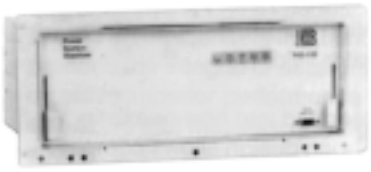

Panel Mount

Rack Mount

PSS-100 Power System Stabilizer

The Power System Stabilizer Model PSS-100 is a two-input, microprocessor-based stabilizer that measures change of speed and change of power to produce the integral of accelerating power. The PSS-100 provides supplementary damping for low frequency power system oscillations ranging from 0.1 to 5.0Hz, which covers local mode, inter-area mode and inter-unit mode power system oscillations. The isolated ±10Vdc analog output of the PSS-100 is applied into the excitation system summing point to dampen the oscillations.

FEATURES

- Microprocessor and Digital Signal Processor based design
- Calculates Integral of accelerating power (Dual Input)
- Optional frequency sensing with two-stage torsional filter
- Non-volatile flash memory
- Password protection
- Isolated output signal with gain adjustments
- Metering capabilities
- Internal diagnostics
- Event Recording
- Data Capturing
- IRIG-B provisions
- Up to four setting groups for optimizing system tuning
- Testing and commissioning features
- 50Hz or 60Hz operation
- 1 Amp or 5 Amp models
- Programmable logic timers for sequencing
- Accepts 3 phase 4 wire (Wye) or 3 phase 3 wire (Delta) sensing voltages
- UL recognized, CSA certified, and CE compliant

WINDOWS® SOFTWARE

Interface for setting and communicating with the PSS-100

Request BESTCOMS-PSS100-32
(Windows® NT 3.5 or later, 95, 98, or Me)

ADDITIONAL INFORMATION

INSTRUCTION MANUAL

Request Publication 9318600990

Basler Electric

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APPLICATION

Power system stability has become an increasingly important subject as demands for reliable power to meet system requirements continue to be of concern. The transmission of power from sources to the load can be limited due to various factors in the power system. A sudden fault in the system can cause power oscillations that may continue to grow and lead to loss of machine synchronism. In other cases, a turbine generator such as a hydro may be power-limited due to turbine rough loading or resonance in the penstock. Attempts to increase power output could result in power oscillations, potentially tripping the machine off-line. At times, severe power oscillations may occur with as little as 25% of the machine's capacity, curtailing any further increase of power.

Numerous factors affect power system stability. These include the excitation system, relay coordination, generator characteristics, system impedance, and dynamics of the turbine. Unless power oscillations can be stabilized, power flow will be limited. Power oscillations generally fall into one of three commonly observed classifications.

1) **Inter-Area Mode** – Commonly occur between one set of machines swinging against another set of machines in a different area of the transmission system. Inter-Area Mode oscillations typically occur in the frequency range of 0.2 to 0.5 Hertz.

2) **Local Mode** – Involves one or more machines at a power plant swinging against a large power source or network. Local Mode oscillations typically occur in the frequency range of 0.7 to 2.0 Hertz.

3) **Inter-Unit Mode** – Usually occur when one machine swings against another machine in the same power plant. Inter-Unit Mode oscillations typically occur in the frequency range of 1.5 to 3 Hertz.

With increasing demands on transmission systems, there is a greater emphasis on the installation and operation of equipment to respond to power system oscillations that will provide immediate correction for stabilization. Power system stabilizers are designed to provide the type of correction needed to stabilize power swings for any of the cases described above. The PSS-100 works through the excitation system by sensing the change in frequency and power to cause a modulation of the excitation output, dampening the oscillation via the generator field.

The PSS-100 can be integrated into new or existing excitation systems. The open design allows compatibility with any size synchronous machine's analog or digital excitation system that can accept a bipolar dc input adjustable to ±10Vdc.

The PSS-100 can be used in applications where the excitation system works directly into either the brush or brushless rotating exciter, as well as static excitation systems working into the main field of the generator. Digital design techniques used in the PSS-100 allow for precise control and improved performance when replacing older analog-type power system stabilizers.

The PSS-100 requires current inputs from two or three CTs and three phase voltage sensing from the generator output. The power system stabilizer can be enabled by external contacts or software switches programmed through the serial communication ports and can be programmed to turn on above a specific power level. The PSS-100 can also be programmed for up to four different sets of time constants and gain configurations to accomodate changing system conditions such as loss of a transmission line or other network configuration changes.

