Intelligent Gyro Compass (iGC)

Product Manual

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Outstanding Performance in Underwater Technology

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1.0 Safety Statements

The installation of this unit is fully the responsibility of the end user.

Full consideration has been given to the requirements for CE marking and the relevant safety information is contained within this manual.

Since the unit is supplied as a subsystem and its safe use is installation specific, actual compliance is the responsibility of the installer.

It must be operated in accordance with the following instruction manual. Failure to follow the recommendations of this manual may lead to safety hazards or equipment failure.

Danger! Throughout the manual certain safety related comments and requirements that could lead to injury or loss of life will be highlighted to the operator by indications in the margin identified as opposite.

Caution! Throughout the manual certain safety related comments and requirements that could result in damage to the product or other property will be highlighted to the operator by indications in the margin identified as opposite.

1.1 Technical Support And Software Upgrades

Contact your local agent or Tritech International Ltd

Mail	***Tritech International Ltd.*** Peregrine Road, Westhill Business Park, Westhill, Aberdeen, AB32 6JL, UK
Telephone	++44 (0)1224 744111
Fax	++44 (0)1224 741771
Email	support@tritech.co.uk
Web	www.tritech.co.uk

An out-of-hours emergency number is available by calling the above telephone number

If you have cause to use our Technical Support service, please ensure that you have the following details at hand **prior** to calling:

- iGC Assembly Part No. iGC Serial No.
- Operating mode settings (if known) Firmware version (if known)
- Fault Description
- Details of other equipment used in the iGC system (e.g. iFG, iIF etc.)
- Details of remedial action or faultfinding already implemented

It is worthwhile keeping a copy of this manual to hand, together with any system drawings showing how the iGC connects to your system prior to making a call to the help-line. This will ensure that we can diagnose the problem as quickly as possible.

1.2 Safety Notes

Danger!

4.2.1 General

The iGC may contain fluid or gas under pressure and electrical systems at potentially hazardous voltages.

All installation, operation, maintenance and repair works must be carried out by competent personnel.

The installation of the iGC and associated components is fully the responsibility of the user.

The iGC shall be installed, commissioned, operated and maintained in accordance with this instruction manual, including staying within the maximum operating conditions given in Appendix A - iGC Supply Specification. Failure to do so may lead to safety hazards or equipment failure.

Before starting installation, commissioning, operation or maintenance of the iGC, personnel should read and understand all relevant sections of this manual.

Any queries, comments or suggestions regarding the content of this manual or the safe installation, operation or maintenance of the iGC should be referred to Tritech.

Caution!

1.2.1 Pressure

If a seal has failed AND then acts as a one-way check during flooding, it is possible that pressurised fluid and gas has been trapped inside the iGC pressure vessel. This may be indicated by one or more of the following:

- The iGC has ceased to function after flooding;
- A water-ingress alarm has been generated;
- If the iGC is shaken fluid can be heard or felt moving around inside the housing;
- During removal, the pressure dome is very tight on its threads;
- During removal of the pressure dome there is fluid leakage at the joint.

The pressure housing has been designed so that the main seal will cease to function whilst there is still sufficient thread engagement to prevent the components from flying apart. The correct procedure for disassembly is given in Section 11 – Maintenance.

Caution!

1.2.2 Electrics

Any electrical supply or connection should be regarded as dangerous until proven otherwise by disconnection and isolation or by measurement. This applies as much to supply circuitry as to the equipment described in this manual.

Before doing any work inside the iGC the electrical power supply to the iGC should isolated and the power connector unplugged. This includes electrical faultfinding so as to avoid inadvertent contact between the pressure housing and exposed connections on any of the electrical components or circuit boards during removal / installation of the dome.

2.0 Introduction

2.1 Intelligent Gyro Compass (iGC):

The Tritech intelligent gyrocompass is the core component within an integrated and flexible family of products that provide the user with heading direction, attitude and motion data. This device finds numerous applications as a component in underwater navigation and positioning systems, ranging from ROV heading sensors, tooling skid positioning, heave compensation systems, construction projects, vessel navigation etc.

As standard the iGC is supplied in a 1-atmosphere pressure housing suitable for use down to 4000 metres depth, but is available in a 6000 metre version or in a ‘surface’ housing (i.e. suitable for use inside an existing pressure vessel or at the surface) as an option.

The iGC is based around a sophisticated set of sensors measuring acceleration, magnetic field and rate of turn on three orthogonal axes. Data from these sensors is processed internally using state of the art digital signal processing and advanced adaptive filtering techniques to give outputs of heading, pitch, roll and heave acceleration. Optionally, the unit can also provide surge and sway accelerations.

In order to find applications in a wide range of areas, the output data from the iGC is selectable by the user to match numerous industry standard formats. This allows the iGC to ‘emulate’ more expensive or existing heading sensors and therefore provide an easy upgrade or replacement path for customers looking for a more reliable or compact solution.

As standard, the iGC is supplied with a PC software application that gives a clear animated display of heading, pitch, roll, turns counter, heave acceleration and iGC status. This PC programme is normally used when the user does not have an effective heading display, for diagnostics / additional data control or in applications where an additional display is useful to complement the existing heading display system.

The iGC communicates with the ‘host’ system via a digital communication link, either using RS232, RS485 or ‘Arcnet’ protocols. The data rate and output telegram format are user selectable depending on the application. When in Arcnet mode, the iGC can co-exist with other Tritech sensors on an Arcnet network (e.g. sonars, profilers etc.).

Power to the iGC is nominally 24V dc at 250mA, but supply voltages in the range 12V to 26V are acceptable.

Since the iGC is based around magnetic North detecting sensors, it is sensitive to external magnetic fields that are not produced by the earth’s magnetic field. Such fields may vary in intensity and direction, and will affect the performance and accuracy of the iGC outputs to a greater or lesser extent, depending on their severity.

By careful positioning of the iGC on the host system, local ‘soft iron’ magnetic errors can normally be avoided, but external effects may produce undesirable results under certain circumstances.

There are several other members of the iGC product family that increase the functionality and application areas of the iGC.

These are described in more detail later in this manual and comprehensively in their own Operators Manuals, but comprise:

2.2 Intelligent Fibre-optic Gyro (iFG):

This is a solid-state single-axis fibre-optic gyro (FOG) sensor system that measures rate of turn to a high degree of accuracy, and with very low drift-rate. This sensor when coupled with an iGC provides a magnetic-north referenced fibre-optic stabilised gyro system with a drift rate of ~1º heading per hour. The combination of an iGC and iFG can be used to replace traditional spinning mass gyrocompasses with a more reliable solid-state solution with significantly better drift-rate performance. The effects of extraneous magnetic fields is also much reduced with the iGC / iFG combination.

2.3 Intelligent Interface PCB (iIF):

For systems where an RS232 or RS485 sensor output is not compatible with the existing heading sensor interface, Tritech have developed a number of interface PCBs that can be used to convert the digital telemetry signals from the iGC and iFG into a compatible format. These PCBs are installed in the host system in place of the existing heading sensor interface PCB, and emulate the original sensor outputs (e.g. synchro, analogue, digital etc.) but use the iGC / iFG as the data source.

These PCBs offer a simple ‘hardware’ upgrade to existing systems, without the requirement to rewrite control system software or redesign hardware. They also offer additional capabilities over existing systems, such as the ability to receive data from a North-seeking gyro and convert to the host format, output of pitch and roll signals in the host system’s correct format, automatic selection of the ‘best’ heading source and improved autoheading / turns counter interfaces.

At the time of writing this manual, the following iIF PCBs are available:

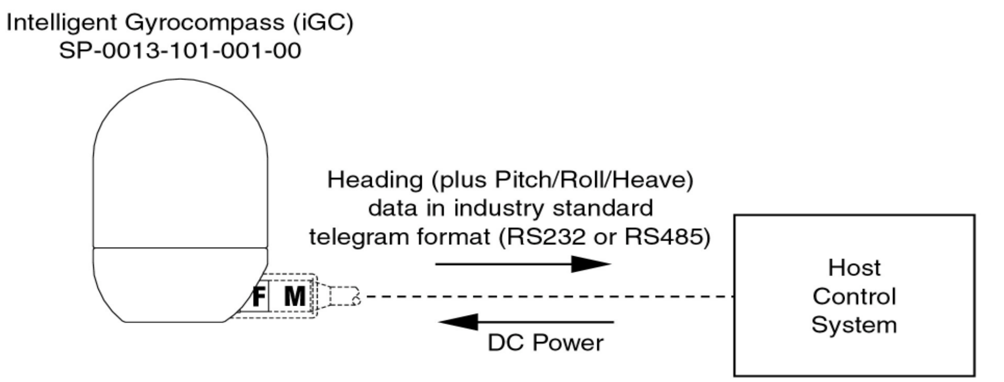
- Ametek Straza / Perry Tritech Scorpio ROV
- Perry Tritech Super Scorpio ROV
- Subsea 7 (Subsea Offshore) Pioneer ROV

Tritech are continually expanding the range of supported systems, so please contact Tritech if you have requirements that are not covered by the list above.

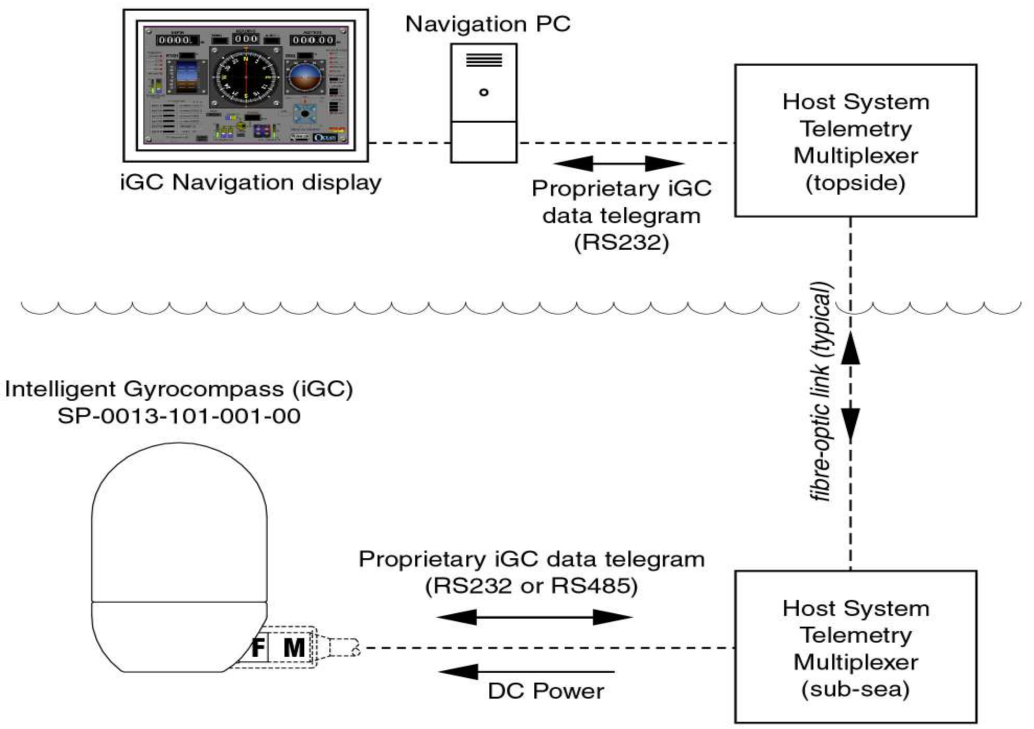
Refer to the ‘Typical Applications’ drawings below for details of some of the possible configurations that the iGC product family can be used in.

3.0 Typical Applications Drawings

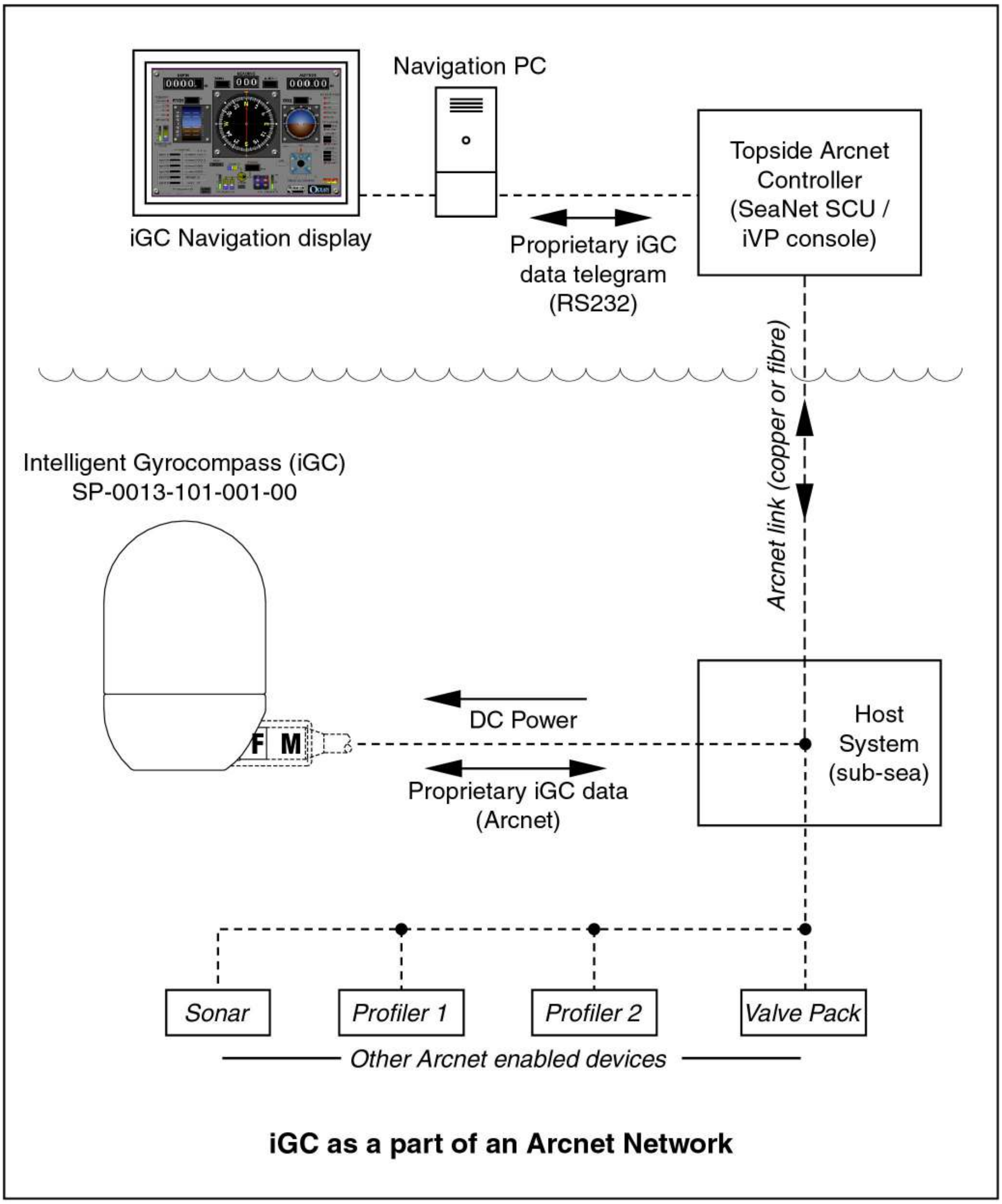
There are various methods of integrating the iGC with existing control systems, the following sketches showing typical applications:



