

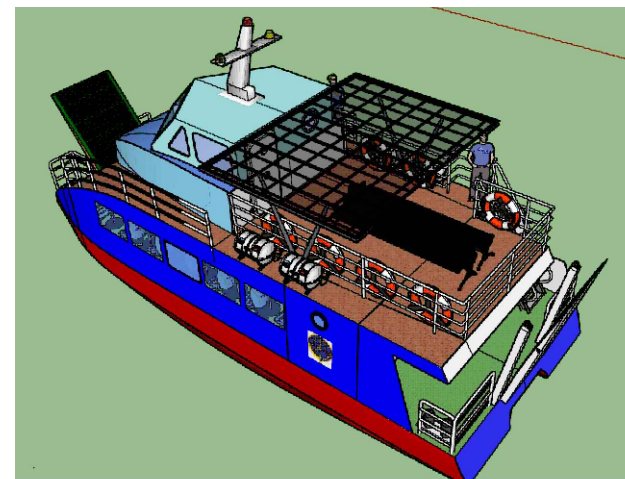
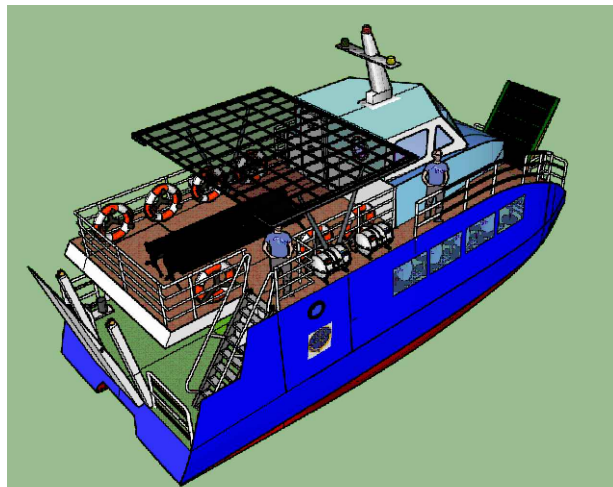
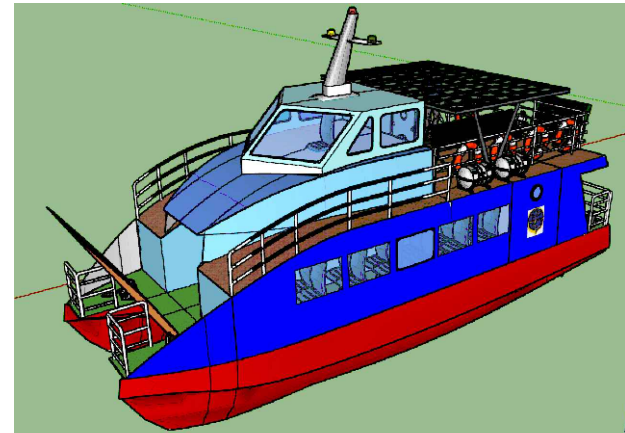
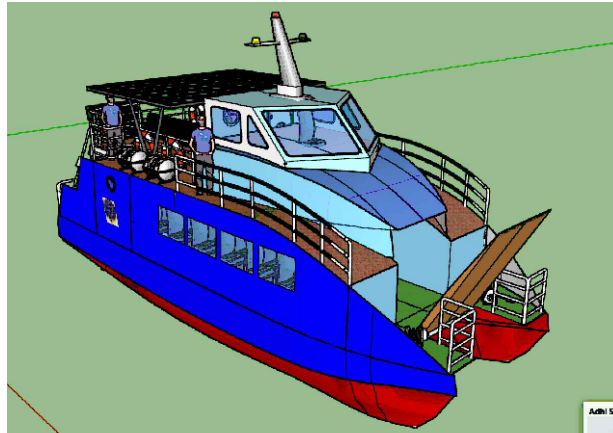
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LAMPIRAN

1. Gambar 3D Bus Air Roro
2. Spesifikasi Teknis Panel Surya
3. Spesifikasi Teknis Baterai
4. Spesifikasi Teknis Inverter
5. Spesifikasi Teknis *Solar Charge*
6. Spesifikasi Teknis Generator
7. Tabel Potensi Panel Surya dalam 1 hari
8. Perhitungan *Load Balance*
9. Komponen Listrik Pada Bus Air Roro
10. Beban Kelistrikan yang akan disuplai Sel Surya
11. Perhitungan Perencanaan Sistem Pembangkit Listrik *Hybrid*
12. *Wiring Diagram* Panel Surya



	PROYEKSI	SCALE : 1 : 50	DRAWN BY : MEI	NOTES :
		SIZE : MM	CHEKED BY : AKHI	
		DATE : 11/04/2022	APPROVED BY : 1. DAYAT 2. IHSAN	
	PT. Dok & Perkapalan Air Kantung Docking, Ship repair, Ship building, Boatbuilding Collocation, Sailing & Boatbuilding, Boatbuilding Facilities Sekeloa, Kabupaten Ogan Komering Ilir, Sumatera Selatan			BUS AIR RORO GAMBAR 3D
	Jl. Timah Jaya No. 100, WISMA 38811 Phone 08-717 90281, 0721, Fax. 08-717 90280			



SunPower® X-Series Residential Solar Panels | X21-335-BLK | X21-345

More than 21% Efficiency

Ideal for roofs where space is at a premium or where future expansion might be needed.

Maximum Performance

Designed to deliver the most energy in demanding real-world conditions, in partial shade and hot rooftop temperatures.¹

Premium Aesthetics

SunPower® Signature™ Black X-Series panels blend harmoniously into your roof. The most elegant choice for your home.



Maxeon® Solar Cells: Fundamentally better
Engineered for performance, designed for durability.

Engineered for Peace of Mind

Designed to deliver consistent, trouble-free energy over a very long lifetime.²

Designed for Durability

The SunPower Maxeon Solar Cell is the only cell built on a solid metal foundation. Virtually impervious to the corrosion and cracking that degrade conventional panels.

Same excellent durability as E-Series panels.
#1 Rank in Fraunhofer durability test.³

Unmatched Performance, Reliability & Aesthetics



SIGNATURE™ BLACK
SPR-X21-335-BLK



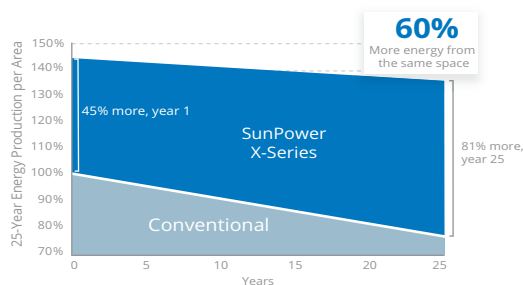
SPR-X21-345



High Efficiency

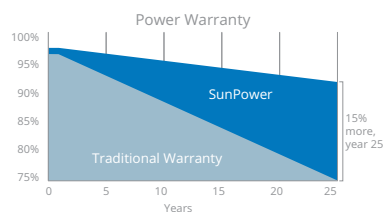
Generate more energy per square foot

More energy to power your home. X-Series residential systems convert more sunlight to electricity by producing 45% more energy in the first year. This advantage increases over time, producing 60% more energy over the first 25 years to meet your needs.¹

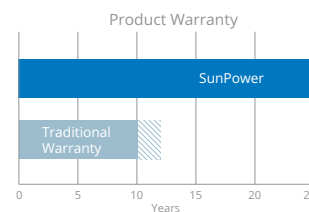


Best Reliability, Best Warranty

A better warranty starts with a better product. Proven performance backs up our industry-best coverage, including out warranted 0.25% per year degradation rate.⁴



