and can be viewed only with dedicated, binary COMTRADE viewer software. Binary files are smaller and download more quickly than ASCII files.
?	3 = data record files (1, 2 not supported)
.ext	Extension of the file to be downloaded. .LOG This extension downloads a data record in plain ASCII text format. LOG files contain all data required to view a record. .CFG This extension downloads the configuration file for the COMTRADE data file. .DAT This extension downloads the data file in the COMTRADE format. The file can be in binary or ASCII form, depending on the A/B parameter.

Both a configuration (.CFG) and data (.DAT) file are required to view a data record, but only one file can be requested at a time. The format selected with the A/B parameter must be the same (either binary or ASCII) for a data record to be viewed.

RO Command Examples

1. Initiate a transfer of a .LOG file for data record number one.

   RO-1A3.LOG

2. Initiate transfer of an ASCII COMTRADE configuration file for data record number 6.

   RO-6A3.CFG

3. Initiate transfer of an ASCII COMTRADE data file for data record number 6.

   RO-6A3.DAT

The files of examples two and three can be viewed together. If the data is required in binary format, both files must be downloaded in binary format.

RS Command

Purpose: Reads or resets the sequence of events record data.
Syntax: RS[-n/ALM/IO/LGC/NEW][=0]
Comments: Privilege G or R is required to reset sequence of events record data.
RS command parameters are described in Table C-14.

Table C-14. RS Command Parameters

Parameter	Parameter Description
n	Provides a detailed SER report on the last n events
ALM	Provides an SER report of all alarm events since the last RS=0 command was issued. This information is also provided by the RA-SER command.
IO	Provides an SER report of all input and output events since the last RS=0 command was issued.
LGC	Provides an SER report of all logic events since the last RS=0 command was issued.
NEW	Provides an SER report of all events since the last RS=0 command was issued.
NEW=0	Resets/clears the NEW RECORDS counter in the directory, but all SER reports are retained.

RS Command Examples

1. Read the directory report or records.

RS

```
PSS-100 SEQUENCE OF EVENTS DIRECTORY
REPORT DATE   : 12/10/98
REPORT TIME   : 11:34:36
STATION ID    : SUBSTATION_1
DEVICE ID     : PSS-100
USER1 ID      : USER1_ID
USER2 ID      : USER2_ID
DEVICE ADDRESS: 0
NEW RECORDS   : 14  (11:26:19.875 12/10/98 - 11:34:03.038 12/10/98)
TOTAL RECORDS : 14  (11:26:19.875 12/10/98 - 11:34:03.038 12/10/98)
```

2. Read the new event records.

RS-NEW

```
RS-NEW
PSS-100 SEQUENCE OF EVENTS RECORD
REPORT DATE   : 12/10/98
REPORT TIME   : 11:34:50
STATION ID    : SUBSTATION_1
DEVICE ID     : PSS-100
USER1 ID      : USER1_ID
USER2 ID      : USER2_ID
DEVICE ADDRESS: 0

--DATE-- ----TIME---- ----------POINT DESCRIPTION---------- --STATUS--
12/10/98 11:34:03.038 PSS CONTROL                          FALSE
12/10/98 11:34:03.030 INPUT_1                              OPEN
12/10/98 11:33:13.978 PSS ON                               FALSE
                      VO1_LABEL                            FALSE
                      VO5_LABEL                            FALSE
                      OUTPUT 1                             OPEN
                      OUTPUT 5                             OPEN
                      POWER BELOW THRESHOLD ALARM          SET
12/10/98 11:32:36.500 ALARM MINOR                          FALSE
12/10/98 11:32:36.456 VO2_LABEL                            FALSE
                      VO13_LABEL                           FALSE
                      PSS TEST ON                          FALSE
                      OUTPUT 2                             OPEN
12/10/98 11:32:36.428 PSS TEST CONTROL                     FALSE
12/10/98 11:32:36.420 INPUT_3                              OPEN
12/10/98 11:28:27.266 ALARM MINOR                          TRUE
12/10/98 11:28:27.150 VO2_LABEL                            TRUE
                      VO13_LABEL                           TRUE
                      PSS TEST ON                          TRUE
                      OUTPUT 2                             CLOSED
```

```
12/10/98 11:28:27.126 PSS TEST CONTROL                      TRUE
12/10/98 11:28:27.118 INPUT_3                               CLOSED
12/10/98 11:27:12.324 PSS ON                                TRUE
                      VO1_LABEL                             TRUE
                      VO5_LABEL                             TRUE
                      OUTPUT 1                              CLOSED
                      OUTPUT 5                              CLOSED
                      POWER BELOW THRESHOLD ALARM           RESET
12/10/98 11:26:19.883 PSS CONTROL                           TRUE
12/10/98 11:26:19.875 INPUT_1                               CLOSED
```

3. Read the last five event records.

RS-5

```
PSS-100 SEQUENCE OF EVENTS RECORD
REPORT DATE    : 12/10/98
REPORT TIME    : 11:34:42
STATION ID     : SUBSTATION_1
DEVICE ID      : PSS-100
USER1 ID       : USER1_ID
USER2 ID       : USER2_ID
DEVICE ADDRESS: 0
--DATE-- ----TIME---- ----------POINT DESCRIPTION---------- --STATUS--
12/10/98 11:34:03.038 PSS CONTROL                           FALSE
12/10/98 11:34:03.030 INPUT_1                               OPEN
12/10/98 11:33:13.978 PSS ON                                FALSE
                      VO1_LABEL                             FALSE
                      VO5_LABEL                             FALSE
                      OUTPUT 1                              OPEN
                      OUTPUT 5                              OPEN
                      POWER BELOW THRESHOLD ALARM           SET
12/10/98 11:32:36.500 ALARM MINOR                           FALSE
12/10/98 11:32:36.456 VO2_LABEL                             FALSE
                      VO13_LABEL                            FALSE
                      PSS TEST ON                           FALSE
                      OUTPUT 2                              OPEN
```

4. Read all records pertaining to alarm events.

RS-ALM

```
PSS-100 SEQUENCE OF EVENTS RECORD
REPORT DATE    : 12/10/98
REPORT TIME    : 11:35:04
STATION ID     : SUBSTATION_1
DEVICE ID      : PSS-100
USER1 ID       : USER1_ID
USER2 ID       : USER2_ID
DEVICE ADDRESS: 0
--DATE-- ----TIME---- ----------POINT DESCRIPTION---------- --STATUS--
12/10/98 11:33:13.978 POWER BELOW THRESHOLD ALARM           SET
12/10/98 11:32:36.500 ALARM MINOR                           FALSE
12/10/98 11:32:36.456 VO13_LABEL                            FALSE
12/10/98 11:28:27.266 ALARM MINOR                           TRUE
12/10/98 11:28:27.150 VO13_LABEL                            TRUE
12/10/98 11:27:12.324 POWER BELOW THRESHOLD ALARM           RESET
```

5. Read all records pertaining to input and output events.

RS-IO

```
PSS-100 SEQUENCE OF EVENTS RECORD
REPORT DATE    : 12/10/98
REPORT TIME    : 11:35:10
STATION ID     : SUBSTATION_1
DEVICE ID      : PSS-100
USER1 ID       : USER1_ID
USER2 ID       : USER2_ID
DEVICE ADDRESS: 0
--DATE-- ----TIME---- ----------POINT DESCRIPTION---------- --STATUS--
12/10/98 11:34:03.038 PSS CONTROL                           FALSE
12/10/98 11:34:03.030 INPUT_1                               OPEN
12/10/98 11:33:13.978 PSS ON                                FALSE
                      OUTPUT 1                              OPEN
                      OUTPUT 5                              OPEN
```

```
12/10/98 11:32:36.500 ALARM MINOR                                       FALSE
12/10/98 11:32:36.456 PSS TEST ON                                       FALSE
                      OUTPUT 2                                          OPEN
12/10/98 11:32:36.428 PSS TEST CONTROL                                  FALSE
12/10/98 11:32:36.420 INPUT_3                                           OPEN
12/10/98 11:28:27.266 ALARM_MINOR                                       TRUE
12/10/98 11:28:27.150 PSS TEST ON                                       TRUE
                      OUTPUT 2                                          CLOSED
12/10/98 11:28:27.126 PSS TEST CONTROL                                  TRUE
12/10/98 11:28:27.118 INPUT_3                                           CLOSED
12/10/98 11:27:12.324 PSS ON                                            TRUE
                      OUTPUT 1                                          CLOSED
                      OUTPUT 5                                          CLOSED
12/10/98 11:26:19.883 PSS CONTROL                                       TRUE
12/10/98 11:26:19.875 INPUT_1                                           CLOSED
```

6. Obtain a report of all logic events.

RS-LGC

```
PSS-100 SEQUENCE OF EVENTS RECORD
REPORT DATE    : 12/10/98
REPORT TIME    : 11:35:20
STATION ID     : SUBSTATION_1
DEVICE ID      : PSS-100
USER1 ID       : USER1_ID
USER2 ID       : USER2_ID
DEVICE ADDRESS: 0
--DATE-- ----TIME---- ----------POINT DESCRIPTION---------- --STATUS--
12/10/98 11:34:03.038 PSS CONTROL                                       FALSE
12/10/98 11:34:03.030 INPUT_1                                           OPEN
12/10/98 11:33:13.978 PSS ON                                            FALSE
                      VO1_LABEL                                         FALSE
                      VO5_LABEL                                         FALSE
12/10/98 11:32:36.500 ALARM MINOR                                       FALSE
12/10/98 11:32:36.456 VO2_LABEL                                         FALSE
                      VO13_LABEL                                        FALSE
                      PSS TEST ON                                       FALSE
12/10/98 11:32:36.428 PSS TEST CONTROL                                  FALSE
12/10/98 11:32:36.420 INPUT_3                                           OPEN
12/10/98 11:28:27.266 ALARM_MINOR                                       TRUE
12/10/98 11:28:27.150 VO2_LABEL                                         TRUE
                      VO13_LABEL                                        TRUE
                      PSS TEST ON                                       TRUE
12/10/98 11:28:27.126 PSS TEST CONTROL                                  TRUE
12/10/98 11:28:27.118 INPUT_3                                           CLOSED
12/10/98 11:27:12.324 PSS ON                                            TRUE
                      VO1_LABEL                                         TRUE
                      VO5_LABEL                                         TRUE
12/10/98 11:26:19.883 PSS_CONTROL                                       TRUE
12/10/98 11:26:19.875 INPUT_1                                           CLOSED
```

RR Command

Purpose: Reads, resets, or triggers record log data.
Syntax: RR[-n,#][=<0 or TRIG>]
Comments: Privilege G or R password access is required to trigger a data record or reset the new records counter.
n = specific data record number or NEW for the newest data record and first row or record
# = specifies the number of data rows to be displayed
0 or TRIG = 0 resets the new records counter to zero and clears the NEW RECORD TRIGGERED ALARM. TRIG triggers a new record. The record will be completed unless there is a true to false transition on the trigger logic expression.