Basic iGC emulation of Industry Standard Gyrocompass

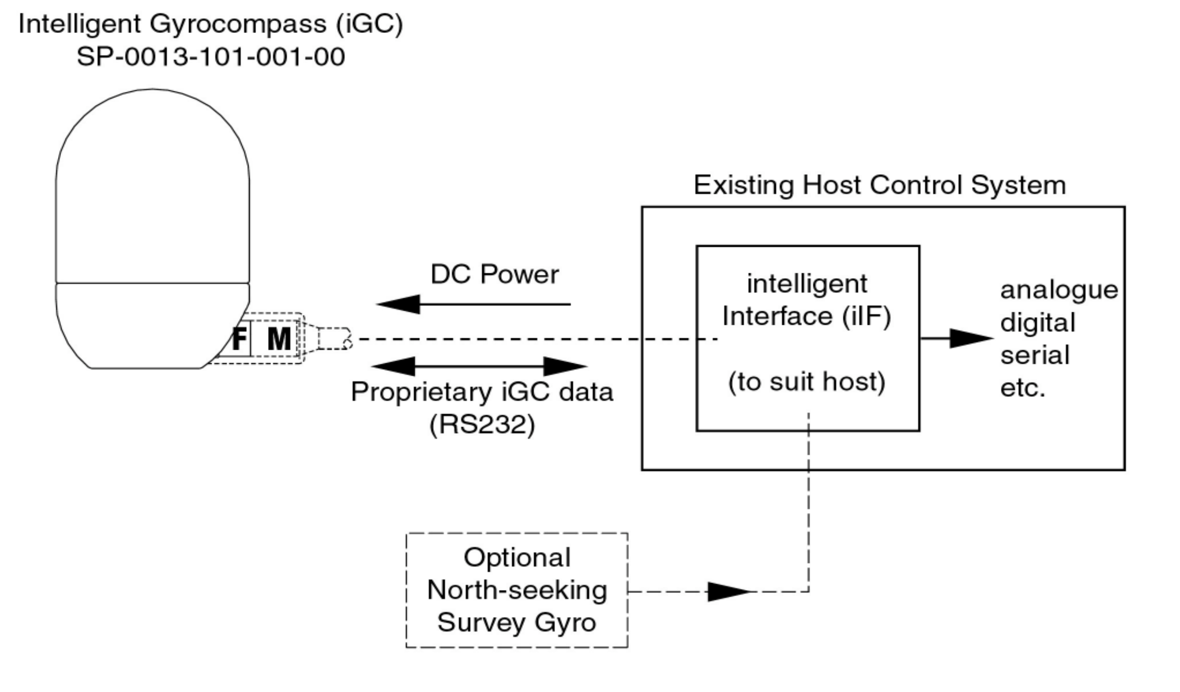


iGC with dedicated navigation display

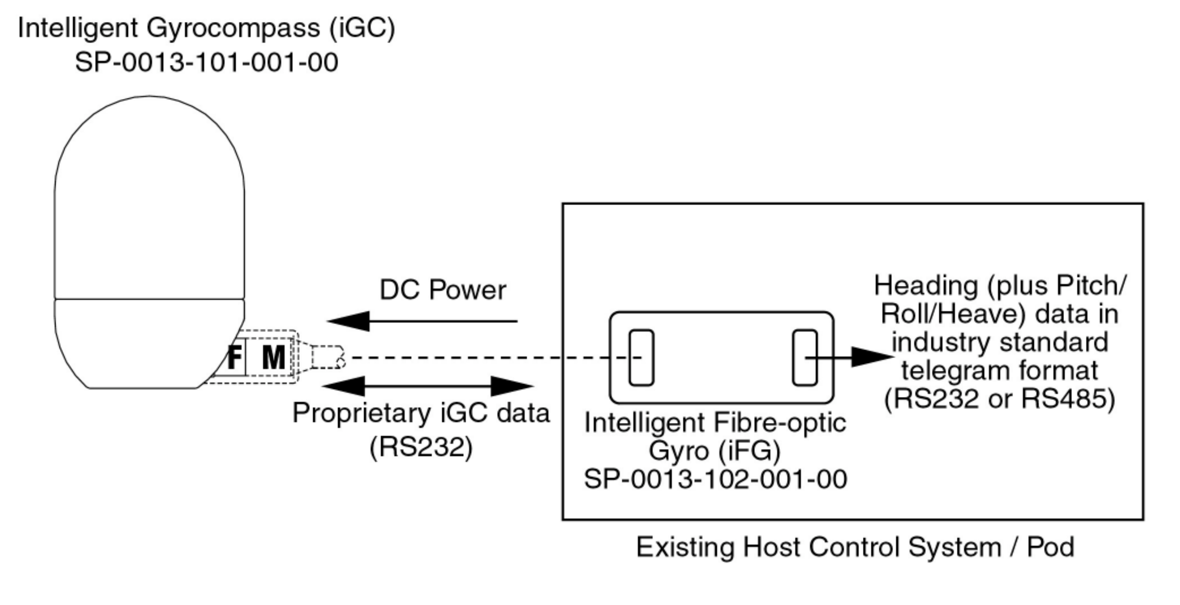


Arcnet applications offer significant advantages where there are a number of Tritech Arcnet-enabled devices on the host system, such as integrated data management and control, reduced telemetry path requirements, reliability etc.

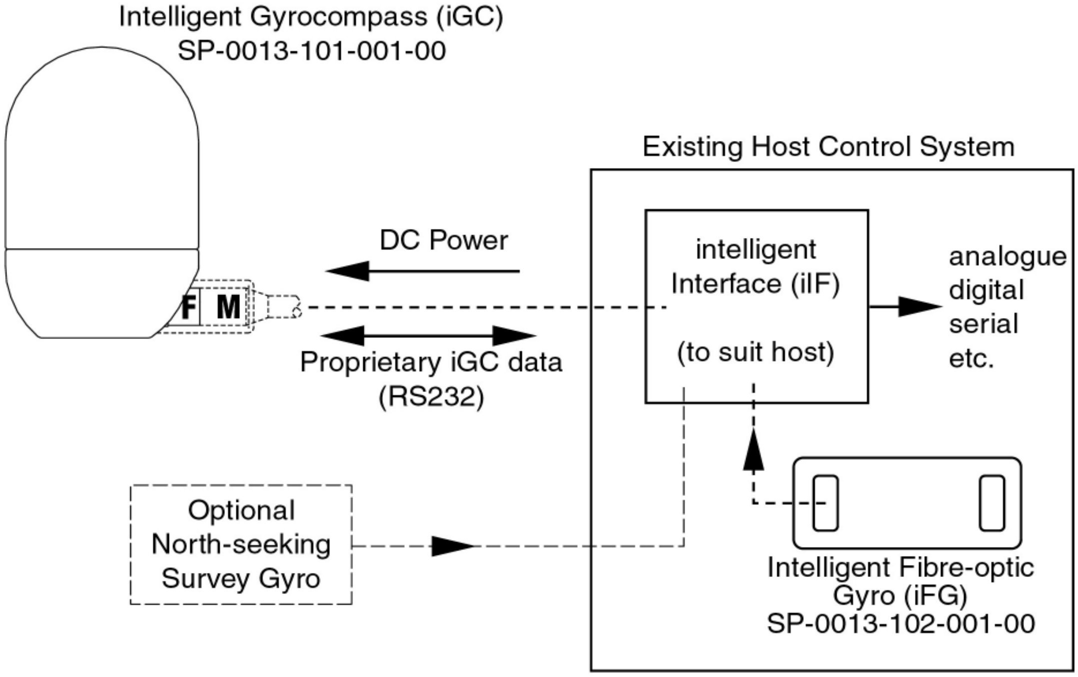
In applications where Arcnet is used, a separate RS232 Industry Standard iGC telegram can be selected to interface directly with the Host control system or navigation system. This is available either directly from the iGC or from the topside Arcnet controller.



iGC interfaced to existing Host using iIF PCB



iGC and iFG pair - with serial interface to Host control system



iGC and iFG interfaced to existing Host using iIF PCB

In addition to the sketches shown, there are numerous alternative options for interconnection of the iGC product family to existing or bespoke control systems.

If your desired application is not shown, please contact Tritech for advice on the best method of achieving the interface that you require.

4.0 Installation

4.1 Safety Note

Before commencing installation of the iGC:

- Refer to Section 4.2 - Safety Notes in this manual.
- All relevant parts of this section of the manual should be read and understood.

4.2 iGC Mechanical Installation

4.2.1 Introduction

When deciding where to mount the iGC, consideration should be given to:

- Its location relative to magnetically active materials on the host system;
- Alignment with the axes of the host system;
- Stiffness of the mounting arrangement;
- Collision protection.

4.2.2 Magnetic Disturbance

To reduce the effects of fixed magnetic disturbances on the iGC output, it should be mounted as far as is practically possible from the following:

- Ferrous or other magnetically active materials (including fasteners or brackets used to mount the iGC);
- Sources of electrically induced magnetic fields such as motors and transformers.
- Moving equipment (e.g. manipulator arms, pan & tilt units etc.).

The iGC is more susceptible to ferrous materials underneath the assembly than from the side or above.

4.2.3 Alignment

The electrical connector is mounted at the “rear” of the iGC. In addition, three meridian lines have been engraved into the body of the iGC. These show the forward, port and starboard directions of the iGC axes. (Refer to Section 7.3 Installation Drawing for details).

To maximise the accuracy of the iGC outputs, its pitch, roll and yaw axes should be aligned, as accurately as possible, with the pitch, roll and yaw axes of the host system / vehicle.

If necessary, small corrections can be made in accordance with the commissioning and calibration sections of this manual, provided that the existing host control system can provide this function, or the iGC is being used with the iGC PC software, iFG or iIF.

4.2.4 Stiffness

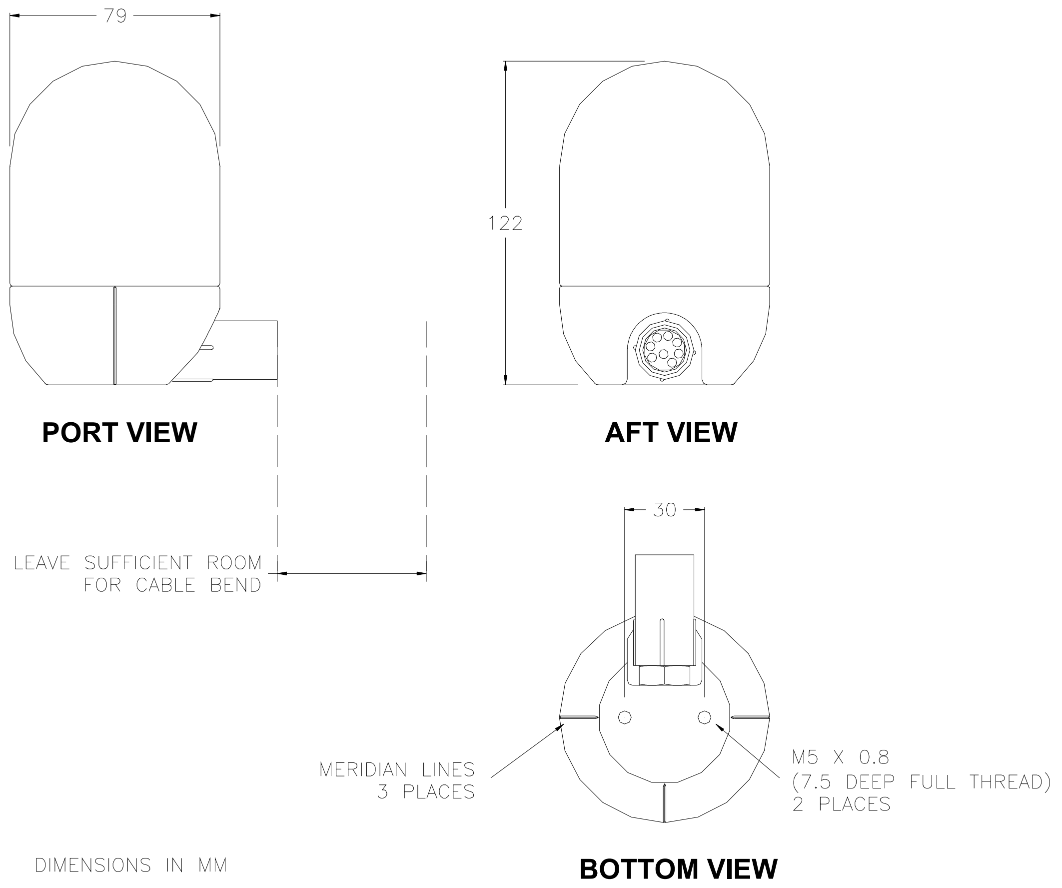
The iGC should be rigidly mounted so that flexibility and / or system vibration does not affect the outputs.

4.2.5 Collision Protection

To protect against accidental damage, the iGC should be mounted in a protected location. The protection around the iGC should not be manufactured form a ferrous material.

4.3 Installation Drawing

The following drawing shows installation dimensions and fastener details for the installation of the iGC:



NB: As stated previously non-magnetic fasteners and mounting bracket should be used for mounting the iGC.

4.4.1 iGC Electrical Installation

4.4.1 Preparation

All electrical connections to the iGC are via a single Subconn 8-pin micro series connector. This connector is a Male on the iGC (MCBH8MSS) and therefore a female is required on the interface cable (MCIL8F or equivalent).

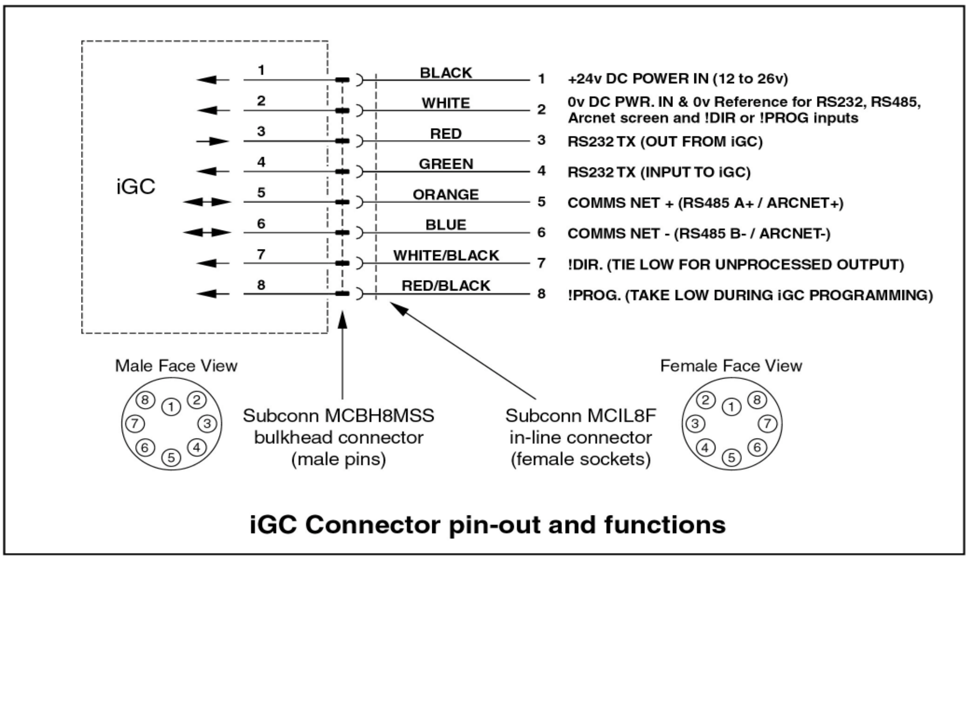
The connector should be made up in accordance with Subconn guidelines, as detailed below (taken from MacArtney Subconn standard literature):

- *The connector should not be exposed to long-term heat or sunshine. If this occurs, and the connectors are very dry, soak in fresh water before use.*
- *Ensure the connectors are lubricated - the recommended lubricant is Molykote 44 Medium -but use sparingly. Half a match head dose per contact is adequate.*
- *Any accumulation of sand or mud in the female contact should be removed with fresh water. Failure to do so could result in the splaying of the female contact and damage to the O-ring seals.*
- *Do not overtighten the bulkhead nuts.*
- *Do not disconnect by pulling on the cable and avoid sharp bends at cable entry.*
- *When using bulkhead connectors see that there are no angular loads as this destroys the connector.*
- *When disconnecting, pull straight, not at an angle. Ensure the above points are fulfilled to get the best out of your connectors. If in doubt, please contact your local distributor or MacArtney A/S for advice.*

The mated connector should be retained using the Delrin locking sleeve supplied with the iGC. This ensures that the connector does not become inadvertently partially or fully disconnected.

The iGC requires electric power at 24v DC nominal supply, operating current typically between 220mA and 250mA. The iGC will however function correctly at any voltage in the range 12v DC to 26v DC. The power supply should be from a regulated and smooth (low ripple) power supply for best results. An unregulated or un-smoothed supply should not be used.

The following drawing details the pin-outs of the iGC:



iGC Connector pin-out and functions

Prior to installation, a plan should be made of the interface method to be used for the iGC. Pease refer to Appendix D

If the operating mode that the iGC is to be used in differs from the mode settings as the unit was supplied (refer to Appendix A – iGC Supply Specification), the iGC will need to be opened and the Mode Switch settings adjusted. This is covered in section 7.4.2 below.

If the RS485 or Arcnet telemetry modes are to be used, check that the selector jumpers JP1, JP2 and JP3 are in their correct positions as the unit was supplied (refer to Appendix A – iGC Supply Specification). If not, the iGC will need to be opened and the Jumper settings adjusted as described in section 7.4.2 below. The correct settings are given in the following table:

Table 7.4.1 – Jumper settings

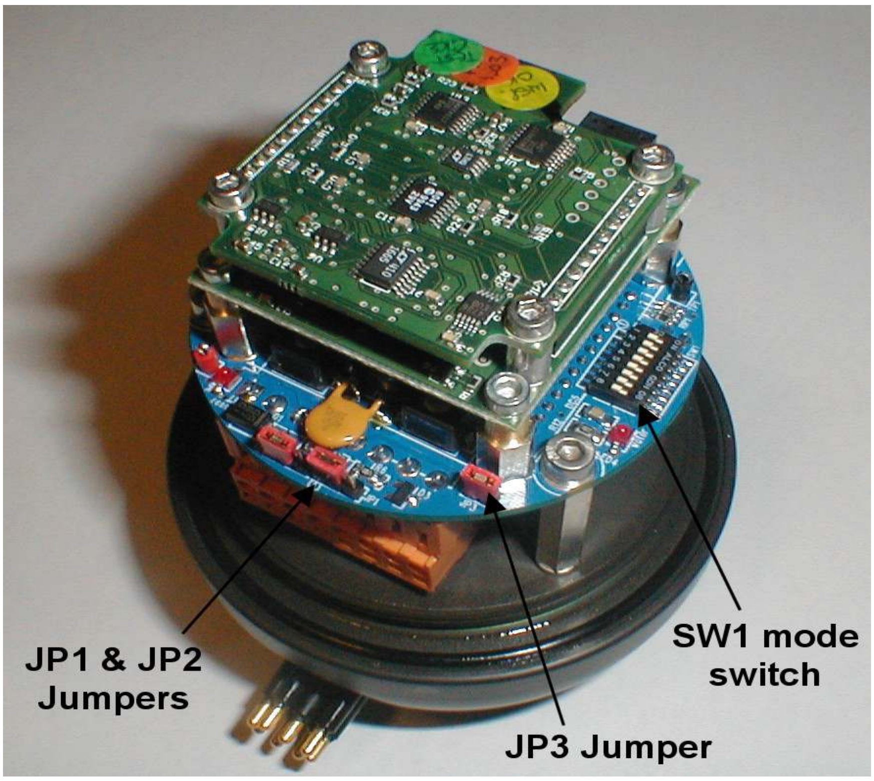
Mode	Jumper JP1	Jumper JP2	Jumper JP3
RS232 only	(don't care)	(don't care)	(don't care)
RS485 (end terminated)	Position 2-3	Position 2-3	IN
RS485 (unterminated)	Position 2-3	Position 2-3	OUT
Arcnet	Position 1-2	Position 1-2	(don't care)

4.4.2 Adjusting iGC Mode or Jumpers

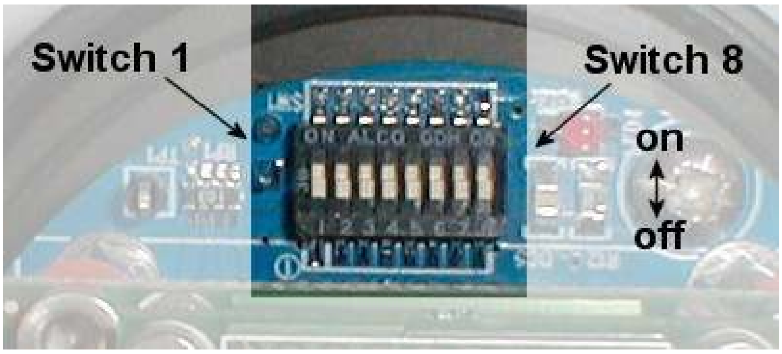
In order to adjust the Mode switch settings or the RS485 / Arcnet jumper links, the iGC must be opened. Firstly isolate the iGC supply and disconnect the iGC from its interconnecting cable (if already connected).

