Typhoon Camera

Product Manual

0708-SOM-00001, Issue: 02

Outstanding Performance in Underwater Technology

A Moog Inc. Company

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Help & Support

First please read this manual thoroughly (particularly the Troubleshooting section, if present). If a warranty is applicable, further details can be found in the Warranty Statement, 0080-STF-00139, available upon request.

Tritech International Ltd can be contacted as follows:

	Mail	*Tritech International Ltd* Peregrine Road Westhill Business Park Westhill, Aberdeenshire AB32 6JL, UK
	Telephone	++44(0)1224 744 111
	Fax	++44(0)1224 741 771
	Email	support@tritech.co.uk
	Website	www.tritech.co.uk

Prior to contacting *Tritech International Ltd* please ensure that the following is available:

1. The Serial Numbers of the product and any *Tritech International Ltd* equipment connected directly or indirectly to it
2. Software or firmware revision numbers
3. A clear fault description
4. Details of any remedial action implemented

Contamination

If the product has been used in a contaminated or hazardous environment you *must* de-contaminate the product and report any hazards *prior* to returning the unit for repair. *Under no circumstances should a product be returned that is contaminated with radioactive material.*

The name of the organisation which purchased the system is held on record at *Tritech International Ltd* and details of new software or hardware packages will be announced at regular intervals. This manual may not detail every aspect of operation and for the latest revision of the manual please refer to www.tritech.co.uk

Tritech International Ltd can only undertake to provide software support of systems loaded with the software in accordance with the instructions given in this manual. It is the customer's responsibility to ensure the compatibility of any other package they choose to use.

Warning Symbols

Throughout this manual the following symbols may be used where applicable to denote any particular hazards or areas which should be given special attention:

Note

This symbol highlights anything which would be of particular interest to the reader or provides extra information outside of the current topic.

Important

When this is shown there is potential to cause harm to the device due to static discharge. The components should not be handled without appropriate protection to prevent such a discharge occurring.

Caution

This highlights areas where extra care is needed to ensure that certain delicate components are not damaged.

Warning

DANGER OF INJURY TO SELF OR OTHERS

Where this symbol is present there is a serious risk of injury or loss of life. Care should be taken to follow the instructions correctly and also conduct a separate Risk Assessment prior to commencing work.

1. Introduction

The Typhoon colour zoom camera incorporates the latest innovations in CCD sensor technology enhanced by intelligent fuzzy digital signal processing control logic to adjust the shutter speed, white balance and back lighting to maximise the low-light working capabilities.

A switch mode power supply board provides all the necessary voltages for the camera module. The module is controlled internally by RS232 providing full adjustment of all camera functions.

In addition external voltage controls are provided for focus and zoom. A three stage line driver is available to compensate for cable attenuation of the video signal.

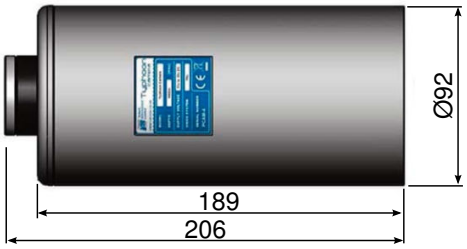
The camera module is protected from damage in the event of an accidental misconnection, a water-corrected port is fitted to optimise picture quality. The overall package provides an extremely robust unit for use in harsh environments.

Note

The camera is factory configured to be either PAL or NTSC, if a change is desired to an existing product, please contact *Tritech International Ltd* for the available options.

2. Specification

2.1. Dimensions Diagram



Shows standard aluminium alloy housing
Not to scale, dimensions in mm.

2.2. Electrical Properties

Property	Details
Voltage range	12 to 40V DC
Zoom & focus control	Analog ±12 to 24V DC or RS232 serial interface
Power consumption	5W at 24V DC

2.3. Physical Properties

Property	Details
Weights	1.9kg in air, 0.7kg in water (aluminium alloy housing)
Depth rating	4000m standard (6000m option)
Temperature range	-20°C to 50°C storage -10°C to 35°C operating
Shock	*DEF STAN 00-35 Part 3, chapter 2-03* $30g_n$ for 6ms in each axis (while operating)
Vibration	*DEF STAN 00-35 Part 3, chapter 2-01* Sinusoidal sweep & dwell in each axis from 5 to 150Hz at $10g_n$
Standard connector	Tritech 6 pin
Housing material	Hard anodised aluminium alloy, stainless steel 316 or titanium alloy 6AL4V
Viewport material	Acrylic

2.4. Optical Properties

Property	PAL	NTSC
Sensitivity with IR cut filter on	1.0 lux at 1/60s shutter speed 0.1 lux at 1/4s shutter speed 0.05 lux at 1/2s shutter speed	1.0 lux at 1/50s shutter speed 0.1 lux at 1/3s shutter speed 0.05 lux at 1s shutter speed
Sensitivity with IR cut filter off	approx. 0.01 lux B&W, 1/4s shutter speed	approx. 0.01 lux B&W, 1/3s shutter speed
Vertical resolution	540 lines (1/4s shutter speed)	470 lines (1/3s shutter speed)
CCD Module	1/4" progressive scan	
Viewing angle	66° in water (diagonal)	
Focus range	10mm to infinity	
Primary lens	3.6mm to 82.8mm (f/1.6 to f/3.6) Ivanoff water corrected optics	
Optical zoom	x23	
Digital magnification	x12	
Iris control	DSP controlled Auto Iris	
Video output	1V peak to peak composite, 75Ω unbalanced	
Signal to noise ratio	>50dB	
GUI functions	Save/load custom configurations, video preview, reset default settings.	
Other features	Digital Slow Shutter (DSS), Back light compensation, auto focus, Wide Dynamic Range (WDR), auto/manual white balance, video freeze, frame noise reduction, minimum focus length adjustment.	

2.5. Options

Property	Details
Video Line Driver	Up to 1500m with good quality RG59 coaxial cable
Connector options	Schilling 7 pin SeaNet, Burton/Seacon 5506 Series, Subconn BH and MCBH Series Customer Specified Connection

3. Installation

3.1. General Guidelines

The unit should be clamped securely around the body-tube. Non metallic clamps are preferable to reduce the risk of corrosion.

For Typhoon cameras not fitted with a Tritech Waterblock it may not be possible to determine the orientation prior to installation so it is advisable to install the camera in such a way that rotation of the unit is possible to correct for any mis-alignment of the displayed image.

Caution

Ensure the correct polarity of the power supply cable prior to connecting the lead. Incorrect polarity may cause damage to the internal electronics.

Before attaching the connector to the camera ensure that the 'O' ring is in position and lightly smeared with lubricant (Dow Corning #111 or equivalent is recommended).

3.2. Test Cable Wiring

To connect the camera to a computer for testing or operation it will be necessary to construct an appropriate test cable. See Section 3.3, “Standard Connector Pin-Out” for the pin-out diagram for units fitted with the standard Tritech 6 pin water block.

for any other connectors it will be necessary to refer to the documentation that was provided with the camera to establish the correct wiring scheme.

To connect to a computer it will be necessary to provide the camera a minimum of three connections:

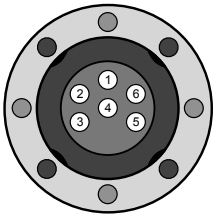
1. The RS232 serial for passing control commands
2. DC Power and ground
3. The video capture output.

Note

The connections above assume the Typhoon has been setup for RS232 control.

