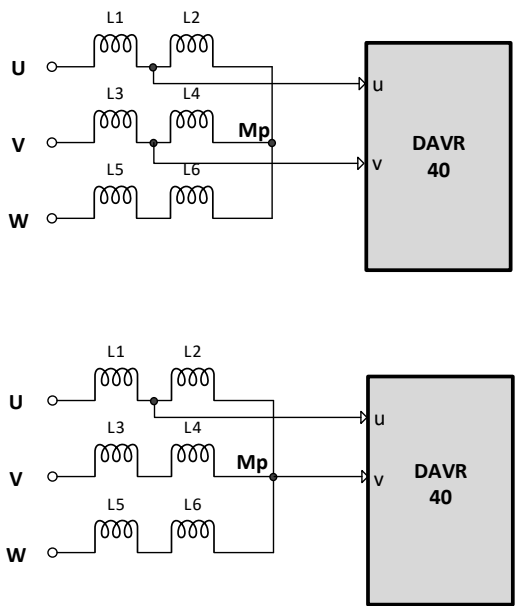
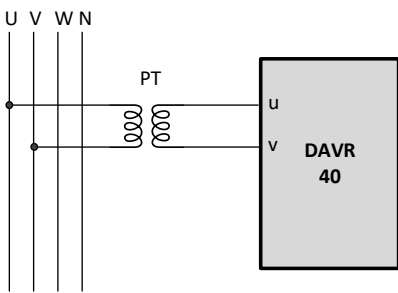


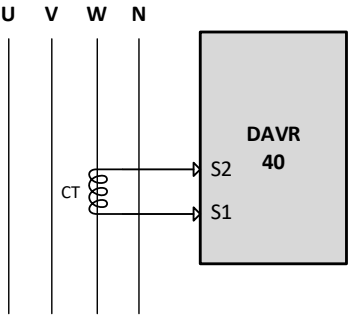
2021

# DAVR-40

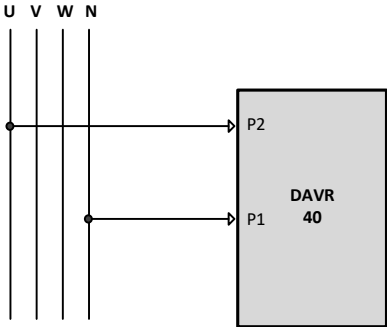
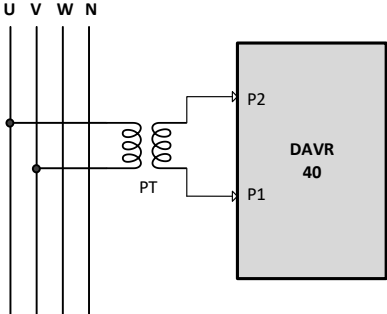
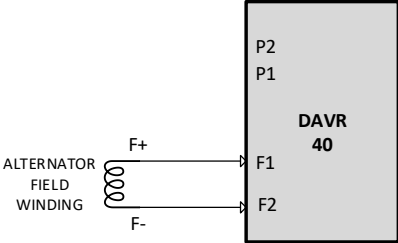
**TECHNICAL SPECIFICATIONS &  
APPLICATION WIRING DIAGRAMS**

# TECHNICAL SPECIFICATIONS

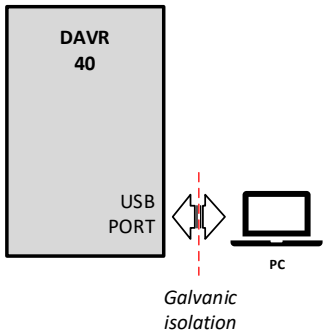
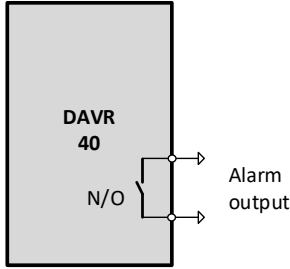
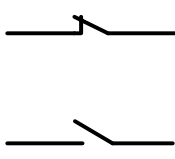
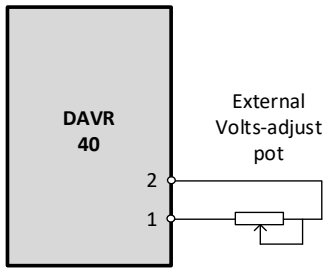
OPERATING MODE:	DESCRIPTION:
OPERATION MODE:	Operation only in AVR mode, which regulates the stator voltage based on the SENSE signal connection configuration.
GENERATOR VOLTAGE SENSING:	DESCRIPTION:
Sense input voltage wiring configuration:	 <p>2-phase connection, no neutral configuration (2W) 1-phase connection between phase and neutral Limited maximum sense voltage value: 480V<sub>AC</sub></p>
Sense input voltage configuration with high-voltage input ( $V_{SENSE} > 480V_{AC}$ )	 <p>Transformer (PT) primary/secondary voltage ratio is S/W configurable</p>

Voltage sensing type:	True-RMS voltage reading, Phase-phase voltage sensing, Average voltage sensing of two-phase input,	Voltage transformer must be used for sense inputs if phase-phase sense voltage exceeds 480Vac rms (max. limit)
Voltage sensing range:	100Vac – 276Vac (Phase-Neutral) 100Vac – 480Vac (2-phase) Software configurable  <i>(Given sense voltage range values are referred to phase windings mid-point connection points)</i>	25Hz to 75Hz operation
Voltage setting range:	<ul style="list-style-type: none"> <li>Manual voltage setting of regulation level with on-board trimmer (<math>\pm 15\%</math> of S/W configured voltage setting value)</li> <li>Voltage setting via S/W using, PC configuration tool</li> </ul> (Voltage setting of the AVR MUST match the wiring configuration of the alternator in the system)	
<b>GENERATOR CURRENT SENSING:</b>	<b>DESCRIPTION:</b>	
Current sense input connection:	 <p>Current sense transformer connection on "W" phase line Current transformer conversion ratio is X/1A (CT connection must be made according to IEC61000-6-4)</p>	
CT ratio setting:	CT ratio setting via configuration S/W CT configuration: X / 1A	Rated overload level: 200% continuous max. 300% for 120 seconds
Current sense error:	<1% of measured value, over full range	S1-S2 terminal inputs are galvanically isolated
Operation mode:	<ul style="list-style-type: none"> <li>Quadrature droop for reactive load sharing (parallel operation)</li> <li>Line droop compensation (+V/KVA)</li> <li>Stator-load current monitoring</li> <li>Motor-start current limit according to set parameter value</li> </ul> <i>(If QUADRATURE DROOP function is selected, other functions cannot be selected)</i>	
CT load burden:	<1VA (over nominal operation range)	