RR Command Examples

1. Display the newest data record and the first row of the associated record.

RR-NEW

```
PSS-100 RECORD LOG SUMMARY
LOG DATE               : 04/21/99
```

```
LOG TIME               : 15:39:33.203
STATION ID             : SUBSTATION_1
DEVICE ID              : PSS-100
USER1 ID               : USER1_ID
USER2 ID               : USER2_ID
DEVICE ADDRESS         : 0
RECORD NUMBER          : 4
RECORD TRIGGER         : IN4
RECORD TYPE            : LOGIC
LOG INTERVAL           : 1
PRE TRIGGER DATA       : 100
TOTAL DATA             : 316
ACTIVE GROUP           : 0
[  TIME][  WATTS][  VARS][ GEN TERM V][ GEN COMP F][ WASH POWER][  PSS OUT]
  0.000  0.94429  0.14031      0.96909      0.00000     -0.00079    0.00000
```

The above record was terminated by a true to false transition on the trigger logic expression. It contains 316 data points instead of 600.

2. Display four rows of data from data record number two.

RR-2,4

```
PSS-100 RECORD LOG SUMMARY
LOG DATE               : 04/21/99
LOG TIME               : 15:34:19.886
STATION ID             : SUBSTATION_1
DEVICE ID              : PSS-100
USER1 ID               : USER1_ID
USER2 ID               : USER2_ID
DEVICE ADDRESS         : 0
RECORD NUMBER          : 2
RECORD TRIGGER         : RR=TRIG
RECORD TYPE            : SERIAL COMMAND
LOG INTERVAL           : 1
PRE TRIGGER DATA       : 100
TOTAL DATA             : 600
ACTIVE GROUP           : 0
[  TIME][      WATTS][ GEN TERM V][ GEN TERM I]
  0.000     0.94876      0.97262      0.98655
  8.333     0.94826      0.97257      0.98607
 16.667     0.95007      0.97258      0.98755
 25.000     0.95010      0.97248      0.98768
```

In the previous examples, the list of variables to be recorded in the SG-LOG setting had bee changed so that the two records show different variables being recorded.

S Command

Purpose: Reads all relay setting parameters.
Syntax: S<g>
Comments: No password access is required to read settings.
Parameter g is omitted to obtain all PSS-100 parameters or 0, 1, 2, or 3 is entered to obtain settings for settings group 0, 1, 2, or 3.

The S command can be used at the end of a programming session to make a record of PSS-100 settings. If saved to a file, the record can be used to set up another stabilizer with the same settings by sending the data to the other PSS-100.

The following procedure describes how settings can be read, modified, saved to a file, and uploaded to PSS-100 stabilizers.

1. Use the S command to obtain a report of all settings.
2. once the settings are displayed, copy the settings to a text editor such as Microsoft Notepad.
3. Edit the settings by making changes and deletions where required. You should ensure that each command is terminated with a carriage return or semicolon. Text or characters that must be removed prior to uploading include the “PRESS ENTER TO CONTINUE …” message and command prompt (>). The “PRESS ENTER TO CONTINUE …“ message can be avoided by disabling the PSS-100 page mode parameter with a setting of 0.

4. Once all changes are made, save the settings as a text file. The settings saving process can be automated by ending the settings list with the command string EXIT;Y followed by a carriage return.
5. The text file containing the settings can be uploaded to any PSS-100 using the communications software that was used to view the PSS-100 settings.

When using ASCII text files for setting the PSS-100, it is possible to include comments in the file by starting the string of comment characters with two forward slashes (//). When the PSS-100 sees these characters, it ignores all following characters until the next carriage return or line-feed character.

SA Command

Purpose: Reads all alarm settings.
Syntax: SA
Comments: No password access is required to read settings.

Major, minor, logic, and reset alarm settings are reported as numbers that correspond to the programmable alarms of Table C-15. Multiple diagnostics for an alarm are separated by slashes (/) for clarity. A setting of zero (0) indicates that no diagnostics are assigned to an alarm.

Table C-15. Programmable Alarms

ID NO.	Name	Description
1	POWER BELOW THRESHOLD*	Power Below Threshold Alarm
2	SPEED FAILURE ALARM*	Speed Failure
3	VOLTAGE UNBALANCE*	Voltage Unbalance
4	CURRENT UNBALANCE*	Current Unbalance
5		Unused
6		Unused
7		Unused
8		Unused
9	NEW RECORD TRIGGERED ALARM	Indicates that a data record has been triggered since the last RR=0
10	ACCESS LOST ALARM	Access lost
11	GROUP OVERRIDE*	Setting Group Override in effect
12	SYS I/O DELAY	Excessive Delay in operation of Serial Communications
13	COMM ERROR ALARM	Communications Failure
14	CLOCK ERROR*	Real time clock has not been set
15	uP RESET ALARM	Microprocessor has been reset
16	SETTINGS CHANGED	Settings Change made by User
17	EE NON-FATAL ERR	EEPROM non-fatal recoverable error
18	OUTPUT OVERRIDE*	An override condition is active in one or more outputs
19	LOSS OF IRIG*	Loss of IRIG sync
20	SGC ACTIVE	Setting Group Change Alarm Active
21	VO13 LOGIC ALARM*	VO13 logic is TRUE. (User programmable logic alarm.)
22	VO14 LOGIC ALARM*	VO14 logic is TRUE. (User programmable logic alarm.)
23	VO15 LOGIC ALARM*	VO15 logic is TRUE. (User programmable logic alarm.)
24	LOGIC = NONE ALARM	Programmable logic not selected

SA Command Example

Read all alarm settings.

SA

```
SA-LGC=11/19
SA-MAJ=11/12/23
SA-MIN=15/16/17/22
SA-RESET=IN3+IN4
```

SA-LGC, SA-MAJ, and SA-MIN Command

Purpose: Reads or sets the alarm settings mask for the major, minor, and logic alarms.
Syntax: SA[-<TYPE>][=<alarm num 1>[/<alarm num 2>]…[/<alarm num n>]]
Comments: Privilege G or S password access is required to change settings.
type = MAJ (major), MIN (minor), or LGC (logic)
alarm num = numeric designator of diagnostic (from Table C-15) that will cause an alarm.
Multiple diagnostics are separated by slashes (/). Alarm is disabled by a setting of 0.

SA-LGC, SA-MAJ, and SA-MIN Command Examples

1. Set the major alarm to monitor when voltage and current unbalance occurs.

   SA-MAJ=3/4

2. Set the minor alarm to monitor when power decreases below threshold and when a new data record is triggered.

   SA-MIN=1/9

3. Configure the BESTlogic variable ALMLGC to assert when virtual output 13 becomes true.

   SA-LGC=21

SA-RESET Command

Purpose: Reads or sets the programmable alarms reset logic.
Syntax: SA-RESET[=<rst alm logic>]
Comments: Privilege G or S password access is required to change settings.

The programmable alarms are reset when the programmable alarms reset logic expression becomes true. Logic expression variables may include virtual inputs, logic module outputs, and virtual outputs. Operators AND (∗), OR (+), and NOT (/) are used with the variables.

SA-RESET Command Example

Reset the programmable alarms when contact input three or four become true.

SA-RESET=IN3+IN4

SG Command

Purpose: Reads all general settings.
Syntax: SG
Comments: No password access is required to read settings.

SG Command Example

Obtain a report of PSS-100 general settings.

SG

```
SG-CLK=M,24,0
SG-COM0=9600,A0,P0,R1,X1;               SG-COM1=9600,A0,P0,R1,X1
SG-COM2=9600,A0,P0,R1,X0,MF1,MPN,MR10,MS1
SG-CT=10000,3,1
SG-FREQ=60
SG-HOLDA=0;          SG-HOLD1=1;          SG-HOLD2=1;          SG-HOLD3=1
SG-HOLD4=1;          SG-HOLD5=0;          SG-HOLD6=1
SG-ID1=UNIT_3
SG-ID2=HIGHLAND
SG-ID3=.
SG-ID4=.
SG-IN1=  4, 16;      SG-IN2=  4, 16;      SG-IN3=  4, 16;      SG-IN4=  4, 16
SG-IN5=  4, 16;      SG-IN6=  4, 16;      SG-IN7=  4, 16;      SG-IN8=  4, 16
SG-KV=  0.120
SG-LOG=1/2/4/7/14/19,   1, 10
```

```
SG-MVA=  0.0010
SG-SGCON= 5
SG-TRIG=IN4
SG-TUNE=0
SG-VT=1,4
SG-OPRG=1,0.039,  3.2,  40, 1.0, 2.0
SG-OPFB=1, 48,0.25,12,0.05
```

SG-CLK Command

Purpose: Reads or programs the time and date display format.
Syntax: SG-CLK[=<date format(M/D)>,<time format(12/24)>,<dst enable(0/1>]
Comments: Privilege G or S password access is required to change settings. SG-CLK parameters are described in Table C-16.

Table C-16. SG-CLK Command Parameters

Parameter	Parameter Description	Default
date format	D (day first) M (month first)	m
time format	12 (12 hour format) 24 (24 hour format)	24
dst enable	0 (daylight saving time disabled) 1(daylight saving time enabled)	0

SG-CLK Command Examples

1. Read the clock format.

   SG-CLK

   M,24,0

2. Change the clock format so that time is displayed in the 12 hour format and daylight saving time correction is enabled.

   SG-CLK=,12,1

SG-COM Command

Purpose: Reads or sets the communication port protocol.
Syntax: SG-COM[#[=[<baud>][,A<addr>,P<pglen>,R<reply ack>,X<XON ena>]]]
Comments: Privilege G or S password access is required to change settings.
= 0 for front RS-232 port, 1 for rear RS-232 port, 2 for rear RS-485 port
SG-COM parameters are described in Table C-17.

Table C-17. SG-COM Command Parameters

Parameter	Parameter Description	Setting Range
baud	Signaling speed	300, 600, 1200, 2400, 4800, 9600, 19K
addr	Address for polled operation	1 to 65534 0 disables polling
pglen	Page length (lines per page)	1 to 40 0 disables page mode
reply ack	Reply acknowledgment	0 = disabled 1 = enabled
XON ena	Handshaking	X0 = disabled X1 = enabled

SG-COM Command Examples

1. Read the communication settings for all ports.

SG-COM

```
SG-COM0=9600,A0,P0,R1,X1;            SG-COM1=9600,A0,P0,R1,X1
SG-COM2=9600,A0,P0,R1,X0,MF1,MPN,MR10,MS1
```

2. Set the rear RS-232 port baud at 19200 and enable handshaking.

   SG-COM0=19K,,,,X1

3. Set the front RS-232 port baud at 4800 and the page length at 35 lines.

   SG-COM0=4800,,P35

SG-CT Command

Purpose: Reads or sets the current transformer ratios.
Syntax: SG-CT[=<ct ratio>,<ct config>,<ct phases>]
Comments: Privilege G or S password access is required to change settings. SG-CT parameters are described in Table C-18.

Table C-18. SG-CT Command Parameters

Parameter	Parameter Selection	Range	Increment
ct ratio	pri:sec pri/sec or calculated ratio	1 to 50000 for pri, sec, and calculated ratio	1
ct config	2 (2 wattmeters, 2 CTs)	2, 3	N/A
ct phases	1 (CTs on phases A, B) 2 (CTs on phases B, C) 3 (CTs on phases A, C)	1, 2, 3	N/A

SG-CT Command Examples

1. Enter a current transformer ratio of 300 to 5 (300:5) and configure the unit for the three wattmeter method of measurement.

