

FREQUENTLY ASKED QUESTIONS

Is the system available now?

Yes it is but in limited numbers until the end of 2018. Systems will be more widely available from quarter 1 2019 as we continue to sign up our distribution partners.

How is the Integrel system different from a high power alternator?

The Integrel system is much more than just a generator; it is a complete power generation, storage, conversion and distribution system.

Focussing on the Integrel generator itself, this is manufactured specifically for Triskel Marine and is very different from a conventional high power alternator:

- The generator will deliver its rated power continuously. For example, with an ambient temperature of 25C the generator will deliver a constant 8.3kW
- The coupling of the magnetic flux between the rotor and stator has been dramatically improved to give very high generation efficiency
- The windings have been changed to give the specific voltage range we need and to provide unusually high power output at low revs. With a suitable engine, up to 3.5 kW of output DC power is available at engine idle
- The generator itself has no embedded electronics and much improved cooling air flow to cope with the higher power output
- The customised engine mountings are specifically designed to minimise side loads on the engine, to eliminate shock loading and to maximise belt life
- The control system is radically different from that of a conventional alternator (see next question)

Why does Integrel need such a smart controller?

Integrel is a complete power generation, storage, conversion and distribution system, deeply embedded in the operation of the vessel. To achieve this without compromising safety and to deliver ample electrical power automatically at all times requires a very smart control system.

The Integrel controller receives information in real time from multiple sources around the vessel (where available). This includes the engine ECU; the vessel's on board data system, such as NMEA 2000; other proprietary data systems and Integrel's own battery sensors and system components.

The controller uses this data to ensure that the engine is optimally loaded and that propulsion is never compromised. It also delivers the precise amount of power required to service the electrical loads and ensures that the batteries are kept in optimum condition. In the background, the controller also monitors key safety parameters such as battery and generator temperature, voltage and current limits and battery state of charge.

Because of the high power output from the generator, the load on the engine has to be managed very carefully. The controller checks that the engine is at its operating temperature before slowly ramping up the electrical power until the engine is loaded to its most fuel efficient point. At the same time, the controller prioritises propulsion so if it senses a change in gear or a rapid change in engine revs, it shuts the generator down until the engine returns to a steady state. At high engine revs when the propeller uses all the engine power, or when manoeuvring at low speeds, the generator is also shut down.

Generator power output is calculated and adjusted 100 times every second to give a virtually instantaneous response to the constantly changing environment on board an operational vessel.

Why is power sometimes quoted in kVA and sometimes in kW?

Power from an AC generator is quoted in kVA and power from a DC generator is normally quoted in kW. Integrel is a DC generator and so its power output is quoted in kW. The figures that we provide are the actual electrical power measured at the output of the controller, which is the amount of useable power from the system. To compare power quoted in kVA with Integrel's output, multiply the kVA number by the power factor of the AC circuit, which is typically about 0.8. For example, this means that a 10kVA AC generator is equivalent to about 8kW.

Does a catamaran need two systems, one on each engine?

A catamaran can have a system fitted to each engine but does not necessarily need it. The Integrel system is self-organising and is perfectly happy to run with two interconnected generators, sharing the load as needed with no user intervention. Two systems provide redundancy and balanced engine running hours; they can also charge multiple battery banks faster than a single system and can support high continuous loads.

A single system fitted on a twin-engine boat performs perfectly well but will take a little longer to charge multiple battery banks. If the engine is run in generator only mode when only one engine is fitted with an Integrel generator, it will accumulate more hours than the second engine.

What are the main differences between a generator and an Integrel system?

The most obvious difference is that the Integrel system does not require a separate engine. This means that the fitting costs are less than for a stand-alone generator with no need for through hull fittings and no separate fuel, exhaust or cooling systems. Through life maintenance costs are also substantially less, as Integrel only needs a periodic belt change; no more second engine checks and maintenance schedules.

Other key differences are that the Integrel system improves the fuel efficiency of the propulsion engine, reducing overall vessel fuel consumption. It is fully automatic, managing electrical power generation, storage, conversion and distribution in one package.

Integrel also allows you to reduce the size of your 12 and 24 volt house battery banks with its powerful battery to battery charging capability and reduces the size and weight of the cabling for power hungry consumers such as bow thrusters, windlasses and winches.

Can I remove a generator and replace it with an Integrel system?

An Integrel system will replace a generator of up to about 10kVA. The Integrel generator itself is fitted directly on to the propulsion engine occupies very little space and weighs only 15kg. The storage batteries that it uses are normally fitted into the same space as the stand alone generator it replaces; a 10kWh lead acid battery pack for example measures 600 x 600 x 350mm and weighs 260kg. Lithium ion batteries have about the same volume depending on the supplier and are less than half the weight.

