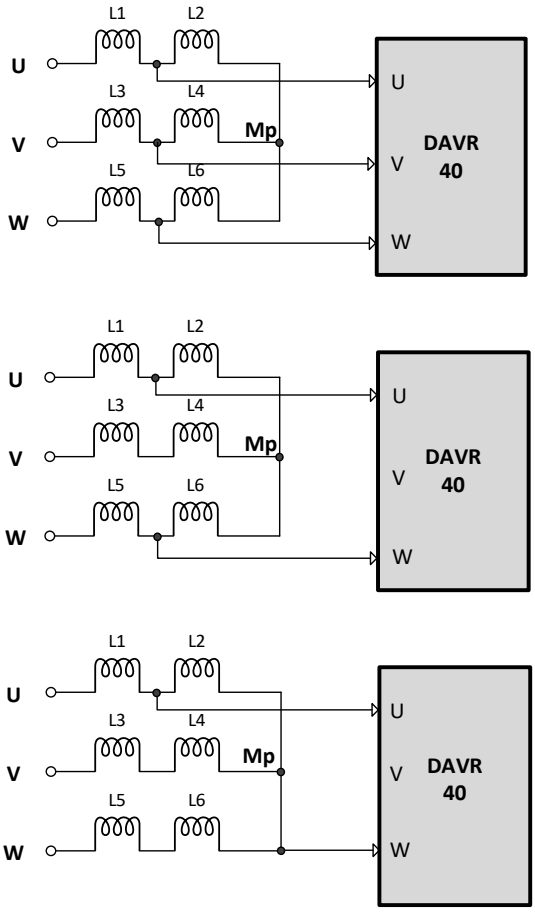
2021

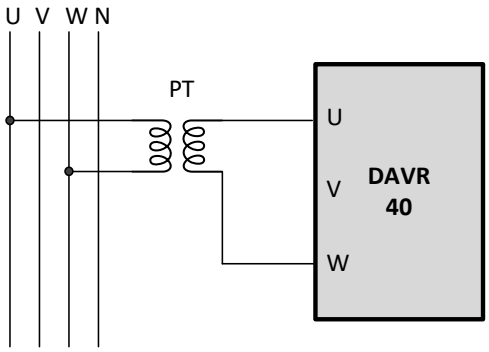
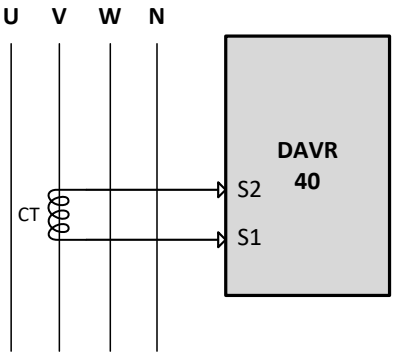
DAVR-40

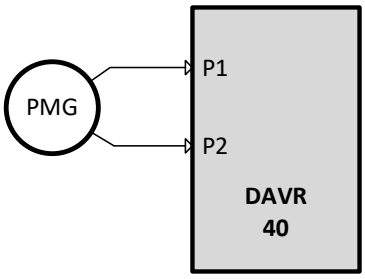
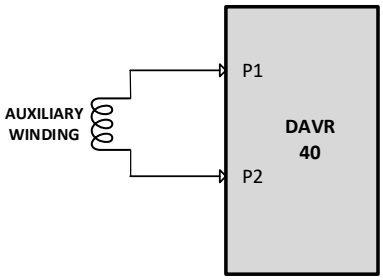
TECHNICAL SPECIFICATIONS &
APPLICATION WIRING DIAGRAMS (R8)

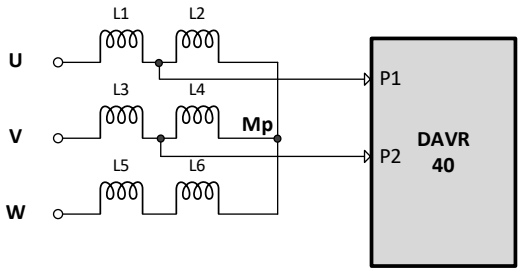
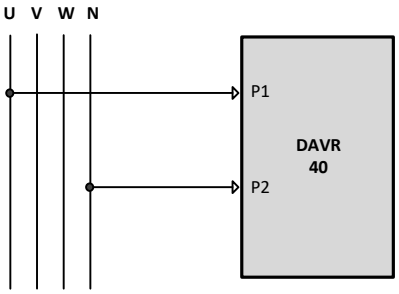
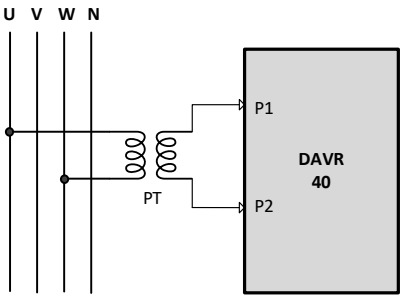
ENKO ELECTRONICS | Turkey