3.3. Standard Connector Pin-Out

The standard connector fitted to the Typhoon camera is the *Tritech International Ltd* 6-pin 4000m water block.



Pin	Function
1	Focus ±/RS232 Tx
2	Zoom ±/RS232 Rx
3	12 to 40V DC
4	0V DC
5	Video Out
6	AutoFocus

For Typhoon Cameras not fitted with the Tritech Waterblock, please refer to the supplied build documentation for the appropriate pin out allocations.

4. Operation

4.1. Overview

Depending on its initial specification, the camera will be compatible with any video recorders or monitors working on the PAL or NTSC standards.

Note

The Typhoon is designed for use under water. While in use the surrounding water will have a cooling effect on the body and use out of water should be kept to a minimum to avoid shortening the life of the electrical components.

During power up there will be a delay of several seconds while the camera module initialises. During this time the monitor will remain dark.

4.2. Analogue Based Control

When the Typhoon has been setup for control via an Analogue signal it will be controlled in one of two ways:

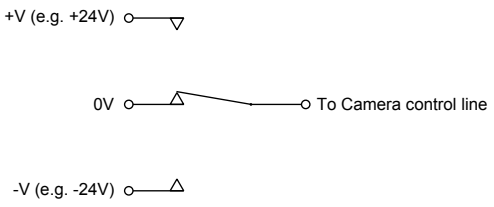
- Bi-Polar
- Tri-State

4.2.1. Bi-Polar Control

When setup to operate with Bi-Polar control, the input voltage control will be set to one of two options:

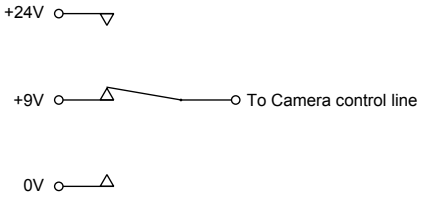
- 12V to 24V and -12V to 24V
- 5V to 12V and -5V to -12V

The control line signal is either the +V level, 0V, or the -V level. 0V is the resting default for the control line.



4.2.2. Tri-State Control

When setup to operate with Tri-State control, the control line has a resting voltage of about +9V. The control line signal will then be either +24V or 0V.



Note

Tri-State control should be specified at point of purchase. It is not a field selectable option, any unit requiring modification to this mode should be returned to *Tritech International Ltd*

4.2.3. Auto Focus Control

Regardless of the setup for the other control lines, the Auto Focus is controlled by a single voltage signal.

- +12V to 24V sets Auto Focus ON
- 0V or not connected sets Auto Focus OFF

Auto Focus Control can be automatically enabled, depending on the Control Board settings (see Chapter 7, *Control Board*). If Auto Focus has been set to be enabled after startup, to disable Auto Focus a manual focus command must first be sent to the camera before using the Auto Focus control line.

4.3. RS232 Based Control

When the Typhoon has been setup for control via a RS232 serial data link the camera can be controlled by Tritech's GUI.

4.3.1. Graphical User Interface

The Typhoon camera is supplied with software which provides a user interface that can control the functions of the camera and display the image output. This is useful for bench testing prior to deployment and can also be used for simple setups where the camera is connected directly to a computer.

The software is designed to work with the Microsoft Windows operating system.

Note

In order to enable communication with the camera it will be necessary to construct an interface cable between it and the computer. It will also be necessary to have an appropriate video capture card installed (or a USB video capture device) and a free RS232 serial port. If integrating with other Tritech equipment the SeaHub unit can provide RS232 ports and also power to the camera.

Note

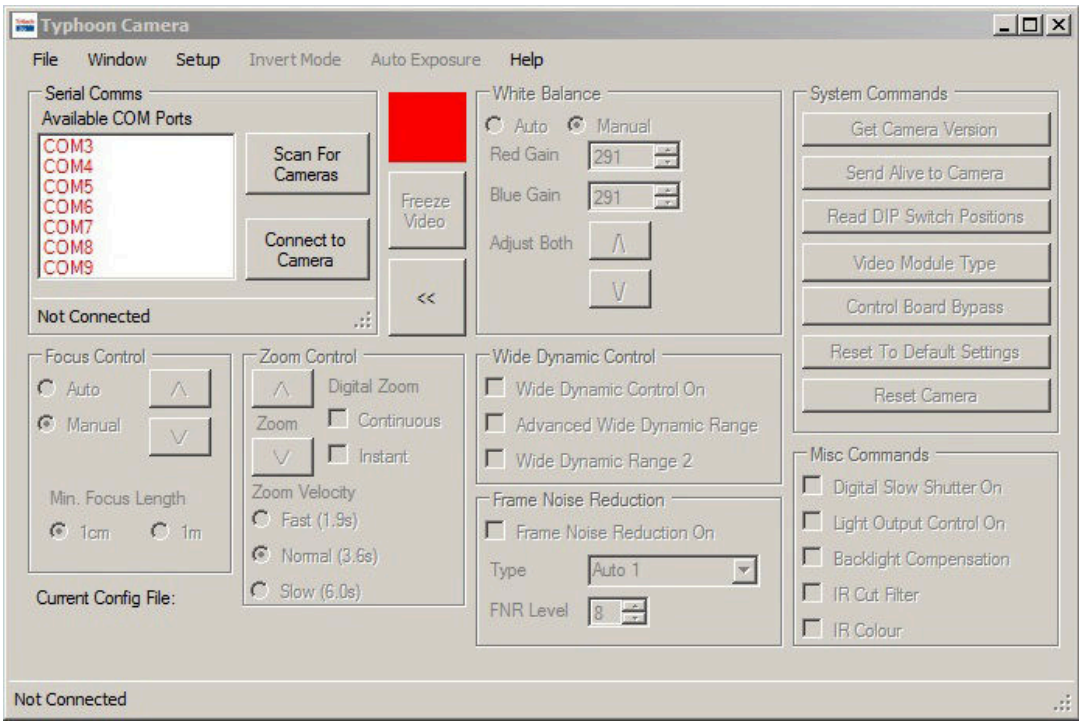
Any settings altered while running the GUI are not retained and power cycling the camera will restore the default setup.

Caution

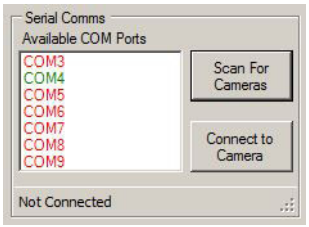
The Typhoon camera is designed for operation underwater where the surrounding liquid will have a cooling effect using the camera body as a heatsink.

Extended operation above water is not recommended because this may limit the life of the electronic components.

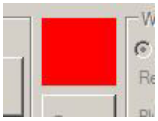
Connecting a camera



When the user interface is initially started it will detect any RS232 serial ports that are in the system and list them under `Available COM ports`. Clicking on `Scan For Cameras` will detect any cameras connected to the RS232 ports and highlight the available connections in green text.



It will then be necessary to click on the appropriate COM port and then click `Connect to Camera`. This will initialise the connection routine, with its progress displayed in the `Comms Window`. Completion of this connection process is indicated by a the red square turning green.

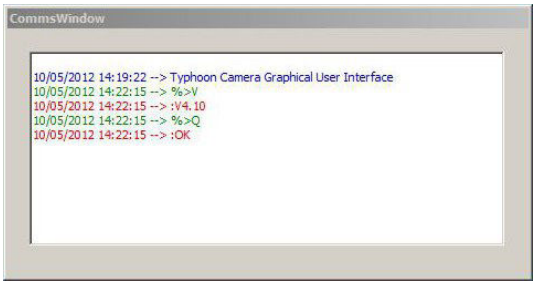


Camera not connected.