More guaranteed power: 98% for first year, -0.25%/yr. to year 25



Combined Power and Product defect 25-year coverage



SunPower® X-Series Residential Solar Panels | X21-335-BLK | X21-345

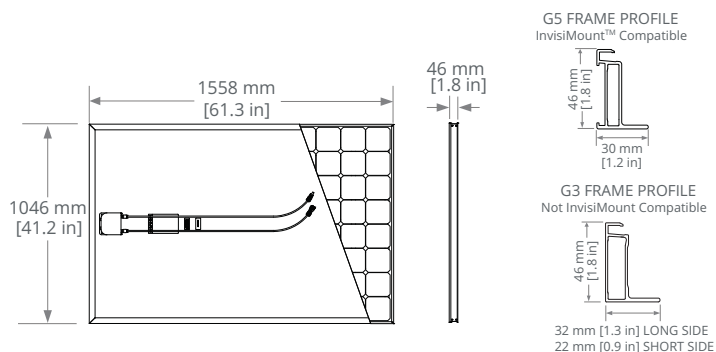
Electrical Data		
	SPR-X21-335-BLK	SPR-X21-345
Nominal Power (P _{nom}) ⁵	335 W	345 W
Power Tolerance	+5/-0%	+5/-0%
Avg. Panel Efficiency ⁶	21.0%	21.5%
Rated Voltage (V _{mpp})	57.3 V	57.3 V
Rated Current (I _{mpp})	5.85 A	6.02 A
Open-Circuit Voltage (V _{oc})	67.9 V	68.2 V
Short-Circuit Current (I _{sc})	6.23 A	6.39 A
Max. System Voltage	600 V UL & 1000 V IEC	
Maximum Series Fuse	15 A	
Power Temp Coef.	-0.29% / °C	
Voltage Temp Coef.	-167.4 mV / °C	
Current Temp Coef.	2.9 mA / °C	

Tests And Certifications	
Standard Tests ⁷	UL1703 (Type 2 Fire Rating), IEC 61215, IEC 61730
Management System Certs	ISO 9001:2015, ISO 14001:2015
EHS Compliance	RoHS, OHSAS 18001:2007, lead free, REACH SVHC-163, PV Cycle
Sustainability	Cradle to Cradle Certified™ Silver (contributes to LEED categories) ⁸
Ammonia Test	IEC 62716
Desert Test	10.1109/PVSC.2013.6744437
Salt Spray Test	IEC 61701 (maximum severity)
PID Test	1000V: IEC62804, PVEL 600hr duration
Available Listings	UL, TUV, MCS, CSA, FSEC, CEC

Operating Condition And Mechanical Data	
Temperature	-40° F to +185° F (-40° C to +85° C)
Impact Resistance	1 inch (25 mm) diameter hail at 52 mph (23 m/s)
Appearance	Class A+
Solar Cells	96 Monocrystalline Maxeon Gen III
Tempered Glass	High-transmission tempered anti-reflective
Junction Box	IP-65, MC4 compatible
Weight	41 lbs (18.6 kg)
Max. Load	G5 Frame: Wind: 62 psf, 3000 Pa front & back Snow: 125 psf, 6000 Pa front
	G3 Frame: Wind: 50 psf, 2400 Pa front & back Snow: 112 psf, 5400 Pa front
Frame	Class 1 black anodized (highest AAMA rating)

REFERENCES:

- 1 SunPower 360W compared to a Conventional Panel on same sized arrays (260W, 16% efficient, approx. 1.6 m²), 4% more energy per watt (based on 3pty module characterization and PVSim), 0.75%/yr slower degradation (Campeau, Z. et al. "SunPower Module Degradation Rate," SunPower white paper, 2013).
- 2 "SunPower Module 40-Year Useful Life" SunPower white paper, May 2015. Useful life is 99 out of 100 panels operating at more than 70% of rated power.
- 3 X-Series same as E-Series, 5 of top 8 panel manufacturers tested in 2013 report, 3 additional panels in 2014. Ferrara, C., et al. "Fraunhofer PV Durability Initiative for Solar Modules: Part 2". Photovoltaics International, 2014.
- 4 See us.sunpower.com/home-solar-system-warranty/ for more details.
- 5 Standard Test Conditions (1000 W/m² irradiance, AM 1.5, 25° C). NREL calibration Standard: SOMS current, LACCS FF and Voltage.
- 6 Based on average of measured power values during production.
- 7 Type 2 fire rating per UL1703:2013, Class C fire rating per UL1703:2002.
- 8 See salesperson for details.



G5 frames have no mounting holes. Please read the safety and installation guide.



PowerBrick+

24V Lithium-Ion battery pack



24V battery pack - Lithium Iron-Phosphate (LiFePO₄) - 150Ah

- **High Service Life : 3000 cycles** and more (see chart)
- **Deep discharge** allowed up to 100 %
- Ultra safe **Lithium Iron Phosphate** chemistry (no thermal run-away, no fire or explosion risks)
- **Embedded BMS** (Battery Management System) : **improve lifespan AND secure the battery**
- No **Lead**, no **rare earths**, no **acid**, no **degassing**
- Calendar life > **10 years**
- Excellent **temperature** robustness (-20 °C up to +60 °C)
- **Flexible** deployment : up to 16 packs in parallel and 4 in series
- **Constant power** during discharge (very low internal resistance)
- **Very low Peukert's losses** (energy efficiency >98 %)
- **Very low self discharge** (<3 % per month)
- **No memory effect**
- About **50 % lighter** and **40% smaller** than equivalent Lead-AGM battery with same usable energy
- **Certification : CE, RoHS, UN 38.3**

Technical Specifications

Electric	Nominal voltage	25.6 V
	Nominal capacity	150 Ah
	Stored energy	3.840 kWh
	Internal resistance	≤ 50mΩ
	Cycles	> 3000 cycles (see chart)
	Self discharge	< 3% per month
	Energy efficiency	> 98%
Standard Charge	Charge voltage	28.8 V ± 0.4V
	Charge mode	CC/CV : Constant Current / Constant Voltage
	Continuous charge current / Maximum charge current	100 A / 150 A
	BMS charge cut-off voltage	29.6 V ± 0.1V
Standard Discharge	Instant peak discharge current	550 A ± 50 A (max 300mS)
	Continuous discharge current	120 A (3.07 kW)
	Maximum discharge current (< 30s)	180 A (4.61 kW)
	BMS discharge cut-off voltage	20 V
Environment	Charge temperature range	0°C to +60°C
	Discharge temperature range	-20°C to +60°C
	Storage temperature	0°C to +50°C @60±25% relative humidity
	IP protection level	IP 65
Mechanical	Type of cells	Cylindrical
	Casing material	ABS
	Dimensions	L : 500mm (520mm) x W : 239mm x H : 217 mm
	Weight	32.6 kg
	Terminal	M8 bolt



APPLICATIONS

- **Electrical vehicles and utilities**
- **Robotics and AGVs**
- **Solar and wind energy storage**
- **Marine**
- **Street lightning**
- **CCTV and security camera**
- **UPS, electric back-up**
- **Telecom**
- **Medical equipments**
- • •



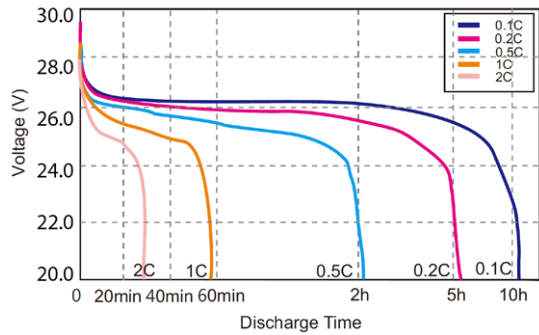
PowerBrick+

24V Lithium-Ion battery pack

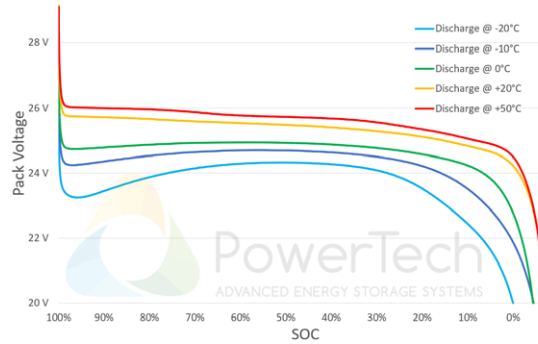


Charts and curves

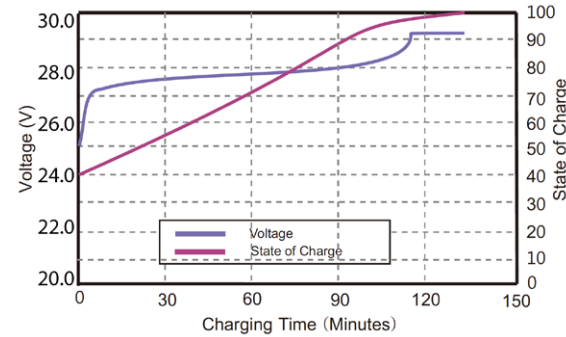
Different Rate Discharge Curve @25°C



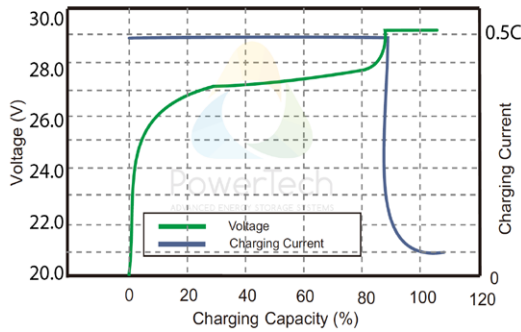
Discharge Curves (0.5C) at different Temperatures



