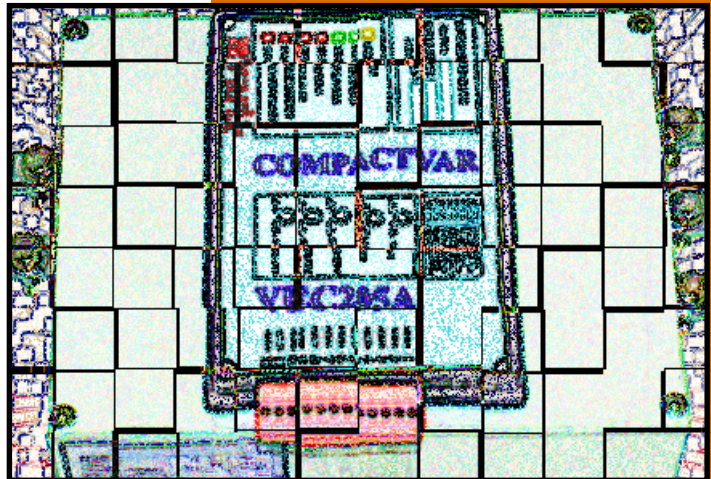


Bulletin

210EE

VEC205E COMPACT AVR / EXCITER



GENERATOR STATIC EXCITER

VEC205D Series Static Exciters

BULLETIN 210D

COMPACTVAR



VEC 205E/1/50

The VEC 200 series is a family product that include AVRs (Automatic Voltage Regulators) for Generators, Static Exciter and Drivers for Synchronous Motors and Alternators, High Current Controlled Rectifiers or Simple 1 quadrant CC Motor Drive. The VEC205E is an AVR Automatic Voltage Regulator/ Generator Static Exciter to be used in all types of alternators.

The VEC205E utilizes IGBT (Insulated Gate Bipolar Transistor) that dispenses synchronism in the exciting power inputs (A, B and C) and enables the use of continuous current supply like CC PMG (Permanent Magnet Generator). The PWM control is made at more than 1000 Hz frequency getting very low dead time.

The VEC205E is an economical, monoboard architecture, plug in, reliable and good performance product.

The VEC205E has some incorporated functions and protections. The control signal type could be chosen when ordering.

The voltage sensing is made synchronously by sample and hold integrated circuit, and than averaged, which provides low second order retard and fast response time.

The VEC205E has separated P + I + D adjusts that together with the sensing characteristics enable it to operate virtually in any machine. Five adjusts are available at the front panel.

Seven LEDs signalizes its functions and fails conditions.

Eight DIP Switches at front panel, simplifies the function selection.

The removable connector enables an easy control module change.

The control module VEC205EC is the core



VEC205E + EXCITATION TRANSFORMER

of the system. When plugged to power module, from 10 to 1000 Ampere, forms the final equipment, that could be an AVR, a compact exciter, or if mounted inside a panel, with auxiliary equipment (like circuit breaker, crowbar, fuses and transformers), a complete Generator Static Exciter system.

The VEC205E is a good choice for reliable and economical equipment, with a good performance. The mono board architecture, encapsulated Plug In modules allows high tolerance to hostile environment and to vibrations besides allowing easy maintenance with a simple module change. The power semiconductors used are encapsulated insulated base types, highly reliable and allow clean assemblage and ease maintenance. The control module uses a 3-phase or 2-phase diode bridge with IGBT for the PWM chopper.

There are two modes of KVAR compensation available for paralleling generators: by an external power factor transducer or by an internal power factor transducer included in module. The P.F. sensed by the Power Factor transducer is added to the voltage readings to get the Droop by Reactive Power Factor Compensation" method.

The IGBT Firing Module are fully encapsulated in high insulation epoxy resins.

VEC205E

• **Applications:** AVR and Static Exciter for Synchronous Alternators.

• **Available control signal:**

0 to 5 V, 0 to 10 V, Potentiometer, 0 to 20 mA, 4 to 20 mA.

• **Modes:** Voltage regulation with Droop by KVAR portion of the load (Compound), allowing Reactive Droop Compensation for parallel operated generators or electric network paralleling (Cogeneration).

• **Trips:** Overvoltage, Underfrequency, Overtemperature, and Loss of signal.

• **Signalizers:** Power On, Enable, Droop, Signal Loss, Overvoltage, Underfrequency and Overtemperature.

• **Function Selections:** Inhibit On Fail, P.F. Internal/ External, P.F. Polarity, Setting Range Wide/Narrow, Proportional Enable, Proportional Integrative Enable, Derivative Enable and Mode Automatic / Manual.

• **Power:** 3-phases or 2-phases diode bridge rectifier and PWM controller by IGBT (Chopper). Power can be supplied by AC or DC source.

The VEC205E (series VEC 20X) is a good choice for generators exciters. It can be used as AVR / exciter for generators with auxiliary mechanical exciter or Brushless generator or it can be a Power Static Exciter for collector ring generators.