Follow the procedure for iGC Disassembly in section 8.7.1 below. This procedure exposes the internal iGC components.

Identify the Mode Selector switch (SW1) on the Interface PCB (Item 4 on the G.A.). Refer to the photograph below, and to the General Assembly drawing in Appendix A.



Set the DIL mode switch (SW1) to the desired setting (as determined above – and according to the switch settings from Appendices C and D). Operate the switches carefully with a sliding motion using a small jeweller's screwdriver or similar, ensuring that the switches are moved fully into the desired position.

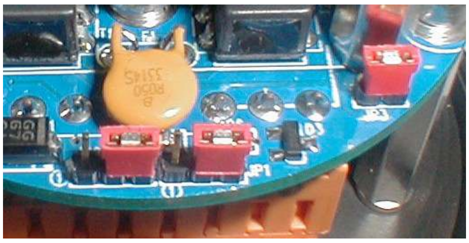


Once the DIL switch has been set, the RS485 jumpers should be checked / set according to Table 7.4.1 above.

The Jumpers are identified as small red shorting links (see photograph). The position to set the Jumpers can be seen from the photographs below:

Settings for Arcnet mode:

Settings for RS485 mode terminated with 120R:



Settings for RS485 mode un-terminated:

After setting the Mode Switch and Jumpers, the iGC can be re-assembled according to the procedure in Section 8.7.

4.5 Electrical Installation

The following procedure should be followed to complete the Electrical Installation of the iGC:

1. Make any necessary wiring and modifications to the Host control system to provide the appropriate power supply and telemetry circuits.
2. With the power to the Host control system isolated, attach the interconnecting cable to the appropriate underwater connector at the Host end.
3. Using a digital multimeter, insert probes into sockets 1 and 2 of the interconnecting cable (prior to connecting to the iGC).
4. Carefully power-up the Host supply (or the iGC supply circuit if switchable). Confirm that the output voltage is the correct value and polarity.

Caution!

Do not connect the cable to the iGC until provision of correct voltage to the correct pins on the iGC connector has been checked (see Section 5 - Commissioning).

Note:
The iGC input power connection is protected against reverse polarity supply connections. If power is inadvertently connected in reverse polarity, the iGC will not power up, but will not be damaged.

Caution!

Care should be taken when providing power to an iGC and iFG combined system. The iGC has a lower voltage range than the iFG.
Over voltaging the iGC will result in damage.

1. When the correct iGC supply voltage has been confirmed, isolate the iGC supply and check that there is no power present on the connector sockets (pins 1 & 2).
2. Connect the female Subconn connector to the iGC, following the Subconn instructions in Section 7.4.1 above.
3. Carefully power-up the Host supply (or the iGC circuit if switchable).
4. Check correct operation of the iGC according to Section 10 below.

5.0 Commissioning

5.1 General

Before starting commissioning of the iGC :

- Refer to the Section 4.2 - Safety Notes above.
- All relevant parts of this section of the manual should be read and understood.
- All electrical power and data connections must be complete and tested.

5.2 Overview

If the Electrical Installation procedures in Section 7.4 above have been followed correctly, the iGC should function correctly when it is powered-up for the first time.

On application of DC power, the iGC reads the Mode selector switch and calculates the required internal settings to match the required output format. Prior to entering the operational mode, the iGC transmits a configuration data packet from the RS232 port. This packet is sent at a data rate of 19,200 baud, N,8,1 and comprises a number of ASCII text messages about the iGC mode switch settings and its interpretation of these.

After 5 seconds, the iGC enters the actual output mode selected and begins to function according to the rules of the mode settings.

The reason for transmitting the configuration packet is that it allows users to check the correct operating mode and settings using a simple terminal programme (e.g. HyperTerminal) for faultfinding. Under most circumstances, the Host data interface should ignore or discard this data and begin responding to or processing the normal output telegram packets once they start. If the configuration packet causes problems for the Host interface software, it can be disabled as a factory or field-installable firmware option.

5.3 Powering up for the first time

With the host control system powered up and ready, apply power to the iGC. Check that the correct data appears 5 seconds or so after application of power. If the data is detected and appears to be correct, the iGC data check procedures in Section 8.7 below should be followed.

If no data appears, check that the iGC connections and interfaces are all correct. A very common commissioning problem that can occur with RS232, RS485 and Arcnet interfaces is that the TX and RX lines (for RS232), A+ and B- lines (for RS485) or Arcnet + and – lines are accidentally swapped the wrong-way around.

With these lines swapped, no damage should occur but the system will not function – it is therefore safe to try swapping the telemetry connections.

If problems persist, it may be necessary to examine the data signals with an oscilloscope or a breakout box with LED indicators.

If the iGC data is still not received correctly, the output and mode settings of the iGC should be checked with a terminal programme. This is described below.

5.4 Checking iGC output using a terminal programme

The output data from the iGC RS232 port should be connected to a PC or Laptop with an RS232 serial port using a suitable test cable.

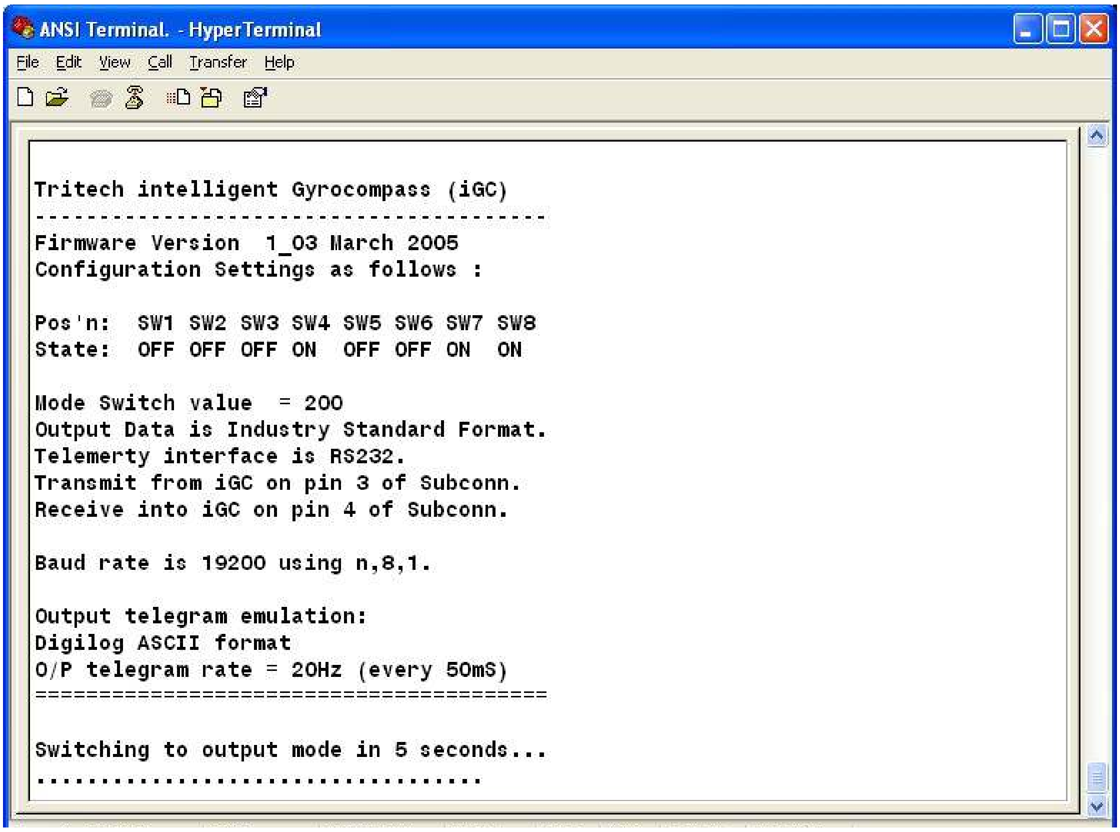
Details of a suitable cable are found in Appendix K – the programming switch connections are not required however for this test.

Boot the PC and run up a terminal emulator programme (e.g. HyperTerminal, Procomm, Telix etc.).

Select the correct COM port that the iGC is attached to in the terminal software. Note that PCs that are using a USB to Serial converter often assign a COM port above COM3. Check under Device Manager (or equivalent) to check if in doubt.

Set the terminal programme's port settings to 19,200 baud No parity, 8 data bits and 1 stop bit. Enable the terminal programme into 'connected state' if applicable.

Power up the iGC and observe the terminal output window. The configuration data message should be seen on the terminal screen – a typical output is shown below:



If the configuration screen is not seen, check the cabling and power supply to the iGC, check the terminal programme with a known good data source (or looped back from itself by connecting pins 2 & 3 of the PC com port and typing on the keyboard). Check that if using a programming cable that the programming switch is NOT in programming position.

Investigate the problem until a satisfactory configuration message is received.

In exceptional circumstances, it may be necessary to re-open the iGC and check status LEDs. Refer to the Section 12 – Faultfinding for details.

Once the configuration message is correctly received, it is likely that the 'live' iGC data will be received also (particularly if the output data is via the RS232 port on the iGC). For RS485 or Arcnet, there may be additional work required to commission the interface.

For RS232 output data from the iGC, check the output telegram from the iGC using the terminal programme. For ASCII protocols this is very easy – just select the correct baud-rate on the terminal software and power up the iGC. After 5 seconds, the data should appear on the terminal display.

Binary protocols (e.g. Proprietary iGC data or SKR80 data) are more difficult to confirm. There should however be some data received if the terminal is set at the correct baud-rate – although this data will not be easily decipherable. Note that SKR80 data only generates printable ASCII characters at certain heading angles – so rotating the iGC is sometimes required to see data on the terminal screen in this mode.

5.5 Checking iGC output on an RS485 interface

Checking the data from the iGC when connecting via the RS485 interface may require additional investigation. One method of checking the output is to use an RS485 to RS232 converter and read the data with the PC terminal. Alternatively, an oscilloscope may be required to check the state of the interface lines.

Some common RS485 problems and remedies are noted below:

- Data lines A+ and B- crossed – this generates inverted output data that the receiving UART interprets as multiple 'Break' signals. Swap the RS485 wires and check operation – alternatively use an oscilloscope to check signal voltages;

- RS485 bus not correctly terminated – there should be a 120 ohm resistor at each end of the RS485 bus, but no more than 2 on the bus at any one time. There is a jumper (JP3) o the iGC PCB that enables this terminator;

- Signal ground not connected correctly – The RS485 interface requires that the common-mode voltage between devices is in the range –7V to +12V typically. The 0V signal ground connection between the iGC and the Host MUST be connected for reliable performance;

- Additional 'alien' devices on the RS485 bus – if the iGC RS485 bus is connected other than 'point-to-point' from iGC to Host, the other devices on the bus should be approved Tritech devices, and configured to Tritech specifications. Do not connect non-Tritech devices to the iGC RS485 bus;

- Transmitter enabled on the receiving port – The iGC only enables its transmitter for just enough time to transmit the complete telegram. At other times the transmitter is disabled and the iGC is listening for received data. If the Host interface attempts to transmit during the iGC transmissions data will be lost. If the Host enables its transmitter continually (as is done with RS422 interfaces), no data will be seen from the iGC;

- Receiver not a 'failsafe' type and receives 'Breaks' when iGC is in Receive mode – this can occur particularly with older RS485 interface circuits. The receiver does not see an idle (i.e. nobody transmitting) RS485 pair as idle data – rather it interprets this as inverse polarity (serial 'Break' characters). This can be remedied by fitting two resistors to the RS485 signal lines – a 330ohm resistor between A+ and +5V, and a 180 Ohm resistor between B- and ground. This should be done at the Host end, as the iGC is a 'failsafe' receiver device and does not suffer from this problem.

If the RS485 interface still proves difficult to diagnose, please contact Tritech for assistance.

5.6 Checking iGC output on an Arcnet interface

Using Arcnet for integrating the iGC into existing Tritech sensor networks offers some significant advantages over multi-path data communications methods. It does however follow that the complexity of Arcnet based systems is greater than simple RS232 or RS485 point-to-point implementations.

Refer to the Arcnet settings descriptions in Appendix G or in Section 10 – Operation below for details of the type of data packets being transmitted over the Arcnet interface and the addressing modes used.

In almost all cases where Arcnet systems are implemented, Tritech will have been involved with the initial network design and set-up / testing. It is therefore recommended that where problems occur, Tritech help-desk be contacted in the first instance to assist with the problem diagnosis. It is also usual that specific procedures and documentation will exist for the Arcnet implementation. If this data is not to hand or cannot be found, Tritech should have a copy of the original system configuration notes, settings and drawings.

5.7 iGC data Check procedures

Once the 'live' iGC data is received correctly via the telemetry interface with the Host, the validity of this data should be checked.

5.7.1 Heading Checks

Heading data should be checked against a known good heading reference (e.g. surveyed Magnetic North reference line or a calibrated gyrocompass). If comparing the iGC heading against a True North seeking gyro (NSG), the appropriate corrections should be made to the NSG heading to convert it to a Magnetic North reference prior to checking the iGC.

When the North reference is confirmed, rotate the Host platform that the iGC is mounted to through 360º heading and check the correlation with the reference gyrocompass or against cardinal compass points.

If the data from the iGC is not satisfactory, following steps in Section 9 – Calibration below, may make improvements.

It should be noted that attempting to check magnetic heading performance on a Steel hulled / decked vessels or in close proximity to steel structures (e.g. bulwarks, handling system components etc.) may produce results that are not ideal.

5.7.2 Pitch & Roll Checks

The output of Pitch and Roll should be checked either with the Host system on a known horizontal flat surface or alternatively against a calibrated vertical reference unit. The iGC gives accurate Pitch and Roll data over the range +/- 50º and beyond. Pitch angles that approach 90º however cause instability with the heading output of the device. This is not a limitation with the iGC sensors, but with the mathematical angle conversions used in generating the output data. If users require pitch angles to be measured beyond +/-60º, please contact Tritech for an alternative firmware implementation that does not suffer from this problem.

Note that only certain Industry Standard telegram formats include the Pitch and Roll data, so if this data is not requested it cannot be checked.

5.7.3 Heave Acceleration Data Checks

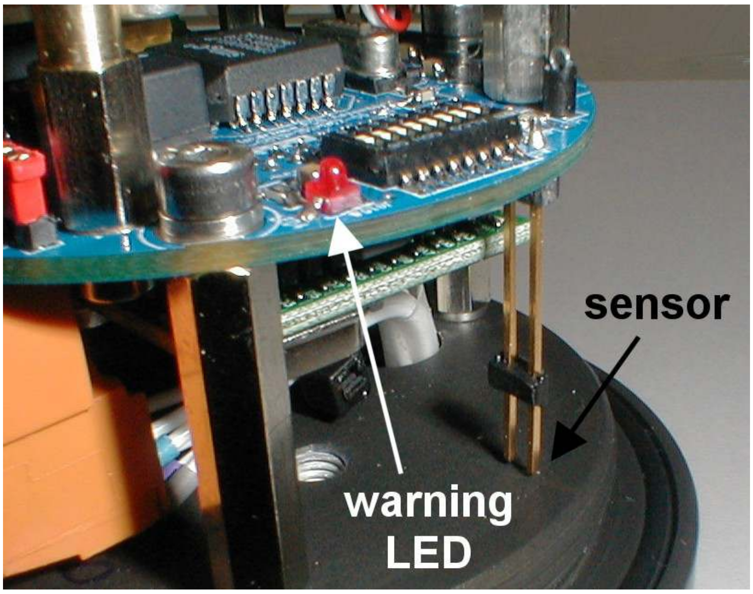
In certain modes, the iGC transmits the raw heave acceleration from its ‘z-axis’ accelerometer sensor. This can be used for heave compensation systems or for other navigation / survey purposes.

If the selected operating mode supports this output, check that with the system at rest the output is nominally 1.00g acceleration or -9.81 ms^{-2} depending on the selected telegram format. By moving the iGC up and down, a change to the heave acceleration should be seen. Note that certain telegram formats show the acceleration due to gravity, and others remove this offset prior to transmission.