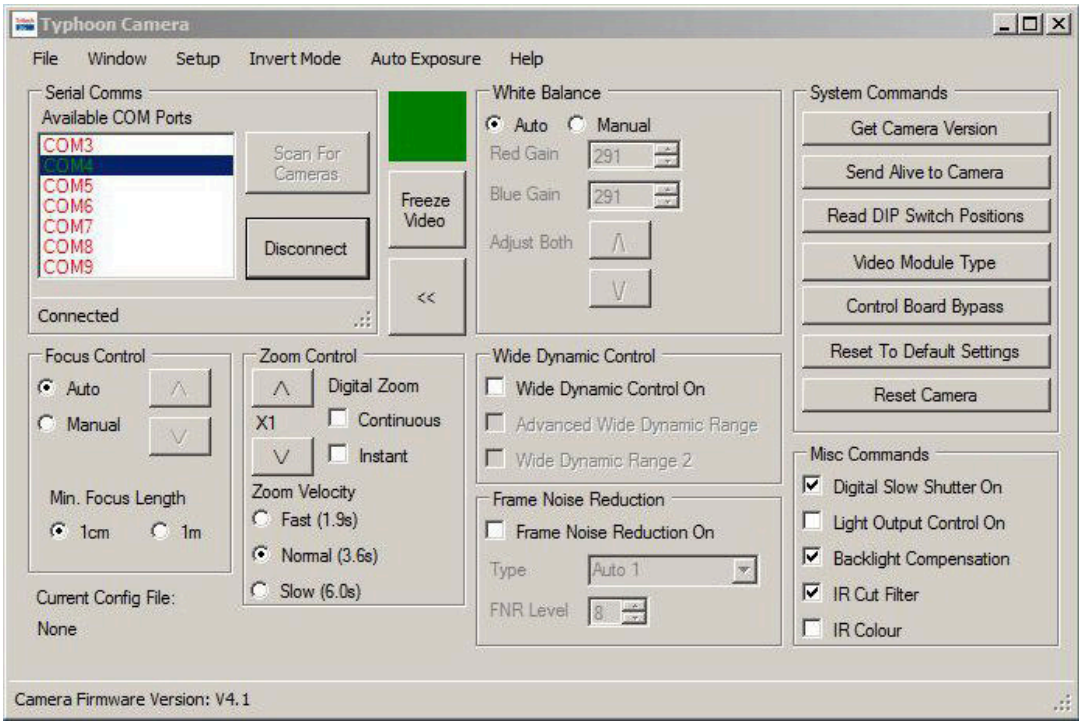
Connection routine in progress.

Camera connected successfully.

The `Comms Window` will indicate the ASCII strings that are being sent to and received from the camera and any errors that may occur. This window can be opened by selecting it from the `Windows` menu:

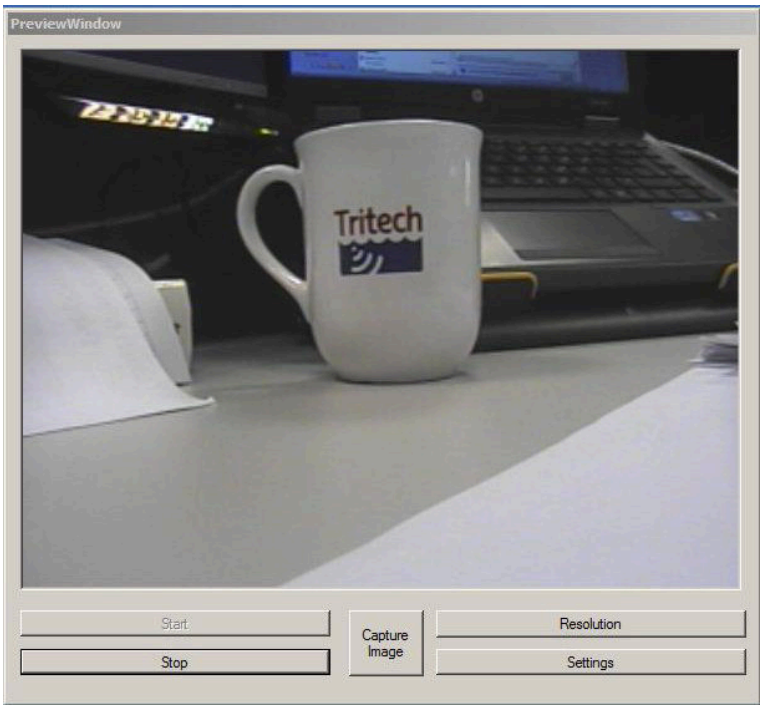


Once connected successfully the main controls for the camera will become available and the screen will then look as follows:



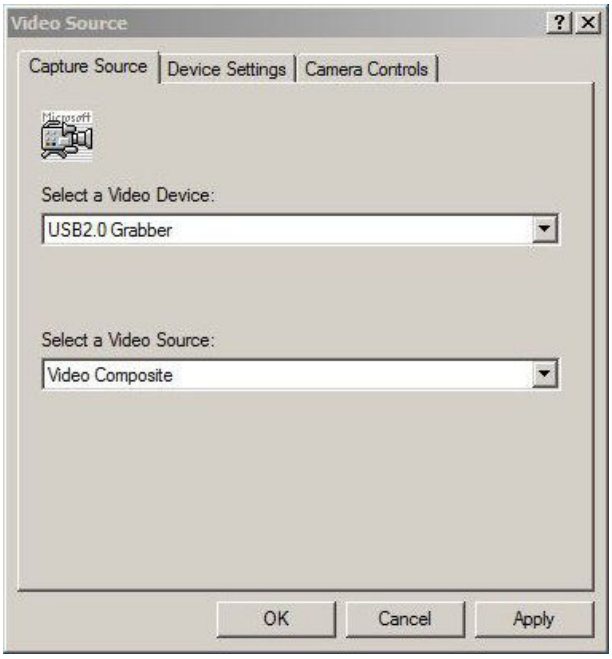
The Preview Window

The `Preview Window` is available by selecting it from the `Windows` menu.



It is possible to connect to the camera and generate a preview prior to establishing control communications (as detailed above) but the image displayed will merely be with the default settings for the camera and it will not be possible to control it.

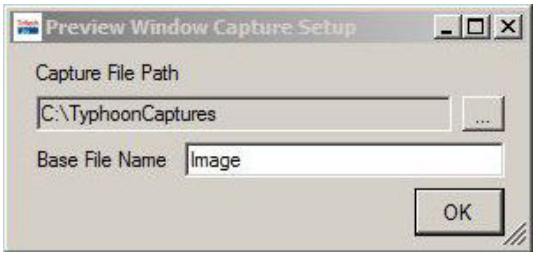
The Preview Window relies on having a working video capture device installed on the operating system and it talks directly to the camera using this system. The first time that the preview is started it will be necessary to configure and select the correct video capture device and a dialog will open automatically the first time that the `Start` button is pressed. Any subsequent changes can be made by selecting the `Settings` button.



Note

The actual `Video Device` and `Video Source` shown will vary depending on the type of video capture hardware present in the computer.

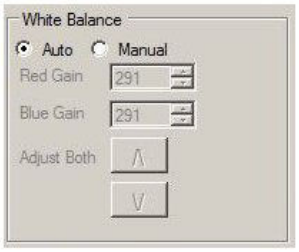
It is possible to capture still images from the video preview by clicking on the `Capture Image` button and the manner in which these are stored can be controlled from the main program `Setup` menu.