It was developed mainly to get high reliability and simplicity.

It can be applied in machines to 30.000 KVA and up.

The plug in monoboard encapsulated architecture, allows clean and reliable assemblage.

The LEDs signalization and DIP switches makes the equipment friendly and intuitive. It allows simple commissioning and use.

Five options of input signals are available.

Varix can supply a complete line of Exciter, including digital programmable models.

COMPACTVAR

VEC205D

BULLETIN 210D

GENERATOR EXCITATION:

- **AVR (AUTOMATIC VOLTAGE REGULATOR): VOLTAGE REGULATOR FOR BRUSCHLESS ALTERNATOR OR WITH EXTERNAL AUXILIARY ROTARY EXCITER TO 50 AMPERE FIELD CURRENT OR STATIC EXCITER FOR COLLECTOR RING TYPE TO 1000 AMPERE FIELD CURRENT:**

It allows keeping constant voltage at the generator output and getting reactive current compensation in parallel operated generators for KVAR sharing with another machines or with the electrical supplier network. The sharing of the reactive load is made by Droop method based in the machine Power Factor.

The Power Factor is digitally measured, by means of signals from P.T. and C.T. in the stator circuits or by an external transducer, like the GE Multilin SPM model. In both cases the Droop rate can be adjusted from 0 to 5%.

The regulation mode can be selected by an external command, to "Constant Voltage" or "Compound Voltage with Reactive Droop Compensation".

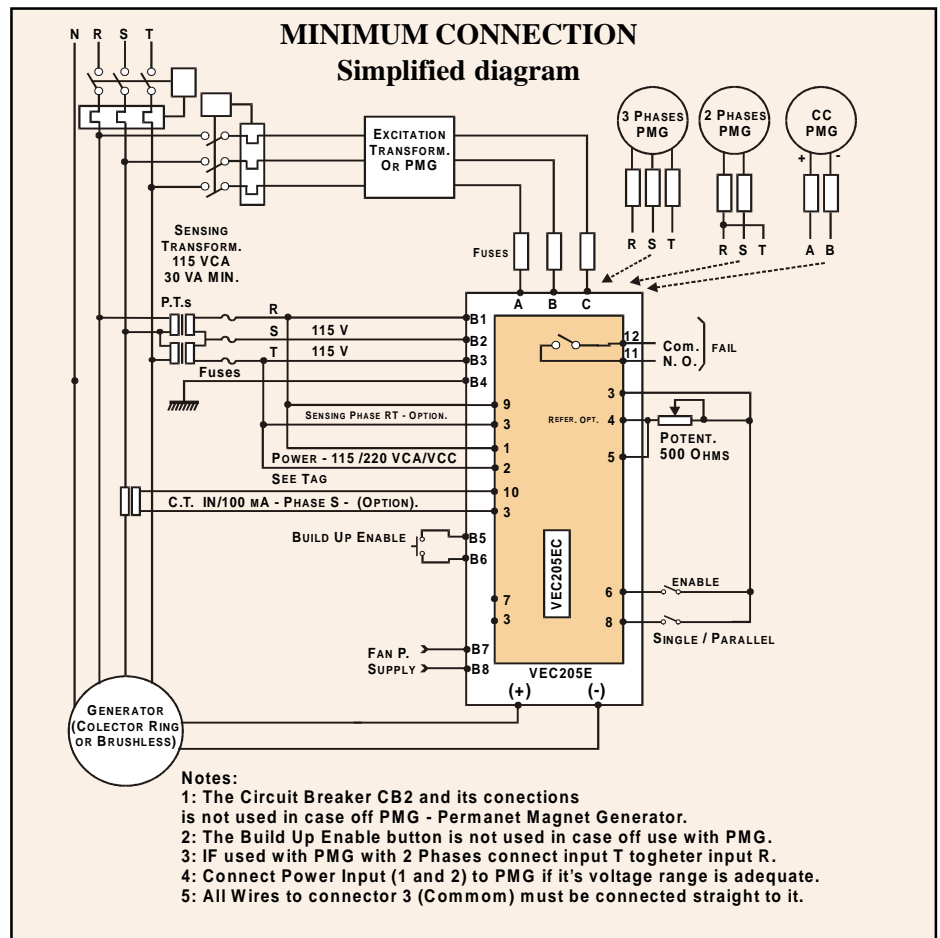
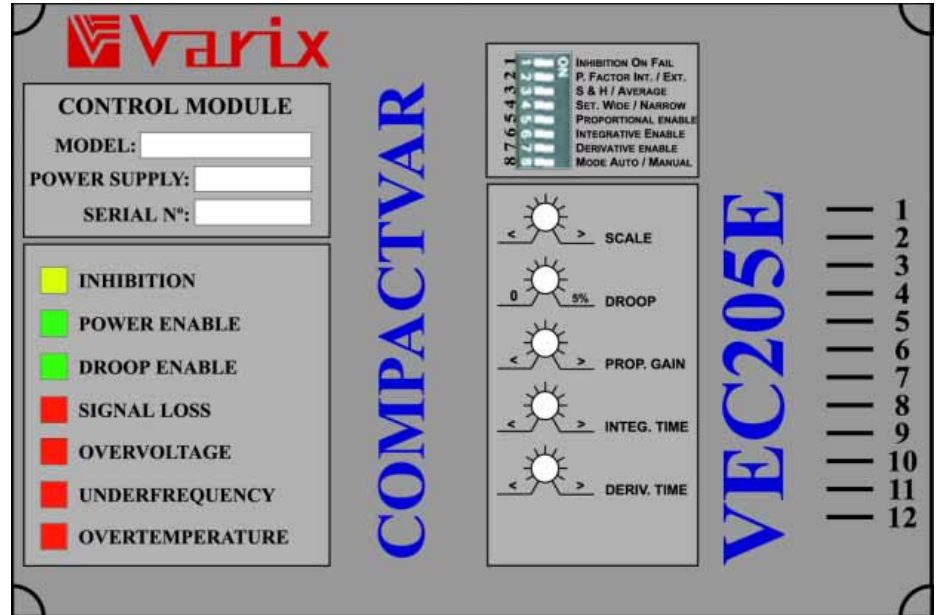
The protections Loss of Signal, Generator Overvoltage, Generator Underspeed and Exciter Overtemperature are active in this application.