POWER INPUT TO AVR:	DESCRIPTION:
PMG CONNECTION:	<div> </div> <p>PMG type: "SINGLE-PHASE" PM type alternator (50Hz/60Hz)            Phase output voltage (L – L): 170Vac – 300Vac</p> <p>Power rating: 3500VA max (for maximum filed power delivery)            Operating frequency: <b>40Hz to 75Hz</b></p>
AVR POWER INPUT WITH AUXILIARY WINDING:	<div> </div> <p>AUXILIARY power winding voltage: Single phase, 170Vac – 300Vac (maximum allowed voltage limit)</p> <p>Rated power: 3500VA, connected across P1 and P2 terminals            Frequency range: 40Hz to 75Hz</p>
AVR POWER INPUT WITH TWO PHASE SHUNT CONNECTION:	<div> </div> <p>Two phase SHUNT connection across P1 and P2. (Voltage limit across terminals P1 and P2 is limited to 300Vac max)</p>

<p>AVR POWER INPUT WITH PHASE-NEUTRAL SHUNT CONNECTION</p>	 <p>SHUNT connection between phase and Neutral line. (300Vac maximum allowed voltage limit across terminals P1 and P2)</p>	
<p>AVR POWER INPUT FROM HIGH POTENTIAL:</p>	 <p>PT must be used if AVR power is connected from high potential. Voltage across P1 and P2 is limited to 300Vac max.</p>	
FIELD DRIVE OUTPUT:	DESCRIPTION:	
<p>FIELD WINDING WIRING CONFIGURATION:</p>	 <p>Cable length between AVR and Exciter winding should NOT exceed 50 meters maximum length.</p>	
<p>EXCITATION VOLTAGE RANGE:</p>	<p>Continuous drive: 100V<sub>DC</sub> Overload status (120 sec): 160V<sub>DC</sub> Overload status (10 sec): 200V<sub>DC</sub></p>	<p>Power into the EXCITER winding is limited with the available power across P1 and P2</p>
<p>EXCITATION CURRENT RANGE:</p>	<p>Continuous drive: 5A<sub>DC</sub> Overload status (120 sec): 7A<sub>DC</sub> Overload status (10 sec): 10A<sub>DC</sub></p>	

FIELD WINDING IMPEDANCE:	Nominal: 15Ω Minimum: >5Ω (@ room temperature)	Wiring impedance from AVR to FIELD winding should NOT exceed 5% of FIELD winding nominal impedance at room temperature
AVR POWER STAGE CONFIGURATION:		<p>For AUX and SHUNT connection, terminals P1 and P2 must be used.</p> <p>SCR drive with PID control</p> <p>5A<sub>dc</sub> continuous 7A<sub>dc</sub> for 120 sec 10A<sub>dc</sub> for 10 sec</p> <p>(Given at max. operating temperature limit)</p>
ANALOGUE INPUTS:	DESCRIPTION:	
DIFFERENTIAL ANALOG VOLTAGE SIGNAL INPUT (±5V <sub>dc</sub> / 0-10V <sub>dc</sub> ):	<p>(Only one analogue signal can be connected at any time)</p>	<p>0 – 10V<sub>dc</sub> input</p> <p>±5V<sub>dc</sub> input (configuration as 5V<sub>dc</sub>/0V/+5V<sub>dc</sub> with E2 terminal internally connected to GND)</p> <p>S/W configurable, no on-board trimmer</p> <p>Resolution: 1/1000 (non-isolated input)</p>
DIFFERENTIAL ANALOG CURRENT SIGNAL INPUT (4-20mA):	<p>(Only one analogue signal can be connected at any time)</p>	<p>4 -20mA current input connection (E2 connected to GND internally)</p> <p>Burden load: 100Ω &lt;4mA corresponds to “low level input” 12mA set as mid-point</p> <p>S/W configurable parameters, no on-board trimmer. Resolution: 1/1000 (Non-isolated input)</p>

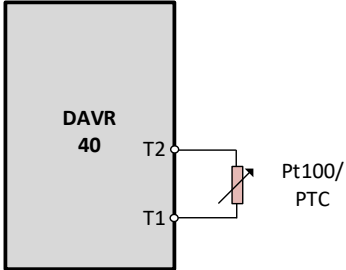
COMMUNICATION PORTS:	DESCRIPTION	
USB COMMUNICATION PORT (ISOLATED):	 <p>Galvanic isolation</p>	<p>Device configuration port for PC connection</p> <p>Power supply (internal &amp; external) MODBUS protocol Type-B socket on-board</p> <p>Power and data galvanically isolated</p>
ALARM OUTPUT:	DESCRIPTION	
ALARM OUTPUT:		<p>N/O Alarm contact output.</p> <p><i>(Contacts are closed/energized during normal operation)</i></p>
CONTACT CAPACITY:	 <p>Energized state</p> <p>De-energized state</p>	<p>SPST Relay contact output 3.0 A<sub>AC</sub> (max) @ 230Vac 1.0 A<sub>DC</sub> (max) @ 24Vdc</p>
ALARM FUNCTIONS LIST:	<ul style="list-style-type: none"> <li>○ Threshold / trigger status</li> <li>○ Time delay</li> <li>○ Enable / Disable</li> <li>○ Latched</li> <li>○ Masked</li> <li>○ Relay activation</li> <li>○ Automatic fault reset</li> </ul>	<p>Each of the defined functions can be allocated to any alarm signal using PC Tool configuration software.</p>
EXTERNAL VOLTS ADJUST:	DESCRIPTION	
EXTERNAL POT CONNECTION:		<p>External voltage adjust pot connected to terminals 1 and 2</p> <p>Adjustment range: <math>\pm 15\%</math> of set voltage parameter (S/W configurable)</p>

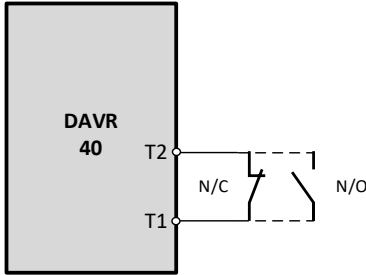
POT VALUE:		Value: 1K $\Omega$ Power rating: 1W Single turn or multi-turn  (POT connection cable MUST be shielded and GROUNDED)
DETECTION:	Pot wiring open circuit detection Automatic pot connection continuity detection (Function is S/W configurable)	
VISUAL INDICATORS (RGB LED):	DESCRIPTION	
PWR USB Com.	AVR power supply indicator LED Permanent ON if internal power supply is healthy. FLASHING when USB is connected and operating	POWER: GREEN Healthy: ON continuous  USB: BLUE Healthy: FLASHING
EXCW EXCT	Excitation overload warning LED Flashing when alarm is triggered.  Excitation overload trip warning LED Permanent ON when triggered and latched	Colour: RED Healthy: OFF  Warning: FLASHING Trip: ON continuous
LOS	Loss of sensing LED Permanent ON if one of the phase sensing voltages is lost. Parameters are S/W configurable	Colour: BLUE / ORANGE  Healthy: OFF Warning: FLASHING
STOV STCL	Warning for STATOR high voltage Warning for LOAD over current limit	Colour: RED / GREEN High voltage: FLASHING High current: ON cont.
SMF	START MOTOR fault detection, MOTOR START function	Normal: OFF Active: RED / BLUE flashing
UFRO	Under-frequency roll-off warning LED FLASHING if UFRO function is activated Parameters are S/W configurable	Colour: ORANGE Normal: OFF Active: FLASHING
TEMP	AVR and Stator winding over-heat warning LED, FLASHING when set temperature levels are exceeded	Colour: YELLOW Normal: OFF Active: FLASHING