The directory is where all the images are stored and the `Base File Name` is a suffix attached to each image file. The images are then stored in ascending numerical order, for example `Image_1.jpg`, `Image_2.jpg` and so on.

Camera Commands

It is possible to control all of the Typhoon camera functions from the GUI and changes are shown immediately on the `Preview Window` if it is open. These settings will be reset to default when power is removed.

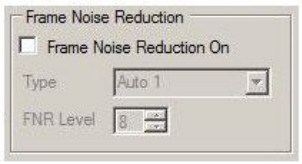


Select whether to automatically adjust the white balance or apply a manual adjustment.

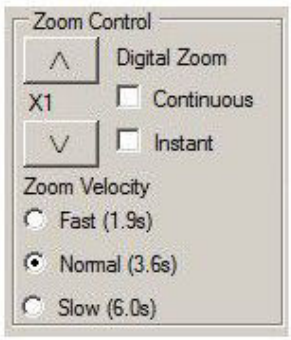
Query the camera for information regarding the version number or hardware settings. `Reset To Default Settings` is the equivalent of a power cycle and will set the camera to the settings as determined by the internal dip switch positions which can be checked with `Read DIP Switch Positions`.
The `Control Board Bypass` passes control directly to the camera module bypassing the functions from the camera GUI. **This control may cause damage to the camera module and is intended for factory use only**.

Other control commands, the default settings are usually optimal but may be changed if desired. `Digital Slow Shutter On` is useful for low light conditions, but will cause a reduction in frame rate.

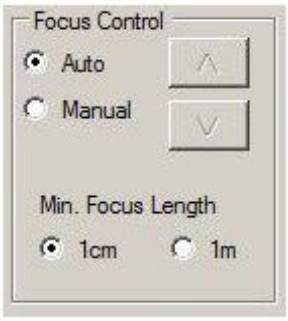
Toggle between enable or disable the Wide Dynamic Control and when enabled select which type of control to use. This can be useful for enhancing images in low light conditions.



Enable the frame noise reduction to ensure accurate, clear images with a minimum of random noise - even in challenging low light conditions.



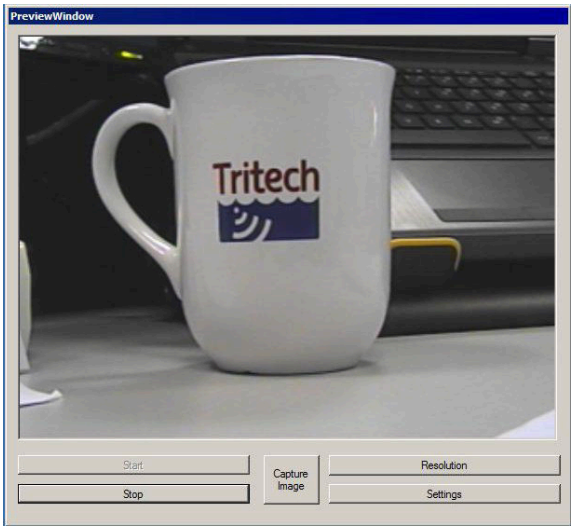
The zoom control changes the manner in which the camera zooms and also provides zoom in and zoom out buttons. The `Instant` check box will automatically apply a digital zoom and the `Continuous` option is for enabling the zoom to seamlessly transition between optical and digital while it is zooming.



Like other subsea cameras, manual focus is the normal means of controlling the Typhoon camera. However an Auto Focus mode is also available.

Additional control is available from the menu in the form of the `Invert Mode` and `Auto Exposure`.

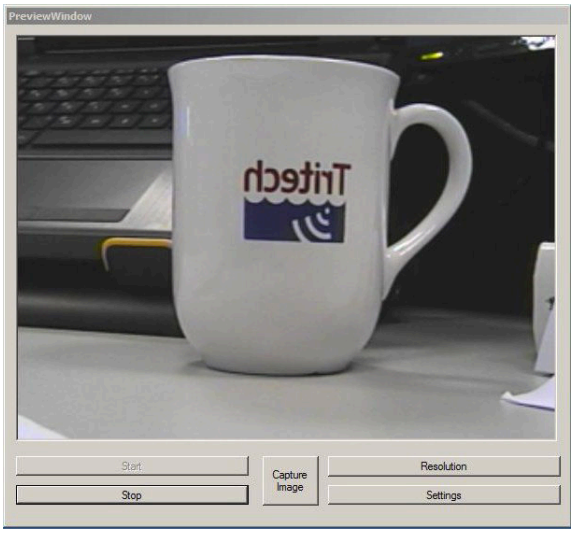
Invert Mode



The preview with `Invert Mode` turned off.

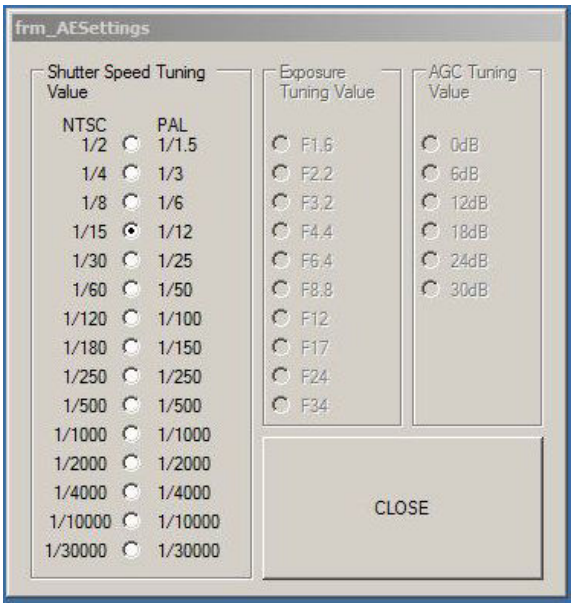
Vertical invert

Reverse invert



Mirror invert

Auto Exposure Settings



Depending on the option selected from the `Auto Exposure` menu this dialog will enable different areas. The automatic control is often sufficient for most applications but if desired the shutter speed can be slowed manually. This is especially useful for low light conditions but a stable platform will be required if the shutter speed is reduced significantly (turning on `Frame Noise Reduction` may help to reduce any distortions from a low shutter speed).

Saving Camera Setup

The camera will automatically reset to defaults during a power cycle but it is possible to store the command setup in a configuration file and load that instead of manually changing all the settings each time the camera is used.

To create a configuration file first connect to the camera and set all the controls to the desired positions and then click on `Save Config` from the `File` menu.

Note

To load a configuration it will be necessary to connect to the camera first.

4.3.2. Using Other Interfaces

It is possible to direcly control the camera through an RS232 cable and serial console without using the Tritech Graphical User Interface.

To do this, or to develop a custom interface, please refer to the complete list of serial commands in the Software Development Kit section of the "Typhoon Camera Workshop Manual" (*document reference: 0708-SOM-00002*) which is available for download from www.tritech.co.uk

5. Maintenance

Note

There are no user serviceable parts within the camera and it should not be necessary to disassemble the unit during normal usage.

After submersion the camera should be inspected for any obvious signs of corrosion and should be cleaned of any debris or marine growth.

The unit can be cleaned with a mild soap solution, ensuring that the connector is fully dried before reconnecting.

