iStar VPO Specification

Voltage Optimisation (VO) is an energy-saving solution for regulating and optimizing the voltage supplied to electrical equipment to the optimal level for efficient operation. The purpose of VO is to reduce energy consumption, lower electricity bills, and decrease carbon emissions by ensuring that electrical devices operate at their most efficient voltage level.

Specification

Date	1st July 2025
Document reference	iStar-VPO-01072025-003
Rating	Supply rated to match incoming power supplies.
Manufacture	Brand iStar, manufactured by Ultima Grid Solutions, Australia.
Metering	Revenue Class 1 4G metering included.
VPO Type	Multi-tap fixed ratio, with under voltage control.

Photographs

Figure 1 175 KVA VPO : typical installation **(same enclosure size as 70kVA and 110 KVA)**

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Dimensions and weights

iStar Unit Rating	Width (mm)	Depth (mm)	Height (mm)	Weight (kg)
70kVA / 100A	600	403	1388	120
110kVA / 160A	600	403	1388	152
175kVA / 250A	600	403	1388	170
220kVA / 315A	800	500	1455	200
280kVA / 400A	800	500	1455	222
350kVA / 500A	800	500	1455	270
440kVA / 630A	800	500	1455	300
560kVA / 800A	800	650	1790	450
690kVA / 1000A	800	650	1790	530
830kVA / 1200A	800	650	1790	610
1000kVA / 1450A	1000	750	1990	650
1250kVA / 1800A	1000	750	1990	800
1500kVA / 2150A	1200	800	2210	1200
2000kVA / 2900A	1200	800	2210	1400

Enclosure specification

Enclosure	Indoor rated.
Colour	Green.
Construction	Purpose built, self-ventilated enclosure. Back of unit may be mounted against a wall, as ventilation pathway is designed in.
Base frame	Rigid construction, vented with levelling feet and provision for moving with pallet jack.
Finish	Powder coated.
Environmental Rating	IP22 standard.
Optional Ratings	IP44/55/double skinned/IP66 with HEX cooling system.
Optional materials	Aluminium or Stainless Steel.

Transformer core specification

Insulation Class	Class H (180°C).
Operating Ambient	-10~+50°C.
Cooling	AN (Air Natural).

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Core type	High efficiency cold rolled grain oriented laminated core.
Conductor type	High purity copper - class H insulated.
Thermal Protection	PTC thermistors embedded in each coil.
Varnish	Complete transformer is fully vacuum impregnated and cured with high build polyester resin.
Exclusions	Shipment and installation is excluded from the Supply price basis.
Guidance	Site specific requirements always have a bearing on installation costs (eg: location, site legacy issues, cable sizing, etc) and are subject to a site survey prior to firm quotation on installation. Excludes any additional circuit protection, remedial or compliance works required on switchboard.
Tap selection	5 tap positions, which may be selected in 2.5V steps Depending upon production selection, the ranges are: • 5V to 15V Reduction, in 2.5V steps • 10V to 20V Reduction, in 2.5V steps • 15V to 25V Reduction, in 2.5V steps • 7.5V to 17.5V Reduction, in 2.5V steps
Savings	Subject to data logging and site survey. Energy savings performance (% kWh pa) is site specific, reflecting grid supply conditions, site equipment type and usage. Savings performance will be assessed using EVO Period ON – Period OFF measurement method at the time of commissioning. Automated function reporting to Cloud, duration 2.5 hours total.

Protection

Protection may be optionally specified within the enclosure, as either isolation or a main circuit breaker:

- Supply side Circuit Breaker
- Supply side Isolator
- No Supply side Isolator or Circuit Breaker

Under Voltage Control

The Under-Voltage Controller (UVC) is a protective and control function designed to monitor supply voltage and automatically bypass the fixed-ratio Voltage Power Optimiser (VPO) when the output voltage drops below a programmable threshold. The controller prevents undervoltage conditions at the load during grid sag events, high-demand periods, or weak network locations.

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The controller operates a motorised or electrically held bypass contactor, switching the VO control windings based on real-time line voltage measurements. Note the unit does not switch either the Supply or Load circuit, as control is achieved using the control windings.

The Under-Voltage Controller (UVC) routine is tested during the Factory Acceptance Test (FAT) process, using a press button. Once the routine is started, it may take about 20 minutes to complete a test sequence. Data is logged remotely on the Cloud system. Once initiated, the routine may be left unattended.