Note that this output is referenced to the vertical iGC axis, not to ‘earth’ frame. It follows that the output at pitch and roll angles other than 0º will give a heave acceleration figure approximately equal to the measured Heave multiplied by the combined cosine of the pitch and roll angles.

5.7.4 Water Ingress Alarm Checks

Inside the iGC there is a water ingress detector, comprising two gold pins that extend from the interface PCB down to the lowest point inside the iGC housing. See photograph below for details:



Certain output formats support the transmission of a Water ingress alarm. If used in one of these modes, during checks the water ingress signal should be ‘Dry’. If not, the reasons for this should be investigated before operating the system underwater.

When the interface PCB detects a water ingress condition, the Red LED (shown in the photograph) illuminates. The water ingress sensor function can be checked by placing a wet finger (or a resistance less than 300kohm) across the sensor pins.

5.7.5 Other Data Checks

In iGC Proprietary data formats, additional data such as iGC temperature, serial number etc. are available. These can be checked using the iGC Navigation Software.

6.0 Calibration

6.1 Introduction

If the iGC has been mounted to align closely with the host system's axes and away from the magnetic influence of other equipment, it is expected that, in the majority of cases, no further calibration will be required.

If the full accuracy of the iGC is needed then the system can be calibrated and the necessary offsets applied.

Note:
For this to be achieved, additional measuring equipment for heading, pitch and roll will be required. This equipment should have greater accuracy and resolution than the values that are to be calibrated.

6.2 Physical Offsets

If the iGC has been mounted with reasonable care and with normal manufacturing tolerances, it is expected that in the majority of cases no further calibration will be required.

If the full accuracy of the iGC is needed then the system can be calibrated and offsets applied either mechanically or by using the Host system's control software or the iGC Navigation software (whichever is being used).

To calibrate the iGC mechanically its mounting bracket should be designed to incorporate vernier adjustment on the axes to be calibrated.

With the vehicle's pitch, roll and heading measured or set to known values (e.g. 0º pitch and roll and known magnetic heading), the mounting bracket is adjusted until the iGC outputs match the measured reference values.

Where the Host system's own software is used to process and display the iGC data, fixed offsets to heading, pitch and roll data can be applied within this software (if this facility is catered for in the software application).

Where the supplied iGC Navigation software is used, heading, pitch and roll offsets can be easily applied from the system set-up screen. These offsets are added in the PC software only, and will adjust the live data as it is displayed. They do not adjust the actual output data from the iGC.

6.3 Magnetic Offsets

Magnetically generated offsets that remain after mounting the iGC as far away from magnetic influences as possible can in certain cases be calibrated out by conducting a compass swing calibration procedure.

7.0 Operation

7.1 Introduction

Operation of the iGC depends mainly on its application, but in general the iGC transmits the requested output data in the desired format, commencing this transmission immediately after power-up and continually until the unit is switched off.

Making the best use of the output data is the user's responsibility, but Tritech can offer valuable assistance to ensure that the performance of the sensor is maximised.

7.2 Data Output Formats

7.2.1 Proprietary Outputs

Proprietary operating modes are selected by setting the mode switch position SW8 to the OFF position.

The proprietary modes are mainly used in applications where the iGC is interfaced with other Tritech iGC product family devices or directly to the iGC Navigation software.

There is also a fixed-length ASCII output proprietary mode that provides additional iGC data to 'Industry Standard' ASCII formats. This mode is useful where specific telegram decoding / parsing can be implemented by the Host system.

Full details of the output data formats in Proprietary modes can be found in Appendix G.

7.2.2 Industry Standard Outputs

The iGC emulates a large number of commonly used heading sensors. In the Industry Standard emulation modes, data telegrams are transmitted at data rates and in formats that match the original heading sensors they are emulating.

Emulated modes are selected by setting the mode switch position SW8 into the ON position.

Full details of the output data formats in Proprietary modes can be found in Appendix H.

7.2.3 Special Modes

For special applications, a non-standard data telegram may be required to interface with existing equipment or software. Normally data in a non-standard format can be implemented for no additional cost – if requested at the time of purchase of the iGC. If requested after delivery, a nominal charge may be made for providing updated firmware to support the required output.

7.3 Operational Issues

During operations, the iGC may be used in areas where external magnetic influences cause a deviation to the heading output data. Under these conditions, the data should be used with caution.

If problems from magnetic influences are regularly encountered, the addition of an iFG to the heading sensor system will provide significant improvements.

If the iGC is used in applications where the pitch angle goes beyond around 70º from vertical, the standard mathematical data processing methods will cause anomalies with the heading data until 90º is reached, at which point the heading data will be unstable. If this type of use is expected, please contact Tritech and the firmware conversion routines can be changed to support correct operation over the full 360º pitch range.

7.4 Using iGC Navigation Software

The iGC PC software is a stand-alone application that provides the user with a real-time display of Heading, Pitch, Roll, turns counter, heave and iGC status. Normally this software is used where the iGC is not integrated to a complete host control system, but it can be used in parallel with an existing host control system, providing certain interface criteria are met.

The software operates under the Windows® operating system, and provides a clear graphical display of iGC data. There are various options selectable by the User in the software that allows integration with different iGC configurations. It is also a useful tool for faultfinding, commissioning and setting up iGC applications.

The minimum requirements of the host PC are as follows:

- 1GHz Pentium 3 or 4 (or AMD equivalent);
- Windows 98, Windows NT, Windows 2000 or Windows XP;
- 256MB RAM;
- 200MB Free disk space;
- 1 x RS232 serial port (or USB port for USB to RS232 converter);
- 1024 x 768 display;
- CD ROM drive.

The Navigation Display presents the following information:

Display Item	Description
Analogue Heading	Animated rotating compass card – this shows instantaneous output of the active heading sensor output.
Digital Heading	Numeric display of the active heading sensor output to 1 decimal place.
Digital Reciprocal	Numeric display of the active heading sensor reciprocal heading output to 1 decimal place.
Analogue Pitch	Animated artificial horizon display of iGC pitch sensor. +/- 30º range.
Digital Pitch	Numeric display of the iGC pitch sensor output to 1 decimal place. +/-90º range.
Analogue Roll	Animated artificial horizon display of iGC pitch sensor. +/- 90º range.
Digital Roll	Numeric display of the iGC roll sensor output to 1 decimal place. +/-90º range.
Analogue Heave	Animated heave acceleration sensor display. +30 to –40 ms^{-2} range.
Digital Heave	Digital heave acceleration sensor display to 1 decimal place. +/- 99ms^{-2} range.
Turns Counter	Digital display of number of turns made by iGC system since power-up or last reset. Range +/- 9.9 turns to 1 decimal place.
IGC Temperature	Digital display of iGC internal temperature. –9.9ºC to +70ºC range to 1 decimal place.
System Time	Digital display of PC system time in format hh:mm:ss

Display Item	Description
Telemetry status	LED indicator showing telemetry status of iGC, iFG, iIF, North-Seeking Gyro (survey gyro / NSG) and Seanet SCU. LED colours as follows: Red = comms failed / absent. Green = comms good. Grey = no comms expected (not enabled). Yellow = comms failed / absent.
Sensor status box	Text description of each sensor's status.
Heading source	Indicators to show the source of the current displayed heading. This can be one of the following: *iGC* This is the iGC heading output alone. *IFG relative* This is the iFG relative heading output prior to a valid iGC heading having been received. *IFG unslaved* This is the iFG heading after having been slaved to the iGC, but the iGC data stream has been lost (or the slaving function has been switched off). *IFG/iGC slaved* This is the ideal output mode where the iFG is providing stabilised heading output with magnetic slaved corrections from the iGC. *Survey Gyro* Where a survey gyro or North-seeking Gyro is used with the system, this shows when the NSG is providing the active displayed heading data.
System Alarm	Illuminates Red when any system alarm is detected (e.g. telemetry failure, water ingress etc.).
Turns counter 'Reset' button	Resets the turns counter to 0.0 turns.
'Setup' button	Accesses the set-up and configuration screen(s).
'Exit' button	Quits the application.

Typical screenshot:

8.0 Maintenance

8.1 Safety

Before starting any maintenance of the iGC:

- Refer to the Section 4.2 - Safety Notes at the beginning of this manual.
- All relevant parts of this section of the manual should be read and understood.

8.2 General

The iGC is designed for low maintenance operation using corrosion resistant materials, and generally speaking does not require any preventative maintenance.

In addition there are no user serviceable parts inside the iGC.

8.3 Seals

Seal integrity is vital for the continued reliability of the iGC. There are two 'O'-ring seals in the assembly – one between the dome and end-cap and the other between the Subconn connector and end-cap. The following should be noted:

- Any time that a seal is disturbed, before replacement in the iGC it should be thoroughly cleaned and inspected for damage.
- The seal housing should be thoroughly cleaned and inspected for damage.
- Any damaged seals or components with damaged sealing faces should be replaced with new components.
- All replacement seals should be correctly specified as per the iGC parts lists.
- Never use 'O'-rings made up by gluing cord to the correct length.
- When replacing an 'O'-ring, use an approved 'O'-ring grease (such as Dow Corning 111 silicone compound) sparingly and make sure that all surfaces are kept clean during the process of replacement.
- The 'O'-rings fitted to the iGC have a recommended service life of seven years.
- Spare 'O'-rings should be stored in suitable UV light proof bags or containers.

8.4 Basic Maintenance Procedures

8.4.1 Pre and Post-dive Checks:

1. Check that the interconnecting cable is secure and undamaged.
2. Check that the mountings are secure.
3. Visually check the iGC for external damage to the anodised surfaces.
4. Function check the system as appropriate.

8.4.2 Storage

If the iGC is taken out of service, the connector should be cleaned and blanked off and the unit thoroughly washed with fresh water.

Repair any damage to the anodised surfaces of the iGC as per the procedure in Section 11.5.

8.5 Procedure For Repair Of Anodised Surfaces

Every effort should be made to preserve the integrity of the anodised surface on the iGC. If the anodised layer is broken, the following procedure should be followed in order to minimise damage to the affected component:

1. Mechanically remove all visible corrosion products to get a clean metal surface.
2. Clean the affected area.
3. Apply an etch primer to the affected area, following the manufacturer's instructions.
4. Apply a suitable paint coating(s) to the etch primer, following the manufacturer's instructions.

Note: If the damaged area extends to and over a sealing surface the component should be replaced.

8.6 Flooding

If the iGC is flooded for any reason, then speed is of the essence. If the system software / interface supports the water ingress sensor signal, the iGC should be powered down immediately that the sensor detects water ingress.

After ensuring that pressure is not trapped inside the pressure vessel (see disassembly procedure), the iGC should be opened and inspected. If the unit has suffered a significant leak and the PCBs have become contaminated with seawater, the entire assembly should be washed in clean fresh water, preferably by immersion. After washing, excess water should be removed carefully by blowing clean with an airline, and the assembly should be sprayed with a water displacing fluid (e.g. WD40) and excess blown off again.

After serious flooding it is recommended that the iGC returned to Tritech for repair.

If however the leakage into the iGC is only very minor and the PCBs have not become contaminated, it may be possible to clean the internals without immersing in fresh-water. Under these circumstances, the seawater should be dried off and a de-watering fluid (e.g. WD40) used to displace any traces of water. It is recommended that the Subconn connector be removed and the 'O'-ring replaced after flooding, and at this time any traces of seawater that bay have entered the connector wire gallery should be removed.

In all cases it is recommended that the unit be returned to Tritech for repair / test and pressure testing prior to returning to service.

8.7 Dismantling and Re-assembly

Before starting to dismantle the iGC:

1. Refer to Section 4.2 - Safety Notes at the beginning of this manual.
2. All relevant parts of this section of the manual should be read and understood.
3. Refer to the Appendices for details of exploded views and identification of components.
4. Ensure that power to the iGC has been turned off, the connector disconnected and the iGC removed to a suitable workshop environment. Opening the iGC

The main components inside the iGC include:

1. Sensor Assembly (Item 3), which consists of the top two boards;
2. Interface PCB Assembly (Item 4) – the blue circular PCB;
3. Processor module (Item 24) – the small PCB underneath the interface PCB.
4. Underwater connector tails and orange interface connector (Item 11).

The Sensor Assembly, Interface PCB and Processor module should be regarded as a single replaceable unit.

8.7.1 Removal Of pressure Dome

The procedure for removal of the dome is as follows:

1. Thoroughly clean and de-grease the outside of the iGC.

2. Unscrew the dome (Item 1) from the end cap (Item 2). Normally this can be done by hand with the assistance of clean rubber gloves (or rubber sheet) to improve grip on the smooth anodised surface. If additional torque is required a pair of strap wrenches can be used, or fasteners can be inserted into the end cap to allow it to be held in a vice and a strap wrench then used to unscrew the dome.

In all cases care must be taken to avoid damaging the anodising.

8.7.2 Removal Of Sensor Assembly, Interface PCB and Processor Module

The procedure for removal of the Sensor Assembly, Interface PCB and Processor Module (as a single unit) is as follows:

1. Remove the dome (Item 1).

2. Unscrew the two cross head screws (Item 16) that attach the two regulators to the heatsink block projecting from the end cap base. Remove the washers (Item 13), small plastic insulating bushes (Item17) and the flat insulating washer (Item18) and store carefully.

3. Unscrew the three M3 socket head cap screws (Item 12) that attach the Interface PCB (Item 4) to the three hexagonal spacers (Item 10).

4. Raise the stack of PCBs together and remove the cable end plug (Item 11) from the orange connector on the Interface PCB.

8.7.3 Removal Of the Underwater Connector

The procedure for removal of the underwater Subconn connector is as follows:

1. Remove the Sensor Assembly, Interface PCB and Processor Module.
2. Using a 2.5mm flat-blade screwdriver, remove the connector wires from the plug (Item 11).
3. Using a box spanner or a deep socket (19mm A/F), slacken the connector. Holding the iGC end-cap (Item 2) in a vice by means of two M5 screws in the mounting holes is the easiest way to react the torque required to slacken the connector.
4. Remove the cable tie from the connector tails. Carefully unscrew the connector and at the same time, turn the connector wire tails inside the wire gallery. When fully slackened, carefully feed the wires through the gallery and pull the connector clear. It may be necessary to remove the bootlace ferrules, or alternatively pull the wires through in stages.

8.7.4 Replacement Of the Underwater Connector

The procedure for replacing the underwater Subconn connector is as follows:

1. If a new connector is to be used, attach heat-shrinkable wire numbers (1-8) to the wire tails and cut tails to the same length as the removed connector.
2. Fit a 30mm length of 4.8mm diameter heatshrink over the connector wire tails. This is used to protect the wire tails from abrasion when the connector is screwed into the end-cap.
3. Remove, clean, re-grease and re-fit the connector sealing ‘O’-ring. Ensure that the ‘O’-ring groove is clean.
4. Insert the wires into the connector hole and carefully screw the connector into the end-cap while turning the wires to avoid twisting them.
5. When fully home, re-torque the connector with a 19mm A/F box-spanner or deep socket.
6. If previously removed or a new connector is being installed, strip wires and fit new bootlace ferrules to the connector tails. Crimp in place.
7. Insert the wires into the 8-way orange connector (Item 11) and tighten with a 2.5mm flat-blade screwdriver. Wires are connected in sequence from pin 1 to 8 of the PCB connector attached to pins 1-8 of the Subconn. Pin 1 of the PCB connector is identified by the square pad on the topside of the PCB (it is at the end closest to the regulators).

8.7.5 Replacement Of Sensor Assembly, I/F PCB and Processor Module

The procedure for replacement of the Sensor Assembly, Interface PCB and Processor Module (as a single unit) is as follows:

1. Insert the PCB stack between the pillars and secure with the 3 x M3 cap screws to the pillars. Engage the 8-way orange connector when lowering the PCBs into position.

2. Slide the insulating washer (Item 18) between the mounting block on the end-cap and the two regulators. Position this washer so that the holes align with the regulator holes and tapped holes in the end-cap.

3. Fit the small black plastic insulating bushes (Item 17) into the regulator tabs. Screw in the 2 x M3 screws and washers (Items 16 & 13). Do not overtighten.

4. Check tightness of the 3 x M3 Interface PCB retaining screws.

5. Using a multimeter, check that there is no electrical continuity between the tab of both regulators and the iGC end-cap. There is a threaded hole on the inside surface of the end-cap that facilitates electrical continuity for checking. This is important, as a short-circuit between the regulator tabs and the iGC housing may cause rapid corrosion of the iGC housing. If continuity is measured, check the positioning of the insulating washer and bushes.

6. Refit dome and function-check.

9.0 Basic Fault Finding

9.1 General

This section is intended to help with fault finding down to easily replaceable components (i.e. to PCB assembly level).

The following are guidelines on how to approach the diagnosis of a fault in the system:

1. Assemble all relevant information on the iGC and any other systems that interface with the iGC. This might include:
    a. Manuals.
    b. System drawings (particularly electrical diagrams).

2. Have a good set of diagnostic tools.

3. Start at the general & work towards the particular.

4. Use all the information available. For example:
    a. Are any other systems malfunctioning?
    b. Are all functions malfunctioning or just one or a few?
    c. Are there connections between these faults?

9.2 Fault Symptoms

The following table gives a list of fault symptoms with components to check in order to narrow down the cause of the likely fault. This should act as a pointer towards which items should be replaced.