PSS Settings Analysis – In order for the power system stabilizer to be properly applied, information regarding the excitation system, the generator, and the system are needed. The information includes the excitation system transfer function, generator reactances, and system impedances which are utilized in a mathematical model to determine the time constants and gain settings required for the power system stabilizer. The system-tuned settings ensure proper compensation via the excitation system to respond to power modulations when they occur.

PSS Commissioning – Commissioning of the PSS with the excitation system verifies the value settings of the PSS with the excitation equipment intended. Both *Settings Analysis* and *commissioning time* need to be considered when purchasing a power system stabilizer for proper application of the device.

FUNCTIONS

Two Input Stabilizer
The PSS-100 monitors 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.

Single Input Stabilizer
The PSS-100 can also be configured to monitor frequency only. Two second order filters are available for attenuating the stabilizer signal at machine torsional frequencies to minimize potential resonance problems.

Non-Volatile Flash Memory
Allows embedded software to be upgraded with a computer without changing chips.

Communications Ports
Three communication ports are provided that allow the user to interface with the PSS-100 via a computer. The front RS-232 port provides a temporary local connection for all communication functions. The two rear ports provide a permanent interface for the same communications functions. One of these is an RS-232 connection and the other is an RS-485 connection. The PSS-100 communication protocol supports ASCII, which is compatible with readily available modem/ terminal software. The PSS-100 BESTCOMS Windows®–based PC software allows fast and easy programming and customization of settings.

Password Protection
Four password levels are provided that will allow access privileges to specific programmable parameters and settings within the PSS-100.

Metering
The PSS-100 provides metered values (via communication ports) for system voltage, current, frequency, positive and negative sequence voltages, positive and negative sequence currents (if installed using three CT inputs), watts, vars, power factor, and compensated frequency deviation for diagnosis and test evaluations.

Data Recording and Capture
Up to six PSS-100 monitored variables can be logged in a record. This feature is typically used to record the behavior of the stabilizer during commissioning tests or system disturbances. These records may then be downloaded from the PSS-100 for analysis. The record can be saved in ASCII text string format, in the COMTRADE (IEEE Standard Common Format for Transient Data Exchange) format, or Log file format.

Capable of Automatic or External Triggering of Data Recorder
Automatic Data Recording may be activated when a PSS-100 monitored variable exceeds a user specified level. Utilizing the contact sensing inputs can also control when to trigger the Data Recorder.

Sequence of Events Recording (SER)
A sequence of events report is a very useful tool in reconstructing the exact sequence and timing of events during a power disturbance or even normal system operations. The PSS-100 will store the last 127 Sequence of Events Reports in volatile memory.

Automatic System Supervisory Functions
The Automatic System Supervisory feature disables the PSS-100's output automatically when it detects the power below a fixed threshold, a speed error calculation, along with voltage and current unbalance conditions.

User Programmable Supervisory Functions
The User Programmable Supervisory feature enables the PSS-100 output when the sensed power is above the user selectable threshold. The PSS-100 will also disable its output when the sensed power is below the user selectable threshold level. Hysteresis is provided to prevent quick changes near the threshold level.

IRIG-B Time Synchronization
An IRIG-B port is available to add time synchronization capabilities to the PSS-100’s internal clock.

Programmable Major, Minor, and Logic Alarms
Programmable alarms can be prioritized into Major, Minor, and Logic alarm groups used to monitor the power system. Alarms detected that are assigned to the Major or Minor Alarm group will cause the appropriate front panel LED to illuminate and assert the applicable logic variable. Logic Alarms will cause the logic variable to be asserted. Any of these alarm logic variables may be used to drive an output contact for external indication.

Built-in Test and Commissioning Features
Several features are provided in the PSS-100 to simplify testing and commissioning.

- Various self-generated test signals are available to inject internally to the PSS-100 or externally into the excitation system. Test signals include Sine, Step, Sine Sweep, and Square Wave modes.
- Dedicated input for external test signal generators.
- Software controlled switches allow test signal insertion at different points in stabilizer algorithm.
- Data logging of PSS-100 internal variables for test results review.
- Programmable logic and serial commands to control tests and data logs.

