

**VICTRON INVERTER - ADVANCED BATTERY BACKUP SYSTEMS**
**Description**

The Victron range of Inverter/Chargers provide advanced solutions to ensure that MacLennan Pumping Systems continue pumping during power interruption by inverting 12V DC power from a battery (or multiple batteries) to clean and efficient 230V power. The battery back-up range includes 4 specifically sized Inverter/Charger units plus a number of ancillaries to provide advanced system control and telemetry. For the ultimate in battery back-up protection, the top-of-the-range Quattro unit is mated with a generator that recharges the batteries once they reach a predetermined state of depletion to give unequalled protection

**Batteries**

The Victron Inverter/Charger units draw 12V power from a single or a bank of 12V batteries which is inverted into clean, pure sine wave, 230V power.

The recommended batteries are:

- NorthStar NSB 60FT- 59Ah High Efficiency battery - 12V
- NorthStar NSB 100FT - 99Ah High Efficiency battery - 12V
- NorthStar NSB 190FT - 191Ah High Efficiency battery - 12V

**Inverter sizing - Quattro 12/3000/120**

The Quattro 12/3000/120 is sold together with a 6 kVA remote start generator. All MacLennan Pumps up to 750W can be used with this system.

**Model Attributes**

12/XXX/XX

Units are to be used with 12V batteries

12/XXX/XX

Output power in VA (volt amperes)

12/XXX/XX

Charger size in A (amps)

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**Typical Application**

To provide continued pumping of MacLennan pumps and pumping systems during power disruption.

**Battery Backup performance**

The Victron Inverter/Charger units and batteries detailed above have been chosen to provide continued removal of water by the pumping system if a power outage occurred. We are often asked how long will the battery back-up system last for, and whilst the following information is designed to give as much information as possible, it should be understood that 'how long?' is not really the appropriate question; 'how much?' is much more pertinent. To better explain this we will use the following examples:

**Example 1 - 50Ah Battery with small pump**

A small pump has a pumping capability of 1000 litres per day. The battery has sufficient charge to keep the pump running for 5 days and in total pumps out 5,000 litres (1000 x 5).

**Example 2 - 150A/h Battery with larger pump**

A more powerful pump has a pumping capability of 15,000 litres per day. The battery has sufficient charge to keep the pump running for 1 day and in total pumps out 15,000 litres (15,000 x 1).

The pump in Example 1 is pumping for longer than the pump in Example 2; five times as long indeed, but longer is not better than more. The pump size dictates the rate of flow but the battery size dictates the volume of water removed.

If the volume of water entering the basement during the period of the power outage is 10,000 litres it makes no matter that the pump in Example 1 can pump for five days. Once 5,000 litres of water has been pumped, the battery has no more power available and the pumps will stop working. The larger pump coupled with the larger battery in Example 2 removes the 10,000 litres quickly and with capacity to spare. In Example 1, pumping for longer has no benefit.

Ultimately what is required to keep the basement dry is the ability to remove the water that enters the basement. The volume of water that can be removed is directly proportional to the capacity and efficiency of the battery and the efficiency of the inversion from 12V DC to 230V AC power. The battery back-up systems set out in this document combine class leading inverter and battery efficiency to remove the largest possible volumes of water to keep your basement dry.

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## TECHNICAL DATA - INVERTER/CHARGER UNITS