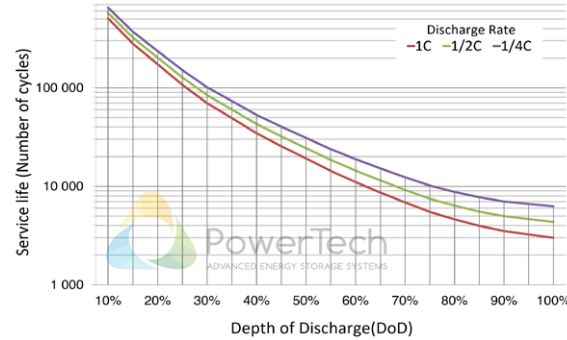
State of Charge Curve @0.5C 25°C



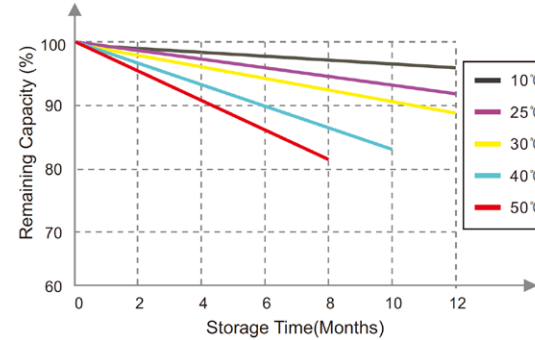
Charging Characteristics @0.5C 25°C



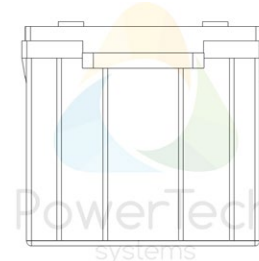
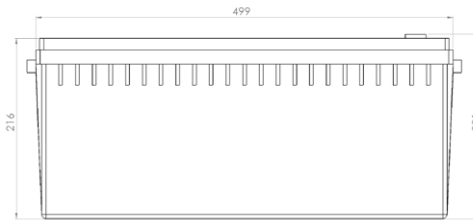
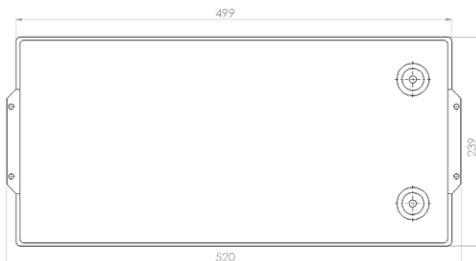
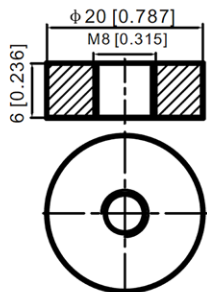
Number of cycles vs. Depth of discharge (DoD)



Different Temperature Self Discharge Curve



Dimensions



V1.4

PowerTech Systems SAS
 ZA Charles Renard - Batiment A1
 6 Bld Georges Guynemer
 78210 ST CYR L'ÉCOLE - France

SAS au capital de 800 000 Euros
 SIREN : 793926577 - TVA : FR33793926577

www.powertechsystems.eu
 +33 185 400 970
contact@powertechsystems.eu

Smart String Inverter

SUN2000-17/20KTL



Smart

- 6 strings intelligent monitoring and fast trouble-shooting
- RS485 and USB ports for communication and data management
- Local graphic LCD display and remote monitoring

Efficient

- Max. efficiency 98.6%
- European efficiency 98.3%
- 3 MPPTs per unit, effectively reducing string mismatch

Safe

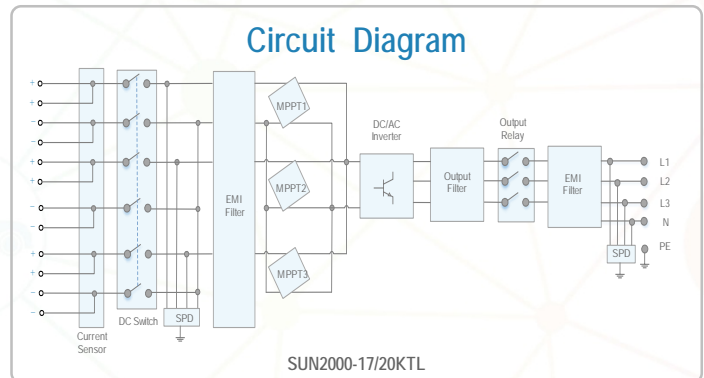
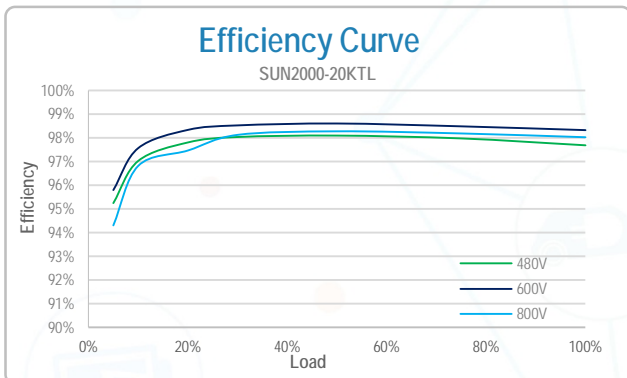
- DC switch integrated, safe and convenient for maintenance
- Residual Current Monitoring Unit (RCMU) integrated
- Fuse free design

Reliable

- Natural cooling technology
- Protection degree of IP65
- Type II surge arresters for both DC and AC

Smart String Inverter (SUN2000-17/20KTL)

