Reviewed by John Philips

The Iceman Cometh!

A sophisticated gyro system for EP fixed wing, rotary wing models and mulitcopters, from Blue Light Technologies...

Eugene O'Neill's story of pipedreams, salvation and the evasion of guilt – The Iceman Cometh – has little to do with this terrific piece of kit, other than Blue Light Technologies having called their BL-3G unit 'Ice-Man'. Certainly, this ultra stable 3-axis gyro is no pipedream and offers salvation to those wanting to tame a skittish model without feeling any guilt having used this electronic solution!

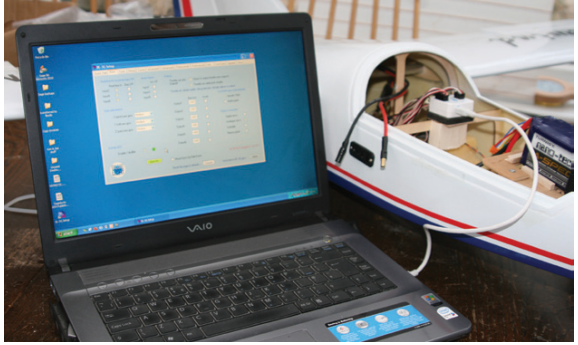
The Ice-Man 3-axis gyro, henceforth referred to as the BL-3G (the Blue Light part number), can be used in fixed wing aircraft and helicopters, be they single rotor or multi rotor (as in quadcopters) and can be set up quite simply, or more exacting, using a USB lead between the gyro and your PC, to set parameters to your specific requirements – and do a lot more besides. To quote Blue Light, "…the BL-3G gyro is an ultra stable 3-axis gyro based on MEMS technology. It offers excellent quality and performance at a low price. Utilising the L3GD20 from STMicroelectronics and an ARM based processor, it offers users an unprecedented level of fine-tuning/programming to meet the needs of professionals and hobbyist users alike. Ideal for any number of UAV, conventional aircraft, or robotic projects, as well as enabling the very best performance for competition aeroplane and other RC recreational flying". OK, let's take a closer look at what it can do.

Video overview

Before going a little more into the features of the BL-3G, I would thoroughly recommend that you both visit the Blue Light website: www.bluelight-tech.com/BL-3G.htm where you can see some short videos of the BL-3G in action, and better still, visit YouTube and search for 'Iceman gyro' for an interesting video giving an overview of the installation and set up of the 'Quick Start' mode, plus a little bit explaining what else the BL-3G offers.

Quick set-up

The Ice-Man package contains the gyro, a USB lead, a mini DVD PC set-up tool and manual, a small screwdriver (to adjust the gain pots), four short male/male ended servo leads (to connect the 3 Rx inputs to the BL-3G and one for switching gyro on/off) and two sided brochure that shows you how to how to install the basic software (Guide 1) and install the Ice Man in the aeroplane (Guide 2). You need a PC with .NET installed – if not, you should install this first from the free download. Also check that the PC tool software. The Guide also prompts you to check the Bluelight website for latest updates.



Setting up the BL-3G in the Seawind. Gryo is upright and sat on a foam mat.

Guide 1, steps 1 to 5 take you through the software installation process, but the Gyro must not be connected to the PC via the USB cable until step 5, which is the gyro self-calibration stage. Four LEDs on the front panel of the gyro give an indication of what is happening. When calibration is complete, an icon on the PC screen will say "BL-3G is plugged in via USB. Note: if you have installed the unit in the aeroplane and connected the servo leads as indicated to the Rx and the connector leads between the rx and the gyro BEFORE the calibration stage (no reason not to), then you must power the Rx via a 5v battery or via an esc (if EP with BEC). The LEDs indicate thus: one RED LED on with the USB lead disconnected shows that the gyro has power on via the Rx battery; After plugging in the USB lead, the BLUE LED will flash briefly and then after calibration (about 2 seconds) will start to flash intermittently (gyro firmware operating normally) finally, one GREEN LED will flash intermittently indicating that the Gyro is enabled and functioning at the factory default setting (the default gain setting is medium gain).