OVER-EXCITATION PROTECTION:	DESCRIPTION	
FIELD CURRENT MONITORING:	Current limit set point $0 \leq I_F \leq 10A_{DC}$  Parameters are S/W configurable	Resolution: $\pm 0.1 A_{DC}$
TIME DELAY CONTROL:	Time delay set point $0 \leq T_D \leq 10s$ for $I_F = 10A_{DC}$ $0 \leq T_D \leq 120s$ for $5A_{DC} < I_F < 7A_{DC}$ Parameters are S/W configurable  <i>(current / time thermal effect function calculation with <math>I^2t</math> characteristic)</i>	Resolution: $\pm 0.1$ sec
TRIP:	Alarm output activation (latching / non-latching) LED indicator activation Parameters are S/W configurable	
FIELD OVER-VOLTAGE PROTECTION:	DESCRIPTION	
FIELD VOLTAGE MONITORING:	Maximum field voltage limit setting $0 \leq V_F \leq 250V_{DC}$ Parameters are S/W configurable	Resolution: $\pm 1.0 V_{DC}$
TIME DELAY CONTROL:	Time delay set point $0 \leq T_D \leq 15s$ Parameters are S/W configurable	Resolution: $\pm 0.1$ sec
TRIP:	Alarm output activation (latching / non-latching) LED indicator activation Parameters are S/W configurable	
LOSS-OF-SENSING PROTECTION:	DESCRIPTION	
PHASE-PHASE VOLTAGE MONITORING:	Phase sense voltage detection $-50\% \leq V_{SETPOINT (EFF)} \leq 0\%$ Parameters are S/W configurable	Resolution: $\pm 1.0 V_{AC RMS}$ (% reduction of phase voltage, referenced to effective setpoint)
TIME DELAY CONTROL:	Time delay setting $0 \leq T_D \leq 25s$ Parameters are S/W configurable	Resolution: $\pm 1.0$ sec
TRIP:	Alarm relay activation (latching / non-latching) LED indicator activation Parameters are S/W configurable	

GENERATOR OVER-VOLTAGE PROTECTION:		DESCRIPTION
OVER-VOLTAGE MONITORING:	Alternator phase-phase STATOR voltage monitoring, Over-voltage set point: 100% to 150%	Resolution: $\pm 1.0\%$ (% of effective stator voltage setpoint)
OVER-VOLTAGE TIME DELAY CONTROL:	Time delay set point $0 \leq T_D \leq 20s$	Resolution: $\pm 1.0$ sec
TRIP:	Alarm relay activation (latching / non-latching) LED indicator activation Parameters are S/W configurable	
GENERATOR UNDER-VOLTAGE PROTECTION:		DESCRIPTION
UNDER-VOLTAGE MONITORING:	Alternator phase-phase STATOR voltage monitoring, Undervoltage set point: 50% to 100%	Resolution: $\pm 1.0\%$ (% of effective stator voltage setpoint)
TIME DELAY CONTROL:	Time delay set point $0 \leq T_D \leq 20s$	Resolution: $\pm 1.0$ sec
TRIP:	Alarm relay activation (latching / non-latching) LED indicator activation Parameters are S/W configurable	
STATOR CURRENT MONITORING:		DESCRIPTION
STATOR CURRENT MONITORING:	Alternator STATOR current monitoring, $100\% \leq I_{CL} \leq 300\%$ CT ratio S/W configurable	Resolution: $\pm 1.0\%$ of actual stator current value
TIME DELAY CONTROL:	Time delay set point $0 \leq T_D \leq 120s$ Parameters are S/W configurable (Function is based on alternator $I^2t$ thermal effect characteristic calculation)	Resolution: $\pm 1.0$ sec
CONDITIONS:	STATOR current limit protection can only be active, if generator is not in parallel operation (reactive droop control active)	
TRIP:	Alarm relay activation (latching / non-latching) LED indicator activation Parameters are S/W configurable	

START MOTOR FUNCTION & FAULT PROTECTION:	DESCRIPTION	
MOTOR CURRENT MONITORING:	Alternator STATOR current monitoring, $100\% \leq I_{CL} \leq 200\%$ CT ratio S/W configurable	Resolution: $\pm 1.0\%$ of actual stator current value
TIME DELAY CONTROL:	Time delay set point $0 \leq T_D \leq 60s$ Parameters are S/W configurable	Resolution: $\pm 1.0$ sec
CONDITIONS:	<p>Motor start fault protection can only be active if “reactive droop compensation” is not selected.</p> <p>During “Motor Start” function (if selected and activated), conflicting protection functions will be disabled automatically.</p>	
TRIP:	<p>Alarm relay activation (latching / non-latching) LED indicator activation</p> <p>Trip function parameters are S/W configurable</p>	
AUXILIARY INPUTS:	DESCRIPTION	
AMBIENT TEMPERATURE SENSING:	<b>On-board sensor</b> for microcontroller ambient temperature sensing (temperature on the PCB) $+10^{\circ}C$ to $+100^{\circ}C$	Resolution: $\pm 1.0^{\circ}C$
EXTERNAL TEMPERATURE SENSING & PROTECTION:	 <p>Monitoring of external temperature point <math>+40^{\circ}C \leq T_{EXT} \leq +300^{\circ}C</math> 1 independent PTC or Pt100 sensor input, T1 – T2 input terminals <i>(Parameters S/W configurable)</i></p>	<p>Resolution: <math>\pm 1.0^{\circ}C</math>  (non-isolated input)</p>

EXTERNAL DIGITAL SIGNAL INPUT CONFIGURATION:	 <p>N/O or N/C external DRY-CONTACT input for DIGITAL signal input detection (Parameter is S/W configurable)</p>	T1/T2 temperature input can be configured as DIGITAL signal INPUT  (non-isolated input)
TIME DELAY CONTROL:	Time delay control setting, $0 \leq T_D \leq 30 \text{ sec}$	Resolution: $\pm 1.0 \text{ sec}$
TRIP:	Alarm relay activation (latching / non-latching) LED indicator activation Parameters are S/W configurable	
<b>VOLTAGE REGULATION:</b>	<b>DESCRIPTION</b>	
VOLTAGE REGULATION:	2-phase RMS voltage regulation Phase-Neutral voltage regulation	Regulation: $< \pm 0.25\%$
REGULATION CONDITIONS:	Prime mover speed change: $< 4\%$ $\text{Cos}\phi: > 0.8$ THD (3-phase average): $< 5\%$	
TEMPERATURE DRIFT:	$\Delta T < 40^\circ\text{C}$ Unchanged load conditions	
SOURCES OF REGULATION SETPOINT:	<ul style="list-style-type: none"> <li>S/W voltage regulation set-point</li> <li>On-board trimmer voltage setting</li> <li>External pot voltage setting</li> <li>AUX input-controlled voltage setting (control from an external device)</li> </ul>	All regulation source selections are S/W configurable during AVR set-up
<b>SOFT-START SEQUENCE CONTROL:</b>	<b>DESCRIPTION</b>	
START TIME DELAY:	$0 \leq T_{\text{DELAY}} \leq 7200 \text{ sec.}$ Parameters S/W configurable	Time based start-delay in seconds Resolution: $\pm 1.0 \text{ sec}$
START FREQUENCY CONTROL:	$25\text{Hz} \leq F_{\text{START}} \leq 75\text{Hz}$ Parameters S/W configurable	Frequency based start-delay in Hz. Resolution: $\pm 0.5\text{Hz}$