6. Disassembling the Camera

Important

The steps outlined below will expose electronics which are sensitive to static electricity. It will be necessary to take precautions against static discharge while carrying out these procedures.

Note

Every time the camera is disassembled the O-ring seal between the end cap and body tube should be inspected for signs of wear or deterioration. Prior to reassembling the camera this seal should be lubricated with a small amount of Dow Corning #111 or equivalent.

6.1. Removing the Body Tube

First it will be necessary to remove the retaining cord which secures the end cap in place. Carefully tease out the cord from the cord slot and pull it all the way out. Keep this cord in a safe place for when the camera is reassembled.

Next it will be necessary to remove the end cap which also contains the camera electronics. The end cap is removed by grasping the body tube in one hand and the water block connector in the other and pulling them apart. If the end cap is a tight fit it may be necessary to gently warm the body tube prior to pulling.

Caution

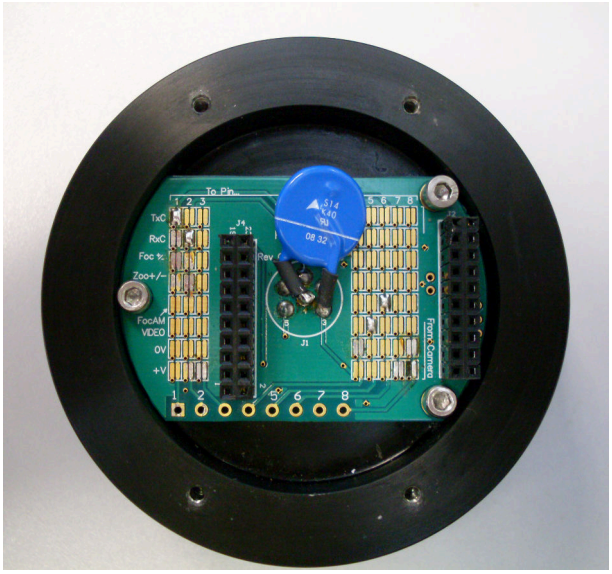
The electronic stack also has a lens on the end and should be handled carefully to avoid marking or scratching the optical surface.

Caution

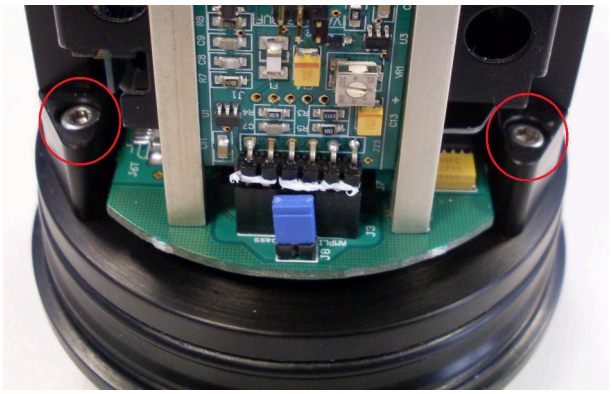
Once the body tube is free from the housing the lens will not be secured so care must be taken so that it does not fall out.

6.2. Accessing the Plug Board

Housed within the end cap is the plug board on which the configuration for the camera is made using a matrix of solder pad splashes (the plug board is for configuration of the pin-out and for selecting analgue or serial output only).

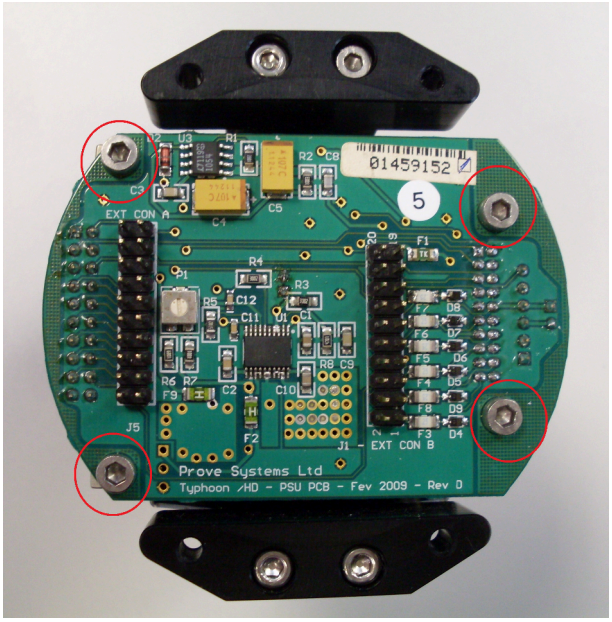


To access this board it will be necessary to remove the camera module assembly, control board, PSU board and amplifier board (if fitted) from the end cap. This can be done by removing four screws which are located around the edge of the end cap. A 2.5mm Hex key will be required.



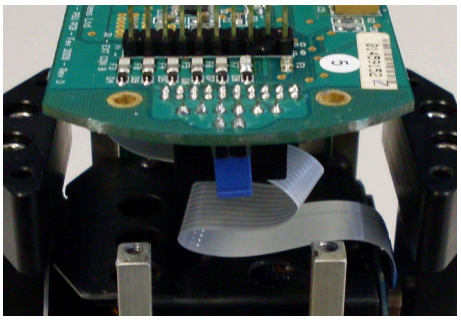
6.3. Control and Amplifier Boards

To replace a defective control board or to add in an amplifier board further disassembly will be necessary. Each of these boards is held in place using two rails and it is necessary to remove four screws to gain access to them.

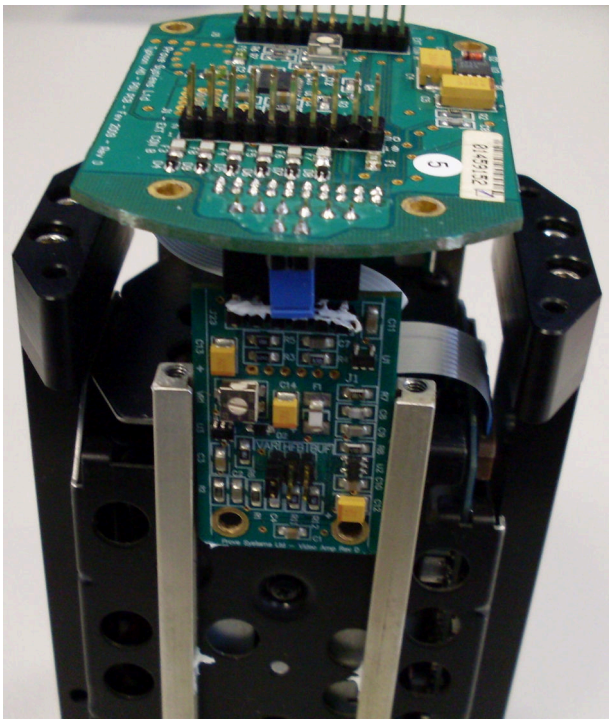


Caution

A ribbon cable connects the board to the camera module and care should be taken not to pull this cable out when removing the boards. It will not be possible to remove the boards completely without removing the ribbon cable, but it is possible lift them clear of the securing rails and remove them from the PSU board to enable replacement.



Once the board has been placed onto the connector it should be carefully lowered between the securing rails ensuring it is maintained in the correct position (if the position is incorrect it will not be possible to replace the four screws that were previously removed). After it has been lowered all the way the screws can be replaced.



Note

When installing an amplifier or control board note that the correct orientation is maintained. For both boards the dip switches/jumpers should be facing outwards.