   SG-CT=300:5,3 *or* SG-CT=300/5,3 *or* SG-CT=60,3

2. Read the current transformer ratio.

   SG-CT

   `60,3,1`

SG-FREQ Command

Purpose: Reads or sets the power system frequency.
Syntax: SG-FREQ[=<freq>]
Comments: Privilege G or S password access is required to change settings. This command does not read the actual system frequency.
freq = 50 or 60 (hertz)

SG-FREQ Command Example

Read the power system frequency value used by the PSS-100.

SG-FREQ

`60`

SG-ID Command

Purpose: Reads or sets the identification label used in reports.
Syntax: SG-ID[n][=<ID label>]
Comments: Privilege G or S password access is required to change settings.
n = 1 for device identification, 2 for station identification, 3 for user label one, 4 for user label two
Each ID label can consist of up to 30 alphanumeric characters.

SG-ID Command Example

Enter the following PSS-100 identifier information: a device ID of 3, a station ID of HIGHLAND, and one user ID of UNIT_3

SG-ID1=3
SG-ID2=HIGHLAND
SG-ID3=UNIT_3

SG-IN Command

Purpose: Reads or sets the input recognition/debounce.
Syntax: SG-IN[#[=<r(ms)>,<db(ms)>]]
Comments: Privilege G or s password access is required to change settings.
= contact input number 1 to 8
SG-IN command parameters are described in Table C-19.

Table C-19. SG-IN Command Parameters

Parameter	Description	Range
r	Recognition time in milliseconds	4 to 255
db	Debounce time in milliseconds	4 to 255

When ac input contact wetting voltage is used, only the positive half-cycles are sensed by the contact sensing circuitry. Therefore, the contact recognition time should be less than half a cycle of the wetting voltage and the debounce time should be greater than half a cycle of the wetting voltage.

SG-IN Command Example

Assign a recognition time of 4 milliseconds and a debounce time of 16 milliseconds to contact input 3.

SG-IN3=4,16

SG-HOLD Command

Purpose: Reads or sets output hold operation.
Syntax: SG-HOLD[n][=<1/0 hold ena>]
Comments: Privilege G or S password access is required to change settings.
n = output number A, 1, 2, 3, 4, 5, or 6
hold ena = 0 to disable hold time or 1 to enable hold time

SG-HOLD Command Examples

1. Read the output hold settings for all outputs.

   SG-HOLD

   ```
   SG-HOLDA=0;    SG-HOLD1=1;    SG-HOLD2=1;    SG-HOLD3=1
   SG-HOLD4=1;    SG-HOLD5=0;    SG-HOLD6=1
   ```

2. Disable the output hold feature for hardware output 1 (OUT1).

   SG-HOLD1=0

SG-LOG Command

Purpose: Reads or sets the record log points and record interval.
Syntax: SG-LOG[=<pt1/pt2/pt3/pt4/pt5/pt6>,<interval>,<pretrigger points>]
Comments: Privilege G or S password access is required to change settings. SG-LOG command parameters are described in Table C-20.

Table C-20. SG-LOG Command Parameters

Parameter	Range	Description
pt1 pt2 pt3 pt4 pt5 pt6	0 to 20	Each variable is assigned a number that corresponds to the desired variable in Table C-21. The selected variable is then logged in a record when a trigger occurs. Placing a zero in the string terminates the string and prevents any following data points from being recorded. This allows fewer than six variables in a data record. The default setting is 1/2/3/4/5/6.

Parameter	Range	Description
interval	1 to 1000	Number of half-cycles (98.33 ms at 60 Hz) between data logs. Since 600 variables are saved in a record, record duration can range from 5 to 5,000 seconds at 60 Hz. The default setting is 1.
pretrigger points	0 to 599	Number of pre-trigger data points recorded. The default value is 0. (At least one post-trigger data point will be recorded.)

Table C-21. Data Log Variables

Number	Description	Lower Limit ∗	Upper Limit ∗
0	Disable logging and don’t display more variables	N/A	N/A
1	Three-phase watts	-2.00000	+2.00000
2	Three-phase vars	-2.00000	+2.00000
3	Power factor	-1.00000	+1.00000
4	Generator terminal voltage	-2.00000	+2.00000
5	Generator terminal current	-2.00000	+2.00000
6	Generator terminal frequency deviation	-1.00000	+1.00000
7	Compensated generator terminal frequency deviation	-1.00000	+1.00000
8	Positive sequence voltage magnitude	-2.00000	+2.00000
9	Positive sequence current magnitude	-2.00000	+2.00000
10	Negative sequence voltage magnitude	-2.00000	+2.00000
11	Negative sequence current magnitude	-2.00000	+2.00000
12	Test Signal input magnitude	-2.00000	+2.00000
13	Washed out speed	-2.00000	+2.00000
14	Washed out power	-2.00000	+2.00000
15	Filtered mechanical power	-2.00000	+2.00000
16	Stabilizing signal	-2.00000	+2.00000
17	pss prelimit out	-2.00000	+2.00000
18	pss postlimit out	-2.00000	+2.00000
19	pss out	-2.00000	+2.00000
20	pss test out	-2.00000	+2.00000

∗ Lower and upper limits are expressed as per-unit values.

SG-LOG Command Examples

1. Configure the data record to log three-phase watts, terminal frequency deviation, and the stabilizer output. Establish a logging interval of once every cycle, and include 100 pre-trigger data points.

   SG-LOG=1/6/19/0,2,100

2. Read the data logging parameters programmed in the PSS-100.

   SG-LOG

   `1/2/4/7/14/19,8,200`

These settings indicate that the PSS-100 is configured to log three-phase watts, three-phase vars, generator terminal voltage, compensated generator terminal frequency deviation, washed out power, and stabilizer output. Data is recorded every four cycles (about 66.7 milliseconds at 60 hertz), and 200 pre-trigger data points will be included.

Once a data record is completed, the PSS-100 will start on the next data record immediately, recording the data in a circular buffer in preparation for saving the pre trigger data. If the next trigger occurs too soon before the correct number of pre trigger data points have been recorded, then only as many pre-trigger data points will be recorded as are available.

If there is an attempt to save any SG-LOG setting while a data record is in progress, the "save" will be aborted with a warning message, as though a "continue" response had been entered after an EXIT command. The changes may be saved after the data record is complete or terminated by trigger logic.

SG-KV Command

Purpose: Reads or sets the voltage rating.
Syntax: SG-KV[=<voltage>]
Comments: Privilege G or S password access is required to change setting.
voltage = generator line voltage in kilovolts

SG-KV Command Example

Set the line voltage for a machine rated at 13,800 volts, line-to-line.

SG-KV=13.8

SG-MVA Command

Purpose: Reads or sets the rated generator voltamperes.
Syntax: SG-MVA[=<voltamps>]
Comments: Privilege G or S password access is required to change settings.
voltamps = generator voltampere rating in MVA

SG-MVA Command Example

Set the voltamperes for a machine rated at 88.4 MVA

SG-MVA=88.4

SG-SGCON Command

Purpose: Reads or sets the on time for the setting group change alarm.
Syntax: SG-SGCON[=<time>]
Comments: Privilege G or S password access is required to change settings.
time = the SGC alarm output on-time. Setting range is 1 to 10 seconds, 0 disables.

SG-SGCON Command Example

Set the SGC alarm output to pulse on/true for one second after a settings group is changed.

SG-SGCON=1

SG-TRIG Command

Purpose: Reads or sets the report log trigger logic.
Syntax: SG-TRIG[=<trigger logic>]
Comments: Privilege G or S password access is required to change settings.

Trigger logic is defined by a programmable BESTlogic expression. A false-to-true transition on this expression triggers a data record. The record terminates when 600 data points are logged or when the trigger logic transitions from true to false.

SG-TRIG Command Example

Configure the data recording trigger logic so that a record is triggered when contact sensing input 1 or 2 is true (1).

SG-TRIG=IN1+IN2

SG-VT Command

Purpose: Reads or sets the voltage transformer ratios and configuration
Syntax: SG-VT[=<vt ratio>,<vt config>]
Comments: Privilege G or S password access is required to change settings. SG-VT command parameters are described in Table C-22.

Table C-22. SG-VT Command Parameters

Parameter	Parameter Selection	Range	Increment
ratio	pri:sec pri/sec or calculated ratio	1 to 50000 for pri, sec, and calculated ratio	1
config	3 (3-wire, delta) 4 (4-wire, wye)	3, 4	N/A

SG-VT Command Examples

1. Configure the voltage transformer information for four-wire, wye connections and a ratio of 400 to 5.

   SG-VT=13800:120 or SG-VT=13800/120 or SG-VT=115

2. Read the voltage transformer ratio and wiring configuration.

   SG-VT
   ```
   115,4
   ```

SL Command

Purpose: Reads the setting logic information.
Syntax: SL[:<name>]
Comments: No password access is required to read settings.

Entering SL reads the logic equations associated with the active logic scheme. Entering SL: reads the names of the available logic schemes. Entering SL:<name> reads all logic equations associated with a particular logic scheme. Entering SL-<xxx> reads a logic equation associated with logic variable xxx.

SL Command Examples

1. Read the list of available logic schemes.

   SL:
   ```
   PSSLOGIC, NONE_1, NONE_2, NONE_3, NONE_4, NONE_5, NONE_6, NONE
   ```

NOTE

Currently, only the custom logic scheme is supported. (This scheme is named PSSLOGIC in the example above.) This name can be changed by the user. All logic schemes labeled NONE are for future expansion.

2. Read all logic equations associated with the custom (PSSLOGIC) logic scheme.

   SL *or* SL:PSSLOGIC
   ```
   SL-N=PSSLOGIC
   SL-PSS=1,IN1,IN3+43
   SL-62=0,0,0
   SL-162=0,0,0
   SL-43=0
   SL-143=0
   SL-243=0
   SL-343=0
   SL-443=0
   SL-543=0
   SL-643=0
   SL-743=0
   ```

```
SL-GROUP=0,0,0,0,0,0
SL-VOA=0
SL-VO1=PSSON
SL-VO2=TSTON
SL-VO3=ALMMAJ
SL-VO4=ALMLGC
SL-VO5=PSSON+TSTON
SL-VO6=0
SL-VO7=0
SL-VO8=0
SL-VO9=0
SL-VO10=0
SL-VO11=0
SL-VO12=0
SL-VO13=TSTON
SL-VO14=0
SL-VO15=0
SL-OP=1,0,0
```

For user-programmable custom logic, an equal sign (=) is used to separate the command from the setting data. For read-only logic schemes, a colon (:) is used to separate the command from the setting data to indicate that the scheme setting cannot be changed.

3. Read the logic equation associated with logic variable VO5.

   SL-VO5

   ```
   PSSON+TSTON
   ```

SL-43 Command

Purpose: Reads or sets the virtual switch logic.
Syntax: SL-<x>43[=mode]
Comments: Privilege C or G password access is required to change settings.
x = blank, 1, 2, 3, 4, 5, 6, or 7
mode = 0 for off or disabled, 1 for on/off/pulse (all modes), 2 for on/off, or 3 for pulse

SL-43 Command Examples

1. Set virtual selector switch 143 for on/off operation.

   SL-143=2

2. Disable virtual selector switch 43

   SL-43=0

SL-62 and SL-162 Commands

Purpose: Reads or sets the 62 or 162 programmable timer logic.
Syntax: SL-x62[=<mode>,<INI logic>,<BLK logic>]
Comments: x = blank for 62, 1 for 162
SL-62 and SL-162 command parameters are described in Table C-23.

