INSTRUCTION MANUAL

FOR

DIGITAL EXCITATION CONTROL SYSTEM

Models: DECS 32-15, 63-15 & 125-15

Part Numbers: 9 2653 00 134 through 139

For DECS Software Version 2.0.9 and Subsequent

Basler Electric

Publication Number: 9 2653 00 996
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INTRODUCTION

This manual provides information concerning the operation and installation of a DECS 32-15, 63-15, and 125-15 Digital Excitation Control System. To accomplish this, the following is provided.

- Specifications
- Functional Description
- Installation Information
- Operation
- Communications
- Maintenance

WARNING!

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

CAUTION

The case of the DECS must be properly connected to a suitable power system ground to ensure proper operation and to prevent the possibility of electrical shock.

CAUTION

Do not megger or hipot the generator with the DECS connected. Do not megger or hipot the DECS. To do so will damage the internal electronics of the DECS.

CAUTION

The DECS field output terminals (F+ and F-) should NEVER be disconnected or shorted during operation. Disconnecting or shorting the field terminals can result in permanent damage to the DECS unit.

Large capacitors in the Power Module must be allowed to discharge before shorting the field terminals. Excessive current drawn through a short across the field terminals will cause permanent damage to the DECS unit.

If a power switch is desired to disconnect the power, it should be connected to the DECS power input terminals (3 and 4).

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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 Company, Highland, Illinois.

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CONTENTS

CONTENTS – Continued

CONTENTS - Continued

SECTION 1 • GENERAL INFORMATION

GENERAL

The Basler Digital Excitation Control System (DECS) is an electronic, solid-state, micro-processor based control device. DECS regulates the voltage output of a brush-type or brushless, ac generator by controlling the current into the generator exciter field. Input power to the DECS can be from a multi-pole, high-frequency, permanent magnet generator (PMG), or from the generator output when used as a conventional shunt-excited excitation system through the DECS Power Module. This module is included with every DECS.

Refer to Figure 1-1 for the DECS style chart. In the example shown in the chart, a DECS 32-15 B2C5 is has the following features.

DECS 32-15 - Digital Excitation Control System with continuous field voltage of 32Vdc

(B) - var/PF Control

(2) - UEL/OEL (Under and overexcitation limiting)

(C) - Voltage Matching

(5) - Five amp CT secondary

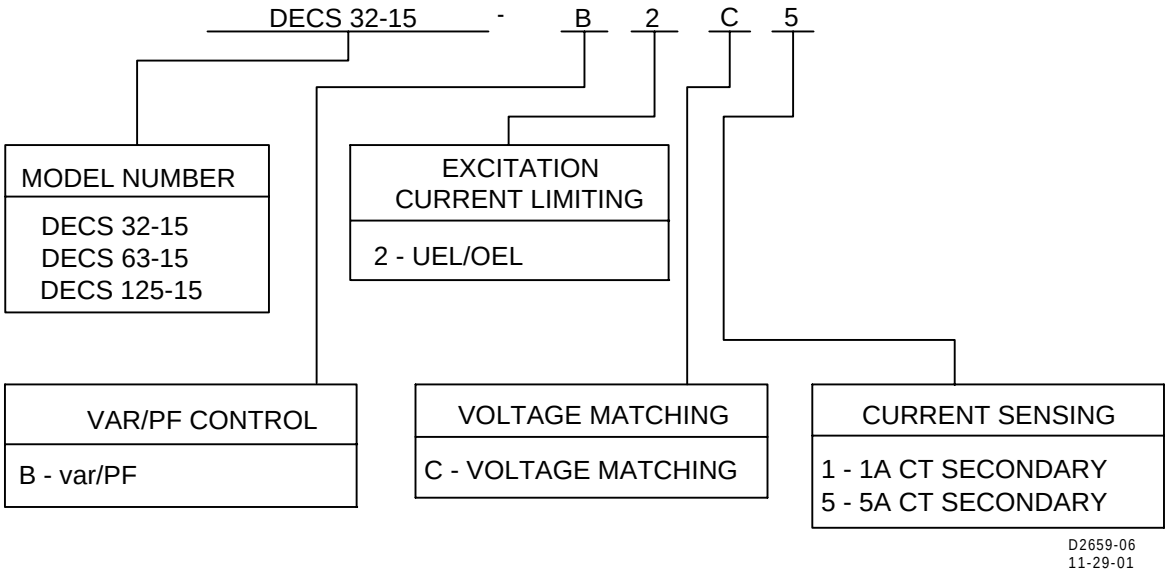


Figure 1-1. DECS Style Chart

SPECIFICATIONS

Refer to Tables 1-1 and 1-2 for the DECS electrical specifications, Table 1-3 for generator field requirements, and to Table 1-4 for the DECS physical specifications.

Table 1-1. DECS Electrical Specifications

Regulation Accuracy:	Regulates within ±0.25% of nominal, no-load to full-load.
Power Input:	See Table 1-2.
Solid State (Internal) Build-up:	Minimum of 8 Vac power input required.
Input Sensing:	120, 208, 240, 416, 480, or 600 Vac ±10%, 60 Hz nominal, 100, 220, or 400 Vac ±10%, 50 nominal, Selectable single-phase or three-phase RMS.
Sensing Burden:	<1 VA per phase.
External Voltage Adjust Range:	Customer-adjustable from ±6V to ±60V in 0.5V steps.
Underfrequency (V/Hz) Limiting:	Customer adjustable from continuous to 3 times V/Hz. Transition frequency ("corner" frequency) is adjustable from 40 Hz to 65 Hz. (Refer to Figure 1-2 for V/Hz curves.)
Parallel Compensation:	Can use either reactive droop or reactive differential (cross-current) compensation. Adjustable 20% voltage droop with optional 1 A or less or 5 A or less input. For parallel compensation, burden <1VA.
Accessory Input:	A ±3 Vdc input results a ±30% change in regulated voltage. Input impedance is 1k ohms.
Alarm Indication:	When an alarm condition exists the normally open contacts of the relay will be closed. Contacts are rated 30 A for .2 seconds, 7A continuous, or .3 A at 125 and 250 Vdc (L/R ≤ .04).
Overvoltage Protection:	Factory preset at 35% above nominal with a 0.75 sec. time delay.
Soft Start Ability:	Included with customer adjustable rate of build-up.
Overexcitation Limiting:	See Figure 1-3.
Underexcitation Limiting:	Adjustable from 0-100% maximum reactive current.
Manual Excitation Control:	Regulates field current from 0.0 Amps to 25.0 Amps.
Voltage Matching:	Matches utility bus RMS voltage with generator output RMS voltage to within 1%.

Table 1-2. DECS Electrical Specifications - Power Input Requirements (50-400 Hz)

DECS Model No.	Nominal Input	Power Input Into Power Module (50 - 400 Hz)	Burden
DECS 32-15-XXXX	60 V_{RMS}	56 - 70 V_{RMS} ±10%, 1 or 3 Phase	780 VA
DECS 63-15-XXXX	120 V_{RMS}	100 - 139 V_{RMS} ±10%, 1 or 3 Phase	1570 VA
DECS 125-15-XXXX	240 V_{RMS}	190 - 277 V_{RMS} ±10%, 1 or 3 Phase	3070 VA

Table 1-3. Generator Field Requirements

	DECS 32-15	DECS 63-15	DECS 125-15
Minimum Field Resistance at 25°C	2.13 ohms	4.2 ohms	8.3 ohms
Rated Continuous Field Voltage	32 Vdc	63 Vdc	125 Vdc
Rated 10-Second Forcing Voltage For Rated Power Input Voltage*	50 Vdc	100 Vdc	200 Vdc
Rated Maximum Field Current	15 Adc	15 Adc	15 Adc
Rated 10-Second Forcing Current	30 Adc	30 Adc	30 Adc
Rated 120 Second Forcing Current	20 Adc	20 Adc	20 Adc

The above parameters are with nominal RMS voltage levels listed in Table 1-2 above.

* Forcing voltages may be up to 50% greater than listed if:

1) 3 Phase input power is used, OR
2) Field current is significantly lower than that listed. Please consult factory for further details.

Table 1-4. DECS Physical Specifications

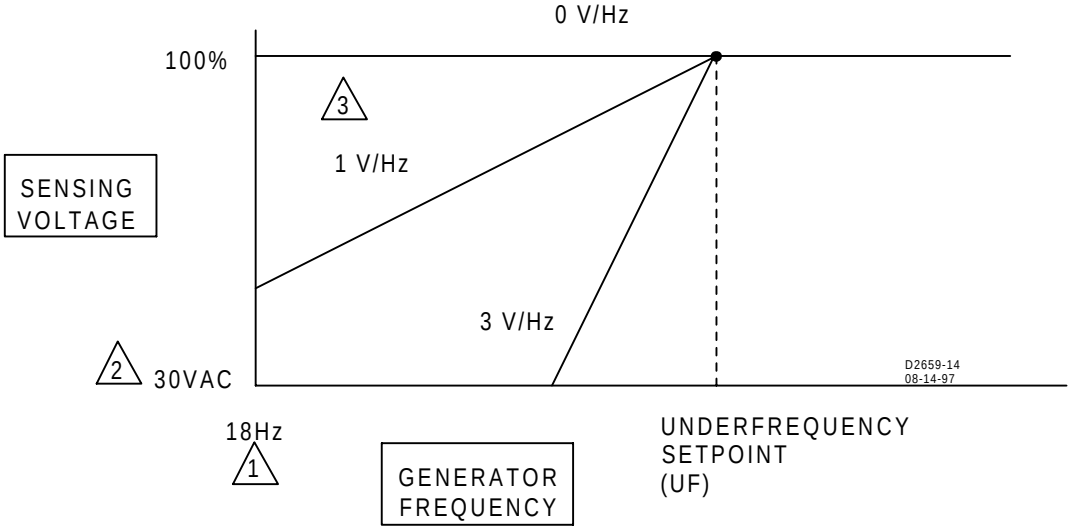
UL Recognized/ CSA Certified	UL Recognized per Standard 508, UL File No. E 97035. CSA Certified per Standard CAN/CSA-C22.2 No. 14-M91, CSA File No. LR 23131-139. Note: Output contacts are not UL recognized/CSA Certified for voltages greater than 250 volts.
CE Qualified	The DECS meets the criteria set forth by the following standards: EN 50081-2:1994, Electromagnetic Compatibility-Generic Emissions Standard, Part 2. Industrial Environment, Class A. EN50082-2: 1995, Electromagnetic Compatibility-Generic Immunity Standard, Part 2. Industrial Environment. EN61000-4-3: Radiated Electric Field Immunity. (10 V/m, 26 MHz – 1000MHz) EN61000-4-6: Radiated Conducted Immunity. (10 VRMS, 150 KHz – 80 MHz) The DECS is considered to be in installation Category III (Overvoltage Category). Per IEC 664, Insulation Coordination Within Low Voltage Systems Including Clearances and Creepage Distances for Equipment, Installation Category III

	(Overvoltage Category) is defined as: Distribution level, fixed installation, and following Installation Category IV (Overvoltage Category). The DECS falls under Pollution Degree 1. Per IEC 664, Insulation Coordination Within Low Voltage Systems Including Clearances and Creepage Distances for Equipment. Pollution Degree 1 is defined as: Non-conductive pollution. However, occasionally, a temporary conductivity caused by condensation must be expected.
Operating Temperature:	-40°C to +60°C.
Storage Temperature:	-40°C to +85°C.
Shock:	15 G's in each of three mutually perpendicular planes.
Vibration:	1 G at 5 to 26 Hz. 0.036" double amplitude at 27 to 52 Hz. 5 G's at 53 to 500 Hz.
Weight:	9 lbs. (4.05 kg) net, 12 lbs. (5.40 kg) shipping.

Table 1-5. DECS Power Transformer Selection Chart

Primary Voltage	**DECS 32-15-XXX**	**DECS 63-15-XXX**		**DECS 125-15-XXX**	
	3 Phase	**3 Phase**	**1 Phase**	**3 Phase**	**1 Phase**
240			BE 22209-001		BE 12819-001
480	BE 24588-001	BE 26103-001	BE 22209-001	BE 26660-001	BE 12819-001
600			BE 11050-001	BE 26819-001	BE 22209-001
2400		BE 20221-001	BE 13487-001	BE 21027-001	BE 12818-001
4160		BE 21027-001	BE 13487-001	BE 21027-001	BE 12818-001
7200			BE 22136-001	BE 25921-001	BE 22136-001
13800			BE 21327-001	BE 26728-001	BE 21327-001

Note to the customer: If your transformer needs cannot be satisfied from this chart, please consult the factory.



1. DECS operation is not specified for generator voltages below 18Hz. Power must be removed from DECS below this frequency.

2. DECS operation is not specified for sensing voltages below 30VAC.

3. Operation above the 1V/Hz curve for extended periods may overheat the generator.

Figure 1-2. Typical Volts per Hertz Curves

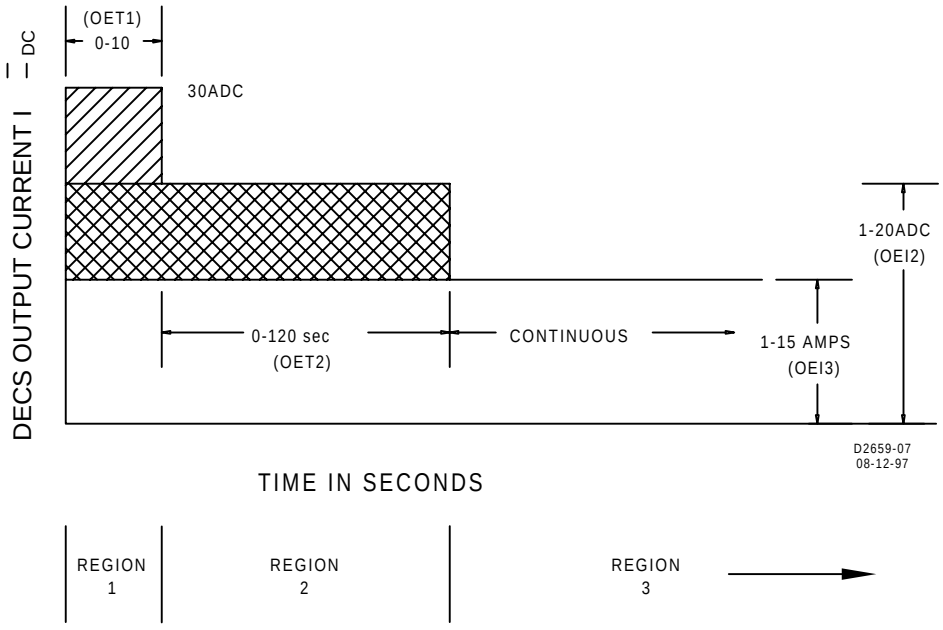


Figure 1-3. Overexcitation Limiter

SECTION 2 • FUNCTIONAL DESCRIPTION (Refer to Figure 2-1)

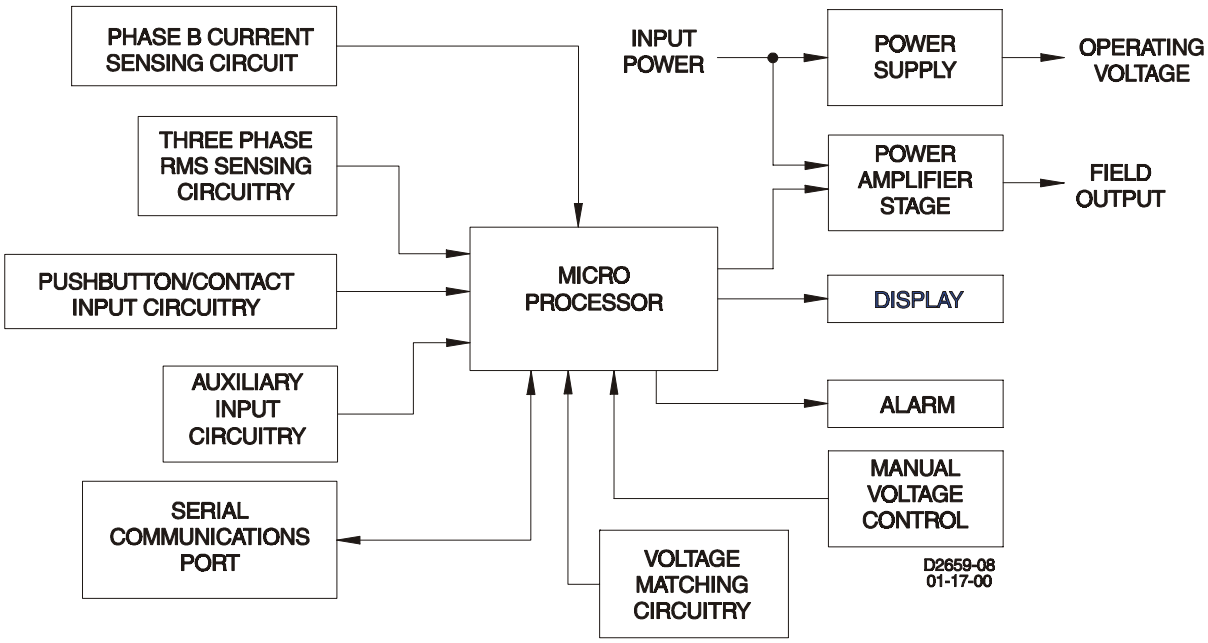


Figure 2-1. DECS-15 Functional Block Diagram

POWER SUPPLY

The Power Supply converts the input voltage, rectifies and filters it, and supplies all the operating voltages required by the internal circuitry of the DECS. A minimum of 8 Vac into the DECS Power Module is required to allow automatic generator line voltage buildup when using DECS.

POWER AMPLIFIER STAGE

The Power Amplifier receives input power and will output the field voltage and current depending upon the timing of the firing pulses from the microprocessor. The Power Amplifier uses a single IGBT for supplying the field voltage and current required by the exciter.

DISPLAY

The front panel Display consists of nine LEDs and an alphanumeric display. The LEDs continually monitor the unit's condition. The four-character alphanumeric display is for system set-up/adjustment and the monitoring of select conditions. The LED and the alphanumeric display are controlled by the microprocessor.

VOLTAGE MATCHING CIRCUITRY

This circuit will control the generator output and match it to the bus prior to synchronizing. This circuit is enabled via the front panel of DECS or the optional DECS Communication Interface Module (DCIM).

PHASE B CURRENT SENSING CIRCUIT

This circuit monitors the generator current output on phase B. This signal is rectified and converted within the DECS to a digital signal for use by the microprocessor. It is used for measuring Power Factor (PF) and vars. It is also used when paralleling the generators.

RMS SENSING CIRCUITRY

This circuit monitors the generator voltage output on any or all three phases. This signal is rectified and converted within the DECS to a digital signal for use by the microprocessor. It is selectable through the adjustment menu on the front panel of the DECS.

PUSHBUTTON/CONTACT INPUT CIRCUITRY

This circuit provides a means for the front panel pushbuttons and the external switch contacts to interact with the microprocessor and control the DECS operation.

AUXILIARY INPUT CIRCUITRY

This circuit allows an external device to control the DECS output and, thus the generator output voltage. This is accomplished by receiving a ±3 Vdc voltage. The circuit induces a 1K ohm burden on the ±3 Vdc customer supplied source. A ±30% change in generator output voltage is associated with a ±3 Vdc signal received into terminals A and B.

Table 2-1. Auxiliary Input Circuit Requirements.

DECS Style	Vdc Applied At DECS Terminals		Change In Gen. Output Voltage	DECS Display "ACC" Polarity
DECS XXX-15-XXC	+ @ A	- @ B	Increase	+

RS-232 PORT

The DECS can be connected to a PC, running Basler Communication Software, though the PCs RS-232 port. This optically isolated port is used for troubleshooting and re-programming of the DECS. The DCIM (DECS Communication Interface Module) is no longer required. A more detailed description is provided later in this manual.

MICROPROCESSOR

The microprocessor controls all functions of the DECS by the use of its built-in programming. It has an EEPROM which provides a non-volatile memory for storing settings after power is removed from the unit. This enables customer programming of the setpoints before and after unit installation.

ALARM

This circuit is a normally open, form A, output which is controlled by the microprocessor and the internal overexcitation hardware. This circuit is a protective feature which is rated at 125 Vdc at 300 mA. The relay, if enabled, will close if monitored trouble conditions occur, and open when alarm conditions cease.

MANUAL EXCITATION CONTROL CIRCUITRY

The manual excitation control allows an operator to manually set the amount of the dc excitation current output of DECS. Once set, DECS will regulate that current. This circuit is also used for the case of the loss of sensing voltage. DECS will regulate the dc excitation current setpoint if the sensing voltage is lower than 25% of the generator terminal voltage for more than a customer adjustable activation delay time. This circuit is not intended as a back-up system to the Automatic mode of operation. It will be useful in the commissioning of the generator system.

SECTION 3 • INSTALLATION

MOUNTING

The DECS is normally located in the generator conduit box, but is also designed to operate in remote switchgear cubicles with convection cooling. When remotely mounted, the DECS may either be mounted through the panel or behind the panel with the optional behind the panel mounting kit. Figures 3-1 through 3-3 provide the DECS outline dimensions and Figures 3-4 and 3-5 provide the DECS Behind the Panel Mounting Kit dimensions. Figure 3-6 is the DECS Power Module dimensions. Figure 3-7 shows the terminals, terminal numbers, and their functions.