Symptom	Suggested Action
No output data from iGC.	Check that power is applied. Under normal conditions, the iGC feels warm to the touch when switched ON – this can be used as a quick check that power is present.
No power present on pins 1 & 2 of the interconnecting cable.	Check that the supply is switched on. Check status of fuses, or output from power supply. Check continuity of interconnecting cable.
No output data from iGC, but power is present at the interface connector.	Check interconnecting cable. Remove cable and check continuity of wiring and insulation value. More than 50% of underwater system faults are attributable to cables and connectors.
No output data from iGC received by host, but cable checks OK.	Attach a test-cable, Laptop and power supply to the iGC and check correct operation. If data is OK from iGC, investigate the host system telemetry interfaces. If no data from iGC, see below:
No output data from iGC when tested with test cable and laptop.	Use a terminal programme set to 19,200 n, 8, 1 and check for configuration output message when the iGC is powered up. Refer to Section 10 – Commissioning for details of what to expect. If configuration data looks OK, check host interface for correct operation / function.

Symptom	Suggested Action
No configuration output data from iGC ant 19k2 on start-up.	Check that Laptop is set to the correct COM port and that the terminal emulator is working OK (do a loopback test by shorting pins 2 & 3 of COM port connector on laptop).
No configuration output data from iGC, Laptop checked OK	Open up iGC and check for damage / water ingress and status LED function. When switched on, the green power LED should be illuminated. The green status LED should flicker as data is transmitted, the red Reset LED should flash once when power is first applied, then go dark.

9.3 Firmware Reprogramming

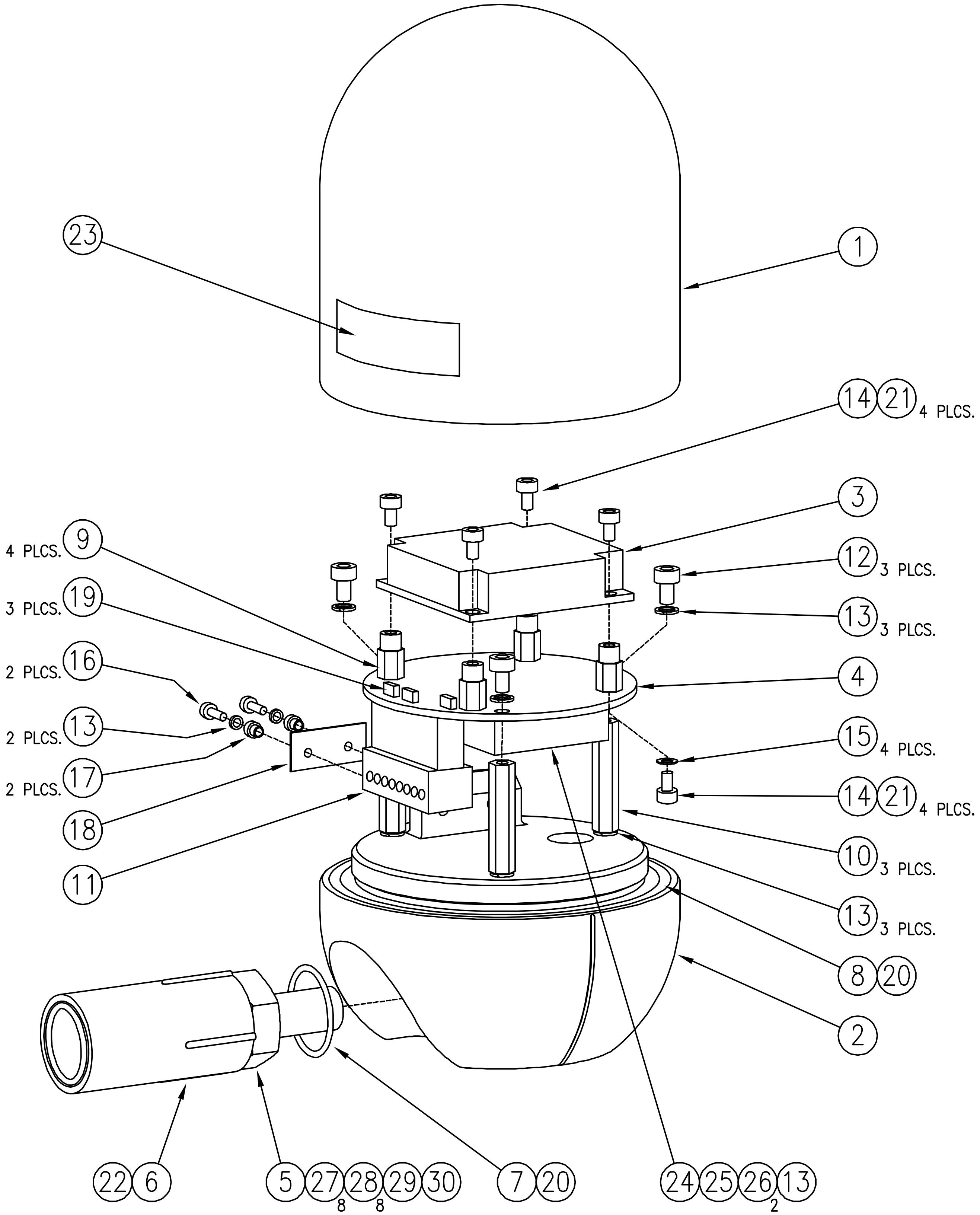
Occasionally, there may be a requirement to upgrade the embedded firmware inside the iGC. This upgrade may be to update the system to a more recent version that may include additional features, or may be to load a custom firmware version for a specific task.

Programming is performed simply by using the Programming & Test cable and a laptop or desktop PC. Refer to Appendix K for details of the programming cable.

The replacement firmware will be provided by Tritech, together with the required PC utility programme that is used to transfer the replacement firmware from the PC to the iGC. Full instructions are always supplied with the firmware files, but the following is an outline of the procedure to be followed:

1. Connect up the iGC to the laptop or PC COM port using the Programming cable.
2. Connect a 12-24V DC power supply to the iGC.
3. Ensure that the ‘Direct’ switch is OFF.
4. Switch ON the Programming switch.
5. Run up the programming utility on the laptop or PC.
6. Apply power to the iGC.
7. Transfer the new / replacement .bin file to the iGC using the programming software.
8. Monitor programming progress / status.
9. Once complete, power down the iGC and return the Programming switch to OFF.
10. Power up the iGC and test the revised firmware using a terminal programme, host system or the iGC Navigation Display software.

Appendices



Tritech	iGC – General Assembly	SP–0013–101–001–00 Rev. A

Tritech Intelligent Gyrocompass (iGC)

Bill of Materials (refer to iGC General Assembly drawing SP-0013-101-001-00 Rev. A)

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Item	Qty	Description	Part No.
1	1	Dome	SP-0013-101-001-01
2	1	End Cap	SP-0013-101-001-02
3	1	Sensor Assembly	SP-0013-101-003-00
4	1	iGC Interface PCB Assembly	SP-0013-101-002-00
5	1	Subconn 8-way micro bulkhead male connector (SS)	T-MCBH8MSS
6	1	Subconn Locking Sleeve	T-MCDLSF
7	1	Subconn connector 'O'-ring	TI-BS014N170
8	1	O'-Ring	TI-BS039N170
9	4	M2.5 mounting pillar	SP-0013-101-002-01
10	3	M3 mounting pillar	SP-0013-101-002-02
11	1	8-way screw terminal connector	*SP-0013-101-001-00-11*
12	3	M3 x 6mm lg. Skt. head cap screw - st.stl.	*SP-0013-101-001-00-12*
13	9	M3 spring washer - st.stl.	*SP-0013-101-001-00-13*
14	8	M2.5 x 6mm lg. Skt. head cap screw	*SP-0013-101-001-00-14*
15	4	M2.5 plain washer	*SP-0013-101-001-00-15*
16	2	M3 x 10mm lg. Pan head pozi m/c screw - st. stl.	*SP-0013-101-001-00-16*
17	2	TO-220 insilating bush	SP-0013-101-001-03
18	1	Insulating washer	SP-0013-101-001-04
19	3	2mm Jumper Link (red)	*SP-0013-101-001-00-19*
20	-	Silicone grease	111
21	-	Thread locking compound	222
22	1	Subconn Locking Sleeve circlip	*SP-0013-101-001-00-22*
23	1	Identification / Serial No. Label	SP-0013-101-001-05
24	1	Processor module	SP-0013-101-001-06
25	1	M3 x 6mm lg. Pan head pozi m/c screw - st. stl.	*SP-0013-101-001-00-25*
26	2	M3 red fibre washer	*SP-0013-101-001-00-26*
27	8	Heat-shrinkable wire ident markers	*SP-0013-101-001-00-27*
28	8	Bootlace ferrule 0.34mmsq	*SP-0013-101-001-00-28*
29	1	30mm length 4.8mm clear heatshrink	*SP-0013-101-001-00-29*
30	1	100mm lg. Cable tie	*SP-0013-101-001-00-30*

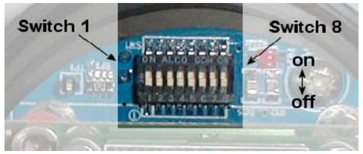
Notes:

1. Spares are available from Tritech by quoting BOM and item number.
2. Refer to Recommended Spares List for cross-reference.
3. To maintain warranty and get the best performance from the iGC, only use genuine spare parts.

iGC Mode Listing (SW8 OFF = Proprietary iGC Outputs)

- Baudrate selection [off][off]=19200, [on][off]=9600, [off][on]=4800, [on][on] = 38,400 (SW 1–2)
- Hardware Protocol [off][off] = RS232, [on][off] = RS485, [off][on] = Arcnet, [on][on] = Arcnet & RS232 (SW 3–4)
- Proprietary Mode (8 possible selections) (SW 5–7)
- Protocol type - [off] = iGC Proprietary, [on] = Industry Standard (SW 8)

Telegram Code	Mode code	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8	Telegram Description	Protocol	Baudrate	Parameters	rate (Hz)	Notes	Implemented at firmware version
	0	off	off	off	off	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	RS232	19200	n, 8, 1	20	Standard binary output packet in iGC Proprietary format - streamed ouput	
	1	on	off	off	off	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	RS232	9600	n, 8, 1	20	Contents:	
	2	off	on	off	off	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	RS232	4800	n, 8, 1	20	Heading, Pitch, Roll, Heave acceleration, CRC.	
	3	on	on	off	off	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	RS232	38400	n, 8, 1	20		
	4	off	off	on	off	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	RS485	19200	n, 8, 1	20	Will accept command requests and poll commands for extended packets	
	5	on	off	on	off	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	RS485	9600	n, 8, 1	20		
	6	off	on	on	off	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	RS485	4800	n, 8, 1	20		
0	*7*	on	on	on	off	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	RS485	38400	n, 8, 1	20		***1.03***
	8	off	off	off	on	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	Arcnet	156.25k	Broadcast	20	iGC Arcnet adderss is always 0x78 or 120 decmal. For baudrate - see table.	***& later***
	9	on	off	off	on	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	Arcnet	156.25k	tx to NID 0x64	20	Broadcast Arcnet transmits packet to all listening nodes.	
	10	off	on	off	on	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	Arcnet	156.25k	tx to NID 0x6e	20	Transmit to NID 0x64 transmits to iVP node only.	
	11	on	on	off	on	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	Arcnet	78.125	Broadcast	20	Transmit to NID 0x6e transmits to iPP node only.	
	12	off	off	on	on	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	232 & Arc	19200	n, 8, 1 & brcast	20		
	13	on	off	on	on	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	232 & Arc	9600	n, 8, 1 & brcast	20	Modes 12 to 15 where RS232 and Arcnet both enabled provides parallel data streams.	
	14	off	on	on	on	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	232 & Arc	4800	n, 8, 1 & brcast	20	Arcnet transmissions are all broadcast in these modes.	
	15	on	on	on	on	off	off	off	off	Standard iGC Packet output - Streaming @ 20Hz	232 & Arc	38400	n, 8, 1 & brcast	20		
	16	off	off	off	off	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	RS232	19200	n, 8, 1	20	Extended binary output packet in iGC Proprietary format - streamed output	
	17	on	off	off	off	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	RS232	9600	n, 8, 1	20	Contents:	
	18	off	on	off	off	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	RS232	4800	n, 8, 1	10	Heading, Pitch, Roll, Heave acceleration, Serial No., Temperature, status, CRC.	
	19	on	on	off	off	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	RS232	38400	n, 8, 1	20		
	20	off	off	on	off	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	RS485	19200	n, 8, 1	20	Will accept command requests and poll commands for extended packets	
	21	on	off	on	off	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	RS485	9600	n, 8, 1	20		
	22	off	on	on	off	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	RS485	4800	n, 8, 1	10		
1	*23*	on	on	on	off	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	RS485	38400	n, 8, 1	20		***1.03***
	24	off	off	off	on	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	Arcnet	156.25k	Broadcast	20	iGC Arcnet adderss is always 0x78 or 120 decmal. For baudrate - see table.	***& later***
	25	on	off	off	on	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	Arcnet	156.25k	tx to NID 0x64	20	Broadcast Arcnet transmits packet to all listening nodes.	
	26	off	on	off	on	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	Arcnet	156.25k	tx to NID 0x6e	20	Transmit to NID 0x64 transmits to iVP node only.	
	27	on	on	off	on	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	Arcnet	78.125	Broadcast	20	Transmit to NID 0x6e transmits to iPP node only.	
	28	off	off	on	on	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	232 & Arc	19200	n, 8, 1 & brcast	20		
	29	on	off	on	on	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	232 & Arc	9600	n, 8, 1 & brcast	20	Modes 28 to 31 where RS232 and Arcnet both enabled provides parallel data streams.	
	30	off	on	on	on	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	232 & Arc	4800	n, 8, 1 & brcast	10	Arcnet transmissions are all broadcast in these modes.	
	31	on	on	on	on	on	off	off	off	Extended iGC Packet output - Streaming @ 20Hz	232 & Arc	38400	n, 8, 1 & brcast	20		
	32	off	off	off	off	off	on	off	off	Polled iGC Packet output	RS232	19200	n, 8, 1	as required	Standard binary output packet in iGC Proprietary format - polled outputs only	
	33	on	off	off	off	off	on	off	off	Polled iGC Packet output	RS232	9600	n, 8, 1	as required	Contents:	
	34	off	on	off	off	off	on	off	off	Polled iGC Packet output	RS232	4800	n, 8, 1	as required	Standard or Extended packets, Special packets and industry standard packets	
	35	on	on	off	off	off	on	off	off	Polled iGC Packet output	RS232	38400	n, 8, 1	as required	depending on poll command.	
	36	off	off	on	off	off	on	off	off	Polled iGC Packet output	RS485	19200	n, 8, 1	as required	Will accept ad-hoc command requests and all poll commands	
	37	on	off	on	off	off	on	off	off	Polled iGC Packet output	RS485	9600	n, 8, 1	as required		
	38	off	on	on	off	off	on	off	off	Polled iGC Packet output	RS485	4800	n, 8, 1	as required		
2	*39*	on	on	on	off	off	on	off	off	Polled iGC Packet output	RS485	38400	n, 8, 1	as required		***1.03***
	40	off	off	off	on	off	on	off	off	Polled iGC Packet output	Arcnet	156.25k	Broadcast	as required	GC Arcnet adderss is always 0x78 or 120 decmal. For baudrate - see table.	***& later***
	41	on	off	off	on	off	on	off	off	Polled iGC Packet output	Arcnet	156.25k	tx to NID 0x64	as required	Broadcast Arcnet transmits packet to all listening nodes.	
	42	off	on	off	on	off	on	off	off	Polled iGC Packet output	Arcnet	156.25k	tx to NID 0x6e	as required	Transmit to NID 0x64 transmits to iVP node only.	
	43	on	on	off	on	off	on	off	off	Polled iGC Packet output	Arcnet	78.125	Broadcast	as required	Transmit to NID 0x6e transmits to iPP node only.	
	44	off	off	on	on	off	on	off	off	Polled iGC Packet output	232 & Arc	19200	n, 8, 1 & brcast	as required		
	45	on	off	on	on	off	on	off	off	Polled iGC Packet output	232 & Arc	9600	n, 8, 1 & brcast	as required	Modes 44 to 47 where RS232 and Arcnet both enabled provides parallel data streams.	
	46	off	on	on	on	off	on	off	off	Polled iGC Packet output	232 & Arc	4800	n, 8, 1 & brcast	as required	Arcnet transmissions are all broadcast in these modes.	
	47	on	on	on	on	off	on	off	off	Polled iGC Packet output	232 & Arc	38400	n, 8, 1 & brcast	as required		