Table C-23. SL-x62 Command Parameters

Parameter	Parameter Selections
mode	0 (disabled), 1 (pickup/dropout), 2 (one-shot non-retriggerable), 3 (one-shot retriggerable), 4 (oscillator), or 5 (integration)
INI logic	Any OR logic term. The timer starts when this logic term is true (1).
BLK logic	Any OR logic term. The timer is blocked or reset when this logic term is true (1).

SL-62 and SL-162 Command Examples

1. Read the 62 logic.

   SL-62

2,IN2,0 The 62 logic indicates that the timer is enabled for edge trigger operation with timer initiation by IN2 and blocking disabled.

2. Configure the 162 timer for pickup/dropout operation, timer initiation by input 3, and blocking disabled.

   SL-162=1,IN3,0

SL-GROUP Command

Purpose: Reads or sets the setting group logic.
Syntax: SL-GROUP[=<mode>,<D0logic>,<D1logic>,<D2logic>,<d3logic>,<AUTOlogic>]
Comments: Privilege G or S password access is required to change settings. SL-GROUP command parameters are described in Table C-24.

Table C-24. SL-GROUP Command Parameters

Parameter	Parameter Selections
mode	0 Limits settings group selection to SG0. 1 SG0 - SG3 are enabled by discrete selection. “Control Override” or “Automatic Control” is active. Settings group selection is made by applying a logic TRUE signal to inputs D0, D1, D2, or D3. A pulsed TRUE signal may be used if a minimum on time of one second is maintained. If more than one input is TRUE at the same time, then the higher D# will take priority. 2 SG0 - SG3 are enabled by binary selection. “Control Override” or “Automatic Control” is active. Settings group selection is made by applying the appropriate binary coded signal to inputs D0 and D1. The input must be stable for 0.5 to 0.75 seconds for the new state to be accepted. The binary codes for each settings group are: **D1** **D0** **Decimal Equivalent** **Settings Group** 0 0 0 SG0 0 1 1 SG1 1 0 2 SG2 1 1 3 SG3
D# logic	OR logic term used to select the active settings group as determined by the mode setting.
AUTO logic	OR logic term, when FALSE, enables the D# input logic, disables the automatic logic and resets the automatic logic timers. When AUTO is TRUE, the D# input logic is disabled and automatic logic is enabled.

SL-GROUP Command Examples

1. Enable discrete input operation, with contact inputs 1 and 2 controlling settings groups 1 and 2 respectively. If both contact inputs are active, settings group 2 (being higher) will be active. If IN1 and IN2 are false or inactive, the last group selected will continue to be active.

   SL-GROUP=1,0,IN1,IN2,,0

2. Enable binary input operation, with contact inputs 3 and 4 controlling the settings groups. The binary combination of contact inputs 3 and 4 decides which group is active.

   SL-GROUP=2,IN3,IN4,0,0,0

SL-N Command

Purpose: Reads or sets the custom logic name.
Syntax: SL-N[=<name>]
Comments: Privilege G or S password access is required to change settings.
name = any alphanumeric string of one to eight characters

SL-N Command Examples

1. Read the name of the custom logic scheme.

SL-N

PSS1

2. Copy the standard logic scheme PSS1 over to the custom logic scheme.

   SL-N=PSS1

3. Rename the custom logic by assigning a completely new logic name.

   SL-N=NEWNAME

SL-PSS Command

Purpose: Reads or sets the output logic.
Syntax: SL-PSS-100[=<mode>,<cntrl logic>,<test logic>]
Comments: Privilege G or S password access is required to change settings. SL-PSS command parameters are described in Table C-25.

Table C-25. SL-PSS Command Parameters

Parameter	Parameter Description
mode	0 = disabled 1 = enabled
cntl logic	OR logic expression that enables the PSSCNTL output
test logic	OR logic expression that enables the TSTCNTL output

SL-PSS Command Example

Enable the stabilizer output when contact input 1 (IN1) is energized. Enable the test output when contact input 3 (IN3) is energized or the 43 control switch is on.

SL-PSS-100=1,IN1,IN3+43

SL-OP Command

Purpose: Reads or programs the operating logic for Motor mode and the phase sequence control functions.
Syntax: SL-OP[=<mode>,<motor mode logic>,<ph. seq. logic>]
Comments: Privilege G or S password access is required to change settings. SL-OP command parameters are described in Table C-26.

Table C-26. SL-OP Command Parameters

Parameter	Parameter Description
mode	0 = disabled 1 = enabled
motor mode logic	OR logic expression that enables the MOTCTL output
ph. seq. logic	OR logic expression that enables the SEQCTL output

SL-OP Command Example

Enable Motor mode when contact input one is energized. Enable ACB sequence when contact input three is energized.

SL-OP=1,IN1,IN3

SL-VO Command

Purpose: Reads or sets the output logic.
Syntax: SL-VO[x[=<Boolean equation>]]
Comments: Privilege G or S password access is required to change settings.
x = virtual output number 1 through 15, A
Boolean equation = logic expression using variables Ix (virtual inputs), logic module outputs, Vox (virtual outputs), and operators AND (∗), OR (+), and NOT (/).

SL-VO Command Example

Turn on virtual output 1 when any of the two timers (62 or 162) time out.

SL-VO1=62+162

SN Command

Purpose: Reads or sets the user-programmable names.
Syntax: SN[-<var>[=<name>,<TRUE label>,<FALSE label>]
Comments: var = BESTlogic variable
name = user-assigned name for the BESTlogic variable (10 characters, maximum)
TRUE label = user-assigned label for the variable's true state (7 characters, maximum)
FALSE label = user assigned label for the variable's false state (7 characters, maximum)

SN Command Example

Assign contact input 1 with a name of "BREAKER". Assign contact input 1 a true label of "OPEN" and a false label of "CLOSED".

SN-IN1=BREAKER,OPEN,CLOSED

S<g> Command

Purpose: Reads all protection settings.
Syntax: S<g>
Comments: No password access is required to read settings.
g = 0, 1, 2, or 3 for settings groups 0, 1, 2, or 3, omitted for all stabilizer settings.

S<g>-62 and S<g>-162 Commands

Purpose: Reads or sets the 62 and 162 timer delays.
Syntax: S<g>-<f>62[=<td1>,<td2>]
Comments: Privilege G or S password access is required to change settings.
g = setting group number (0–3) or # to read or change settings for all groups
f = no entry for 62 time delay, 1 for 162 time delay

Parameters td1 and td2 have a setting range of 0 to 9,999 seconds. Default units are milliseconds (m), but cycles (c) or seconds (s) can be used by adding the proper suffix (m/c/s) at the end of the time string. Parameters td1 and td2 are used according to the mode selection made by the SL-#62 command.

S<g>-62 Command Example

Set the setting group 0 62 timer to delay pickup for 100 milliseconds with an immediate dropout and set the setting groups 1, 2, and 3 62 timer to delay pickup for 150 milliseconds with a dropout time of 50 milliseconds.

S0-62=100,0
S1-62=150,50
S2-62=150,50
S3-62=150,50

S<g>-CNTL Command

Purpose: Reads or sets the logic control variable to enable or disable the PSS-100.
Syntax: S<g>-CNTRL[=<enable>]
Comments: Privilege G or S password access is required to change settings.
g = setting group 0, 1, 2, or 3. #reads or changes the settings in all groups.

An enable value of 0 disables and resets the stabilizer equation. An enable value of 1 enables the stabilizer and places the PSS-100 back in service. After a reset (software or power-up), the enable value is 0.

S<g>=CNTL Command Examples

1. Read the status of the stabilizer algorithm control settings for all settings groups.

   S<g>-CNTL

   ```
   S0-CNTL=1
   S1-CNTL=1
   S2=CNTL=1
   S3=CNTL=1
   ```

2. Disable the settings group two stabilizer control.

   S2-CNTL=0

S<g>-ET Command

Purpose: Reads or sets the terminal voltage limiter and low-pass filter time constants.
Syntax: S<g>-ET[=<tl>,<set pt>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.
S<g>-ET command parameters are described in Table C-27.

Table C-27. S<g>-ET Command Parameters

Parameter	Parameter Description	Range	Increment
tl	Et limiter time constant	0.02 to 5.0 (seconds)	0.01
set pt	Et limiter setpoint	0.90 to 1.25 (per unit)	0.01

S<g>-ET Command Examples

1. Read the terminal voltage limit settings.

   S#-ET

   ```
   S0-ET=  5.00,  1.25
   S1-ET=  1.00,  1.00
   S2-ET=  1.00,  1.00
   S3-ET=  1.00,  1.00
   ```
2. In setting group 0, change Et limiter time constant 1 and 2 to 4.00 and the Et limiter setpoint to 1.10.

   S0-ET=4.00,1.10
3. Change the setting group 0 Et limiter setpoint to 1.15

   S0-ET=,1.15

S<g>-H Command

Purpose: Reads or sets the unit inertia setting.
Syntax: S<g>-H[=<h>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.

Parameter h, measured in MW-seconds/MVA, has a setting range of 0.01 to 25.0.

S<g>-H Command Examples

1. Read the rotor inertia constant setting for setting group 0.

   S0-H

   ```
   3.00
   ```
2. Set the rotor inertia constant setting at 3.5 for setting group 0.

   S0-H=3.5

S<g>-KS Command

Purpose: Reads or sets the stabilizer gain constant.
Syntax: S<g>-KS[=<ks>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.

Parameter ks is the stabilizer gain constant and has a setting range of 0.00 to 50.0.

S<g>-KS Command Examples

1. Read the stabilizer gain for all settings groups.

   S#-KS

   ```
   S0-KS=10.00
   S1-KS=20.00
   S2-K2=15.00
   S3-KS=25.00
   ```

2. Set the stabilizer gain at 35.0 for settings group 3.

   S3-KS=35

S<g>-LIM Command

Purpose: Reads or changes the upper and lower limit settings for the stabilizer gain stage output.
Syntax: S<g>-LIM[=<stab max>,<stab min>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups. S<g>-LIM command parameters are described in Table C-28.

Table C-28. S<g>-LIM Command Parameters

Parameter	Description	Range
stab max	Upper limit of gain stage (K_s) output	0.00 to 0.50
stab min	Lower limit of gain stage (K_s) output	–0.50 to 0.00

S<g>-LIM Command Examples

1. Read the stabilizer output limits for setting group 0.

   S0-LIM

   `0.50, -0.25`

2. In settings group 1, set the upper gain stage limit at 0.35 and the lower gain stage limit at –0.10.

   S1-LIM=.35,-.1

S<g>-LLG Command

Purpose: Reads or sets the logic limiter parameters.
Syntax: S<g>-LLG[=<lmt_hi>,<lmt_lo>,<lmt_dly>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups. S<g>-LLG parameters are described in Table C-29.