Some parameters can be adjusted in the front panel: Proportional Gain (P - proportional action), Integrative Time (I - Integrative action), Derivative time (D - derivative action), Voltage scale and Droop percentage.

Automatic Build Up with manual enabling is available.

The mode of operation can be choused Automatic or Manual. The manual operation can be used for a full range generator voltage adjust, especially with auxiliary power supply, for tests and characteristics measurement purpose or used in emergency operation as a second channel manual or manual follow up.

The Manual mode (or Drive mode) can be used as a drive for an external regulator actuating at the setting range input.



DIP SWITCHES SELECTIONS:

- **S1- “Inhibition On Fail”**: Selects the Inhibition function of the output in case of fail. If not selected the only action will be a Fail Relay signalization.
- **S2- “Droop Internal/External”**: Selects the power factor transducer source for Droop signal.
- **S3- “Sensing Type”**: Selects the type of the sensing: **“Sample & Hold”** that provides fast response but is a little sensitive to wave distortions and **“Average”** that presents second order retard but is more insensitive to wave distortions).
- **S4- “Setting Range Wide/Narrow”**: Selects setting range: narrow or wide (0 to 100% / +/- 10% of the scale).
- **S5- “Proportional Gain”**: Enables the pure proportional gain error amplifier. The value must be adjusted in the front panel for the best response, without oscillations and minimum overshoot and undershoot. Normally used in almost all applications.
- **S6- “Integrative Time”**: Enables the I portion of the error amplifier. The integrative time must be adjusted in the front panel for the best stability and to get the minimum overshoot, undershoot and the fastest reaction time possible. Normally used in almost all applications.
- **S7- “Derivative Time”**: Enables derivative gain error amplifier. The value must be adjusted in the front panel for the fastest reaction time, but without oscillations and to get the minimum overshoot, and undershoot. Used in a few applications.
- **S8- “Automatic/Manual or Regulator/Drive”**: At “OFF” it selects the mode “Automatic” (or Regulator), with regulation based in the error signal. At “ON” it selects “Manual” (or Drive); it means that the output is proportional only to setting signal (reference). In this mode there is not a local closed loop and the equipment is simply a drive for external regulators or a manual exciter.

LEDs SIGNALIZATION:

- **L1- “Inhibit”**: (Yellow) - Signalizes that the equipment is powered ON.
- **L2- “Power Enable”**: (Green) - Signalizes that the equipment is enabled by a signal at corresponding connector.
- **L3- “Droop Enable”**: (Green) - Signalizes that there is a Droop command at corresponding connector.
- **L4- “Signal Loss”**: (Red) - Signalizes “Loss of Signal” (setting signal loss). This function is enabled by the command signal at corresponding connector. The condition is memorized until a power down occurs.
- **L5- “Overvoltage Trip”** - (Red): Signalizes a trip by excess of generated voltage.
- **L6- “Underfrequency Trip”** - (Red): Signalizes a trip by a machine underspeed.
- **L7- “Overtemperature”**: (Red) - Signalizes an overtemperature condition in the exciter power heater exchanger.

Note: There is a 2 to 3 seconds time delay to avoid erroneous tripping. The trip condition is memorized until a power down occurs, if auxiliary power supply is used. Otherwise, if “Inhibition on Fail” is selected or relay signalization is used to trip the system, the indication will be lost. To reset a memorized fail indication is necessary that the module be powered off and powered on again.