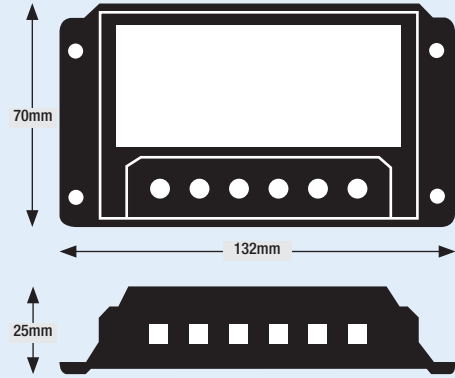
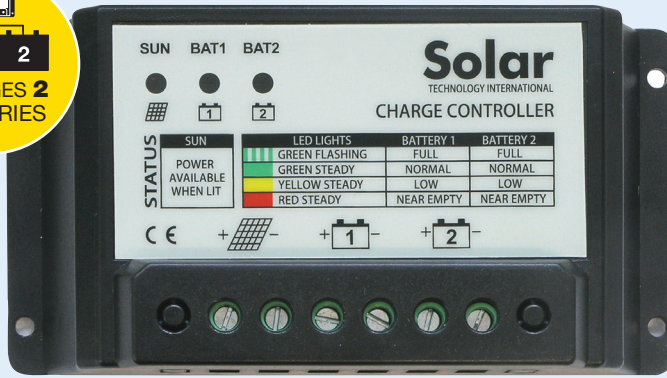
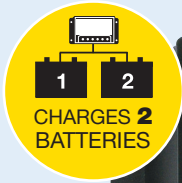
Technical Specifications	SUN2000-17KTL	SUN2000-20KTL
Efficiency		
Max. Efficiency	98.6%	98.6%
European Efficiency	98.3%	98.3%
Input		
Max. Input Voltage	1,000 V	
Max. Current per MPPT	18 A	
Max. Short Circuit Current per MPPT	25 A	
Start Voltage	250 V	
MPPT Operating Voltage Range	200 V ~ 950 V	
Rated Input Voltage	620 V	
Number of Inputs	6	
Number of MPP Trackers	3	
Output		
Rated AC Active Power	17,000 W	20,000 W
Max. AC Apparent Power	18,700 VA	22,000 VA
Max. AC Active Power (cosφ=1)	18,700 W	22,000 W
Rated Output Voltage	220 V / 380 V, 230 V / 400 V, 3W+N+PE	220 V / 380 V, 230 V / 400 V, 3W+N+PE
Rated AC Grid Frequency	50 Hz / 60 Hz	50 Hz / 60 Hz
Rated Output Current	25.8 A @380 V, 24.7 A @400 V	30.4 A @380 V, 29 A @400 V
Max. Output Current	28.5 A	33.5 A
Adjustable Power Factor Range	0.8 LG ... 0.8 LD	0.8 LG ... 0.8 LD
Max. Total Harmonic Distortion	< 3%	< 3%
Protection		
Input-side Disconnection Device	Yes	
Anti-islanding Protection	Yes	
AC Overcurrent Protection	Yes	
DC Reverse-polarity Protection	Yes	
PV-array String Fault Monitoring	Yes	
DC Surge Arrester	Type II	
AC Surge Arrester	Type II	
DC Insulation Resistance Detection	Yes	
Residual Current Monitoring Unit	Yes	
Communication		
Display	Graphic LCD	
RS485	Yes	
USB	Yes	
General		
Dimensions (W x H x D)	520 x 610 x 266 mm (20.5 x 24.0 x 10.5 inch)	
Weight (with mounting plate)	50 kg (110.2 lb.)	
Operating Temperature Range	-25°C ~ 60°C (-13°F ~ 140°F)	
Cooling Method	Natural Convection	
Max. Operating Altitude	3,000 m (9,842 ft.)	
Relative Humidity	0 ~ 100%	
DC Connector	Amphenol Helios H4	
AC Connector	Amphenol C16/3	
Protection Degree	IP65	
Topology	Transformerless	
Standard Compliance (more available upon request)		
Certificate	EN 62109-1/-2, IEC 62109-1/-2, IEC 62116	
Grid Code	IEC 61727, NB/T 32004-2013, VDE-AR-N-4105, VDE 0126-1-1, BDEW, G59/3, UTE C 15-712-1, CEI 0-16, CEI 0-21, C10/11, EN 50438-Ireland, EN 50438-Turkey, AS 4777, PEA (Only 20KTL), MEA (Only 20KTL), NRS 097-2-1	



The text and figures reflect the current technical state at the time of printing. Subject to technical changes. Errors and omissions excepted. Huawei assumes no liability for mistakes or printing errors. For more information, please visit solar.huawei.com. Version No. 01-(201807)

Solar Charge Controller

10A charger control 12v/24v DC (STCC10) • 20A charger control 12v/24v DC (STCC20)



The latest Solar Technology charge controllers provide the very best in power delivery from solar panel to 12v or 24v battery whether charging a single or twin batteries.

These PV Logic Pulse Width Modulation (PWM) controllers deliver sizeable benefits over standard charge controllers by achieving a constant battery voltage and thereby producing a higher charge efficiency, rapid recharging and a longer life expectancy for any battery.

Dual Battery Charging Function - Ideal if twin batteries are used in a caravan or boat or to charge the leisure and vehicle battery in an RV. The dual charge function only occurs when a second battery is connected. In this configuration the controller will still focus its power delivery on the battery connected to the No 1 terminals until that battery is 70% fully charged. Once this is reached power will be delivered to both batteries equally until both are 100% charged.

PRODUCT FEATURES

- 12V/24V AUTOMATIC RECOGNITION ON BOTH BATTERY & SOLAR CONNECTIONS
- UNIQUE SINGLE OR DUAL BATTERY CHARGING FUNCTIONS
- EFFICIENT SERIES PWM CHARGING
- CHARGING & STATUS LEDS
- REVERSE CURRENT PROTECTION

WHICH MODEL?

- 10AH UP TO MAX OF 150W (10A) OF SOLAR PANEL(S)
- 20AH UP TO MAX OF 300W (20A) OF SOLAR PANEL(S)

WARRANTY

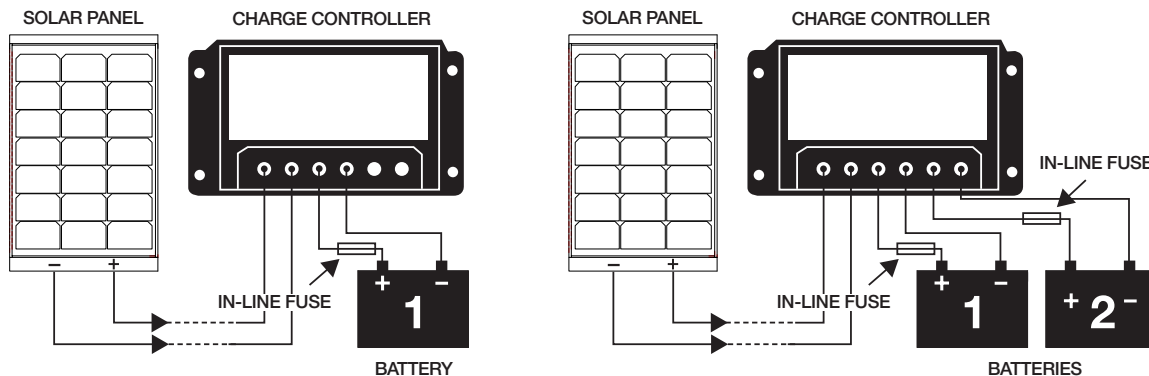
This Solar Charge Controller is supplied with a 12 month warranty. Should a failure occur during this time Solar Technology International Ltd will repair or replace any faulty part, at its discretion. Solar Technology International Ltd does not accept liability for any 3rd party damage how so ever caused or any costs associated with the return of faulty products. To make a warranty claim please telephone Solar Technology International Ltd on +44 (0) 1684 774000.

These warranty conditions in no way affect your statutory rights. A full set of Solar Technology International Ltd terms and conditions are available on request.