Note

It will also be necessary to remove jumper J8 on the PSU board which is immediately in front of the amplifier board socket. If J8 is left connected then the amplifier board will be bypassed.

7. Control Board

The control board which is connected to the PSU PCB via the 20 pin socket J2 allows control of the analogue settings and also communication protocols via a set of dip switches.

In total there are three banks of switches and their function is outlined below:

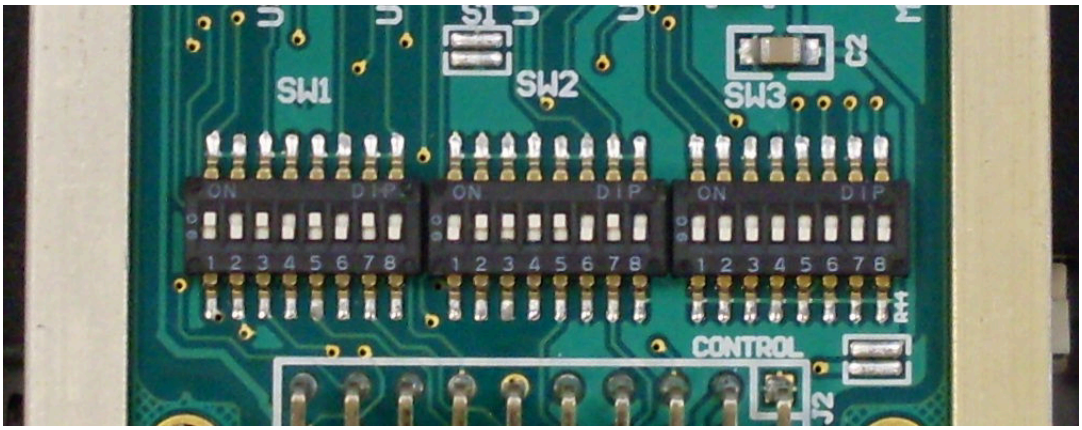


Table 7.1. Dip switches for analogue control

	Switch Bank SW1								Switch Bank SW2			
Switch	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**5**	**6**	**7**	**8**
Function	Iris A/M		Focus A/M		(factory use only)				Focus		Zoom	
Tri-State	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
Bi-Polar	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON

Table 7.2. Dip switches for software configuration

	Switch Bank SW2				Switch Bank SW3				
Switch	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5 - 8**
Function	DSS at startup	Auto focus at startup	Auxiliary switch	Baud rate	Backlight correction at startup	Continous digital zoom	Wide Dynamic Control	Minimum Focus Length	not used
ON	Enable	Enable	Focus A/M	9600 baud	Enable	Enable	Enable	1m	
OFF	Disable	Disable	Laser toggle	2400 baud	Disable	Disable	Disable	1cm	

Note

Switch banks SW1 and SW2 allow control of the camera functions by a single wire with an applied bi-polar signal or in tri-state mode, changing to tri-state will require modification to the plug board and will require that the camera is returned to *Tritech International Ltd*. For more information about Bi-Polar and Tri-State modes see Section 4.2, “Analogue Based Control”.

Command control can also be achieved using RS232 protocols as detailed in Chapter 9, *Software Development Kit*.

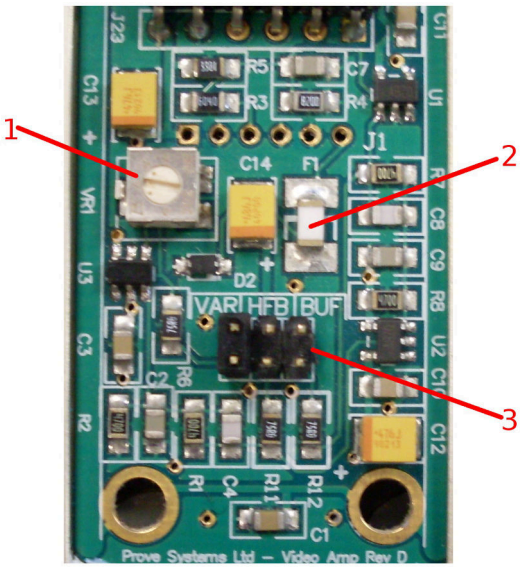
8. Long Line Amplifier

If there is a need to use the camera with a long coaxial cable then the long line amplifier board is required. This board may be already fitted to the camera but can also be retrofitted as required. For details on obtaining this board contact *Tritech International Ltd*

Important

The procedures outlined here could result in damage to the camera module through static discharge. Ensure that all appropriate measures are taken to protect the unit from static electricity.

First disassemble the camera unit to remove the camera module from the housing then locate the 6-pin socket J3 on the PSU PCB. This may already have the amplifier board installed:



1. VR1 variable resistor.

2. F1 250mA quick blow fuse (protecting the video line).

3. Amplifier mode selector jumper (if a jumper is not present in one of the locations then the board is not active).

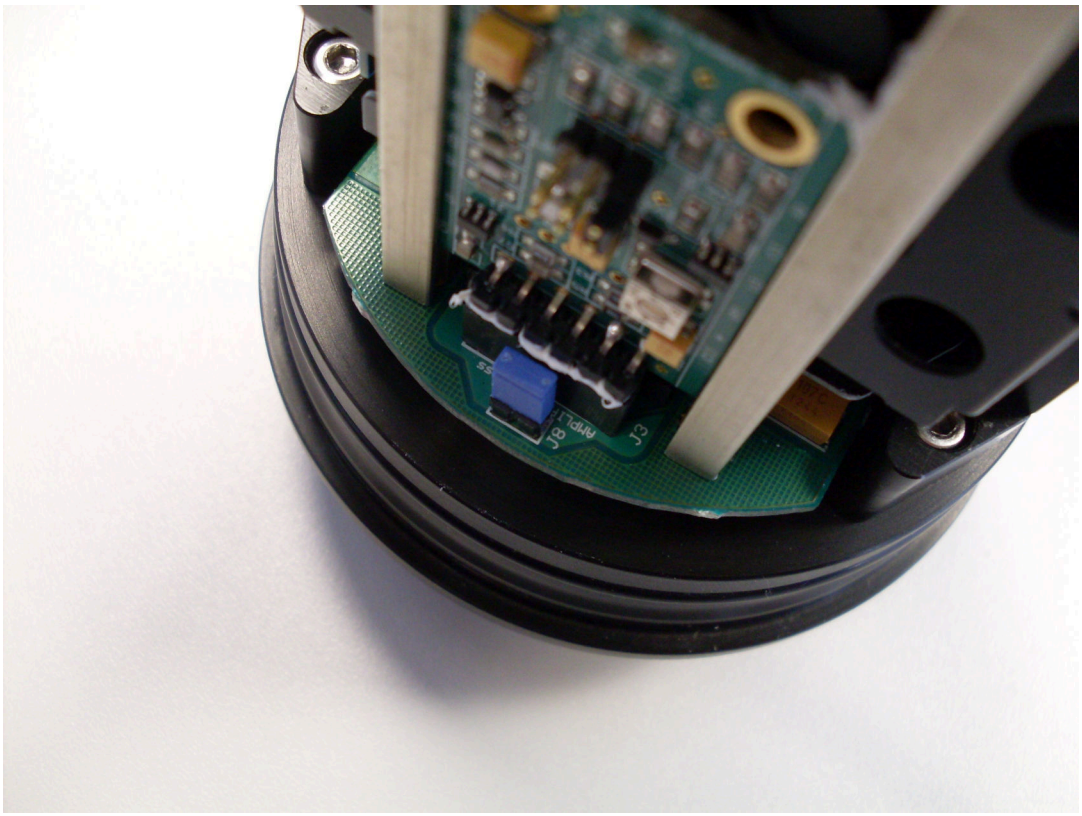
Amplifier Board Modes

BUF Unity gain, standard buffered video output.