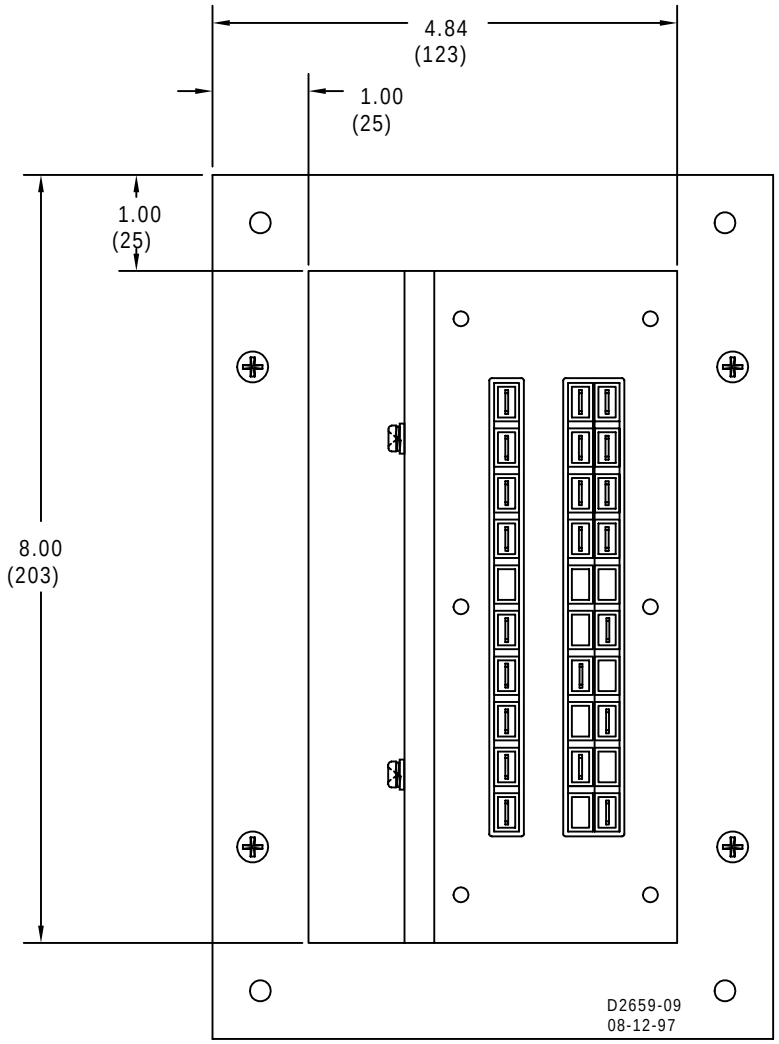


Figure 3-1. DECS Outline Drawing, Front View

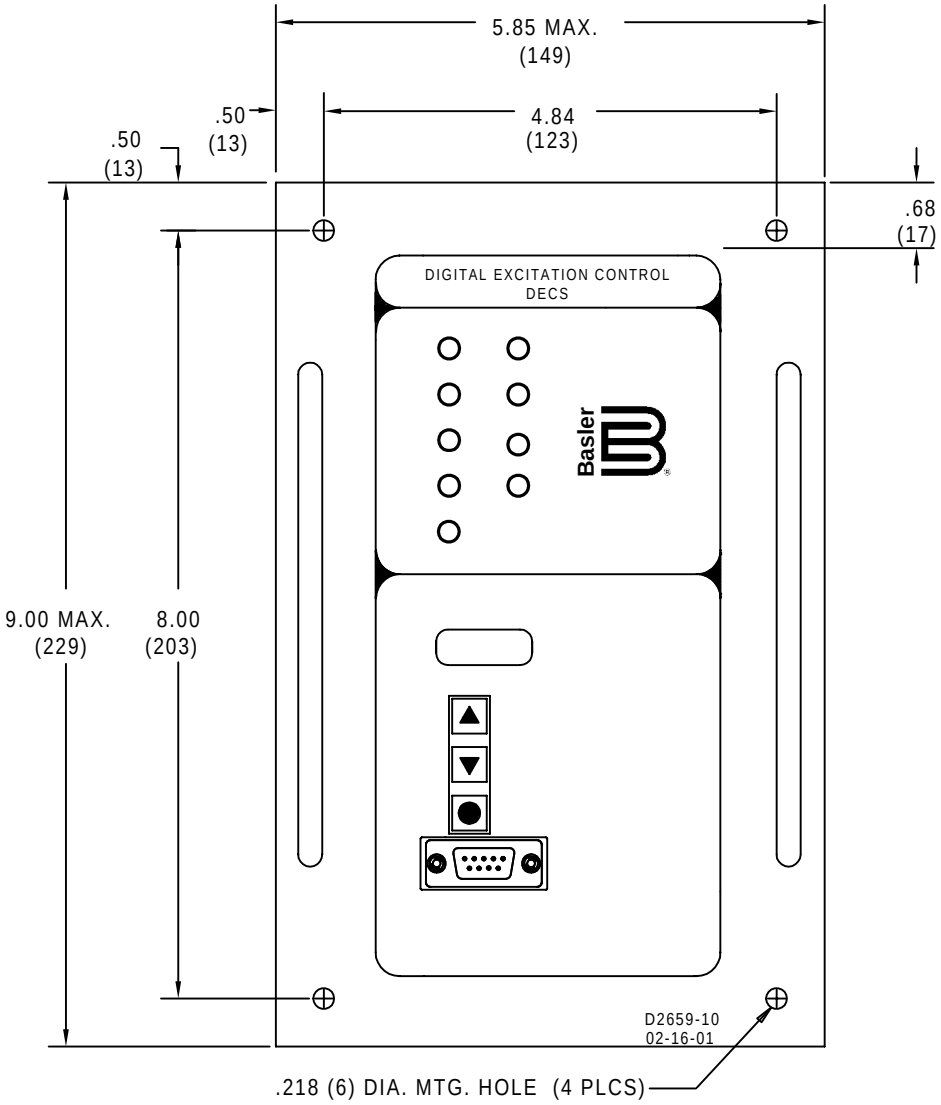


Figure 3-2. DECS Outline Drawing, Rear View

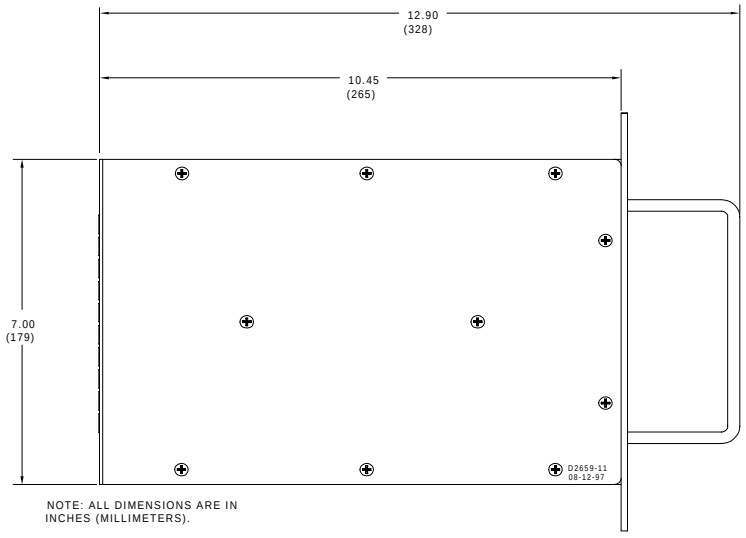


Figure 3-3. DECS Outline Drawing, Side View

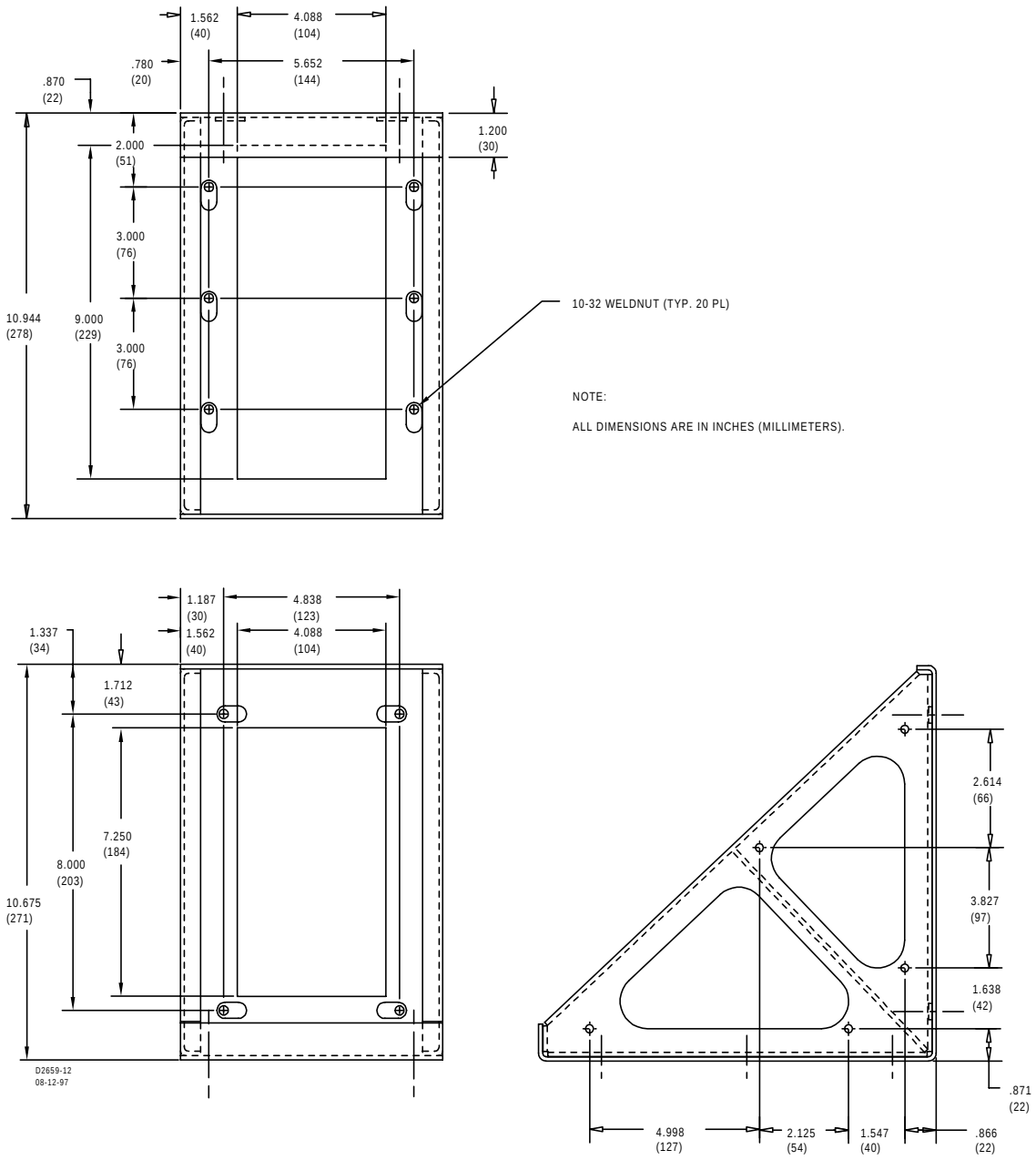


Figure 3-4. Optional Behind the Panel Mounting Kit Outline Drawing
P/N: 9 2653 04 100

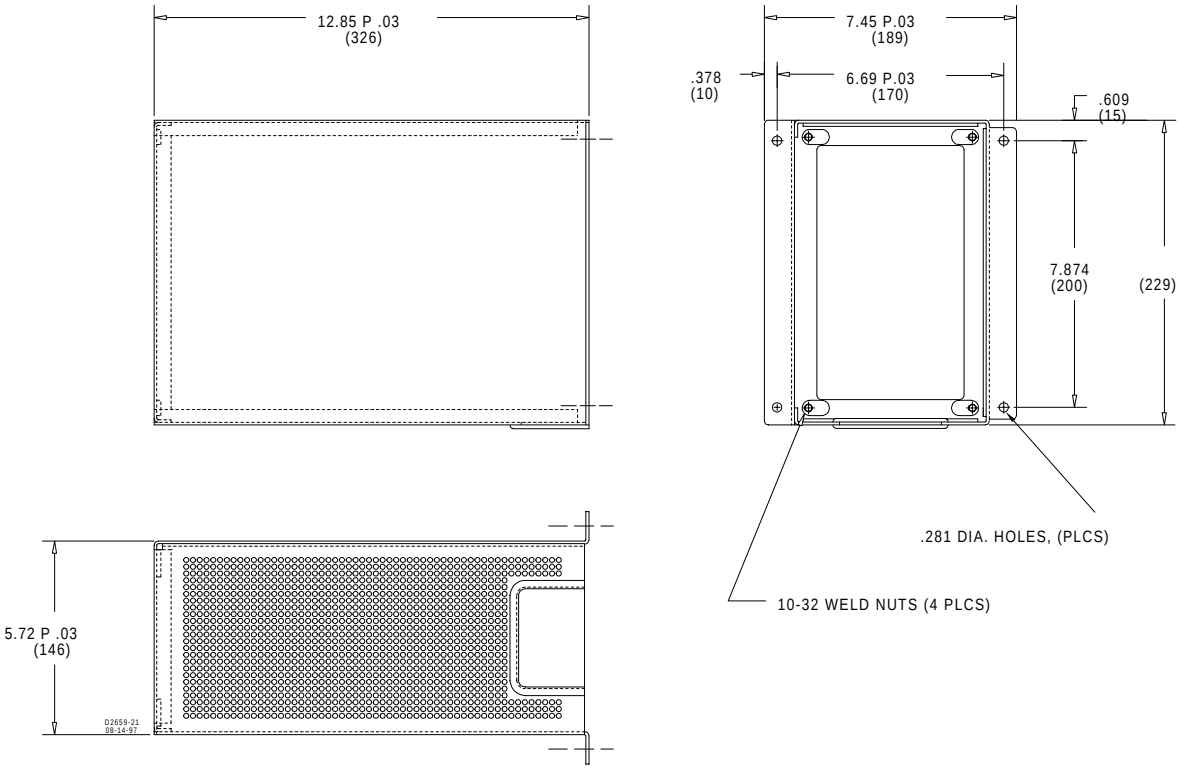


Figure 3-5. Optional Rear Panel Mounting Kit Outline Drawing
P/N: 9 2653 00 026

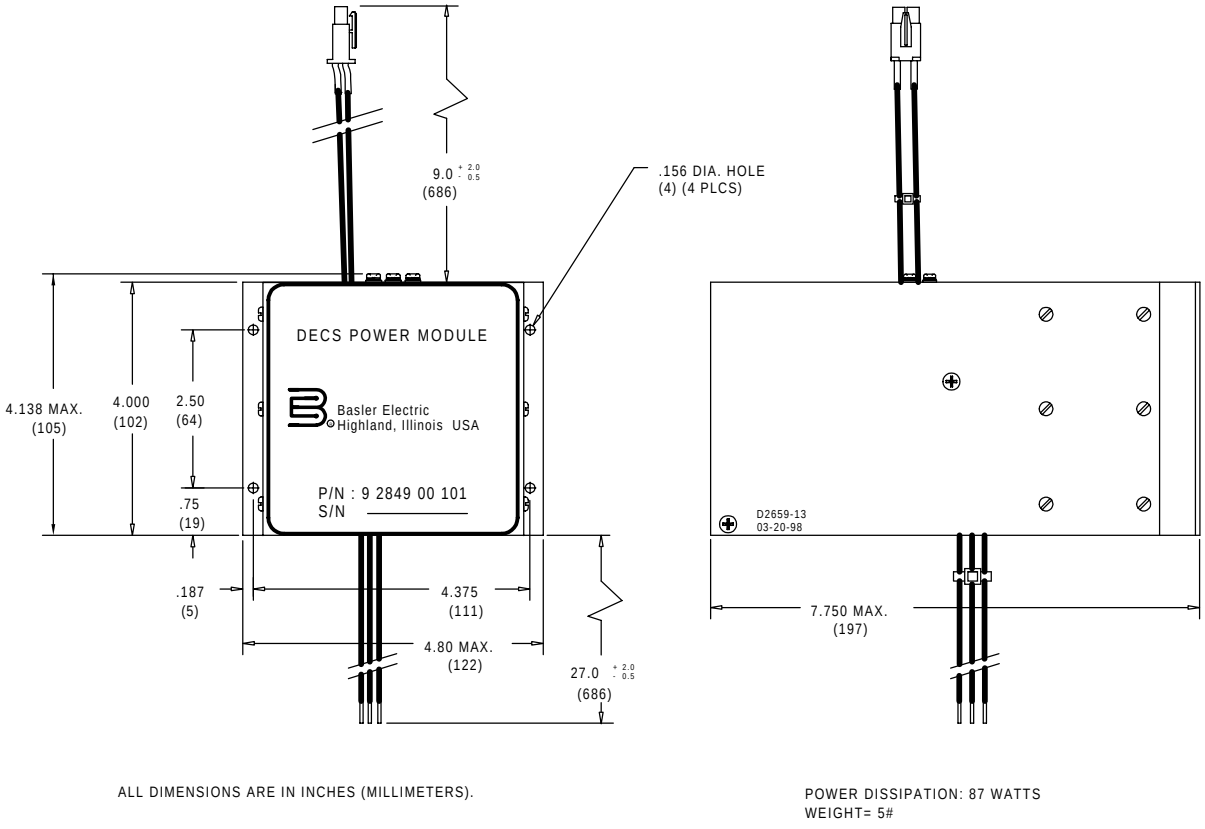


Figure 3-6. DECS Power Module Dimensions (A power module is provided with ever DECS unit)

INTERCONNECTION

Connect the DECS as shown in Figures 3-7 through 3-11 and in accordance with the following paragraphs. Use shielded, twisted-pair cable when connecting contact inputs (52J, 52K, 52L, 52M, 6D, 7, and 6U).

CAUTION

The case of the DECS must be properly connected to a suitable power system ground to ensure proper operation and to prevent the possibility of electrical shock**.**

CAUTION

Do not megger or hipot the generator with the DECS connected. Do not megger or hipot the DECS. To do so will damage the internal electronics of the DECS.

NOTE

When shunt powered on generators with output voltages greater than the requirements of Table 1-2, an external potential transformer must be used to provide the proper input power to the DECS Power Module. Refer to Table 1-5 for power PT selection.

(1) Whenever a potential transformer is used for sensing, an open circuit on the primary side of the transformer will cause maximum forcing from the regulator.

(2) Verify that all connections are tight and secured from possible vibration.

Remote Adjust

If a Remote Voltage Adjust is required, a single-pole, double-throw, spring-return, center-off, switch rated for 240 Vac, 1 A is best suited. To connect this switch, the center pole, or common terminal, must be connected to DECS terminal 7. The other two (2) poles or terminals are connected to DECS terminals 6U and 6D. Shorting terminals 6U to 7 causes the DECS to raise the setpoint of the mode of operation it is in; i.e., voltage, manual vars or PF Similarly, shorting 6D to 7 causes the setpoint to be lowered. Care must be taken because "input power" voltage is present across terminals 6U, 6D, and 7. This connection can be made using any wire gauge from 12 to 22 (.3-2.5 m^{m2}). The Remote Voltage Adjust switch can be mounted up to 150 feet from the DECS when using twisted, shielded cable.

Sensing Voltage

The DECS comes equipped for three-phase RMS voltage sensing as standard. It can optionally be used with single-phase sensing by connecting the Generator Output Phase A to the DECS Sensing terminal E1 and connecting the Generator Output Phase C to DECS Sensing terminals E2 and E3. The DECS sensing programming must agree with the type of interconnection. From the front panel, the proper phase rotation must be selected for three-phase sensing, A-B-C or A-C-B or the single-phase sensing setting (A-C) must be selected.

Power Output

The DECS Power Output terminals are labeled F+ and F-. These terminals are connected to the Exciter Field Leads. Be sure to observe polarity (i.e.: DECS F+ must be connected to Generator F+ and DECS F- must be connected to Generator F-).

CAUTION

The DECS field output terminals (F+ and F-) should NEVER be disconnected or shorted during operation. Disconnecting or shorting the field terminals can result in permanent damage to the DECS unit.

Large capacitors in the Power Module must be allowed to discharge before shorting the field terminals. Excessive current drawn through a short across the field terminals will cause permanent damage to the DECS unit.

If a power switch is desired to disconnect the power, it should be connected to the DECS power input terminals (3 and 4).

Power Input

(Reference Table 1-2.) The DECS Power Input terminals are labeled 3 and 4. The DECS Power Module (Basler P/N: 9 2849 00 101) is included to interface between the PMG or the generator output and the DECS power input. Basler Electric recommends external fusing of the power input with Bussman type KTK-20 or equivalent fuses.

Paralleling Input

The DECS comes equipped with paralleling provisions as standard. The Paralleling Input terminals are labeled CTB1 and CTB2. If paralleling is desired, connect the leads from a standard 1 A OR 5 A, 1 VA, 5P5, current transformer to these terminals. For cross current (reactive differential), see Figure 3-12.

(1) One standard for generator phase rotation is A-B-C. With this phase rotation and three-phase sensing, connect the Generator leads as follows:

Generator Phase	DECS Terminal
A	E1
B	E2
C	E3

The Paralleling Transformer must be in the Generator Phase B lead with the H1 towards the Generator and the X1 to DECS terminal CTB1.

(2) Another standard for generator phase rotation is A-C-B. With this phase rotation and three-phase sensing, connect the Generator leads as follows:

Generator Phase	DECS Terminal
A	E1
B	E3
C	E2

The Paralleling Transformer must be in the Generator Phase C lead with the H1 towards the Generator and the X1 to DECS terminal CTB1.

(3) With single-phase sensing, connect the generator lead as follows:

Generator Phase	DECS Terminal
A	E1
C	E2 & E3

The Paralleling Transformer must be in the Generator Phase B lead with the H1 towards the Generator and the X1 to the DECS terminal CTB1.

(4) If a Unit/Paralleling Switch is desired, this switch or contacts are connected to the DECS terminals 52M and 52L. Paralleling is activated when the DECS terminals 52M and 52L are open. Paralleling is disabled when the terminals are shorted. Refer to the following chart.

Operation Mode	52 J-K	52 L-M
Droop Mode Active	closed	open
Voltage Mode Active, NO DROOP, NO VAR/PF	closed	closed
VAR/PF Active	open	closed
VAR/PF Active (version 1.4.4 or later)*	open	open

* This mode is not allowed for versions 1.4.3 or earlier. For versions 2.0.5 or later, it is recommended that Droop Mode be active when VAR/PF is active.

CAUTION

For versions 1.4.3 or earlier, inputs 52 J-K and 52 L-M must not be left open simultaneously, even momentarily, or erratic operation may result.

(5) The Current Transformer used for paralleling may also be used for Generator Output Current metering.

Field Flashing

When the DECS is powered by a PMG, field flashing is not required or necessary. If the unit is connected as a standard shunt exciter (non-PMG), and generator residual voltage is such that the input to the power module drops below 8 Vac, field flashing may be needed. If needed, conventional field flashing circuits may be used.

Voltage Matching Input

The standard DECS is equipped with an input for a utility or bus side voltage input. There are two terminals for this input. They are labeled BUS1 and BUS3. This input can accept up to 660 Vac directly. Above 660 Vac an appropriate transformer must be used. In the following typical connection diagrams (Figures 3-8 through 3-11), switch S3, when closed, provides the voltage matching input. Switch S3 should be open to disable voltage matching after the generator is paralleled.

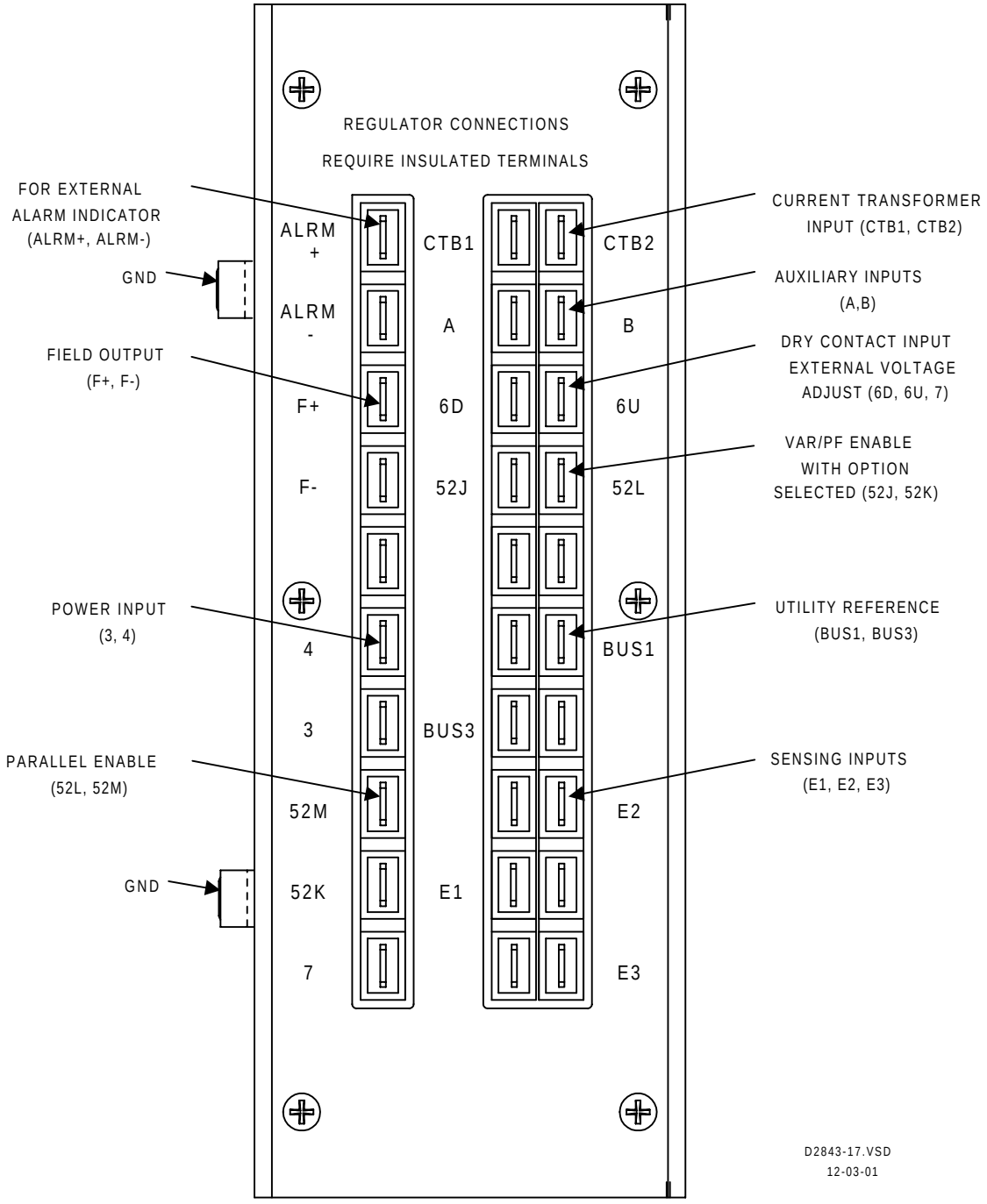


Figure 3-7. DECS Terminal Connections, Rear View

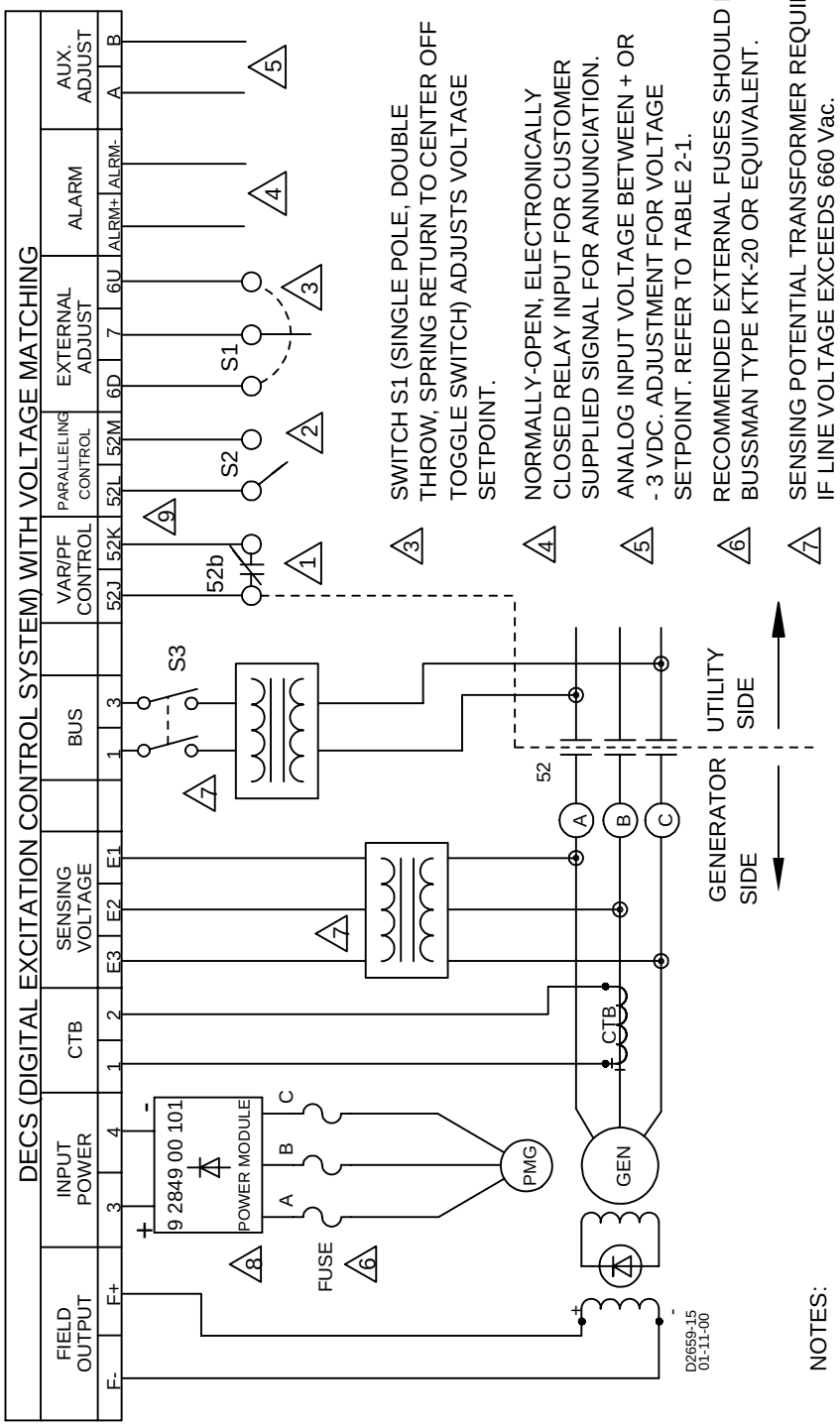


Figure 3-8. Typical Connection (PMG Application, A-B-C Rotation) Three Phase Sensing