FRONTAL PANEL ADJUSTS:

- **P1- “Scale”**: End of scale calibration if a 100% setting range (Wide) is selected at DIP S4, or to calibrate the nominal value for medium of scale if a +/-10% (Narrow) setting range is selected at DIP S4.
- **P2- “Droop”**: Adjustable from 0 to +5% Droop. The 5% compounding rate is got with 90° rotor polar angle. Normally used from 0 to 2.5% for parallel operating generators, maintaining the correct reactive load sharing. The compensation will be initiated at Droop command. In single generator system without cogeneration this function is not used.
- **P3- “Proportional Gain”**: adjustable from 1 to 20. Active if selected at corresponding DIP. How this is a pure proportional amplifier, this adjust has influence in dynamic regulation and static regulation. It must be adjusted to get the fastest compensation of the input changes but without instability.
- **P4- “Integration Time”**: This is a integrative gain amplifier with integration time adjustable from 0.01 to 1 S. Active if selected at corresponding DIP. It must be adjusted to get the best stability possible with minimum overshoot and undershoot. This portion of error amplifier is mainly responsible for the static regulation and it must be selected in almost all cases.
- **P5- “Diferentiation Time”**: adjustable from 0.01 to 1 S. Active if selected at corresponding DIP. It allows a fast compensation of dynamic variations. Normally utilized for generators with slow response time. It must be adjusted to get the fastest response and the best stability. This portion of error amplifier is mainly responsible for dynamic regulation.

CONTROL MODULE ELECTRICAL DATA:

The side table shows the electrical data of the inputs and outputs of the control module, for both connectors (the front connector and the rear side DB15 connector). Also some signals connected to the power module (TB) are shown.

Some signals are chosen at order. This way the various options are shown separated. The type and real data are filled in a data sheet that is sent with the equipment. The data sheet shows some important information including signals, power components, date of delivery, guarantee period, input and output data etc.

The user's manual includes this bulletin, electrical drawings, mechanical drawings, and the custom data sheet.

	Bornes		Minim.	Nominal	Maxim.	
TOP CONNECTOR						
0 to 5 V Setting	B4 / B3	Input Impedance	—	10 K	—	Ohms
0 to 10 V Setting	B4 / B3	Input Impedance	—	10 K	—	Ohms
0/4 to 20 mA Setting	B4 / B3	Input Impedance	—	250	—	Ohms
500 Ohms Pot Setting	B4 - B5 / B3	Output Current	—	10	—	mA
0 to 5 V P. Factor Sygnal	B7 / B3	Input Impedance	—	10 K	—	Ohms
0 to 10V P. Factor Sygnal	B7 / B3	Input Impedance	—	10 K	—	Ohms
0/4 to 20 mA P. Factor S.	B7 / B3	Input Impedance	—	250	—	Ohms
Ext. Power Factor Input	B7 / B3					
Voltage Phase Sensing (Internal Power Factor)	B9 / B3	Input Impedance	—	10 K	—	Ohms
Voltage Phase Sensing (Internal Power Factor)	B9 / B3	Input Voltage	20	115	150	Volts
Current Phase Sensing (Internal Power Factor)	B10 / B3	Input Impedance	—	1	—	Ohms
Current Phase Sensing (Internal Power Factor)	B10 / B3	Input Current	0,1	—	1	Amper
Power Enable Input	B6 / B3	Current Source	—	10	—	mA CC
Droop Enable Input	B8 / B3	Current Source	—	10	—	mA CC
Fail Relay Contact	B11 / B12	Voltage	—	—	240	VAC
Fail Relay Contact	B10 / B11 / B12	Voltage	—	—	30	VCC
Fail Relay Contact	B11 / B12	Current	—	—	1	A AC
Fail Relay Contact	B11 / B12	Current	—	—	0,25	A CC
Power Supply (115 / 220)	B1 / B2	Voltage	92 / 176	115 / 220	138 / 264	VAC/CC
Power Supply	B1 / B2	Power	—	4	—	Watts
DB15 CONNECTOR						
Over Temp. Input (Dry Contact N. C.)	DB2 / DB1	Source Current	—	2,5	—	mA CC
Sensing Input	DB6 to DB 8 / DB9	Input Voltage	—	18	—	VAC
Firing Signal	DB10 to DB15/ DB9	Volts Output	10	11	12	Volts CC
Firing Signal	DB10 to DB15/ DB9	Current Output	—	—	20	mA CC
TB / POWER CONNECTOR						
Sensing	TB1 to TB3	Voltage Input	92 / 176	115 / 220	138 / 264	VAC
Power / Sincro	R / S / T	Voltage	30	—	254	Volts
Build Up Enable (Dry Contact N. O.)	TB5 / TB6	Current	—	—	1	Amper
Fan Power Supply	TB7 / TB8	Voltage	—	110 / 220	—	Volts
Fan Power Supply	TB7 / TB8	Power		See Tag		



FUNCTION BY TYPE OF APPLICATION:

The side table shows the functions available, with the kind of action (selection or adjust) and the range of adjust.