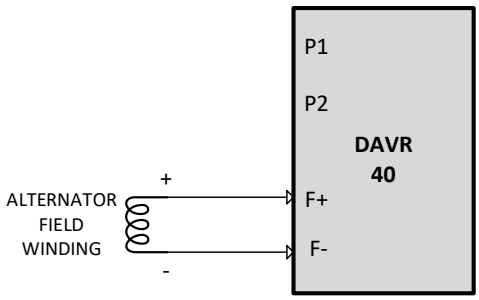
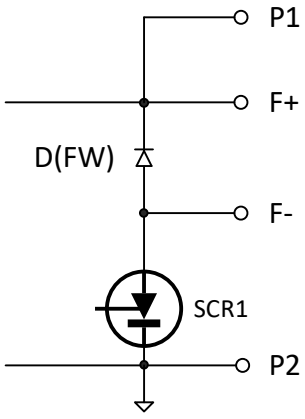
TECHNICAL SPECIFICATIONS

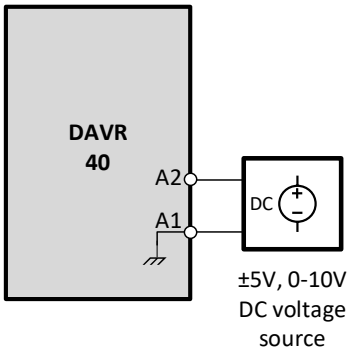
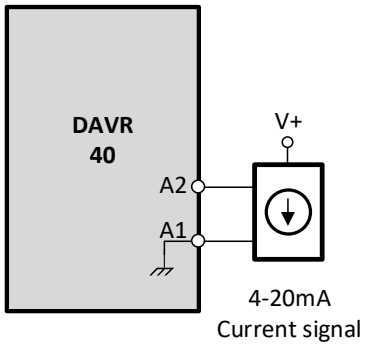
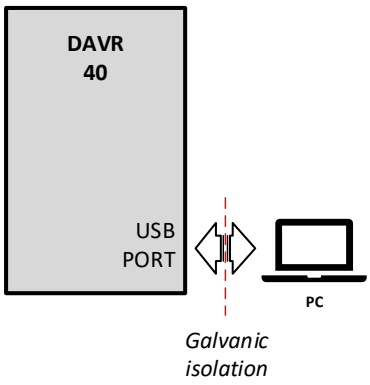
OPERATING MODE:	DESCRIPTION:
OPERATION MODE:	Operation only in AVR mode, which regulates the stator voltage based on the SENSE signal connection configuration.
GENERATOR VOLTAGE SENSING:	**DESCRIPTION:**
Sense input voltage wiring configuration:	 3-phase connection, no neutral (3W) 2-phase connection, no neutral configuration (2W) 1-phase connection between phase and neutral Limited maximum sense voltage value: 480V_{AC}