Different servo loads – battery

One important issue regarding the installation is the likely current draw by all the servos fitted on the aeroplane. The BL-3G can only pass through 600mA of power for the servos using the standard battery set up i.e. from an ESC or a separate Rx battery. If the servos you are using in total need more than that, alternative set-ups are shown, using a second battery connected to the Ice-Man and servos – on the output side of the gyro.

As a rough guide, small park flier models are at one end of the servo current draw line, with fast models (high aerodynamic loads) and 3D models (all servos operating at the same time) as the other – you could measure the static draw on your setup using a watt meter, but that will not include aerodynamic loads on the servos as experienced in flight – to do that you will need inflight telemetry. Most aeroplanes need just a few simultaneous inputs to fly normally, so the draw should be steady and below 600mA, but the Ice-Man instructions make it clear that "it is the RC pilot's responsibility to ensure that al the servos get adequate power". If in doubt, follow the 'high power draw' set up regarding an additional battery for the servos.

Follow the installation instructions, Step 1 through to Step 8 and the result will be an aeroplane with all three axis correctly configured, set at a Gain level appropriate for the aircraft type selected, with the ability to switch the Gyro on or off.

When flying with the Gyro for the first time, always fly and trim the model with the Gyro off, first.

Using the PC tool

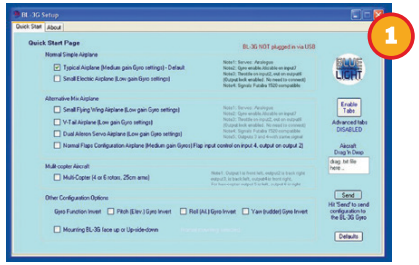
This is optional, as you get straight into utilising the Ice-Man via the Quick Set Up, but if you want to get the best out of your purchase, then it is well worth looking at what the Iceman can do in its programming mode. I'm not going through every set up, when the instruction manual is perfectly comprehensive (all 71 pages), but an overview of each programming screen option is really necessary to explain what it can do.

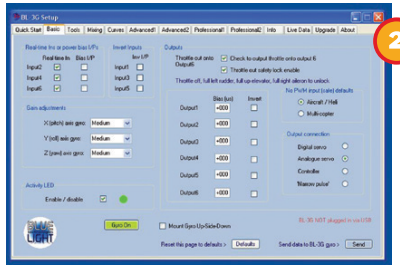
The idea is to set up the Iceman in the aircraft and with the radio on, check the controls work properly WITHOUT the gyro switched on - then switch the gyro on – check the LED display as described above and when you have a flashing green LED, connect the IceMan to the PC with the supplied USB lead.

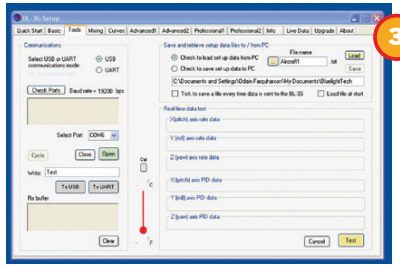
The first screen that opens is the Quick Start page (see screen 1) , which really just identifies what type of aircraft the model is – Small EP (low Gain), typical Aircraft (medium Gain), Small flying wing, V-tail, dual aileron servo, normal flap configuration and multicopter (4-6 rotors, 25cm arms) – you can leave the boxes opposite these options blank (the default setting is for Typical Aircraft. Or you can click on the appropriate boxes for you model. Also you have the option to invert the 3 axes – pitch, roll and yaw (should the gyro move the control surface move the wrong way) – and select whether the gyro is mounted face up or upside down in the aircraft.

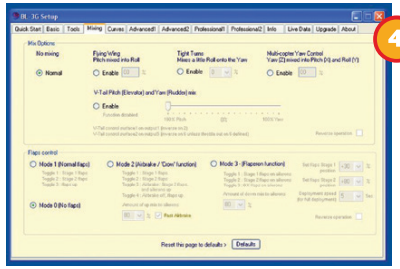
The selections made on this screen will be automatically carried forward to the other screens should you opt to use them.