SOFT-START RAMP CONTROL:	$1 \leq T_{\text{SOFTSTART}} \leq 7200 \text{ sec.}$ Parameters S/W configurable	Soft-start ramp time in seconds
EXTERNAL START CONTROL:	Start function control with "External Start" input Parameters S/W configurable	Start signal from external input
DIGITAL START FUNCTION:	AVR function start from USB COM Bus	Start from PC Software Tool
<b>STABILITY (PID) CONTROL:</b>	<b>DESCRIPTION</b>	
PID PARAMETERS CONTROL:	$K_P / K_I / K_D$ PID parameters gain control S/W configurable parameters	Automatic setting of PID parameter gain constants
TRIMMER CONTROL:	Manual setting of $K_P / K_I$ constant	On-board trimmer controlled
<b>FREQUENCY RESPONSE:</b>	<b>DESCRIPTION</b>	
UFRO KNEE POINT CONTROL:	$40\text{Hz} \leq F_{\text{UFRO}} \leq 65\text{Hz}$ STATOR voltage roll-off point control Parameters S/W configurable	Resolution: 0.1 Hz increments
LAM FUNCTION SLOPE CONTROL:	$0\text{V/Hz} \leq V_{\text{COEFF.}} \leq 15\text{V/Hz}$ Coefficient of rate of volts control per Hz speed change Parameters S/W configurable	Resolution: 0.1 V/Hz increments
LAM FUNCTION DELAY TIME CONTROL:	$0\text{V/sec} \leq T_{\text{COEFF.}} \leq 100\text{V/sec}$ Coefficient of rate of volts control per time-second change Parameters S/W configurable	Resolution: 0.1V/sec increments
<b>QUADRATURE DROOP / LINE DROOP CONTROL:</b>	<b>DESCRIPTION</b>	
REACTIVE DROOP COMPENSATION:	Manual DROOP control with on-board trimmer $-5\% \leq \text{DROOP} \leq +5\%$ (Percent of the "droop" value set by S/W)	Set for parallel operation with automatic reactive load sharing
	Automatic DROOP control with S/W Initial set value: 5% (droop at full load) Droop control: >3% (stability limit) DROOP slope: -20% to +20% (S/W configurable)	

PHASE COMPENSATION:	Control of PHASE OFFSET ANGLE, -60° ≤ ρ ≤ +60° S/W configurable with automatic compensation	
LINE DROOP COMPENSATION:	Voltage line DROOP compensation -10% ≤ L <sub>DROOP</sub> ≤ +10%  Compensation of line drop per KVA output	Compensation of the load line drop per KVA power output of the generator
CONDITION:	If LINE DROOP is selected, REACTIVE Droop compensation cannot be active. (Look at conditions of CT function selection list)	
DATA LOGGING:	DESCRIPTION	
ALARM LOG:	Last 50 alarms logged in memory, (Time stamp based on alternator operating hours)	FIFO register configuration (Logged data to be viewed via USB com port)
EVENT LOG:	Last 10 events logged with time stamping (Referenced to alternator operating hours)	
ENVIRONMENTAL LIMITS:	DESCRIPTION	
TEMPERATURE:	Operating temperature range:	-40°C to +70°C
	Storage temperature range:	-40°C to +85°C
HUMIDITY:	Operating humidity range Non-condensing:	30%RH to 95%RH
	Storage humidity range Non-condensing:	0%RH to 99%RH
VIBRATIO / SHOCK:	x, y, z axis	20g
	20Hz to 100Hz	1.2g
	53Hz to 500Hz	5g
MECHANICAL CONSTRUCTION:	DESCRIPTION	
ASSEMBLY:	Laid in PU encapsulation (UL compliant) Housed into a plastic tray (PA66GF20)	Solid assembly suitable for rigid mounting
HEATSINK:	Custom made aluminium heatsink (Horizontal or vertical mounting only)	No live parts exposed
TERMINALS:	Power terminals:	Fast-on terminals
	Signal terminals:	Spring mount terminals

IP PROTECTION:	Terminals	IP00
	Electronic assembly:	IP68
	Com ports:	IP00
MOUNTING:	Horizontal mounting Vertical mounting (no other mounting positions allowed)	Rigid mounting Mounting on AVMs
INDICATORS:	RGB LED (single LED configuration)	Integrated in AVR body
DIMENSIONS:	140mm(W) x 105mm(D) x 55mm(H)	Most outer dimensions
WEIGHT:	190gr	
<b>COMPLIANCE:</b>	<b>DESCRIPTION</b>	
EMISSIONS:	EN55011, Level B	
ELECTROSTATIC DISCHARGE:	IEC1000-4-2 / EN61000-4-2, Level B	
RADIATED IMMUNITY:	IEC1000-4-3 / EN61000-4-3, Level A	
ELECTRICAL FAST TRANSIENT:	IEC1000-4-4 / EN61000-4-4, Level B	
RADIO FREQUENCY (CONDUCTED):	IEC1000-4-6 / EN61000-4-6, Level A	
POWER FREQUENCY (MAGNETIC):	IEC1000-4-8 / EN61000-4-8, Level A	
DIELECTRIC STRENGTH:	IEC255	
SURGE IMMUNITY:	IEC1000-4-5 / EN61000-4-5, Level B	
VOLTAGE DIP, FLUCTUATION IMMUNITY:	IEC1000-4-11 / EN61000-4-11, Level C	
SAFETY, EMC:	UL508	
FLAMMABILITY:	UL94	
EARTHQUAKE:	EN60255-21-3	
SHOCK:	EN60255-21-2	
VIBRATION:	EN60068-6-2	