FUNCTIONS, continued

Programmable Logic Timers
Two programmable logic timers (62 and 162) with five modes of operation to accommodate a variety of applications.

Isolated dc Output with Gain and Scaling Adjustments
This is the ±10Vdc analog output of the PSS-100 that is intended to modulate the excitation system to dampen low frequency power oscillations. Isolation is provided to prevent undesirable current loops that may cause damage. Gain and Scaling adjustments are incorporated into the PSS-100 to match the input requirements of any digital or analog excitation system that can accept a bipolar dc input.

Up to Four Setting Groups
This provision allows the user to preselect up to 4 different setting groups that can pertain to a variety of system conditions affecting system stability, such as large load changes, unavailable transmission lines, or different power system configurations. Each may require a different set of stabilizer parameters. Individual setting groups allow the user to configure the PSS-100's time constants and gains to adapt to the appropriate situation. The PSS-100 can initiate a change from one settings group to another dynamically based on the power level being monitored, by control override via serial port, or by utilizing the contact sensing inputs.

Diagnostics
The PSS-100 has continuous self-monitoring of core functions. Depending on the type of discrepancy detected, the PSS-100 will either attempt to correct the problem by resetting the microprocessor or disable itself, illuminate the Failure LED on the front of the unit, and de-energize the PSS Failure Output (OUTA). When disabled, the analog output is shorted by a contact to allow the regulation system to function normally.

Torsional Filter
Torsional filters provide the desired gain reduction at a specified frequency. The filters compensate the tortional frequency components present in the input signal. In the PSS-100, two torsional filters are available after the stabilizing signal and before the lead-lag blocks.

Adjustment Settings
- Up to four lead / lag stages
- Terminal voltage limiter
- Adjustable washout time constant
- Low power threshold
- Stabilizer gain setting
- Upper and lower output limits
- Output scale adjustment
- Ramp-tracking filter time constant
- Machine Inertia Constant
- Machine reactance

SPECIFICATIONS

Power Supply
PSS-100-Y1 and -Y5:
48, 110 and 125Vdc - 35 to 150Vdc
67, 110 and 120Vac - 55 to 135Vac

PSS-100-Z1 and -Z5:
110, 125 and 250Vdc - 90 to 300Vdc
110, 120 and 240Vac - 90 to 270Vac

AC Voltage Sensing

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

AC Current Sensing
PSS-100-Y1 and -Z1:
Range: 0.5 to 1.0A nominal @ rated power factor
Continuous: 1.0A

PSS-100-Y5 and -Z5:
Range: 2.5 to 5.0A nominal @ rated power factor
Continuous: 5.0A
30 seconds: 15A
1 second: 50A
Burden: Less than 0.2VA

Voltage Metering Accuracy
±2% or ±1.2Vac, whichever is greater

Current Metering Accuracy

1 amp unit:	±2% or ±10mA, whichever is greater
5 amp unit:	±2% or ±50mA, whichever is greater

Frequency	50Hz ±5Hz 60Hz ±6Hz

Analog to Digital Converter
Sampling Rate: 24 samples per cycle

Contact Sensing Inputs
Number of inputs: 8
Recognition time: 4 to 250ms (programmable)
Wetting voltage range: Same as power supply selected

SPECIFICATIONS, continued

Y Power Supply
36 kOhm / 93.4 kOhm

Z Power Supply
94 kOhm / 189 kOhm

Programmable Output Contacts

Type of contact:	N.O., SPST (OUT1 – OUT4) Form C, SPDT (OUT6)
Alarm Contact:	N.O., SPST (OUTA)

Contact Ratings

Make and carry:	30A for 0.2 seconds, 7A continuous
Break:	0.3A at 125 or 250Vdc (L/R = 0.04 maximum)

Analog Output

Range:	±9Vdc ±10%, isolated (OUT5)
D/A Resolution:	12 bits
Burden:	1kohm minimum

Communication Ports, 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

Automatic Setting Group Characteristics

Number of Settings groups:	Four

Switch Level Range: 0 to 150% of setting

Switch Level Accuracy: ±2%

Switch Timer Range: 0 to 60 minutes

Switch Timer Accuracy:	±5% or ±2 seconds, whichever is greater

General Purpose Timers (62, 162)