Table C-29. S<g>-LLG Command Parameters

Parameter	Description	Range
lmt_hi	High limit value	0.01 to 0.04
lmt_lo	Low limit value	–0.04 to –0.01
lmt_dly	Time delay	0.00 to 2.00

S<g>-LLG Command Examples

1. Read the logic limiter parameters for setting group 0.

   S0-LLG

   `0.020, -0.020, 0.50`

2. In setting group 1, set the limiter time delay at one second.

   S1-LLG=,,1

S<g>-LPF Command

Purpose: Reads or sets the mechanical power low-pass filter time constant.
Syntax: S<g>-LPF[=<tl>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.

Parameter tl has a setting range of 0.05 to 0.2 seconds in 0.01 increments.

S<g>-LPF Command Examples

1. Set the low-pass filter constant at 0.09 for setting group 1.

   S1-LPF=0.09

2. Read the low-pass filter constant for all settings groups.

   S<g>-LPF

```
S0-LPF=0.10
S1-LPF=0.12
S2-LPF=0.15
S3-LPF=0.08
```

S<g>-LV Command

Purpose: Reads or sets the log trigger variables.
Syntax: S<g>-LV#[=<value>,<dir>,<abs>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.
S<g>-LV command parameters are described in Table C-30.

Table C-30. S<g>-LV Command Parameters

Parameter	Description
value	Trigger level value. All values are per unit. If the value of the variable crosses this setting and the conditions of the dir and abs parameters are met, a data record will be triggered. The range of each trigger level value is listed in Table C-22.
dir	Direction of crossing the level for data triggering where 0 is up and 1 is down. A setting of 0 means that a data record will be triggered if the variable value crosses from below the setting to above the setting.
abs	Actual or absolute value of the trigger level value where 0 is actual and 1 is absolute. For a 0 setting, the variable value and the setting value will be compared as programmed to generate a data record trigger. For a 1 setting, the absolute value of the variable will be compared with the programmed setting to generate the trigger. This enables data record triggers by variables that are nominally zero, but could jump too high in either direction.

S<g>-LV Command Examples

1. Set the data record to automatically trigger when the generator terminal voltage increases above 1.2 per unit. Since the generator terminal voltage is recorded as a magnitude, the absolute value parameter will not make any difference in this case.

   S0-LV4=1.2,0,0

2. Set the data record to automatically trigger when the compensated generator frequency deviation increases above 0.05 per unit (3 Hz at 60 Hz, nominal) in either direction.

   S0-LV7=0.05,0,1

S<g>-PWR Command

Purpose: Reads or sets the power-on threshold and hysteresis.
Syntax: S<g>-PWR[=<pwr thres>,<pwr hys>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.
S<g>-PWR command parameters are described in Table C-31.

Table C-31. S<g>-PWR Command Parameters

Parameter	Description	Range
pwr thres	Per unit value that is based on the value of the SG-MVA setting. pwr thres defines the power level required to enable PSS-100 operation.	0.00 to 1.00
pwr hys	Per unit value that is based on the value of the SG-MVA setting. pwr hys provides a margin below the pwr thres parameter so that transient dips in power will not disable the stabilizer. When the power level decreases below the pwr hys threshold, a fixed timer of 20 half-cycles (160 ms at 60 Hz) begins timing. If the power increases above the pwr thres setting before the timer expires, the PSS-100 will stay enabled. If the power level fails to increase above the pwr thres setting before the timer expires, the PSS-100 will be disabled.	0.00 to 1.00

Although the S<g>-PWR parameters can be set as low as 0.0, their effective range at the lower end is restricted by the fixed, instantaneous power level supervisory function.

S<g>-PWR Command Examples

1. Read the power-on threshold and hysteresis levels for all settings groups.

   S#-PWR

   ```
   S0-PWR= 0.25, 0.05
   S1-PWR= 0.20, 0.10
   S2-PWR= 0.40, 0.05
   S3-PWR= 0.35, 0.10
   ```

2. In setting group 0, set the power-on threshold at 25% and the hysteresis level at 20% of the SG-MVA setting. remember that the hysteresis value is expressed as the power-on threshold level minus the desired hysteresis level.

   S0-PWR=0.25,0.05

S<g>-QCOMP Command

Purpose: Reads or sets the quadrature axis compensation.
Syntax: S<g>-QCOMP[=<quad comp>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.

Parameter “quad comp” has a setting range of 0.000 to 5.000 (per unit) in 0.001 increments.

S<g>-QCOMP Command Example

Assign a quadrature axis compensation value of 0.55 for settings group 0.

S0-QCOMP=0.55

S<g>-SCALE Command

Purpose: Reads or sets the output scaling constant.
Syntax: S<g>-SCALE[=<output scale>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.

Parameter “output scale” has a setting range of –300 to +300 in 0.01 increments.

S<g>-SCALE Command Examples

1. Read the stabilizer output scaling constants.

   S<g>-SCALE

```
S0-SCALE=55
S1-SCALE=60
S2-SCALE=70
S3-SCALE=45
```

2. Change the setting group 2 scaling factor to 75.

   S2-SCALE=75

S<g>-SW0 Command

Purpose: Reads or sets software switch 0, 1, 2, and 3 settings.
Syntax: S<g>-SW0[=<sw0>,<sw1>,<sw2>,<sw3>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.
S<g>-SW0 command parameters are described in Table C-32.

Table C-32. S<g>-SW0 Command Parameters

Parameter	Description	Range
sw0	Torsional filter 1	0 = excluded 1 = included
sw1	Torsional filter 2	0 = excluded 1 = included
sw2	Mechanical low-pass filter	0 = bypassed 1 = included
sw3	Speed select	0 = derived speed 1 = frequency

S<g>-SW0 Command Examples

1. Read software switch SSW 0, 1, 2, and 3 settings for all settings groups.

   S<g>-SW0

```
S0-SW0=0,0,1,1
S1-SW0=0,0,1,0
S2-SW0=0,0,0,0
S3-SW0=0,0,0,0
```

2. Enable the mechanical low-pass filter for setting group 3.

   S3-SW0=,,1

S<g>-SW4 Command

Purpose: Reads or sets software switch 4, 5, 6, and 7 settings.
Syntax: S<g>-SW4[=<sw4>,<sw5>,<sw6>,<sw7>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 1, 2, 3, or 3. # reads or changes the settings in all groups.
S<g>-SW4 command parameters are described in Table C-33.

Table C-33. S<g>-SW4 Command Examples

Parameter	Description	Range
sw4	Stabilizer signal select	0 = power 1 = derived speed or frequency
sw5	Optional phase lead	0 = included 1 = excluded
sw6	Limiter enable	0 = disabled 1 = enabled
sw7	Output block	0 = blocked 1 = enabled

S<g>-SW4 Command Examples

1. Read software switch SSW 4, 5, 6, and 7 settings for settings group zero.

   S0-SW4

   `S0-SW4=1,1,1,1`

2. Disable the stabilizer output in settings group 2.

   S2-SW4=,,,0

S<g>-SW8 Command

Purpose: Reads or sets software switch 8 and 9 settings.
Syntax: S<g>-SW8[=<sw8>,<sw9>]
Comments: Privilege G or S password access is required to change settings.
G = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.
S<g>-SW8 command parameters are described in Table C-34.

Table C-34. S<g>-SW8 Command Parameters

Parameter	Description	Range
sw8	Logic limiter select	0 = blocked 1 = enabled
sw9	Optional phase lead/lag	0 = included 1 = excluded

S<g>-SW8 Command Examples

1. Read software switch SSW 8 and 9 settings for settings group zero.

   S0-SW8

   `1,1`

2. Disable the second optional phase lead/lag block in settings group two.

   S2-SW8=,1

S<g>TCON Command

Purpose: Reads or sets the phase lead and phase lag time constants.
Syntax: S<g>-TCON[=<t1>,<t2>,<t3>,<t4>,<t5>,<t6>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.
S<g>-TCON command parameters are described in Table C-35.

Table C-35. S<g>-TCON Command Parameters

Parameter	Description	Range
t1	1st phase lead time constant	0.001 to 6.0
t2	1st phase lag time constant	0.001 to 6.0
t3	2nd phase lead time constant	0.001 to 6.0
t4	2nd phase lag time constant	0.001 to 6.0
t5	3rd phase lead time constant	0.001 to 6.0
t6	3rd phase lag time constant	0.001 to 6.0

S<g>-TCON Command Examples

1. Read the lead/lag time constants for setting group 0.

   S0-TCON

   `0.05, 0.01, 0.07, 0.25, 1.00, 1.00`

2. In setting group 1, set the second stage lead time constant at 0.08. Set the second stage lag time constant at 0.02.

   S1-TCON=,,0.08,0.02

S<g>-TCON2 Command

Purpose: Reads or sets the phase lead and phase lag time constants.
Syntax: S<g>-TCON2[=<t7>,<t8>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.
S<g>-TCON2 command parameters are described in Table C-36.

Table C-36. S<g>-TCON2 Command Parameters

Parameter	Description	Range
t7	4^{th} phase lead time constant	0.001 to 6.0
t8	4^{th} phase lag time constant	0.001 to 6.0

S<g>-TCON2 Command Examples

1. Read the lead/lag time constants for setting group 0.
   S0-TCON2
   `0.05, 0.01`
2. In setting group 1, set the fourth stage lag time constant at 0.08.
   S1-TCON2=,0.08

S<g>-TFLT1 Command

Purpose: Reads or sets the torsional filter 1 parameters.
Syntax: S<g>-TFLT1[=<z1n>,<z1d>,<wn1>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.
S<g>-TFLT1 command parameters are described in Table C-37.

S<g>-TFLT2 Command

Purpose: Reads or sets the torsional filter 2 parameters.
Syntax: S<g>-TFLT2[=<z2n>,<z2d>,<wn2>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.
S<g>-TFLT1 command parameters are described in Table C-37.

Table C-37. S<g>-TFLT1 and S<g>-TFLT2 Command Parameters

Parameter	Description	Range
z1n z2n	Numerator damping ratio	0.00 to 1.00
z1d z2d	Denominator damping ratio	0.00 to 1.00
wn1 wn2	Resonant frequency	10.0 to 150

S<g>-TFLT1 and S<g>-TFLT2 Command Examples

1. Read the torsional filter 1 parameters for setting group 0.
   S0-TFLT1
   `0.05, 0.25, 42.0`
2. In setting group 1, set the resonant frequency for torsional filter 2 at 30.
   S1-TFLT2=,,30

S<g>-TFREQ Command

Purpose: Reads or sets the test frequency parameters.
Syntax: S<g>-TFREQ[=sweep,start,step,end]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3
S<g>-TFREQ command settings are described in Table C-38.

Table C-38. S<g>-TFREQ Command Parameters

Parameter	Description	Range
sweep	Sweep type	0 = linear 1 = logarithmic
start	Starting frequency	0.000 to 20.000
step	Frequency step	0 to +1.000000
end	End frequency	0.000 to 20.000

For linear sweeps, the test signal frequency is incremented by “step” every half-cycle of the system frequency. For logarithmic sweeps, the test signal frequency is multiplied by (1.0 + step) every half-cycle of the system frequency.

S<g>-TSIG Command

Purpose: Reads or sets test signal parameters
Syntax: S<g>-TSIG[=<sel>,<mag>,<offset>,<dur>,<freq>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3
S<g>-TSIG command settings are described in Table C-39.