HFB High Frequency Boost, standard buffered video output with colour boost.

VAR High frequency and DC boost gain variable using VR1. This setting is the same as HFB but allows manual adjustment of the signal amplitude via variable resistor VR1 up to a maximum peak-to-peak voltage of 2V.

If the amplifier board is fitted but is not going to be used then it can be bypassed by connecting the pins on J8.



Note

If the camera was originally supplied without an amplifier board then this jumper will already be in place and will need to be removed if the amplifier board is retrofitted.

9. Software Development Kit

9.1. System Setup

The camera can be controlled using an RS232 protocol please first note these general guidelines:

- All commands should be sent using upper case characters with ASCII encoding applied.
- All commands, unless stated, will only apply to the camera when it is addressed.
- The link to the camera requires 2400 or 9600 baud with 8 data bits, 1 stop bit, no parity and no handshaking (note: communication speed is selected using the dip switches as outlined in Chapter 7, *Control Board*).
- Data sent to control the camera should be preceded by the synchronisation character "%" and confirmed with a `<CR><LF>` character pair to start command processing.
- Data received from the camera will be preceded by the character ":" and followed by a `<CR><LF>` character pair.
- Communication or system errors will only be reported if the camera is enabled and will start with the symbols ":E".
- The camera will not normally send an unsolicited message (it must be instructed to send data).

Note

If talking to the communication interface using terminal software such as Hyper-Terminal, backspace will not work and if a mistake is made it will be necessary to press the `Return` key to cancel the current instruction and start the command again. Use the `Return` key and not the number pad `Enter` key.

9.2. Start-up Procedure

When powering up the unit it takes several seconds before the video module will accept any commands. At power up the string `:WAIT` is transmitted to show that the control PCB has initialised correctly and the unit is waiting for the camera to initialise.

When initialisation is completed and the unit is ready to receive instructions the string `:OK` is sent to the computer.

9.3. Serial Command Syntax

9.3.1. System Commands

Command	Alive
Syntax	`>?`

Command	Alive
Returns	OK
Variables	None
Description	This command returns OK when the RS232 is properly connected and the camera is switched on.

Command	Dump data buffer
Syntax	>DD
Returns	>DD<space><CR><LF>
Variables	None
Description	Used in versions prior to 3.00 to dump out the data buffer.

Command	Reset
Syntax	>Q
Returns	WAIT then either OK or E14
Variables	None
Description	Performs a software reset, the video module will be reinitialised to the dip-switch settings.

Command	Version
Syntax	>V
Returns	V<x.yy>
Variables	x and y are ASCII characters representing the major and minor versions of the software.
Description	Allows the version of the software installed on the camera to be checked.
Example	V3.00

Command	Read the dip-switch position
Syntax	>S
Returns	S<abcd.e>
Variables	abcd are ASCII characters representing dip switch position on switch bank SW2 and e represents position on switch bank SW3. A value of 0 indicates the switch is OFF/down and 1 indicated ON/up.
Description	The dip switches are on the control board and should be set according to Chapter 7, *Control Board*. This command only reads the software configuration dip switches. The returned value could be used to configure the graphical interface. Dip switches are as follows: a. Switch SW2-1 Digital Slow Speed Shutter at startup. b. Switch SW2-2 Auto focus at startup. c. Switch SW2-3 Auxiliary switch. d. Switch SW2-4 Baud rate. e. Switch SW3-1 Back-light Compensation.

9.3.2. Camera Control Commands

Command	Focus Auto
Syntax	FA
Returns	Nothing
Variables	None
Description	Sets the focus mode to automatic, it disables the Focus Near, Far and Stop commands.

Command	Focus Far (manual focus mode only)
Syntax	FF
Returns	Nothing
Variables	None
Description	Starts the "focus far" operation of the focus mode is selected with the FM command.

Command	Focus Manual
Syntax	FM
Returns	Nothing
Variables	None
Description	Sets the focus mode to manual, allowing use of the Focus Near, Far and Stop commands.

Command	Focus Near (manual focus mode only)
Syntax	FN
Returns	Nothing
Variables	None
Description	Starts the "focus near" operation if the manual focus mode is selected with the FM command.

Command	Focus Stop (manual focus mode only)
Syntax	FS
Returns	Nothing
Variables	None
Description	Stops the current manual focus operation in progress.

Command	Digital Slow Shutter (DSS) Control
Syntax	MD<x>
Returns	OK
Variables	<x> is 0 for DSS OFF or 1 for DSS ON.
Description	Turns on or off the DSS shutter.

Command	Light Output Control
Syntax	ML<x>
Returns	OK
Variables	<x> is 0 for lights OFF or 1 for lights ON.

Command	Light Output Control
Description	Turns on or off the output of the light controller, also used to control the laser ranging module (VMS) if this is fitted.

Command	Back Light Compensation Control
Syntax	`MB<x>`
Returns	`OK`
Variables	`<x>` is 0 for OFF or 1 for ON.
Description	Turns on or off the back-light compensation, when the compensation is enabled the picture may look lighter on the display.

Command	Wide Dynamic Control (newer modules only)
Syntax	`MW<x>`
Returns	`OK`
Variables	`<x>` is 0 for OFF or 1 for ON.
Description	Turns on or off the wide dynamic range which uses two shutter speeds in alternative video fields (high and normal) every 60th or 50th of a second to increase the camera sensitivity.

Command	Zoom Digital - Continuous
Syntax	`ZDC<x>`
Returns	Nothing
Variables	`<x>` is 0 for OFF or 1 for ON.
Description	Turns on or off the continuous digital zoom.

Command	Zoom Digital - Instant
Syntax	`ZDI<x>`
Returns	Nothing
Variables	`<x>` is 0 for OFF or 1 for ON.
Description	Turns on or off the instant digital zoom (x10).

Command	Read Zoom Position
Syntax	`ZPR`
Returns	`ZPR<xxxx>`
Variables	`<xxxx>` is an ASCII character string representing the current zoom position given in hexadecimal format (see conversion below).
Description	Returns the current zoom position of the camera.

Table 9.1. Hexadecimal codes for Zoom position

Position	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11
From	0000	14BB	2DDE	3A57	422E	47C8	4C16	4F97	528F	5518	575C
To	14BA	2DDD	3A56	422D	47C7	4C15	4F96	528E	5517	575B	5953
Position	x12	x13	x14	x15	x16	x17	x18	x19	x20	x21	x22
From	5954	5B21	5CB2	5E19	5F4C	605E	6144	6209	62AB	6334	63A3
To	5B20	5CB1	5E18	5F4B	605D	6143	6208	62AA	6333	63A2	6400

Command	Zoom Stop
Syntax	`ZS`

Command	Zoom Stop
Returns	Nothing
Variables	None
Description	Stops any zoom operation.

Command	Zoom Telephoto (zoom in)
Syntax	ZT
Returns	Nothing
Variables	None
Description	Starts the "zoom telephoto" operation, which will continue at the specified zoom speed until a "zoom stop" command is issued.

Command	Zoom Speed (velocity)
Syntax	ZV<x>
Returns	Nothing
Variables	<x> is a single ASCII character: 0 = slow (6.0 seconds), 1 = normal (3.6 seconds), 2 = fast (1.9 seconds).
Description	Sets the speed of a wide or telephoto zoom operation.