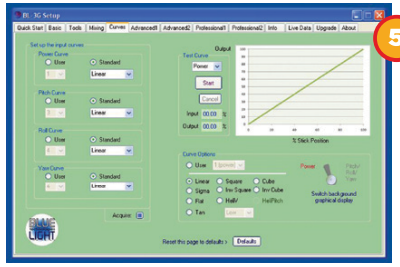
If you are happy with the aircraft configuration you have selected, plus the inverts as necessary and the gyro

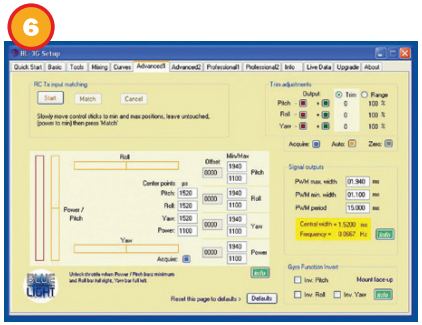


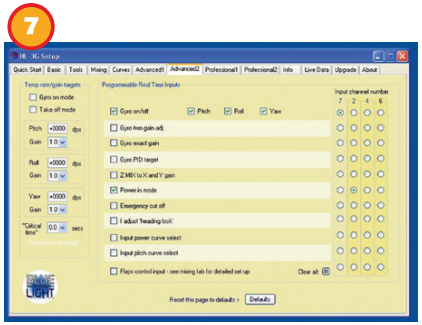


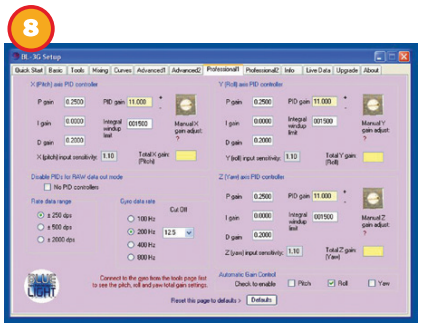


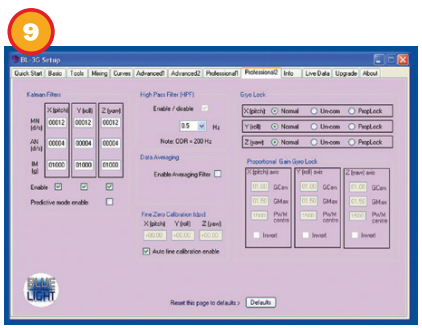












orientation indicated, you can click on the 'Send' button and the Gyro is updated with your selected info. You can return the Gyro to the factory default settings by hitting the 'Default' button at any time (as long as the gyro is powered and the USB lead is connected).

If you disconnect the USB lead and move the aircraft, you will be able to see the movement of the control surfaces as the gyro inputs the servo gains to correct the movement – check the direction of the movements, if they are the wrong way, reconnect the USB lead and rest the Gyro function Invert button for the appropriate axis (axes), hit the 'Send' button and the Gyro should correct itself to reverse the control surface Gyro-controlled movement.

To explore the features more, the other setting screens can be accessed by pressing the 'Enable Tabs' button. The next screen 'Basic' will be presented on your PC.

Basic options (Screen 2)

On the Gyro face, you will have noticed that there are two input and output ports for each axis. This allows you to change the direction of the corrective throw when the aircraft is moved with the gyro enabled, if the control surface is operated by a single servo. Simply change the servo plug to the free axis output – for elevator change output1 to output 2, for example. If, however, you are using two servos per axis, and you just want to switch the operation to inverse, you can click on the Output invert box for the particular output.

On this screen you can change the gain for each axis (on the Quick set-up all three are the same) from Medium to Low, or to High, by selecting the desired gain on each axis (fast aircraft – low gain, slow aircraft – high gain).

You can select which type servos you have fitted (digital or analogue), but you must not have a mixture of both types in your aircraft.

You can switch the gyro off so it is off at all times (the gyro then becomes a mixing unit).