Table C-39. S<g>-TSIG Command Parameters

Parameter	Description	Range
sel	Test signal type	0 = none 1 = step 2 = sine 3 = swept sine 4 = external
mag	Test signal magnitude (except gain for external signal)	–10.000 to +10.000
offset	Test signal dc offset	–10.000 to +10.000
dur	Test signal duration in seconds. For sine and external test signals, this is the total test duration. For step test signals, this is the “ON” period of the step signal. dur should be less than the reciprocal of the frequency.	0.0 to 49999.0
freq	Test signal frequency	0.000 to 20.000

S<g>-TSIG Command Example

Set the test signal as a 2.5 hertz, 0.75 volts peak, sine wave with a zero dc offset. Test duration should be 10 minutes.

S0-TSIG=2,0.75,0,600,2.5

S<g>-TSW Command

Purpose: Reads or sets the test switch parameters.
Syntax: S<g>-TSW[=<sw1>,<sw2>,<sw3>,<sw4>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3.
S<g>-TSW command parameters are described in Table C-40.

Table C-40. S<g>-TSW Command Parameters

Parameter	Description
sw1	A setting of 1 applies the test signal at the PSS-100 output.
sw2	A setting of 1 applies the test signal at the speed input.
sw3	A setting of 1 applies the test signal at the power input.
sw4	A setting of 1 applies the test signal at the phase lead input.

Test switches are disabled by a setting of zero. For meaningful results, only one switch should be turned on at a time.

S<g>-TSW Command Examples

1. In settings group zero, set the test signal to be added at the speed input.
   S0-TSW=0,1,0,0
2. In settings group zero, set the test signal to be added at the PSS-100 output.
   S0-TSW=1,0,0,0

S<g>-TW5 Command

Purpose: Reads or sets the washout time constants.
Syntax: S<g>-TW5[=<tw5_nrl>,<tw5_lmt>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.
S<g>-TW5 command parameters are described in Table C-41.

Table C-41. S<g>-TW5 Command Parameters

Parameter	Description	Range
tw5_nrl	Normal time constant	5.0 to 30.0
tw5_lmt	Limit time constant	0.00 to 1.00

S<g>-TW5 Command Examples

1. Read the logic limiter time constants for setting group 0.
   S0-TW5
   `10.2, 0.30`
2. In setting group 1, set the normal time constant at 15.
   S1-TW5=15

S<g>-WASH Command

Purpose: Reads or sets the washout time constants.
Syntax: S<g>-WASH[=<tw1>,<tw2>]
Comments: Privilege G or S password access is required to change settings.
g = settings group 0, 1, 2, or 3. # reads or changes the settings in all groups.
S<g>-WASH command parameters are described in Table C-42.

Table C-42. S<g>-WASH Command Parameters

Parameter	Description	Range
tw1	First high-pass filtering time constant	1.0 to 20.0
tw2	Second high-pass filtering time constant	1.0 to 20.0

S<g>-WASH Command Examples

1. Read the washout time constants for all settings groups.

   S<g>-WASH

```
S0-WASH=5.00,5.00
S1-WASH=5.00,7.00
S2-WASH=6.00,7.00
S3-WASH=8.00,10.00
```

2. Change the second washout time constant to 5.5 for settings group zero.

   S0-WASH=,5.5

SP-GROUP Command

Purpose: Reads or programs auxiliary setting group operation.
Syntax: SP-GROUP[<g>]=[<sw time>,<sw level>,<ret time>,<ret level>,<pwr level>]
Comments: Privilege G or S password access is required to change settings.
G = automatic settings group number 1, 2, or 3
SP-GROUP command parameters are described in Table C-43.

Table C-43. SP-GROUP Command Parameters

Parameter	Description	Range
sw time	Time in minutes that conditions to change group must stay valid before a settings group change is allowed.	1 to 60 0 = disabled
sw level	Percentage of power level setting that the measured power must stay greater than or equal to for sw time to permit an automatic change to SGn.	0 to 150
ret time	Time in minutes that conditions to change group must stay valid before return from setting group n is allowed.	1 to 60 0 = disabled
ret level	Percentage of power level setting that the measured power must stay less than for ret time to permit an automatic return from SGn.	0 to 150
pwr level	Power level in megawatts	0 to 5,000

SP-GROUP Command Examples

1. Read the automatic operation settings for each settings group.

   SP-GROUP

```
SP-GROUP1=25, 75, 15, 75, 1e6;   SP-GROUP2=15,75,5,70,20e6
SP-GROUP3=0,0,0,0,0.0
```

   When power increases above 75% of 1 MW for 25 minutes, the PSS-100 will automatically switch to group 1. The settings group will return to group 0 when power decreases below 75% of 1 MW for 15 minutes. Group 2 is an automatic group with a switch time of 15 minutes and a switch level equal to 75% of 20 MW. The return time is equal to five minutes; the return level is 70% of 20 MW. Automatic switching to group 3 is disabled.

2. Disable settings group 2 as an automatic settings group.

   SP-GROUP2=0

ST-ON Command

Purpose: Reads or sets the test-on enable switch.
Syntax: ST-ON[=<sw0>]
Comments: Privilege G or S password access is required to control test signal application.
Test signal application is enabled when sw0 equals 1, disabled when sw0 equals 0.

ST-ON Command Example

Enable the test signal.

ST-ON=1

APPENDIX D • SEQUENCE OF EVENTS SUMMARY

INTRODUCTION

This appendix provides a listing of all possible Sequence of Events combinations along with the status types for each event. MM/DD/YY represents the date and xx:xx:xx.xxx represents the time of the event.

COMPLETE LISTING

Table D-1 lists all of the records made possible by the 96 programmable logic bits. These records can be displayed using the RS-# and RS-LGC commands. An asterisk (*) denotes records also available through the RS-IO command.

Table D-1. Complete Listing of Records

--DATE--	----TIME----	----------POINT DESCRIPTION----------	--STATUS--
MM/DD/YY	xx:xx:xx.xxx	PSS ON	FALSE/TRUE *
MM/DD/YY	xx:xx:xx.xxx	PSS CONTROL	FALSE/TRUE *
MM/DD/YY	xx:xx:xx.xxx	PSS TEST CONTROL	FALSE/TRUE *
MM/DD/YY	xx:xx:xx.xxx	PSS TEST ON	FALSE/TRUE *
MM/DD/YY	xx:xx:xx.xxx	LV1 TRIGGER < WATTS >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV2 TRIGGER < VARS >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV3 TRIGGER < PF >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV4 TRIGGER < GEN TERM V >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV5 TRIGGER < GEN TERM I >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV6 TRIGGER < GEN TERM F >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV7 TRIGGER < GEN COMP F >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV8 TRIGGER < POS SEQ V >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV9 TRIGGER < POS SEQ I >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV10 TRIGGER < NEG SEQ V >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV11 TRIGGER < NEG SEQ I >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV12 TRIGGER < AUX SIG >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV13 TRIGGER < WASH SPEED >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV14 TRIGGER < WASH POWER >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV15 TRIGGER < MECH LPF OUT >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV16 TRIGGER < SYNTH SPEED >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV17 TRIGGER < PRELIM OUT >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV18 TRIGGER < POSTLIM OUT >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV19 TRIGGER < PSS OUT >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	LV20 TRIGGER < TEST OUT >	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	62	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	162	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	43	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	143	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	243	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	343	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	443	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	543	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	643	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	743	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT A	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT 1	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT 2	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT 3	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT 4	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT 5	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT 6	FALSE/TRUE

--DATE--	----TIME----	----------POINT DESCRIPTION----------	--STATUS--
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT 7	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT 8	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT 9	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT 10	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT 11	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT 12	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT 13	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT 14	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	VIRTUAL OUTPUT 15	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	INPUT 1	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	INPUT 2	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	INPUT 3	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	INPUT 4	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	INPUT 5	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	INPUT 6	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	INPUT 7	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	INPUT 8	OPEN/CLOSED *
MM/DD/YY	xx:xx:xx.xxx	ALARM LOGIC	FALSE/TRUE *
MM/DD/YY	xx:xx:xx.xxx	ALARM MAJOR	FALSE/TRUE *
MM/DD/YY	xx:xx:xx.xxx	ALARM MINOR	FALSE/TRUE *
MM/DD/YY	xx:xx:xx.xxx	SETTING GROUP 0 ACTIVE	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	SETTING GROUP 1 ACTIVE	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	SETTING GROUP 2 ACTIVE	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	SETTING GROUP 3 ACTIVE	FALSE/TRUE

OUTPUTS

Table D-2 lists all records pertaining to stabilizer outputs. The RS-# and RS-IO commands can be used to display these records.

Table D-2. Output Records

--DATE--	----TIME----	----------POINT DESCRIPTION----------	--STATUS--
MM/DD/YY	xx:xx:xx.xxx	OUTPUT A	OPEN/CLOSED
MM/DD/YY	xx:xx:xx.xxx	OUTPUT 1	OPEN/CLOSED
MM/DD/YY	xx:xx:xx.xxx	OUTPUT 2	OPEN/CLOSED
MM/DD/YY	xx:xx:xx.xxx	OUTPUT 3	OPEN/CLOSED
MM/DD/YY	xx:xx:xx.xxx	OUTPUT 4	OPEN/CLOSED
MM/DD/YY	xx:xx:xx.xxx	OUTPUT 5	OPEN/CLOSED
MM/DD/YY	xx:xx:xx.xxx	OUTPUT 6	OPEN/CLOSED

SINGLE-STATE EVENTS

Table D-3 lists all records pertaining to single-state events. These records can be displayed using the RS-# and RS-IO commands.

Table D-3. Single-State Event Records

--DATE--	----TIME----	----------POINT DESCRIPTION----------	--STATUS--
MM/DD/YY	xx:xx:xx.xxx	FAIL ALARM RESET	
MM/DD/YY	xx:xx:xx.xxx	MAJOR ALARM RESET	
MM/DD/YY	xx:xx:xx.xxx	MINOR ALARM RESET	
MM/DD/YY	xx:xx:xx.xxx	LOGIC ALARM RESET	
MM/DD/YY	xx:xx:xx.xxx	RR=TRIG TRIGGER	
MM/DD/YY	xx:xx:xx.xxx	NEW RECORD COUNTER RESET	
MM/DD/YY	xx:xx:xx.xxx	NEW SER COUNTER RESET	
MM/DD/YY	xx:xx:xx.xxx	TIME SET	
MM/DD/YY	xx:xx:xx.xxx	DATE SET	

--DATE--	----TIME----	----------POINT DESCRIPTION----------	--STATUS--
MM/DD/YY	xx:xx:xx.xxx	OUTPUT A LOGIC OVERRIDE	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	OUTPUT 1 LOGIC OVERRIDE	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	OUTPUT 2 LOGIC OVERRIDE	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	OUTPUT 3 LOGIC OVERRIDE	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	OUTPUT 4 LOGIC OVERRIDE	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	OUTPUT 5 LOGIC OVERRIDE	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	OUTPUT 6 LOGIC OVERRIDE	FALSE/TRUE
MM/DD/YY	xx:xx:xx.xxx	RECORD TRIGGER	FALSE/TRUE

FATAL ERROR ALARMS

Table D-4 lists all records pertaining to fatal error alarms. The RS-#, RS-ALM, and RA-SER commands can be used to display these records.