# MECHANICAL DRAWINGS:

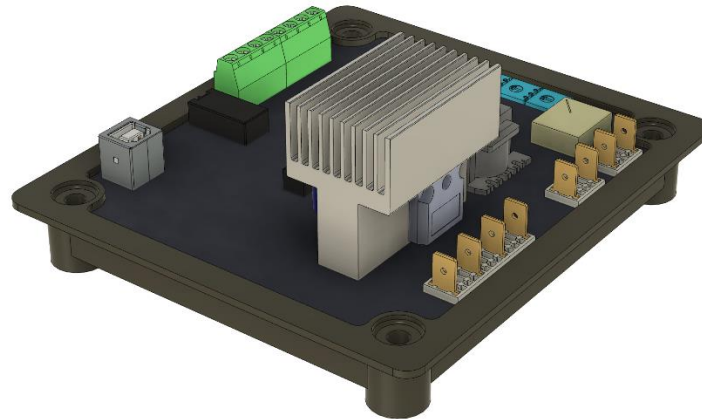


FIGURE 1: DAVR40 TRAY CONSTRUCTION

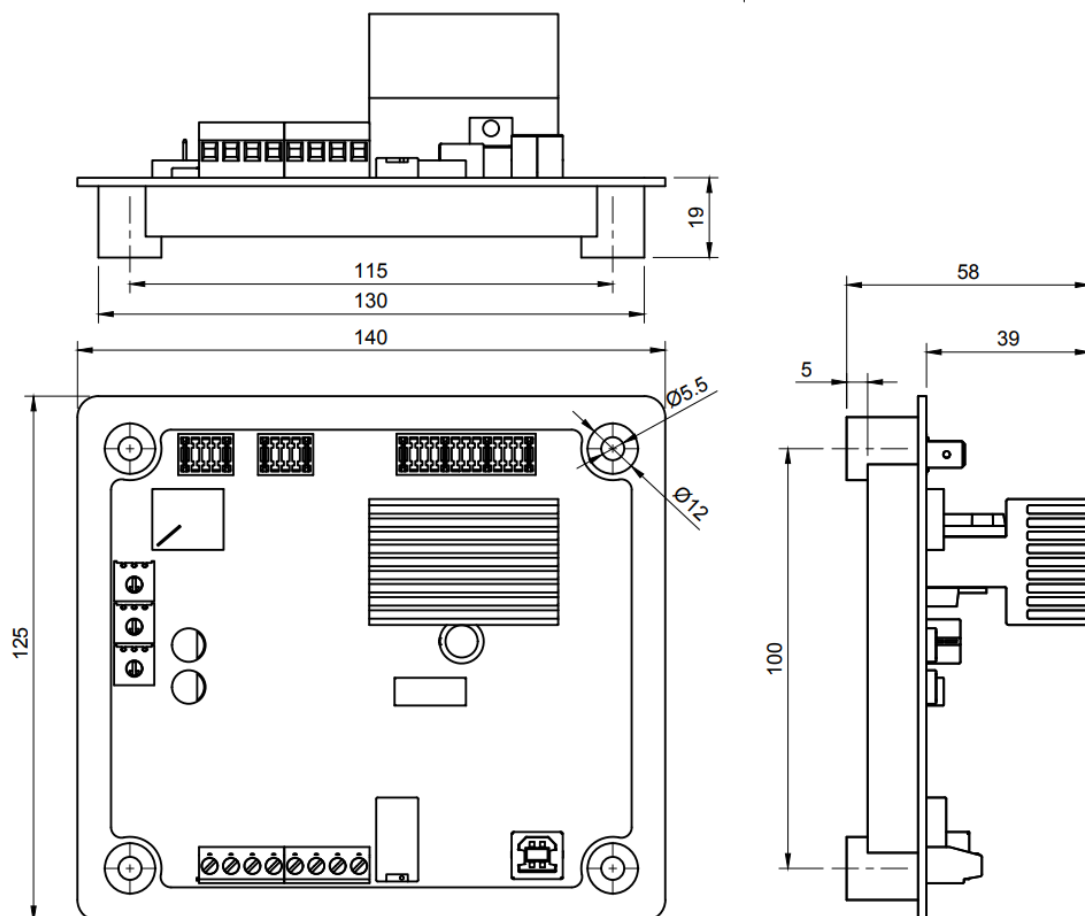


FIGURE 2: DAVR40 DIMENSIONS (MM)