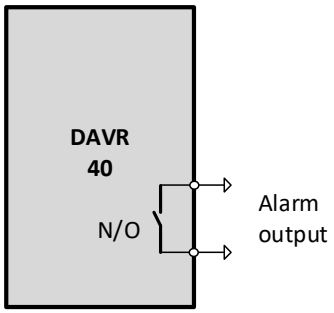
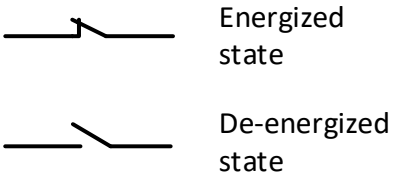
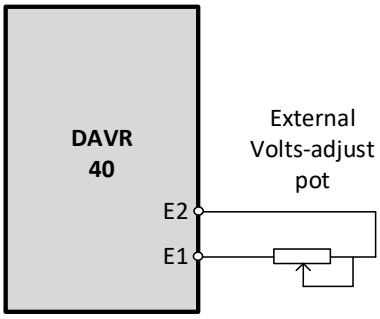
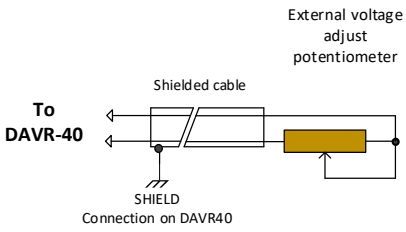
Sense input voltage configuration with high-voltage input (V_{SENSE} > 480V_{AC}	 Transformer (PT) primary/secondary voltage ratio is S/W configurable	
Voltage sensing type:	True-RMS voltage reading, Phase-phase voltage sensing, Average voltage sensing of two-phase input,	Voltage transformer must be 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 *(Given sense voltage range values are referred to phase windings mid-point connection points)*	25Hz to 75Hz operation
Voltage setting range:	○ Manual voltage setting of regulation level with on-board trimmer (±15% of S/W configured voltage setting value) ○ Voltage setting via S/W using, PC configuration tool (Voltage setting of the AVR MUST match the wiring configuration of the alternator in the system)	
GENERATOR CURRENT SENSING:	**DESCRIPTION:**	
Current sense input connection:	 Current sense transformer connection on “V” phase line Current transformer conversion ratio is X/1A (CT connection must be made according to IEC61000-6-4)	
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:	○ Quadrature droop for reactive load sharing (parallel operation) ○ Line droop compensation (+V/KVA) ○ Stator-load current monitoring ○ Motor-start current limit according to set parameter value *(If QUADRATURE DROOP function is selected, other functions cannot be selected)*	
CT load burden:	<1VA (over nominal operation range)	
POWER INPUT TO AVR:	**DESCRIPTION:**	
PMG CONNECTION:	 PMG type: “SINGLE-PHASE” PM type alternator (50Hz/60Hz) Phase output voltage (L – L): 170Vac – 300Vac Rated power is limited with maximum allowed excitation power output of the AVR under specified conditions.	
AVR POWER INPUT WITH AUXILIARY WINDING:	 AUXILIARY power winding voltage: Single phase,170Vac – 300Vac (maximum allowed voltage limit) Rated power is limited with maximum allowed excitation power output of the AVR under specified conditions.	
NOTE:	Protection safety fuses are not included on the AVR unit. It is mandatory to use appropriate additional protection fuses in the AVR installation, based on the application requirements.	

AVR POWER INPUT WITH TWO PHASE SHUNT CONNECTION:	 Two phase SHUNT connection across P1 and P2. (Voltage limit across terminals P1 and P2 is limited to 300Vac max)
AVR POWER INPUT WITH PHASE-NEUTRAL SHUNT CONNECTION	 SHUNT connection between phase and Neutral line. (300Vac maximum allowed voltage limit across terminals P1 and P2)
AVR POWER INPUT FROM HIGH POTENTIAL:	 PT must be used if AVR power is connected from high potential. Voltage across P1 and P2 is limited to 300Vac max.
NOTE:	Protection safety fuses are not included on the AVR unit. It is mandatory to use appropriate additional protection fuses in the AVR installation, based on the application requirements.

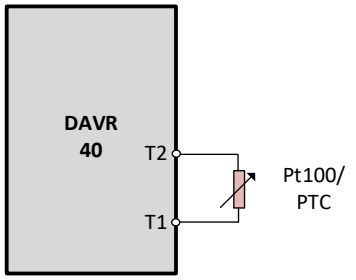
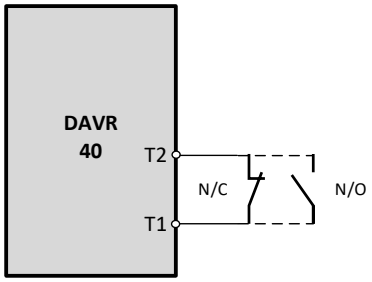
FIELD DRIVE OUTPUT:	DESCRIPTION:	
FIELD WINDING WIRING CONFIGURATION:	 Cable length between AVR and Exciter winding should NOT exceed 5 meters maximum length.	
EXCITATION VOLTAGE RANGE:	Continuous drive: $100V_{DC}$ Overload status (20 sec): $160V_{DC}$ Overload status (10 sec): $200V_{DC}$	Power into the EXCITER winding is limited with the available power across P1 and P2
EXCITATION CURRENT RANGE:	Continuous drive: $5A_{DC}$ Overload status (20 sec): $7A_{DC}$ Overload status (10 sec): $10A_{DC}$	
FIELD WINDING IMPEDANCE:	Nominal: 15Ω Minimum: >5Ω (@ room temperature) Range: 5Ω to 50Ω	Wiring impedance from AVR to FIELD winding should NOT exceed 5% of FIELD winding nominal impedance at room temperature
AVR POWER STAGE CONFIGURATION:		For AUX and SHUNT connection, terminals P1 and P2 must be used. SCR drive with PID control 5Adc continuous 7Adc for 20 sec 10Adc for 10 sec Maximum excitation power is: 600W@60°C Derate with -5%/°C between 60°C to 70°C