Table D-4. Fatal Error Alarm Records

--DATE--	----TIME----	----------POINT DESCRIPTION----------	--STATUS--
MM/DD/YY	xx:xx:xx.xxx	RAM FAILURE	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	FLASH FAILURE	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	uP FAILURE	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	EEPROM FATAL ERR	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	ANALOG FAILURE	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	CALIBRATION ERR	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	PWR SUPPLY ERR	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	WATCHDOG FAILURE	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	SET DFLTS LOADED	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	CAL DFLTS LOADED	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	DSP FAILURE	RESET/SET

PROGRAMMABLE ALARMS

Table D-5 lists all records pertaining to programmable alarms. These records can be displayed using the RS-#, RS-ALM, and RA-SER commands. An asterisk (*) denotes records also available through the RS-IO command.

Table D-5. Programmable Alarms Records

--DATE--	----TIME----	----------POINT DESCRIPTION----------	--STATUS--
MM/DD/YY	xx:xx:xx.xxx	POWER BELOW THRESHOLD ALARM	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	SPEED FAILURE ALARM	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	VOLTAGE UNBALANCE ALARM	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	CURRENT UNBALANCE ALARM	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	NEW RECORD TRIGGERED ALARM	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	ACCESS LOST ALARM	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	GROUP OVERRIDE ALARM	RESET/SET *
MM/DD/YY	xx:xx:xx.xxx	SYS I/O DELAY ALARM	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	COMM ERROR ALARM	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	CLOCK ERROR ALARM	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	uP RESET ALARM	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	SETTING CHANGE ALARM	MADE *
MM/DD/YY	xx:xx:xx.xxx	EE NONFATAL ERR ALARM	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	OUTPUT OVERRIDE ALARM	ACTIVE/SET
MM/DD/YY	xx:xx:xx.xxx	IRIG SYNC LOST ALARM	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	SGC ACTIVE ALARM	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	VO13_LABEL	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	VO14_LABEL	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	VO15_LABEL	RESET/SET
MM/DD/YY	xx:xx:xx.xxx	LOGIC = NONE ALARM	RESET/SET

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APPENDIX E • PSS-100 SETTINGS

INTRODUCTION

This appendix contains two lists of settings. The first list shows every possible setting with the default values. The second list contains typical settings that could be used to program a PSS-100. Power System Stabilizers are delivered programmed with similar settings.

COMPLETE SETTINGS LIST

SL-N=NONE
SL-62=0,0,0
SL-162=0,0,0
SL-43=0
SL-143=0
SL-243=0
SL-343=0
SL-443=0
SL-543=0
SL-643=0
SL-743=0
SL-GROUP=0,0,0,0,0,0
SL-PSS=0,0,0
SL-VOA=0
SL-VO1=0
SL-VO2=0
SL-VO3=0
SL-VO4=0
SL-VO5=0
SL-VO6=0
SL-VO7=0
SL-VO8=0
SL-VO9=0
SL-VO10=0
SL-VO11=0
SL-VO12=0
SL-VO13=0
SL-VO14=0
SL-VO15=0
SL-OP=1,0,0
SP-GROUP1= 0, 0, 0, 0,0.0000
SP-GROUP2= 0, 0, 0, 0,0.0000
SP-GROUP3= 0, 0, 0, 0,0.0000
S0-62= 0m, 0m
S0-162= 0m, 0m
S0-CNTL=0
S0-ET= 1.00, 1.00
S0-H= 1.00
S0-KS= 0.00
S0-LIM= 0.00, 0.00
S0-LLG=0.020,-0.020,0.50
S0-LPF= 0.10
S0-LV1= 0.00000,0,0
S0-LV2= 0.00000,0,0
S0-LV3= 0.00000,0,0
S0-LV4= 0.00000,0,0
S0-LV5= 0.00000,0,0
S0-LV6= 0.00000,0,0

S0-LV7= 0.00000,0,0
S0-LV8= 0.00000,0,0
S0-LV9= 0.00000,0,0
S0-LV10= 0.00000,0,0
S0-LV11= 0.00000,0,0
S0-LV12= 0.00000,0,0
S0-LV13= 0.00000,0,0
S0-LV14= 0.00000,0,0
S0-LV15= 0.00000,0,0
S0-LV16= 0.00000,0,0
S0-LV17= 0.00000,0,0
S0-LV18= 0.00000,0,0
S0-LV19= 0.00000,0,0
S0-LV20= 0.00000,0,0
S0-PWR= 0.00, 0.00
S0-QCOMP= 0.000
S0-SCALE= 0.00
S0-SW0=0,0,0,0
S0-SW4=0,0,0,0
S0-SW8=0,0
S0-TCON= 1.00, 1.00, 1.00, 1.00, 1.00, 1.00
S0-TCON2=1.00,1.00
S0-TFLT1=0.05,0.25,42.0
S0-TFLT2=0.05,0.25,42.0
S0-TFREQ=0, 0.000,0.000000, 0.000
S0-TSIG=0, 0.000, 0.000, 0.0, 0.000
S0-TSW=0,0,0,0
S0-WASH= 1.00, 1.00
S1-62= 0m, 0m
S1-162= 0m, 0m
S1-CNTL=0
S1-ET= 1.00, 1.00
S1-H= 1.00
S1-KS= 0.00
S1-LIM= 0.00, 0.00
S1-LLG=0.020,-0.020,0.50
S1-LPF= 0.10
S1-LV1= 0.00000,0,0
S1-LV2= 0.00000,0,0
S1-LV3= 0.00000,0,0
S1-LV4= 0.00000,0,0
S1-LV5= 0.00000,0,0
S1-LV6= 0.00000,0,0
S1-LV7= 0.00000,0,0
S1-LV8= 0.00000,0,0
S1-LV9= 0.00000,0,0
S1-LV10= 0.00000,0,0
S1-LV11= 0.00000,0,0
S1-LV12= 0.00000,0,0
S1-LV13= 0.00000,0,0
S1-LV14= 0.00000,0,0
S1-LV15= 0.00000,0,0
S1-LV16= 0.00000,0,0
S1-LV17= 0.00000,0,0
S1-LV18= 0.00000,0,0
S1-LV19= 0.00000,0,0
S1-LV20= 0.00000,0,0
S1-PWR= 0.00, 0.00
S1-QCOMP= 0.000
S1-SCALE= 0.00
S1-SW0=0,0,0,0

S1-SW4=0,0,0,0
S1-SW8=0,0
S1-TCON= 1.00, 1.00, 1.00, 1.00, 1.00, 1.00
S1-TCON2=1.00,1.00
S1-TFLT1=0.05,0.25,42.0
S1-TFLT2=0.05,0.25,42.0
S1-TFREQ=0, 0.000,0.000000, 0.000
S1-TSIG=0, 0.000, 0.000, 0.0, 0.000
S1-TSW=0,0,0,0
S1-TW5=10.0,0.30
S1-WASH= 1.00, 1.00
S2-62= 0m, 0m
S2-162= 0m, 0m
S2-CNTL=0
S2-ET= 1.00, 1.00
S2-H= 1.00
S2-KS= 0.00
S2-LIM= 0.00, 0.00
S2-LLG=0.020,-0.020,0.50
S2-LPF= 0.10
S2-LV1= 0.00000,0,0
S2-LV2= 0.00000,0,0
S2-LV3= 0.00000,0,0
S2-LV4= 0.00000,0,0
S2-LV5= 0.00000,0,0
S2-LV6= 0.00000,0,0
S2-LV7= 0.00000,0,0
S2-LV8= 0.00000,0,0
S2-LV9= 0.00000,0,0
S2-LV10= 0.00000,0,0
S2-LV11= 0.00000,0,0
S2-LV12= 0.00000,0,0
S2-LV13= 0.00000,0,0
S2-LV14= 0.00000,0,0
S2-LV15= 0.00000,0,0
S2-LV16= 0.00000,0,0
S2-LV17= 0.00000,0,0
S2-LV18= 0.00000,0,0
S2-LV19= 0.00000,0,0
S2-LV20= 0.00000,0,0
S2-PWR= 0.00, 0.00
S2-QCOMP= 0.000
S2-SCALE= 0.00
S2-SW0=0,0,0,0
S2-SW4=0,0,0,0
S2-SW8=0,0
S2-TCON= 1.00, 1.00, 1.00, 1.00, 1.00, 1.00
S2-TCON2=1.00,1.00
S2-TFLT1=0.05,0.25,42.0
S2-TFLT2=0.05,0.25,42.0
S2-TFREQ=0, 0.000,0.000000, 0.000
S2-TSIG=0, 0.000, 0.000, 0.0, 0.000
S2-TSW=0,0,0,0
S2-TW5=10.0,0.30
S2-WASH= 1.00, 1.00
S3-62= 0m, 0m
S3-162= 0m, 0m
S3-CNTL=0
S3-ET= 1.00, 1.00
S3-H= 1.00
S3-KS= 0.00

S3-LIM= 0.00, 0.00
S3-LLG=0.020,-0.020,0.50
S3-LPF= 0.10
S3-LV1= 0.00000,0,0
S3-LV2= 0.00000,0,0
S3-LV3= 0.00000,0,0
S3-LV4= 0.00000,0,0
S3-LV5= 0.00000,0,0
S3-LV6= 0.00000,0,0
S3-LV7= 0.00000,0,0
S3-LV8= 0.00000,0,0
S3-LV9= 0.00000,0,0
S3-LV10= 0.00000,0,0
S3-LV11= 0.00000,0,0
S3-LV12= 0.00000,0,0
S3-LV13= 0.00000,0,0
S3-LV14= 0.00000,0,0
S3-LV15= 0.00000,0,0
S3-LV16= 0.00000,0,0
S3-LV17= 0.00000,0,0
S3-LV18= 0.00000,0,0
S3-LV19= 0.00000,0,0
S3-LV20= 0.00000,0,0
S3-PWR= 0.00, 0.00
S3-QCOMP= 0.000
S3-SCALE= 0.00
S3-SW0=0,0,0,0
S3-SW4=0,0,0,0
S3-SW8=0,0
S3-TCON= 1.00, 1.00, 1.00, 1.00, 1.00, 1.00
S3-TCON2=1.00, 1.00
S3-TFLT1=0.05,0.25,42.0
S3-TFLT2=0.05,0.25,42.0
S3-TFREQ=0, 0.000,0.000000, 0.000
S3-TSIG=0, 0.000, 0.000, 0.0, 0.000
S3-TSW=0,0,0,0
S3-TW5=10.0,0.30
S3-WASH= 1.00, 1.00
SA-LGC=0
SA-MAJ=0
SA-MIN=0
SA-RESET=0
SG-CLK=M,24,0
SG-COM0=9600,A0,P0,R1,X1
SG-COM1=9600,A0,P0,R1,X1
SG-COM2=9600,A0,P0,R1,X0
SG-CT=1,3,1
SG-FREQ=60
SG-HOLDA=0
SG-HOLD1=1
SG-HOLD2=1
SG-HOLD3=1
SG-HOLD4=1
SG-HOLD5=0
SG-HOLD6=1
SG-ID1=PSS-100
SG-ID2=SUBSTATION_1
SG-ID3=USER1_ID
SG-ID4=USER2_ID
SG-IN1= 4, 16
SG-IN2= 4, 16

```
SG-IN3= 4, 16
SG-IN4= 4, 16
SG-IN5= 4, 16
SG-IN6= 4, 16
SG-IN7= 4, 16
SG-IN8= 4, 16
SG-KV= 0.120
SG-LOG=1/2/3/4/5/6, 1,  0
SG-MVA= 0.0010
SG-SGCON= 5
SG-TRIG=0
SG-VT=1,4
SN-IN1=INPUT_1,TRUE,FALSE
SN-IN2=INPUT_2,TRUE,FALSE
SN-IN3=INPUT_3,TRUE,FALSE
SN-IN4=INPUT_4,TRUE,FALSE
SN-IN5=INPUT_5,TRUE,FALSE
SN-IN6=INPUT_6,TRUE,FALSE
SN-IN7=INPUT_7,TRUE,FALSE
SN-IN8=INPUT_8,TRUE,FALSE
SN-43=SWITCH_43,TRUE,FALSE
SN-143=SWITCH_143,TRUE,FALSE
SN-243=SWITCH_243,TRUE,FALSE
SN-343=SWITCH_343,TRUE,FALSE
SN-443=SWITCH_443,TRUE,FALSE
SN-543=SWITCH_543,TRUE,FALSE
SN-643=SWITCH_643,TRUE,FALSE
SN-743=SWITCH_743,TRUE,FALSE
SN-VOA=VOA_LABEL,TRUE,FALSE
SN-VO1=VO1_LABEL,TRUE,FALSE
SN-VO2=VO2_LABEL,TRUE,FALSE
SN-VO3=VO3_LABEL,TRUE,FALSE
SN-VO4=VO4_LABEL,TRUE,FALSE
SN-VO5=VO5_LABEL,TRUE,FALSE
SN-VO6=VO6_LABEL,TRUE,FALSE
SN-VO7=VO7_LABEL,TRUE,FALSE
SN-VO8=VO8_LABEL,TRUE,FALSE
SN-VO9=VO9_LABEL,TRUE,FALSE
SN-VO10=VO10_LABEL,TRUE,FALSE
SN-VO11=VO11_LABEL,TRUE,FALSE
SN-VO12=VO12_LABEL,TRUE,FALSE
SN-VO13=VO13_LABEL,TRUE,FALSE
SN-VO14=VO14_LABEL,TRUE,FALSE
SN-VO15=VO15_LABEL,TRUE,FALSE
```