Telegram Code	Mode code	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8	Telegram Description	Protocol	Baudrate	Parameters	rate (Hz)	Notes	Implemented at firmware version
		Baudrate selection [off][off]=19200, [on][off]=9600, [off][on]=4800, [on][on] = 38,400														
				Hardware Protocol [off][off] = RS232, [on][off] = RS485, [off][on] = Arcnet, [on][on] = Arcnet & RS232												
						Proprietary Mode (8 possible selections)										
									Protocol type - [off] = iGC Proprietary, [on] = Industry Standard							
	48	off	off	off	off	on	on	off	off	Standard iGC ASCII output - Streaming @ 20Hz	RS232	19200	n, 8, 1	20	Standard ASCII output packet in iGC ASCII format - streamed ouput. Contents:	
	49	on	off	off	off	on	on	off	off	Standard iGC ASCII output - Streaming @ 20Hz	RS232	9600	n, 8, 1	20	Fixed length (27 chars) ASCII telegram in format:	
	50	off	on	off	off	on	on	off	off	Standard iGC ASCII output - Streaming @ 20Hz	RS232	4800	n, 8, 1	20	HhhhhPspppRsrrrrZsaaaafw<cr><lf> where: H is a 'H' character	
	51	on	on	off	off	on	on	off	off	Standard iGC ASCII output - Streaming @ 20Hz	RS232	38400	n, 8, 1	20	hhhh is ASCII heading in degrees * 10, packed with leading zero(es)	***1.03***
	52	off	off	on	off	on	on	off	off	Standard iGC ASCII output - Streaming @ 20Hz	RS485	19200	n, 8, 1	20	P is a 'P' character, s is + or - sign, pppp is pitch angle in degrees * 10	***& later***
	53	on	off	on	off	on	on	off	off	Standard iGC ASCII output - Streaming @ 20Hz	RS485	9600	n, 8, 1	20	R is an 'R' character, s is + or - sign, rrrr is roll angle in degrees * 10	
	54	off	on	on	off	on	on	off	off	Standard iGC ASCII output - Streaming @ 20Hz	RS485	4800	n, 8, 1	20	Z is an 'Z' character, s is + or - sign, aaaa is heave accel. in ms-2 * 100 (-0981 at rest)	
3	*55*	on	on	on	off	on	on	off	off	Standard iGC ASCII output - Streaming @ 20Hz	RS485	38400	n, 8, 1	20	f is flag 'E' is OK, 'N' is invalid data; w is WIA status 'D' for dry, 'W' for wet.	
	56	off	off	off	on	on	on	off	off							
	57	on	off	off	on	on	on	off	off							
	58	off	on	off	on	on	on	off	off							
	59	on	on	off	on	on	on	off	off							
	60	off	off	on	on	on	on	off	off							
	61	on	off	on	on	on	on	off	off							
	62	off	on	on	on	on	on	off	off							
	63	on	on	on	on	on	on	off	off							

Special Modes

Telegram Code	Mode code	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8	Telegram Description	Protocol	Baudrate	Parameters	rate (Hz)	Notes	Implemented at firmware version
									Protocol type - [off] = iGC Proprietary, [on] = Industry Standard							
4	*64*	off	off	off	off	off	off	on	off	iFG Arcnet Relay Mode	232 & Arc	19200	n, 8, 1 & 0x87	20	Arcnet Streaming output of iFG processed data - 20Hz, RS232 data to/from iFG	**>= 1.03**
5	*64*	on	off	off	off	off	off	on	off	TSS1 on RS485, HEHDT on RS232	232 & 485	19200	n, 8, 1 both	20	TSS1 heave pitch & roll (modified) on RS485 port, NMEA HEHDT on RS232 port.	**1.03**
6	*66*	off	on	off	off	off	off	on	off	Watson ASCII AHRS-E304 For Perry - Type 1	232	9600	n, 8, 1	10	I HHH.H +rr.r +pp.p +hh.h +RR.R +PP.P +TT<cr> 42 chars pitch + is bow up	**>= 1.06**
7	*67*	on	on	off	off	off	off	on	off	Watson ASCII AHRS-E304 For Perry - Type 2	232	9600	n, 8, 1	10	I HHH.H +rr.r +pp.p +hh.h +RR.R +PP.P +TT<cr> 42 chars pitch + is bow down	**>= 1.06**
8	*68*	off	off	on	off	off	off	on	off	TCM2 data string	232	9600	n, 8, 1	10	$Cxxx.xPxx.xRxx.x*6C<cr><lf>	**>= 2.02**
9	*69*	on	off	on	off	off	off	on	off	IGC expanded OEM data	485	115200	n, 8, 1	40	Hnnn.nnnr+n.nnnnP-nnn.nq-n.nnnnR-nnn.np+n.nnnnX-nn.nnnY+nn.nnnZ-	**>= 2.05**
	70	off	on	on	off	off	off	on	off	*All others undefined - for future expansion*					nn.nnnfw<cr><lf>	
	71	on	on	on	off	off	off	on	off						H is a 'H' character, nnn.nnn is ASCII heading in degrees * 1000, packed with leading zero(es)	
	72	off	off	off	on	off	off	on	off						r is a 'r' character, + or - sign, n.nnnn is heading rate in rad/s * 10000	
	73	on	off	off	on	off	off	on	off						P is a 'P' character, + or - sign, nnnn is pitch angle in degrees * 10	
	74	off	on	off	on	off	off	on	off						q is a 'q' character, + or - sign, nnnnn is pitch rate in rad/s * 10000	
	75	on	on	off	on	off	off	on	off						R is a 'R' character, + or - sign, nnnn is roll angle in degrees * 10	
	76	off	off	on	on	off	off	on	off						p is a 'p' character, + or - sign, nnnnn is roll rate in rad/s * 10000	
	77	on	off	on	on	off	off	on	off						X is an ‘X' character, + or - sign, nnnnn is X accel. in ms-2 * 1000 (0 at rest)	
	78	off	on	on	on	off	off	on	off						Y is an 'Y' character, + or - sign, nnnnn is Y accel. in ms-2 * 1000 (0 at rest)	
	79	on	on	on	on	off	off	on	off						Z is an 'Z' character, + or - sign, nnnnn is heave accel. in ms-2 * 1000 (-0981 at rest)	
															f is flag 'E' is OK, 'N' is invalid data; w is WIA status 'D' for dry, 'W' for wet.	
	80	off	off	off	off	on	off	on	off							
	81	on	off	off	off	on	off	on	off							
	82	off	on	off	off	on	off	on	off							
	83	on	on	off	off	on	off	on	off							
	84	off	off	on	off	on	off	on	off							
	85	on	off	on	off	on	off	on	off							
	86	off	on	on	off	on	off	on	off							
	87	on	on	on	off	on	off	on	off							

Special Modes

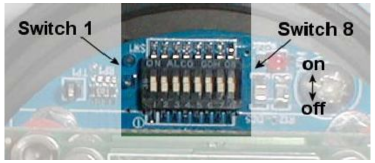
Protocol type - [off] = iGC Proprietary, [on] = Industry Standard

Telegram Code	Mode code	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	8	Telegram Description	Protocol	Baudrate	Parameters	rate (Hz)	Notes	Implemented at firmware version
	88	off	off	off	on	on	off	on	off							
	89	on	off	off	on	on	off	on	off							
	90	off	on	off	on	on	off	on	off	*All undefined - for future expansion*						
	91	on	on	off	on	on	off	on	off							
	92	off	off	on	on	on	off	on	off							
	93	on	off	on	on	on	off	on	off							
	94	off	on	on	on	on	off	on	off							
	95	on	on	on	on	on	off	on	off							
	96	off	off	off	off	off	on	on	off							
	97	on	off	off	off	off	on	on	off							
	98	off	on	off	off	off	on	on	off							
	99	on	on	off	off	off	on	on	off							
	100	off	off	on	off	off	on	on	off							
	101	on	off	on	off	off	on	on	off							
	102	off	on	on	off	off	on	on	off							
	103	on	on	on	off	off	on	on	off							
	104	off	off	off	on	off	on	on	off							
	105	on	off	off	on	off	on	on	off							
	106	off	on	off	on	off	on	on	off							
	107	on	on	off	on	off	on	on	off							
	108	off	off	on	on	off	on	on	off							
	109	on	off	on	on	off	on	on	off							
	110	off	on	on	on	off	on	on	off							
	111	on	on	on	on	off	on	on	off							
	112	off	off	off	off	on	on	on	off							
	113	on	off	off	off	on	on	on	off							
	114	off	on	off	off	on	on	on	off							
	115	on	on	off	off	on	on	on	off							
	116	off	off	on	off	on	on	on	off							
	117	on	off	on	off	on	on	on	off							
	118	off	on	on	off	on	on	on	off							
	119	on	on	on	off	on	on	on	off							
	120	off	off	off	on	on	on	on	off							
	121	on	off	off	on	on	on	on	off							
	122	off	on	off	on	on	on	on	off							
	123	on	on	off	on	on	on	on	off							
	124	off	off	on	on	on	on	on	off							
	125	on	off	on	on	on	on	on	off							
	126	off	on	on	on	on	on	on	off							
	127	on	on	on	on	on	on	on	off							

Notes:

1. *Modes are selected on SW1 8-way DIL switch on iGC processor PCB (See photo at top of page or manual for details)*
2. *RS232 telemetry is via Subconn connector pins 3 (transmit from iGC) and 4 (iGC receive input)*
3. *RS485 telemetry is via Subconn connector pins 5 (485 A or +) and 6 (485 B or -)*
4. *RS485 or Arcnet must be selected by JP1 & JP2 on iGC processor PCB (select between Arcnet or RS485)*
5. *Arcnet modes are all at address 0x78 (hex) or 120 decimal.*

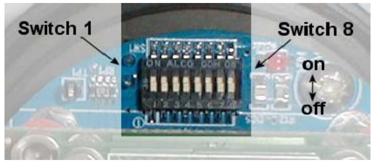
iGC Mode Listing (SW8 ON = Industry Standard Outputs)



Baudrate selection [off][off]=19200, [on][off]=9600, [off][on]=4800, [on][on] = 2400 (SW 1, SW 2)
Hardware Protocol [off] = RS232, [on] = RS485 half-duplex (SW 3)
Emulated telegram type (16 possible selections) from Industry standard formats (SW 4–SW 7)
Protocol type - [off] = iGC Proprietary, [on] = Industry Standard (SW 8)

Telegram Code	Mode code	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8	Telegram Description	Protocol	Baudrate	Params	rate (Hz)	Notes	Implemented at firmware version
	128	off	off	off	off	off	off	off	on	Robertson SKR80/SKR82	RS232	19200	n, 8, 1	20	Streaming output - see 'rate' column for output telegram frequency	
	129	on	off	off	off	off	off	off	on	Robertson SKR80/SKR82	RS232	9600	n, 8, 1	20	4 bytes sent in sequence (no delimiter)	
	130	off	on	off	off	off	off	off	on	Robertson SKR80/SKR82	RS232	4800	n, 8, 1	20	hundreds pattern (0)(0)00hhhh	
0	***131***	on	on	off	off	off	off	off	on	Robertson SKR80/SKR82	RS232	2400	n, 8, 1	20	tens pattern (0)(0)01tttt	***1.03***
	132	off	off	on	off	off	off	off	on	Robertson SKR80/SKR82	RS485	19200	n, 8, 1	20	units pattern (0)(0)10uuuu	***& later***
	133	on	off	on	off	off	off	off	on	Robertson SKR80/SKR82	RS485	9600	n, 8, 1	20	decimals pattern (0)(0)11uuuu	
	134	off	on	on	off	off	off	off	on	Robertson SKR80/SKR82	RS485	4800	n, 8, 1	20		
	135	on	on	on	off	off	off	off	on	Robertson SKR80/SKR82	RS485	2400	n, 8, 1	20		
	136	off	off	off	on	off	off	off	on	Robertson SKR80/SKR82	RS232	19200	0, 8, 2	20	Streaming output - see 'rate' column for output telegram frequency	
	137	on	off	off	on	off	off	off	on	Robertson SKR80/SKR82	RS232	9600	0, 8, 2	20	4 bytes sent in sequence (no delimiter)	
	138	off	on	off	on	off	off	off	on	Robertson SKR80/SKR82	RS232	4800	0, 8, 2	20	hundreds pattern (0)(0)00hhhh	
1	***139***	on	on	off	on	off	off	off	on	Robertson SKR80/SKR82	RS232	2400	0, 8, 2	20	tens pattern (0)(0)01tttt	
	140	off	off	on	on	off	off	off	on	Robertson SKR80/SKR82	RS485	19200	0, 8, 2	20	units pattern (0)(0)10uuuu	
	141	on	off	on	on	off	off	off	on	Robertson SKR80/SKR82	RS485	9600	0, 8, 2	20	decimals pattern (0)(0)11uuuu	
	142	off	on	on	on	off	off	off	on	Robertson SKR80/SKR82	RS485	4800	0, 8, 2	20		
	143	on	on	on	on	off	off	off	on	Robertson SKR80/SKR82	RS485	2400	0, 8, 2	20		
	144	off	off	off	off	on	off	off	on	Robertson ASCII short (no leading zeroes)	RS232	19200	n, 8, 1	20	Streaming output - see 'rate' column for output telegram frequency	
	145	on	off	off	off	on	off	off	on	Robertson ASCII short (no leading zeroes)	RS232	9600	n, 8, 1	20	Variable length (11, 12 or 13 chars) ASCII telegram in format:	
	146	off	on	off	off	on	off	off	on	Robertson ASCII short (no leading zeroes)	RS232	4800	n, 8, 1	20	$HHH.H,N,SS<cr><lf>	
2	***147***	on	on	off	off	on	off	off	on	Robertson ASCII short (no leading zeroes)	RS232	2400	n, 8, 1	10	where: $ is a '$' character	***1.03***
	148	off	off	on	off	on	off	off	on	Robertson ASCII short (no leading zeroes)	RS485	19200	n, 8, 1	20	HHH.H is ASCII heading, no leading zero(es), decimal place always sent	***& later***
	149	on	off	on	off	on	off	off	on	Robertson ASCII short (no leading zeroes)	RS485	9600	n, 8, 1	20	N is Normal - always sent as 'N'	
	150	off	on	on	off	on	off	off	on	Robertson ASCII short (no leading zeroes)	RS485	4800	n, 8, 1	20	SS is status, ASCII '00' (two zero chars) is OK	
	151	on	on	on	off	on	off	off	on	Robertson ASCII short (no leading zeroes)	RS485	2400	n, 8, 1	10	80' is 'not ready', '10' is water ingress.	
	152	off	off	off	on	on	off	off	on	Robertson ASCII short (with leading zeroes)	RS232	19200	n, 8, 1	20	Streaming output - see 'rate' column for output telegram frequency	
	153	on	off	off	on	on	off	off	on	Robertson ASCII short (with leading zeroes)	RS232	9600	n, 8, 1	20	Fixed length (13 chars) ASCII telegram in format:	
	154	off	on	off	on	on	off	off	on	Robertson ASCII short (with leading zeroes)	RS232	4800	n, 8, 1	20	$HHH.H,N,SS<cr><lf>	
3	***155***	on	on	off	on	on	off	off	on	Robertson ASCII short (with leading zeroes)	RS232	2400	n, 8, 1	10	where: $ is a '$' character	***1.03***
	156	off	off	on	on	on	off	off	on	Robertson ASCII short (with leading zeroes)	RS485	19200	n, 8, 1	20	HHH.H is ASCII heading, packed with leading zero(es)	***& later***
	157	on	off	on	on	on	off	off	on	Robertson ASCII short (with leading zeroes)	RS485	9600	n, 8, 1	20	N is Normal - always sent as 'N'	
	158	off	on	on	on	on	off	off	on	Robertson ASCII short (with leading zeroes)	RS485	4800	n, 8, 1	20	SS is status, ASCII '00' (two zero chars) is OK	
	159	on	on	on	on	on	off	off	on	Robertson ASCII short (with leading zeroes)	RS485	2400	n, 8, 1	10	80' is 'not ready', '10' is water ingress.	
	160	off	off	off	off	off	on	off	on	Robertson ASCII long (no leading zeroes)	RS232	19200	n, 8, 1	20	Streaming output - see 'rate' column for output telegram frequency	
	161	on	off	off	off	off	on	off	on	Robertson ASCII long (no leading zeroes)	RS232	9600	n, 8, 1	10	Variable length (26 to 30 chars) ASCII telegram in format:	
	162	off	on	off	off	off	on	off	on	Robertson ASCII long (no leading zeroes)	RS232	4800	n, 8, 1	10	$HHH.H,N,SS,+LL,QQ,+RR.R,+PP.P<cr><lf>	
4	***163***	on	on	off	off	off	on	off	on	Robertson ASCII long (no leading zeroes)	RS232	2400	n, 8, 1	5	where: $ is a '$' character, HHH.H is ASCII heading, no leading zero(es)	***1.03***
	164	off	off	on	off	off	on	off	on	Robertson ASCII long (no leading zeroes)	RS485	19200	n, 8, 1	20	N is Normal - always sent as 'N', SS is status (as Robertson Short),	***& later***
	165	on	off	on	off	off	on	off	on	Robertson ASCII long (no leading zeroes)	RS485	9600	n, 8, 1	10	+LL is latitude, always sent as '+0' QQ is speed, always sent as '0'	
	166	off	on	on	off	off	on	off	on	Robertson ASCII long (no leading zeroes)	RS485	4800	n, 8, 1	10	+RR.R is roll degrees in -30 to +30 range, decimal always sent.	
	167	on	on	on	off	off	on	off	on	Robertson ASCII long (no leading zeroes)	RS485	2400	n, 8, 1	5	+PP.P is pitch degrees in -30 to +30 range, decimal always sent.	
	168	off	off	off	on	off	on	off	on	Robertson ASCII long (with leading zeroes)	RS232	19200	n, 8, 1	20	Streaming output - see 'rate' column for output telegram frequency	
	169	on	off	off	on	off	on	off	on	Robertson ASCII long (with leading zeroes)	RS232	9600	n, 8, 1	10	Fixed length (30 chars) ASCII telegram in format:	
	170	off	on	off	on	off	on	off	on	Robertson ASCII long (with leading zeroes)	RS232	4800	n, 8, 1	10	$HHH.H,N,SS,+LL,QQ,+RR.R,+PP.P<cr><lf>	
5	***171***	on	on	off	on	off	on	off	on	Robertson ASCII long (with leading zeroes)	RS232	2400	n, 8, 1	5	where: $ is a '$' character, HHH.H is ASCII heading, packed leading zero(es)	***1.03***
	172	off	off	on	on	off	on	off	on	Robertson ASCII long (with leading zeroes)	RS485	19200	n, 8, 1	20	N is Normal - always sent as 'N', SS is status (as Robertson Short),	***& later***
	173	on	off	on	on	off	on	off	on	Robertson ASCII long (with leading zeroes)	RS485	9600	n, 8, 1	10	+LL is latitude, always sent as '+0' QQ is speed, always sent as '0'	
	174	off	on	on	on	off	on	off	on	Robertson ASCII long (with leading zeroes)	RS485	4800	n, 8, 1	10	+RR.R is roll degrees in -30 to +30 range, leading zero & decimal sent.	
	175	on	on	on	on	off	on	off	on	Robertson ASCII long (with leading zeroes)	RS485	2400	n, 8, 1	5	+PP.P is pitch degrees in -30 to +30 range, leading zero & decimal sent.	