Level Triggered, Edge Triggered, Retriggerable, Integrating and Oscillator

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

Real Time Clock

Accuracy:	1sec per day at 25°C (free running) ±2ms (with IRIG-B synchronization)
Resolution:	1ms
Date and time setting provisions:	Communications ports and IRIG interface Leap year correction provided
Power supply holdup:	8-24 hours

ENVIRONMENTAL

Isolation

2,000Vac applied between isolated groups of terminals in accordance with IEEE C37.90 and IEC 255.5

Surge Withstand Capability

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

Radio Frequency Interference (RFI)

Tested using a five watt, hand-held 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

Operating Temperature:	-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, First 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

PHYSICAL

Case Size (Panel mount unit):
16.2"W x 6.61"H x 8.625" deep
16.2"W x 6.61"H x 7.625" deep (alternate mounting)

Case Size (Rack mount unit):
14.32"W x 5.22"H x 8.95" deep without flanges
14.32"W x 5.22"H x 7.95" deep (alternate mounting)

Weight:	11 pounds (5 kilograms)

CONNECTIONS

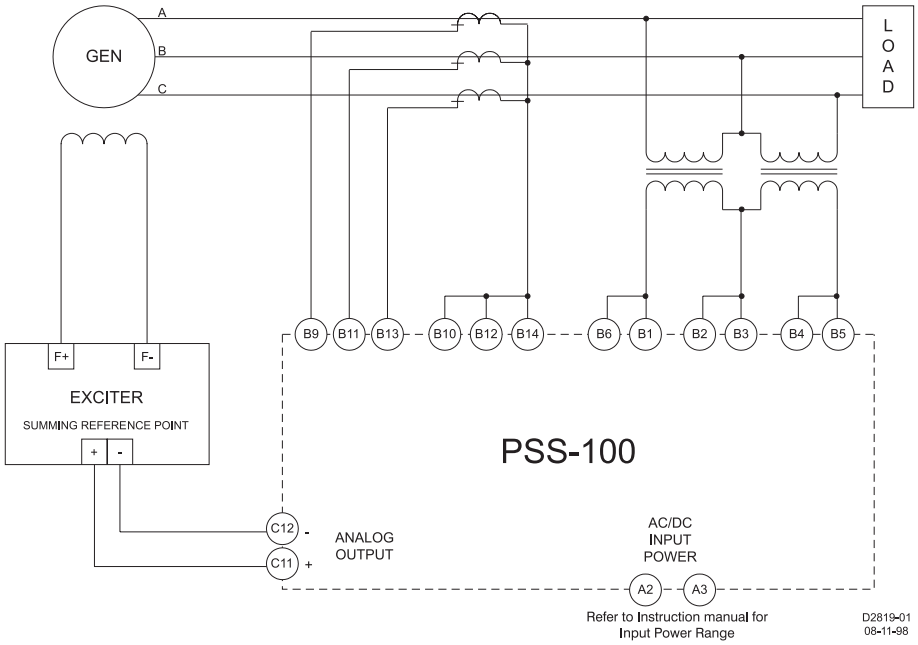


Figure 1 - Typical Three Wire (Delta) Connections Diagram

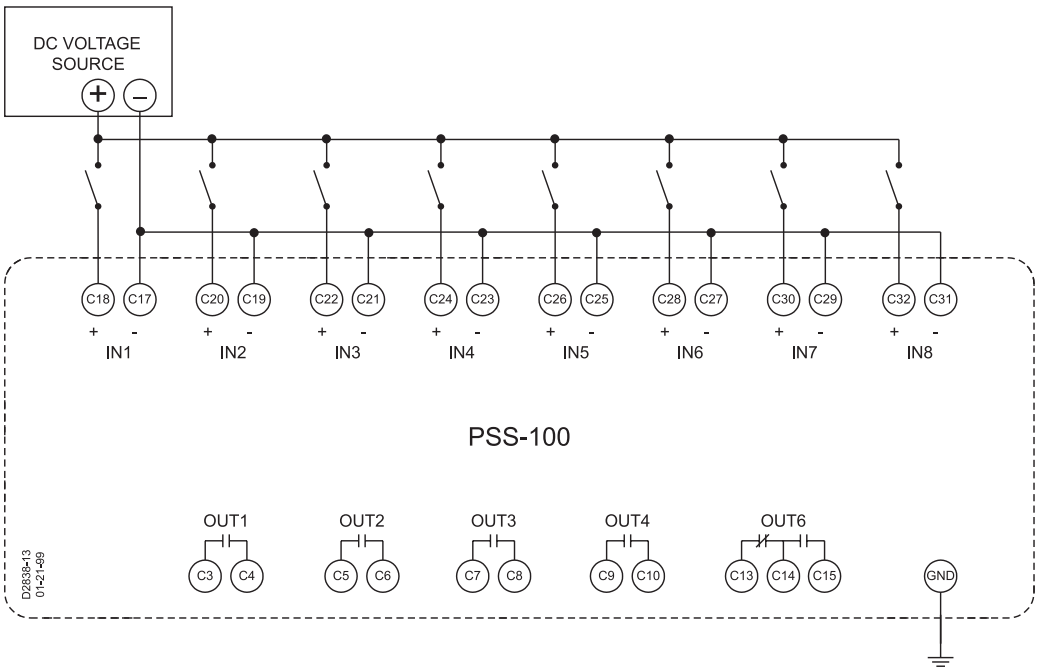


Figure 2 - Control Input Connections and Output Contact Configurations

MOUNTING

Each PSS-100 is supplied with hardware that allows for panel or rack mounting installations. An escutcheon plate is provided for panel mounting; brackets are supplied for rack mounting. Two mounting depths are possible by alternate escutcheon plate and mounting bracket screw holes.