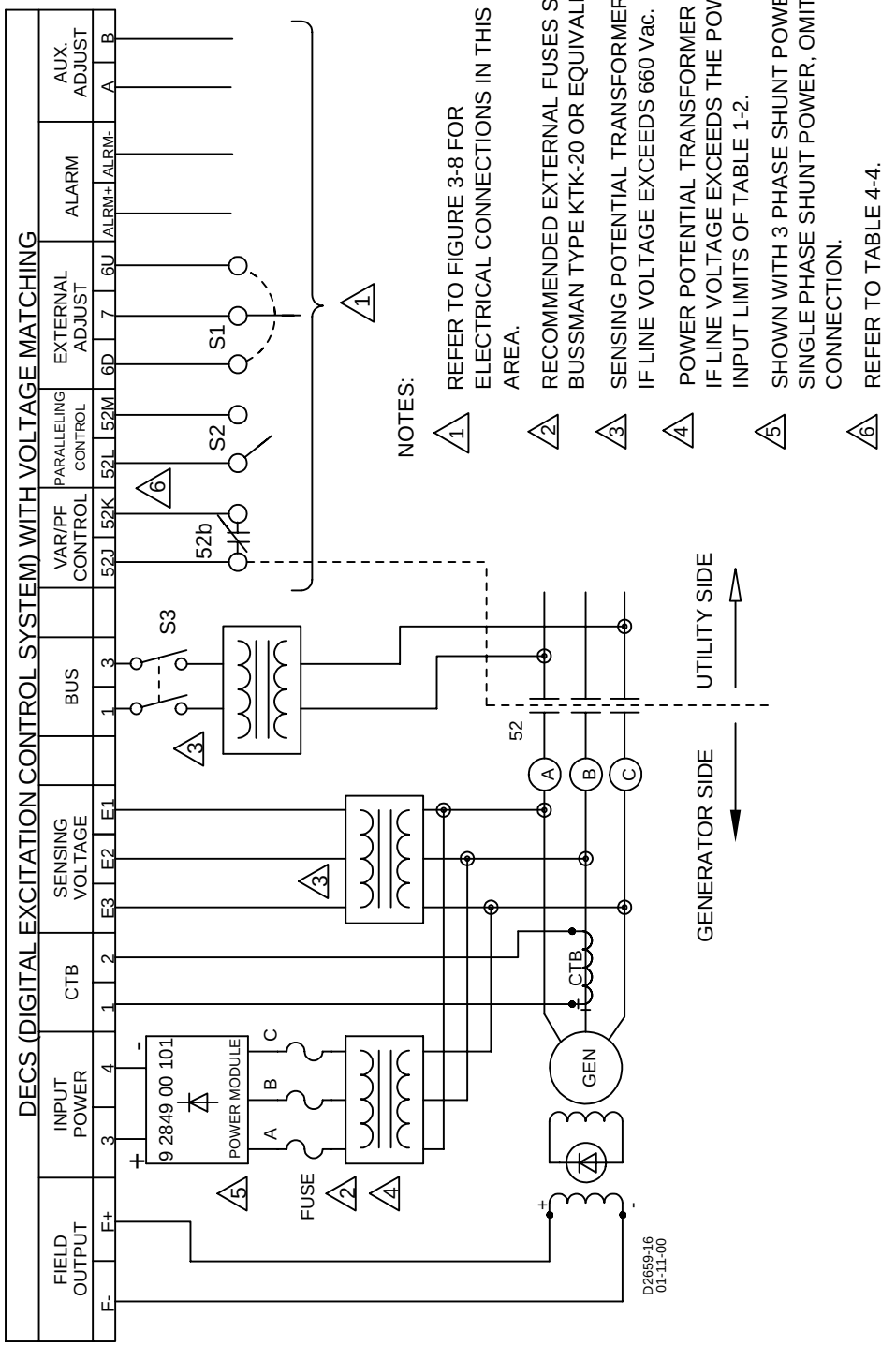


Figure 3-9. Typical Connection (Shunt Application, A-B-C Rotation) Three Phase Sensing

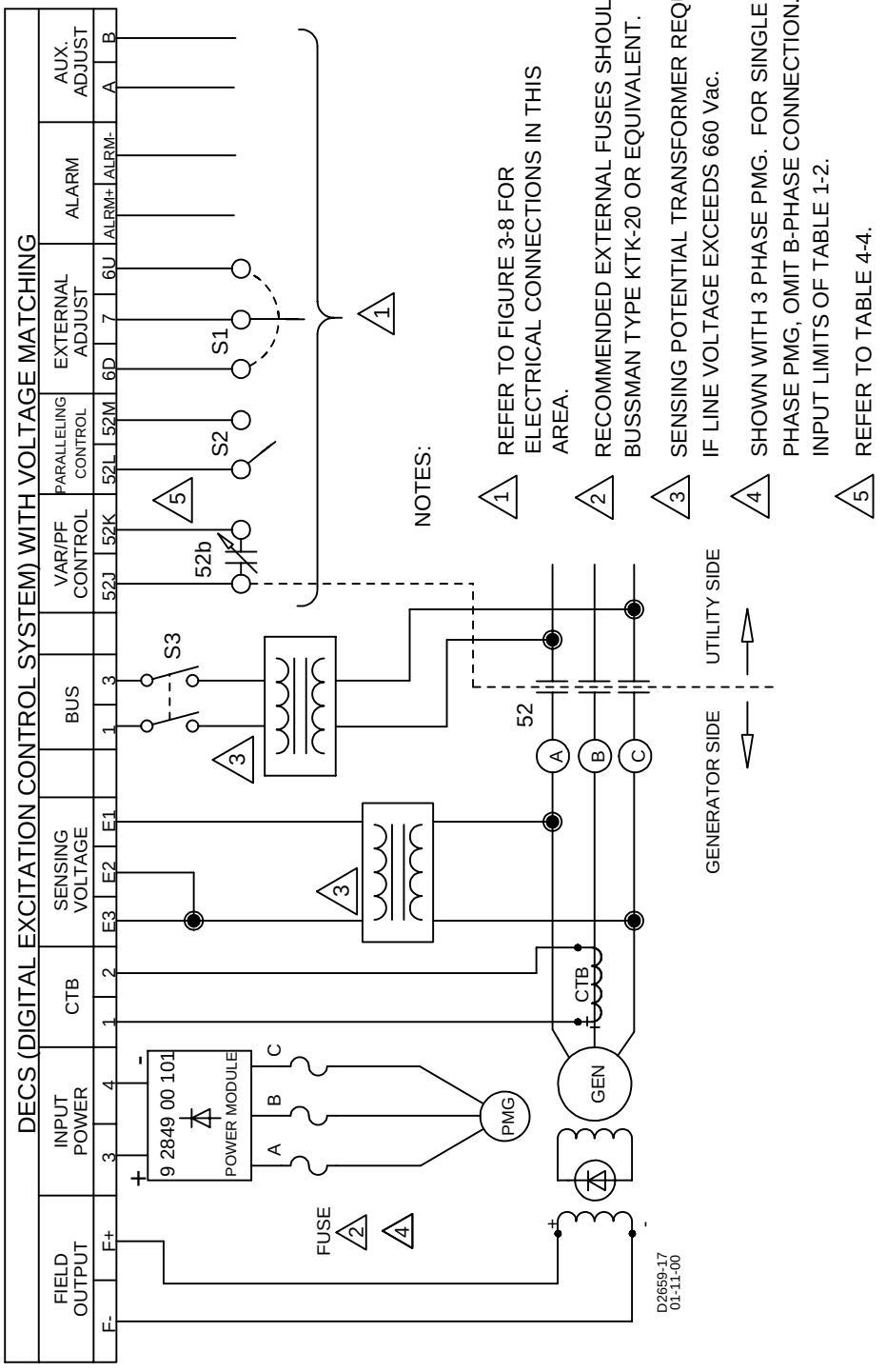


Figure 3-10. Typical Connection (PMG Application, A-B-C Rotation) Single Phase Sensing

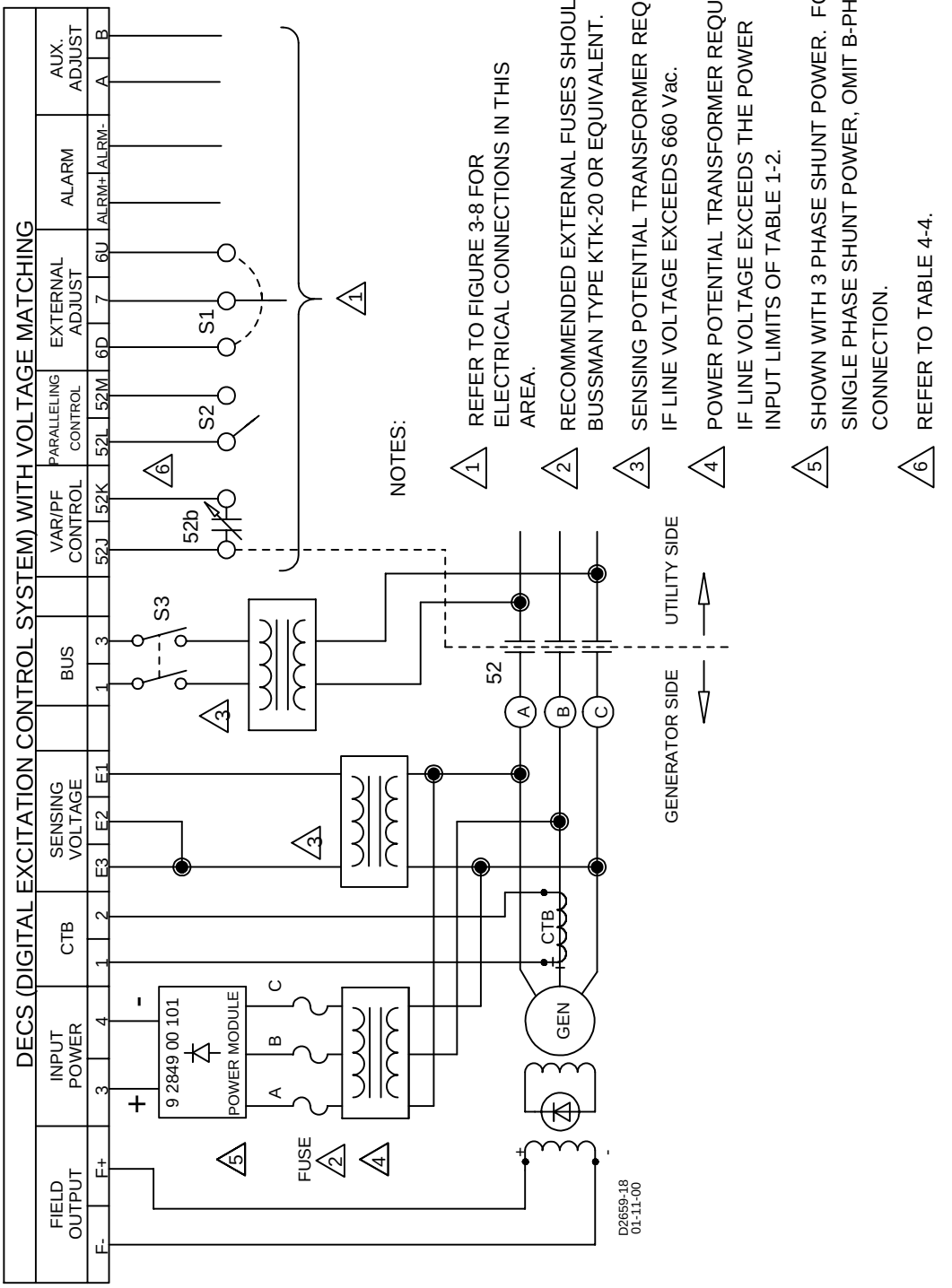


Figure 3-11. Typical Connection (Shunt Application, A-B-C Rotation) Single Phase Sensing

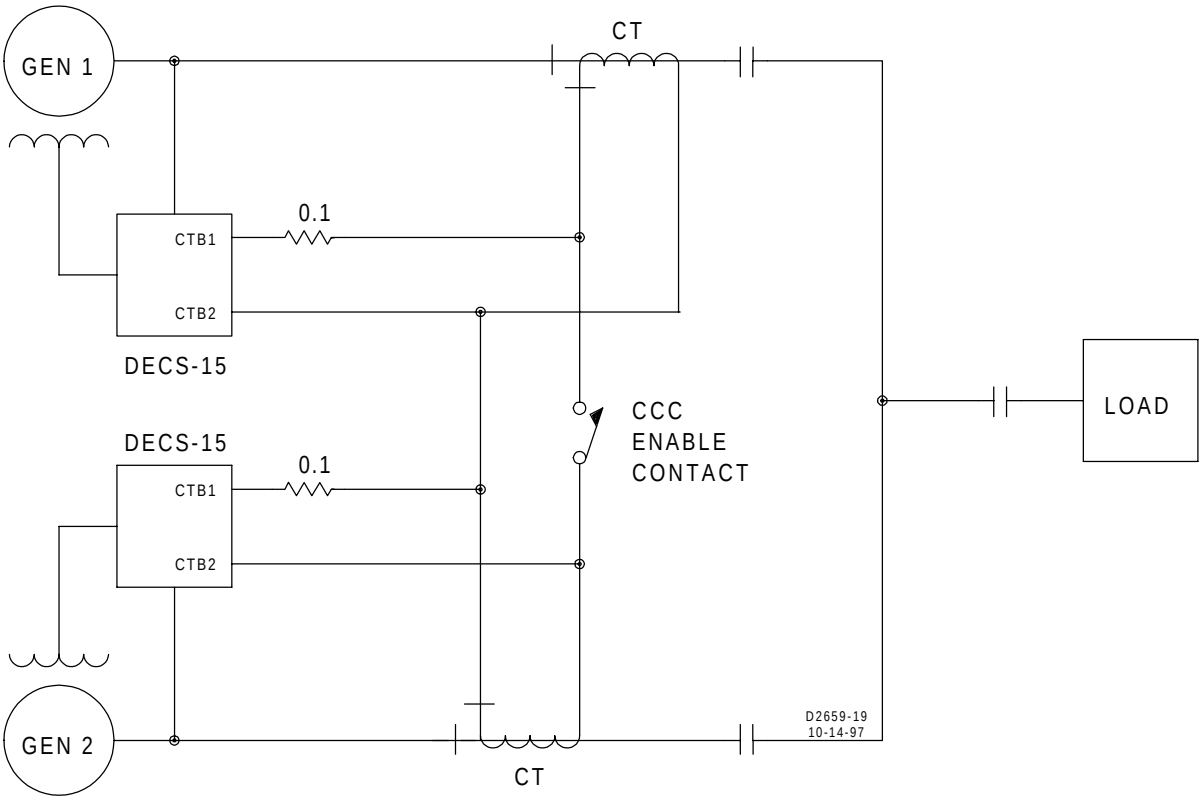


Figure 3-12. Cross Current (Reactive Differential) Connection

SECTION 4 • OPERATION

GENERAL

Refer to Figure 4-1 for the front panel controls and indicators. All adjustments are made either using external switching, the pushbuttons located on the DECS front panel, or via the RS-232 Port.

The three front panel pushbuttons are:

- **SELECT** - Systematically selects the adjustment feature by successive presses of the button.
- **UP** - Increases the level of the selected adjustment feature.
- **DOWN** - Decreases the level of the selected adjustment feature.

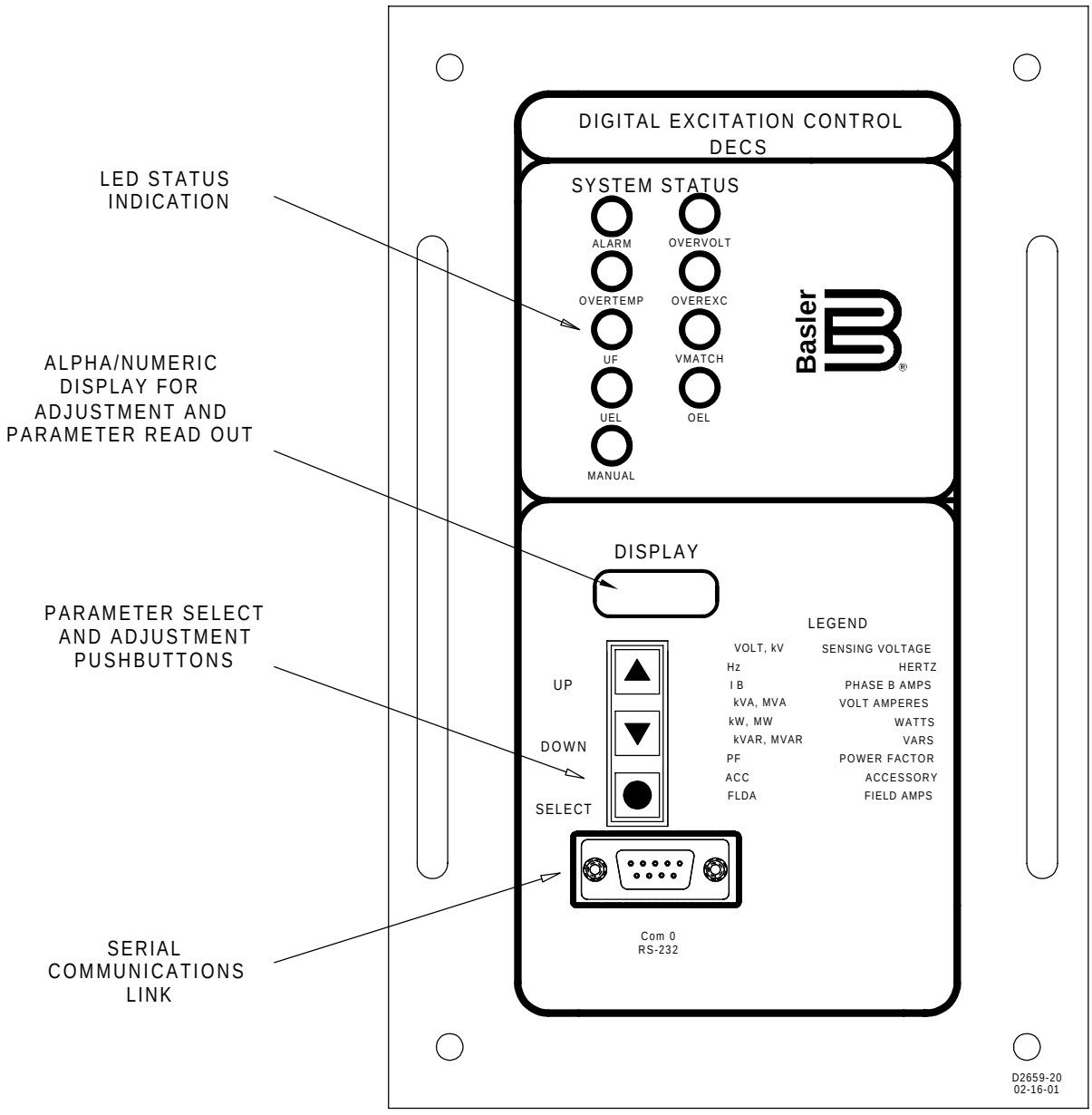


Figure 4-1. Front Panel Controls and Indicators
(Standard DECS is shown for reference only)

Successive presses of the front panel **SELECT** button will step through the various adjustment features. Once the desired adjustment feature is reached, the front panel **UP/DOWN** buttons will increase or decrease the level of the adjustment feature selected. Once the proper level is attained, the **SELECT** button must be pressed once more in order to save the new level in memory.

While in **SELECT** mode, if no button is pressed for a period of one minute, the DECS will automatically save the new level into memory. If input power to the DECS is interrupted before the automatic save function is enabled, the previous adjustment level will be the one recalled on the next power-up. The new level will not have been saved.

The **SELECT** button must be pressed in order to step through the adjustment features. The **UP** and **DOWN** buttons may then be successively pressed to increase or decrease the level. If either button is held down, the level will automatically increase or decrease at a rate of two increments per second. IF at any time both the **UP** and **DOWN** buttons are pressed simultaneously, the **UP** button will take precedence.

Refer to Table 4-1 for the front panel adjustments available on the DECS: The "Acronym" column in the table shows the acronym that will appear in the front panel display.

Table 4-1. DECS Front Panel Adjustments

Adjustments	Acronym
Coarse Voltage	CV
Fine Voltage	FV
Fine Voltage Adjust Band	FVAB
Voltage Matching	VMAT
Voltage Matching	BAND
Voltage Matching Speed	MSPD
Voltage Matching Step	MSTP
Manual Mode Switch	MANL
Manual Mode Setpoint	MANL
Underfrequency Setpoint	UF
Volts/Hertz Slope	V/HZ
Stability Range	SR
Stability Adjustment	STAB
Power Factor Mode Switch	PF
Power Factor Setpoint	PF
VAR Mode Switch	VAR
VAR Mode Setpoint	VAR
Droop Adjust	DRP
Under Excitation Limit	UEL
Overexcitation Select	OES
Overexcitation Time Delay #1	OET1

Adjustments	Acronym
Overexcitation Current Limit #2	OEI2
Overexcitation Time Delay #2	OET2
Overexcitation Current Limit #3	OEI3
Soft Start	SFST
Sensing Configuration	SNSE
CT Rating	CT R
PT Ratio	PT R

PRELIMINARY SET-UP

Before starting the generator and DECS for the first time, proceed as follows:

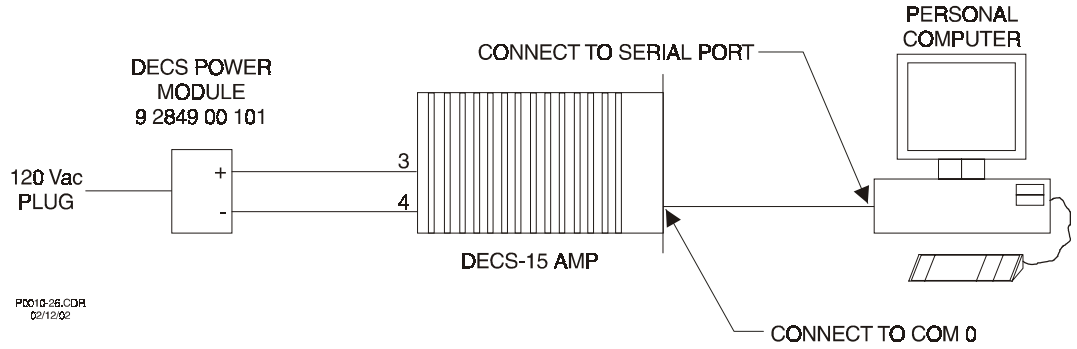


Figure 4-2. DECS-15 Communications Connection for Prgrogramming

a. Tag and disconnect all wiring to the DECS. Be sure to insulate the wire terminals to prevent a short.

b. Start the prime mover and perform all engine governor adjustments.

c. After all initial governor adjustments have been made, shut down the prime mover.

d. Connect **only** the power input leads of the DECS Power Module to a temporary auxiliary power source of 120 Vac for DECS 32-15 or DECS 63-15, or 240 Vac, for DECS 125-15, 50/60 Hz, 1 Amp for programming initial settings.

e. Perform all initial adjustments as described in the following paragraphs. Use the front panel **SELECT** button and the **UP** and **DOWN** buttons. If desired, these adjustments can be made via the serial link with an IBM-compatible (386 or better) PC running the DECS BESTCOMS software.

f. Remove power and reconnect the rest of the DECS leads using the tagged identification.

g. Start the prime mover/generator and perform the final adjustments at rated speed and load.

h. After the initial start-up, the DECS should not require any further adjustments unless there is a change in the system. If desired, the user's final settings may be recorded for future reference upon the included, shipped-loose, "settings label".