Feature Category	Requirement
Primary Purpose	Protect downstream load from undervoltage caused by fixed-ratio voltage reduction.
Control Action	Automatically bypass VO when “output voltage” < “output threshold”. The following test will apply in practice: “input voltage” < “input threshold”.
Voltage Measurement	True RMS, continuous sampling, single or three-phase. Input voltage should be measured.
Hysteresis Control	Separate trip and restore thresholds to prevent relay chatter.
Time Delay Logic	Programmable trip delay (TD1) and restore delay (TD2).
Auto-Return	Returns to VO mode when voltage is stable for defined period (TD3).
Temporary Lockout	Logic: If #Trip > 3 within 20 minutes, then keep tripped for period (TD4, optional).
Manual trigger	To operate requires manual button press for 5 seconds. To cancel requires manual button press for 10 seconds.
Manual Override	The system can be placed in either “forced bypass” or “forced VO” modes To activate “forced bypass” requires manual button press for 20 seconds. To activate “forced VO” requires manual button press for 30 seconds. To Cancel Override modes requires manual button press for 45 seconds.
Fail-Safe Mode	Loss of controller power forces system into bypass mode.
HMI	On the UVC PLC character display, the message “BYPASS” is displayed during UVC bypass operation. The optional Cycle “#” may be included in the message text, being the number of times the controller has been in bypass mode. The message “OVERRIDE” is displayed during UVC override operation.
Control Method	Period-based enable/disable logic: VO “ON” for defined duration, VO “OFF” for defined duration.
Control Accuracy	±1 second for cyclic timing.
Power-Up Behaviour	Automatically commences UVC control operation.

Period ON / Period OFF Test Function

The Period ON / Period OFF routine is a control function in the VPO designed to cyclically enable and disable a Voltage Optimisation (VPO) unit based on a defined schedule.

The primary purpose is to enable the measurement of the load voltage sensitivity.
In practical terms, this provides the necessary machine states for the remote online energy usage measurement to be logged, and thereby the Energy Savings at the site to be determined.

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The Period ON / Period OFF routine is typically initiated during the commissioning process. Once the routine is started, it may take approximately 2.5 hours to complete. Data is logged remotely on the Cloud system.

Once initiated, the routine may be left to complete unattended.

Feature Category	Requirement
Control Method	Period-based enable/disable logic: VO "ON" for defined duration, VO "OFF" for defined duration
Operating Modes	Cyclic Period Control: Activation perform 4 x [20 min ON / 20 min OFF] cycles. Machine is restored to whatever state it was in prior to the test sequence.
Manual trigger	To operate requires manual button press for 5 seconds. To cancel requires manual button press for 10 seconds.
HMI	On the UVC PLC character display, the message "IPMVP" or "EVO IPMVP" are displayed during the routine. The optional Cycle "#" may be included in the message text.
Output Type	The routine drives the logic of the UVC PLC contactor outputs.
Fail-Safe Mode	Default to VO bypass (OFF) if controller fault, loss of power, or invalid timing data
Control Accuracy	±1 second for cyclic timing
Power-Up Behaviour	Not activated by power up. Requires manual button press to initiate.

Metering

The iStar cloud dashboard system provides measurement and reporting of voltages and currents at revenue grade (Class 1) accuracy.

The energy monitor measures 3 phase voltages (Volts) and neutral and 3 phase currents (Amps). CTs are matched to each phase. All metering and CTs are fully factory installed and tested within the VPO, providing simplified installation and commissioning of the VPO system. It also provides 3 phase measurement of active power (kW), apparent power (kVA), power factor (pf) and energy consumption of the load (kWh).

Metering does not require access to customer WiFi or networks. All communication is secure on 4G Wireless networks, using a universal international SIM. Multilevel security features are provided for user access configuration and data security.

Data packets are transmitted every 1 minute. If there are network outages the metering solution stores data for up to 48 hours and flushes out any locally stored data at next connection.

The metering solution comes with a standard cloud based dashboard for monitoring of the 3 phase active power (kW) and measurement of the 3 phase energy consumption of the load (kWh). Data can be exported to .csv or .xlsx files for analysis in Excel or other applications.

The customised cloud based dashboard also provides status of the VO system (ON or OFF) and the status of the monitoring equipment (ON or OFF). If either of the VO or the monitoring devices are OFF, an alarm email is generated so that a site inspection can be scheduled to investigate what has occurred.