DIMENSIONS

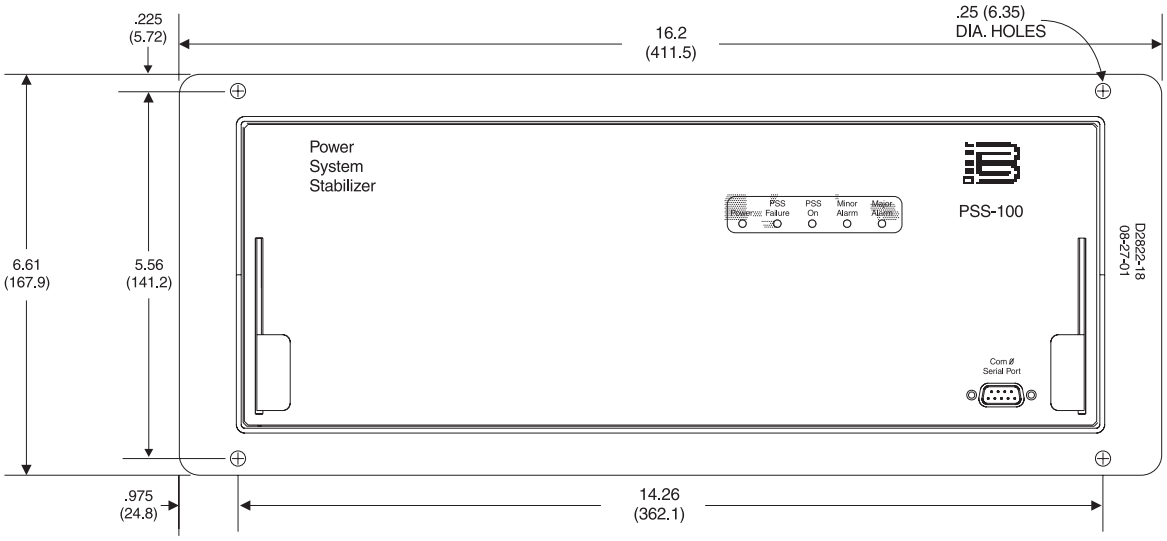


Figure 3 - Panel Mount Outline Dimensions, Front View

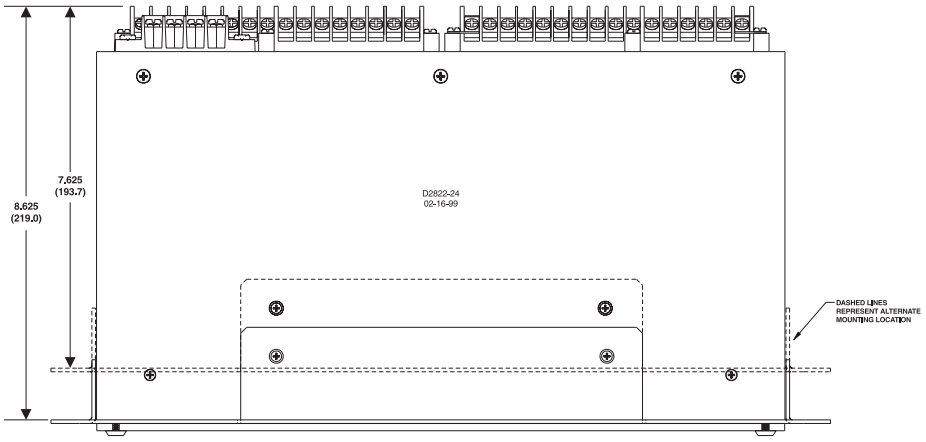


Figure 4 - Panel Mount Outline Dimensions, Top View

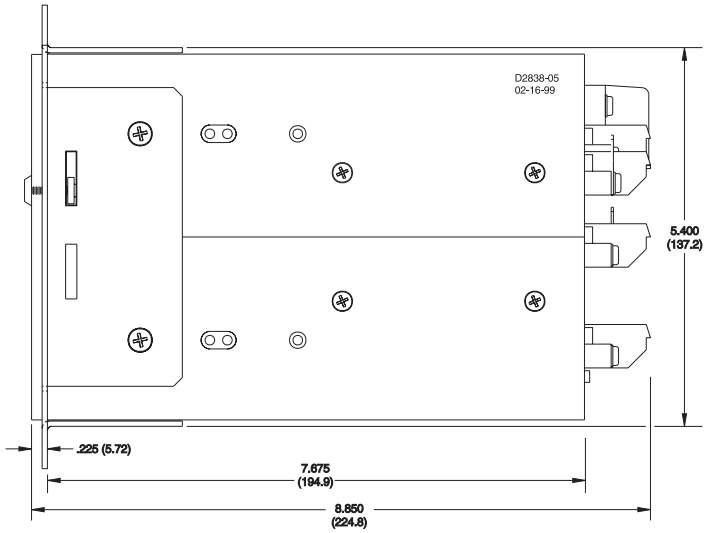


Figure 5 - Panel Mount Outline Dimensions, Side View

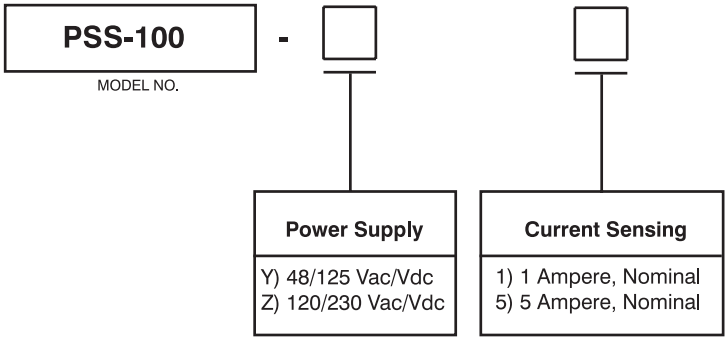
SAMPLE SPECIFICATION

The power system stabilizer shall be a 100% solid state, microprocessor-controlled device capable of providing positive damping of power system oscillations within the range of 0.1 and 5.0 Hertz. It shall use ASCII communication protocol via RS-232 or RS-485 ports for setting and calibration and shall include built-in testing software. It shall have three phase voltage and current input signals that utilize accelerating power to calculate speed deviation. Devices that are strictly speed-based or power-based will not be accepted. It shall have an adjustable gain, isolated bipolar ±10Vdc output. The device shall be the Basler Electric model PSS-100 Power System Stabilizer.

ORDERING

Sample Style Number: PSS-100-Y5. This style number describes a PSS-100 Power System Stabilizer with the following features:

Power Supply	Y	48/125 Vac/Vdc
Current Sensing	5	5 Ampere nominal



NOTE: A Power Systems Settings Analysis is strongly recommended when purchasing a power system stabilizer. Please see page 2 and contact Basler Electric for more details.

Basler Electric

Visit our web site http://www.basler.com

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