What if I already have a large 12v battery bank, inverter, solar and it's working pretty well. Can I replace my 180-amp alternator with this system? So I would have a small 48v bank and a large 800-1000AH 12v bank. Also will my 12-volt bank being charged by solar and my inverter (when on shore power or gen.) be able to charge the 48v bank?

You would want to reconfigure the batteries to maximize the 48v bank, as this will optimize the charge acceptance rate and reduce battery-charging times. You would then have a small 12v 'buffer' bank, maintained in a full state of charge by a Triskel 48v to 12v battery-to-battery charger. Your 12v inverter/charger will not charge the 48v bank so you will either need a stand-alone 48v charger, or a 48v inverter/charger, both of which Triskel can supply

Are 48v solar regulators available?

Yes, there are high quality 48v solar regulators available. Using the solar array to charge the main battery banks directly is a good way to use the energy and it can then be trickled down to the house banks via the battery-to-battery charger.

What if I have a large generator that I am constantly under loading. Can I put this on the generator motor? Would that even make sense?

Although you could in theory add an Integrel system to the generator, it would not be in any sense optimal because the Integrel control system is based on the assumption that the installation is on a propulsion engine with loads based on a propeller load curve.

Now that I have a 48v battery bank can I install an Elco electric motor connected to its own shaft and prop as a get home engine? It would be used if my prop or shaft on the main was fouled or damaged. I would put the main in neutral and use the alternator to run the Elco motor. Would that work?

It would work. The Integrel system would simply see the electric propulsion motor as another load. It doesn't care what that load is.

Will I have problems running my main engine in generator only mode?

No. Integrel generates a lot of power at low engine revs. This optimises engine fuel consumption, which keeps the fuel bills down and ensures that the engine is properly loaded even at low revs. Your main engine becomes an optimally loaded, fuel efficient, stand-alone generator.

Without Integrel (or a stand alone generator), most cruisers have to run the main engine at anchor to charge the batteries from a conventional alternator; this does not load the engine optimally, is an expensive way of producing power and is not good for the engine due to the light load.

Can I mix and match different batteries?

No. Mixing battery types will result in incorrect charging and potential battery damage. Ideally all batteries should be installed at the same time, be from the same manufacturer and be of exactly the same type. They will then charge and discharge consistently, balance correctly and achieve the longest possible life.

What type of batteries can I use?

The Integrel control system supports both advanced lead acid and some brands of lithium ion batteries. We will advise on battery type when helping you to specify your system.

The key factor in selecting batteries is that they must be capable of high charge rates in order to minimise the amount of time taken to recharge and to make the most of the high power output available. The Integrel generator is software limited to 170A and 9kW allowing us to charge a typical 48v bank at the 1C rate, which is the amp hour rating normally quoted by the battery manufacturer.

How big a battery bank do I need?

Basically, there are two core parameters, with the tougher one in any application being the determining factor:

1. The maximum DC load between Integrel run periods. Typically, you want to calculate the worst-case overnight loads, which in many applications is air conditioning loads, and then, if using advanced AGM lead-acid batteries, double that for the battery capacity, and if using lithium-ion, multiply by 1.2, to establish a minimum battery capacity.
2. The charge acceptance rate of the batteries. If the batteries cannot soak up the output of the Integrel system you lose a lot of the benefits of the system. You really need at least 10 kWh of lead-acid batteries to optimize the system, and even then the charge acceptance rate will taper off once the batteries are much above 50 percent charged. With lithium-ion, we like to keep the charge rate no higher than the 1C rate, which is a charge rate equal to the rated capacity of the batteries, so a ~7.5 kWh battery capacity rating fits nicely with the 7-8 kW output of the Integrel system.

How big an inverter do I need?

The inverter should be sized to meet the peak AC load. This is not the sum of all of the possible AC loads but the sum of the loads likely to be on at the same time. For example, an electric cooker will draw up to 5kW; an electric kettle 3.5kW; a fan heater 2kW; a hair dryer or a water immersion heater 1.5kW. It is unlikely that all of these will be on at the same time so a boat fitted with all of these devices would probably need a 6 or 8kW inverter. The inverter will draw power directly off the 48v system, 8kW being 160A at 50v, which is well within the capability of the system.

Why generate at 48 volts DC?

We use DC because it allows us to generate useable electrical power regardless of the rotational speed of the generator. It is also very flexible in its management and directly compatible with battery storage. Most boats have DC systems on board and we can service these with a minimum of conversion losses.

48 volts was chosen as it is classified as "low voltage" and is safe to handle. If you accidentally touch a live terminal, it will not harm you. 48 volts also allows us to use relatively small diameter cables which are less expensive and physically easier to install.