ANALOGUE INPUTS:	DESCRIPTION:	
DIFFERENTIAL ANALOG VOLTAGE SIGNAL INPUT (±5Vdc / 0-10Vdc):	 *(Only one analogue signal can be connected at any time)*	0 – 10Vdc input ±5Vdc input (configuration as -5Vdc/0V/+5Vdc with A1 terminal internally connected to GND) S/W configurable, no on-board trimmer Resolution: 1/1000 (non-isolated input)
DIFFERENTIAL ANALOG CURRENT SIGNAL INPUT (4-20mA):	 *(Only one analogue signal can be connected at any time)*	4 -20mA current input (A1 connected to GND internally) Burden load: 100Ω <4mA corresponds to “low level input” 12mA set as mid-point S/W configurable parameters, no on-board trimmer. Resolution: 1/1000 (Non-isolated input)
COMMUNICATION PORTS:	**DESCRIPTION**	
USB COMMUNICATION PORT (ISOLATED):		Device configuration port for PC connection Power supply (internal & external) MODBUS protocol Type-B socket on-board Power and data galvanically isolated

ALARM OUTPUT:	DESCRIPTION	
ALARM OUTPUT:		N/O Alarm contact output. Contact rating is: 1A/30Vdc *(Contacts are closed/energized during normal operation)*
CONTACT CAPACITY:		SPST Relay contact output 1.0 A_{DC} (max) @ 30Vdc
ALARM FUNCTIONS LIST:	○ Threshold / trigger status ○ Time delay ○ Enable / Disable ○ Latched ○ Masked ○ Relay activation ○ Trip activation	Each of the defined functions can be allocated to any alarm signal using PC Tool configuration software.
EXTERNAL VOLTS ADJUST:	**DESCRIPTION**	
EXTERNAL POT CONNECTION:		External voltage adjust pot connected to terminals 1 and 2 Adjustment range: ±15% of set voltage parameter (S/W configurable)
POT VALUE:		Value: 1KΩ 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**	
AVR OPERATING:	No alarm, AVR is powered and operating under normal conditions	GREEN (continuous)
ALARM:	Triggered ALARM condition	RED (continuous)
USB PORT:	Active USB data transmission	BLUE (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: ±0.1 A_{DC}
TRIP TIME DELAY CONTROL:	Time delay set point $0 \leq T_D \leq 10s$ for $I_F = 10A_{DC}$ $0 \leq T_D \leq 20s$ for $5A_{DC} < I_F < 7A_{DC}$ Parameters are S/W configurable *(current / time thermal effect function calculation with I^2t characteristic)*	Resolution: ±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: ±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: ±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: ±1.0% (% of effective stator voltage setpoint)
OVER-VOLTAGE TIME DELAY CONTROL:	Time delay set point $0 \leq T_D \leq 20s$	Resolution: ±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: ±1.0% (% of effective stator voltage setpoint)
TIME DELAY CONTROL:	Time delay set point $0 \leq T_D \leq 20s$	Resolution: ±1.0 sec
TRIP:	Alarm relay activation (latching / non-latching) LED indicator activation Parameters are S/W configurable	
STATOR VOLTAGE UNBALANCE:	**DESCRIPTION**	
STATOR VOLTAGE UNBALANCE PERCENTAGE:	Stator voltage unbalance monitoring, $0\% \leq V_{UNBALANCE} \leq 50\%$	Resolution: ±1.0% of 3-phase average value
TIME DELAY CONTROL:	Time delay set point $0 \leq T_D \leq 30s$ Parameters are S/W configurable	Resolution: ±1.0 sec
RELAY ACTIVATION:	S/W selectable RELAY action	
TRIP ACTIVATION:	S/W selectable TRIP action programming	

AUXILIARY INPUTS:	DESCRIPTION	
AVR TEMPERATURE SENSING:	**On-board sensor** for microcontroller ambient temperature sensing (temperature on the PCB) +10ºC to +100ºC	Resolution: ±1.0ºC
WINDING TEMPERATURE SENSING:	 Monitoring of external temperature point +40ºC ≤ T_{EXT} ≤ +300ºC 1 independent PTC or Pt100 sensor input, T1 – T2 input terminals *(Parameters S/W configurable)*	T1-T2 temperature sensing input (RTD type) Resolution: ±1.0ºC (non-isolated input)
EXTERNAL DIGITAL SIGNAL INPUT CONFIGURATION:	 N/O or N/C external DRY-CONTACT input for DIGITAL signal input detection *(Parameter is S/W configurable)*	T1/T2 temperature input can be configured as DIGITAL signal INPUT (non-isolated input)
TIME DELAY CONTROL:	Time delay control setting, 0 ≤ T_D ≤ 30 sec	Resolution: ±1.0 sec
TRIP:	Alarm relay activation (latching / non-latching) LED indicator activation Parameters are S/W configurable	