Throttle out to Output 6 – this directs the throttle operation to output 6 and allows the throttle to be locked in the closed position until unlocked. Very useful on an EP model, preventing unintended motor starts. To unlock, the Tx sticks need to each be held in a certain position at the same time (these positions vary from type of Tx mode, invert selections, etc) – the instruction manual shows you how to achieve this.

You can adjust the bias for each output to allow more movement in one direction or the other to introduce differential on the ailerons, for example, using the bias box in the Output Bias and Invert area of the screen. The Invert box can be used to invert one output where two servos are used for an axis and both signals need to be the same (i.e. elevator).

Tools (Screen 3)

This screen has various tools to both programme and test the BL-3G. I haven't used it, can't comment on it, but advise you to refer to pages 20/21 of the manual for an overview of the tools.

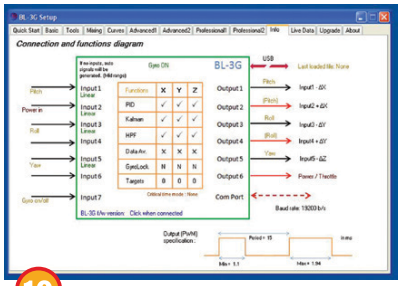
Mixing (Screen 4)

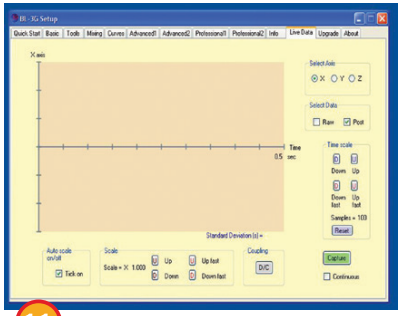
This is a very useful screen. The various mixes available covers a lot of situations that even sports modellers will find very useful. If the aircraft is a flying wing without rudder control you can mix pitch with roll in percentage. If a normal fixed wing layout, you can mix in a percentage of Roll into Yaw to keep the wings level. For a V- tail, you can mix Pitch with Roll from 100% Pitch down to zero and back up to 100% Roll and for flap configuration, you can select none, normal (3 positions), airbrake/crow and flaperon – all done by the Gyro, not at the Tx! You can also set the speed at which the flaps are deployed.

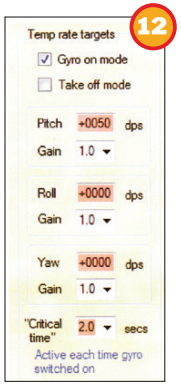
Additional Screens (Screen 5 – Screen 11)

The Advanced screens allow the Tx to be matched perfectly to the Gyro. Some brands of Tx, in particular not so good quality ones, will have variable output pulses at full stick movements and there could be variances between the three axes, too. Using the Advanced screens, these output pulses can be matched, so you can use a low cost radio system and still benefit from the full motion of the Tx sticks.

Screen 7 looks very useful, although I have not set up an aircraft yet to try out a couple of the features yet. The first is the LH column in the screen 'Temp/rate/gain targets' (Temp refers to Temporary, rather than Temperature), which allows two modes to be enabled. The first (Screen 12), is entered into every time the gyro is switched on with a programmable strobe. The second mode (Screen 13), is enabled only once during the take off run, when almost full power is applied. The first would be very useful should an undesired spin be entered into (e.g. when teaching novice fliers). In the first - 'Gyro on' -mode, and if in a spin, it is desirable to stop the wings rotating, so a zero roll rate is selected. A positive pitch is then applied to stop the aircraft losing further height (50 deg/sec in this case). The duration of all the above rates is then set up in the 'Critical Time' box. This sets the number of seconds the rates (and gains) are applied for. An input is then set up to allow the gyro to be switched on and off. A 'Zero' time in the 'Critical Time' box disables this function.







The second mode – 'Take-off' – allows special rates and gains to be set during the take off run (notably to track straight against the motor torque and wind). It is entered into only when 30% of full power is applied. Once 30% power has been applied, the gyro assumes the model has commenced its take off run. At this point, the special gains are applied. To achieve a straight take off at slow speed (initial acceleration), the Yaw gain rate would typically be increased (doubled in the example shown in Screen 13), while setting all the rate targets to zero. After the pre-defined 'Critical Time' (4 seconds in the example shown Screen 13) the 'Take-off' mode is exited and the Gyro acts as normal.