Command	Zoom Wide (zoom out)
Syntax	ZW
Returns	Nothing
Variables	None
Description	Starts the "zoom wide" operation which will continue at the specified zoom speed until a "zoom stop" command is issued.

9.4. Error Messages

If a program error occurs the Typhoon camera will transmit an error code back to the host system. All errors start with the transmission synchronisation character (:) and finish with the carriage return and line feed characters (<CR><LF>). All error codes start with the prefix character E followed by an ASCII-Hex byte containing the error that occured.

Note

When an error occurs it it placed in the transmission buffer so if any transmission is already in progress the error will not b returned until the previous transmission has completed (i.e. it is not in real-time).

Command	Incorrect Syntax
Returns	E10
Variables	None
Description	The command characters sent are not recognised as commands. The command processor is reset ready for the next command. (Note: all commands should be in uppercase).

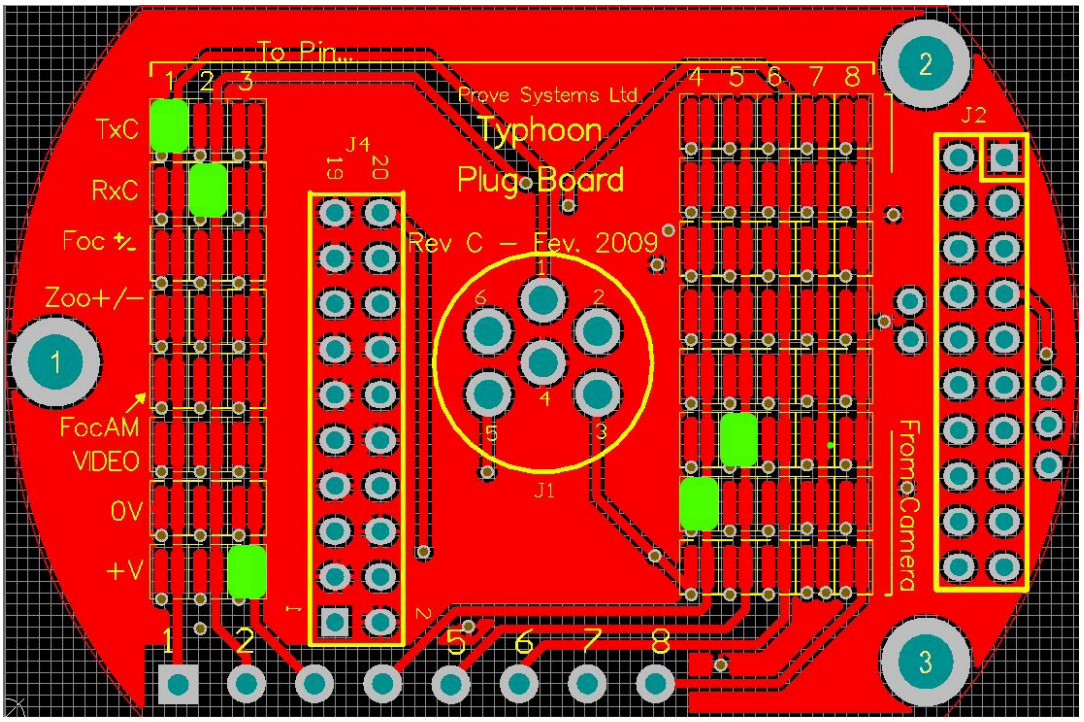
Command	Data Buffer Full (of bytes) or Invalid Data Length
Returns	E12

Command	Data Buffer Full (of bytes) or Invalid Data Length
Variables	None
Description	The amount of data sent has filled the data buffer (to defined length in bytes), so no more data can be received.

Command	Video module not detected
Returns	`E14`
Variables	None
Description	The video module has not been detected after the initialisation. The camera will not be able to process any commands.

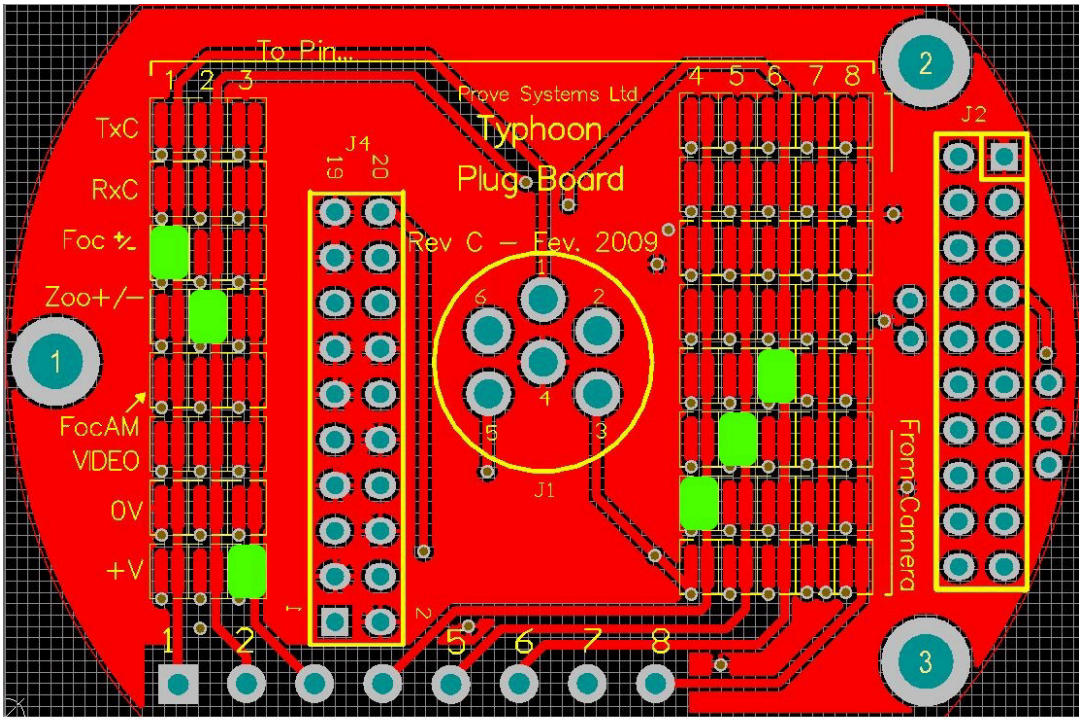
Appendix A. Plug Board Configurations

Serial Output Tritech Connector



Tritech Waterblock - Serial Control

Analogue Output Tritech Connector



Tritech Waterblock - Analogue Control

Glossary

ASCII	American Standard Code for Information Interchange - a character encoding scheme originally based on the English alphabet.
CCD	Charge-coupled device - an electronic light sensor used in digital cameras.
COM	Short for "communications". When used in the context of computers typically it refers to the Microsoft Windows® designation of a serial communications port (in this instance it may be given a number, "COM3", for example). In the context of sonar hardware it can be used to refer to the circuit board that controls the communication to the surface.
DC	Direct Current
GUI	Graphical User Interface
NTSC	National Television System Committee - an analogue television standard used in most of North America.
PAL	Phase Alternating Line - an analogue television colour encoding system.
PCB	Printed Circuit Board
PSU	Power Supply Unit
RS232	Traditional name for a series of standards for serial binary data control signals.
Tritech waterblock	The 4000m depth rated connector developed by *Tritech International Ltd* for their subsea equipment.