In case of trip, the output will be inhibited (If S1 ON), the corresponding LED will be turned on and the trip relay will be energized.

There is a time retard of approximately 0.5 seconds for the effective actuation of the protection.

The error amplifier is a selectable P + I + D type. Note that it is different of a unique PID amplifier. This way it can be adapted to virtually any process because its versatility. The user can select and adjust the response types needed.

The second portion, the “I” error amplifier, is mainly responsible for the static regulation. Its Integrative time is adjustable from 0.01 to 1 Seg. This portion of error amplifier needs to be selected in almost all applications.

The first portion of the error amplifier is a pure proportional gain amplifier (P) and it is mainly responsible for dynamic regulation. It is necessary in almost all applications, to increase the response and to get fast corrections. It must be adjusted as high as possible avoiding instability and yet getting fast response time with low overshoot and undershoot.

The third portion of the error amplifier is a pure derivative gain amplifier (D) and it is mainly responsible for dynamic regulations. It is necessary in a very few applications to increase the stability and get fast corrections. It must be adjusted as low as possible to get stability and better response time. Avoid use if it is not necessary.

FUNCTIONS	TYPE / DEFAULT	DISPOSITIVE
0 TO 10 VOLTS SET	Option	Opt.
0 TO 5 VOLTS SET	Option	Opt.
0 OR 4 TO 20 MA SET	Option	Opt.
POTENTIOMETER SET	Option	Opt.
100% / 10% SET SELECTION	Select.	S4 OFF / ON
PROPORTIONAL GAIN 1 TO 20	Select. / Adjust.	S5 ON / P3
INTEGRATIVE TIME TI = 0.01 S TO 1 S	Select./Adjust.	S6 ON / P4
DERIVATIVE TIME TD = 0.01 TO 1 S	Select./Adjust.	S7 ON / P5
PURE VOLTAGE REGULATION	Select	B8/B3 Open
REACTIVE DROOP COMEPASATION	Sel./Adj.0 to 10%	B8/B3 Closed
SCALE ADJUST	Adjust	P1
INHIBITION ON FAIL	Select	S1 ON
SENSING SELECTION	Sample & Hold / Average	S3 OFF/ON
POWER FACTOR SOURCE	Select Inter. / Exter.	S2 OFF/ON
DROOP RANGE (ADJ. 0 - 5%)	Select /Adjust	B8-B3 / P2
SETTING SIGNAL LOSS	OK	L4
OVER VOLTAGE TRIP	120% / 0.5 SEC.	L5
UNDERFREQUENCY TRIP	- 15% / 2 SEC.	L6
OVER TEMPERATURE TRIP	90 °C	L7
DROOP ENABLE INDICATION	OK	L3
POWER ENABLE INDICATION	OK	L2
INHIBIT COMMAND INDICATION	OK	L1
AUTO / MANUAL SELECTION	Select	S8 OFF / ON

Model VEC205E/	Nominal Current (A)	Maxim. Current (1min (A)	Surge Current (10 mS (A)	Cooling Forc./ Natural	Wide (W) mm	Tall (T) mm	Long (L) mm
0025	25	50	100	N	225	290	200
0050	50	100	200	N	240	290	270
0100	100	200	400	F	290	290	270
0150	150	300	600	F	340	290	270
0200	200	400	800	F	377	290	270
0250	250	500	1000	F	377	330	270
0300	300	600	1200	F	377	380	300
0400	400	800	1600	F	377	430	300
0500	500	1000	2000	F	377	480	300
0650	650	1300	2600	F	377	530	330
0750	750	1500	3000	F	377	580	330
1000	1000	2000	4000	F	540	850	315



CONTROL MODULE VEC205DC

The side drawing shows the connections to top connector and rear connector (DB15) of the VEC205EC.

To connectors 1 and 2 are plugged to the command power supply of 110 or 220 VAC depending off the model.

Connector 3 is the common connector for all the inputs.

Connector 4 is the setting input. This input can be chosen at order (0 to 5 VCC or 0 to 10 VCC or 500 Ohms or 10k Ohms digital scale potentiometer, 0 to 20 mA or 4 to 20 mA).

Connector 5 is a auxiliary current source (10 mA) for direct use of a potentiometer for setting range adjust (500 Ohms in a 5 VCC model or 1K ohms in a 10 VCC model) This output must be tight to connector 4 for potentiometer use.

Connector 7 is the input for an optional secondary input signal or Droop signal (same signal options). This signal can be provided by a Power Factor Transducer (Ex: GE-Multilin SPM model), Hall effect sensor, tachogenerator, etc.