TECHNICAL SPECIFICATIONS

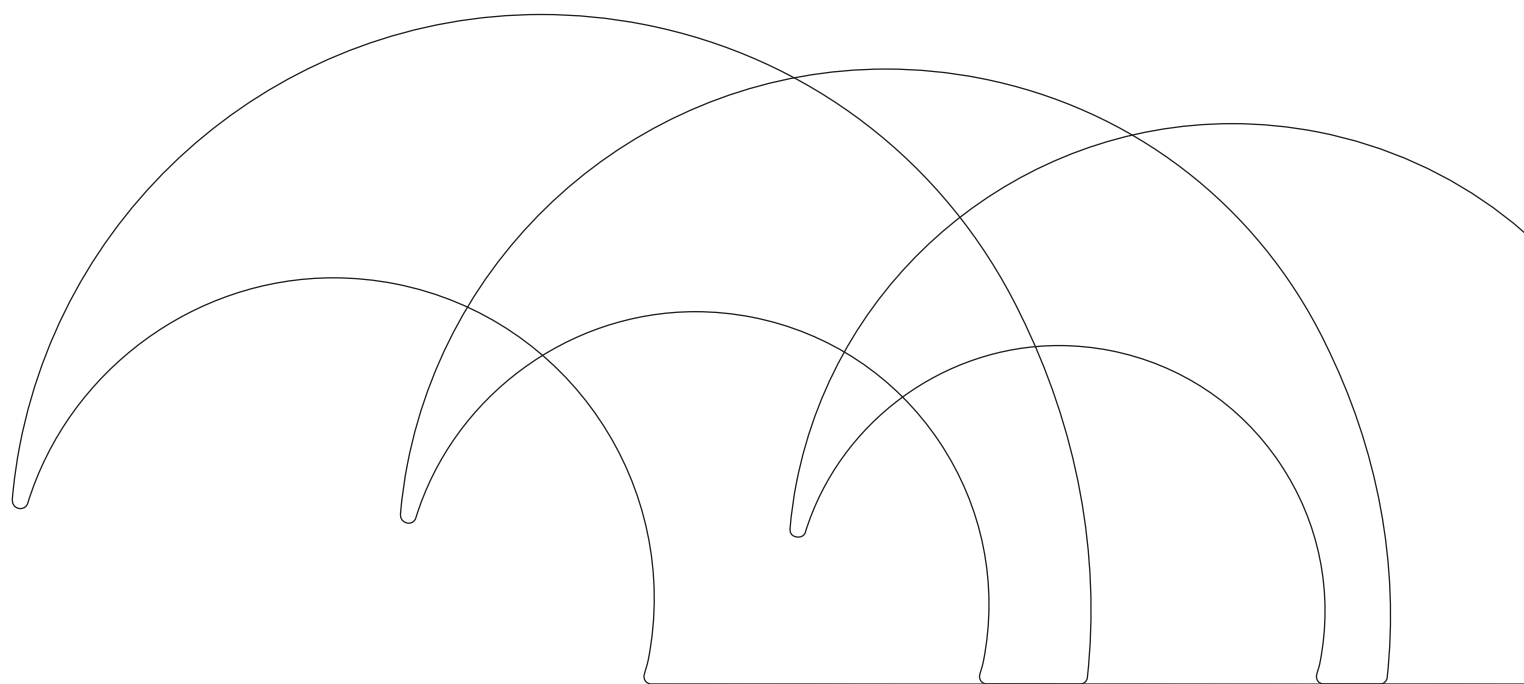
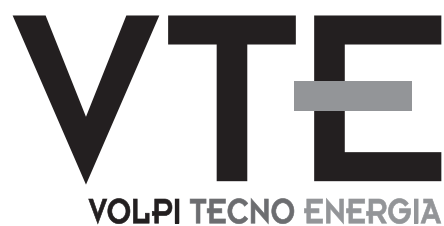
Nominal System Voltage	12/24VDC (automatic system voltage recognition)
Battery Voltage Range	6-36V
Rated Battery Current	10A/5A/20A depending on model selected
Charge Circuit Voltage Drop	≤0.26V
Self-consumption	≤6mA
Temperature Compensation Coefficient	-30mV/°C/12V(25° ref)
Over Voltage Disconnect Voltage	16V/32V
Charging Limit Voltage	15.5V/31V
Equalize Charging Voltage	14.6V/29.2V
Float Charging Voltage	13.8/27.2V
Operating temperature	-35°C to +55°C
Overall dimensions	135 x 70 x 35mm
Mounting hole size (in case)	3.8mm
Terminals	6mm ²
Net weight	155g
Suitable battery type	Sealed, Flooded and Gel
Solar Panel and battery protection against	Short circuit and reverse polarity, overload, battery removal and lightning strike

Battery connections



RoHS ✓

PAGURO
9000V
9 KVA - 8 KW



PAGURO GENERATORS

PAGURO 9000V 9 KVA - 8 KW

Codice prodotto
Product reference
Produktcode
Référéncé du produit
Código de producto

AP09023050M0

Dimensioni L x L x H mm
Dimensions L x W x H mm
Abmessungen L x B x H mm
Dimensions L x l x H mm
Dimensiones L x A x A mm

660 X 460 X 620

Peso (capsula inclusa)
Weight (capsule included)
Gewicht (inkl. Kapsel)
Poids (capsule incluse)
Peso (cápsula incluida)

kg 150 + 15

Emissione acustica dB(A) 7 mt
Noise level dB(A) 7 mt
Lärmpegel Entfernung dB(A) 7 m
Niveau sonore dB (A) 7 mt
Emisión acústica dB(A) 7 mt

50 - 53 dB(A)

ALTERNATORE

Alternatore a magneti permanenti (PMG) di ridotte dimensioni e peso contenuto
L'elettronica di controllo consente in automatico l'utilizzo del generatore a giri variabili a seconda della richiesta di energia
Forma d'onda pulita
Carica batterie per batteria d'avviamento dedicata (12 V 8 A)
Isolamento in classe H

ALTERNATOR

Permanent magnets alternator (PMG) in compact size and reduced weight
The electronic control box allows variable speed generator automatically, according the power demand
Clean sine-wave
Battery charger for dedicated starting battery (12V 8A)
Insulation Class H

LICHTMASCHINE

Dauermagnet-Lichtmaschine (PMG) in kompakter Größe und reduzierter Gewicht
Die elektronische Steuereinheit ermöglicht den automatischen Betrieb des Generators mit variabler Geschwindigkeit entsprechend dem Leistungsbedarf
Reine Sinuswelle
Ladegerät für dedizierte Starterbatterie (12 V 8 A)
Isolationsklasse H

ALTERNATEUR

Alternateur à aimants permanents (PMG) de taille compacte et de poids réduit
La boîte de contrôle électronique permet le générateur de vitesse variable automatiquement, selon la demande de puissance
Propre onde sinusoïdale
Chargeur de batterie pour batterie de démarrage dédiée (12V 8A)
Classe d'isolation H

ALTERNADOR

Alternador magneticos permanentes (PMG) en tamaño compacto y peso reducido
La caja de control electrónica permite el generador de velocidad variable automáticamente, según la demanda de potencia
Limpia onda sinusoidal
Cargador de batería para batería de arranque dedicada (12V 8A)
Clase de aislamiento H

MOTORE

Alimentato a diesel
2 cilindri
Raffreddamento a mezzo scambiatore di calore
Quattro cicli

ENGINE

Diesel fueled
2 cylinders
Cooling circuit via heat exchanger
Four cycle

MOTOR

Mit Dieselmotor
2 Zylinder
Kühlkreislauf über Wärmetauscher
Viertakt-Motor

MOTEUR

Alimenté au diesel
2 cylindres
Le refroidissement par radiateur
À quatre temps

MOTOR

Alimentado con diesel
2 cilindros
Refrigeración a través del intercambiador de calor
Cuatro ciclos

COMANDO REMOTO

Comando remoto con display LCD
Contaore, indicatore di carico
Arresto automatico per bassa pressione olio e/o sovratemperatura
Connettore rapido e 15 mt di cavo
Avviamento automatico (optional)

REMOTE CONTROL

Remote control with LCD display
Load indicator, hour meter
Automatic shut down for low oil pressure and/or high temperature
With 15 mt of cable and quick connector
Automatic start (optional)

FERNBEDIENUNG

Fernbedienung mit LCD-Display
Ladeanzeige, Betriebsstundenzähler
Automatische Abschaltung bei niedrigem Öldruck und/oder hoher Temperatur
Mit 15 m Kabel und Schnellverbinder
Automatischer Start (optional)

COMMANDE À DISTANCE

Télécommande avec écran LCD
Indicateur de charge, horamètre
Arrêt automatique en cas de pression d'huile basse et / ou de température élevée
Avec 15 m de câble et un connecteur rapide
Démarrage automatique (facultatif)

CONTROL REMOTO

Control remote con display LCD
Indicador de carga, cuenta horas
Parada automática por baja presión de aceite y sobre-temperatura
Con 15 mts. de cableado y conectores rápidos
Inicio automático (opcional)

CAPSULA

INSONORIZZANTE

Isolamento acustico con capsula in vetroresina rinforzata a stratificazione composita e rivestimento in materiale fonoassorbente ad alta densità
La capsula composta da due parti superiori ed una inferiore consente l'installazione anche in vani angusti
Doppio sistema antivibrante, interno a 4 supporti soffici ed esterno a 4 supporti semielastici

SOUNDPROOF CAPSULE

Soundproof capsule made from multi layer GRP, a high density sound absorbing material and heat insulating foam lining
Split into two halves, the capsule lids enable easy of access for servicing, even in tight spaces
Dual anti-vibration system based on 4 internal soft shock absorbers and 4 firm captive engine mounts outside the capsule

SCHALLDICHE KAPSEL

Schalldichte Kapsel aus mehrschichtigem GFK, schallabsorbierendes Material mit hoher Dichte und wärmedämmendem Schaumstoff
In zwei Hälften geteilt, ermöglichen die Kapseldeckel auch bei beengten Platzverhältnissen einen einfachen Zugang zur Wartung
Duales Anti-Vibrations-System auf der Basis von 4 internen weichen Stoßdämpfern und 4 festen Motorhalterungen außerhalb der Kapsel