VOLTAGE REGULATION:	DESCRIPTION	
VOLTAGE REGULATION:	2-phase RMS voltage regulation Phase-Neutral voltage regulation	Regulation: < ±0.5%
REGULATION CONDITIONS:	Prime mover speed change: <4% Cosφ: >0.8 THD (3-phase average): <5%	
TEMPERATURE DRIFT:	ΔT < 40ºC Unchanged load conditions	
SOURCES OF REGULATION SETPOINT:	• S/W voltage regulation set-point • On-board trimmer voltage setting • External pot voltage setting • AUX input-controlled voltage setting (control from an external device)	All regulation source selections are S/W configurable during AVR set-up
SOFT-START SEQUENCE CONTROL:	**DESCRIPTION**	
START TIME DELAY:	$0 \leq T_{DELAY} \leq 7200$ sec. Parameters S/W configurable	Time based start-delay in seconds Resolution: ±1.0 sec
START FREQUENCY CONTROL:	$25Hz \leq F_{START} \leq 75Hz$ Parameters S/W configurable	Frequency based start-delay in Hz. Resolution: ±0.5Hz
SOFT-START RAMP CONTROL:	$1 \leq T_{SOFTSTART} \leq 7200$ 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
STABILITY (PID) CONTROL:	**DESCRIPTION**	
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

FREQUENCY RESPONSE:	DESCRIPTION	
UFRO KNEE POINT CONTROL:	40Hz ≤ F_{UFRO} ≤ 65Hz STATOR voltage roll-off point control Parameters S/W configurable	Resolution: 0.1 Hz increments
LAM FUNCTION SLOPE CONTROL:	0V/Hz ≤ $V_{COEFF.}$ ≤ 15V/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:	0V/sec ≤ $T_{COEFF.}$ ≤ 100V/sec Coefficient of rate of volts control per time-second change Parameters S/W configurable	Resolution: 0.1V/sec increments
QUADRATURE DROOP / LINE DROOP CONTROL:	**DESCRIPTION**	
REACTIVE DROOP COMPENSATION:	Manual DROOP control with on-board trimmer -5% ≤ DROOP ≤ +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, -60º ≤ ρ ≤ +60º S/W configurable with automatic compensation	
LINE DROOP COMPENSATION:	Voltage line DROOP compensation -10% ≤ L_{DROOP} ≤ +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:	-40ºC to +70ºC Power derating above 60°C ambient
	Storage temperature range:	-40ºC to +85ºC
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	5g
	20Hz to 100Hz	1.2g
	53Hz to 500Hz	5g
MECHANICAL CONSTRUCTION:	**DESCRIPTION**	
ASSEMBLY:	PU encapsulation (UL compliant) Housed into a plastic tray (PA66GF20)	Solid assembly suitable for rigid mounting
HEATSINK:	Aluminium anodized heatsink	No live parts exposed
TERMINALS:	Power terminals:	Fast-on terminals
	Signal terminals:	Screw type header terminals
IP PROTECTION:	Terminals	IP00
	Electronic assembly:	IP54
	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	

COMPLIANCE:	DESCRIPTION
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:

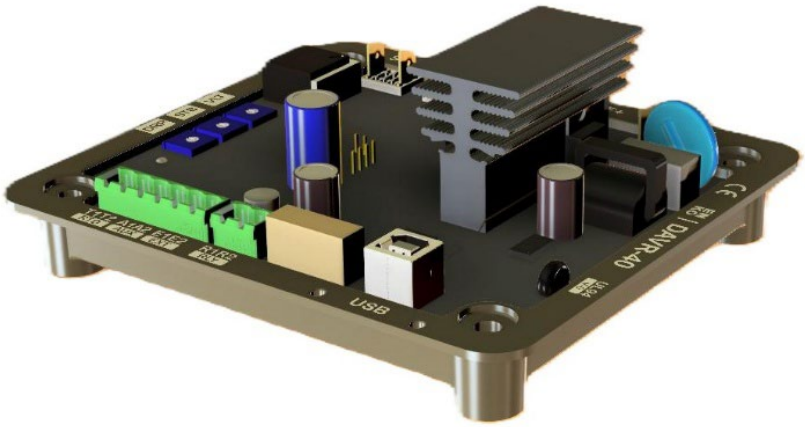


FIGURE 1: DAVR40 TRAY CONSTRUCTION

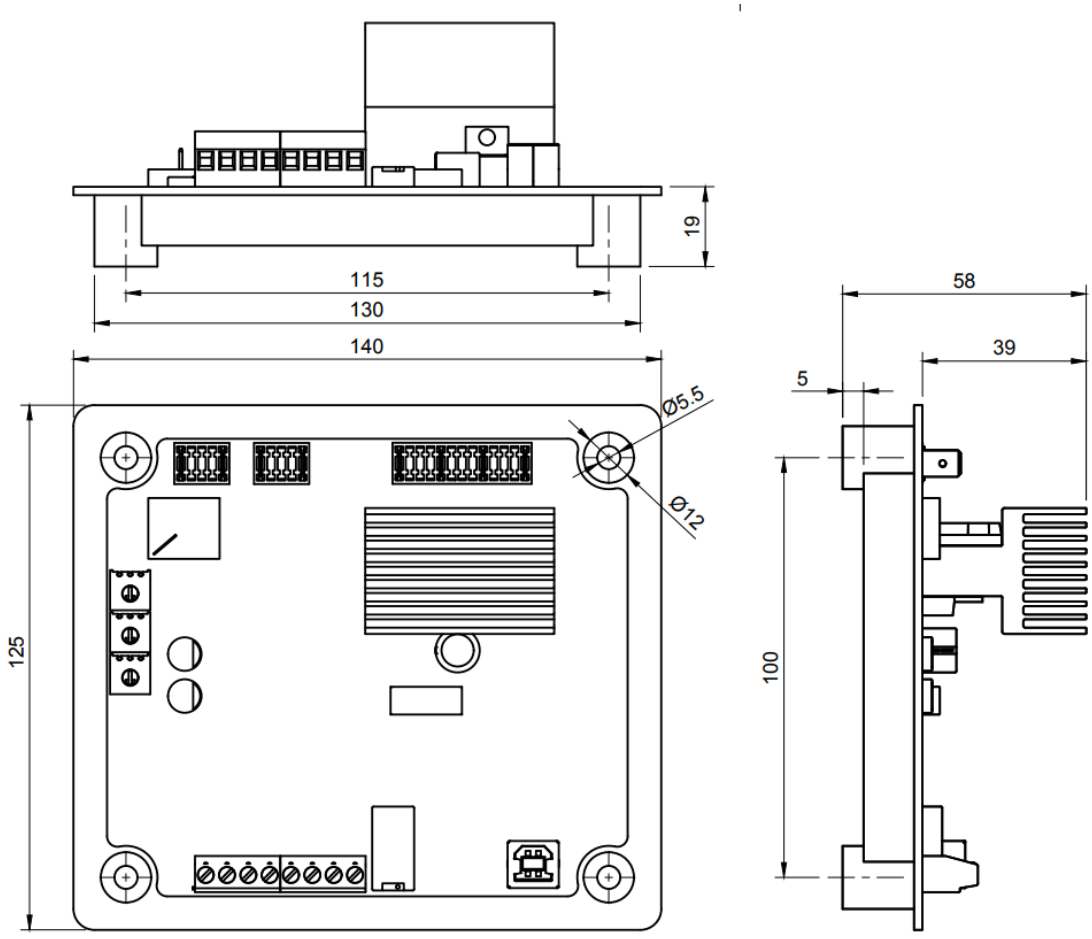


FIGURE 2: DAVR40 DIMENSIONS (MM)