ADJUSTMENTS

The sub-paragraphs below describe each adjustment that can be made to the DECS from its front panel. Refer to Table 4-1 for the display acronyms that will be displayed when each adjustment is selected. Table 4-2 lists the factory default settings for each adjustment. To access the Adjustment Menu, proceed as follows:

1. Press the front panel SELECT button until MENU is displayed in the alphanumeric display.

2. Press the front panel UP button to display MENU 1.
3. Press the front panel SELECT button to access the various adjustable features as described below.
4. After each adjustment is complete, press SELECT once more to save the new setting in memory and to progress to the next adjustment.

COARSE VOLTAGE Adjustment (CV)

To select the Coarse Voltage Adjustment, press the front panel **SELECT** button until the acronym **CV** appears in the front panel display. Each up or down adjustment will increase or decrease the sensed generator output voltage by 6.0 Vac. The maximum range of the Coarse Voltage Adjust is from 0 to 660 Vac.

FINE VOLTAGE Adjustment (FV)

To select the Fine Voltage Adjustment, press the front panel **SELECT** button until the acronym **FV** appears in the front panel display. Each up or down adjustment of the Fine Voltage Adjust will increase or decrease the sensed generator output voltage by 0.5 Vac. The range of the Fine Voltage Adjust is ±60 Vac. Thus, the total range is 120 Vac from minimum to maximum of the sensed voltage.

FINE VOLTAGE ADJUST BAND (FVAB)

This adjustment is accessed similarly through the front panel, and is provided to allow the customer to establish his preferred upper and lower boundaries around the Fine Voltage Adjust setpoint. The intention is to limit the range of adjustment about a selected setpoint. It is also used for the upper and lower boundaries of the voltage correction of the VAR and PF controller. The adjustment's range is from 6 to 60 in integer steps. It may be necessary to adjust the Fine Voltage setpoint to realize the preferred upper and lower boundaries.

A setting of "12" means that the band has a range of ±12 Volts around the generator voltage setpoint.

For example:	Generator Voltage:	120 Vac
	FVAB:	12
	Max. Voltage:	132 Vac
	Min. Voltage:	108 Vac

MANUAL MODE SWITCH

This feature enables/disables the manual mode of control. When in the manual mode, the operator must adjust excitation for any load variations on the generator.

To enable the manual mode, press the SELECT button until the MANL appears on the front panel. The display will indicate if the manual mode is ON or OFF. Use the UP or DOWN buttons until the proper condition is obtained.

CAUTION

The manual mode excitation level must be evaluated prior to enabling this feature. If the level of excitation current is inappropriate for the generator loading, severe damage to the generator may occur.

MANUAL MODE SETPOINT

To select the level of excitation current in the manual mode, press the select button until MANL appears on the front panel. Use the UP or DOWN buttons to obtain the appropriate level of excitation. The range of this mode is from 0 to 25 Amps dc. Care must be taken not to exceed 15 Amps on a continuous basis and 20 Amps dc for more than 20 seconds. Damage to the DECS unit or the generator may occur if excitation levels are exceeded for any period of time.

UNDERFREQUENCY (UF)

The Underfrequency adjustment changes the frequency at which the DECS begins to operate on a constant volts/Hertz ramp. The adjustment range is from 40 to 65 Hertz. Increasing the adjustment will increase (raise) the transition frequency in 0.1 Hz steps. Decreasing the adjustment will decrease (lower) the transition frequency in 0.1 Hz steps. To select the Underfrequency adjustment, press the front panel **SELECT** button until the acronym **UF** appears on the front panel display. The display will also indicate the current transition level in Hertz. If another transition level is desired, press the front panel UP or DOWN buttons until the desired level is attained.

VOLTS PER HERTZ SLOPE (V/Hz)

This adjustment allows the user to set the slope of the Volts per Hertz line of the DECS. The range of V/Hz adjustment is from 0.0 to 3.0 per unit V/Hz in 0.1 per unit V/Hz steps.

STABILITY RANGE SELECT (SR)

The first step in acquiring stable generator output is to select the appropriate stability range, or "stability network", for the frame size of the generator and the excitation system used. A guide for selecting the Stability Range setting is provided by Table 4-3. By successively pressing the **SELECT** button on the front panel, **SR** will be displayed. With every push of the **UP** or **DOWN** buttons, the stability range setting can be changed. After selecting a stability range, the DECS will automatically load a preset stability level that should be acceptable for most applications.

STABILITY LEVEL ADJUSTMENT (STAB)

Adjusting the stability level within each stability range up or down will increase or decrease respectively the gain of the DECS, which, in turn, will increase or decrease the response time of the system. Adjusting the stability level is analogous to "turning a stability potentiometer" in a conventional voltage regulator. This adjustment is the fine gain adjustment of the DECS unit, and allows the user to modify the stability to suit his specific needs. A higher value of **STAB** gives a more stable performance along with a more sluggish response than would a lower value of **STAB**. **STAB** has a scaled range of 0 (least stable/fastest response) to 250 (most stable/slowest response).

To select the Stability Level Adjustment, press the **SELECT** button until **STAB** appears on the front panel display. The display will indicate the present relative level of stability. If another level is desired, press the front panel **UP** or **DOWN** buttons until the proper level is attained.

Instability is best observed by monitoring the generator output voltage. Do not try to monitor the DC field voltage. Even when the generator output voltage is stable, a DC voltmeter will show small fluctuations in the field voltage. If instability is seen in the generator output, proceed as follows:

a. Operate the generator under no-load conditions.

b. Select an appropriate stability range (**SR**) for the generator being tested. Refer to Table 4-3.

c. Adjust the Stability Level (**STAB**) as required that provides acceptable no-load stability.

d. Apply load. If the generator remains stable and the system response is acceptable, no further adjustment is needed. If the generator is still unstable, increase the Stability Level by pressing the **UP** button until satisfactory stability is attained.

e. Reject and apply the load one or two more times. The generator should remain stable.

f. If the generator is not stable, or if the system response time is too slow, then adjust the stability level one or two increments at a time. Apply and reject the load after each adjustment until optimum performance is achieved.

g. If the generator is still unstable, recheck the appropriateness of the selected Stability Range (**SR**) and reselect if required. Retest any adjustments.

h. If the generator is still unstable and every other stability-bearing variable has been verified, then a custom stability range may be required. Entering a custom stability range requires a computer running BESTCOMS Communications Software. See sections 5 and 6.

Table 4-2. Factory Default Settings

Adjustment Acronym	Setting
CV	80 Vac
FV	80.0 Vac
FVAB	10 Vac
UF	50.1 Hz
V/Hz	1.0 V/Hz
SR	1
STAB	196
PF	1.0
VAR	+7%
DRP	0.0%
UEL	20%
OES	OFF
OET1	10 sec.
OEI2	20 Amps
OET2	120 sec.
OEI3	15 Amps
SFST	2
SNSE	ABC rotation
CT R	1
PT R	1.0
VMAT	OFF
BAND	20%
MSPD	2
MSTP	2
MANL	OFF
MANL	1.0 Amps

Table 4-3. Stability Range Settings For DECS As Accessed Through The Front Panel

Generator Size	Generator Data			Stability Range
	Gen. Open Circuit Time Constant (T'dO)	Gen. Exciter Time Constant (Texc)	Generator Frequency	
Small	1.0 Seconds	0.17 Seconds	50 Hz	0
	1.0 Seconds	0.17 Seconds	60 Hz	1
	1.5 Seconds	0.25 Seconds	50 Hz	2
	1.5 Seconds	0.25 Seconds	60 Hz	3
	2.0 Seconds	0.33 Seconds	50 Hz	4
	2.0 Seconds	0.33 Seconds	60 Hz	5
	2.5 Seconds	0.42 Seconds	50 Hz	6
	2.5 Seconds	0.42 Seconds	60 Hz	7
	3.0 Seconds	0.50 Seconds	50 Hz	8
	3.0 Seconds	0.50 Seconds	60 Hz	9
	3.5 Seconds	0.58 Seconds	50 Hz	10
	3.5 Seconds	0.58 Seconds	60 Hz	11
	4.0 Seconds	0.67 Seconds	50 Hz	12
	4.0 Seconds	0.67 Seconds	60 Hz	13
	5.0 Seconds	0.83 Seconds	50 Hz	14
	5.0 Seconds	0.83 Seconds	60 Hz	15
	5.5 Seconds	0.92 Seconds	50 Hz	16
	5.5 Seconds	0.92 Seconds	60 Hz	17
	6.0 Seconds	1.00 Seconds	50 Hz	18
Large	6.0 Seconds	1.00 Seconds	60 Hz	19

Var/POWER FACTOR ADJUSTMENTS (VAR or PF)

The **var/PF** is an optional feature and is used when paralleling a generator to a utility. It is only available with models DECS 32/63/125-15-BXX. If it has not been purchased, it cannot be selected. The **PF** range is from -0.6 to +0.5 in 0.01 steps. A -0.8 Power Factor setting means that the generator is set to operate at a 0.8 leading (underexcited) power factor condition. A +0.8 Power Factor setting means the generator is set to operate at a 0.8 lagging (overexcited) power factor condition.

The **var** adjustment affects the Volt Amp Reactive power setpoint. The range is from -100 to 0 to 100% of the 1 Amp C.T. input to the DECS unit. It is adjustable in integer steps. If the DECS receives a 1 Amp C.T. signal from the phase B C.T., and the VAR setpoint is at +100, then the DECS would be exporting 100% reactive power (Var's). A setpoint of -100 indicates the DECS would be importing VAR's.

Increasing the level of **vars** or the **PF** will increase the amount of field excitation. Conversely, decreasing the level of **vars** or the **PF** will decrease the amount of field excitation.

The **var/PF** feature has two states: (a) Inactive. The feature is available, but is disabled by shorting a set of contacts across terminals 52J and 52K. (b) Active. The feature is available and active when terminals 52J and 52K are not shorted.

Table 4-4. VAR/PF Operation Mode

Operation Mode	52 J-K	52 L-M
Droop Mode Active	closed	open
Voltage Mode Active, NO DROOP, NO VAR/PF	closed	closed
VAR/PF Active	open	closed
VAR/PF Active (version 1.4.4 or later)*	open	open

* This mode is not allowed for versions 1.4.3 or earlier. For versions 2.0.5 or later, it is recommended that Droop Mode be active when VAR/PF is active.

To select **var** or **PF** control adjustment, press the front panel **SELECT** button until the desired adjustment acronym is displayed. The display will also indicate whether the feature is active (**ON** or **OFF**), and the relative level of adjustment present. If another level is desired, press the **UP** or **DOWN** buttons until the desired setting is acquired.

DROOP ADJUSTMENT (DRP)

The Droop Adjustment is used when paralleling generators. The settings range from 0% to 20% droop in 0.5% steps. Increasing the **DRP** level will increase the amount of generator voltage droop with the application of a reactive load. A 1 or 5 amp signal from a 1 or 5 VA, 5P5 current transformer (CT) into DECS terminals CTB1 and CTB2 will give approximately a 20% voltage droop with the application of a 0 PF load and the **DRP** adjustment level set to maximum.

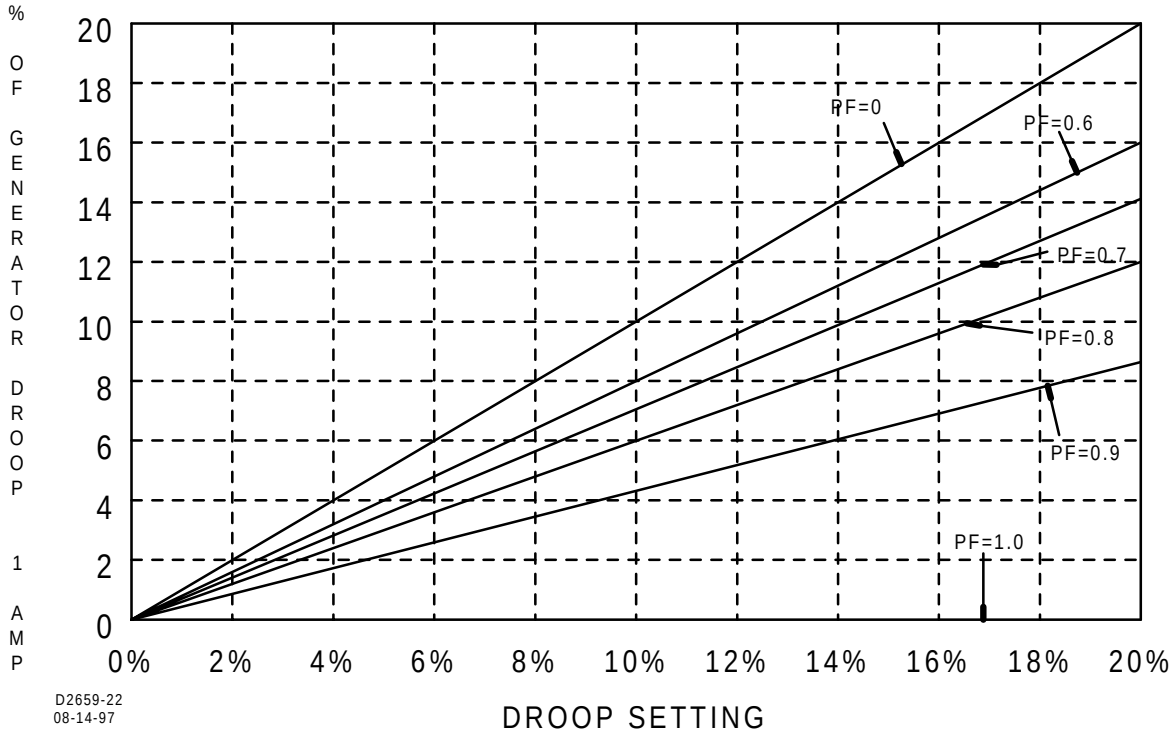


Figure 4-2. % GeneratorDroop VS Droop Setting At Different Power Factor Loads.

The **DRP** feature has two states: (a) Inactive. The feature is available, but is disabled by shorting a set of contacts across terminals 52L and 52M. (b) Active. The feature is available and is active when terminals 52L and 52M are not shorted. Refer to Table 4-4 for other input connection considerations.

To select the Droop adjustment, press the front panel **SELECT** button until **DRP** appears on the front panel display along with the present, relative droop level. If another level of droop is desired, press the front panel **UP** or **DOWN** buttons until the desired level is acquired.

The best method of setting the droop level is to first operate each generator individually (non-paralleled) and apply rated or near-rated current at a +0.8 PF. The amount of droop for each generator can be set based upon the instruction above. An alternate method of setting the droop is as follows:

a. Ensure the prime mover is stopped and that all power is off before proceeding any further.

b. With the droop CT installed into the generator Phase B lead, temporarily connect the generator E1 sensing lead to the generator Phase B lead. Connect the E2 and E3 sensing leads to generator Phase A lead.

c. Operate each generator individually (non-paralleled) and apply rated or near-rated load at unity (1.0) PF. The amount of droop can then be set by adjusting the Droop adjustment as needed for the application.

d. If, when adjusting the generator droop, the generator output voltage does not decrease with the application of load, recheck the CT polarity and the sensing lead connections.

e. After completing the droop adjustments, reconnect the DECS sensing leads to the appropriate configuration as determined by one of the interconnect diagrams on Figures 3-7 through 3-10.

When the generators are operated in parallel, they will share the load equally. If no reactive load is present, the generator voltage should not droop. If it does droop, recheck the sensing connections, the CT connections, and CT polarity. If needed, repeat the adjustment procedure.

For cross current or reactive differential compensation, a series resistor must be used for proper current sharing. (See Figure 3-12.)

UNDEREXCITATION LIMITING/OVEREXCITATION LIMITING (UEL/OEL)

Over and Underexcitation limiters establish and maintain a safe level of excitation for the generator. They will not allow the excitation to drop to a level where the generator could slip out of synchronization nor will they allow the generator to be overexcited to the point of damaging the generator field windings.

CAUTION

For versions 1.6.0 or earlier, when UEL is used, auto ranging of the sensing input must be disabled via DCIM interface.

The adjustable level of reactive current, for the Underexcitation Limiter, is from 1 to 80% of the maximum reactive current rating of the generator. The UEL is only active while in the DROOP, PF or var mode. The front panel UEL LED will illuminate whenever the reactive current exceeds the programmed level. When the reactive current decreases below the programmed level, the UEL LED will extinguish. To adjust the UEL setpoint, press the front panel SELECT button until the UEL acronym appears in the display. Subsequent presses of the UP or DOWN buttons will adjust the point at which the UEL activates.

The Overexcitation Limiter has three regions of operation. Refer to Figure 1-3. Region 1 is fixed at a maximum of 30 Adc. The timing for this region starts anytime the current level of OEI3 is exceeded. The timing is adjustable in Region 1 by the OET1 setting. OET1 is adjustable from 0 to 10 seconds. Once OET1 expires, the dc excitation current is driven down to the level as set by OEI2.

The time delay for Region 2 is adjustable by OET2. This adjustment is from 0 to 120 seconds, starting upon the expiration of OET1. The current level of Region 2 is set by OEI2. This is adjustable from 1 to 20 Adc. If the dc current level exceeds the OEI2 setting and remains there until OET2 expires, then the dc current is driven down to the level as set by OEI3.

The dc excitation current will remain at the level of OEI3 continuously until the fault is cleared by external means. OEI3 is adjustable from 1 to 15 Adc.

Overexcitation current limiting will occur whenever OEI3 is exceeded, which is indicated by the front panel OEL LED illuminating. The OEL action will halt once the field current drops 1 Amp below the field current limiting setpoint. To adjust the OEI/OET setpoints, press the front panel SELECT button until the appropriate acronym appears on the front panel display along with its present relative setpoint. Subsequent presses of the UP or DOWN buttons will adjust the setpoint value.2

OVEREXCITATION SELECT (OES)

This optional feature is integral with the **OEL** feature and allows the user to enable or disable the **OEL**. "Enabled" is indicated with a "1", and "disabled" is indicated with a "0". To change the state of **OES**, press the front panel select button until the acronym **OES** appears on the front panel display. By pressing the **UP** or **DOWN** buttons, the state can be toggled.

SOFT START (SFST)

The DECS provides the user the opportunity to set how fast the DECS unit will bring up the generator's voltage to the "generator voltage setting". The scaled range of adjustment is from "0", which will be the slowest rate of voltage build-up, to "99", which will be the fastest. To adjust the soft start rate, press the **SELECT** button until the acronym **SFST** appears on the front panel display. Subsequent presses of the **UP** or **DOWN** buttons will adjust the soft start rate to the desired setting.

DECS SENSING CONFIGURATION (SNSE)

This adjustment allows the user to configure the DECS for either single or three-phase sensing. The factory default setting is for three-phase sensing with A-B-C rotation. However, the user can select A-C-B rotation as well as single-phase sensing. When selecting single-phase sensing, inputs E2 and E3 must be connected to Phase C of the generator output. (Refer to Figures 3-9, 3-10 for single-phase sensing interconnection.) Single-phase sensing has been selected when "A-C" is displayed on the front panel display.

CURRENT TRANSFORMER PRIMARY RATNG(CT R)

This adjustment allows the user to set the current transformer primary rating. It has a range from 1 to 5000 in single integer steps. As an example, if the DECS is style DECS XX-15-XXX1-VXX and the system current transformer steps the current down from 200 A to 1 A,then the current transformer primary rating should be set to 200. Similarily, if the DECS is style DECS XX-15-XXX5-VXX and the system current transformer steps the current down from 200 A to 5 A, then the current transformer primary rating should be set to 200. To access this adjustment, press the **SELECT** button until the acronym **CT R** is displayed on the front panel. To adjust the setting, press the **UP** or **DOWN** buttons until the desired setting has been acquired.

SENSING POTENTIAL TRANSFORMER RATIO (PT R)

This adjustment allows the user to set the sensing transformer ratio. It has a range of adjustment from 0.1 to 99.9 in 0.1 steps and 100 to 200 in 1.0 steps. It is used so that the displayed voltage of the DECS will match the actual generator output voltage. For example, if the system has a sensing potential transformer that steps the voltage down from 3300 Vac to 100 Vac, then the sensing potential transformer ratio (**PT R**) should be set to 33.0. To access this adjustment, press the **SELECT** button until the acronym **PT R** is displayed on the front panel. To adjust the setting, press the **UP** or **DOWN** buttons until the desired setting has been acquired.

VOLTAGE MATCHING (VMAT)

This feature is used to control the generator output prior to implementing conventional generator-to-utility synchronizing procedures. The **VMAT** option compares the generator and utility bus voltages, adjusts the generator output and once the voltages are within 1% of each other, then the **VMATCH** LED illuminates; thereby indicating to the user that he may commence synchronizing procedures. To enable the Voltage Matching option, press the **SELECT** button until the **VMAT** acronym appears on the front panel display. The factory default setting is **OFF**. By pressing the **UP** or **DOWN** buttons, the feature can be enabled (**ON**) or disabled (**OFF**).

VOLTAGE MATCHING BAND (BAND)

This feature is used to set a band about the generator voltage setpoint within which the voltage matching feature will operate. The band width is adjustable with a range from 1% to 20% in 1% steps. For example, if the generator voltage setpoint is 120 Vac and the user sets the **BAND** value at 10, then the band limits are set at 10% above and 10% below 120 Vac. The upper limit would then be at 132 Vac, and the lower limit would be at 108 Vac with a nominal setpoint of 120 Vac. If the voltage at the DECS BUS1 and BUS3 inputs is outside of this band, then the **VOLTAGE MATCHING** feature will not operate. To access this adjustable feature, press the **SELECT** button until the acronym **BAND** appears on the front panel display. Subsequent presses of the **UP** or **DOWN** buttons will allow the user to set the desired band limits.

VOLTAGE MATCHING SPEED (MSPD)

This adjustable feature is used to set the speed of the **VMAT** feature and has a scaled range from 1 to 20 in integer steps. A setting of 1 provides the slowest speed while a setting of 20 is the fastest. To access this adjustment, press the **SELECT** button until the acronym **MSPD** appears on the front panel display. Subsequent presses of the **UP** or **DOWN** buttons allows the user to set **MSPD** value. The factory default setting is at 20.

VOLTAGE MATCHING STEP (MSTP)

This adjustable feature is used to set the size of the correction step in voltage matching mode. The range of this adjustment is from 1 to 8 in integer steps. A setting of 1 will provide voltage correction in 0.5 V steps. Similarly, a setting of 8 will provide 4.0 V steps. To access this adjustment, press the **SELECT** button until the acronym **MSTP** is displayed on the front panel. Subsequent presses of the **UP** or **DOWN** buttons will allow the user to determine his step setting.

FRONT PANEL OPERATION

There are 4 parts to the DECS front panel:

- Nine status and diagnostic LED's provide continuous information about the operation of the DECS unit.
- A 4-character alphanumeric display is used for display and adjustments/set-up.
- A 3-button keypad allows for the selection of information to be displayed and entering of adjustments.
- A serial data link connection provides for computerized factory testing and field troubleshooting by Basler-trained engineers and technicians. It also provides a means to connect the DCIM for tuning various parameters for unique generator applications.

STATUS AND DIAGNOSTIC LED'S.

ALARM LED. The front panel red **ALARM** LED shows the status of the solid state Alarm Output relay. AC and DC loads can be connected to this relay at the "ALRM+" and "ALRM-" terminals on the DECS unit.

Both hardware and software protective features control the Alarm relay operation. Overexcitation hardware in the DECS unit will turn on the Alarm Relay when generator field voltage exceeds a level preset in hardware for 15 seconds. Refer to Table 4-5.