Metering specification

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Item	Information
Communications	GSM/GPRS/EDGE: Quad band 850/900/1800/1900MHz UMTS/HSPA+: Five band 800/850/900/1900/2100MHz External antenna
Power Supply	Built in (operates from phase 1) universal power supply
Measurement Channels	Up to 6 depending on configuration
Hosting	Hosted on AWS
Device Management	Device management features **including** Firmware updates, remote network diagnostics, configurable reporting rate
Measurement Interval	5 to 150 seconds (configurable)
Energy Logging	5 minute intervals; servers request logged data
Logged Values	Real and reactive power, min and max voltage and current, frequency
Logging Period	30 days of 5 minute data for 6 channels. The log is kept current and used after an operational device has been offline.
Reporting Interval	Default 30 seconds, configurable between 5 to 150 seconds
Report Contents	Real, reactive energy, voltage, current, frequency
Data Volume	18 MB / month (30 second data, indicative only)
Protocol	Proprietary
Current Sensing	Standard CTs: 60A, 120A, 400A, 600A field interchangeable 3000A Rogowski coils must be pre-configured
Configuration	No network configuration required at install time. All APN settings pre-configured
Product Certifications & Markings	Conforms with all relevant Australian, New Zealand and US standards Is certified for network connection to the 3G AT&T cellular network in the US (PTCRB) Conforms with a range of other international standards relevant to the European Economic Community (including the UK) Carries a number of marks (UL, CE, FCC) for which NATA registered laboratories have issued test reports

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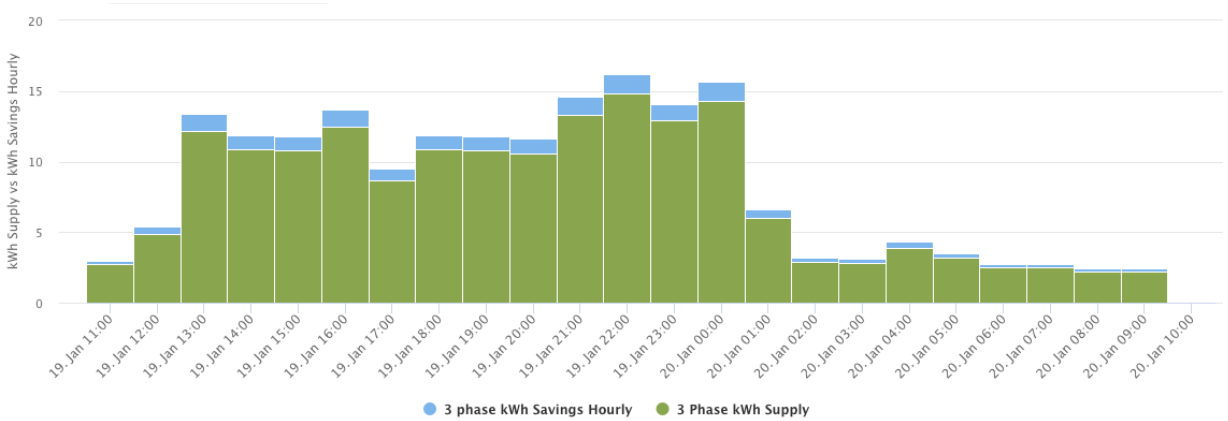
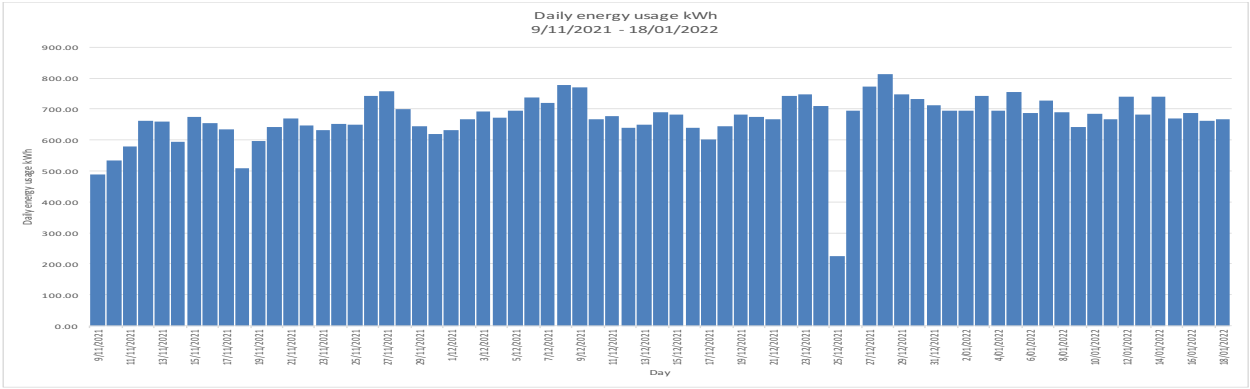
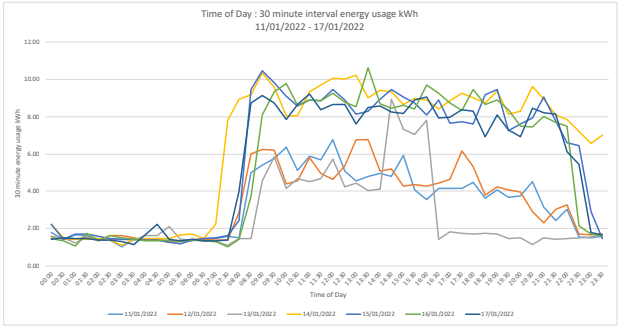
Sample Dashboard Reports