	Multiplus 12/800/35	Multiplus 12/1200/50	Multiplus 12/3000/120	Quattro 12/3000/120	
Newton product code	BB1	BB2	BB3	BB4	
Inverter	Results				Units
Input voltage range	9.5 - 17				V DC
Output voltage	230				V AC $\pm$ 2%
Output frequency	50				Hz $\pm$ 0.1%
Continual output power at 25°C	800	1200	3000	3000	VA
Continual output power at 25°C	700	1000	2500	2500	W
Continual output power at 40°C	650	900	2200	2200	W
Peak power	1600	2400	6000	6000	W
Maximum efficiency	92	93	93	93	%
Zero load	8	8	15	15	W
Zero load power in AES mode	5	5	10	10	W
Zero load in search mode	2	2	4	4	W
Charger	Results				Units
AC input voltage range	187-265				V AC
AC input frequency	45-65				Hz
Charge voltage 'absorption'	14.4				V DC
Charge voltage 'float'	13.8				V DC
Storage mode	13.2				V DC
Charge current	35	50	120	120	A
Battery temperature sensor	Yes				
Maximum combined battery capacity	400	700	1200	1200	Ah
General	Results				Units
Programmable relay	Yes				
Auxiliary output	N/A	N/A	16	25	A
V.E. Bus communication port	For remote monitoring & system integration				
General purpose com. port to communicate with BMS	N/A	N/A	1x	1x	
Remote On/Off	Yes				
Operating temperature	-40 to +50				°C
Maximum humidity (non condensing)	95%				RH
Protection	Output short circuit; Overload; Battery voltage too high; Battery voltage too low; Temperature too high; 230V AC on inverter output; Input voltage ripple too high				
Warranty	2				years

FOR MORE INFORMATION

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Enclosure	Results		Units		
Material	Aluminium				
Colour	Blue - RAL 5012				
Protection category	IP21				
Battery connection	Battery cables of 1.5		m		
230V AC connection	G-ST18i connector	Screw terminals 13	mm <sup>2</sup>		
Weight	10	10	18	19	kg
Dimensions	375 x 214 x 110		362 x 258 x 218	HxWxD in mm	

Standards	Results	
Safety	EN 60335-1, EN 60335-2-29	
Emission, Immunity	EN 55014-1, EN55014-2, EN 61000-3-3, EN 61000-6-1, EN 61000-6-2, EN 61000-6-3	

Technical data - Batteries	NorthStar NSB 60FT	NorthStar NSB 100FT	NorthStar NSB 190FT	Units
Newton product code	BB20	BB21	BB22	
Battery capacity	59	99	191	Ah
Battery life cycles at 50% depth of discharge	500	700	1700	
Service design life	12+	12+	12+	
Starting efficiency draw	800	1545	1600	MCA
Weight	21	33	60	kg
Dimensions	287x108x263	396x108x287	560x125x320	L x W x H in mm
Warranty	5	5	5	years

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**Description**

The table below is test data from our pump testing rig and confirms the volumes of water that should be removed with the specified system. The test rig was set with a pumping head of 4m with 4 pump starts per hour, approximately 66 litres of water discharged at each start, water discharge temperature of 20°C and standard DC power cables. 400 watt pump flow rate was 137 litres per minute. 750 watt pump flow rate was 225 litres per minute, measured by flow per metre.

	400W Pumps				750W Pumps			
	Start Volts	Starts	Hours	Litres	Start Volts	Starts	Hours	Litres
1 x NorthStar NSB 60FT	12.84	56	14.2	3825	12.98	48	12.0	3154
2 x NorthStar NSB 60FT	12.71	104	26.6	7035	12.84	102	25.7	6879
1 x NorthStar NSB 100FT	12.98	106	27.1	7295	13.08	87	21.9	5803
2 x NorthStar NSB 100FT	12.85	212	54.0	14417	12.90	180	45.5	11992
1 x NorthStar NSB 190FT	12.80	182	46.7	12394	12.82	162	41.0	11002
2 x NorthStar NSB 190FT	12.84	395	101.5	26822	13.10	353	89.6	23936
1 x NorthStar NSB 190FT <sup>1</sup>	12.80	2568	642.0	282480	13.10	1632	408.0	244800

<sup>1</sup> Figure is based upon the actual performance of 1 x NorthStar NSB 190FT and the charging rate of the generator and is calculated, not tested. Figures based upon one full tank of fuel and generator recharge set to 50% of battery discharge. Refuelling as required would give unlimited number of starts, duration and volume of water pumped.

**Options**

A number of sophisticated options are available, which, when added to the base Inverter/Charger, provide the end user or maintenance engineer with a host of features for the control and monitoring of the battery back-up system.