Table 4-5. Overexcitation Presets

DECS Model Number	Voltage Trip Point
DECS 32-15	50
DECS 63-15	100
DECS 125-15	200

If the field voltage returns to a level below the voltage trip point preset in hardware, then the 15 second timer will reset to zero.

OVEREXC LED. The red **Overexcitation** LED is turned on when the observed field voltage exceeds a factory preset value (Refer to Table 4-5). Should the overexcitation condition last for 15 seconds, then the Alarm Relay and the front panel **ALARM** LED will be turned on.

OVERVOLT LED. The red **Overvoltage** LED is turned on whenever the generator output voltage exceeds 135%. If this overvoltage condition continues for 0.75 seconds, then the Alarm relay and the front panel **ALARM** LED will be turned on.

OVERTEMP LED. The red **Overtemperature** LED is turned on when the observed temperature of the power semiconductors exceeds a set limit. The DECS unit will also turn on the Alarm Relay and the front panel **ALARM** LED.

UF LED. The yellow **Underfrequency** LED displays the state of the underfrequency feature of the DECS unit. When the generator frequency falls below the underfrequency setpoint, the LED is turned on and the underfrequency features is activated.

MANUAL LED. This red LED will be illuminated anytime the manual excitation mode is enabled.

UEL LED. The yellow **Underexcitation Limit** LED displays the state of the reactive current underexcitation limit features of the DECS unit. The DECS unit will keep the generator reactive current from going below a customer-selected minimum level. While the DECS unit is limiting, this LED will be turned on. The underexcitation limit is operational only when the DECS unit is in a parallel connection (52J-K is open or 52L-M is open).

OEL LED. The yellow **Overexcitation Limit** LED displays the state of the field current overexcitation limit feature of the DECS unit. The DECS unit will keep the generator field current from going above a customer-selected maximum level. While the DECS unit is limiting, this LED will be turned on. This

feature is operational whenever the field current has exceeded the OEI3 limit. Refer to Figure 1-2 for settings.

VMATCH LED: The yellow **Voltage Matching** LED displays the status of the Voltage Matching circuitry comparing the sensed generator voltage and the sensed utility bus voltage. Once the compared voltages are within 1% of each other, the LED illuminates; thereby indicating to the user that he may then initiate generator-to-utility synchronizing procedures. Once paralleled, the DECS reverts to **var/PF** control, and the **VMATCH** LED remains illuminated only as long as the compared voltages are within 1% of each other.

ALPHANUMERIC DISPLAY

This 4 character display is used for 2 modes: display and adjustments: The DECS unit will power up in the display mode. In the display mode, the customer can step through a list of measured and calculated generator parameters by pressing the front panel **SELECT** button. The next entry on the metering list labeled "**MENU**" allows the customer to toggle between the display list and the adjustment list by pressing the up or down button. **MENU 1** will allow the user to access to the Adjustment List. Refer to Table 4-6 for the Display List and to Table 4-1 for the Adjustment List.

Table 4-6. Display List

Display Acronym	Function/Value Displayed
VOLT	True RMS value of the system three-phase or single-phase voltage.
Hz	Generator frequency in Hertz.
I B	Phase B current in Amperes.
kVA or MVA	Apparent Power
kW or MW	Real Power
kVAR or MVAR	Reactive Power
PF	Power Factor
ACC	Accessory input in Volts.
FLDA	Field current in Amperes.
MENU	Allows selection of the display or adjustment list.

CAUTION

Generator parameters are displayed to an accuracy of 10% of the full scale reading for each parameter. For greater accuracy of displayed information deemed critical to generator operation, external meters should be used.

DECS COMMUNICATION SOFTWARE AVAILABLE FEATURES

Optional communications software is available to aid in the calibration and configuration of the DECS unit. However, communications software is required to select or adjust the following DECS features:

- Loss of Sensing Timing
- UEL Enable
- Range Select (Sensing)
- Fine Voltage Adjust Speed
- Generator Overvoltage Setting
- AVR Gain: Custom Gain Settings for KP, KI, KD, Scale Factor
- VAR/PF/OEL/UEL: Discrete KP and KI settings for each function
- PWM Start
- Step Responses
- Metering

The software version available is:

BESTCOMS-DECS15-32 (For Windows® 95, 98, and ME Users)

DECS ALARM ENABLE/DISABLE

The DECS has been designed to provide an alarm indication and a relay closure for each of the following trouble conditions:

- Overtemperature of the DECS
- Overvoltage
- Overexcitation
- Underfrequency

The relay has been provided to allow the user to customize these alarm functions to suit his specific needs; such as remote alarm annunciation or various system relay trips.

The Overtemperature, Overvoltage, and Overexcitation alarm functions are factory preset and are enabled. The Underfrequency alarm function is disabled as shipped from the factory, but each and every alarm feature can be enabled or disabled by the customer if he chooses via Communication Interface software.

DECS SHUTDOWN ENABLE/DISABLE

The DECS has been designed with inherent protective features that, if enabled, will shutdown the DECS field output and, hence, the excitation system. The trouble conditions monitored are identical to those for the DECS Alarm conditions:

- Overtemperature of the DECS
- Overvoltage
- Overexcitation
- Underfrequency

To allow the customer the greatest in flexibility, none of the above shutdown conditions are enabled from the factory. As is the case for the Alarm conditions, the customer can tailor these shutdown features to meet his specific needs via the optional DECS Communication software. The shutdown conditions, if activated, are cleared and reset only if power to the DECS is cycled.

SECTION 5 • BESTCOMS SOFTWARE

INTRODUCTION

DECS BESTCOMS software is an application that enhances communication between the PC user and the DECS Models DECSXXX-15-XXX. DECS BESTCOMS interface software serves three main purposes. First, it provides a user friendly environment for changing DECS settings. Second, it provides on-screen real time metering that is updated approximately every six seconds. Third, it provides PID (Proportional-Integral-Derivative) software that allows users to experiment and find the right generator and exciter time constants. The interface software also allows users to save the current configurations and data information to a disk. Users can save multiple setups for later use which saves setup time when configuring multiple units. Without this software, users must be familiar with the limited function operations at the front panel of the DECS units. PID settings can only be changed by using DECS communications software.

INSTALLATION

DECS BESTCOMS Software contains a setup utility that installs the program on your personal computer (PC). When it installs the program, an uninstall icon is created that you may use to uninstall (remove) the program from your PC. The minimum operating requirements are listed in the following paragraph.

Operating Requirements

To use DECS BESTCOMS Software, you will need the following:

- IBM compatible PC, 486DX2 or faster, with a minimum of four megabytes of RAM
- Microsoft Windows NT® 3.51 or later, Windows®95, Windows®98, Windows®Me
- 3.5 inch floppy drive
- Serial port

Installing The Program On Your PC Using Microsoft Windows

1. Insert disk 1 in the 3.5 inch floppy drive.
2. From Windows™, select **Start** then **Run**.
3. If operating Windows NT® , Windows®95, Windows®98, or Windows®ME Software, then at the Command Line type: **a:\Setup.exe** and press the **Enter** key or click on browse and select the A: drive and double click Setup.exe. The setup utility automatically installs the DECS Windows NT® or Windows®95 Software.

Configuring The System

Verify that the host computer is configured for 2400 baud, 8 data bits, 1 stop bit, no parity and that the serial cable is connected.

INITIALIZING COMMUNICATIONS

Review what we have done up to this point. You have loaded the software on your computer and you have the Basler Electric directory with the BESTCOMS-DECS15 icon. You have also connected the serial cable to the DECS, the computer, and supplied operating power. Now you are ready to initialize communications.

Initialize Communications

Select the DECS icon to start the DECS Windows™ software. A momentary dialog box (splash screen) opens that displays the Basler Electric Logo, program application, and revision identification. After the splash screen appears, click <OK>. The initial screen (Figure 5-1) will follow. Pull down the Help menu as shown in Figure 5-1 and select **Instruction.** This information will help you in operating the DECS software.

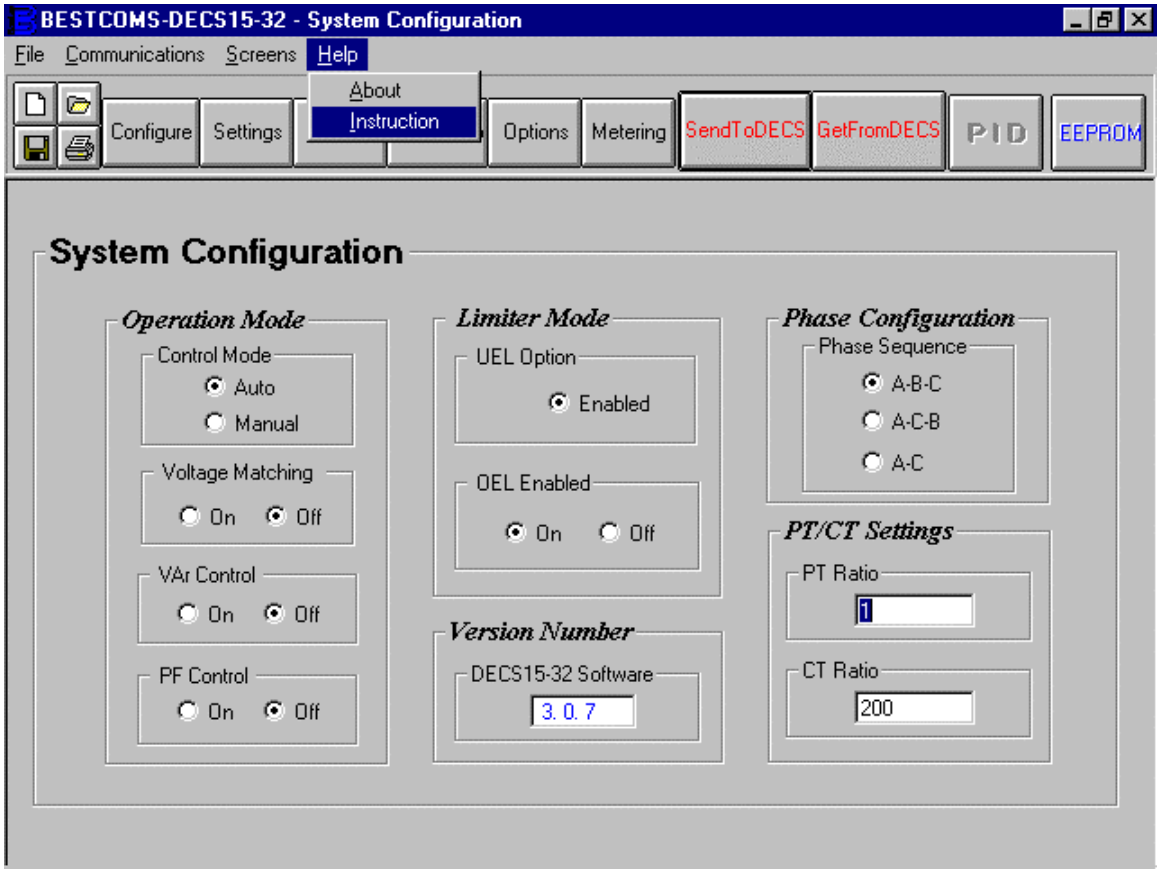


Figure 5-1. DECS Communications Software Initial Screen

Pull down the **Communications** menu and select **Open** (Figure 5-2). This should open a Comm Port screen like the one shown in Figure 5-3.

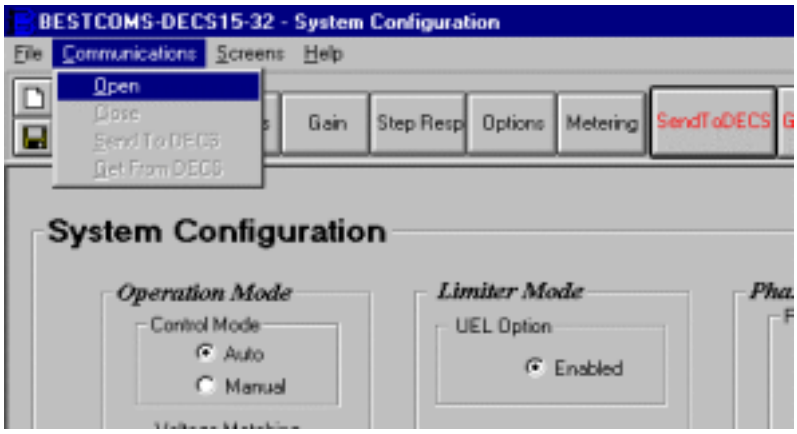


Figure 5-2. Communications Open Screen

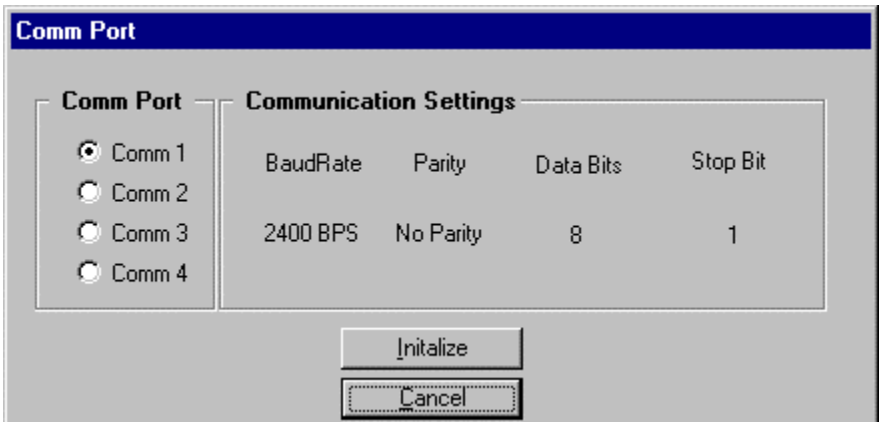


Figure 5-3. Comm Port

Select a comm port (like Comm 1 in Figure 5-3) and initialize it. A password (Figure 5-4) is required for access to communication (the default password is DECS). After entering the password press **Enter.** You now have the option to change your password. (When you see this symbol, < >, with a label designating one of the software buttons as in the following sentence, it means that you are to click on (select) that button.) A new password is changed by the following three steps: <Reset>, <Confirm>, and <Change>. If the password is changed, then the new password will replace the old one permanently and start communications with the DECS unit (Figure 5-5). The communication port opens and returns the current system configurations from the DECS unit. You do not have to select the communication protocol parameters because the software application program does it automatically. Figure 5-6 is a sample of the screen showing the system configurations returned from the DECS unit.

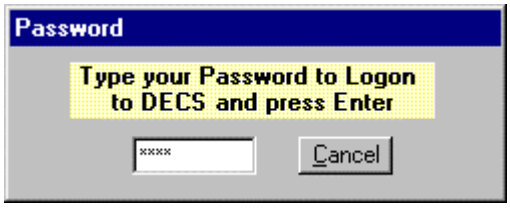


Figure 5-4. Password

NOTE

DECS - **CURRENT SCREEN** settings are only updated after **Communications** are opened or **SendToDECS** menu/button has been executed. When a red waiting box appears like the one shown in Figure 5-5, it is important to wait until the box disappears. Trying to execute communication commands may interrupt the operating program.

Figure 5-5. Communications In progress

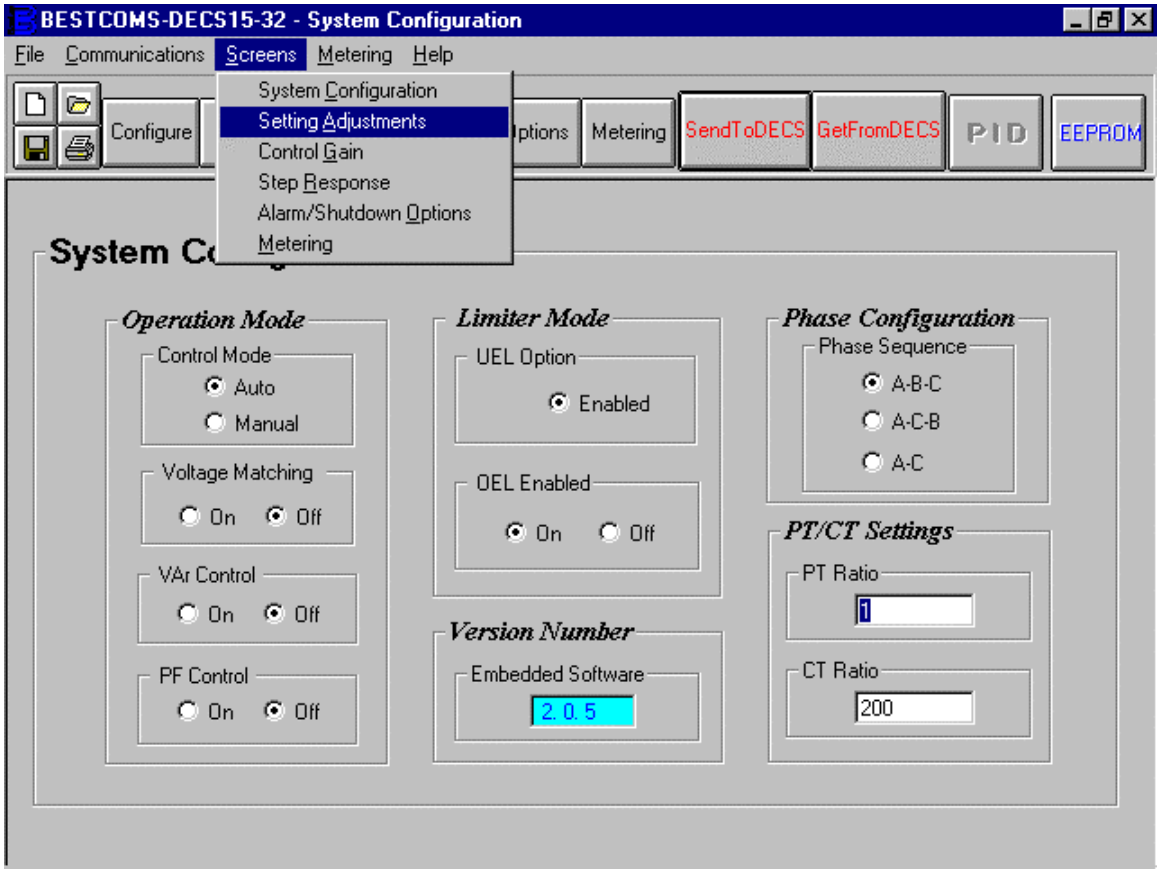


Figure 5-6. System Configurations

CHANGING SETTINGS

Settings are arranged in six groups.

- System Configuration
- Setting Adjustments
- Control Gain
- Step Response
- Alarm/Shutdown Options
- Metering (includes front panel lock setting and switch status display)

To change settings, you must first select the group by selecting the button associated with that group or by the *Screens* pull down menu. To then change the settings, select (click on and highlight) the setting to be changed. Enter the new setting. Double click any setting white rectangular box and it will show you the setting limits for this setting. Once all the settings on the **CURRENT SCREEN** have been entered, the new settings can be sent to the DECS unit by selecting the <SendToDECS> button or executing the communications command. The following paragraphs describe these functions.

SENDING AND RECEIVING SETTINGS

When communications is in progress, the user may send settings to or receive settings from the DECS unit.

Send To DECS

To send data to the DECS unit (update settings), you can pull down the **Communications** menu and select **SendToDECS**. Settings displayed on the current settings screen become the DECS unit settings. Selecting (clicking on) the **SendToDECS** button serves the same function.

Get From DECS

To retrieve data from the DECS unit (get settings), you can pull down the **Communications** menu and select **GetFromDECS**. Settings previously saved to the DECS unit are displayed on the settings screen. Selecting (clicking on) the **GetFromDECS** button serves the same function.

EEPROM

Default settings are saved in non volatile memory (EEPROM). In the event of a power loss, these are the settings that are active at power up. If you change settings and send them to the DECS, but do not send them to EEPROM, the changed settings are lost if power is lost. When you exit the communications program or close communications, you are asked if you want to save the settings to EEPROM. This question is asked even if you made no changes.

You can save changes to EEPROM two different ways. As described in the previous paragraph, when you exit the file or close communications or by selecting the EEPROM button during communication.

SETTINGS DEFINITIONS

Definitions for all the available settings are provided in the following paragraphs. These definitions are also arranged in six groups according to the screen displays.

System Configuration - Operation Mode

Refer to Figure 5-6 for the System Configuration settings descriptions.

Control Mode, Auto/Manual. This setting allows the user to select auto or manual control of the exciter field current. Manual Mode overrides all other modes of operation.

Voltage Matching, On/Off. This setting is used to enable or disable the voltage matching feature on the Voltage Matching DECS unit.

Var Control, On/Off. This setting allows the user to enable or disable the var regulation mode using the DECS software. There also exists a hardware enable/disable of the var regulation mode. The 52 J-K contacts on the back of the DECS unit enable the var regulation mode when open and disable when closed. Finally, if both Power Factor and var control modes are enabled using the DECS software, the var control mode takes priority.

PF Control, On/Off. This setting allows the user to enable or disable Power Factor regulation from the DECS software. There is also a hardware enable/disable of the Power Factor mode. The 52 J-K contacts on the back of the DECS unit enable Power Factor regulation mode when open and disable when closed.

System Configuration - Limiter Mode

Under Excitation Limit (UEL) Option, Enabled. This indicator identifies when the UEL Option is enabled. UEL Enabled is a factory only setting.

OEL Enabled, On/Off. This setting allows the user to enable or disable the Over Excitation limiter from the DECS software.

System Configuration - Phase Configuration

CAUTION

It is important that the phase rotation and sensing is verified before setting the Droop setting. Droop is related to the phase angle between the generator voltage and the phase B current**.**

Phase Sequence, ABC/ACB/AC. This setting allows the user to define how the DECS will be implemented in the generator system. The DECS sensing is adjustable in three different modes: Three Phase A-B-C Rotation, Three Phase A-C-B Rotation, and Single Phase A-C Rotation. The settings are made by selecting the corresponding button to select the sensing configuration.

System Configuration - PT/CT Settings

PT Ratio (Sensing Transformer Ratio). This setting allows the user to set the sensing transformer ratio. It has a range of 0.1 to 200.0 in 0.1 steps. It is used so that the displayed voltage of the DECS unit will match the actual generator output voltage.

An example of setting this setting is as follows. If the system has a sensing transformer that steps the voltage down from 3300 Vac to 100 Vac, then the sensing transformer ratio should be set to 33.0.

CT Ratio (Current Transformer Ratio). This setting allows the user to set the current transformer primary rating. It has a range of 1 to 5000 in integer steps.

Examples of setting this setting are as follows. If the style of the DECS is DECS XX-15-XXX1 VXX and the system current transformer steps the current down from 200A to 1A, then the current transformer rating should be set to 200.

If the style of the DECS is DECS XX-15-XXX5 VXX and the system current transformer steps the current down from 200A to 5A, then the current transformer rating should be set to 200.

System Configuration - Version Number

This display indicates either the embedded software version or the DECS software version. If the DECS unit is OFF Line (communications not in progress), the screen display shows Version Number, DECS Embedded Software and the indicated version number for the production version of the BESTCOMS-DECS Windows™ Software (Refer to Figure 5-6). If the DECS unit is ON Line (communications is in progress), the screen display shows Version Number, Embedded Software and the indicated version number for the DECS software inside the DECS unit (Refer to Figure 5-1).

Setting Adjustments - Block 1

See Figure 5-7 for the Setting Adjustments Block 1 settings descriptions.