Connector 9 is the input for an optional voltage transformer for power factor sensing (Polar Angle sensing), to get internal generation of Droop signal.

Connector 10 is the input for an optional current transformer for power factor sensing (Polar Angle sensing), to get for internal generation of Droop signal.

The connector 6 is the input for a dry contact for "Power Enable" command.

Connector 8 is the input for a dry contact for the "Droop Enable" command.

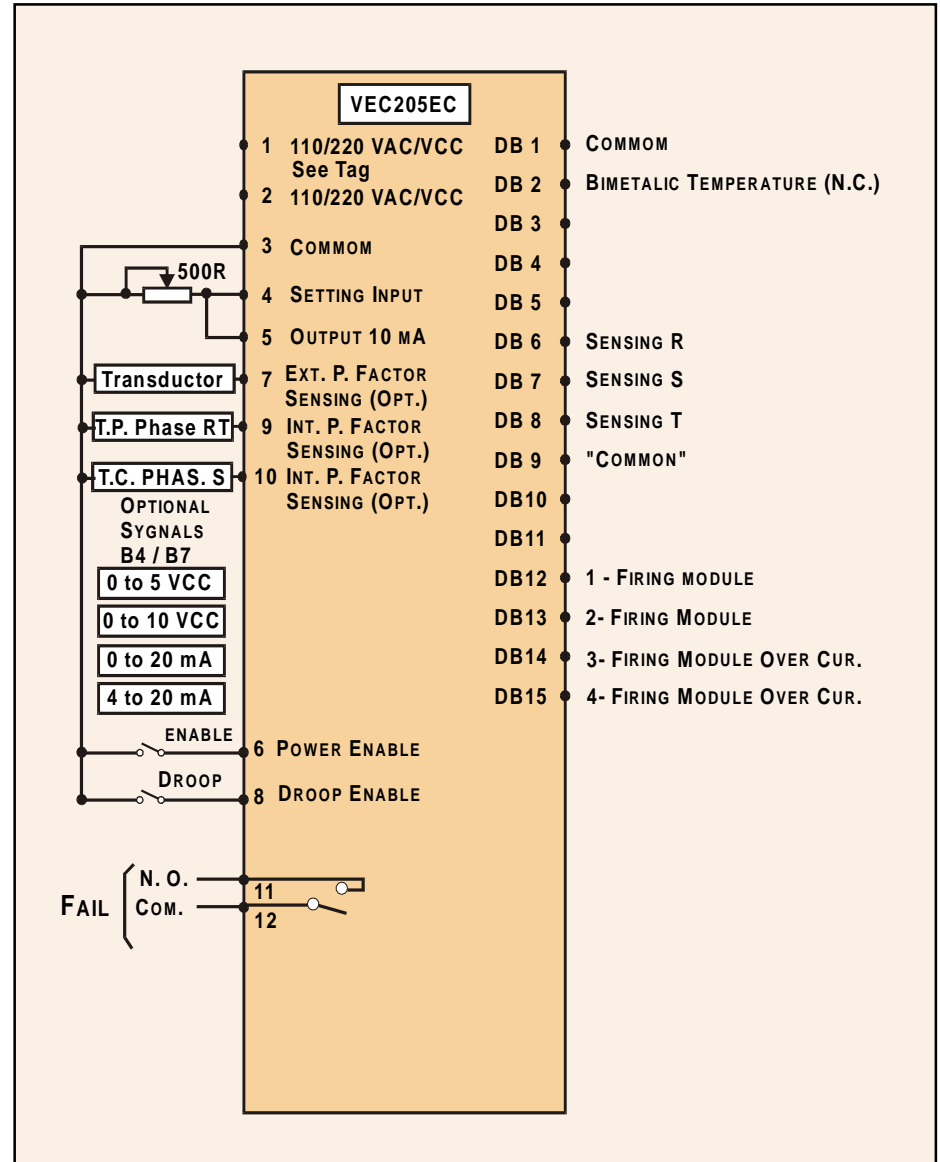
Connectors 11 and 12 are the N.O. Dry contact of the fail indication relay.

DB1 and DB9 are the common input connectors.

DB2 is input for a N.C. dry contact of a temperature sensor (common at DB1).

Connectors DB6 to DB8 are the inputs for voltage sensing signal (common at DB9). Connectors DB10 to DB15 are the outputs for the thyristors firing modules (common at DB9).

Signals to connectors 4 / 5, 6, 7, 8 / 9 and 10 must be routed preferably with sepa-



rated shielded cable with common cable connected straight to connector 3.

GENERATORS EXCITERS:

This application is for all types of alternators ("Collector Ring", "Brushless" or "Collector Ring" with auxiliary rotary exciter).