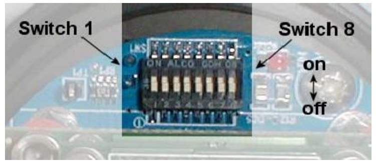
iGC Mode Listing (SW8 ON = Industry Standard Outputs)



Baudrate selection [off][off]=19200, [on][off]=9600, [off][on]=4800, [on][on] = 2400
Hardware Protocol [off] = RS232, [on] = RS485 half-duplex
Emulated telegram type (16 possible selections) from Industry standard formats
Protocol type - [off] = iGC Proprietary, [on] = Industry Standard

Telegram Code	Mode code	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	8	Telegram Description	Protocol	Baudrate	Params	rate (Hz)	Notes	Implemented at firmware version
6	*176*	off	off	off	off	on	on	off	on	SG Brown ASCII (fixed length)	RS232	19200	n, 8, 1	20	Streaming output - see 'rate' column for output telegram frequency	
	177	on	off	off	off	on	on	off	on	SG Brown ASCII (fixed length)	RS232	9600	n, 8, 1	20	Fixed length (6 chars) ASCII telegram in format:	
	178	off	on	off	off	on	on	off	on	SG Brown ASCII (fixed length)	RS232	4800	n, 8, 1	20	HHHH<cr><lf>	
	179	on	on	off	off	on	on	off	on	SG Brown ASCII (fixed length)	RS232	2400	n, 8, 1	20	where:	***1.03***
	180	off	off	on	off	on	on	off	on	SG Brown ASCII (fixed length)	RS485	19200	n, 8, 1	20	HHHH is ASCII heading in degrees x 10	***& later***
	181	on	off	on	off	on	on	off	on	SG Brown ASCII (fixed length)	RS485	9600	n, 8, 1	20	leading zeroes always sent	
	182	off	on	on	off	on	on	off	on	SG Brown ASCII (fixed length)	RS485	4800	n, 8, 1	20	e.g. 0461 is heading 46.1 degrees.	
	183	on	on	on	off	on	on	off	on	SG Brown ASCII (fixed length)	RS485	2400	n, 8, 1	20		
7	*184*	off	off	off	on	on	on	off	on	NMEA 0183 $HEHDT (north seekng gyro) ASCII	RS232	19200	n, 8, 1	20	Streaming output - see 'rate' column for output telegram frequency	
	185	on	off	off	on	on	on	off	on	NMEA 0183 $HEHDT (north seekng gyro) ASCII	RS232	9600	n, 8, 1	20	Variable length (17-19 chars) ASCII telegram (no leading zeroes) in format:	
	186	off	on	off	on	on	on	off	on	NMEA 0183 $HEHDT (north seekng gyro) ASCII	RS232	4800	n, 8, 1	10	$HEHDT,hhh.h,T*kk<cr><lf>	
	187	on	on	off	on	on	on	off	on	NMEA 0183 $HEHDT (north seekng gyro) ASCII	RS232	2400	n, 8, 1	5	where: $HEHDT signifies north seeking gyro, true heading	***1.03***
	188	off	off	on	on	on	on	off	on	NMEA 0183 $HEHDT (north seekng gyro) ASCII	RS485	19200	n, 8, 1	20	hhh.h is heading without leading zeroes	***& later***
	189	on	off	on	on	on	on	off	on	NMEA 0183 $HEHDT (north seekng gyro) ASCII	RS485	9600	n, 8, 1	20	T signifies relative to True North	
	190	off	on	on	on	on	on	off	on	NMEA 0183 $HEHDT (north seekng gyro) ASCII	RS485	4800	n, 8, 1	10	* is a '*' character	
	191	on	on	on	on	on	on	off	on	NMEA 0183 $HEHDT (north seekng gyro) ASCII	RS485	2400	n, 8, 1	5	kk is XOR checksum of all chars between $ and * exclusive.	
8	*192*	off	off	off	off	off	off	on	on	NMEA 0183 $HCHDM (mag. compass) ASCII	RS232	19200	n, 8, 1	20	Streaming output - see 'rate' column for output telegram frequency	
	193	on	off	off	off	off	off	on	on	NMEA 0183 $HCHDM (mag. compass) ASCII	RS232	9600	n, 8, 1	20	Variable length (17-19 chars) ASCII telegram (no leading zeroes) in format:	
	194	off	on	off	off	off	off	on	on	NMEA 0183 $HCHDM (mag. compass) ASCII	RS232	4800	n, 8, 1	10	$HCHDM,hhh.h,M*kk<cr><lf>	
	195	on	on	off	off	off	off	on	on	NMEA 0183 $HCHDM (mag. compass) ASCII	RS232	2400	n, 8, 1	5	where: $HCHDM signifies magnetic compass, magnetic heading	***1.03***
	196	off	off	on	off	off	off	on	on	NMEA 0183 $HCHDM (mag. compass) ASCII	RS485	19200	n, 8, 1	20	hhh.h is heading without leading zeroes	***& later***
	197	on	off	on	off	off	off	on	on	NMEA 0183 $HCHDM (mag. compass) ASCII	RS485	9600	n, 8, 1	20	M signifies relative to Magnetic North	
	198	off	on	on	off	off	off	on	on	NMEA 0183 $HCHDM (mag. compass) ASCII	RS485	4800	n, 8, 1	10	* is a '*' character	
	199	on	on	on	off	off	off	on	on	NMEA 0183 $HCHDM (mag. compass) ASCII	RS485	2400	n, 8, 1	5	kk is XOR checksum of all chars between $ and * exclusive.	
9	*200*	off	off	off	on	off	off	on	on	Digilog ASCII (fixed length with leading zeroes)	RS232	19200	n, 8, 1	20	Streaming output - see 'rate' column for output telegram frequency	
	201	on	off	off	on	off	off	on	on	Digilog ASCII (fixed length with leading zeroes)	RS232	9600	n, 8, 1	20	Fixed length (20 chars) ASCII telegram in format:	
	202	off	on	off	on	off	off	on	on	Digilog ASCII (fixed length with leading zeroes)	RS232	4800	n, 8, 1	10	HhhhhPsppppRsrrrrf<cr><lf>	
	203	on	on	off	on	off	off	on	on	Digilog ASCII (fixed length with leading zeroes)	RS232	2400	n, 8, 1	5	where: H is a 'H' character	***1.03***
	204	off	off	on	on	off	off	on	on	Digilog ASCII (fixed length with leading zeroes)	RS485	19200	n, 8, 1	20	hhhh is ASCII heading in degrees * 10, packed with leading zero(es)	***& later***
	205	on	off	on	on	off	off	on	on	Digilog ASCII (fixed length with leading zeroes)	RS485	9600	n, 8, 1	20	P is a 'P' character, s is + or - sign, pppp is pitch angle in degrees * 10	
	206	off	on	on	on	off	off	on	on	Digilog ASCII (fixed length with leading zeroes)	RS485	4800	n, 8, 1	10	R is an 'R' character, s is + or - sign, rrrr is roll angle in degrees * 10	
	207	on	on	on	on	off	off	on	on	Digilog ASCII (fixed length with leading zeroes)	RS485	2400	n, 8, 1	5	f is flag where 'E' is OK, 'N' is invalid heading, 'S' is settling, 'W' is water ingress *	
10	*208*	off	off	off	off	on	off	on	on	OceanTools ASCII (fixed length, leading zeroes)	RS232	19200	n, 8, 1	20	Streaming output - see 'rate' column for output telegram frequency	
	209	on	off	off	off	on	off	on	on	OceanTools ASCII (fixed length, leading zeroes)	RS232	9600	n, 8, 1	20	Fixed length (20 chars) ASCII telegram in format:	
	210	off	on	off	off	on	off	on	on	OceanTools ASCII (fixed length, leading zeroes)	RS232	4800	n, 8, 1	10	HhhhhPsppppRsrrrrf<cr><lf>	
	211	on	on	off	off	on	off	on	on	OceanTools ASCII (fixed length, leading zeroes)	RS232	2400	n, 8, 1	5	where: H is a 'H' character	***1.03***
	212	off	off	on	off	on	off	on	on	OceanTools ASCII (fixed length, leading zeroes)	RS485	19200	n, 8, 1	20	hhhh is ASCII heading in degrees * 10, packed with leading zero(es)	***& later***
	213	on	off	on	off	on	off	on	on	OceanTools ASCII (fixed length, leading zeroes)	RS485	9600	n, 8, 1	20	P is a 'P' character, s is + or - sign, pppp is pitch angle in degrees * 10	
	214	off	on	on	off	on	off	on	on	OceanTools ASCII (fixed length, leading zeroes)	RS485	4800	n, 8, 1	10	R is an 'R' character, s is + or - sign, rrrr is roll angle in degrees * 10	
	215	on	on	on	off	on	off	on	on	OceanTools ASCII (fixed length, leading zeroes)	RS485	2400	n, 8, 1	5	f is flag : 'E' is OK, 'N' is invalid heading, 'M' is settling (aligning), 'W' is water ingress *	
11	*216*	off	off	off	on	on	off	on	on	Anschutz Binary (modified to add Pitch & Roll)	RS232	19200	n, 8, 1	20	Streaming output - see 'rate' column for output telegram frequency	
	217	on	off	off	on	on	off	on	on	Anschutz Binary (modified to add Pitch & Roll)	RS232	9600	n, 8, 1	20	Fixed length (18 chars) binary telegram in format: <stx> b1…b16 <etx> where:	
	218	off	on	off	on	on	off	on	on	Anschutz Binary (modified to add Pitch & Roll)	RS232	4800	n, 8, 1	10	<stx> is binary 0x02, <etx> is binary 0x03	
	219	on	on	off	on	on	off	on	on	Anschutz Binary (modified to add Pitch & Roll)	RS232	2400	n, 8, 1	5	b1 & b2 is 12-bit heading, b3 is incremental heading, b4 & b5 is pitch	
	220	off	off	on	on	on	off	on	on	Anschutz Binary (modified to add Pitch & Roll)	RS485	19200	n, 8, 1	20	b6 & b7 is roll, b8 to b10 is rate of turn, b11 & b12 is status	
	221	on	off	on	on	on	off	on	on	Anschutz Binary (modified to add Pitch & Roll)	RS485	9600	n, 8, 1	20	b13 to b15 is compass data	
	222	off	on	on	on	on	off	on	on	Anschutz Binary (modified to add Pitch & Roll)	RS485	4800	n, 8, 1	10	b16 is checksum	
	223	on	on	on	on	on	off	on	on	Anschutz Binary (modified to add Pitch & Roll)	RS485	2400	n, 8, 1	5	** see manual for full details of bit positions / functions **	

iGC Mode Listing (SW8 ON = Industry Standard Outputs)

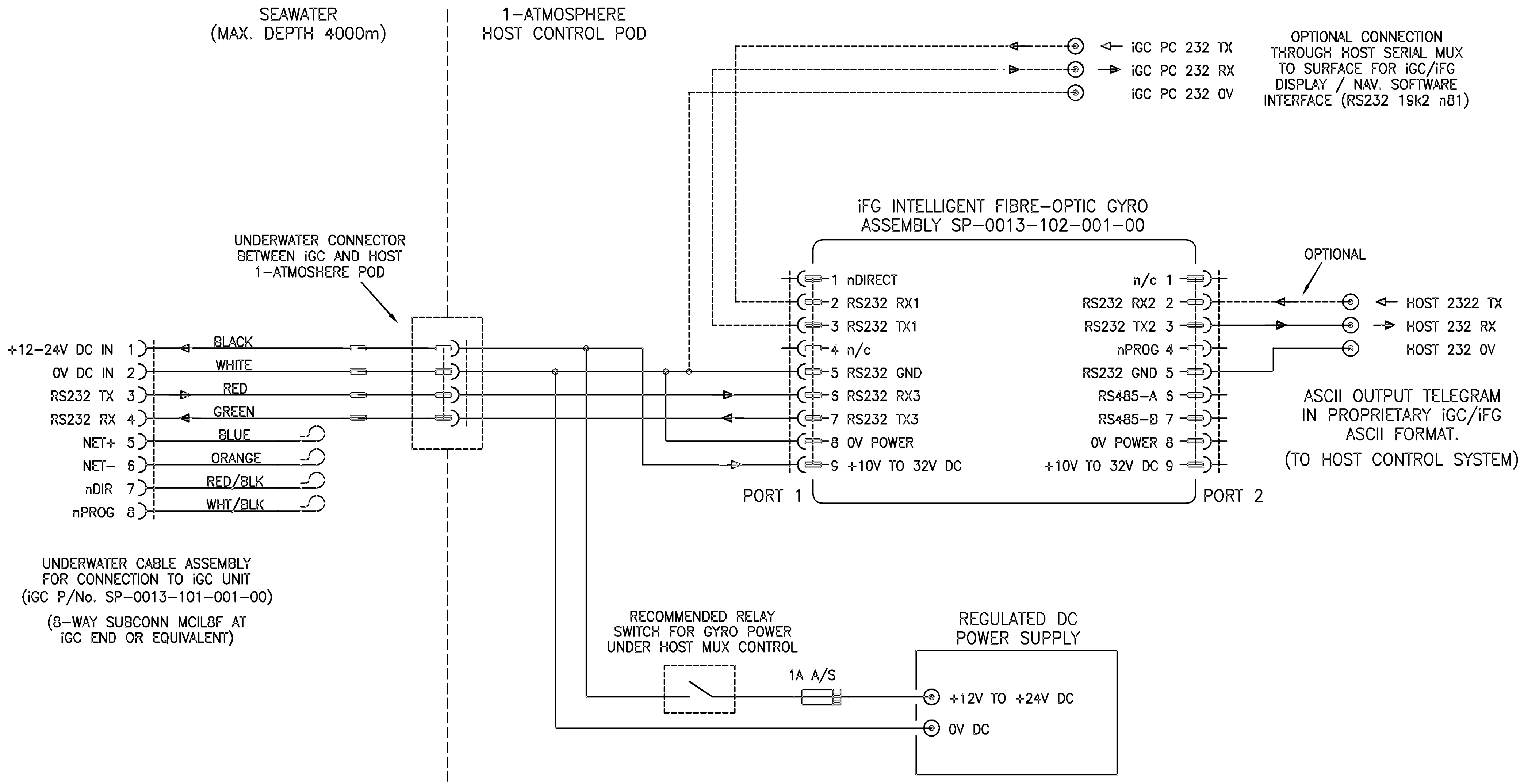


Baudrate selection [off][off]=19200, [on][off]=9600, [off][on]=4800, [on][on] = 2400
Hardware Protocol [off] = RS232, [on] = RS485 half-duplex
Emulated telegram type (16 possible selections) from Industry standard formats
Protocol type - [off] = iGC Proprietary, [on] = Industry Standard