APPLICATION WIRING DIAGRAMS

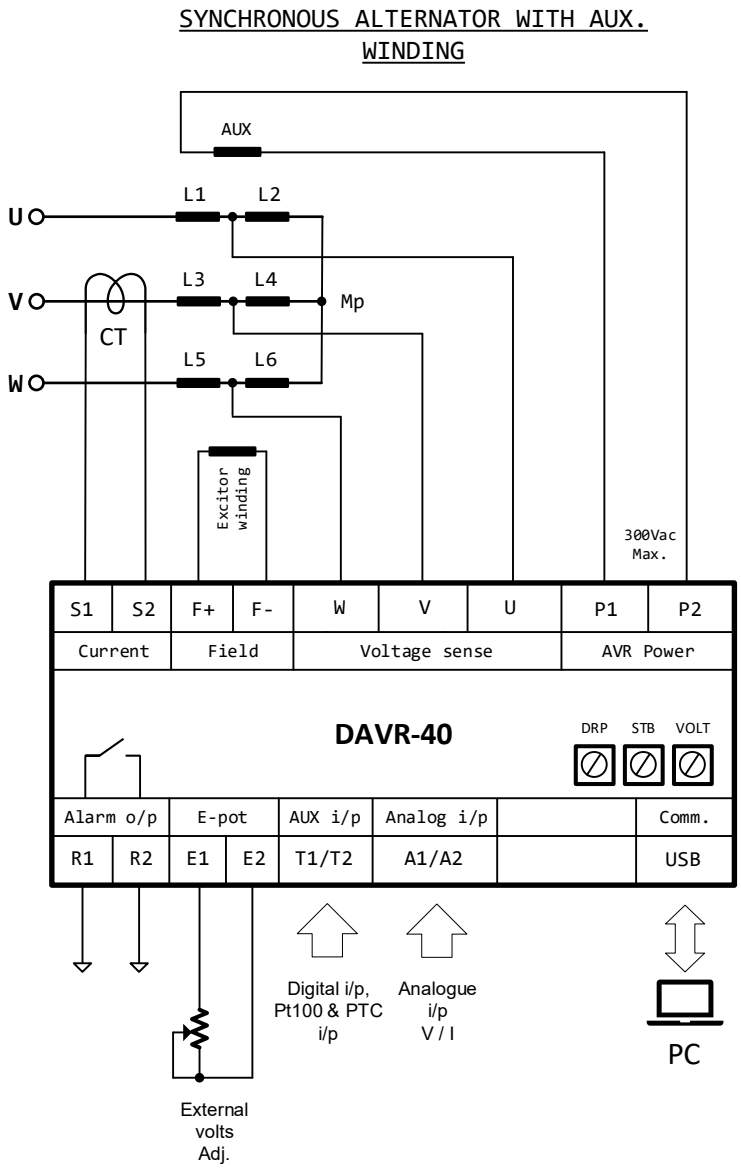


FIGURE 3: DAVR-40 WIRING WITH AUXILIARY WINDING

NOTE:

Protection fuses are not used onboard the AVR due to different regulatory laws in different countries. Therefore, appropriate protection fuses must be used during AVR installation based on the application requirements.

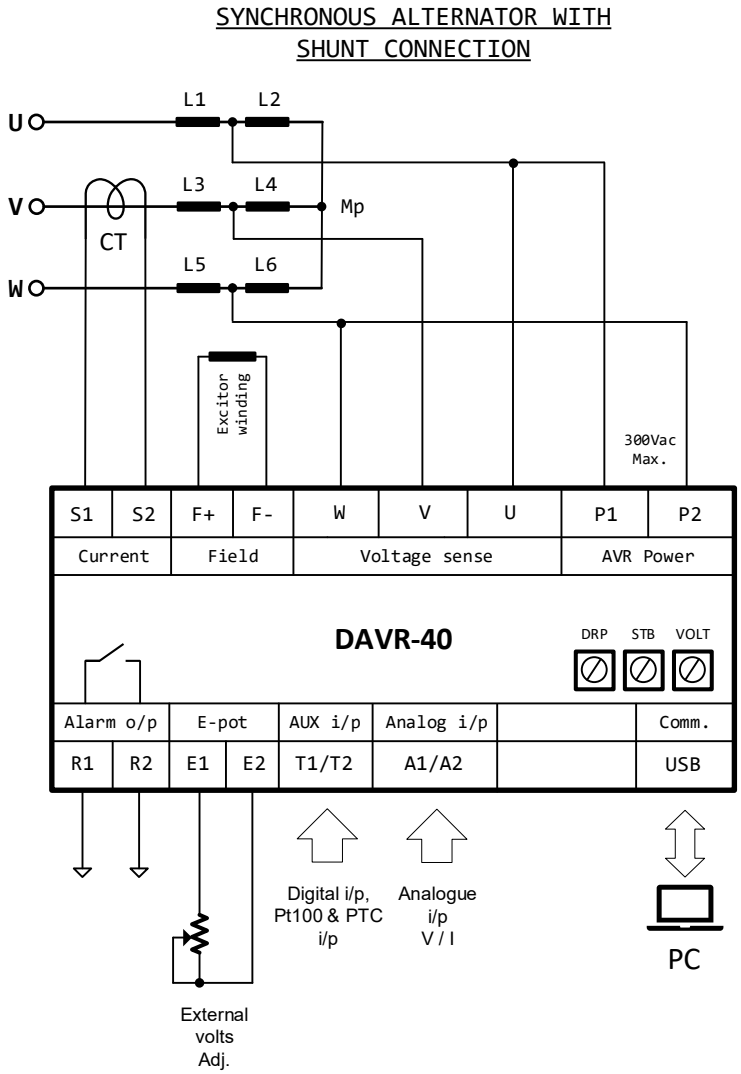


FIGURE 4: DAVR-40 WIRING FOR SHUNT CONNECTION

NOTE:

Protection fuses are not used onboard the AVR due to different regulatory laws in different countries. Therefore, appropriate protection fuses must be used during AVR installation based on the application requirements.