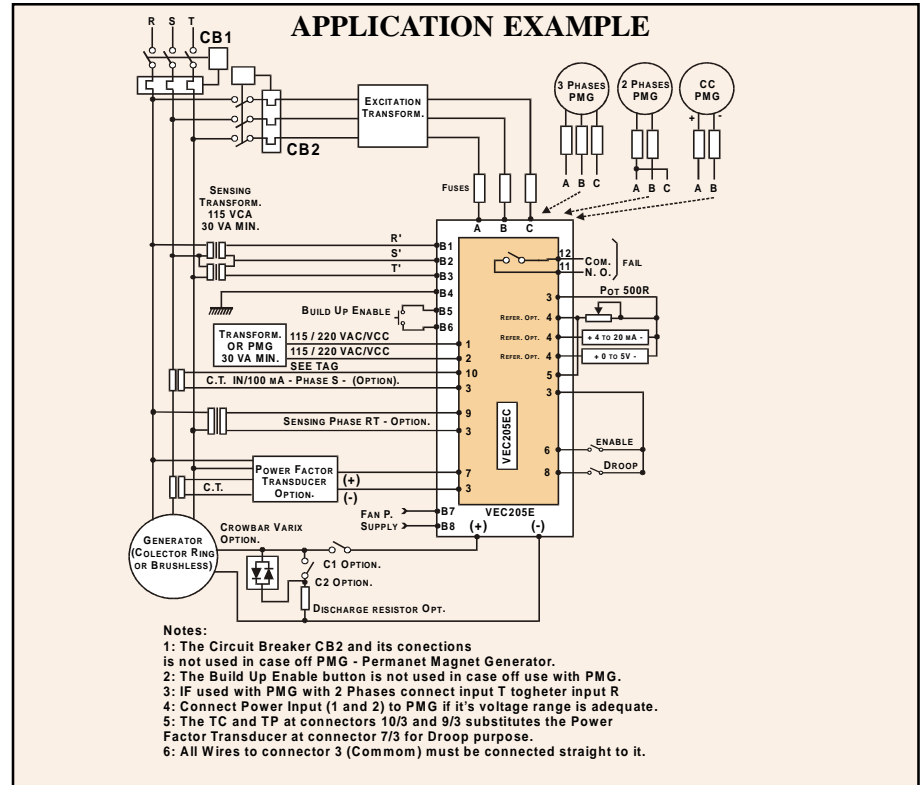
IMPORTANT POINTS FOR WIRING AND START UP:

- Select the DIP as required. Normally S1 ON, S2 ON, S3 ON, S4 ON, S5 ON, S6 ON and S7 OFF.
- The phasing at C.T. and P.T. at connectors 10/3 and 9/3 must be exactly as shown.
- The excitation transformer must have

adequate power and tension to get the correct ceiling voltage.

- The fuses must be ultra-fast types with adequate i^2T (see data sheet).
- The sensing transformer (30 VA) must be connected to point that must be regulated. The secondary nominal tension must be 115 VAC.
- The C.T. for power factor sensing must be at correct motor power cable.
- The C.T. must have secondary rating of 100 mA to 1A (C.T. with secondary rate of 5 Ampere could damage the module).
- The P.T. for sensing the voltage phase angle for internal power factor transducer must be connected at the cables not used for sensing the current phase angle (the middle cable in this case). The nominal voltage is 115 VAC +10%, - 30%.
- If the user chooses to use an external transducer for power factor, the transducer must supply the correct voltage to the module, corresponding to total range, from totally inductive to totally capacitive. The center range voltage must be equal to unity power factor.

- The control signals are commented at control module drawing sheet.
- The excitation must be applied only at nominal speed.
- At Start Up, before enabling definitively the Droop/Power Factor function, the correct polarity of the signal should be verified by this way: You must load the generator in single mode (none paralleled) with inductive loads to get at least 0,80 inductive P.F. with the Droop command closed and . Short circuit the TC momentarily. The output generator tension must increase a little. Open the short in the TC. The Voltage must decrease a lillle. If not, change the polarity of the C.T. - In normal operation the Droop command must be closed at all times if parallel operation are used and opened if parallel operatios are not used. This way you avoid voltage umbalance at Droop circuit in parallel operations and get better static regulation in single mode. The build up enable switch is used to enable the auto build up circuit. It must be a momentary type switch. It is not used if PMG is supplying the power. Try operate at the two modes of "Sensing"



selected at DIP S3 and choose the one that best adapts in your system. Prefer "Average" if is not apreciable difference because it's best insensivity to wave distortion.

Operation Instructions: After the generator got the nominal speed, close the power enable switch. Then momentarily close the Build Up Enable switch if the power is supplied from the generator. If the remnant voltage of generator is at least 10 VAC, the voltage will raise to near the nominal voltage. Adjust the nominal voltage if necessary (level pre defined at Start-Up). The voltage needs not to be readjusted at any time. Put the generator at bus (closing the main circuit Breaker). If it is a multi generator system, the paralleling must be done with a synchronism indicator/relay. The Droop command contact must be closed Share the active load (KVA) at turbine regulators. The AVRs will try to automatically share the reactive load (KVAR). Avoid changing the voltage setting of the regulators, to share ative loads. It can be necessary to readjust slightly the voltage of the generators to share the reactive power at

the beginning of the parallel operation only. The loads must be shared proportionally to the rated generator's power. Note: During the Start Up all the regulators must be adjusted with same Gain and Droop.