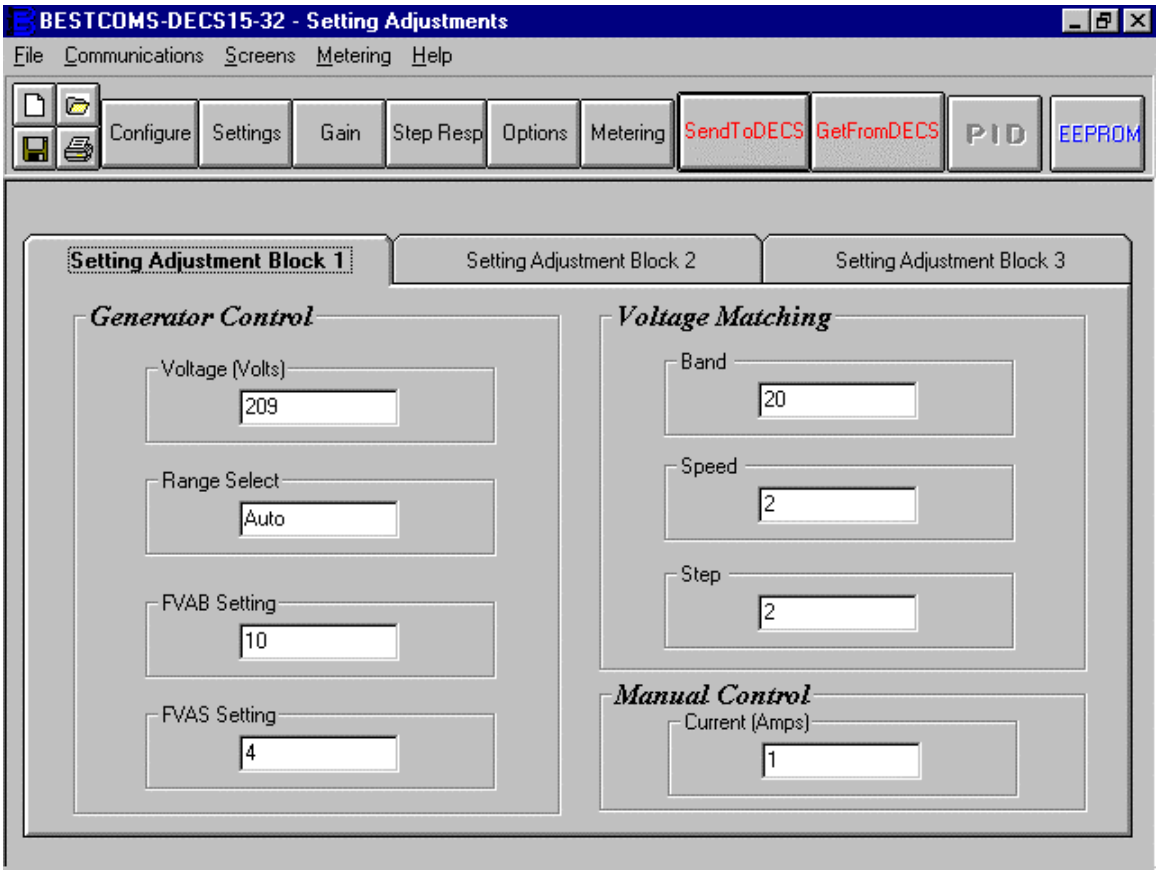


Figure 5-7. Display Setting Adjustment Block 1

Generator Control, Voltage (Volts). This setting allows the user to set the generator output terminal voltage. It combines the settings of Coarse Voltage (CV) and Fine Voltage (FV) that are available from the DECS front panel. It will allow the user to select voltages from 0 to 660 volts ac with a resolution of half volt steps.

Generator Control, Range Select. This setting sets the sensed voltage range which will be present on E1, E2 and E3. A Range Select setting of 0 will allow DECS to select its own range based on the voltage level entered into *Generator Control, Voltage*. Whenever the UEL option is enabled, a Range Select of 1, 2 or 3 should be selected as to the following criteria:

Generator Voltage Set Point	Range Select
0 - 170	1
170 - 300	2
300 - 600	3

This setting is only accessible through the communications software.

Generator Control, FVAB (Fine Voltage Setting Band) Setting. This setting gives the user the ability to set an adjustable band around the generator output voltage. It is also used for the upper and lower boundaries of the voltage correction from VAR and PF controller. It has a range of setting from 6 to 60 in integer steps. A setting of 12 means that the band has a range of ±12 volts around the generator voltage set point. The following example describes the use of FVAB:

Generator Voltage: 120
FVAB: 12
Generators Max Voltage = 132 Vac
Generators Min Voltage = 108 Vac

It may be necessary to adjust the Fine Voltage setpoint to realize the preferred upper and lower boundaries.

Generator Control, FVAS (Fine Voltage Adjust Speed) Settings. This setting allows the user to adjust the rate at which DECS increments or decrements the operating setpoint (fine voltage, VAR, or PF) via the remote adjust terminals, 6U and 6D. This setting has a scaled range from 1 (slowest setting) to 7 (fastest setting). This feature is only accessible through communications software.

Voltage Matching, Band. This setting is used to set a band in which the voltage matching feature will operate. The band is based on the generator output voltage set point. The range of this setting is from 1 to 20 in integer steps. An example of how to set this is listed in the following paragraphs.

Example: Generator Voltage: 120
Voltage Matching Band: 10

This sets the band at 10% above and 10% below the generator set point of 120 Vac. The minimum level would be 108 Vac and the maximum level would be 132 Vac. If the voltage at the BUS1 & BUS3 inputs of the Voltage Matching DECS is outside of this band, then voltage matching will not operate.

Voltage Matching, Speed. This setting is used to set the speed of the voltage matching feature. The range of this setting is from 1 to 20 in integer steps. A setting of a 1 is the slowest speed while a setting of a 20 is the fastest speed.

Voltage Matching, Step. This setting is used to set the size of the correction step in voltage matching mode. The range of this setting is from 1 to 8 in integer steps. A setting of a 1 means the voltage correction steps will be at 0.5 volt size. If the setting of an 8 is used, the voltage correction size is 4 volts.

Manual Control, Current (Amps). This is the field current level setting during Manual Mode of operation. The field current level can be set from 0 to 25.0 amperes in 0.1 ampere steps. Whenever the Manual Switch is set to 1, the field current level will immediately be driven to the setpoint level. Manual mode becomes active if the sensing voltage is lower than 25% of the generator terminal voltage for more than LOS time setting.

Setting Adjustments - Block 2

See Figure 5-8 for the Setting Adjustments Block 2 settings descriptions.

Droop Setting (%). This is the setting that sets the Droop level for the generator system. The settings range from 0 to 20 percent droop, in 0.5 percent steps. Increasing the Droop level will increase the amount of generator voltage droop with the application of a reactive load. A one ampere signal from a one ampere CT into terminals CTB1 and CTB2 will give approximately 20% voltage droop with the application of a zero pf load and the droop setting set to 20%.

Var Setting (%). This is the setting of the Reactive Power (var) set point. The range is from -100 to 0 to 100% of the 1 Amp C.T. input to the DECS unit. It is adjustable in integer steps. If the DECS receives a 1 Amp C.T. signal from the phase B C.T. and the var setpoint is at +100, then the DECS would be exporting 100% reactive power (var's). A setpoint of -100 indicates the DECS would be importing var's.

Power Factor Setting. This is the setting of the Power Factor set point. The range is from -0.6 to +0.5 in 0.01 increments. A -0.8 Power Factor setting means that the generator is set to operate at a 0.8 leading (underexcited) power factor condition. A +0.8 Power Factor setting means the generator is set to operate at a 0.8 lagging (overexcited) power factor condition.

UEL Setting. This setting sets the level of "leading" reactive current which will enable the underexcitation limiter. The range of this setting is from 0 to 80% in 1% steps for leading reactive current only. 100% reactive current is equal to the full-range input level of the CT (i.e. with a 200:1 CT, a setting of 100% UEL would equal 200 Amps reactive). If UEL is being used, a Range Select value of 1, 2, or 3 should be used.

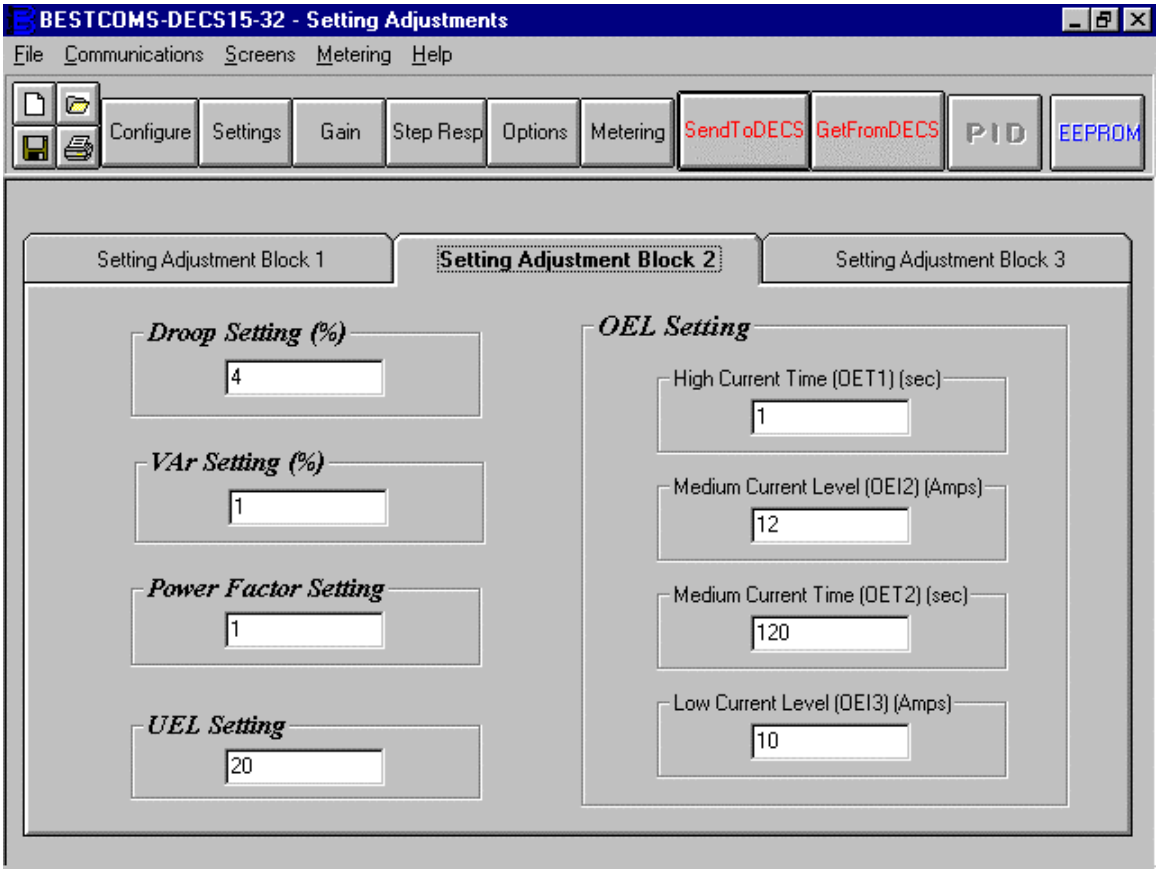


Figure 5-8. Display Setting Adjustment Block 2

OEL Setting, High Current Time (OET1) (sec). This is the setting for OET1. During a field overcurrent condition, field current up to 30 amperes is allowed to flow for the time set by OET1. OET1 is adjustable between 0 to 10 seconds. If the overcurrent condition persists, then OET2 and OEI2 become active after OET1 is fulfilled.

*OEL Setting, Medium Current Level (*OEI2*) (Amps).* This is the maximum allowed field current level to which the field current is regulated as long as the field current remains above OEI3 and the timer for OET2 has not been exceeded. OEI2 is adjustable from 1 to 20 amperes.

OEL Setting, Medium Current Time (OET2) (sec). This is the timer during a field over current condition which has exceeded the OET1 time limit. OET2 is adjustable between 0 to 120 seconds. OET2 sets the time by which the field current is regulated to the level of OEI2.

*OEL Setting, Low Current Level (*OEI3*) (Amps).* This is the maximum allowed field current level to which the field current is regulated after OET2 has been exceeded and the field over current condition persists. This condition will continue for an indefinite time period until the field current drops one ampere below OEI3. OEI3 is adjustable between 1 to the minimum of OEI2 or 15 amperes in 0.1 Amp steps.

Setting Adjustments - Block 3

See Figure 5-9 for the Setting Adjustments Block 3 settings descriptions.

Frequency Setting, Underfrequency (Hz). This setting allows the user to set the corner frequency point of the underfrequency curve. Because of the DECS ability to precisely read the generator frequency, the resolution of this setting is in 0.1 hertz steps with a range of 40.0 to 65.0 hertz.

Frequency Setting, Volt/Hertz. This setting allows the user to set the slope of the Volts/Hertz line of the DECS unit. The allowable setting range is from 0.0 to 3.0 p.u. V/Hz. The resolution of this setting is in 0.1 p.u. V/Hz steps (p.u. is defined as per unit).

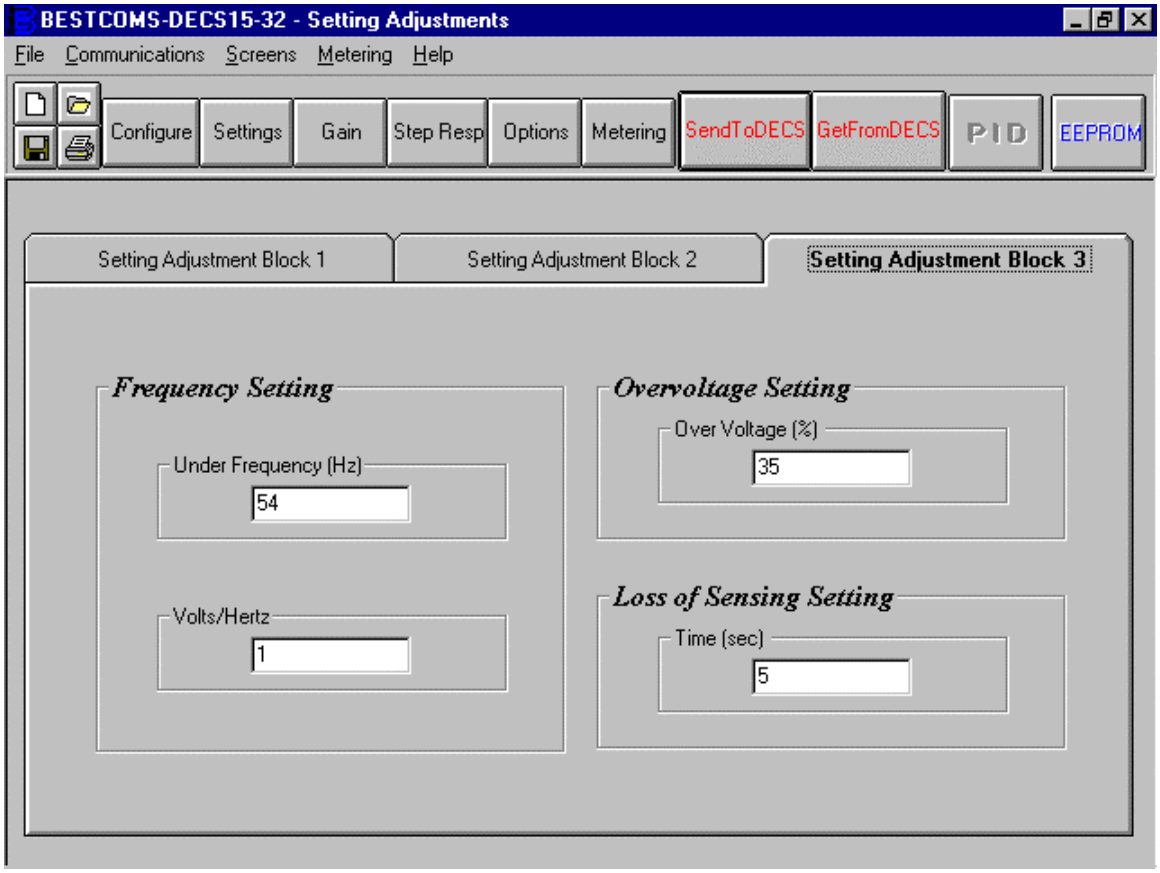


Figure 5-9. Display Setting Adjustment Block 3

Overvoltage Setting, Over Voltage (%). This setting allows the user to set the generator overvoltage trip setting on the DECS unit. The allowable setting range is from 1 to 35% in 1% increments.

Loss of Sensing Setting, Time (sec). This setting allows the user to set the time delay for the loss of sensing. The allowable setting range is from 0.5 to 120 seconds in 0.05 increments. The manual mode will be active if the sensing voltage is lower than 25% of the generator terminal voltage for more than the loss of sensing time setting.

Control Gain

See Figure 5-10 for the Control Gain settings descriptions.

Control Gain, Stability Range (SR). This setting allows the user to select 1 of 19 preset stability networks for the DECS unit. The PID button is disabled with a SR range of 1 to 19. This setting also allows the user to "tune" his own stability setting by entering stability range 20. With the stability range equal to 20, the PID Button will be active. The selections range from 0 to 20 with stability range 20 being customer adjustable through the DECS software.

CAUTION

Even if the PID gains KP, KI, and KD can be selected as described in the following paragraphs, these values must satisfy the following equation: $2(KD) + (KP) \leq 65534$ If this equation is not true, the DECS will be unstable**.**

Control Gain, AVR, Gain KP. This setting allows the user to select the proportional constant (KP) stability parameter. The DECS provides an output value that is equivalent to KP multiplied by the error between the voltage setpoint and the actual generator output voltage. Values of KP may vary from 0 to 65535 in hexadecimal integer format. Typical values of KP range from 20 to 20000. The general guidelines for tuning the value of KP are as follows: If the transient response has too much overshoot, then decrease KP. If the transient response is too slow, with little or no overshoot, then increase KP.

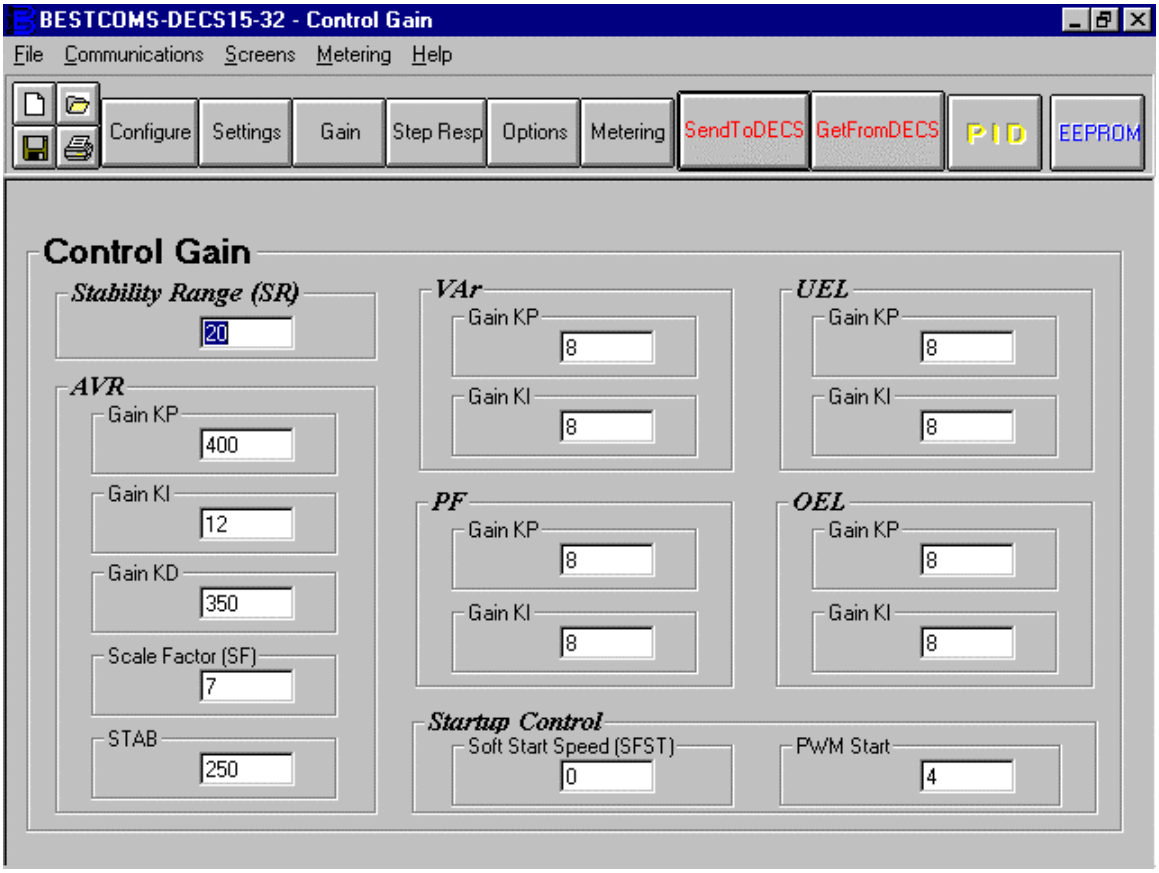


Figure 5-10. Control Gain Settings Screen

Control Gain, AVR, Gain KI. This setting allows the user to select the integral constant (KI) stability parameter. The DECS provides an output value that is equivalent to KI multiplied by the integral of the error between the voltage setpoint and the actual generator output voltage. Values of KI may vary from 0 to 65535 in hexadecimal integer format. Typical values of KI range from 4 to 100. Generally, if the time to reach steady state is deemed too long, then increase the value of KI.

Control Gain, AVR, Gain KD. This setting allows the user to select the derivative constant (KD) stability parameter. The DECS provides an output value that is equivalent to KD multiplied by the derivative of the error between the voltage setpoint and the actual generator output voltage. Values of KD may vary from 0 to 62765 in hexadecimal integer format. Typical values of KD range from 100 to 8000. Generally, if the transient response has too much "ringing", then increase the value of KD.

Control Gain, AVR, Scale Factor (SF). This variable is adjustable from 2 to 8 and allows the user to adjust the coarse loop-gain level of the PID algorithm. When the value of SCALE is changed by 1, then the loop-gain changes by a factor of 2; e.g., if SCALE is increased from a value of 5 to a value of 6, then the loop-gain is decreased by a factor of 2. Similarly, if the value of SCALE is decreased from a value of 5 to a value of 4, then the loop-gain is increased by a factor of 2. Basler Electric has experienced satisfactory performance with a SCALE value of 7. However, through experimentation, the user may elect to change the value of SCALE to suit specific needs.

Control Gain, AVR, STAB. This setting is analogous to the "turning of a stability potentiometer" on conventional voltage regulators. It is adjustable from 0 (least stable/fastest response) to 250 (most stable/slowest response). After custom values of KP, KI and KD have been determined and input into the DECS, it may be necessary to readjust the STAB setting.

Control Gain, VAR, Gain KP. This feature allows the user to adjust the rate (proportional gain) at which the DECS responds to a changed var setting. This setting is a scaled range from 1 (slowest response) to 15 (fastest) with single integer steps.

Control Gain, Var Gain KI. This feature allows the user to adjust the integral gain which determines the characteristic of the DECS dynamic response to a changed var setting. This setting is a scaled range from 1 (largest) to 15 (smallest) with single integer steps.

Control Gain, PF Gain KP. This feature allows the user to adjust the rate (proportional gain) at which the DECS responds to a changed PF setting. This setting Is a scaled range from 1 (slowest response) to 15 (fastest) with single integer steps.

Control Gain, PF Gain KI. This feature allows the user to adjust the integral gain which determines the characteristic of the DECS dynamic response to a changed PF setting. This setting is a scaled range from 1 (largest) to 15 (smallest) with single integer steps.

Control Gain, UEL Gain KP. This feature allows the user to adjust the rate (proportional gain) at which the DECS responds during an underexcitation event. This setting is a scaled range from 1 (slowest response) to 15 (fastest) with single integer steps.

Control Gain, UEL Gain KI. This feature allows the user to adjust the integral gain which determines the characteristic of the DECS dynamic response during an underexcitation event. This setting is a scaled range from 1 (largest) to 15 (smallest) with single integer steps.

Control Gain, OEL Gain KP. This feature allows the user to adjust the rate (proportional gain) at which the DECS responds during an overexcitation event. This setting is a scaled range from 1 (slowest response) to 15 (fastest) with single integer steps.

Control Gain, OEL Gain KI. This feature allows the user to adjust the integral gain which determines the characteristic of the DECS dynamic response during an overexcitation event. This setting is a scaled range from 1 (largest) to 15 (smallest) with single integer steps.

Control Gain, Startup Control, Soft Start Speed (SFST). This setting lets the user set how fast the DECS unit will bring up the generator voltage to the Generator Voltage setting. The range of this setting is from 0 to 99 in integer steps. A setting of 0 will be the slowest speed, while a setting of 99 will be the fastest setting. The user should modify this setting based on his particular soft start requirements for his generator system.

Control Gain, Startup Control, PWM-Start. This setting gives the user the ability to adjust the initial start-up pulse width of the DECS output to the generator field during the soft start sequence. The range of this setting is from 0 to 15 integer steps. The default value is 15 which corresponds to an initial output width of 2.5% duty cycle.

If the generator requires a faster start up speed, lower start up time, the user should increase the SFST setting first. If the generator requires an even faster start up speed and the SFST parameter is set to 99, decrease the PWM-Start number. Exercise extreme caution when changing this variable. A PWM-Start number that is too low for a given generator will result in high values of over shoot in the generator output voltage during startup.

Step Response

See Figure 5-11 for the Step Response settings descriptions.

Step Response, Generator Nominal Terminal Voltage (Volts). This voltage setting description is a read only indication of the generator nominal terminal voltage that was set during the generator control screen. If you want the indicated voltage to be the generator output voltage, select the button adjacent to the indication window. When the button is selected, the voltage indicated is sent to the DECS to be the terminal output voltage.

Step Response, Voltages, Increment of Nominal Voltage (Volts). This setting lets the user set the voltage step size that the DECS unit will use when step changing the generator voltage. The range of this setting is from 1 to 10% in integer steps. If you choose a 10% step size, the generator terminal output voltage plus the 10% increment step is shown in the adjacent window. To send this voltage to the DECS, select the button adjacent to the indication window.