CAPSULE INSONORISÉE

Capsule insonorisée en PRV multicouche, un matériau insonorisant très dense, et doublure en mousse thermo-isolante
Divisés en deux parties, les couvercles de la capsule permettent un accès facile pour l'entretien, même dans les espaces restreints
Système anti-vibration double monté sur 4 amortisseurs souples internes et 4 supports fermes de moteur à l'extérieur de la capsule

CAPSULA INSONORIZADA

Capsula insonorizada fabricada en fibra de vidrio multicapa de alta densidad reforzada y con una capa de material aislante
Capsula compuesta de dos partes superiores y una parte inferior que permiten la instalación en espacios reducidos
Doble sistema anti-vibración basado en 4 soportes internos en la capsula y 4 en la parte externa

Caratteristiche, dimensioni e pesi soggetti a modifiche senza preavviso

Specifications, dimensions and weights may be subjected to modifications without prior notice

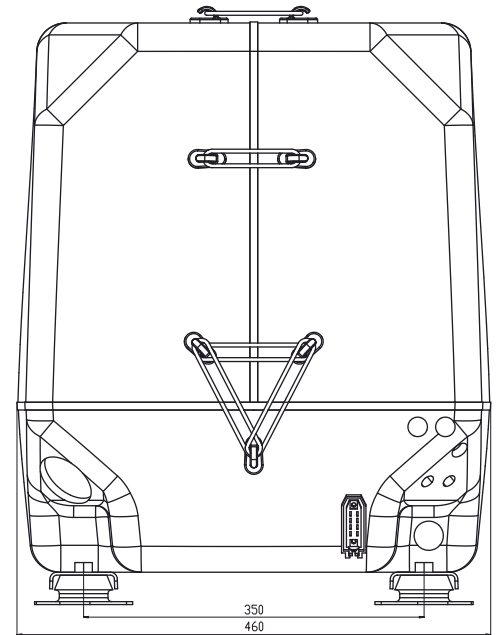
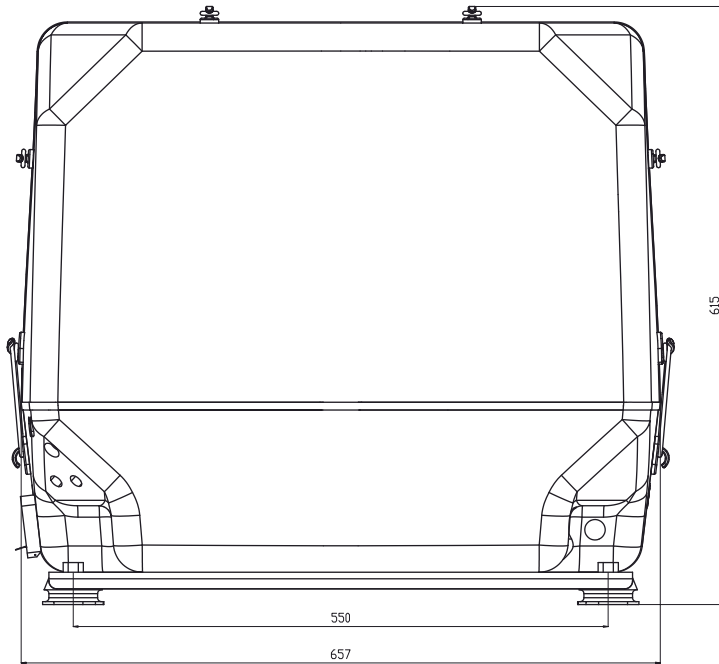
Spezifikationen, Abmessungen und Gewichte können ohne vorherige Ankündigung geändert werden

Les spécifications, dimensions et poids peuvent être modifiés sans préavis

Características, dimensiones y pesos pueden sufrir modificaciones sin previo aviso

**SPECIFICHE TECNICHE E PRESTAZIONI - TECHNICAL SPECIFICATIONS AND PERFORMANCES
TECHNISCHE SPEZIFIKATIONEN UND LEISTUNGEN - CARACTÉRISTIQUES TECHNIQUES ET
PERFORMANCES - ESPECIFICACIONES TECNICAS Y PRESTACIONES**

Costruttore del generatore Generator manufacturer Generator-Hersteller Fabricant du générateur Fabricante generador	VTE Srl - Italy
Tipo alternatore Alternator type Wechselstrommaschine Type d'alternateur Tipo alternador	Alternatore a magneti permanenti (PMG) Permanent magnets alternator (PMG) Dauermagnet-Lichtmaschine (PMG) Alternateur à aimants permanents (PMG) Alternador magneticos permanentes (PMG)
Potenza elettrica continuativa Continuous electrical power Elektrische Dauerleistung Courant électrique continu Potencia eléctrica en continuo	9 KVA - 8 KW
Tensione di uscita Voltage output Spannungsausgang Tension de sortie Tensión de salida	Monofase 230 V (50 HZ) Single-phase 230 V (50 HZ) Einphasig 230 V (50 HZ) À phase unique 230 V (50 HZ) Monofásico 230 V (50 HZ)
Corrente di spunto Peak current Spitzenstrom Courant de crête Pico de arranque	65 A
Sistema raffreddamento alternatore Alternator cooling system Lichtmaschinen-Kühlsystem Système de refroidissement de l'alternateur Sistema refrigeración alternador	Aria Air Arie Air Aire
Costruttore del motore e modello Engine manufacturer and type Motorhersteller und Typ Fabricant du moteur et type Fabricante del motor y modelo	Lombardini 702
Numero cilindri Cylinders nr. Zylinder nr. Nombre de cylindres Numero de cilindros	2
Velocità di rotazione Engine speed Motordrehzahl Régime du moteur Velocidad de rotación	2000-3000 giri - rpm - U/min - tr/min
Sistema di avviamento ed arresto Starting and shut-off system Start- und Stoppsystem Système de démarrage et d'arrêt Sistema de arranque y parada	Elettrico a 12 V con comando a distanza 12V electrical starter, remote controlled 12 V Elektrostarter, ferngesteuert Démarreur électrique 12V, télécommandé Motor de arranque eléctrico a 12V. Con control a distancia
Consumo specifico gasolio Specific fuel consumption Spezifischer Kraftstoffverbrauch Consommation de carburant spécifique Consumo específico de combustible	0,35 lt/KW/h
Sistema di raffreddamento motore Engine cooling system Maschinen-Kühlanlage Système de refroidissement du moteur Sistema de refrigeración del motor	Ad acqua dolce con scambiatore di calore Fresh water with heat exchanger Frisches Wasser mit Wärmetauscher Eau douce avec échangeur thermique Refrigeración a traves del intercambiador de calor
Pompa acqua Cooling pump Kühlpumpe Pompe de refroidissement Bomba de agua	Autoadescante Self priming Selbstansaugend À amorçage automatique Auto aspirante



DIAMETRI INTERNI	INTERNAL DIAMETERS	P9V
Ingresso acqua	Water inlet	19mm x 1/2"
Linea di scarico	Exhaust system	40mm
Alimentazione gasolio	Fuel in	8mm
Ritorno gasolio	Fuel return	8mm
Valvola antisifone	Siphon break	19mm

VTE Srl
 Via Luciano Lama, 5
 33050 Fiumicello (UD) - Italy
 Tel. +39 0431 96488
 Fax +39 0431 970634
www.volpitemcno.com

VTE
VOLPI TECNO ENERGIA



DATA POTENSI PANEL SURYA DALAM 1 HARI BERDASARKAN HOMER

Jam	Global solar (kW/m2)	SunPower X21-345 Output Power (kW)	SunPower X21-345 Cell Temperature ©	Fuel Generator (L)
1	0	0	25.25	0
2	0	0	25.25	0
3	0	0	25.25	0
4	0	0	25.25	0
5	0	0	25.25	0
6	0.01	0	25.25	0
7	0.17	0.22	28.75	1.1
8	0.41	0.71	34.12	1.08
9	0.58	0.88	37.85	1.08
10	0.95	1.6	46.13	0
11	0.98	1.91	46.98	0
12	0.62	1.85	38.97	0
13	0.71	1.67	40.95	0
14	0.63	1.14	39.03	0
15	0.6	1.09	38.39	0
16	0.44	0.91	34.77	0
17	0.22	0.49	30.12	0
18	0.07	0.11	26.64	0
19	0	0	25.25	0
20	0	0	25.25	0
21	0	0	25.25	0
22	0	0	25.25	0
23	0	0	25.25	0