The Droop rate must be as low as possible, mainly if the machines are identical. Normally a 1% to 3% level is a good choice.

To turn OFF one generator, first unload it at speed regulators, then open the main circuit breaker to get it out of the bus, them inhibit it at "Power Enable" (open the switch) and finally slow down the machine speed to zero.

Notes: 1- The diagram is a simplified version. 2- Is advisable that signal connections be made with shielded cables with shield routed to connector 3.

COMPACTVAR

VEC205D

BULLETIN 210D

ACCESSORIES:

- Ultra-Fast fuses.
- Power Transformers.
- Synchronism and sensing transformers.
- Shunt amplifier: VSA650A (60 mv/5V insulated).
- Digital Potentiometer + Servo controller: VSP510A.
- Multi-turn potentiometer panel with digital scale: VP1020E.
- "Field Application Relay": VR9045.
- "Field Ground Fault Relay": VR9030A.
- "Field Over Voltage Relay": VR9031A.
- "Step-Out Relay": VR9035A.
- "Field Loss Relay": VR9034A.
- Other protection relays.
- Control Box (M1 or M2).
- Crowbar.

SPARE PARTS:

- **Control Module:**
VEC205EC/X/X/X/X/X/X. (See Order Code Table)
- **Firing Modules:** VDE115A
- **VV1 and VV2:** - Fans - see custom data sheet at manual.
- **VRN1 and VRN2:** - Thermostats - see custom data sheet at manual.
- **VC12:** - 12 ways female connector.
- **VS204/3E:** - Synchronism module.



STATIC EXCITER WITH VEC 205E, FOR 5000 KVA SYNCHRONOUS GENERATOR

COMPLETE SOLUTIONS FROM VARIX

VARIX or its integrators can offer complete systems, including panels, circuit breakers, fuses, instruments, GE Multilin Relays, PLC and many others. The equipment can be projected and dimensioned by our engineering personnel to satisfy the needs of the customer. Our field personnel can provide the Start Up.



VEC205E PLUG IN CONTROL MODULE

ORDER CODE								
VEC205E/X/XXXX/XXX/X/X/X/X								
	<table border="1"> <tr> <td>A</td> <td>B</td> <td>C</td> <td>D</td> <td>E</td> <td>F</td> <td>G</td> </tr> </table>	A	B	C	D	E	F	G
A	B	C	D	E	F	G		
A POWER SUPPLY	1 = 110 VCA 2 = 220 VCA 3 = OTHER							
B CURRENT	NOMINAL CURRENT							
C VOLTAGE	NOMINAL VOLTAGE							
D SETTING POINT ADJUST	1 = 0 TO 5 VOLTS /POTENTIOM. 2 = 0 TO 10 VOLTS /POTENTIOM. 3 = 4 TO 20 mA. 4 = 0 TO 20 mA.							
E EXT. POWER FACTOR SYGNAL	1 = 0 TO 5 VOLTS /POTENTIOMET. 2 = 0 TO 10 VOLTS /POTENTIOM. 3 = 4 TO 20 mA. 4 = 0 TO 20 mA.							
F FAN VOLTAGE	0 = W/O FAN 1 = 120 VAC 2 = 220 VAC							

EXAMPLE:
VEC205E/1/0050/150/1/2/0: Generator Exciter, Control Power Supply: 110 VCA, Nominal Current: 50 Amper, Nominal Voltage: 150 Volts, Setting Point Adjust: 0 to 5 VCC or Potentiometer, External Power Factor Signal: 0 to 10 VCC, W/O Fan.

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- STATICS EXCITERS FOR GENERATORS.
- STATICS EXCITERS FOR SYNCHRONOUS MOTORS.
 - AVRS - AUTOMATIC VOLTAGE REGULATORS.
 - SOFT STARTERS FOR MOTORS.
 - POWER CONTROLLERS.
 - SSCs - SOLID STATE CONTACTORS.
- CONTROLLED RECTIFIERS UP TO 150.000 A.
 - CHOPPERS FOR MOTORS.
- PROTECTION RELAYS FOR EXCITATION SYSTEMS.
- DIGITAL RELAYS FOR CIRCUIT BREAKERS SUPERVISION.
 - TRANSMITTERS AND TRANSDUCERS.
- SYNCHRONISM CONTROL BOX FOR SYNCHRONOUS MOTORS.
 - CROWBAR FOR SYNCHRONOUS MOTORS.
 - CROWBAR FOR TRANSIENT PROTECTION.
 - SPECIAL EQUIPMENTS.