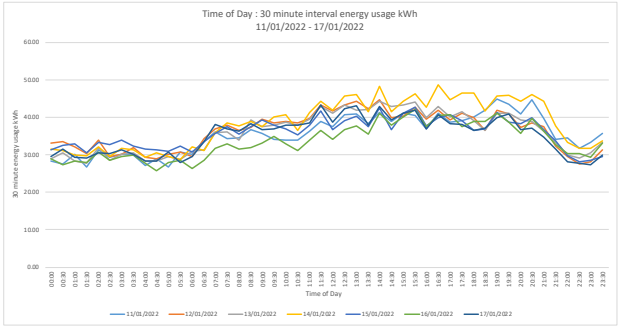


Energy Consumed and Saved (kWh) for analysis and may be exported to Excel



Data may be downloaded and analysed using Excel or other tools





Time of day reports for load energy usage

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Product Configuration

Number of Phases	**F1**
Single Phase	1
Three Phase	3
Rated Supply Voltage	**F2**
200V : Japan	200
208V : North America	208
380V : Parts of Asia, Europe, and South America	380
400V : Europe, Australia, NZ etc	400
415V : Australia, NZ, Asia, Africa (nominal)	415
480V : North America	480
600V : North America	600
Frequency	**F3**
50Hz	50
60Hz	60
Rated Supply Amps	**F4**
Optimisation Reduction Range	**F5**
5V to 15V Reduction, in 2.5V steps	1
10V to 20V Reduction, in 2.5V steps	2
15V to 25V Reduction, in 2.5V steps	3
7.5V to 17.5V Reduction, in 2.5V steps	4
Protection	**O1**
Supply side Circuit Breaker	C
Supply side Isolator	S
No Supply side Isolator or Circuit Breaker	D
Controls	**O2**
UVC	A
PONOFF Test	T
UVC + PONOFF Test	U
Enclosure Rating	**O3**
Indoor - IP22 enclosure	2
Outdoor - IP55 enclosure	5
Enclosure Material	**O4**
Zinc anneal enclosure	Z
Aluminium enclosure	A
Stainless Steel 304 enclosure	4
Stainless Steel 316 enclosure	6
Metering	**O5**
No Metering	N
Load Side	L
Load and Supply Side	S
Colour	**P1**
Green	1
Orange	2
Blue	3
Language	**P3**
English	E
Region Code	**RC**
Europe	EE
North America (US & Canada)	NA
Asia	A1
Australia & Oceania	A2
Africa	A3
South America	SA

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Commercial terms

Order lead time	4 weeks (from PO to ex-works).
Source of manufacture	Australia.
Supply basis	Ex-works, standard specification.
Delivery	Customer arrangements.
Price quoted	The “VPO Equipment” price is quoted on a 30-day firm basis. All prices quoted are AUD$, ex-GST basis. Pricing excludes import duties, local transportation to Port, international freight, clearance, local transportation from Port and delivery to site.
Variation	The price itemisation where provided in the quotation schedules is for information and invoicing purposes only. If any amounts are to be added and subtracted, EMSCAP reserves the right to amend the quotation price accordingly.
Payment terms	50% deposit on PO, 50% ex-works prior freight. Payment on Invoice.
Pricing validity	This quotation shall remain open for acceptance of a 30 day period from the date listed above and shall lapse unless a written request for extension of the period is received in writing no later than 1 business week before the original proposal expiry date.
Security	EMSCAP reserves the right where retention is applicable to provide either cash or bank guarantee at our discretion.

Warranty

Terms and conditions apply

Transformer	5 years.
Enclosure	5 years Indoor (Outdoor period is site specific).
Electronics	1 year.

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