## APPLICATION WIRING DIAGRAMS

### SYNCHRONOUS ALTERNATOR WITH PMG

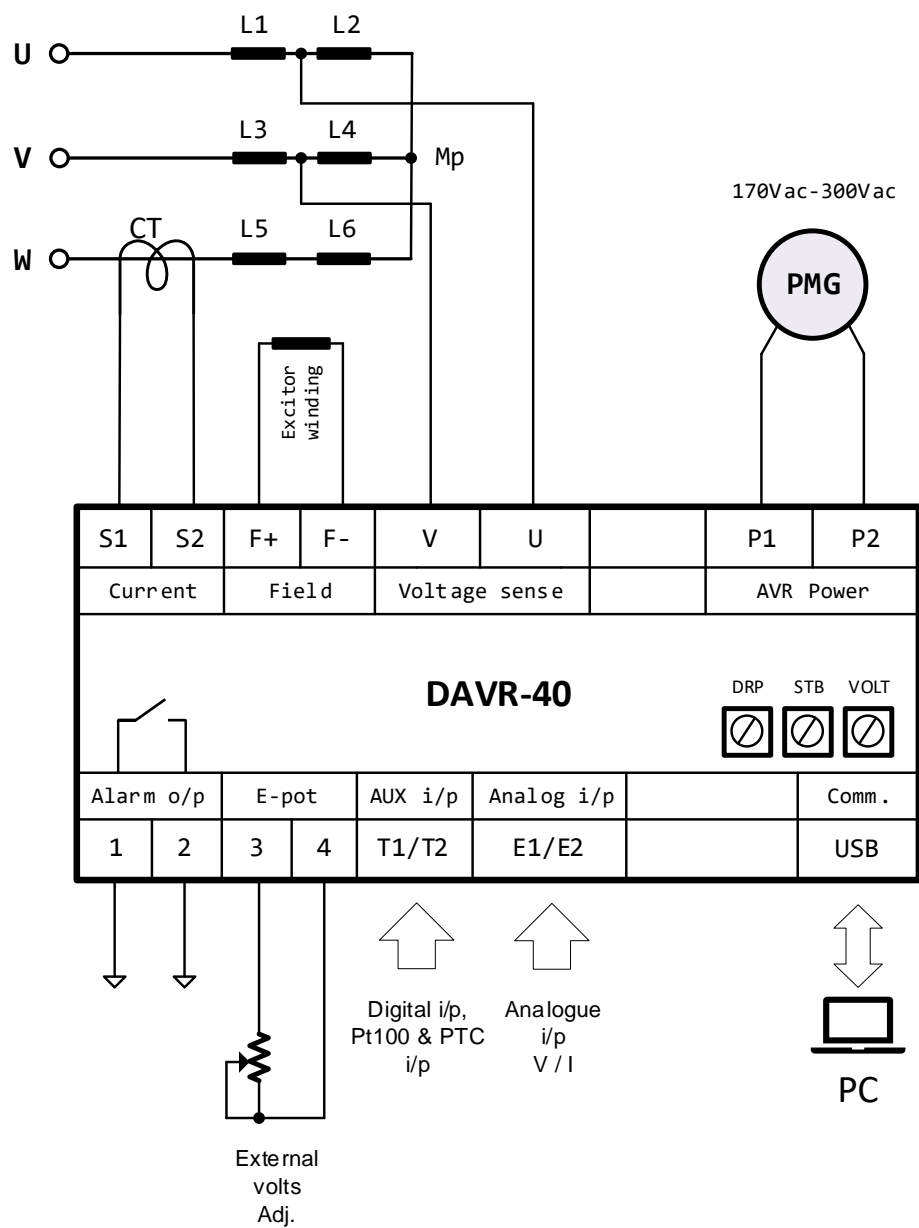


FIGURE 3: DAVR-40 WIRING WITH PMG

# SYNCHRONOUS ALTERNATOR WITH