LOAD BALANCE

NO	DESCRIPTION	OUTPUT KW	QTY PCS	POWER KW	JAM																							
					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	RADAR	0.0550	1	0.0550	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06		
2	AIS	0.0050	1	0.0050	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		
3	GPS	0.0050	1	0.0050	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		
4	Digital Anemometer & Wind Direction	0.0100	1	0.0100	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		
5	Magnetic Compass	0.0120	1	0.0120	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		
6	Marine Wiper	0.1200	1	0.1200				0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12		
7	Electric Horn	0.1500	1	0.1500				0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15		
8	VHF Radio	0.0400	1	0.0400	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06		
9	Lampu Port Side	0.0005	1	0.0005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
10	Lampu Starboard	0.0005	1	0.0005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
11	Lampu Buritan	0.0005	1	0.0005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
12	Lampu Jangkar	0.0005	1	0.0005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
13	Lampu Jangkar	0.0480	1	0.0480	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		
13	Ac Pendingin Ruang Akomodasi	0.40	2	0.8000							0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39		
14	Ac Pendingin Ruang Kemudi	0.40	1	0.4000							0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39		
14	KAMAR MESIN	0.02	4	0.0800							0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06		
15	RUANG PENUMPANG DALAM	0.01	8	0.0800							0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07		
16	RUANG KEMUDI	0.10	1	0.1000	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07		
17	KM/WC PENUMPANG	0.01	12	0.1200							0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10		
18	AREA ILR & GLDK TAMASYA	0.02	5	0.1000							0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07		
19	LAMPU SELANG	0.01	18	0.1800				0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10		
20	LAMPU FLOOD	0.50	2	1.0000				0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70		
					0.2800	0.2800	0.2800	1.3500	1.3500	1.4800	2.4300	1.4200	1.4200	1.4200	1.4200	1.4200	1.4200	1.4200	1.4200	1.4200	1.4200	1.4200	1.4200	1.4200	1.4200	1.4200		

0 0.2800
 1 0.28 0.2800
 2 0.28 0.28
 3 1.35 0.28
 4 1.35 1.35
 5 1.48 1.35
 6 2.43 1.48
 7 1.42 2.43
 8 1.42 1.42
 9 1.42 1.42
 10 1.42 1.42
 11 1.42 1.42
 12 1.42 1.42
 13 1.42 1.42
 14 1.42 1.42
 15 1.42 1.42
 16 1.42 1.42
 17 1.42 1.42
 18 2.43 1.42
 19 1.41 2.43
 20 1.41 1.48
 21 0.98 1.41
 22 0.98 0.98
 23 0.98 0.98
 23 0.98

TOTAL KEBUTUHAN YANG AKAN DISUPLAI 20.4800
 PUKUL 06.00-18.00

Lampiran Komponen Listrik Pada Bus Air Roro

NO	Nama Peralatan	kW
SUMBER AC		
POMPA-POMPA		
1	Pompa GS	1.5
2	Pompa Air Tawar	0.75
3	Pompa Minyak Kotor	0.74
4	Pompa Air Kotor	0.75
5	Pompa Bilga Mesin	0.8
AC PENDINGIN		
6	Ac Pendingin Ruang Akomodasi	0,80
7	Ac Pendingin Ruang Kemudi	0,40
BLOWER		
8	Blower Kanan	0,55
9	Blower Kiri	0,55
PERLENGKAPAN LAIN		
9	Public Adressor	0.36
10	Speaker	2.00
11	Sub Woofer	0.48
12	TV	0.08
LAMPU PENERANGAN		
13	KAMAR MESIN	0,02
14	RUANG PENUMPANG DALAM	0,01
15	RUANG KEMUDI	0,10
16	KM/WC PENUMPANG	0,01
17	AREA ILR & GLDK. TAMASYA	0,02
18	LAMPU SELANG	0,01
19	LAMPO FLOOD	0,50

SUMBER DC		
ALAT DAN LAMPU NAVIGASI		
	RUANG PENUMPANG DALAM	0,01
	RUANG KEMUDI	0,10
	KM/WC PENUMPANG	0,01
	AREA ILR & GLDK. TAMASYA	0,02
	LAMPU SELANG	0,01
	LAMPO FLOOD	0,50
	TOTAL	11.42

Lampiran Beban Kelistrikan yang akan disuplai Sel Surya

NO	Nama Peralatan	kW
ALAT DAN LAMPU NAVIGASI		
1	RADAR	0,0550
2	AIS	0,0050
3	GPS	0,0050
4	Digital Anemometer & Wind Direction	0,0100
5	Magnetic Compass	0,0120
6	Marine Wiper	0,1200
7	Electric Horn	0,1500
8	VHF Radio	0,0600
9	Lampu Port Side	0,0005
10	Lampu Starboard	0,0005
11	Lampu Buritan	0,0005
12	Lampu Jangkar	0,0005
13	Lampu Jangkar	0,0480
AC PENDINGIN		
14	Ac Pendingin Ruang Akomodasi	0,55
15	Ac Pendingin Ruang Kemudi	0,55
LAMPU PENERANGAN		
16	KAMAR MESIN	0,02
NO	Nama Peralatan	kW
17	RUANG PENUMPANG DALAM	0,01
18	RUANG KEMUDI	0,10
19	KM/WC PENUMPANG	0,01
20	AREA ILR & GLDK. TAMASYA	0,02
21	LAMPU SELANG	0,01
22	LAMPO FLOOD	0,50
TOTAL		3.327

PERENCANAAN PANEL SURYA

LOKASI	JUMLAH PANEL	DAYA PANEL	TOTAL (WATT HOUR)	TOTAL WH/HARI
Atap Gelada	8	74,175	593.4	2,967

ikasi Panel Surya

0.62307

SOLAR PANEL		SPR-X21-345	Price	IDR	10,495,835.53
Output Power		345			
Max Power Voltage		57.3			
Max Power Current		6.02			
Open Circuit Voltage		68.2			
Short Circuit Voltage		6.39			
Efficiency		21.5			
Size		1558 X 1046 X 46 mm			
Weight		18.6			

Generator

140,587,521.37

Spesifikasi Baterai		Price	12,715,022.39		/each battery			
Type	Tegangan (V)	Kapasitas (Ah)	Berat	Total berat	daya	total daya	jumlah baterai	HARGA
LVG17-12	12	17	5.8	5.8	0.204	1.02	12.25919118	
HTL12-200	12	200	58.7	58.7	2.4	12	1.04203125	
HTL12-15	12	26	5.1	5.1	0.312	1.56	8.015625	
YUASA L36-100	12	100	22.5	22.5	1.2	6	2.0840625	
PowerBrick+	24	50	11.8	11.8	1.2	6	2.0840625	
PowerBrick+	24	150	32.6	32.6	3.6	18	0.6946875	48,707,892.00

maka kapasitas baterai yang digunakan

W 2.500875

Solar Charge Controller			
Merk		PV LOGIC	
Type		STCC20	
Battery System Voltage		24 V	24
Max. Output Current (A)		20	
Max Charging current continous		20 A	
weight		155	g
Jumlah Charge		3.322259136	3
Jumlah Charge yang dibutuhkan		jumlah panel surya / jumlah charge	
		0.903	1
Arus Output untuk 1 charge controller (A)		18.06	20
Kapasitas Arus Charge Controller (A)		100	Ah
Daya yang dihasilkan oleh 1 unit charge controller (W)		480	0.48
Daya yang dihasilkan oleh 3 unit charge controller (W)		1594.684385	