**Victron Battery Monitor**



The BMV600S provides real time information for the battery or bank of multiple batteries:

- Battery voltage
- Discharge current
- Capacity as a %

**Victron Blue Power Panel**



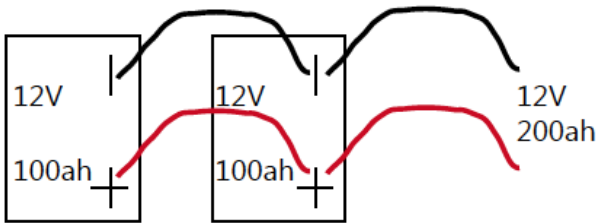
The Blue Power Panel provides control and monitoring of the Victron Inverter/Charger. Features include on/off control of MultiPlus and Quattro Inverter/Charger units and graphic illustration of system charge/discharge, capacity in % real time and time to go until discharged.



**VICTRON INVERTER - ADVANCED BATTERY BACKUP SYSTEMS**
**Increasing Battery Performance With Multiple Batteries**

The Battery Back-Up System will remove water at a volume that is proportional to the available battery charge. By adding further batteries, the available charge is increased and the volume of water that the system can remove during power outage is increased also. The batteries are connected together in parallel, as shown in the diagram below.

Two batteries of the same size connected in parallel doubles the available battery charge. Three batteries triples the charge, and


**Victron Colour Control Panel**


The Color Control Panel adds a number of extra features over the Blue Power Panel such as Ethernet or Sim Card internet capability with remote monitoring via web portal and Data storage on SD card.

**Quattro 12/3000/120 Generator System**

This system, MacLennan purchase code BB4, provides the largest capacity battery back-up available. The system includes:

- Victron Quattro 12/3000/120 Inverter/Charger
  - 6 kVA diesel generator with remote electric start
  - Wheeled weather-proof container (as shown)
- Please note the system does not include battery(s).

This battery back-up system provides continuous power for the MacLennan Pumping System and will remove approximately 282,000 litres from one tank of diesel at four pump starts per hour. If the fuel tank is replenished, the system offers unlimited battery back-up protection.

The generator is started by the Quattro Inverter/Charger at a predetermined level of depletion of the battery(s), normally 50% discharge. The generator will provide 230AC power to the Quattro unit which provides power for the pumping system and also charges the battery(s) with its 120Ah charger. Recharge time is approximately 1.5 hours if the pumps are operating 4 times per hour. Once the batteries are fully charged, the Quattro Unit turns off the generator and the battery(s) once more provide the power for the pumping system.

This system will operate with just one of any of the three batteries mentioned on Page 1, but the whole system will be more efficient if larger battery capacities are chosen and our recommendation is that a minimum of 190Ah battery capacity should be selected. This can be a combination of 2 x NSB 100FT or 1 x NSB 190FT.



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Generator	Results	Units
Model	HGI SKD60D3-R	
Rated output	4.8 - 6	kW-kVA
Voltage - Dual Volt	110/230	V
Socket configuration - 110V	2 x 16 + 1 x 32	A
Socket configuration - 230V	2 x 16	A
Engine & Fuel	Yanmar L100	diesel
Standard fuel tank capacity	22	litres
Runtime (hours at 75% load)	18	hours
Canopy dimension	1206 x 735 x 943	mm
Weight	190	kg
Manoeuvrability	Supplied within a wheeled canopy with fixed handles	

**Training and Competency Of the User**

The Inverter/Charger units are mains powered and should be installed by persons who are electrically competent by way of appropriate training to either fit a fused plug or wire directly to a fused spur. Knowledge of DC input by battery and the connection of DC batteries leads to both the battery(s) and the Inverter/Charger is required.

The Quattro Generator System requires knowledge of the starting and use of diesel generators. In most cases these battery back-up systems will be installed as part of our cavity drain waterproofing system by a MacLennan Registered Contractor (NSBC) who are trained and experienced in the installation of all MacLennan battery back-up systems, pumps, pumping systems, panels and telemetry systems.

**Limitations**

These Battery Back-up systems are intended for the continuation of power to pumps and pumping systems. Users should be aware that the connection of other electrical equipment will deplete the battery charge which may result in pump failure once the battery charge is fully depleted. We ask users to consider which is the most important to them: the continued removal of water or the use of the other electrical equipment.