AUX. WINDING

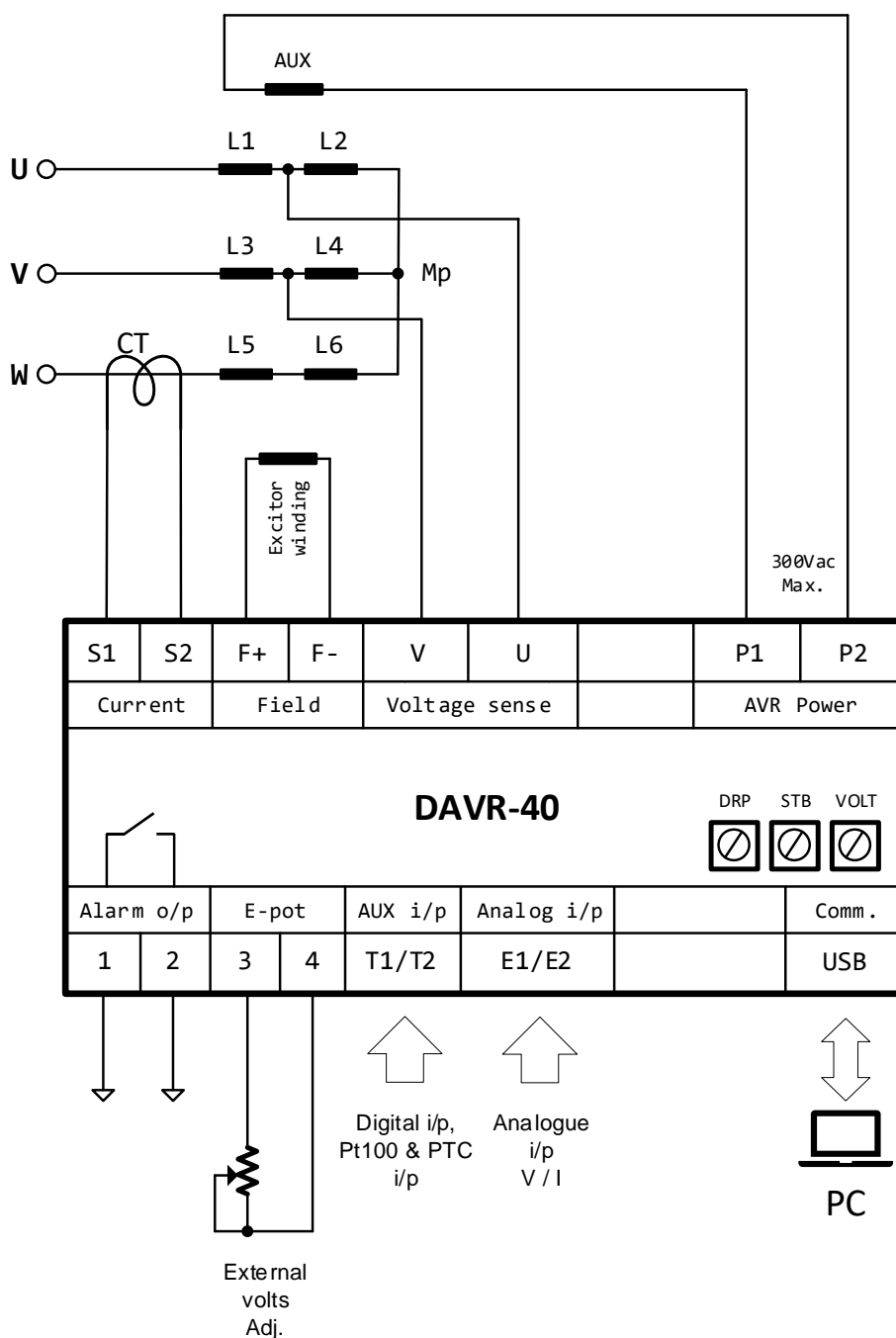


FIGURE 4: DAVR-40 WIRING WITH AUXILIARY WINDING

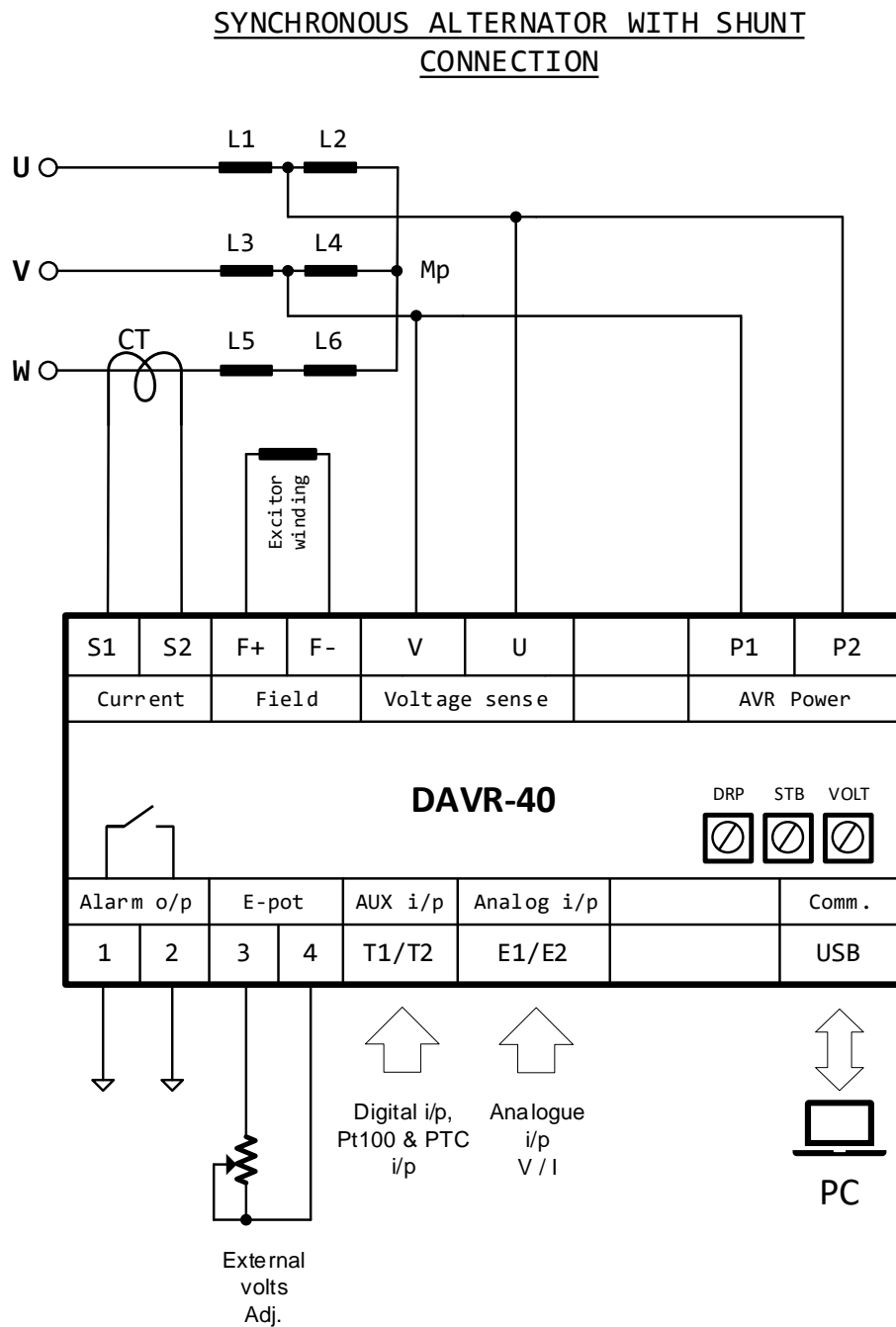
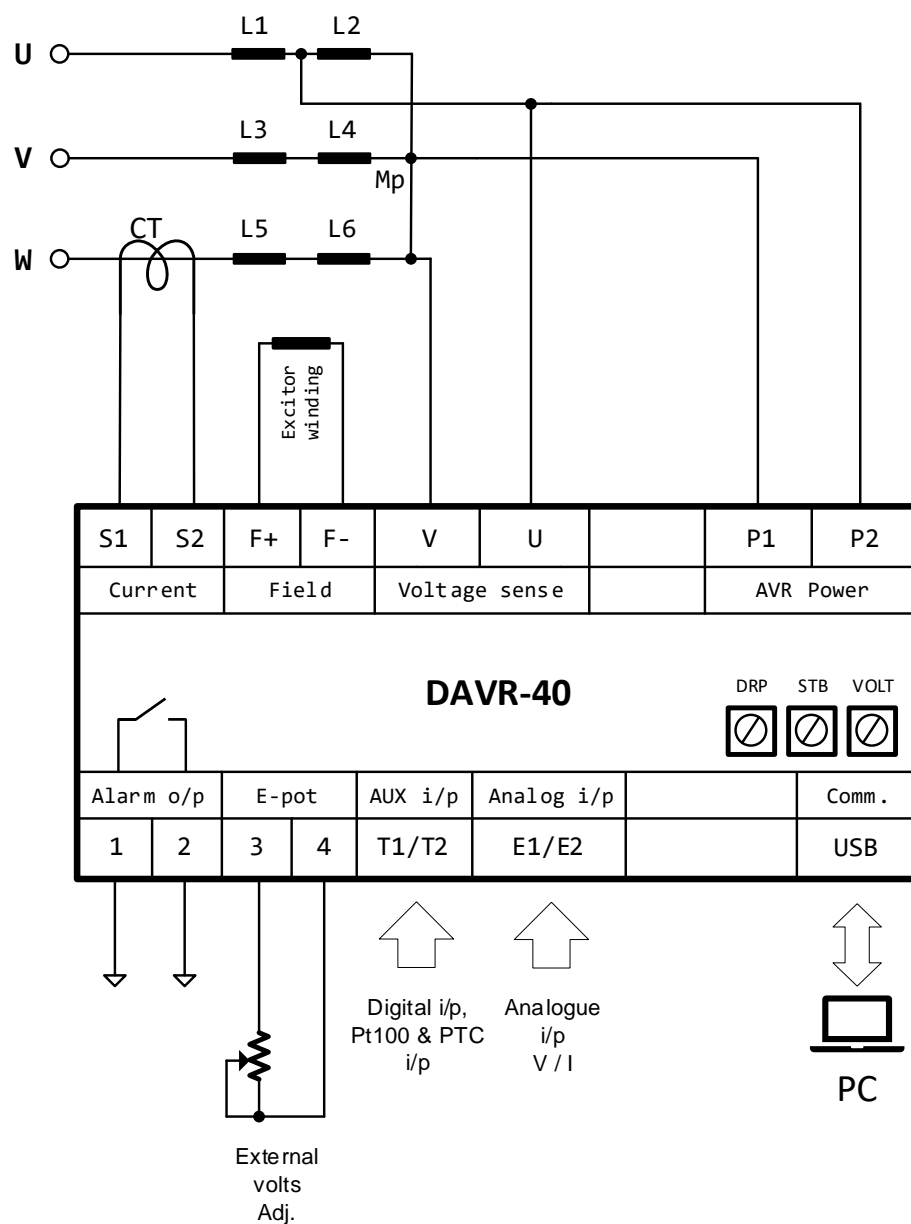