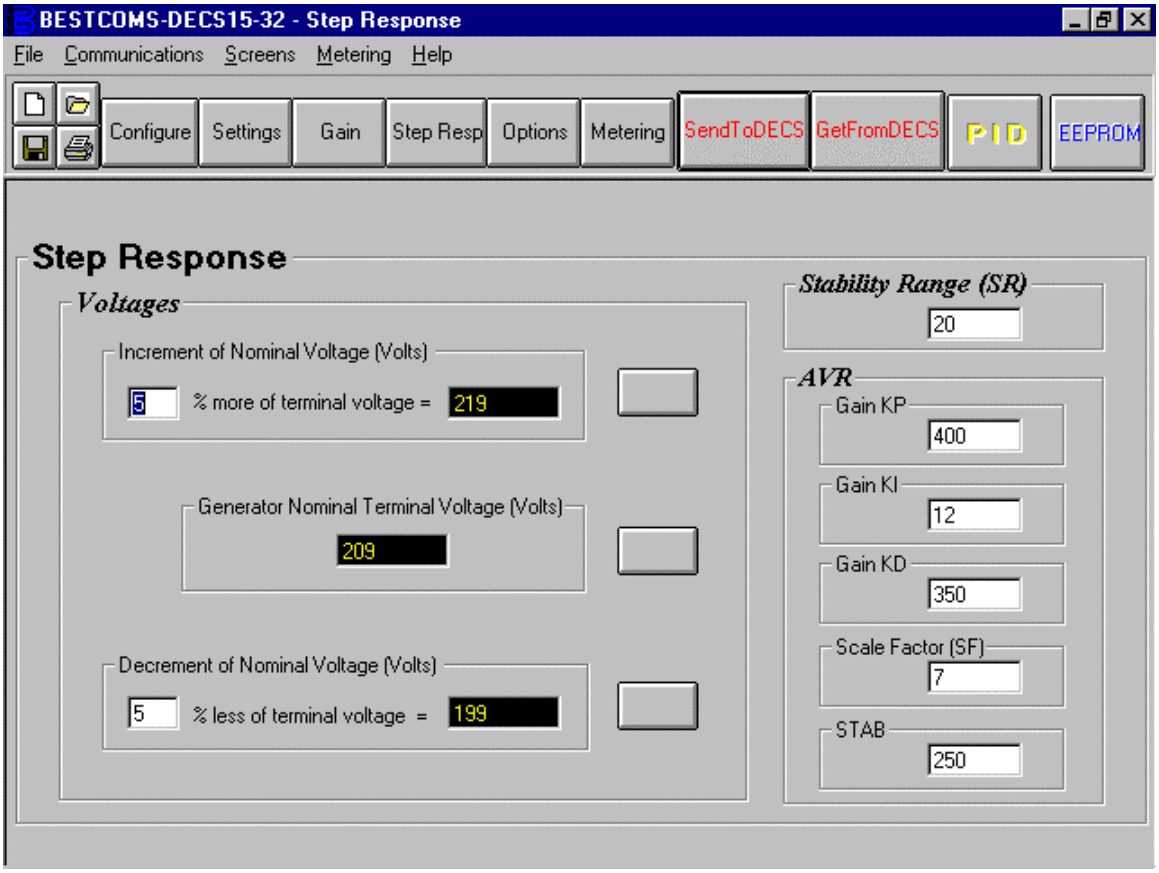


Figure 5-11. Step Response Screen

Step Response, Voltages, Decrement of Nominal Voltage (Volts). This setting lets the user set the voltage step size that the DECS unit will use when step changing the generator voltage. The range of this setting is from 1 to 10% in integer steps. If you choose a 10% step size, the generator terminal output voltage minus the 10% increment step is shown in the adjacent window. To send this voltage to the DECS, select the button adjacent to the indication window.

With this software, you may select the incremental step for the generator terminal voltage and then select the decremental step as the next step. In other words, you may select, in any order, the nominal, incremental, or decremental step response for the generator output voltage.

Step Response, Stability Range (SR) And AVR. The settings shown in the windows for the Stability Range and AVR are identical to those windows in the Control Gain screen display (Figure 5-11). If Stability Range 20 is functional, any changes made to the AVR windows and then sent to DECS also changes the Control Gain windows.

Alarm/Shutdown Options

See Figure 5-12 for the Alarm/Shutdown Options settings descriptions.

Alarm Options. The conditions that control the Alarm Relay are Overexcitation Voltage, Underfrequency, Overtemperature, and Overvoltage. Any one of these conditions can be enabled to activate the Alarm Relay. To enable any condition, select the window associated with the alarm option and an x appears in the window. That condition is then enabled. Selecting the window again toggles the enable off.

Alarm Shutdown. The conditions that control shutting down the DECS output voltage are Overexcitation Voltage, Underfrequency, Overtemperature, and Overvoltage. Any one of these conditions can be enabled to activate shutting down the DECS output voltage. To enable any condition, select the window associated with the shut down option and an x appears in the window. That condition is then enabled. Selecting the window again toggles the enable off.

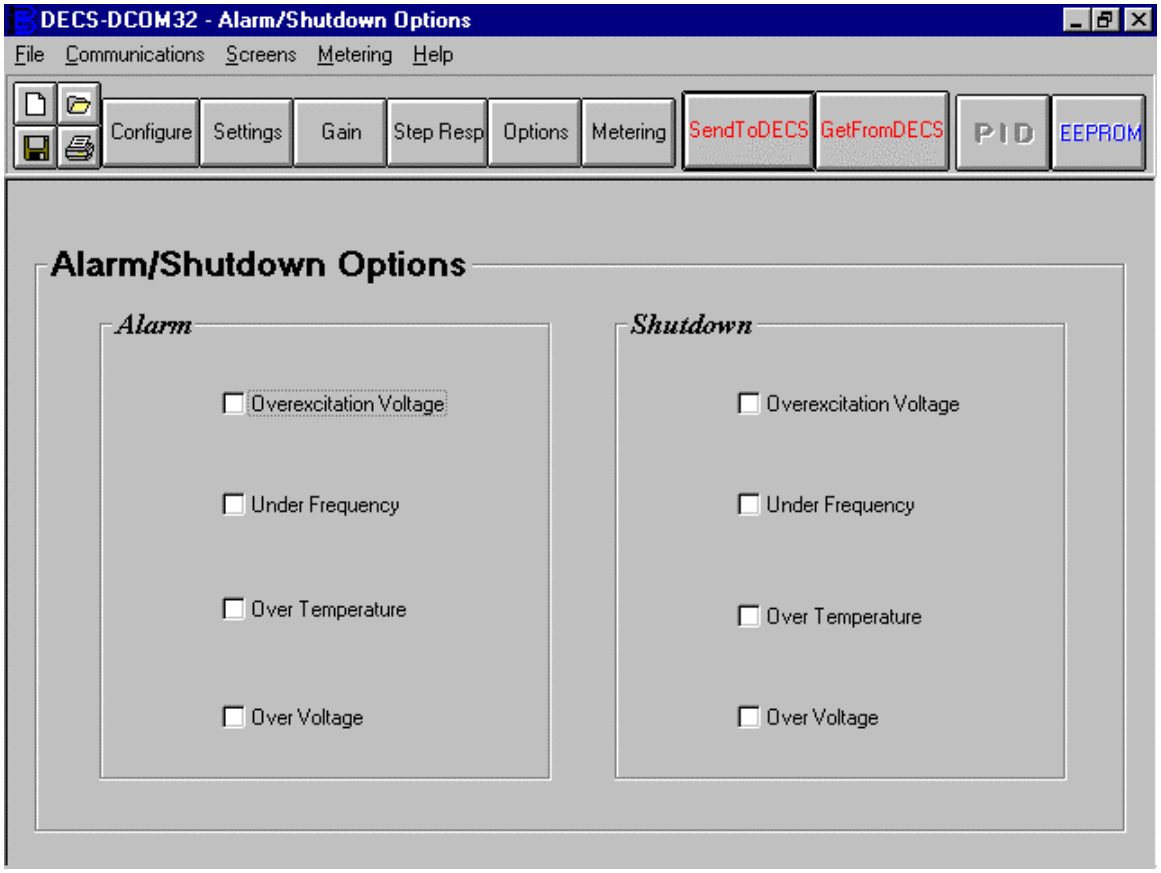


Figure 5-12. Alarm/Shutdown Options Screen

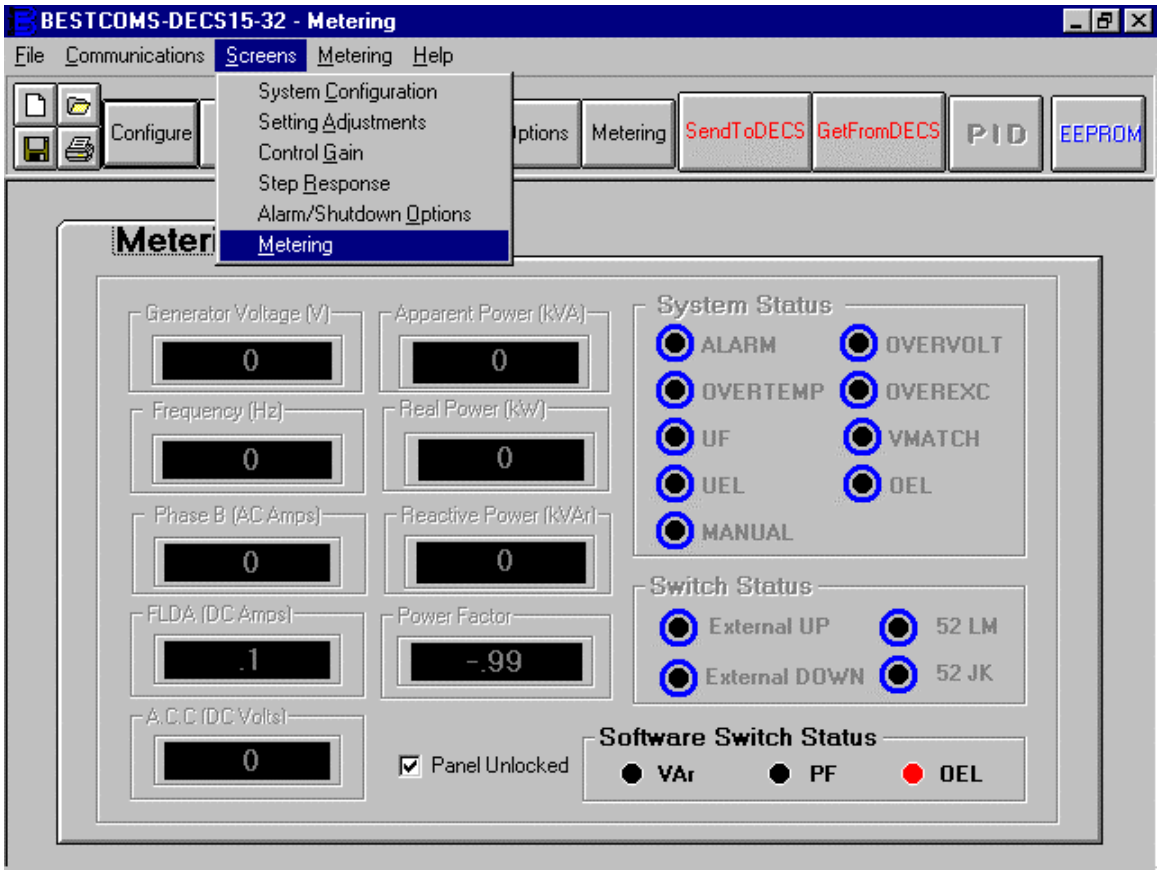


Figure 5-13. Metering Screen

Metering

See Figure 5-14 for the Metering settings descriptions.

DECS Windows™ software provides a means to monitor the metering data and front panel status. Metered data, system status, and switch status are displayed on the computer screen and refreshed approximately every six seconds. Real time monitoring provides critical generator data for evaluating system performance.

Metering. This screen (Figure 5-15) provides real time metering data from the generator system. Data is displayed in the black boxes when active and operating normally. To disable the metering, pull down the **Metering** menu and select **Disable Metering** and wait for the metering mode to terminate (red waiting box disappears).

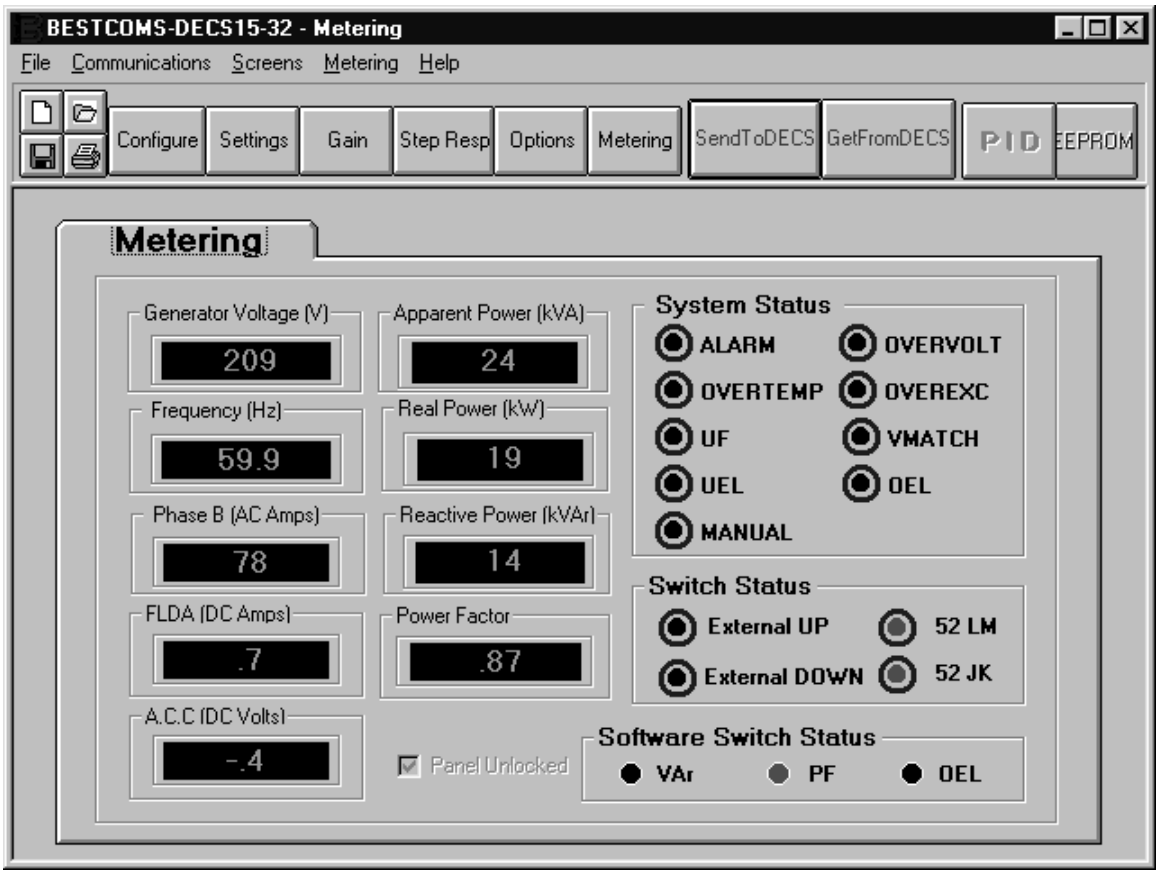


Figure 5-14. Real Time Metering Screen

SAVING, PRINTING, AND OPENING FILES

DECS Windows™ software also allows the user to save setup configurations to a disk. This allows a user to save setups for later use and saves setup time when configuring multiple units. These files may be printed for a hard copy reference and opened in several different ways.

Saving Files

If you have changed the settings on a specific DECS unit, you may want to save those settings for reference or future use. For example, you make the changes to a unit that is in your test system and you want to save the file as *Case1*. Open the pull down **File** menu and select **Save** or click the <Save**>** icon. A message window (Figure 5-15) will ask you what kind of file you want to be saved. Now use normal Windows® techniques and save the file with the default extension (**.dec* for DECS load) or (**.txt* for user edit). If the file is saved as a *.txt file (Figure 5-16), then a dialog box will ask the user to type user's information (Figure 5-17). Click <OK> and a file is now saved in the directory that you selected.

To change the settings in the file, open *Case1.txt* using a word processor such as Windows™ NoteBook, WordPerfect®, or Microsoft® Word. Use normal editing techniques to change the settings values and then print out or save the file with either the same name or a new name.

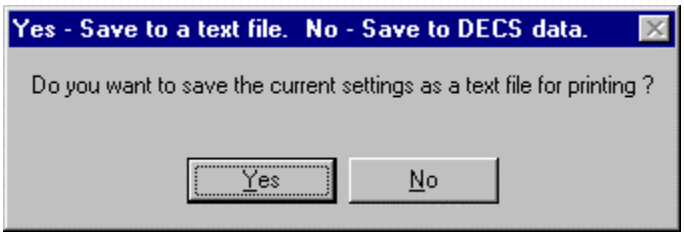


Figure 5-15. Message Window

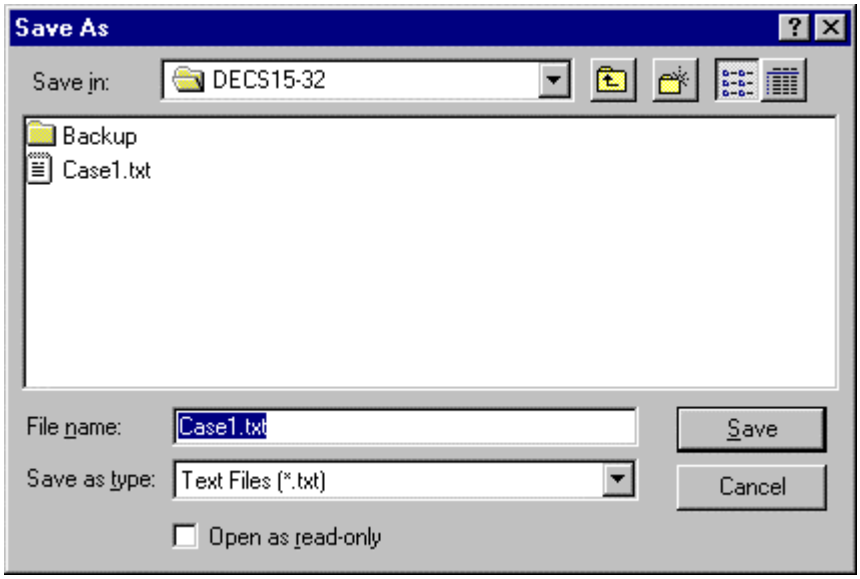


Figure 5-16. Type a file name with extension

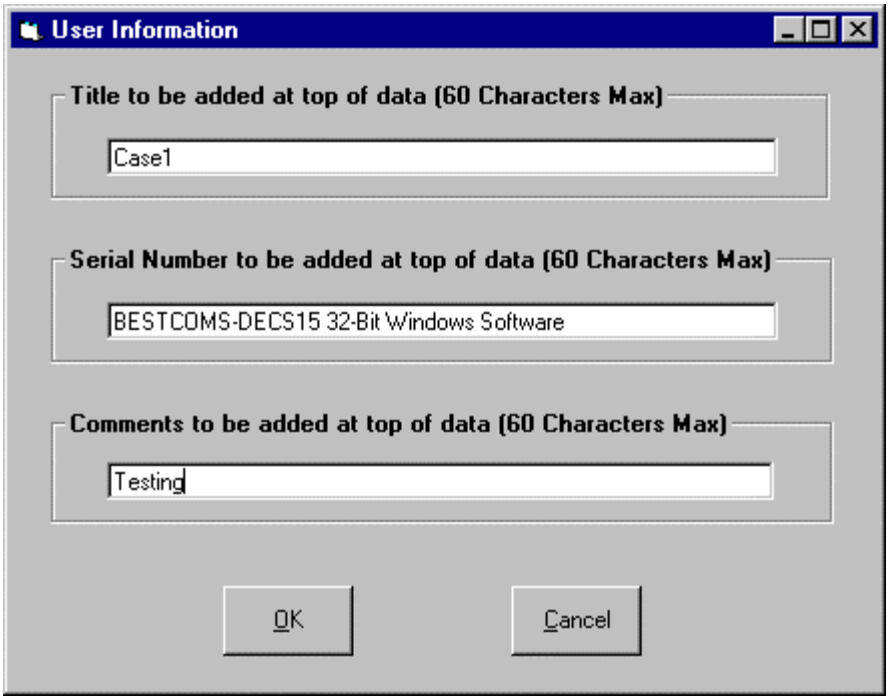


Figure 5-17. User's Information Window

Printing Files

While the *Case1.dec* settings are still shown on the screen, paper copies should be made to be used as reference. To do this, open the **File** pull down menu and select **Print** or click the <Print> icon. When you execute the Print command, you will get a dialog box similar to Figure 5-18. You may fill in the appropriate information for your records, and then complete the Print command. The date, time, user information and data lists are on separate lines. The date and time are referenced to the computers date and time. The following is an example of *Case1.txt* format.

```
********** DECS15-32 Software Version 3.0.7 **********
Date: 11/3/97
Time: 2:27:41 PM
==========User Specified Information==========
Case1
BESTCOMS-DECS15 32-Bit Windows Software
Testing
**************** System Configuration *****************
Control Mode - Manual Switch(MANL):          Off
Voltage Matching Switch(VMAT):               Off
VAR Control Switch(VAR, Optional):           Off
Power Factor Control Switch(PF, Optional):   Off
UEL Option(Factory Setting, Optional):       Enabled
OEL Enabled Switch(OEL, Optional):           On
Phase Configuration:                         A-B-C
Sensing PT Ratio(=Primary/Secondary):         1
Sensing CT Ratio(=Primary/Secondary):         200
***************** Setting Adjustments *****************
Generator Terminal Voltage(GV=CV+FV):         209 Volts
Generator Range Select:                       Auto
Fine Voltage Adjustment Band(FVAB):           10
Fine Voltage Adjustment Speed(FVAS):          4
Voltage Matching Band(BAND):                  20
Voltage Matching Speed(MSPD):                 2
Voltage Matching Step(MSTP):                  2
Manual Field Current Setting(MANL):           1 Amps
Droop Setting(DRP):                           4%
Reactive Power Adjustment Setting(VAR):       1%
Power Factor Setting(PF):                     1
```

```
Under Excitation Limiter Setting(UEL):        20%
OEL - High Current Time Setting (OET1):       1 sec
OEL - Medium Current Level Setting(OEI2):     12 Amps
OEL - Medium Current Time Setting(OET2):      120 sec
OEL - Low Current Level Setting(OEI3):        10 Amps
Under Frequency Setting(UF):                  54 Hz
Volts per Hertz Setting(V/Hz):                1
Over Voltage Trip Setting(OVT):               35%
Loss of Sensing Time Setting(LST):            5 sec
******************** Control Gain *********************
Stability Range(SR):                          20
AVR Generator Proportional Gain KP:           400
AVR Generator Integral Gain KI:               12
AVR Generator Derivative Gain KD:             350
AVR Scale Factor(SF):                         7
STABILITY:                                    250
VAR Proportional Gain KP:                     8
VAR Integral Gain KI:                         8
PF Proportional Gain KP:                      8
PF Integral Gain KI:                          8
UEL Proportional Gain KP:                     8
UEL Integral Gain KI:                         8
OEL Proportional Gain KP:                     8
OEL Integral Gain KI:                         8
Soft Start Speed(SFST):                       0
PWM Start To Adjust Initial Start-Up:         4
******************** Alarm Option *********************
Overexcitation Voltage Alarm Setting:        Off
Under Frequency Alarm Setting:               Off
Over Temperature Alarm Setting:              Off
Over Voltage Alarm Setting:                  Off
****************** Shutdown Option ********************
Overexcitation Voltage Shutdown Setting:     Off
Under Frequency Shutdown Setting:            Off
Over Temperature Shutdown Setting:           Off
Over Voltage Shutdown Setting:               Off

============= All settings were saved ===============
```

Opening Files

Only a DECS file *(*.dec*) can be loaded into DECS for changing settings. Suppose that after you reviewed either the DECSxxx-15-xxx unit performance or the actual settings, you wanted to make a change in those settings but did not have the DECS unit available. Open the *Case1.dec*, which is closest to your desired settings. Update your setting values from screen to screen, then save to a DECS file *(*.dec*).

To get this new DECS file into the DECS unit, initiate communications with the DECS unit as you did previously. Now open the **File** pull down menu and select **Open** or click the <Open> icon. Use normal Windows® techniques to select the new file. When you execute the **Open** command, the existing settings are replaced by the new settings on all screens. Then you can save these new settings by executing the Communications, **SendToDECS** command.

Default Settings Open

When you click the icon at the up left corner of the four pictured icons, the existing settings will be replaced by the factory default settings.