Actual testing

I used two aircraft to assess the BL-3G – the PB Models Skydancer 40 size EP 4 channel conversion, using the Quick Set up format, and an old Seawind 90, converted to EP with flaps and retracts, set up using the more advanced programming screens. Both were fine fliers in their own right, but the chance to try out the gyro to see how it handled crosswinds and the fact that the Seawind's CG, being fairly critical, within a 10mm band, made it a bit skittish in pitch, needing a great deal of concentration on landing, so it would be a good test for the Iceman.

The tests were fairly basic, but showed that the gyro was doing its stuff. I deliberately flew in fairly breezy conditions and both models showed great stability – the SkyDancer particularly, being small and relatively light, can suffer from buffeting as you would expect, but with the gyro switched in, on default settings of medium level gains, flew noticeably more smoothly and needed less rudder held in on take off – it still drifted a little, but further adjustment of the gain levels, although not effected yet, will certainly cure that – the beauty of the Iceman is that fine adjustment can be made at the field using the PC link, to suit variable weather conditions. With the Seawind, initial flights were made with the gains at medium, but I utilised the Take Off feature, giving double the yaw gain above 30% power for 5 seconds, given the length of the normal take off run. The Seawind was always tricky to keep straight until it got up to speed, even though it has a trike uc – something to do with the thrustline being so close to the CG? Anyway, again, in crosswind conditions, which would normally turn the Seawind into an unpredictable beast, the take off was straight as an arrow. The medium gain on the elevator made her feel much more comfortable in pitch, too – excellent result!

BL-3G Ultra Stable 3-Axis Gyro Features:

- Small size (42x38x16mm), weight (19g) and power (nominal 45mA)
- USB/PC connection for set-up and upgrade
- Ultra stable over temperature and time
- Operational temperature: -30 0C to +85 0C
- ST L3GD20 MEMs rate sensor
- ARM Cortex processor for control and I/O
- UART connection for system developers
- Filters: Low pass, High pass (programmable), Kalman (programmable), Rolling average (programmable) and Automatic Gain Control (AGC) option on all axes
- Control algorithm: PID (Proportional, Integrative, Differential) All gain parameters programmable (+I external pots)
- Input Tx/Rx matching
  Match up to any RC transmitter
  Allows low cost system with high end features
- Curves (input stick curves)
  Many standard and also x 4 user programmable
  Good for aircraft control at low cost
- Mixing functions/trim
  Flying-wing, V-tail, Flaps, Flaperon aircraft
  Power in and out (for curve transformation)
  Trim and range adjustments for fine tuning
- 3 Rx inputs and 6 outputs for control signals:
  Pitch, Roll and Yaw
- 4 real time programmable inputs for:
  Gyro PID gain low / high set and rate set
  Gyro PID gain modulation based on input
  Gyro on/off
  "Critical time" mode for spin / crash recovery
  "Take off" mode for perfect crosswind take offs
  Mixing of Z axis (yaw) mix gain control
  Power in
  Emergency cut off
  'Heading lock'gyro function (all axes)
  2 x Input curves switchable in real time
- 1 x UART for 16 bit raw X, Y, Z rate and 8 bit temperature digital data out and PC connection
- Highly programmable for many applications
- Variable input voltage (20v to 5v, or down to 3.3v)
- LED displays to show gyro operational
- Factory-calibrated
- RoHS, "green" compliant
- PC tool
  Intuitive and easy to use software for detailed user programming
  Graphical real time data monitoring
  Graphical matching to RC transmitter
  Graphical curve generation tool
  USB and/or UART ts connection

Summary

I've not yet explored the Ice Man's full capability yet, or fully fine –tuned the Seawind installation, but results so far have shown it to be a great bit of kit, superior to any gyro that I have used before. I will do an update to the potential in the near future when I have had the opportunity to fully explore all the features of the BL-3G. I've seen them advertised for as little as £59.99 – extremely good value for such a feature loaded piece of kit.