PARALLEL CONNECTION OF GENERATORS WITH DAVR-40

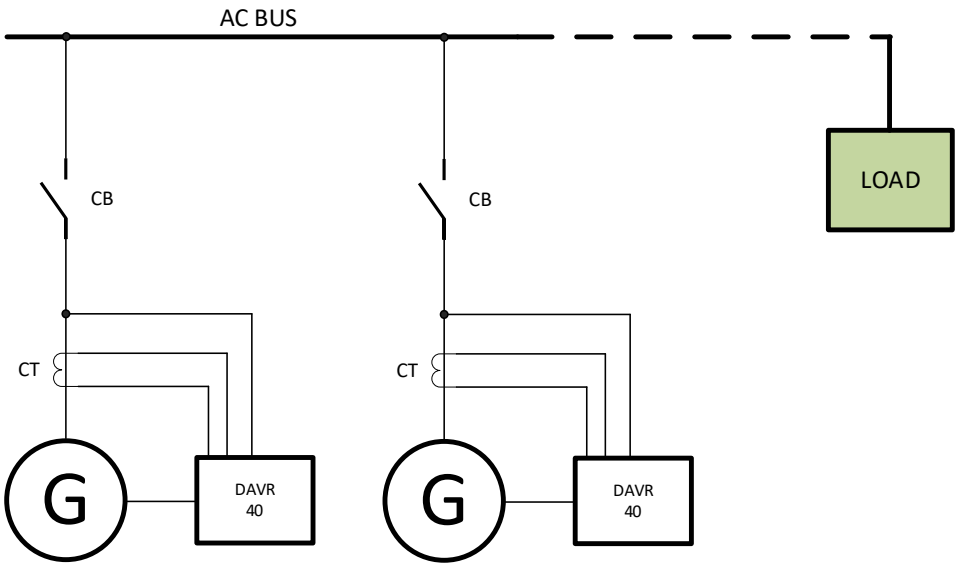


FIGURE 5: DAVR40 CONNECTION FOR PARALLEL GENERATOR OPERATION

DAVR-40 CONNECTION WITH SYNCHRONISATION AMF CONTROLLER

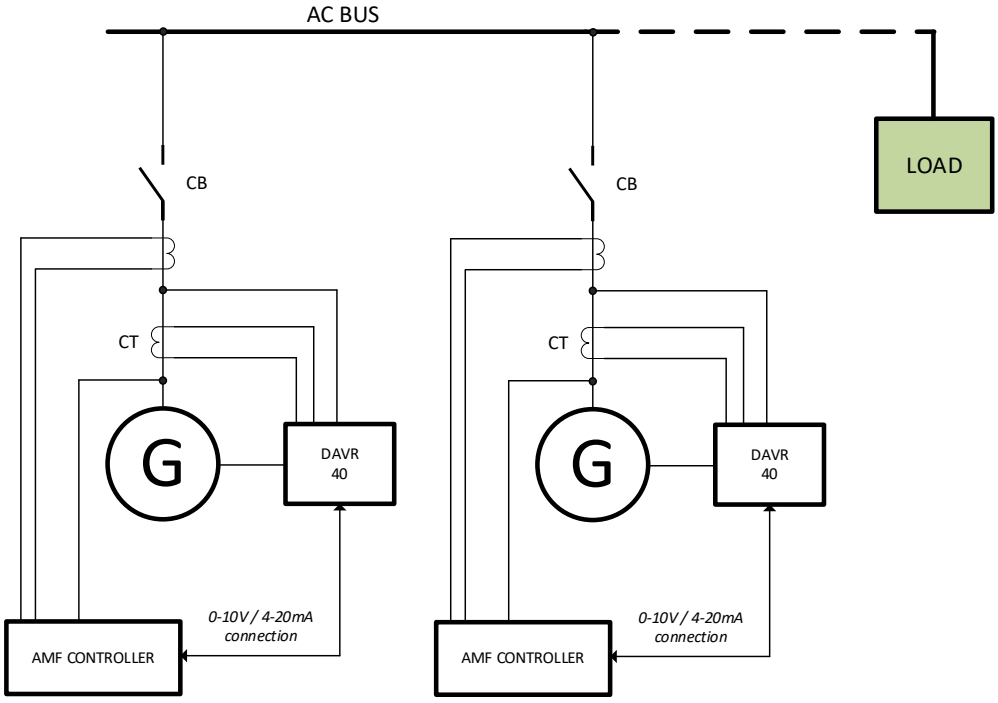


FIGURE 6: DAVR40 CONNECTION WITH AMF CONTROLLER

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