0.514950166

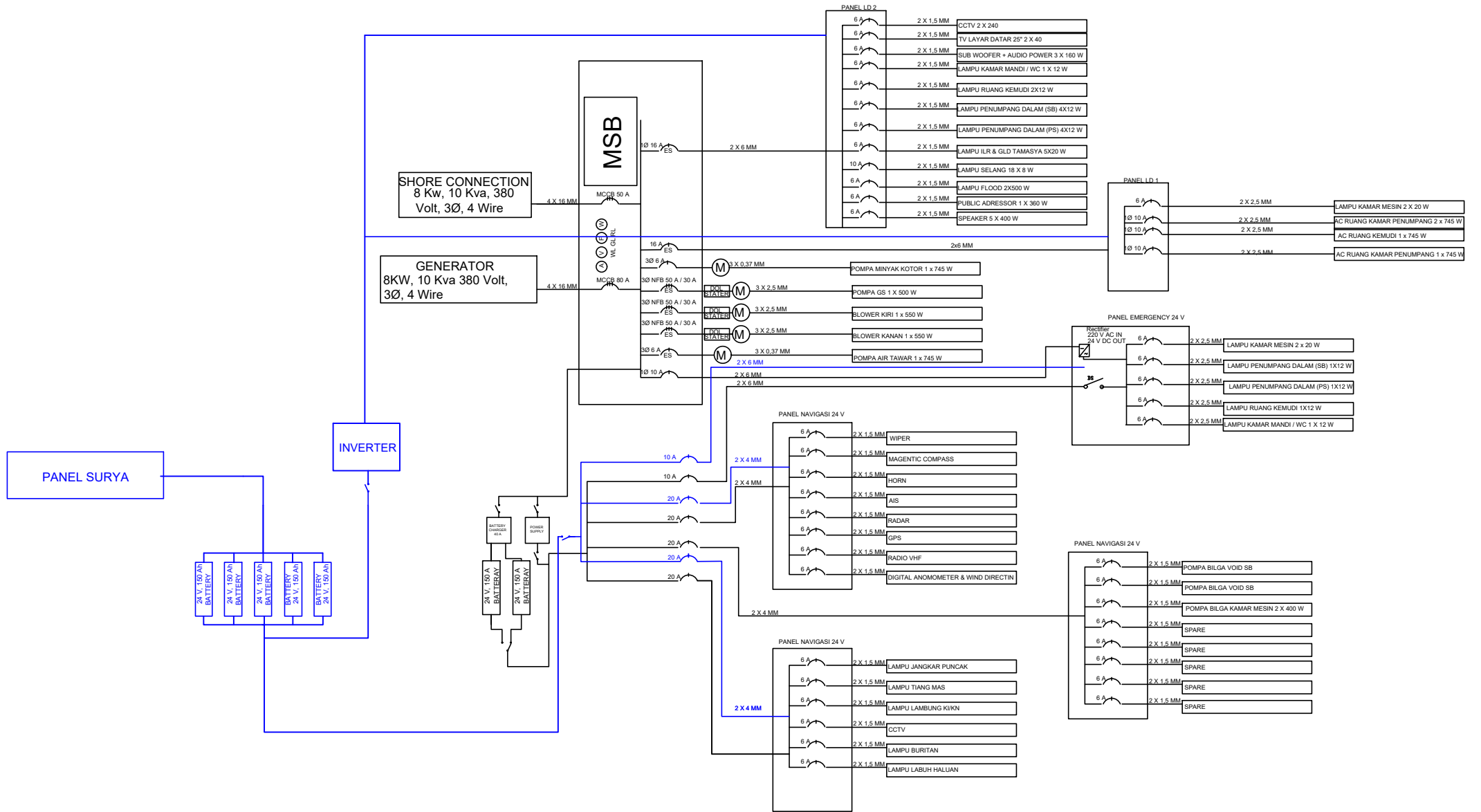
Komponen	Berat	Jumlah	Total berat
Panel Surya	18.6	8	148.8
Baterai	32.6	5	163
Inverter	50	1	50
Solar Charger	0.155	2	0.31

Muatan	Berat	Jumlah	Total berat
Orang	70	40	2800
Motor	105	10	1050
Pengurangan			0.0940545

Inverter	Price	Rp13,318,873.35
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MERK	HUAWEI INVERTER 22000
MODEL	
WEIGHT	50 kg
AC NOMINAL OUTPUT POWER	22000
MAX.AC power	240V
Max. Ac Current	17
Power Factor	99%

jumlah inverter yang dibutuhkan 0.110454545





SURAT PENUGASAN
No. 17399/UN4.7.1/TD.06/2022

Dari : Dekan Fakultas Teknik Universitas Hasanuddin

Kepada : 1. **Surya Hariyanto, S.T., M.T.** **Pemb. I**
2. **Balqis Shintarahayu, S.T., M.Sc.** **Pemb. II**

Isi : 1. Bahwa berdasarkan peraturan Akademik Universitas Hasanuddin Tahun 2018 Pasal 16 (SK Rektor Unhas Nomor : 2784/UN4.1/KEP/2018), dengan ini menugaskan Saudara sebagai PEMBIMBING MAHASISWA, maka dengan ini kami menugaskan untuk membimbing penulisan Skripsi/Tugas Akhir mahasiswa Teknik Sistem Perkapalan Fakultas Teknik Universitas Hasanuddin di bawah ini :

Nama :
Shabrina Velina

No. Stambuk :
D091181311

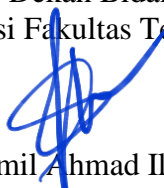
Judul Skripsi/Tugas Akhir :

Perencanaan Optimalisasi Dan Manajemen Sistem Pembangkit Electric-Hybrid (Sel Surya Dan Diesel Generator) Pada Bus Air Roro

2. Surat penugasan pembimbing ini mulai berlaku sejak tanggal ditetapkannya dan berakhir sampai selesainya penulisan Skripsi/Tugas Akhir Mahasiswa tersebut.
3. Agar surat penugasan ini dilaksanakan sebaik - baiknya dengan penuh rasa tanggung jawab.

Ditetapkan di Gowa,
Pada tanggal, 22 Agustus 2022

a.n Dekan,
Wakil Dekan Bidang Akademik, Riset dan
Inovasi Fakultas Teknik UH


Dr. Amil Ahmad Ilham, S.T., M.IT.
Nip. 19731010 199802 1 001

Tembusan :

1. Dekan FT-UH.
2. Ketua Departemen Teknik Sistem Perkapalan FT-UH.
3. Mahasiswa yang bersangkutan



CERTIFICATE NO. JKT 30788



SURAT PENUGASAN

No.20578/UN4.7.1/TD.06/2022

Dari : Dekan Fakultas Teknik Universitas Hasanuddin

Kepada : Mereka yang tercantum namanya dibawah ini.

Isi : 1. Bahwa berdasarkan peraturan Akademik Universitas Hasanuddin Tahun 2018 pasal 19 (SK. Rektor Unhas nomor : 2781/UN4.1/KEP/2018), dengan ini menugaskan Saudara sebagai PANITIA UJIAN SARJANA Program Strata Satu (S1) Teknik Sistem Perkapalan Fakultas Teknik Universitas Hasanuddin dengan susunan sebagai berikut :

Ketua : Surya Hariyanto, S.T., M.T.

Sekretaris : Balqis Shintarahayu, S.T., M.Sc.

Anggota : 1. Andi Haris Muhammad, S.T., M.T., Ph.D
2. Rahimuddin, S.T., M.T., Ph.D.

Untuk menguji bagi mahasiswa tersebut dibawah ini :

Nama/Nim : Shabrina Velina / D091181311

Departemen : Teknik Sistem Perkapalan

Judul Thesis/Skripsi :

Perencanaan dan Optimalisasi Manajemen Sistem Pembangkit Electric-Hybrid (Sel Surya dan Diesel Generator) Pada Bus Air Roro

2. Waktu ujian ditetapkan oleh Panitia Ujian Akhir Program Strata Satu (S1).
3. Agar surat penugasan ini dilaksanakan sebaik-baiknya dengan penuh rasa tanggung jawab.
4. Surat penugasan ini berlaku sejak tanggal ditetapkan sampai dengan berakhirnya Ujian Sarjana tersebut, dengan ketentuan bahwa segala sesuatunya akan ditinjau dan diperbaiki sebagaimana mestinya apabila dikemudian hari ternyata terdapat kekeliruan dalam keputusan ini.

Ditetapkan di Gowa,

Pada tanggal , 28 September 2022

a.n Dekan,

Wakil Dekan Bidang Akademik dan
Kemahasiswaan Fakultas Teknik UH

Dr. Amil Ahmad Ilham, S.T., M.IT.

Nip.19731010 199802 1 001

Tembusan :

1. Dekan FT-UH.
2. Ketua Departemen Teknik Sistem Perkapalan FT-UH.
3. Kasubag Umum dan Perlengkapan FT-UH



CERTIFICATE NO. JKT 36788