PID WINDOW

DECS Windows™ software provides the capability to increase the generator stability. This capability calculates PID (Proportional-Integral-Derivative) parameters automatically after the user selects generator frequency, generator time constant (**T'do),** and exciter time constant (**Texc)**. Users may generate new PID numbers, add to a PID list file, and update the AVR gain settings in the Control Gain or Step Response screens. The <PID> button allows users to access the PID Window. It will be available only when the Stability Range is set to 20 in either the Gain Screen or Step Response Screen.

When you select the PID button, the PID Window (Figure 5-19) allows you to modify the PID numbers. After PID numbers are calculated and updated, you can close this window by pressing the <DONE> button. Modified PID numbers will be shown in the CURRENT SCREEN. When complete, you may use the <SendToDECS> command to update the DECS PID gain settings. If this command is not executed, the setting changes will not be saved.

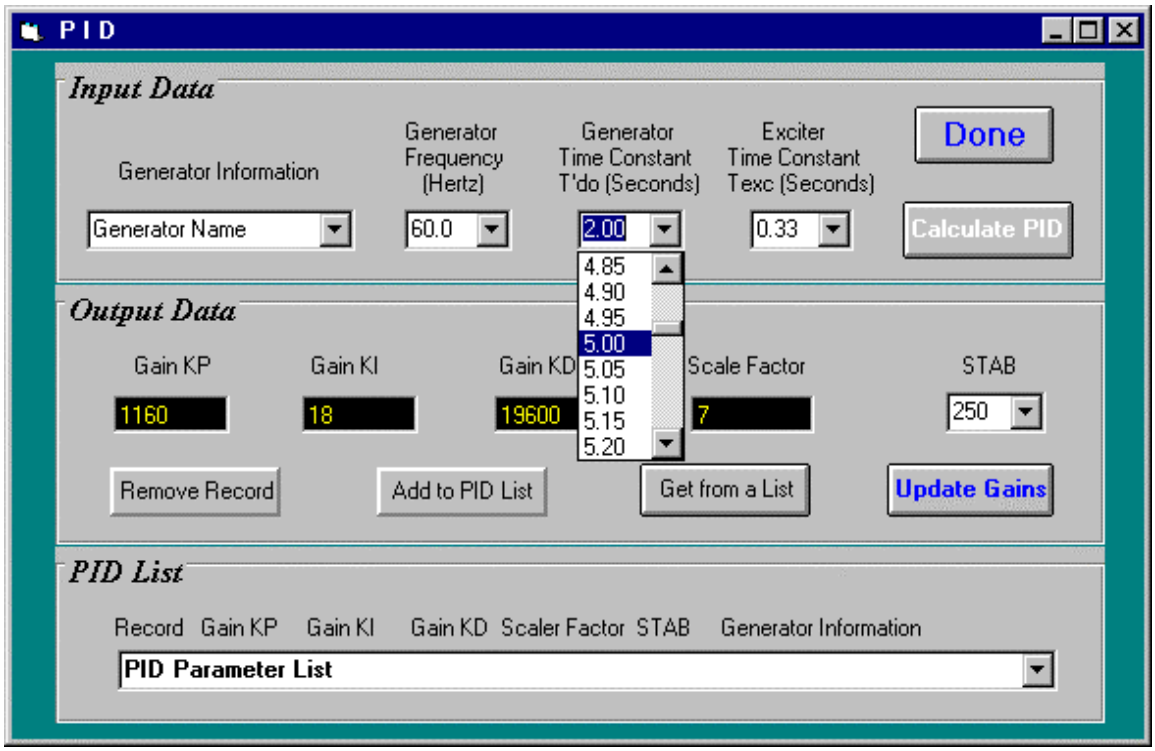


Figure 5-18. PID WINDOW Select Frequency Input

PID Calculations Based On Input Values

At a specified frequency (50 or 60 hertz), the exciter time constant available range is determined by the generator time constant input value. The generator time constant input value must be in the range of 1.00 to 15.00 seconds and in 0.05 second increments. When the generator time constant value is 1.00, the available exciter time constant range is 0.03 to 0.50 in 0.01 second increments. When the generator time constant value is 15.00, the available exciter time constant range is 0.30 to 3.00 in 0.01 second increments.

The default value for the exciter time constant is the generator time constant divided by six. For example, when you set **T'do**=2.0 seconds (Figure 5-19), **Texc** is 0.33. After specifying the input values, a set of PID parameters (Output Data) can be generated by pressing the <Calculate PID> button. Clicking the <Calculate PID>, the KP is 839, KI is 18, KD is 10808, and Scale Factor is 7. If you set **T'do**=14.95 seconds(Figure 5-20), the **Texc** will be 2.49 seconds. Clicking <Calculate PID>, the KP is 277, KI is 1, KD is 32628, and Scale Factor is 6.

PID parameters can be directly added to, removed from, or modified in the PID List Data (Figure 5-21). PID parameters may also be saved to a file (*pidlist.dat*).

Retrieving Existing Data From PID List

Select one case from the PID List (Figure 5-21), then click the <Get from a List> button, the rectangular black boxes will then show the PID numbers that were retrieved. <Update Gains> and <Done> buttons can be used to change the gain settings on the CURRENT SCREEN.

CAUTION

Improper PID numbers will result in poor system performance or equipment damage!

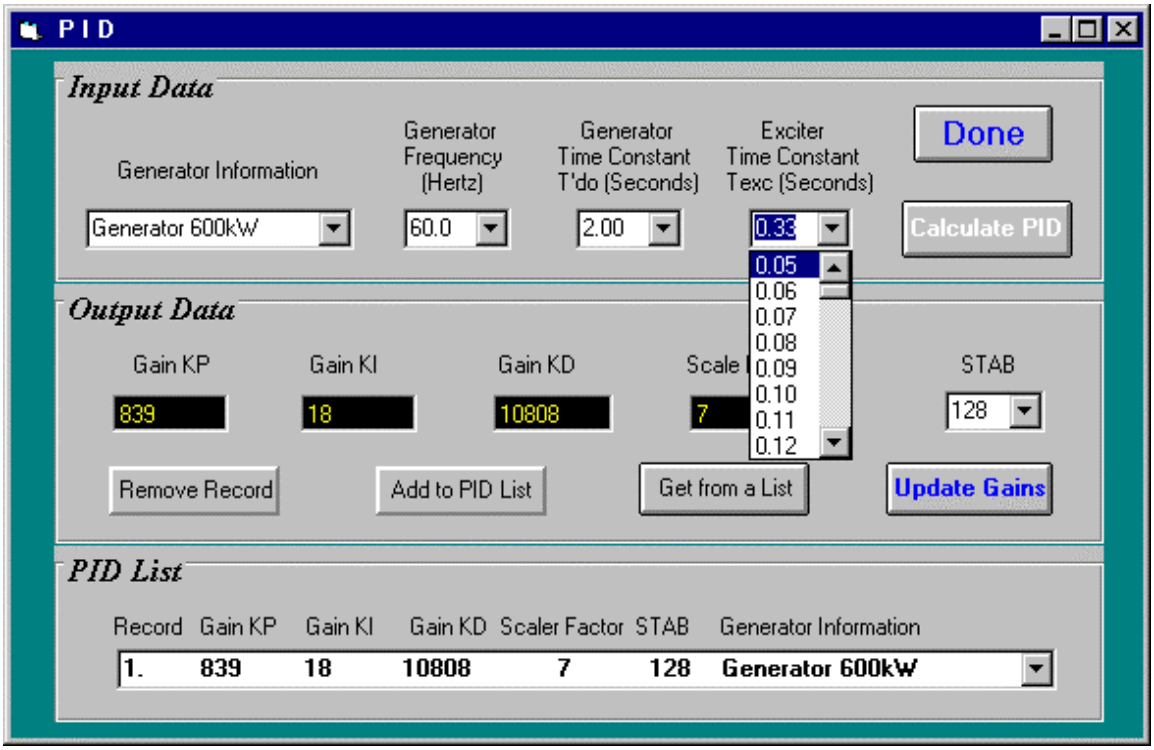


*Figure 5-19. PID Window with a **Texc** Range when **T'do** is 2.00 Seconds*

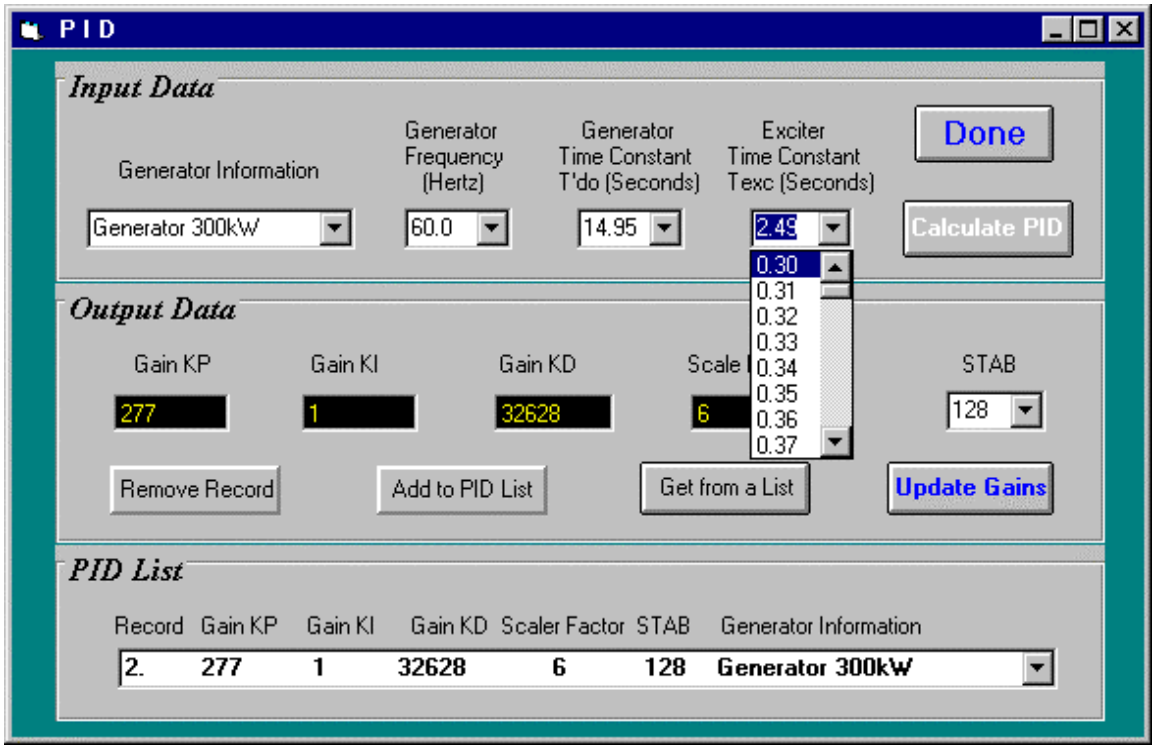


*Figure 5-20. PID WINDOW with a **Texc** Range when **T'do** is 14.95 Seconds*

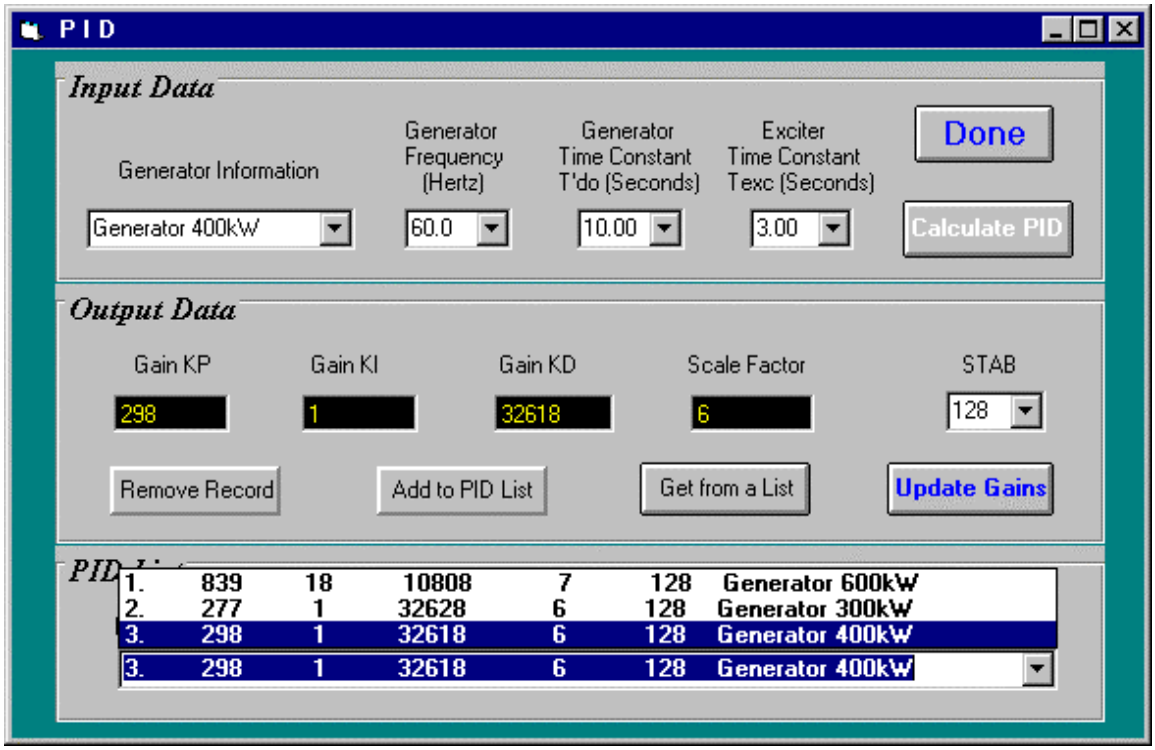


Figure 5-21. PID List Data

TERMINATING COMMUNICATIONS

To terminate DECS communications, pull down the **Communications** menu and select **Close** (Figure 5-22). You are asked if you want to save the settings to EEPROM. This question is asked even if you made no changes. When you execute the Close command (with a Yes or No to save the settings to EEPROM), the communications is terminated. Pull down the **File** menu (Figure 5-23), choose **Exit,** and the DECS Windows™ software is terminated. If you choose to Exit the software program directly and not close the communications first, you will still be asked if you want to save the settings to EEPROM.

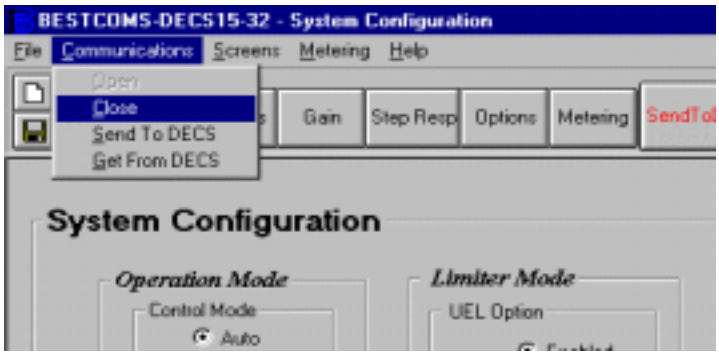


Figure 5-22. Close Communications

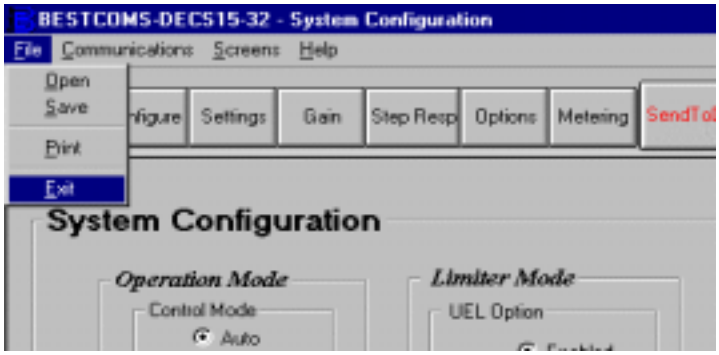


Figure 5-23. Exit BESTCOMS Software

SECTION 6 • MAINTENANCE

PREVENTIVE MAINTENANCE

The only preventive maintenance required on the DECS is to periodically check the following:

- Be sure the connections between the DECS and the system are clean and tight.
- Verify that the DECS cooling fins and housing are free from dust, dirt, and corrosion.

CORRECTIVE MAINTENANCE

The DECS has been designed for easy repair by replacement of electronic modules. Refer to Section 8 for the replacement parts list.

WARRANTY AND REPAIR SERVICE

The Basler DECS is warranted against defective material and workmanship for 18 months from the date of shipment from our factory. Units submitted for warranty repair should be returned to the factory in Highland, Illinois, freight pre-paid, with a complete description of the installation and the reported problem. Pre-arrangement with either the nearest Basler Sales Office or with the Customer Service Department at the factory will assure the fastest possible turn-around time.

TROUBLESHOOTING

Common generator system malfunctions and the appropriate repair procedures are in the following paragraphs.

NO VOLTAGE BUILD-UP

Step 1. Verify that all wiring is properly connected. Refer to Figure 3-7 through 3-11.

If wiring is improperly connected, loose, miswired, etc., reconnect wiring properly.

If wiring is properly connected, proceed to Step 2.

Step 2. Check for correct power input to the DECS. Refer to Table 1-2, "Power Input" requirements.

If voltage is not present, refer to generator manual for PMG repair (PMG system only).

If voltage is present, proceed to Step 3.

Step 3. Verify that all fuses are not open.

If any fuse is open, replace fuse.

If all fuses are not open, proceed to Step 4.

Step 4. Verify that generator is up to rated speed.

If generator is not up to rated speed, increase generator speed to rated.

If generator is up to rated speed, proceed to Step 5.

Step 5. If the DECS is being used in (non-PMG) mode, verify that the generator residual voltage is at least 8 Vac.

If the generator residual voltage is less than 8 Vac, refer to the generator manual and flash the generator field.

If the generator residual voltage is 8 Vac or greater, proceed to Step 6.

Step 6. Verify that the front panel OVEREXC (Overexcitation) LED is extinguished.

If the front panel OVEREXC LED is illuminated, check the generator and/or load conditions. Interrupt input power or shut down the generator for a minimum of 10 seconds.

If the front panel OVEREXC LED is not illuminated, proceed to Step 7.

Step 7. Verify that the front panel OVERVOLT (Overvoltage) LED is extinguished.

If the front panel OVERVOLT LED is illuminated, check the generator and/or load conditions. Interrupt input power or shut down the generator for a minimum of 10 seconds.

If the front panel OVERVOLT LED is not illuminated, proceed to Step 8.

Step 8. Verify that the front panel OVERTEMP (Overtemperature) LED is extinguished.

If the front panel OVERTEMP LED is illuminated, increase cooling air to the DECS or allow the ambient air to cool. Interrupt input power or shut down the generator for a minimum of 10 seconds.

If the front panel OVERTEMP LED is not illuminated, proceed to Step 9.

Step 9. Replace the DECS unit.

If replacing the DECS unit does not correct the malfunction, then the generator is defective. Consult with the generator manufacturer.

LOW OUTPUT VOLTAGE

Step 1. Verify that the Coarse Voltage adjustment is not set too low.

If the Coarse Voltage adjustment is too low, adjust it to a higher range.

If the Coarse Voltage adjustment is not too low, proceed to Step 2.

Step 2. Verify that the Fine Voltage adjustment is not set too low.

If the Fine Voltage adjustment is too low, adjust it to a higher range.

If the Fine Voltage adjustment is not too low, proceed to Step 3.

Step 3. Replace the DECS unit.

HIGH OUTPUT VOLTAGE

Step 1. Verify that the Coarse Voltage adjustment is not set too high.

If the Coarse Voltage adjustment is too high, adjust it to a lower range.

If the Coarse Voltage adjustment is not too high, proceed to Step 2.

Step 2. Verify that the Fine Voltage adjustment is not set too high.

If the Fine Voltage adjustment is too high, adjust it to a lower range.

If the Fine Voltage adjustment is not too high, proceed to Step 3.

Step 3. Replace the DECS unit.

GENERATOR DOES NOT RESPOND AS ADJUSTMENTS ARE MADE

Step 1. Reset the DECS by interrupting input power or by shutting down the generator for a minimum of 10 seconds. If the generator still does not respond, proceed to Step 2.

Step 2. Replace the DECS unit.

POOR VOLTAGE REGULATION

Step 1. Verify that the case of the DECS is properly grounded.

If the DECS' case is not properly grounded, ground the DECS case by:

a) Connect dedicated ground wire to 1/4" faston labeled "GND" at rear of case.

If the DECS' case is properly grounded, proceed to Step 2.

Step 2. Check for grounded field leads.

If the field leads are grounded, isolate them from ground.

If the field leads are not grounded, proceed to Step 3.

Step 3. If used with a PMG, check for grounded PMG leads. If the PMG leads are grounded, isolate them from ground. If the PMG leads are not grounded, proceed to Step 4.

Step 4. Replace the DECS unit.

GENERATOR OUTPUT UNSTABLE (HUNTING)

Step 1. Verify that the genset prime mover governor is operating properly.

Step 2. Verify that the sensing and input power leads are connected securely.

If the sensing or input power leads are not connected securely, tighten the connections.

If the sensing or input power leads are connected securely, proceed to Step 3.

Step 3. Verify that the Stability Range is set to the proper range. (Refer to Section 4.)

If the Stability Range is not set to the proper range, reset the Stability Range.

If the Stability Range is set to the proper range, proceed to Step 4.

Step 4. Verify that the Stability Level is properly set. (Refer to Section 4.)

If the Stability Level is not properly set, reselect the Stability Level.

FRONT PANEL UF (Underfrequency) LED IS ILLUMINATED

Step 1. Verify that the generator is operating at rated speed.

If the generator is not operating at rated speed, change the speed to the rated speed.

If the generator is operating at the rated speed, proceed to Step 2.

Step 2. Verify that the front panel Underfrequency setting is correct.

If the front panel Underfrequency setting is incorrect, reset the transition point.

Step 3. Verify that all sensing and power input connections are secure.
If connections are not secure, secure connections.

FRONT PANEL OVEREXC (Overexcitation) LED IS ILLUMINATED

Step 1. Check for generator overloading.

If generator is operating with a larger than rated load, shed load.

If generator is operating with a rated or less than rated load, proceed to Step 2.

Step 2. Replace the DECS unit. If replacing the DECS unit does not correct the malfunction, proceed to Step 3.

Step 3. Refer to generator manual. Generator is defective.

NO DROOP OR NEGATIVE DROOP (GENERATOR NOT SHARE LOAD)

Step 1. Check for open in Droop CT wiring.

If wiring is open, repair wiring as necessary.

If wiring is not open, proceed to Step 2.

Step 2. Verify that Droop CT polarity is correct.

If polarity is incorrect, reverse connections at terminals CTB1 and CTB2.

If polarity is not reversed, proceed to Step 3.

Step 3. If the above steps fail to correct the malfunction, replace the DECS unit.

NO VOLTAGE MATCHING

Step 1. Verify Voltage Matching option was purchased and is enabled.

If not enabled, adjust state through front panel switches.

If enabled, proceed to Step 2.

Step 2. Verify all connections are correct per Figures 3-10 through 3-13 as required for the Voltage Matching optioned DECS.

If the interconnection is incorrect, reconnect per appropriate interconnect diagram.

If the interconnection is correct, proceed to Step 3.

Step 3. Check for correct utility reference voltage on DECS terminals BUS1 and BUS3.

If the interconnection is incorrect, reconnect per appropriate interconnect diagram.

If the interconnection is correct, check for open system fuses.

Verify correct sensing potential transformer, if used, is used on BUS1 and BUS3 leads.

If correct, proceed to Step 4.

Step 4. Verify the generator output voltage setpoint is within 20% of measured utility bus voltage.

If setpoint is too low, adjust Coarse Voltage (CV) to the appropriate level.

If setpoint is correct, proceed to Step 5.

Step 5. If the above steps fail to correct the Voltage Matching malfunction, replace the DECS.

FINE VOLTAGE ADJUST BAND NOT CENTERED AROUND THE COARSE VOLTAGE ADJUST SETTING

Step 1 Use the **SELECT** button on the front panel to select coarse voltage adjust.

Step 2 Press and release the **DECREASE** button.

Step 3 Press and release the **INCREASE** button.

Step 4 Press and release the **SELECT** button.

OR , ALTERNATIVELY, USE THE DCIM:

Step 1 Select “Generator Voltage”

Step 2 Press and release <ENTER>.

SECTION 7 • REPLACEMENT PARTS

GENERAL

The following list (Table 7-1) describes the components and assemblies of the DECS that have maintenance significance. When ordering parts from Basler Electric Company, be sure to specify the DECS Model and Style Number, reference Basler replacement part number, quantity, and description.

Table 7-1. Replacement Parts

Reference	Part Number	Qty.	Description
--	9 2849 00 101	1	DECS Power Module
--	9 2653 00 046	1	Settings Label, adhesive-backed.

Basler Electric
ROUTE 143, BOX 269
HIGHLAND, IL 62249 USA
http://www.basler.com, info@basler.com
PHONE 618-654-2341 FAX 618-654-2351