Telegram Code	Mode code	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	8	Telegram Description	Protocol	Baudrate	Params	rate (Hz)	Notes	Implemented at firmware version
	224	off	off	off	off	off	on	on	on	Octans 'Gyrocompass 1' format (NMEA)	RS232	19200	n, 8, 1	20	Streaming output - see 'rate' column for output telegram frequency	
	225	on	off	off	off	off	on	on	on	Octans 'Gyrocompass 1' format (NMEA)	RS232	9600	n, 8, 1	20	Three Alternate NMEA 0183 var. length messages Heading / Pitch Roll / Status	
	226	off	on	off	off	off	on	on	on	Octans 'Gyrocompass 1' format (NMEA)	RS232	4800	n, 8, 1	10	$HEHDT,hhh.h,T*kk<cr><lf> (as NMEA format above - 17-19 chars)	
12	***227***	on	on	off	off	off	on	on	on	Octans 'Gyrocompass 1' format (NMEA)	RS232	2400	n, 8, 1	5	$PHTRO,x.xx,a,y.yy,b*kk<cr><lf> where x.xx is pitch in degrees, a is 'M' for	***1.03***
	228	off	off	on	off	off	on	on	on	Octans 'Gyrocompass 1' format (NMEA)	RS485	19200	n, 8, 1	20	bow up, 'P' for bow down, y.yy is roll in degres b is 'B' for port down, 'T' for port up	***& later***
	229	on	off	on	off	off	on	on	on	Octans 'Gyrocompass 1' format (NMEA)	RS485	9600	n, 8, 1	20	checksum etc as standard NMEA. (25 - 29 chars variable).	
	230	off	on	on	off	off	on	on	on	Octans 'Gyrocompass 1' format (NMEA)	RS485	4800	n, 8, 1	10	$PHINF,hhhhhhhh*kk<cr><lf> where hhhhhhhh is status hex chars	
	231	on	on	on	off	off	on	on	on	Octans 'Gyrocompass 1' format (NMEA)	RS485	2400	n, 8, 1	5	00000000 for healthy good data, 00000007 for invalid data. (20 chars)	
	232	off	off	off	on	off	on	on	on	Octans 'Gyrocompass 2' format (NMEA)	RS232	19200	n, 8, 1	20	Streaming output - see 'rate' column for output telegram frequency	
	233	on	off	off	on	off	on	on	on	Octans 'Gyrocompass 2' format (NMEA)	RS232	9600	n, 8, 1	20	Three Alternate NMEA 0183 messages Heading / Pitch Roll Heave / Status	
	234	off	on	off	on	off	on	on	on	Octans 'Gyrocompass 2' format (NMEA)	RS232	4800	n, 8, 1	10	$HEHDT,hhh.h,T*kk<cr><lf> (as NMEA format above 17-19 chars)	
13	***235***	on	on	off	on	off	on	on	on	Octans 'Gyrocompass 2' format (NMEA)	RS232	2400	n, 8, 1	5	$PHTRH,x.xx,a,y.yy,b,z.zz,c*kk<cr><lf> (38chv) where x.xx is pitch in degrees,	***1.03***
	236	off	off	on	on	off	on	on	on	Octans 'Gyrocompass 2' format (NMEA)	RS485	19200	n, 8, 1	20	a is 'M' for bow up, 'P' for bow down, y.yy is roll in degres b is 'B' for port down,	***& later***
	237	on	off	on	on	off	on	on	on	Octans 'Gyrocompass 2' format (NMEA)	RS485	9600	n, 8, 1	20	T' for port up, z.zz is heave acceleration in ms-2, c is 'U' if going up, 'O' if going down	
	238	off	on	on	on	off	on	on	on	Octans 'Gyrocompass 2' format (NMEA)	RS485	4800	n, 8, 1	10	$PHINF,hhhhhhhh*kk<cr><lf> where hhhhhhhh is status hex chars	
	239	on	on	on	on	off	on	on	on	Octans 'Gyrocompass 2' format (NMEA)	RS485	2400	n, 8, 1	5	00000000 for healthy good data, 00000007 for invalid data.	
	240	off	off	off	off	on	on	on	on	Tokimec PTVG Format (NMEA)	RS232	19200	n, 8, 1	20	Streaming output - see 'rate' column for output telegram frequency	
	241	on	off	off	off	on	on	on	on	Tokimec PTVG Format (NMEA)	RS232	9600	n, 8, 1	20	NMEA 0183 message containing Pitch, Roll and Heading (30 chars):	
	242	off	on	off	off	on	on	on	on	Tokimec PTVG Format (NMEA)	RS232	4800	n, 8, 1	10	$PTVG,abbbbPaccccR,ddd.dT*kk<cr><lf> where:	
14	***243***	on	on	off	off	on	on	on	on	Tokimec PTVG Format (NMEA)	RS232	2400	n, 8, 1	5	abbbb is pitch bb(degrees)bb(minutes) a is '-' for bow down, space for bow up.	***1.03***
	244	off	off	on	off	on	on	on	on	Tokimec PTVG Format (NMEA)	RS485	19200	n, 8, 1	20	acccc is roll cc(degrees)cc(minutes) a is '-' for port up, space for port down.	***& later***
	245	on	off	on	off	on	on	on	on	Tokimec PTVG Format (NMEA)	RS485	9600	n, 8, 1	20	ddd.d is heading in degrees	
	246	off	on	on	off	on	on	on	on	Tokimec PTVG Format (NMEA)	RS485	4800	n, 8, 1	10	checksum etc as standard NMEA.	
	247	on	on	on	off	on	on	on	on	Tokimec PTVG Format (NMEA)	RS485	2400	n, 8, 1	5		
	248	off	off	off	on	on	on	on	on	Honeywell HMR3000 $PTNTHPR (NMEA)	RS232	19200	n, 8, 1	5	Streaming output - always at 5Hz to match Honeywell output	
	249	on	off	off	on	on	on	on	on	Honeywell HMR3000 $PTNTHPR (NMEA)	RS232	9600	n, 8, 1	5	NMEA 0183 message containing Pitch, Roll and Heading (30 chars):	
	250	off	on	off	on	on	on	on	on	Honeywell HMR3000 $PTNTHPR (NMEA)	RS232	4800	n, 8, 1	5	$PTNTHPR,ddd.d,N,abbbb,N,acccc,N,kk<cr><lf> where:	
15	***251***	on	on	off	on	on	on	on	on	Honeywell HMR3000 $PTNTHPR (NMEA)	RS232	2400	n, 8, 1	5	abbbb is pitch bb(degrees)bb(minutes) a is '-' for bow down, nothing for bow up.	***1.05a***
	252	off	off	on	on	on	on	on	on	Honeywell HMR3000 $PTNTHPR (NMEA)	RS485	19200	n, 8, 1	5	acccc is roll cc(degrees)cc(minutes) a is '-' for port up, nothing for port down.	***& later***
	253	on	off	on	on	on	on	on	on	Honeywell HMR3000 $PTNTHPR (NMEA)	RS485	9600	n, 8, 1	5	ddd.d is heading in degrees	
	254	off	on	on	on	on	on	on	on	Honeywell HMR3000 $PTNTHPR (NMEA)	RS485	4800	n, 8, 1	5	checksum etc as standard NMEA.	
	255	on	on	on	on	on	on	on	on	Honeywell HMR3000 $PTNTHPR (NMEA)	RS485	2400	n, 8, 1	5		

Notes:

1. *Modes are selected on SW1 8-way DIL switch on iGC processor PCB (See photo at top of page or manual for details)*
2. *RS232 telemetry is via Subconn connector pins 3 (transmit from iGC) and 4 (iGC receive input)*
3. *RS485 telemetry is via Subconn connector pins 5 (485 A or +) and 6 (485 B or -)*
4. *RS485 must be selected by JP1 & JP2 on iGC processor PCB (select between Arcnet or RS485)*
5. *Telegram Output Rate is determined by the baudrate and maximum telegram length.*



NOTES:

1. iGC OPERATING MODE IS 16 (PROPRIETARY iGC EXTENDED BINARY TELEGRAM)
2. iFG OPERATING MODE IS 1 (PROPRIETARY iFG EXTENDED BINARY TELEGRAM ON PORT 1-1)
3. iFG SUBMODE IS 15 (iGC ASCII) - INTERNAL SWITCH
4. iGC CURRENT REQUIREMENT IS 250mA
5. iFG CURRENT REQUIREMENT IS 400mA @ 12V, 200mA @ 24V.
6. iFG OUTPUT TO HOST CONTROL SYSTEM IS 19k2 BAUD, n81, ASCII RS232. TRANSMIT ONLY REQUIRED. 20Hz OUTPUT REPETITION RATE ON PORT 2-2.

iGC PROPRIETARY ASCII TELEGRAM:

27 CHARACTERS, FIXED LENGTH:

HhhhhPsppppRsrrrrZsaaaafw<cr><lf>

WHERE:

H is a 'H' character, hhhh is heading in degrees packed with leading zeroes
P is a 'P' character, s is + or - sign, pppp is pitch angle in degrees x 10
R is a 'R' character, s is + or - sign, rrrr is roll angle in degrees x 10
Z is a 'Z' character, s is + or - sign, aaaa is heave acceleration in m/sec x 100
f is status flag 'E' for data OK, 'N' for bad data.
w is water ingress alarm state, 'D' for dry, 'W' for wet.
Positive pitch angle is bow up. Positive roll angle is port up.
Heave acceleration includes gravity. Output is -981 at rest.

ISSUE DETAILS	REV	DRN	DATE	CKD	DATE	APP	DATE
ISSUED FOR MANUFACTURE	A	GK	15mar05	HWW	15mar05	GK	15mar05
ISSUED FOR CHECKING & APPROVAL	01	GK	15mar05	HWW	15mar05	GK	15mar05

TOLERANCES U.O.S.: GENERAL ±0.1mm; HOLE POSN. ±0.1mm; HOLE CTRS. ±0.1mm; ANGULAR ±0.5°

MATERIAL: SEE NOTES

FINISH: SEE NOTES

Tritech

CLIENT: SMD HYDROVISION

USED ON: SP-0013-105-001-00

TITLE: iGC & iFG ELECTRICAL INTERCONNECTION SCHEMATIC

DRAWING No. SP-0013-105-001-00

ALL DIMENSIONS IN mm U.O.S. | SIZE A3 | SCALE NTS | SHEET 1 OF 1

Tritech Intelligent Gyrocompass (iGC)

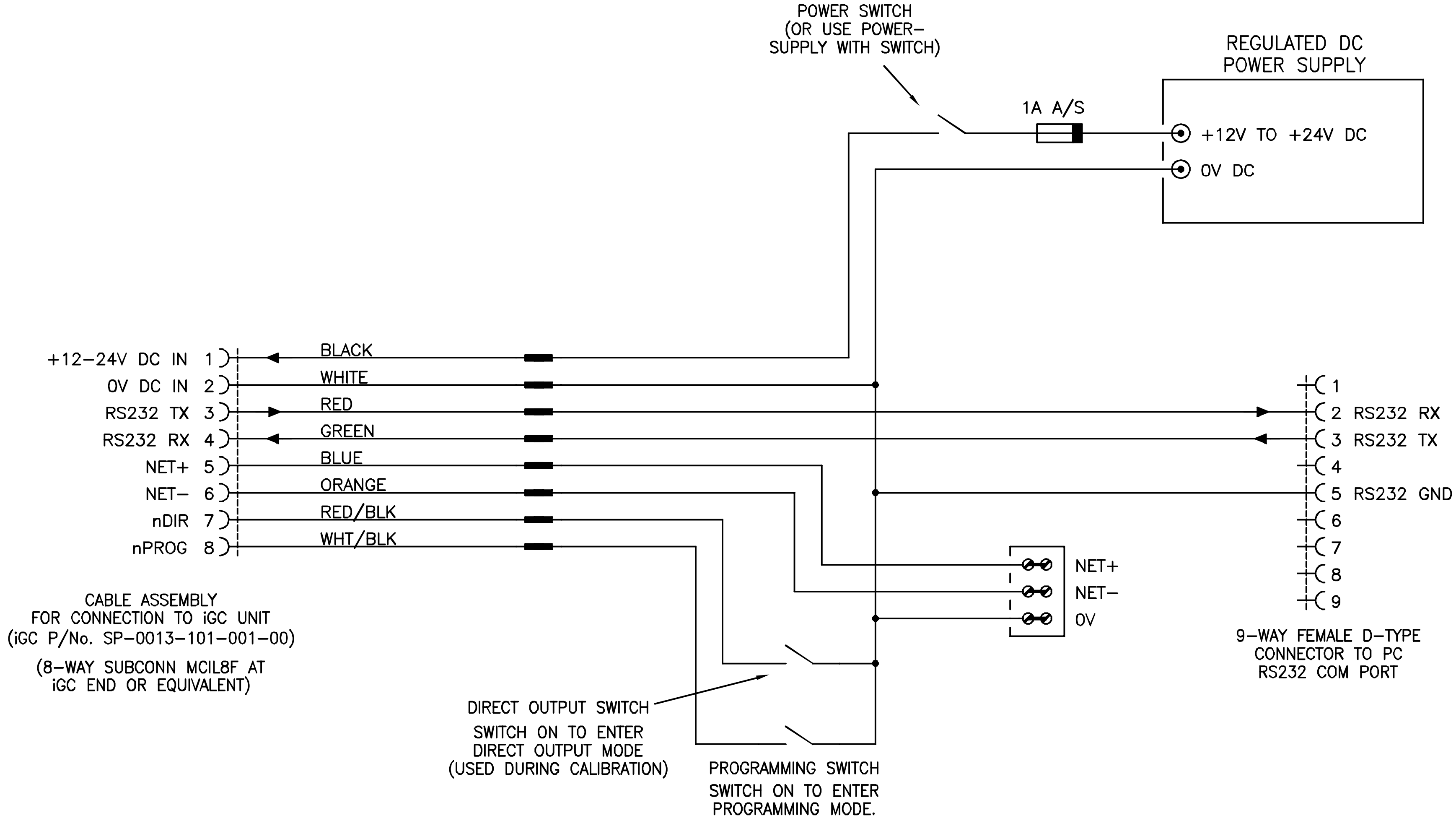
Technical specifications (iGC alone – without iFG stabilisation):

Orientation range	360º heading axis; 360º roll axis; +/- 90º pitch axis with standard firmware, (360º optional)
Angular velocity range	+/-300º / second (max)
Sensor types	3 sensors on each axis (9 total): 3 x magnetometers; 3 x rate gyros; 3 x accelerometers.
Sensor resolution	16 bits
Dynamic compensation	Closed-loop digital control (0-50Hz)
Orientation angle resolution	< 0.1º
Typical accuracy	Better than 1º
Temperature drift	+/- 0.025% ºC
Nonlinearity	0.23% full-scale (tested in static conditions)
Repeatability	0.2º
Output modes	Full range of industry standard protocols; Proprietary iGC formats; Special formats.
Sensor range	Rate gyros: +/-300º/sec. full-scale Accelerometers: +/-5g full-scale Magnetometers: +/- 1 Gauss full-scale
Output hardware interfaces	RS232; RS485; Arcnet.
Output data rate	20Hz update rate typically. Other rates available as options.
Serial data rate	2400, 4800, 9600, 19200, 38400 standard rates. Others available as option.
Power requirements	12-26v DC @ 250mA typically
Operating temperature	-20ºC to +50ºC operating. Extended temperatures on request.
Weight in air	0.95kg
Weight in water	0.45kg
Diameter	79mm
Height	121.5mm

Notes:

1. Specifications are correct at time of issue, but are subject to change in line with Tritech's policy of continual product development.

2. Quoted accuracies are based on typical performance tests.



NOTES:

1. CABLE USED FOR TESTING, CALIBRATION, REPROGRAMMING AND CONFIGURATION OF iGC.
2. 9-WAY D-TYPE CONNECTS TO LAPTOP OR PC COM PORT.
3. REFER TO iGC MANUAL FOR DETAILS ON USE.
4. iGC CURRENT REQUIREMENT IS 250mA
5. +NET AND -NET CONNECTIONS ARE ARCNET OR RS485, DEPENDING ON MODE AND INTERNAL JUMPER SETTINGS. EXTERNAL TEST RS485 OR ARCNET HARDWARE NOT SHOWN.

ISSUE DETAILS	REV	DRN	DATE	CKD	DATE	APP	DATE
ISSUED FOR MANUFACTURE	A	GK	15mar05	HWW	15mar05	GK	15mar05
ISSUED FOR CHECKING & APPROVAL	01	GK	15mar05	HWW	15mar05	GK	15mar05

TOLERANCES U.O.S.
GENERAL ±0.1mm
HOLE POSN. ±0.1mm
HOLE CTRS. ±0.1mm
ANGULAR ±0.5°

MATERIAL: SEE NOTES
FINISH: SEE NOTES

Tritech

CLIENT: TIL
USED ON: SP-0013-105-002-00

TITLE: iGC PROGRAMMING & TEST CABLE ASSEMBLY SCHEMATIC

DRAWING No. SP-0013-105-002-00

ALL DIMENSIONS IN mm U.O.S. | SIZE A3 | SCALE NTS | SHEET 1 OF 1

Tritech Intelligent Gyrocompass (iGC)
Recommended Spares List (refer to iGC General Assembly drawing SP-0013-101-001-00 Rev. A)
Rev. B - July 2015

Item	Qty	Description	Part No.
1	0	Dome	SP-0013-101-001-01
2	0	End Cap	SP-0013-101-001-02
3	0	Sensor Assembly	SP-0013-101-003-00
4	0	iGC Interface PCB Assembly	SP-0013-101-002-00
5	1	Subconn 8-way micro bulkhead male connector (SS)	T-MCBH8MSS
6	0	Subconn Locking Sleeve	T-MCDLSF
7	0	Subconn connector 'O'-ring	TI-BS014N170
8	2	O'-Ring	TI-BS039N170
9	0	M2.5 mounting pillar	SP-0013-101-002-01
10	0	M3 mounting pillar	SP-0013-101-002-02
11	0	8-way screw terminal connector	*SP-0013-101-001-00-11*
12	0	M3 x 6mm lg. Skt. head cap screw - st.stl.	*SP-0013-101-001-00-12*
13	0	M3 spring washer - st.stl.	*SP-0013-101-001-00-13*
14	0	M2.5 x 6mm lg. Skt. head cap screw	*SP-0013-101-001-00-14*
15	0	M2.5 plain washer	*SP-0013-101-001-00-15*
16	0	M3 x 10mm lg. Pan head pozi m/c screw - st. stl.	*SP-0013-101-001-00-16*
17	2	TO-220 insilating bush	SP-0013-101-001-03
18	1	Insulating washer	SP-0013-101-001-04
19	2	2mm Jumper Link (red)	*SP-0013-101-001-00-19*
20	1	Silicone grease	111
21	0	Thread locking compound	222
22	0	Subconn Locking Sleeve circlip	*SP-0013-101-001-00-22*
23	0	Identification / Serial No. Label	SP-0013-101-001-05
24	0	Processor module	SP-0013-101-001-06
25	0	M3 x 6mm lg. Pan head pozi m/c screw - st. stl.	*SP-0013-101-001-00-25*
26	0	M3 red fibre washer	*SP-0013-101-001-00-26*
27	8	Heat-shrinkable wire ident markers	*SP-0013-101-001-00-27*
28	8	Bootlace ferrule 0.34mmsq	*SP-0013-101-001-00-28*
29	1	30mm length 4.8mm clear heatshrink	*SP-0013-101-001-00-29*
30	1	100mm lg. Cable tie	*SP-0013-101-001-00-30*

Notes:

1. Spares are available from Tritech by quoting BOM and item number.
2. Refer to Recommended Spares List for cross-reference.
3. To maintain warranty and get the best performance from the iGC, only use genuine spare parts.