TYPICAL SETTINGS LIST

```
//
// The Stabilizer settings and Power system interface sections of this file may be changed as required.
//
// S0-CNTL=1 or 0 can be used to turn the PSS on and off.
//
//
// Logic
//
a=
SL-N=PSSLOGIC
SL-PSS=1,IN1,IN3+43
//
// Timers
//
SL-62=0,0,0
SL-162=0,0,0
S0-62=  0m, 0m
S0-162=  0m,  0m
//
// Outputs
//
SL-VO1=PSSON
SL-VO2=TSTON
SL-VO3=ALMMAJ
SL-VO4=ALMLGC
SL-VO5=PSSON+TSTON
SL-VO6=0
SL-VO7=0
SL-VO8=0
SL-VO9=0
SL-VO10=0
SL-VO11=0
SL-VO12=0
SL-VO13=TSTON
SL-VO14=0
SL-VO15=0
//
// Alarms
//
SA-RESET=IN2
SA-MAJ=3/4
SA-MIN=21
SA-LGC=9
//
// Stabilizer Settings
//
S0-CNTL=0
S0-ET= 5.0, 1.25
S0-H= 3.0
S0-KS= 1.0
S0-LIM= 0.50, -0.25
S0-LPF= 0.10
S0-PWR= 0.2, 0.05
S0-QCOMP= 0.5
S0-SCALE= 1.00
S0-SW0=0,0,1,1
S0-SW4=1,1,1,0
S0-TCON= 1.0, 1.0, 1.0, 1.0, 1.0, 1.0
```

```
S0-TCON2= 1.0,1.0
S0-WASH= 5.0,  5.0
//
// Test signal settings
//
S0-TFREQ=0,  0.00, 0.000,  0.00
S0-TSIG=1, 1.00, 0.00, 0.5, 1.0
S0-TSW=1,0,0,0
ST-ON=0
//
// Data log trigger levels
//
S0-LV1=0.0,0,0
S0-LV2=0.0,0,0
S0-LV3=0.0,0,0
S0-LV4=0.0,0,0
S0-LV5=0.0,0,0
S0-LV6=0.0,0,0
S0-LV7=0.0,0,0
S0-LV8=0.0,0,0
S0-LV9=0.0,0,0
S0-LV10=0.0,0,0
S0-LV11=0.0,0,0
S0-LV12=0.0,0,0
S0-LV13=0.0,0,0
S0-LV14=0.0,0,0
S0-LV15=0.0,0,0
S0-LV16=0.0,0,0
S0-LV17=0.0,0,0
S0-LV18=0.0,0,0
S0-LV19=0.0,0,0
S0-LV20=0.0,0,0
//
// Data log trigger
//
SG-LOG= 1/2/4/7/14/19, 8, 0
SG-TRIG=IN4+43
//
// Power system interface
//
SG-CT=1
SG-KV=0.120
SG-MVA=0.001
SG-VT=1,3
//
// Input / Output names
//
SN-IN1=PSSCONTROL,ON,OFF
SN-IN2=RESET_ALM,ON,OFF
SN-IN3=TESTSIGNAL,ON,OFF
SN-IN4=DATA_TRIG,ON,OFF
SN-VOA=PSS_FAIL,TRUE,FALSE
SN-VO1=PSSSTATUS,ON,OFF
SN-VO2=TESTSTATUS,ON,OFF
SN-VO3=V_I_UNBAL,UNBAL,OK
SN-VO4=NEW_DATA,READY,RESET
SN-VO5=ANALOG_OUT,ON,OFF
SN-VO13=TEST_ON,ON,OFF
//
// Save settings
//
```

EXIT
YES

APPENDIX F • TERMINAL EMULATION

TERMINAL EMULATION SOFTWARE CONFIGURATION

HyperTerminal (provided with Windows® XP) can be used to communicate with the PSS-100. HyperTerminal is not provided with Windows® Vista. However, stand-alone software, available from other vendors, can be used to communicate with the PSS-100. Configuration of this software is similar to that of HyperTerminal. The following procedure is provided for configuration of HyperTerminal for use with the PSS-100.

1. Click Start: Highlight Programs, Accessories, HyperTerminal.
2. Click HyperTerminal to open the folder.
3. Select the file or icon labeled *Hypertrm* or *Hypertrm.exe*. Once the program has started, you will be presented with a series of dialog boxes.
4. Dialog Box: CONNECTION DESCRIPTION (see Figure F-1).
   a. Type the desired file name, e.g., PSS-100
   b. Click "OK"
5. Dialog Box: PHONE NUMBER
   a. Click drop-down menu: CONNECT USING

      Select *Direct To ComX,* where *X* is the port you are using on your computer.
   b. Click "OK"
6. Dialog Box: COM*X* Properties
   a. Make the following selections using Figure F-2 as a guide.

      Set the bits per second setting so that it matches the setting of the stabilizer. The default baud rate is 9600.

      Set the data bits at *8*.

      Set the stop bits at *1*.

      Set flow control to *Xon/Xoff*.
   b. Click "OK". This creates an icon with the file name entered in Step 4 and places it in the HyperTerminal folder. Future communication sessions can then be started by clicking the appropriate icon.
7. Click File/Properties on the menu bar. Click the Settings tab.
   a. Make the following selections:

      Check the *Terminal Keys* radio button.

      Select *VT-100* emulation.

      Set the Backscroll Buffer to the maximum setting of 500.

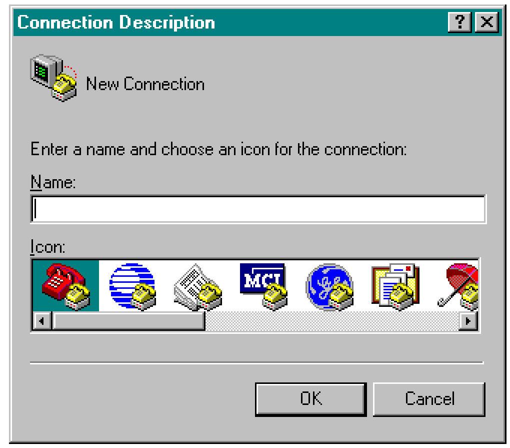

Figure F-1. Connection Description

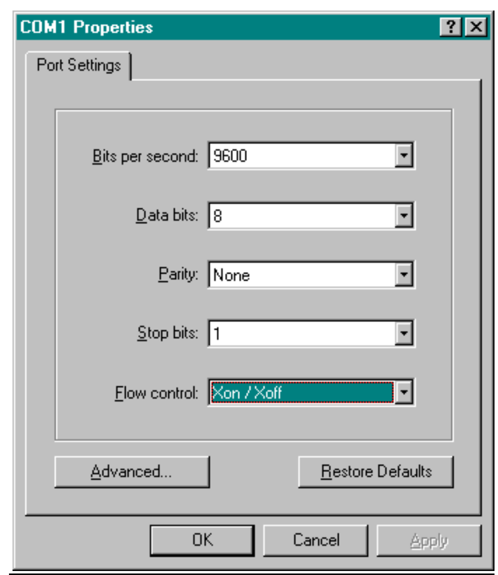

Figure F-2. COM Properties

b. Click the ASCII Setup button. Make the following selections using Figure F-3 as a guide.

ASCII Sending

Place a check at Send line ends...

Place a check at Echo typed...

Select a line delay setting of 100 to 200 milliseconds.

Select the Character delay at 0.

ASCII Receiving

Disable Append line feeds... by leaving unchecked.

Disable Force incoming... by leaving unchecked.

Place a check at Wrap lines...

c. Click “OK”.

d. Click “OK”.

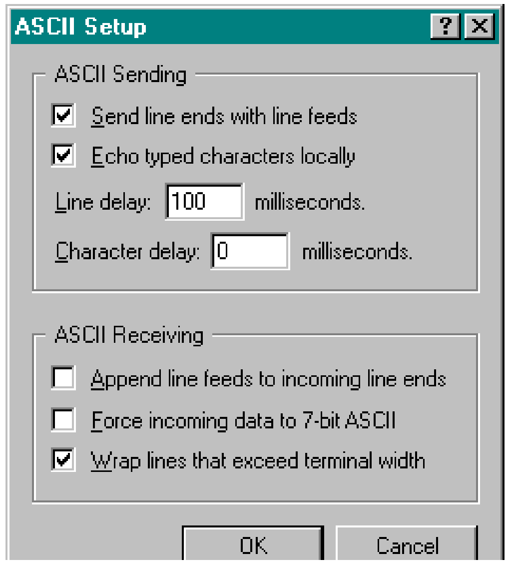

Figure F-3. ASCII Setup

8. Click File and click Save.

NOTE

Settings changes do not become active until the settings are saved.

9. HyperTerminal is now ready to communicate with the stabilizer. Table F-1 describes the required connection for each RS-232 port.

Table F-1. RS-232 Communication Ports

Connection	Type
Front Port	9 pin, female DCE
PC to Front RS232 port cable	Straight
Rear port	9 pin, female DCE
Modem to Rear RS-232 port cable	Null modem
PC to Rear RS-232 port cable	Straight

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