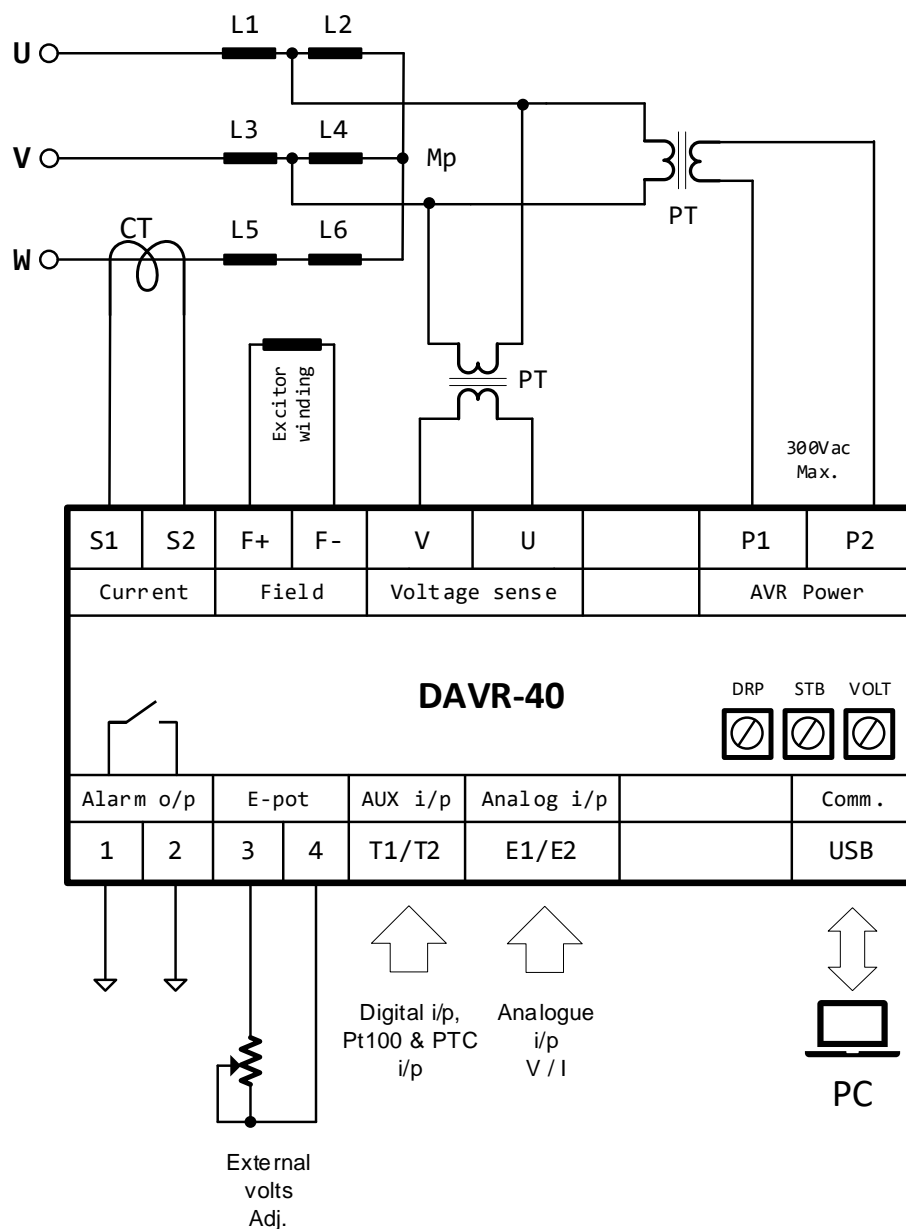
FIGURE 5: DAVR-40 WIRING FOR SHUNT CONNECTION

# SYNCHRONOUS ALTERNATOR WITH PHASE-NEUTRAL CONNECTION

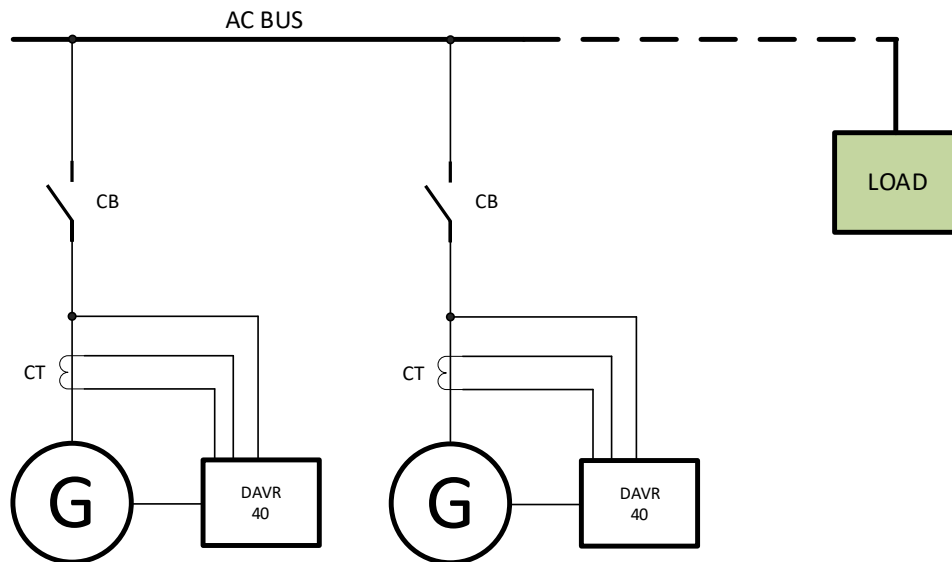


**FIGURE 6: DAVR40 WITH PHASE-NEUTRAL SHUNT CONNECTION**

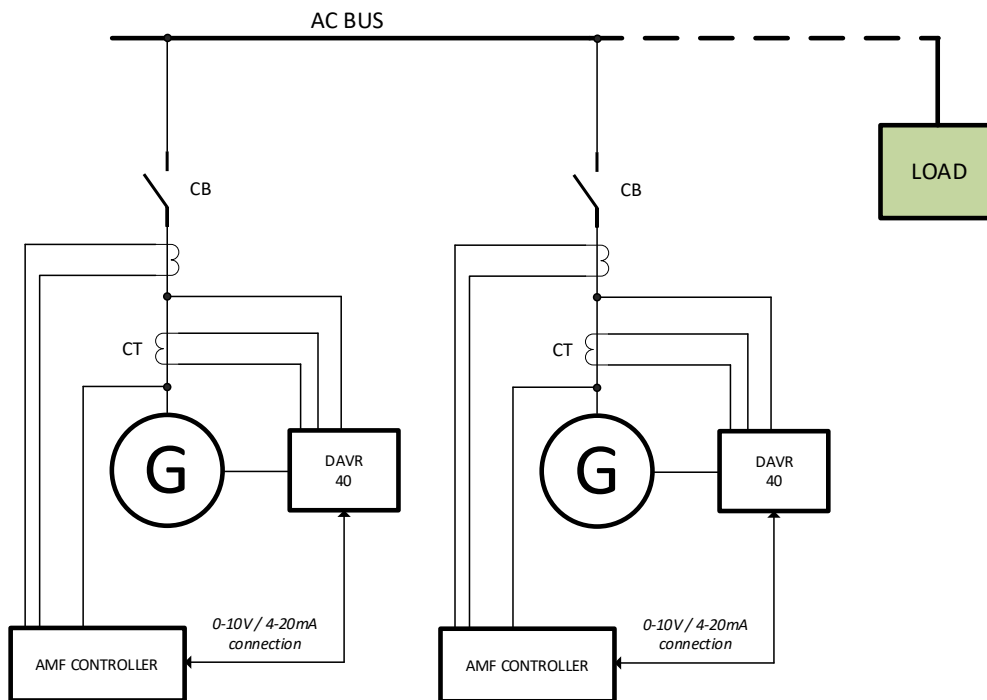
# SYNCHRONOUS ALTERNATOR SHUNT WIRING WITH HIGH POTENTIAL



**FIGURE 7: DAVR-40 SHUNT WIRING WITH HIGH POTENTIAL INPUT**

**PARALLEL CONNECTION OF GENERATORS WITH DAVR-40****FIGURE 8: DAVR40 CONNECTION FOR PARALLEL GENERATOR OPERATION**

**DAVR-40 CONNECTION WITH SYNCHRONISATION  
AMF CONTROLLER**



**FIGURE 9: DAVR40 CONNECTION WITH AMF CONTROLLER**

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